Department of Physics & Astronomy
Response to Program Discontinuance Proposal

The Discontinuance Proposal includes the elimination of all Department of Physics & Astronomy degree programs (the Physics BS; Physics BA; and Physical Science BA).

These programs are of exemplary quality, pedagogically sound, resource efficient, staffed by excellent faculty, contribute to the reputation of the university, highly interdisciplinary, support popular General Education offerings, are distinctive, aligned with the campus mission, in the top 25% nationally for number of Physics degrees awarded annually at primarily undergraduate institutions, having recruitment efforts resulting in incoming majors in 2024-2025 at levels 60% above historic averages, and part of a department that serves a central role in providing service classes to Biology, Chemistry, Computer Science, Engineering, Environmental Studies, Geology, Kinesiology, and Mathematics.

This Department of Physics & Astronomy submission includes:

- This executive summary Response to the Program Discontinuance Proposal
- A collection of over 100 alumni, student, and community partner testimonials
- Our most recent Program Review with external reviewer, Dean, College of Science, Technology & Business, and UPRS findings.

Summary of Degree Programs

Physics BS	The essential physics degree, following national standards - a thorough introduction to the principles of physics, providing a strong foundation for graduate study, industrial research and the STEM workforce. Courses in Optics (PHYS340), Computing and Data Science (PHYS381), and materials science including microanalysis (PHYS366) are designed with our local industries in mind. This degree plan is the essential Physics degree and the positive outcomes detailed herein are not possible without it.
Physics BA	Requiring no course offerings above those in the standard BS, this provides an interdisciplinary option for students interested in pairing core physics offerings with other interests. Notably, it is the degree plan for future High School Physics Teachers, for which we face a national shortage.
Physical Science BA	Designed to produce more and better STEM educators while serving as a strong, yet flexible STEM-focused liberal arts degree. It is efficient, leveraging existing courses and relying on the offering of only one additional course PHYS 107 – Physical Science for Teachers. It satisfies the requirements for a Foundational Science CSET waiver for K-9 science teachers.

Rationale for continuance:
The overall quality of the program.

- Program Review Feedback:
    - Dr. Carol Hood, Associate Dean, College of Natural Sciences, CSU-SB:
      I found the Department ... to embody a collaborative atmosphere, student-focused approach, and commitment to academic excellence.
      ...
      The department has taken multiple measures to provide individualized and structured support to all its students. Recent enhancements ... underscore the department's adaptability and dedication to meeting evolving educational needs

Leveraging a robust array of experimental equipment and strong collaborations in observational astronomy and science education, faculty members provide students with invaluable hands-on learning experiences.

- Dean Elisabeth Wade, College of Science, Technology, and Business:
  The department has done an excellent job of documenting the work they have done around their learning goals, and relating those learning goals to the campus strategic plan, and I want to commend their attention to detail. They have also done an exceptional job of creating a supportive environment for students and a collaborative environment for faculty
- Curriculum Committee, College of Science, Technology, and Business:
  The Physics and Astronomy program very clearly supports the core values of the university, with multiple courses, events, lectures, and learning experiences that speak to each specific value.
  …
  The program has very strong learning outcomes that culminate in the ability to properly analyze and interpret data and experimental uncertainty in order to make meaningful comparisons between experimental measurements or observation and theory.
  …
  The curriculum appears to be well-scaffolded The courses themselves are interesting and accessible with flipped classes, online learning, experiential learning, and hands-on research.
  …
  The curriculum in the Physics and Astronomy department also compares favorably to other Northern California universities and beyond.
  The self-study highlights a strong commitment to student-focused services that promote success.
  …
  [T]he department has developed a multi-faceted [enrollment] strategy that includes creating recruitment materials; establishing stronger relationships with local community colleges, including specific discussions about cross-enrollment opportunities; and being more actively involved in the university's admissions and recruiting efforts.
- UPRS Findings and Recommendations Report (from a draft on 2/17/2025):
  The program review clearly outlines the department's centrality in laying a strong foundation in Physics for incoming students, in supporting several other STEM and non-STEM programs, and in its contribution to the COPLAC identity of SSU.
  …
  The program faculty are very mindful of the university's strategic priorities and the core values of SSU. The alignment of the program's courses, methodologies, student support, and advising with these strategic priorities and core values is very clearly explained in the self-study document. As the external reviewer and the curriculum committee note, the program exemplifies high academic standards and is highly student-centered.
  …

> *The department has a detailed understanding of assessment methods and uses evaluation techniques suited to particular courses and programs.*
> *…*
> *The department effectively closes the assessment loops with departmental discussions and making required adjustments/refinements.*
> *…*
> *[T]he department attracts and serves more individuals identifying as female, underrepresented minorities, and first-generation students in physics. This demonstrates the department's adaptability and leadership in addressing the need to attract students from different demographics into STEM disciplines.*
> *…*
> *Despite the recent downturn, the program review notes that they are still placed in the top 25% of all bachelor's-only Physics departments for the number of graduating majors.*
> *…*
> *This is also among the top few program reviews that is very thorough in presenting their curricular improvements following previous program review and plans for future. It is clear that the faculty have engaged in meticulous work with regard to curriculum matrix and program learning outcomes, and their action plan demonstrates their implementation of multiple, well-suited assessment methods. They can be a model and resource for other departments in this regard.*

- Capacity and ability of the faculty to deliver current curriculum in pedagogically sound ways. (Excerpted from Program Review Self Study):
  - Student Success (SPSS)
    - Active departmental advising, including detailed 4-year and 2-year plans.
    - Recruitment efforts including connections to service-area Junior Colleges
    - Active use of the Care Team, LoboConnect, and Disability Services for Students mechanisms for supporting students
  - Academic Excellence (SPAE)
    - Clear and thoughtful Program Learning Outcomes (see Section 2.2)
    - Program-Specific Pedagogical Methods (see Section 2.3)
    - Two current faculty are recipients of the Excellence in Teaching Award.
  - Leadership Cultivation (SPLC)
    - Student professional development integrated into the curriculum by the Capstone requirement with students receiving one-on-one faculty mentoring and support through PHYS 491 – Capstone Preparatory Seminar
  - Course offerings
    - 26 distinct physics courses, 8 including lab components
      - 8 are service courses required by degree programs in other departments
      - 8 satisfy General Education requirements;
    - 9 distinct astronomy courses, 3 including lab components
      - 6 satisfy General Education Requirements
    - Majors required to complete capstone course

- Research done under supervision of a faculty advisor, Students present a poster at SSU Research Symposium and give talks at the Physics & Astronomy Symposium.

- Adequacy of resources available to deliver in a coherent manner sufficient breadth and depth of program curriculum. (Excerpted from Program Review Self Study):
    - 4 Tenure-Track Faculty and a 5th who has historically had no teaching responsibilities due to running the grant funded EdEon education and public outreach program. Additional Part-Time Faculty, Including 1 currently w/Ph.D.
    - Beyond SSU instructional spaces, the department maintains: two special-purpose physics instructional lab spaces, a stockroom with demonstration equipment, several advanced research labs, and an on-campus observatory (Dr. Severson, director). Dr. Shi from the Department of Physics and Astronomy is the director of the Keck Microanalysis Lab. Additionally the campus Makerspace originated from a Department of Physics & Astronomy grant award which also funded the development of SCI220: Dream, Make, Innovate which is taught by an adjunct in the department.

      Campus Makerspace, SSU Observatory, Keck Microanalysis Lab:



- Ability of the program to attract and retain well-qualified permanent faculty.

The Department of Physics & Astronomy Tenure Track Faculty have specializations that are aligned with the programs we offer and connected to local physics careers. All TT faculty have robust programs of scholarship and support students in capstone work. Our specialties fall in several broad areas: astrophysics (Cominsky, Severson, Targett), material science (Shi), optics (Severson), theory (Miller), and education (Cominsky, Miller, Severson).

- Professor Lynn Cominsky

Lynn Cominsky is an internationally renowned award-winning professor. She is an author on over 225 research papers in refereed journals, and the Principal or Co-Investigator on over $43 million of grants to SSU. Prof. Cominsky is the founder and director of the EdEon STEM Learning group, which develops educational materials for NASA, NSF and the US Department of Education. The group excels at K-12 teacher training, curriculum development, and the development of interactive web activities for students that teach math and science. Dr. Cominsky's most recent project is: NASA's Neurodiversity Network (N3): Creating Inclusive Informal Learning Opportunities Across the Spectrum. N3's goal is to provide a pathway to NASA participation and STEM employment for neurodiverse learners, with a focus on those on the autism spectrum. Prof. Cominsky was named SSU's Outstanding Professor, the California Professor of the Year by the Council for the Advancement and Support of Education, a Fellow of the California Council on Science and Technology, a Fellow of the American Physical Society, a Fellow of the American Association for the Advancement of Science, and was awarded: the Education Prize from the American Astronomical Society, the Wang Family Excellence Award from the California State University, and the Frank J. Malina Education Medal from the International Astronautical Federation. B.A. 1975 Brandeis University, Ph. D. 1981 MIT in Physics.

- Associate Professor Alexandra Miller

Dr. Miller's research is in the field of Quantum Gravity, which aims to answer one of the biggest open questions in physics today: How can one consistently unite Einstein′s theory of General Relativity with Quantum Mechanics? Dr. Miller is Co-PI on a Department of Energy RENEW-HEP Grant (Growth & Research Opportunities With Traineeships in High Energy Physics at Minority Serving Institutions). Other notable achievements including spearheading the Physical Science degree plan, including receiving a Teagle Foundation grant for the work; serving on the Cal-Bridge Steering Committee, Cal-Bridge is a CSU-UC partnership designed for CSU students interested in pursuing a PhD in physics, astronomy, computer science, computer engineering, or related fields; and her research, including authoring the first of a series of technical primers for undergraduate and graduate students: “A Conformal Field Theory Primer in $D \geq 3$”. She received her B.S. in Physics with minors in Theatre and Philosophy from San Francisco State University. She earned both an M.A. and a Ph.D. in Physics at UC Santa Barbara.

- Professor Scott Severson

Dr. Severson is Professor and Chair of the Physics and Astronomy Department, and a recent recipient of Sonoma State University’s Excellence in Teaching Award. Dr. Severson works in the field of astronomical instrumentation, most recently as Co-PI on the KAPAO Adaptive Optics System for Table Mountain Observatory. His scientific research emphasizes high resolution, near-infrared, high-speed photometry to measure transient phenomena in the universe. He serves as an external advisor for the Institute of Science and Engineer Educators (UC Santa Cruz), leading a recent paper on applying their professional development principles to mentoring student research. He is an inaugural consortium member of the Astronomy/STEM Alliance with Lick Observatory (ASTRAL), bringing access to this historic and productive observatory to undergraduates throughout the bay-area, including SSU. He has mentored nearly one-hundred student-semesters of undergraduate research and originated the department’s Capstone Research Seminar. Dr. Severson is the director of the campus observatory, and runs the popular Public Viewing Night series which regularly draws over 100 students and members of the public. He received his B.S. from University of Wisconsin-Madison and his Ph.D. from University of Chicago.

- Professor Hongtao Shi

Dr. Shi’s research is in Condensed Matter Physics, specifically the fields of Nanoscience and nanotechnology, magnetic thin films and magnetism, semiconductors, self-assembly, and photovoltaics. Hongtao Shi has worked extensively with local industry through his role as the Director of SSU’s Keck Microanalysis Laboratory. Dr. Shi was instrumental in the successful NSF MRI Proposal that acquired a Variable Pressure Scanning Electron Microscope with Integrated EBSD, EDS and CL in 2020. Hongtao Shi has over 30 papers in refereed journals for his work in studying the magnetic properties of new types of materials in journals such as the Journal of Applied Physics and Physical Review B. Dr. Shi’s degrees and institutions: Ph.D. West Virginia University, M.S. West Virginia University, M.S. Nanjing University, B.S. Nanjing University.

- Professor Thomas Targett (Chair)

Tom Targett is an author on 38 refereed papers on the properties distant of distant galaxies in journals such as Astrophysical Journal and Monthly Notices of the Royal Astronomical Society.

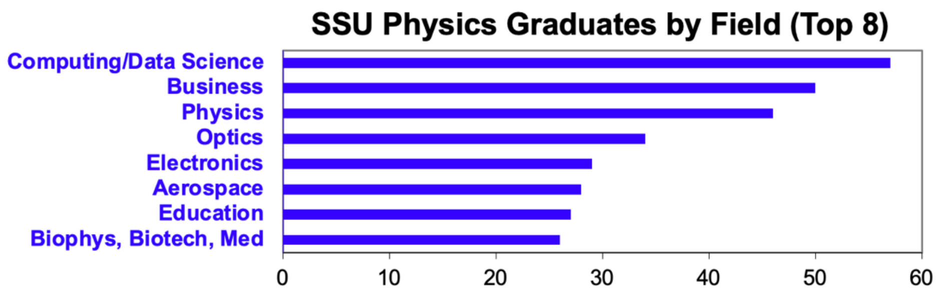
His work focuses on galaxy Evolution including the study of active galaxies and the first galaxies - their origin and properties. Dr. Targett is a member of several international astronomy collaborations and recent work includes James Webb Space Telescope (JWST) studies of the most distant galaxies, as well as crowd-sourcing solar eclipse data for solar coronal research. Dr. Targett leads the NSF-funded Engaging Community Colleges in Collaboration (EC3) program which implements residential research experiences (REUs) for local community college students at SSU. He is a frequent speaker on astronomical topics to schools, clubs and the media. He has an extensive record of service across department, school and university levels, and most recently served as the Faculty Co-Chair of the Academic Master Plan - Learning Spaces & Technologies Group. Dr. Targett's degrees and institutions: Ph.D. University of Edinburgh, M.Phys. Cardiff University.

- How the program's standing and excellence in its discipline contributes to the reputation of the university. (Selected Examples)
    - Professor Cominsky's EdEon is a well renowned STEM Learning Center that creates innovative experiences in formal and informal education for secondary and college students and has brought over $43 million in grant funding to SSU since its inception.
    - Associate Professor Miller, in partnership with Associate Professor Wing To of Stanislaus State was recently awarded a $950,000 grant from the Department of Energy for their proposal, Growth and Research Opportunities With Traineeships in High Energy Physics at Minority Serving Institutions (GROWTH-MSI).
    - Professor Severson's work with ASTRAL connects SSU students with UC Observatory and bay-area institutions such as UCSC, UCB, UCD, and a wealth of junior colleges.
    - Dr. Targett leads the NSF-funded Engaging Community Colleges in Collaboration (EC3) program which implements residential research experiences (REUs) for local community college students at SSU
    - Professor Hongtao Shi is the director of the Keck Microanalysis Laboratory, which opens new worlds of research on the molecular and atomic level for students, faculty, area junior colleges and high schools, and the local high-tech community.
    - The Department runs two popular public programs, the Public Viewing Nights at the SSU Observatory and the venerable "What Physicists Do" (WPD) public lecture series, now in its 109th Semester, with over 1000 speakers: 15 Nobel Prize recipients, 10 National Medal of Science recipients, 9 MacArthur Fellows, 8 Bruce Medalists.

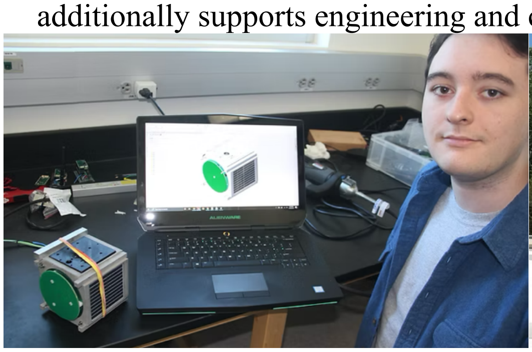
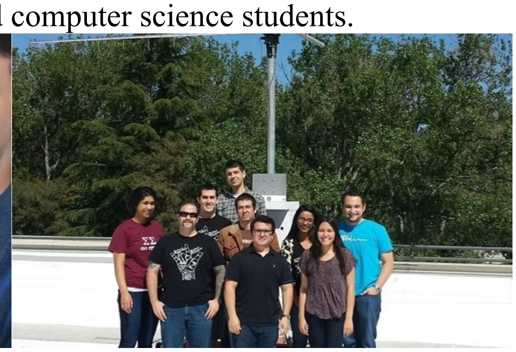
The centrality of the academic program to the curriculum of the University.

- The impact of discontinuing the program on the General Education Curriculum and on other academic programs of the University.
    - The Physics and Astronomy Department teaches a variety of "service courses" that primarily serve other departments.
        - PHYS 100, PHYS 102, PHYS 209A, PHYS 209B, PHYS 210A, PHYS 210B, PHYS 114, PHYS 116, PHYS 214 and PHYS 216 compose our Introductory Physics offerings at three levels, descriptive physics, physics with algebra/trigonometry, and physics with calculus. These courses are required by numerous degree programs including: Biology, Chemistry,

Computer Science, Engineering, Environmental Studies, Geology, Kinesiology, Mathematics and, of course, Physics.
    - The Department of Physics & Astronomy has a long tradition of offering both lower and upper division General Education Courses. The first semester lecture and lab courses of each of the prior service class plans and the very popular ASTR 100 and ASTR 231 serve as Area 5A and 5C GE courses. Other GE areas for our courses are Upper-Division Area 5 and Area 1C. In total we offer 14 GE courses.
- Uniqueness of the provided educational experiences.
    - Physics degree programs are essential because they provide a fundamental understanding of natural laws that drive innovations in a variety of fields, such as engineering and computer science. Physics enables breakthroughs in fields like quantum computing, materials science, and renewable energy that applied disciplines alone might not achieve.
    - Our students have an excellent track record of employment and entering graduate school.
        - approximately one-third of our graduates attend graduate school
        - According to https://www.sfchronicle.com/projects/2025/uc-csu-earnings/ Physics degree recipients have the fifth highest median earnings among SSU fields of study
        - According to our graduate surveys, our students end up in high-impact careers. Here are the 8 most common fields for our alumni:



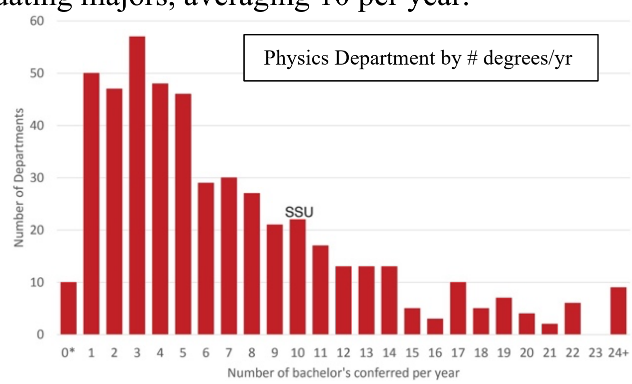
- Endangering the University's mission if the program were discontinued.
    - Education and Public Outreach. 50% of the entire campus' IDC (Indirect Cost grant funding) is from EdEon. EdEon requires Physics to exist, as these grants are reliant on the institution having a physics program.
    - Cubesats – Because of EdEon and the physics major, SSU has a space program. (Two launched, another in development.) The major is necessary for the grant acquisition. Physics drives the science case for these satellites, and the program additionally supports engineering and computer science students.

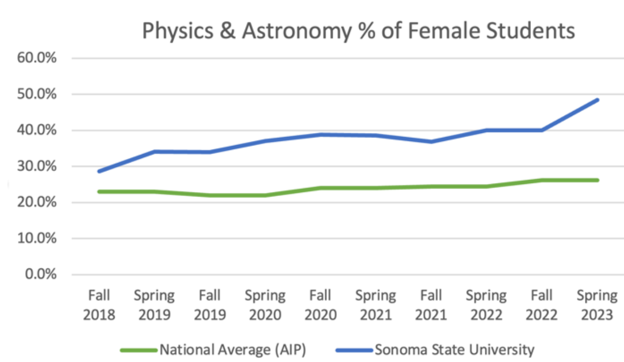
- The loss of the degree programs will further impact the University's mission in the following ways as we lose our population of majors:
    - The loss of the 'What Physicists Do' lecture series (listed above, running for over 54 years. The parent class, PHYS 494 will go away as will the student assistants.
    - The loss of the Public Viewing Nights which have run since the 1970s. Student assistants trained in astronomy and physics are integral to their operation. GE Courses ASTR 100 amd ASTR 231 will be affected by this loss.
    - The loss of physics majors as embedded tutors and supplemental instructors in high DFW rate service courses. Their presence as sources of aid in these courses is a main effort of the department to ensure programs like Engineering keep their up their retention/graduation rate numbers for accreditation.

Enrollment trends and numbers of degrees granted in the program, and the future prospects for these.

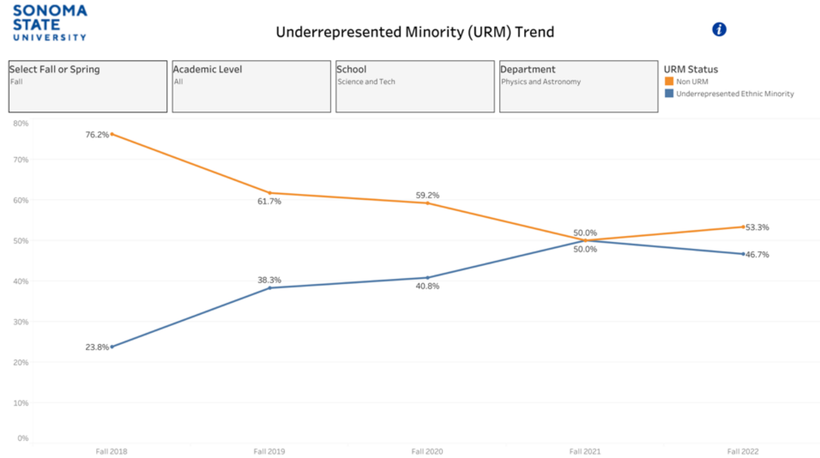
- Our program ranks at the 75th percentile of all bachelor's-only Physics departments for number of graduating majors, averaging 10 per year.



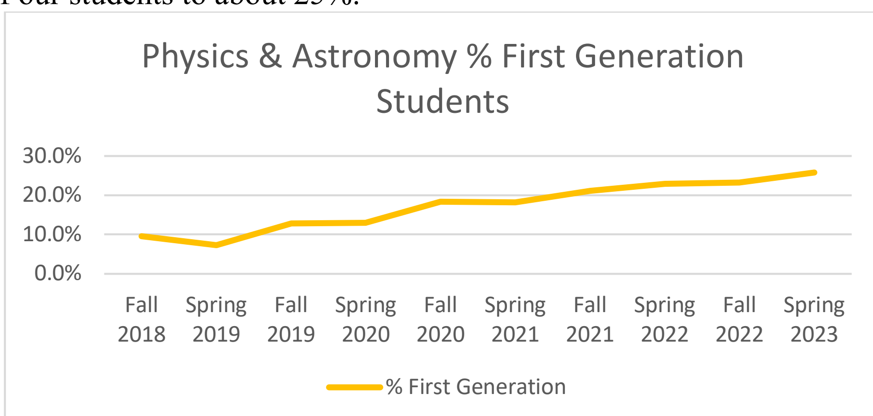
- Our recruitment efforts have yielded remarkable results. Efforts to improve our website, our 4-year and 2-year plans, and recruitment efforts giving talks and sending posters and bookmarks with QR codes have paid dividends. Our 2024-2025 incoming number of majors is 12 students in the First-year physics sequence and 4 more as junior transfers. This is an increase of 60% over historic averages.
- Women in STEM – SSU P&A has exemplary gender balance due to intentional choices in creating a department culture, recruiting, retention, and the introduction of an Astrophysics concentration to the BS Physics degree.



- The Sonoma State University Department of Physics & Astronomy has seen remarkable growth in the percentage of Underrepresented Minority (URM) students as seen in the figure below. This percentage begins at 24% in Fall 2018 and grows to 47% in Spring 2023. Our percentage of URM students is greater than the national average.



- We show remarkable growth in t First-Generation students in the Department of Physics & Astronomy. Between Fall 2018 and Spring 2023 this population has risen from about 10% of our students to about 25%.



The needs of the service area and other constituencies.

- As stated earlier, our programs are designed to meet the workforce needs of our local businesses and produce informed citizens with a strong public liberal arts foundation.
    - Notably, our graduates have become local business leaders and SSU Donors (e.g. Geof Syphers, 1993, CEO Sonoma Clean Power; Ernest Ongaro, 2019, CEO Ongaro and Sons)
- Our impact goes beyond the campus with our two long-running and popular public series. The Science 220 course connect community partners with student makerspace projects
- Our faculty, working with and employing students, conduct research, collaborate, and run education and public outreach programs that have impact at K-12 schools, junior college partners, within the CSU, and to the UC system and beyond.

Conclusion: All these exemplary outcomes result from having these degree programs. The Discontinuance Proposal destroys all of this. The discontinuance will impact students well beyond those in the degree plans, impacting co-curricular offerings (like the observatory) and support in service courses essential to remaining programs.

Katherine Bradley 2027+

When selecting a university, I applied to numerous institutions across California, including many within the UC system. While I was fortunate to be accepted into almost all of them, I chose Sonoma State University for its small class sizes and the opportunity to build meaningful relationships with my professors. This decision has proven invaluable, as SSU has provided me with an enriching education and opportunities I would not have found elsewhere. Working for Dr. Cominsky's grant-funded research unit, EdEon, has allowed me to develop skills in STEM education research, programming, and curriculum development, strengthening my ability to pursue my goal of becoming a physics professor. Additionally, a faculty member has provided me with laboratory space and equipment to develop engaging physics education tools using virtual reality. These experiences have been pivotal in my academic journey, and I fear that eliminating SSU's physics program would deprive future students of similar opportunities.

The professors and lecturers at Sonoma State University have been more than educators to me; they've been personable mentors. The conversations I've had with faculty outside of lectures have provided me with invaluable wisdom and profoundly impacted my future. Discontinuing the Physics program would deny current and future students the chance to engage in this supportive and enriching educational experience, ultimately hindering their ability to pursue their career goals. Students who thrive and place value in personal learning environments and close-knit academic communities should have access to higher education institutions that meet their needs. Cutting Sonoma State's physics program would be a disservice to them and our economy, which relies on innovation from diverse people.

Please consider the broader impact of eliminating programs like Physics and work side-by-side with educators to find alternative solutions. I urge the Board of Trustees to reconsider the proposed cuts and to protect the programs that make SSU a place where all students can thrive

Testimonials

Andrew Rosso 2026

I chose to start at Sonoma State last fall because I was interested in the proportionally extremely diverse range of collaborations and capstone projects available through here. This high amount of connections to other institutions also translates to significantly more funding grants to SSU compared to other departments. I have already in my short time here very much enjoyed the quality of the physics department, and the willingness of my teachers to help me succeed. I hope that this program can continue long after I graduate, and future students will be afforded the same opportunities I have today.

Daniel Downey 2026

The Physics Department at Sonoma State is the reason that I didn’t drop out. The passion and skill of the faculty was a life preserver in a sea of turmoil that was covid. Physics is such a fundamental discipline that underpins the mechanics of how our world works. Defunding it would be a mistake. Investing in the Physics Department is investing in the future of our students and the future of California. Save Sonoma Physics!

Ben Montalbano 2026

[Posted in support of Save Sonoma Physics]

Madison Ambriz 2025

As many others, the first physics class I had take I was fretting over, all I'd ever head was how hard, tedious, and time consuming it is. That is until I actually took the class for myself. Now don't get me wrong, it was the hardest, most tedious, and most time consuming class I had ever taken in my entire life. But as a current senior at SSU, I grew a passion for understanding the universe, and the world all around us. Physics is not only the application of math, it is a way of thinking, a way of seeing the world, and a way of deduction. It is the foundation for all physical sciences and the next step to uncovering mysteries of our universe.

During my time at SSU I have been shown how to fail and how to get back up and succeed. Working so closely with Dr. Miller and Dr. Shi have taught me a work ethic I never knew. I now know how to teach myself material, ask the right questions, how to collaborate, and so much more. These skills directly apply to my job at LBNL, where I collaborate with my team but also spend hours by myself learning new information. I have been able to watch not only myself, but all my classmates around me, grow and succeed. Whether we have graduated or not, we are all making a difference around our communities and beyond. This was only possible due to our hard working professors, and amazingly integrated physics community.

Physics is also just that, a community. It is filled with people who care, people who work hard, and people that go the extra mile. Our department is no different. Everywhere you look you'll see professors dedicating their lives to teaching the next generations, students dedicated to working together and helping each other rise to the top. Because of this amazing community I have had the chance to work with some of the most amazing people, people who I will be lucky to consider life long friends.

If the SSU physics department is gone, community involvement dissipates, research dwindles, and the ability to spread the love and joy of science and math vanishes. Please let us give these amazing opportunities to the next scientists.

Logan Rubalcava 2025

Never before have I seen a group of people more dedicated and more passionate than the students and faculty here in the SSU Physics and Astronomy Department. Although small we are a community of like minded people who put everything they have into their programs and have done so much good for SSU throughout its history such as the Makers Spaceand to cut a program because of its low enrollment and ignore all the positives this program has done not only for the students, but the campus as a whole need to be taken seriously. I know it would be a great loss to this university if we were to lose the physics degree programs. Please! Save Sonoma Physics!

Christopher Bell 2025

Years before, my senior year at high school during the spring of 2020 had been upended by certain events, and along with many other people, my graduation was wiped out and initial plans for college were destroyed. After over a year of turmoil, I had settled on a new roadmap to go forwards which rested upon what Sonoma State's Physics and Astronomy Department had to offer, and I became a transfer student here to pursue an Astrophysics B.S. in the fall of 2023. Once I arrived, I was welcomed into a department with faculty, fellow classmates, coworkers, and off-campus partners of the department who have helped me sharpen my goals for the future and the skills required to pursue them, which has allowed me to continue more firmly reconstructing what I lost due to the pandemic.

For years I have been working in EdEon, a STEM learning center at Sonoma State funded entirely through outside grants, a portion of which incidentally is paid into the campus budget. For over a decade EdEon has been successfully supplying resources for STEM education in many rural high schools across both California and Texas via the Learning by Making (LbyM) program in partnership with other institutions, and scarcely a year ago as a result of this accomplishment, it received nearly $8 million from the US Department of Education to further expand that program into STEMACES to serve at least forty high schools in both states. But despite these achievements, among so many others including two cross-country campaigns to image and analyze total solar eclipses, the employment for at least two people strongly contributing to the successes of EdEon have been endangered by these cuts, harming them, EdEon as a whole, and everyone who could be served by these programs.

A year ago, I was one of the students working together in our astronomical imaging class to use the Shane telescope at Lick Observatory, where we contributed to gathering data for published scientific research. Following that, I was fortunate enough to take part in the STARs program and engage in my own independent research using the Nickel telescope at the same facility following certification as an approved user, an opportunity to utilize a premiere astronomical observatory which has been a hugely transformative experience for me. Many people both on- and off-campus have worked to help set up the infrastructure to make that happen, and it was my personal hope that there would be many future Sonoma State physics students who would also gain the opportunity to engage in their own research and astronomical imaging projects using the facilities at Lick, perhaps something which could entice potential physics and astronomy students to Sonoma State.

Speaking personally, I am lucky enough to have enough weight in units to (ideally) graduate with my bachelor's at the end of this semester. The same however can't be said for what was to be the largest class of freshman entering physics at Sonoma State in many years, a promising sign of growth for a department which has generally functioned smoothly and effectively despite years of upheaval for the campus.

Sonoma State is already experiencing a crisis of low enrollment. When these new students, now experiencing their own educational turmoil, are forced to transfer to other universities still offering physics (and other) degree programs to complete their education, who will replace them? When prospective future students simply bypass Sonoma State for those universities, who will in turn replace them?

I hope that this decision is reconsidered.

Obinna Kalu 2024

I am actually a Computer Science BS graduate. However one of the most rewarding and impactful projects I worked on was in collaboration with our physics department. The NASA Eclipse megamovie project was a massive benefit to my personal development, and has been influential to my life post-grad.

Jake Watkins 2022

I went into Sonoma State not knowing what I wanted to do, I was undeclared and simply chose the school because I loved the campus and the people. I wanted to do physics but honestly did not know if I was smart enough to or not. I took my first physics class with Dr. Targett and ended up declaring for a Physics major. I love physics and that love was amplified by every professor in this department. I don't think I could've gotten my degree if it weren't for the infectious passion they all have for science. My graduating group was only 8 people (don't fact check that). This small size was our strength. We all knew each other, faculty included. The professors knew my strengths and my weaknesses and their doors were always open to provide me with aid. This tight knit physics community allowed myself and many others to achieve success that they otherwise would not. I know my success is not mine alone but the realization of the efforts of everyone who worked beside me in this wonderful program.

I believe that the Sonoma State physics program is a true gem. I would not choose to have gone anywhere else. If this program gets taken away, this school will have removed one of its best departments, and have broken the hearts of many former students like myself who wish for this program to be available to all who come after us. I urge the CSU system to reconsider their decision.

Gage 2021

As an alumnus of Sonoma State University's Physics Program, earning my B.A. in Physics in 2021, I am deeply saddened to hear about the program's potential closure. The education and experiences I gained from this program were pivotal in shaping my career and life path. The physics staff at Sonoma State are top-notch and subject matter experts who are deeply invested in their students' success. Dr. Jones, in particular, had a profound impact on my academic journey. His guidance on my senior capstone project, which focused on spatial disorientation in pilots, was instrumental in my understanding of this topic.

Throughout my studies, I absorbed valuable knowledge that directly translated to my current career as a cargo pilot. The insights I gained on spatial disorientation have been vital in ensuring my safety in the demanding single-pilot freight environment. Moreover, the program's comprehensive physics curriculum helped me grasp complex concepts that I now teach to over 50 students, enriching their understanding of flight fundamentals and the physics behind them.

The Sonoma State Physics Program is more than just an academic curriculum; it is a cornerstone that fosters critical thinking, practical skills, and professional growth. It would be a great loss to future students and the broader scientific community to see this program disappear.

Alex Vasquez 2021

The level of educational advancement and outreach facilitated by SSU Physics and its faculty cannot be understated, and I'm proud and thankful of every teacher and mentor I had while I was there. While I first became a student at SSU in 2019, the beginning of my experience with SSU began in the Fall of 2015. I was a community college student at the time and Dr. Lynn Cominsky was the head of the physics department at the time. I had been advised to talk to her and ask her for something to work on. Communication was difficult for me due to my being autistic. Dr. Cominsky assured me that was not a problem and set me up with a project tracking potential asteroids suspected by the International Astronomical Union Minor Planet Center, which I did for the 2015/2016 school year. This was the start of a years-long partnership, assisting in the testing of experiments for their Learning by Making curriculum development program, and the development of EdgeCube, SSU's second cube satellite.

As an undergraduate student at SSU, I had the honor of being the first ever student from the campus to become a Cal-Bridge Scholar, being awarded a scholarship in no small part thanks to the work I was able to do with the physics program. I saw the rise of community centers such as the Maker Space, made possible by Dr. Cominsky. I was honored to be someone who inspired Dr. Cominsky to start yet another mentorship program. Seeing there were autistic students with strong math skills and interests in STEM careers, she enabled SSU to launch the program NASA's Neurodiversity Network, or N3. This program has created a network of people across the country who identify neurodivergent students with the skills to benefit from being provided with STEM research opportunities. N3's team mentors yet more mentors to work with these students, providing STEM educators and researchers an opportunity to engage with the neurodiverse community, and neurodiverse students continue to grow their knowledge and passion for STEM.

When I started my PhD program at the University of California at Irvine, I wanted to support other neurodivergent students and quickly helped create a neurodiversity support group. By the end of my first year, I had been awarded the NSF Graduate Research Fellowship for my proposed research. In my proposal, my two long-term goals, the improvement of materials used in solar cell devices, and providing educational outreach to local communities surrounding solar energy and space sciences devices, were both inspired by Dr. Cominsky and my time on the EdgeCube research project. And it was thanks to the team at the SSU physics department that I was able to host an outreach event of my very own for the "Science-Based Sonoma County Home Educators" group. Something I learned from one of my first internship experiences with Dr. Cominsky was to create hands-on learning experiences for students. Dr. Cominsky provides for many hands-on learning experiences for students, by teaching teachers to provide those activities to their students, through the many programs she has started. Following her example, I created a hands-on project so the students could build model cube satellites, while learning about their applications for a multi-sensory learning experience.

SSU has not just been a place where I've found mentors, but a place where people become mentors on their way to learn physics. Many of my SSU undergraduate peers and I not only have been provided with the experience to get where we are now, but also have been put in a position to help mentor others for years to come. I will always be grateful for everything this department has done for me, who it helped me become, and will continue to pay it forward through mentoring others in the future.

Meghan Miller 2021

I originally started off as an anthropology major at SSU, but during my sophmore year I switched to the Physics degree path. The faculty of the SSU Physics and Astronomy department are some of the kindest, hardworking, and intelligent people I've had the pleasure of knowing. My time on SSU's campus was cut short due to COVID-19. My professor's effort in keeping our online classes informative and engaging, while also understanding the mental and physical toll the pandemic was taking on everyone, was really amazing to see. I'm so grateful I got to work closely with Dr. Laura Peticolas during my senior thesis, and while working at EdEon, a STEM education company run by Dr. Peticolas and Dr. Lynn Cominsky. It was so inspiring to see successful women working in the field I'd hope to go into, which is largely male dominated. I was one of three women in my graduating class, and had only one female professor, Dr. Alex Miller, in my physics classes. It is crucial to maintain STEM programs, especially for women and girls, who are often not given the opportunity to go into these fields. Please do not let SSU be another one of the institutions taking away these opportunities.

Loren Heins 2021

I earned my bachelor of science in physics with a focus on astronomy from SSU in 2021. I had transferred to SSU from another CSU after feeling lost and confused about what I wanted to do with my academic career and the moment I stepped into the Physics department I immediately felt at home. Dr. Severson was the first person I met, he changed my perspective on education forever, he made me feel capable and excited about Physics. Then I met Dr. Targett and his inspiration, passion, and enthusiasm for astrophysics changed my life. I came to SSU so unsure of what I wanted to do and by the time I left I had so many dreams. This is not something you'll find just anywhere, the physics department at SSU is home to a unique group of passionate teacher who will inevitably leave a positive mark on each of their students lives. At other CSU's I felt overlooked and unimportant, but not at SSU and not in the Physics department. Allowing this department to close would be one of the biggest mistakes you could make, the Physics department is a cornerstone of this school and without it SSU will lose its shine. I will forever be grateful for the education and experiences I had during my time at school and it would break my heart to know no one will ever experience the department the way I had the privilege of experiencing it if you shut it down. Thank you for changing my life for the better SSU Physics.

Jeffery Reedy 2020

My journey to the physics side of the force began with meeting with Dr. Jeremy Qualls back in 2015 and discussing the program with him. He was supportive and thought I would be a good candidate. For a while, I thought about it and really wanted to create a positive change in my life. I made the plunge and took the risk of going back to university after a lapse of 20 years. I am so glad that I did. I found the problem solving aspect and critical thinking and rigorous application of the scientific method. I use the acquired skills every day in all aspects of my life.

I am paying it forward working with Drs. Laura Peticolas and Lynn Cominsky's department of Edeon STEM Learning at SSU. Our mission is simple: Bring STEM curriculum to 8th and 9th graders and bring others to study and have careers in STEM.

I believe what I am doing now would not have been possible if it were not for the supportive staff and faculty such as Drs. Targett, Shi, Cominsky, and Severson. The physics program gives opportunity to students. I urge the decision makers not to make the short sighted decision to cut the program. It should be encouraged and supported so that others can have that same opportunity.

Testimonials

Jorge Bautista 2019

The SSU physics departments currently provides SSU students with a chance to breach into fields that they might have not considered.

As a school in the Northern California, home to technological advances in Silicon Valley/Bay area, a lack of formal physics education would severely hinder prospective students from enrolling.

I sincerely urge the decision to be reconsidered.

As a graduate from the physics department, the Scientific training I received at the physics department geared me towards success in the tech industry as I learned how to approach decisions from a more data based approach.

Erik Castellanos-Vasquez 2019

I earned my BS in physics with a minor in astronomy from Sonoma State in 2019. The physics department at SSU provided me with the opportunity to study physics at a university that was not far from home as I am a first-generation Latino college student so it was very important for me to reduce the financial strain by studying close to home while at the same time continuing my higher education. Despite the smaller size of the Physics and Astronomy Department at SSU, it was able to provided us the opportunity to truly engage with our professors in smaller classroom settings and made it very easy to reach out and interact with our professors regarding any issues or questions we had.
After graduating from SSU I was able to work on campus as a part of the EdEon group and as a lab instructor for a lower division physics lab for a semester before I was off to get my MS in Aerospace Engineering at UCLA. I have now been working at the Space Sciences Lab at UC Berkeley as a Spacecraft Controller for the last two years helping to operate some missions including NuStar and THEMIS, and have been preparing for future missions including Carruthers and ESCAPADE.
I am truly grateful for the opportunities that were provided by the Physics and Astronomy department and I urge the university to not make cuts to this department, otherwise it will affect future generations by not providing them with the opportunities I was fortunate enough to experience during my time at SSU.
As you read through the other testimonials written by other graduates it becomes very clear the wide range of success that has come out of the Physics Department and the positive impact is has had on so many people and the potential is has for future graduates.

Isabella Amyx 2019

I was extremely fortunate to receive my Bachelors of Science from Sonoma State in 2019. SSU has a extraordinary and unique Physics program what provides students with a rigorous program while receiving exceptional mentorship from professors. As a student-athlete with a complicated training and travel schedule, I was always supported by my professors to ensure that I was given the same opportunities as my fellow students. Additionally, with a smaller program like the SSU Physics program, I became very close with all of my classmates which was a very unique experience compared to other degree programs. It was with this support and sense of community from the SSU physics professors and my classmates, that I gained the confidence to enter my career in engineering and eventually receive a masters in Mechanical Engineering so that I could make an impact in the clean energy space. I urge the CSU system to reconsider this decision to ensure that futures students can have access to an incredible program like the Sonoma State Physics Department.

Ernest Ongaro 2019

Sonoma State University's Physics Department changed my life. The rigorous education and mentorship I received from Dr. Severson, Dr. Shi, and Dr. Targett taught me more than just physics—they instilled persistence, ingenuity, and the confidence to tackle any challenge. These lessons have been foundational in my journey from a student to the President and CEO of a thriving local business.

Physics isn't just about equations on a board. It's about problem-solving, critical thinking, and learning how to break down complex systems—skills that I apply daily in managing budgets, forecasting success, and driving innovation in the trades. My physics degree empowered me to transform my family's company into a leader in the industry, and I am proud to give back through three scholarships: a physics-specific award, a Green Science Award for sustainable technology, and a travel fund to ensure students can attend transformative events.

Sonoma State's Physics Department is not just a program—it's a community that fosters excellence. Cutting it would be a devastating loss, not only to future students but to the industries and innovations that depend on the problem-solvers this department produces. I urge the university to recognize the true value of physics and fight to keep this program alive.

#SavePhysicsSonoma

Jake Davidson 2019

I am writing to express my deep concern over the potential discontinuation of the physics bachelor's degree program at Sonoma State University. As a proud graduate, I can personally attest to the profound impact this program has had—not only on my education and career but also on my ability to think critically, solve complex problems, and contribute meaningfully to society.

Physics is not just an academic discipline; it is the foundation of innovation, technological advancement, and scientific discovery. The skills I developed through my coursework—problem-solving, analytical thinking, and quantitative reasoning—have been invaluable in my professional life. More than that, they have allowed me to approach challenges with curiosity and resilience, a mindset that is crucial in today's rapidly evolving world.

Eliminating this program would not only be a loss for students who seek to pursue careers in STEM but also a detriment to the university's reputation as an institution that fosters intellectual curiosity and academic excellence. Universities should be expanding opportunities in science and technology, not cutting them. Future generations of students deserve access to the same transformative education that I received.

Zachary Kurland 2018

I like to say that physicists are like the special forces of the scientific community; you can place us into any technical environment, and we will thrive (I mean, just look at our "What Physicists Do" seminar!!!).

The education I received from SSU's Physics & Astronomy Department has proved itself foundational to the success I have enjoyed in life. I received my Ph.D. in physics in July of 2023, and am now a Technical Lead on one of our nation's most critical engineering efforts.

SSU's Physics Department nurtured my ability to think critically and solve problems through the practical application of theory. In fact, the highly personal and hands-on approach to learning I experienced has proved itself valuable beyond compare! I will forever be grateful for my experience at SSU, and I thank the wonderful faculty for their passionate approach to teaching our future doctors, engineers, business owners, and leaders.

Physics = Progress.

Casey Lewiston 2017

The critical thinking skills I developed when studying for my physics degree has made me, without question, better at my job. As a first generation college student from a lower income family I wasn't sure about getting any kind of degree, but the faculty was welcoming and the material turned out to be exactly what I needed to focus and develop a professional career. The fundamentals of physics apply to much more than just physics itself; I'm a better software developer, communicator and organizer for having had this experience. Losing a program that has brought in substantial grant funding and resources for SSU would be a loss for the community. Doing so at a time when data science and related jobs are becoming more and more important would be a huge mistake for the university.

KB Smith 2017

I graduate from Sonoma State with a BA in Physics in December 2017, where I had also acted as Outreach Coordinator for the Society of Physics Students and was briefly one of the student assistants for our renowned What Physicists Do seminar. My primary interest was related to planetary studies and I did my Capstone project measuring the transit of an exoplanet around its star. I was surprised during my time to learn how many CSUs did not have as extensive astronomy resources, given astronomy is one of the gateways to science, while at SSU, I took multiple astronomy-centric courses on astrobiology, cosmology, and more. Additionally, I learned that many UC physics programs didn't even have the equivalent to the capstone project that CSUs have, with more emphasis being put on graduate studies. It is necessary that CSUs maintain their science programs and physics in particular. In these classes, even the ones not focused on my primary interests, I learned so much about how the world around me works. As someone not at a UC or private school, I would not have had this opporunity had the program been cut. Currently, I am a graduate student getting a Master's in Geography and GIS with the aim of mapping worlds outside Earth. These interests were ignited due to SSU's physics and astronomy courses offering much for a broad range of fields.

Demitri Call 2016

Physics and Astronomy plays a critical role both within Sonoma State, and in the greater community. Many graduates of the program go on to stay in the area and contribute to local technology innovators like Keysight Technologies. Many others, myself included, have continued their education in various graduate programs. I grew up in Sonoma County and without the opportunity to study physics at my local university for my bachelors, I would not have a PhD today. One cannot overstate the need for this program within the community the University serves.

A physics program at SSU enriches both the university and the community. SSU has benefited from excellent physics faculty. The removal of this program will hurt the university's ability to attract the necessary talent to serve as foundational educators for other STEM and pre-med programs. If SSU desires to stay relevant as a hub of education, alternative methods to balance this budget need to be taken. Short sighted measures will not benefit the university, the students, or the community in the long run.

On a personal level, the experiences SSU Physics offered were numerous, unique, and crucial to my development as a scientist and as a community member. Larger university physics departments are not able to provide the level of one-on-one teaching that Sonoma State does. Nor do larger universities have opportunities to learn and begin teaching as a student like SSU does with the Observatory and the Public Viewing Nights. Furthermore, without the close interactions and support of the faculty within the physics department, I would not have had the opportunities or encouragement that resulted in an internship on Capitol Hill, acceptance to a graduate program, or a council seat for the National Society of Physics Students. Future students deserve these opportunities. I implore SSU to change their decision and maintain a physics program.

Angelica Sanchez 2015

Angelica Sanchez 2015

During my first few years at SSU I was completely lost academically. The major I had originally chosen was a part of a large department where l felt like I was simply a number in a sea of students. My professors were strict and unapproachable; moreover, trying to schedule office hours with them was like playing the lottery, hoping I'd be lucky enough to find one hour of availability.

Thankfully, the general education requirements forced me to take different classes and the day I first sat in my intro to physics course, completely changed my academic journey. The professor came in with such joy and showcased a passion for teaching which made me want to learn. The material captivated my attention and I finally felt like I found where I belonged. I instantly decided to switch my major.

From that moment on my academic journey at SSU became joyful and positive. At that time, the physics department was small, but mighty. I got to know all the other students majoring in physics and my professors actually knew my name! In the breaks between our classes, physics students and teachers would share snacks in the study room upstairs in Darwin and we'd help each other with our homework and study together for upcoming tests.

The physics department truly felt like a community, a home away from home. I will forever be grateful to My mentor, Dr. Severson as he'd continuously check in with me and make sure I was taking then right courses and was on track to graduate. Truth be told, he gave me more academic guidance than I had ever received from the academic counselors in Salazar Hall.

The physics department truly looked out for their students. They offered us more than just a degree. They brought us stability, positive student-teacher relationships and they fostered a positive educational experience. I am thankful to have had the opportunity to graduate from SSU as Physics Major and hope my high school students have that opportunity in their future as well.

Angelica Sanchez
Teacher
Fort Bragg High School

Max Torke 2015

Sonoma State was an incredible place to study physics. The professors were deeply concerned with the education and success of their individual students in a way that would not be possible at a larger university. The department fostered a tight-knit group of students and graduates as well as professors.
I worked on a project alongside numerous other SSU students to develop a satellite that was ultimately sent to space. That experience enabled me (along with another SSU student) to get a national internship immediately post-graduation. Thanks to the connections I made with students and faculty during my time at Sonoma, I have received multiple opportunities that have enabled me to have a fulfilling career in the science and tech sector.
This past year, I matriculated to MIT, where I am pursuing a dual-degree MBA and nuclear science engineering masters. I have no illusions that I would have been accepted into this program without the individualized attention I received while at SSU, the opportunities that followed as a direct result, and a recommendation letter from a current faculty member of the Sonoma State Physics Department provided nearly ten years after my graduation! This is what the Sonoma State University Physics Department offers: an incredible education and a lifelong connection to the students and faculty of this fantastic department.
Please don’t prevent future generations from having the same opportunities I did. Save Sonoma Physics!

Clayton Piatt 2015

I earned my Bachelor's degree in physics in 2015 after four years of learning from, and performing research with, the fantastic faculty and staff of SSU's physics department. Dr. Severson and the rest of the faculty worked with me to develop a course of study that allowed me to combine my interests in physics with applications in environmental technologies and engineering. This laid the foundation for me to attend UC Berkeley for a graduate degree in engineering, and started me on the path to my current career. I now hold a leadership position in engineering at a renewable energy company, developing and building power plants that will fight climate change and support growing energy demand in the US for decades.

The excellence of the faculty and facilities at SSU's physics department, diversity of courses, collaborations with other departments, and value for tuition all stand out to me as unique among similar programs based on conversations I've had with other physics majors in my career. Growing up in Northern California, I'm proud to have attended such a high quality program at a local university, and hope that future students can benefit from the same programs in the future.

Angelica Sanchez 2015

My first few years at Sonoma State, I felt a little lost academically. I wasn't happy with the major I had originally chosen, had no relationships with my professors and simply felt like a number in a classroom full of students.

It wasn't until I took a Physics course for my general ed, that I finally felt like I found where I belonged. I instantly switched majors and from then on, my academic journey completed shifted. I no longer felt like another face in a sea of students, my professors actually knew my name! Moreover, they made me feel safe and comfortable to speak up in my classes and ask questions. During my time at SSU, the physics department was small but mighty. I knew almost all of the other students majoring in physics, shared snacks with classmates and professors in the study room in between classes and truly felt like I had a home away from home.

My mentor, Dr. Severson checked in often making sure I was taking the right classes and on track to graduate, offering me more academic guidance than any of the academic counselors on campus ever had.

The physics department truly took care of their students and I am so thankful to have had the opportunity to graduate from SSU as a Physics major. This program offers more than just a degree, it offers students stability, guidance and positive relationships that help foster an excellent education.

Angelica Sanchez
High School Teacher

Angelica Sanchez 2015

Amandeep Gill 2015

As a graduate of the SSU Physics and Astronomy department, I am strongly opposed to eliminating this department. The impact of the P&A department on the lives of their students and the larger campus community is innumerable. I graduated from SSU in 2015, with my B.S. in Physics and a minor in Astronomy. I completed my Ph.D. in Physics from the University of Nevada, Reno in 2023. My achievements within the realm of physics, research, leadership, and advocacy/policy-related all stem from the highly personalized support and teaching I received at SSU.

What makes the SSU P&A department so unique is that it is a well-rounded physics department at a teaching university. You take all of your classes with professors and lecturers, this sets us apart from bigger, R1 institutions where labs are often taught by graduate students. Despite the size, there is a rich research environment, providing a lower barrier for undergraduate research experience, having been in other departments, I have seen how rare this is. Additionally, the Physics Club, Society of Physics Students (SPS), provides peer-to-peer support, unparalleled by what I have experienced at other institutions. One of the main issues in Physics is the lack of support for under-represented groups - BIPOC, women, LGBTQIA+, etc - and when we are as inclusive as possible, science benefits. A small but mighty department can provide this support while prepping students for competitive internships and graduate schools. Taking away this resource hurts not only the campus and surrounding Sonoma County communities, but also affects the far-reaching work of bringing and retaining under-represented groups to Physics as a subject.

Personally, I contribute my major successes to the teaching, guidance, and care of the SSU P&A department. As an undergraduate transfer student, I came in with the plan to complete a B.S. in Physics but no confidence in going further. This department, particularly the mentorship of Dr. Lynn Cominsky, instilled in me the confidence and deep desire to contribute not only to scientific research but, like her, help the women and minorities who come after me by actively engaging in advocacy and outreach. I have, and I will carry this with me for life.

Cutting the Physics and Astronomy Department would be a terrible misstep by SSU.

Kevin Zack 2014

I earned my BS from SSU's Physics and Astronomy department, which gave me a deep understanding of physics that I still use everyday. The projects I worked on at SSU catapulted me into my masters program where I received my MS in Electrical Engineering at Montana State University. I was hired at the Applied Physics Lab at the University of Washington, where I worked on developing instrumentation to study the effects of global warming on our oceans, not because of who I knew but what I knew. My understanding of physics helped me work closely with the scientists to achieve results that would have been impossible without the background I received in the Physics and Astronomy department. Currently I work for the Laboratory for Laser Energetics at the University of Rochester where I work on direct drive laser nuclear fusion in support of the National Ignition Facility and other National Labs in the US.

I was appalled to hear about SSU's shortsighted decision to eliminate the the Physics and Astronomy department because now is not the time in our history that we should be getting rid of the scientists and engineers -- we need all hands on deck to solve the issue of global warming. Climate instability is here. SSU's role in combating this is producing quality scientists that have the critical thinking skills to apply physics in unique and novel ways to attack this problem in as many ways as possible – this might come as educational out reach, becoming scientists, or teachers that will instruct future generations. Every little bit helps. SSU has provided necessary education to those who might otherwise not been able to access and harness the skills and knowledge that is necessary to the progress we must attain. If SSU Physics and Astronomy Department did not exist I would not have been able to go to college at all.

The purpose of a university is to give its students the knowledge so that they can go forward to a make a better world. It is an investment in the quality of life we and future generations experience in the years moving forward, not only in this fiscal year. The repercussion of this action will be felt not only by local families, businesses, and institutions, but globally. The lack of foresight of this action is abhorrent, and I beg you to reconsider cutting the department. This department's existence is not merely a line item on a budget sheet, it is a moral imperative that it be allowed to continue.

SSU's motto is Lux Mentis, Lux Orbis – do not let it go dark.

Jacob Lewis 2014

The Sonoma State University Physics department was a watershed era of my life. My time there unlocked a path in my life that K-12 teachers in nearby Solano County always suspected possible, but never foresaw actually coming to fruition. After studying Physics at SSU, I would continue my education and complete my PhD in Materials Science at University of California, Riverside. While there, I found myself more than adequately prepared for advanced study, relative to peers of larger universities. Now I work as a data Scientist for the semiconductor capital equipment company KLA, with numerous personal side projects that excite me greatly.

My path was through SSU Physics. I do not have confidence that path would have materialized in a different place. SSU represented a safe place - close to my family - for me to study and mature as a person within an environment of close mentorship that I found from experience is not always offered at the undergrad level. I will never forget what SSU Physics provided for me, and I hope it will continue to for others.

Hunter Mills 2014

I graduated with a BS in Physics in 2014 from SSU. Subsequently, I attended Stanford and earned an MS, and am currently a senior data scientist at UCSF. This program taught me how to think analytically and solve problems, which set the foundation for my success.

Additionally, I was a first-generation college student from Sonoma County. College was very foreign to me and my parent, and a local option eased my concerns about the financial risk. Without SSU's department of physics and astronomy, I would have never gone to college.

Katie Badham 2013

Participating in the SSU physics department from 2009-2013 was the most fulfilling educational experience from my life. I was able to learn a dense amount of physics and the department offered significant amounts of help to ensure my success and understanding. Studying with other students in the program was vital and the department encouraged it which further enhanced my experience. I started off a biology major, and when switching to physics the process was smooth and they encouraged me. They cared and simply wanted me, and other students to excel. After graduation I was able to assist with a summer-long adaptive optics project with Scott Severson with led me into an internship, then graduate school, then a job at Lockheed Martin. Then, within 3 years after graduation at SSU I landed a job at Lockheed Martin in Silicon Valley, then another at L3Harris in Santa Rosa - high-paying jobs that were vital to my independence in life and the work world. It would be a silly decision to cut the physics department, also seeing that SSU is located a short distance from Silicon Valley. I strongly advise against removing the physics program. Thank you.

Jude Rowe 2013

My love of Physics and investigating why our existence works the way it does started due to the physics department when I was at Rancho Cotati Highschool as a junior and attending the what physicists do lecture series after school.

Cutting physics degree programs at Sonoma State University is like dismantling the foundation of a bridge to save on maintenance costs—it might seem like an easy way to trim expenses, but it ultimately weakens the entire structure, limiting progress, discovery, and innovation.

I stand in opposition to any removal of Physics Degree programs from Sonoma State University and urge you to find the way forward with these programs intact.

Brandon Baker 2013

I am a proud graduate of Sonoma State University's Physics and Astronomy program, earning my B.S. in Physics in 2013. When I first arrived at SSU, I had no clear direction for my future. That changed when I took Astronomy 101—a class that ignited a deep curiosity about the universe and ultimately led me to pursue physics. The wonders of the cosmos fueled my passion for understanding how things work, driving me to immerse myself in the program. Through this journey, I had the privilege of learning from dedicated faculty who not only equipped students with essential technical skills but also fostered the critical thinking necessary for success in today's world.

Though physics was an incredibly challenging field, the faculty at SSU was dedicated to student success. They didn't just teach formulas and equations; they prioritized understanding. They emphasized the importance of conceptualizing problems, thinking critically, and applying knowledge to find solutions. This way of thinking extended beyond the classroom. It became a foundational skill in my career. It helped me develop a tendency to analyze complex problems, break them down into manageable pieces, and construct solutions with confidence. The problem-solving mindset I developed at SSU has been instrumental in my professional growth.

The program provided me with highly relevant technical skills, including mathematics, programming, and modern technological tools—foundational competencies in today's technology-driven workforce. More than just teaching these skills, the program emphasized their real-world application, using them to analyze and solve complex problems related to the physical phenomena that shape our universe. While these technical abilities were invaluable for building a successful career, the most impactful lesson I gained was the ability to think critically. Through rigorous coursework and the guidance of dedicated faculty, I learned how to break down problems, approach challenges analytically, and develop solutions—an essential skill not only in my professional life but in everyday decision-making.

Eliminating the Physics and Astronomy program would mean removing a gateway to curiosity and discovery for future students like me—students who may not yet know their passion but could find it in the stars, just as I did. This program cultivates critical thinkers, problem solvers, and innovators, and its impact extends far beyond the classroom. I strongly urge the CSU system to preserve this invaluable program.

Crystal Ewen 2012

[Posted in support of Save Sonoma Physics]

Matthew Fontana 2012

I entered SSU in 2008 with a strong interest in both chemistry and physics. In my second year I went from an undeclared student to a chemistry major. At that time, I started performing physical chemistry research with Dr. Su in the Chemistry Department. Since physical chemistry lies at the interface of physics and chemistry, he advised me that I should take as many physics classes as I could; these classes would help me in my future physical chemistry classes/research at SSU and in graduate school. He was entirely right. As it turns out, I took so many physics classes that I decided to add a Physics B.A. in addition to my Chemistry B.S. while in my third year. My SSU physics classes helped give me the preparation needed to succeed in SSU's physical chemistry classes and my graduate school classes at UCLA. Physical chemistry requires a strong understanding of both chemistry and physics, but much of the advanced physics is unfortunately taught at the time it is needed in a typical physical chemistry class. This is typical of chemistry programs and contributes to what makes physical chemistry such a difficult class. I was fortunate to see many topics and approaches in my SSU physics classes that later presented themselves in my physical chemistry classes. As a result, I learned the core concepts in my SSU physics classes and then applied them in my subsequent physical chemistry classes/research. By not being overwhelmed with the input of new material/techniques, I was able to increase my understanding for these topics that most of my chemistry peers had not seen before.

In my fourth year at SSU, I performed materials science research with Dr. Shi. I had not learned about materials science in any of my chemistry classes, but found it to be a fascinating and interdisciplinary topic. I enjoyed working hands-on with a scanning electron microscope, which is an experience not afforded to students at larger institutions. Because of my research and mentorship with Dr. Shi, when I attended UCLA for my Ph.D., I joined a physical chemistry lab that performed materials science research on plastic solar cells. Without my SSU physics education, I would not have been exposed to this field. Most importantly, by engaging with materials science before selecting which graduate school to attend, I was able to make an informed decision about what type of school and lab I wanted to attend/join.

Testimonials

In 2018 I was hired by Santa Rosa Junior College as a chemistry instructor, where I work closely with the physics faculty and students. I am always promoting SSU to my students as an affordable and high-quality place for a STEM education. Santa Rosa Junior College is very fortunate to have SSU so close, where our students can attend seminars like What Physicists Do and share resources/experiences. As someone who was born and raised in Sonoma County, I understand how many of my students feel when deciding which school to attend when it comes to cost. If SSU were to cease offering degrees in physics, then there would be no affordable option available for local students.

Had I attended a larger university, I would not have benefited from the personalized instruction and close research mentorship of the SSU Physics and Astronomy Department. This allowed me to grow and succeed as an undergraduate student. I strive to pay forward that mentorship as an instructor at Santa Rosa Junior College, as I have amazing examples to follow from the SSU Physics and Astronomy Department.

Jarod Fahle 2012

I earned my Bachelor of Science in Physics in 2012 after attending public high school and junior college, and I can confidently say that the education I received at the Sonoma State Physics Department was top-notch. For students from poorer, rural areas, affordable access to quality education is critical, especially when student debt is often unavoidable. The CSU system—and Sonoma State in particular—provided an invaluable opportunity by offering entry-level courses taught by Ph.D. professors, not graduate students. This, combined with small class sizes and accessible office hours, ensures that students like myself can engage directly with subject matter experts and receive a truly exceptional education.

The hands-on learning opportunities at Sonoma State were transformative for my career. Through my internship with the NASA EPO group, I developed real-world laboratory skills and analytical best practices that continue to serve me to this day. After graduating, I pursued a career in Silicon Valley as a Senior Audio Engineer, where I've now worked for 12 years. My physics degree equipped me with the foundational skills and critical thinking necessary to succeed in a technical and demanding field.

California desperately needs more technical workers who are passionate, skilled, and educated. Cutting the Sonoma State Physics Department would deprive the state of a vital pipeline of such talent. I urge decision-makers to reconsider this proposal and invest in the future of students who, like me, rely on accessible, high-quality education to build meaningful and impactful careers.

Kathleen (Kathy) Morrison 2011

I am an Alumni of SSU. I earned my Bachelor of Arts in Physics with an Astronomy Minor. I matriculated to SSU as a transfer student from College of Matin, in the fall of 2008 with the intention of getting my teaching credential. As an older student, with a family and a full time job, I was taking a night time Astronomy course to fulfill my lab science requirement. One evening after class, I was talking with Dr. Severson about my desire to teach. I learned that Science and Math teachers were in high demand. I wasn't convinced I could do Physics, but I needed an Advisor so agreed to meet and give it a try. With the support of Dr. Severson, Dr. Spear, Dr. Cominsky, and many others on the Physics/Astronomy Faculty I graduated Cum Laude with Distinction in May of 2011. The opportunities to be part of the larger SSU Physics & Astronomy Community were some of the best times - working at the E/PO, assisting with the "What Physicists Do" lecture series, Public Viewing Nights, SPS to name a few. Opportunities and experiences I would not otherwise have had, and that other students deserve to be part of.

The point of the above synopsis is to illustrate the dedication, passion and inclusiveness of the Staff and Faculty in the Physics Department. They all saw something in me I did not see in myself. And that is not only true for me. The result of my time spent within the SSU PA Department, changed my life in a profound way. I gained confidence, knowledge and saw first hand how believing in someone's ability can help manifest that ability. Since that time I have been teaching 8th grade science. I have been able to share the enthusiasm and passion of my professors with my students. Many of whom have gone on to major in Physics or another Science. Some are studying to be engineers, doctors, or work in the tech industry. Even more importantly, they are becoming excited about their understanding of how science is found in their every day lives. I could not do this if not for my experiences with the mentors I had while involved with the Physics and Astronomy Department.

However, I am shocked and saddened by the idea that SSU will no longer offer degree programs in Physics and Astronomy. Where is the Diversity of programs at SSU if a foundational science based programing is lost? How will fact-based and science-based critical thinking be developed in students if only subjective, liberal arts programs remain?

What of Equity for Women in Science if there are no such degree programs offered in schools in their community?

Where will the students interested in Physics and Astronomy degrees go if their local, and affordable, University does not offer these programs?

Can the campus of SSU claim to be Inclusive of all students if it lacks a balance of science forward programs?

Please pause to consider my experiences and questions before the decision is made to defund the "Most Fundamental of Sciences" (physics) and the "Gateway to Science" (astronomy) is finalized.

You hold the future of undiscovered great minds in your hands.

Richard Peters 2009

The Sonoma State Physics program is an amazing institution. My BA in Physics is the cornerstone of my career as a Patent Attorney. It was also one of the most intellectual enriching experiences of my life. I am very saddened to here that this program may be discontinued. I would strongly encourage reconsideration of the decision. I was just speaking with a founder of a materials science company in Silicon Valley. This particular company recently received a valuation of over 100 million dollars. I asked the CEO what enabled him to found the company and create its key innovations, he said without hesitation that it all began with his undergrad Physics degree! In the coming age of AI, he added that he thought degrees that develop deep technically flexible thinkers will be highly needed and sought after. As a regional university, it is important that SSU enable locals to access the coming AI economy. This will be greatly hindered without access to the current wonderful Physics program.

Charlie Granger 2008

I earned a BS in Physics from SSU in 2008 and I cannot stress enough the impact this program has had on my life and career. I discovered my joy for optics and the science of light and have since pursued this to obtain my PhD in Optics and a career as an optical engineer. I have no doubt every other student who has passed through the SSU Physics program has likewise greatly benefited.

In many colleges, Physics programs are notoriously competitive and saturated with students. The program at Sonoma State is refreshingly the opposite. The smaller program is considerably more than just a mill churning out paper degrees. It fosters a community of faculty and students passionate about science and physics, emphasizes building critical skills and knowledge for, and encourages cooperation and growth. An excellent example of this is the long-standing weekly "What Physicists Do" colloquium, where working physicists are "curated" and invited to present on their work and research. The colloquium serves to bring several departments together and provides knowledge and inspiration to all in attendance. The physics program also highlights valuable hands-on experience with several required lab courses utilizing state-of-the art equipment and required research guided by a faculty member.

Walking onto the SSU campus in 2004, I was an introverted student - likely to be washed out in the sea of students in a larger program. Looking back, I can see how the dedicated and impassioned faculty pushed to get to know me, to find my strengths and weaknesses, and work with me to develop and open up. This was further assisted by the bonds with my peers both in and outside the classroom. Upon graduation, I was more vocal and social, I had several semesters of valuable hands-on lab work from courses and research that are required for the degree, and I had letters of recommendation from faculty who actually knew me that would be invaluable in my applications for jobs and graduate school.

I strongly support any effort to keep the Sonoma State Physics program in existence for perpetuity. The devotion of the faculty and structure of the program should serve as a model to others. The loss of the program would be a loss for physics and science, the community, future students, and I believe would ultimately be detrimental to Sonoma State University as a whole. I encourage the CSU system to explore any options to keep SSU Physics at SSU.

Kevin John 2008

Sonoma State University offers an education in physics that's unlike what you can find almost anywhere else. With small class sizes and access to professors that's unheard of in the physics departments at larger universities, Sonoma State's courses have offered those of us who've gone through their program a level of autonomy and ownership over our own education that's proved invaluable to me and others in our ongoing STEM careers.

Furthermore, SSU Physics consistently punches above it's weight class in terms of the projects carried about by faculty and students alike. The CSU system would be wise to think carefully about letting a program that has so consistently over-performed for its students slip away. Because once it's gone, it's too late to realize what we've lost.

Alex McMahon 2007

I spent my first two years at SSU exploring different majors, unsure of where I belonged. It wasn't until I took an introductory physics course and a class on cosmology that I found my home in the Physics Department.

Some of my fondest memories from that time are the countless hours spent in the library's math lounge—grappling with coursework, forming lifelong friendships, and growing both academically and personally. The faculty played a pivotal role in this journey. Their vast knowledge and diverse experiences in research, innovation, and industry were invaluable. Seeing how they applied their expertise—whether through groundbreaking discoveries, impactful inventions, or success in the commercial world—was truly inspiring.

Though I ultimately pursued a career outside of core physics, I carried the lessons and relationships from SSU with me. Today, I've built a successful career—first as a Unix administrator, then as a cybersecurity analyst, and now as a sales engineer for a leading security company. I attribute much of this success to the incredible professors, facilities, and peers I had at SSU's Physics Department.

I may never be able to give back in the same way that Dr. Tenn, Dr. Shi, and Dr. Hichwa have, but I am deeply grateful for the time and dedication they invested in my education. Now, as a father of two young boys, I strive to pass on the lessons I learned at SSU—hoping that one day, they too will contribute something meaningful to this pale blue dot we call home.

The Physics Department at SSU is more than just a program; it's a foundation for critical thinking, problem-solving, and innovation. I urge you to continue supporting and funding it, so future students can experience the same transformative education that shaped my life.

Tyana Stiegler 2003

The SSU Physics and Astronomy department offers a unique collegial environment far different than that found in a 'traditional' leading-edge scientific university. For those students who don't fit the into the standard 'STEM' mold, due to race, gender, ideology, wealth, privilege, neurodivergence of all types, the Sonoma State Physics Department offers them a sanctuary to grow and learn how to be successful both at their chosen careers and personal development.

For myself, SSU was one of only a couple choices for me, but it was the best choice. I didn't have a particularly strong academic background, nor the finances to make-up for that deficit. At SSU I was able to study physics while singing in the choir, taking dance classes, and learning judo. The unique mix of small class sizes, diverse backgrounds of students and professors, as well as the welcoming inclusivity of the SSU campus, makes for a dynamite combination perfect for those students who don't find a place in more main-stream university setting. Sonoma State physics represented a bridge between scientific study, creative expression, and self-realization, that wasn't possible anywhere else.

Studying physics, to the level required to attain a 4 year degree, should be a fundamental staple of any university irrespective of its self-identification as a 'STEM' or 'Liberal Arts' focused institution. I say this because learning physics is the art of learning how to problem solve, how to never give up, how to look at the impossible and break it down into understandable parts, and how to bring multiple seemingly unrelated ideas together to form new and exciting possibilities. Those are skills every institution should strive to instill in their graduates, because they are what create the brightest future for everyone.

I'm a career research scientist at Lawrence Livermore National Laboratory. I work as part of a diverse multi-disciplinary team of dedicated scientists developing nuclear radiation detector monitoring safeguards focused on non-proliferation and the peaceful use of nuclear technologies. I am proud to add my voice to the many fighting for the continuation of this department.

Tim Graves 2001

The Physics and Astronomy program at Sonoma State University (SSU) has played a transformative role in my education, career, and contributions to society. As a graduate of the program, I have directly benefited from the high-quality education, hands-on research opportunities, and dedicated faculty that SSU provides.

My degree in Physics and Astronomy opened doors to impactful work in both science and public service. Early in my career, I collaborated with NASA, contributing to the launch of three research satellites and training over 10,000 high school teachers in innovative methods for teaching national math and science standards. Later, I applied the critical thinking and problem-solving skills I developed at SSU to address some of California's most pressing challenges, including homelessness and community mental health treatment.

The real-world applications of a strong physics and astronomy education extend far beyond academia. The program at SSU has prepared countless students for careers in science, engineering, education, and technology—fields that are essential to California's economy and innovation leadership. Cutting this program would not only limit future students' opportunities but would also be a loss for the industries and communities that depend on a well-educated, STEM-focused workforce.

The Physics and Astronomy program at SSU is not just about equations and experiments—it is about building the next generation of problem-solvers and innovators. It is essential that this program remains a priority so that future students can benefit from the same education that helped shape my career and my ability to give back to society.

I urge decision-makers to recognize the immense value of this program and ensure its continued presence at SSU. The students, the state, and the future of scientific progress depend on it.

Sincerely,

Tim Graves

SSU Graduate 2001

Rod Lee 1997

The Physics and Astronomy Department at Sonoma State University played a pivotal role in my education and career path. The department offered small classes and interaction with faculty that wouldn't be possible in a larger college. I was able to earn a B.S. in Physics (with minors in astronomy and math) while working part-time and while being a commuter student. Other colleges that offered this degree would have required me to move out of the area -- which wasn't an option at the time.

In addition to studying physics and astronomy at SSU, I became involved with the Society of Physics Students (SPS), performed observations at SSU's observatory, worked as a grader for several professors, and connected with many faculty and students. I remember the excitement of touring the Stanford Linear Accelerator (SLAC) on an SPS field trip with Professor Joe Tenn. All of these experiences increased my interest in physics and astronomy education that is still present today.

After graduating from SSU with my physics degree, I entered the teaching credential program and became a high school science and math teacher in California and Oregon. I built upon my education at SSU by later earning a M.S. in Astronomy and an M.S. in Chemical & Life Sciences. After 13 years of high school teaching, I became a full-time community college instructor at Portland Community College in Portland, Oregon. I teach physics, astronomy, and general science -- all thanks to my foundation at SSU.

It is a shame that the college wants to remove physics as a major. Many students before and after me have benefited from their education in physics and astronomy at SSU. Many teachers, college instructors, engineers, and other professionals have the physics major as their foundation. Without it, I'm not sure I would have had such a rewarding 27 year career in physics and astronomy education. Please save the physics major!

Amy (Weber) Madruga 1997

The need for affordable access to quality, science-focused degree programs in Northern California is critical. SSU's Dept of Physics and Astronomy provides a strong, foundational program that can springboard into careers and/or continuing education in science research, academia and engineering.

While still completing my BS Physics in 1997, I began an internship with a local telecommunications company that resulted in full-time employment immediately after graduation that year. I continued to work as a Hardware Engineer in the telecommunications field until I left the workforce and started my family.

Where is the Diversity of programs at SSU if a foundational science based programing is lost? How will fact-based and science-based critical thinking be developed in students if only subjective, liberal arts programs remain?

What of Equity for women in science if there are no such degree programs offered in schools in their community?

Can the campus of SSU claim to be Inclusive of all students if it lacks a balance of science forward programs?

Your community of students must reflect diversity of skills and interests, not just single thought programs. College bound students from Northern California high schools must have equal opportunity access to degrees in the hard sciences.

Northern California is a beautiful region of the state that is strikingly different from Southern California's cities and communities. Where else can students seek and attain a foundational, quality, science based education if not at SSU? Cal Poly? Too impacted. UC Davis? Does the CSU system not want to attract STEM students?

Please reverse the decision and save the Physics & Astronomy degree programs at Sonoma State.

Daniel Hale 1996

I earned a B.S. in Physics with a minor in Astronomy from Sonoma State in 1996. I feel the courses I took there along with the personal interaction I had my professors helped me become the instructor and professor I am today. I feel the enthusiasm and passion my professors had for physics and astronomy was infectious and inspired many students. I initially wanted to work in electronics, but after Dr. Poland's amazing class on the subject, I realized it was not for me but there were many who thrived in the course! Then after Dr Spear's Introductory Astronomy Laboratory I knew I had found my calling! From that point on I focused on anything the department had to offer with respect to Astronomy and Astrophysics. This included the advanced laboratory and even helping develop lower division labs (with Dr. Spear's guidance) and helping with public viewing nights. I really do feel this is where my path in teaching started as I was always pushed to explore options on how to help other students learn physics and astronomy. The courses materials prepared me for graduate school and I loved being able to work with the school observatory and radio telescopes. Also the department's Unix computers and student access opened my eyes to more computing options that the school itself offered. I would not have learned as much Unix as I did if it had not been for the SSU physics department.

As an community college professor at Folsom Lake College try to emulate the many of the professors I had at Sonoma State. I always try to channel the exuberance and passion that Dr. Dunning had for physics and the passion he had for teaching. Many a time I have pulled some obscure physics or astronomy historical fact for my class that Dr. Tenn had shared with the many courses I had taken from him. And of course I use the humor Dr. Rahimi used when teaching complicated subjects like electricity and magnetism or introductory classes like lower division labs. He showed me a laugh and smile helped break the barriers that many students have when it comes to complicated topics like physics and astronomy. There are so many more examples here of how SSU physics prepared me for the teaching and students I encounter everyday.

I hope the department that has helped so many students and has so many opportunities for undergraduate research and close one on instruction will be saved as I hope it can help future generations of students become professionals in their fields like is has for me,

Daniel Hale
Professor of Physics and Astronomy
Folsom Lake College

Cherie Montague 1995

I am a proud 1995 graduate of Sonoma State University with a Bachelor of Science in Physics. SSU was close to home and affordable, which made it possible for me to pursue my passion for science—something I wouldn't have been able to do otherwise. The university's observatory was also a place of wonder for me. Public viewing nights sparked a lifelong fascination with astronomy.

The loss of Physics and Astronomy degree programs at SSU worries me deeply. These programs don't just educate students—they inspire curiosity, foster innovation, and provide essential outreach to local schools and the community. They were life-changing for me and have the potential to do the same for countless others.

Please fight to keep these degree programs funded and thriving. California needs leaders in science, technology, and education, and these programs play a crucial role in that future.

Mallory Roberts 1994

I transferred into the SSU Physics department in Spring 1992, 5 years after having left the University of Michigan due to mounting costs as an out of state student. Realistically, where else could I have finished my degree in 2.5 years and get an excellent grounding in physics, publish as a second author a paper in a presitigious journal with Professor Cominsky, and get into grad school at Stanford which during my time there was ranked as the top physics graduate program in the world? One of my clearest memories at Stanford is a meeting with my fellow incoming graduate students where we said where we had done our undergraduate work, and having the other students who had gone to all the usual top ivy league schools go "what, where?" when I said Sonoma State University. After 30 years as a research astrophysicist, including the Ph.D. program at Stanford, 5 years as a postdoc at McGill, and 10 years as a professor at Ithaca College and New York University Abu Dhabi, I still hold that SSU provided me with better preparation for being a research scientist than many students receive at much more prestigious universities. Physics is THE foundational science. In a world where all of modern society is predominantly shaped by the outcomes of scientific research, especially of physics (eg. computers, internet, wifi, tmobile phones etc. etc. etc. only exist due to physics research) how can a University which provides a key pathway for non-traditional students to become scientists drop a program that literally teaches the basis of everything?

Jeffrey Kavanaugh, Ph.D. 1994

I transferred into SSU's Department of Physics from SJSU's Aerospace Engineering program, and immediately found my academic home. Yes, the department was and is small (which is likely why it's being threatened with closure), but that - along with its excellent and dedicated faculty - is its greatest strength. With its small class and cohort sizes, students get to know each of their professors and all of their classmates; nobody is just a name or student ID number. This also means that students have greater opportunities to contribute to research being conducted by the faculty, providing valuable real-world experience and ensuring that students graduating from SSU's Department of Physics are competitive with those from big-name schools.

Following my receiving a B.Sc. in Physics from SSU, I completed a Ph.D. in Geophysics from the University of British Columbia and a Postdoctoral Fellowship at U.C. Berkeley, and am now a faculty member in the Department of Earth and Atmospheric Sciences at the University of Alberta. I fondly remember my time at SSU, and every one of my professors in the Department of Physics - Joe Tenn, Lynn Cominsky, Saeid Rahimi, Gordon Spear, Sam Greene, John Dunning, and Duncan Poland. In my own career as an academic, I strive to emulate both the quality of their teaching and research and the supportive environment they built at SSU. The Department of Physics might not graduate as many students as do the larger schools, but they train them well. Don't close this gem of a department.

Ben Owen 1993

After graduating from Sonoma State with a BS in Physics and a minor in Astronomy, I went to grad school at Caltech (the top physics school in the world) under future Nobel Prize winner Kip Thorne. I got Caltech's PhD Thesis of the Year award, collaborated with researchers around the world, and played key roles in the historic discovery of gravitational waves. In a perpetually impossible job market, I was able to reconcile career and family and got full Professor positions repeatedly at Penn State, Texas Tech, and UMBC. Many of my own students are now teaching or leading researchers, and a student's student is about to get tenure at Caltech.

I never could have done this without the strong start I got from Sonoma State's Physics Department. Having been a few times around the world, I can say that the quality of the faculty and their attention to student outcomes are amazing. Very young and searching for direction, I was convinced to major in Physics by Saeid Rahimi's general education course. The major wasn't just a collection of courses. The faculty's passion for their subject and their students led me into advanced and independent studies and research with Joe Tenn, Sam Greene, Gordon Spear, and especially Lynn Cominsky. I was a difficult case and I would have floundered in a large, anonymous school without the world class and well rounded mentoring SSU Physics provided. Even the courses were done so well that I tested out of a lot of requirements at Caltech, and the independent study and research were incredibly rare and valuable opportunities. At Caltech, surrounded by the cream of the worldwide crop of physics students, I was ahead of most thanks to the start SSU had given me.

This program is a real gem. In my travels I've bumped into people from herdsmen on the steppe to Nobelists at Caltech and MIT who know the program and regard it highly. It has graduated an astonishing number of scientific leaders in academia and industry for a campus its size. Look around at other small campuses. I can't find anything comparable in California. I doubt it even nationwide. It would take decades to rebuild, even if lightning could be captured in a bottle again. The Physics Department is not just a provider of services for the name makers of the university, it IS one of the name makers.

It would be a terrible loss to the campus and the CSU system to remove such a jewel from the crown for the sake of temporary expediency. In difficult times it is natural to pare down to one's core strengths. Remember that Physics and Astronomy is one of Sonoma State's core strengths, and that it is essential to SSU's continuing mission to serve the community the state, the nation, and humanity.

Matthew J Davis 1993

I have enjoyed a thirty year career in public education since graduating from S.S.U. with a physics degree in 1993. Most of that time I have been a high school physics teacher. While a physics major at S.S.U. I learned I can handle challenging and difficult work. I learned that if I leaned into a problem , asked for help, studied and kept at, I could do almost anything I set my mind to. Through the physics courses I took, I learned some of the secrets of how the universe worked. I also learned important critical thinking and organizational skills. One of my favorite memories of my time at S.S.U. was when I worked as a research assistant to Dr. Gordan Spear on his I.R.A.S. data reduction and analysis project. That was a very positive experience and I learned a great deal from that experience as well.

An S.S.U. physics degree is very versatile and the department has greatly benefitted industry, education and the North Bay community as whole. The physics department has always been there to support local science teachers, Closing down the department would be a mistake and would leave a gap in the educational fabric of the North Bay.

Sincerely,
Matt Davis
Class of 1993

Geof Syphers 1993

When I toured universities as a high school student in 1987, I experienced something special at Sonoma State University. Dr. Saeid Rahimi took two hours to walk me around and ask me about my interests. His personal touch convinced me that SSU was the right choice, even over schools like Stanford or UC Berkeley. The accessibility of SSU's Physics faculty and staff meant I received a superb education at a fraction of the cost of more presitigous schools.

Today, as the head of Sonoma Clean Power, I see every day how SSU graduates power our community. I employ 29 of them, and their skills help keep our local economy strong. Even though the California State University system faces tough budget challenges, closing the Physics Department at SSU would be a false savings. Cutting this program would sever an essential pipeline of talent needed to support our local industries and future growth.

I urge the CSU system to reconsider this decision. Maintaining a robust Physics Department at SSU is not just an investment in education—it is an investment in the future of our community.

Harvey B Hecht 1992

Because of my education at Sonoma State, I have had a successful career as a Physicist and Computer Hardware / Software Engineer. Plus I have been able to continue my education at several graduate schools. The reasons are because of the time and efforts of the professors and staff of Sonoma State. At a time when we need more technical people that other students could not have the opportunity to have such a great education.

William A. Kobabe 1990

Attending and graduating from the Physics and Astronomy Department was a transformative experience for me!

I began attending Cal Poly San Luis Obispo in 1978, and stayed for five years as a floundering Electronic Engineering major. The school as a whole, and my Department there, just wasn't providing the support and direction I needed. I was taking all the classes I was supposed to be taking... and every class under the sun besides. I couldn't stay focused, and my advisor had so many students under his care that I slipped through the cracks. His untimely death only made things worse... I wasn't assigned a new advisor, and his records of the students under his direction were locked down so tight in his computer that no one was ever able to access them. In a school as large as Cal Poly, I was set adrift... forgotten... and eventually I lost momentum and dropped out.

Several years later, my parents impressed upon me the value of completing my degree and said they would help support my return to University. I applied to Sonoma State in 1987 and was accepted... as a Physics major. This surprised me quite a bit! Me? A Physics major? But after reviewing my transcripts, it was suggested that this was the best fit for me at SSU, given the course work I had taken at Cal Poly. I didn't really see myself as a "Physics Major" type of student and was highly skeptical that it would be successful in this field.

It was a meeting with the Department head at the time, Dr. Dunn, that changed my mind. He took the time to meet with me and listened carefully to my story and my concerns. My assured me that he would do everything in his powers to make sure I graduated... assuming I worked hard at it and stayed focused. His personal attention made me a believer. He assigned Dr. Tenn to be my advisor, and together we created a pathway for me to attain my BA in Physics.

It wasn't easy, to be sure. Going back to school as a working adult posed many challenges. My first child was born during my final year, during finals week (of course). And I couldn't resist dabbling in my second interest, Philosophy. Together with Dr. Tenn, we charted a course that not only allowed me to graduate, but to fit in enough Philosophy courses to allow me to complete a minor in Philosophy as well.

I am so grateful to Sonoma State. I feel that the main reason I was successful here was due to the fact the Sonoma is not some giant, impersonal institution like most of the other Cal State Universities. Sonoma State is just the right size to meet the needs of the student I was. A place where the Department head has the time to have a personal relationship with their students. A place with sufficient flexibility to make room for a non-traditional student like me. MY Alma Matter!

So, what happened next? After owning a small business for a time, I decided I wanted to become a school teacher. I attained a teaching credential from CalstateTEACH and began my second career. I wasn't sure why I might need a University degree at the time I graduated... but life's journey is full is twists and turns and my interests changes. I began teaching 17 years ago, something that would not have been possible otherwise. I teach mostly Middle School students, and my specialties: are math and science!

No one knows what the future will bring. It looks like Sonoma State is in a bit of a lull right now... but will this short term trend continue indefinitely? I doubt it! The students will be back... careers requiring college degrees are not going away... and I am optimistic that Sonoma State will continue to add value to the State of California and the residents of the North Bay.

I see only one possible obstacle to my bright vision of the future: If all the programs that make Sonoma State what it is are cut, then students WON'T come. If the school can't meet their needs, more and more students will turn elsewhere. Sonoma State fills an important niche in the Cal State system. Cutting valuable programs will make it irrelevant in the future. The future will be needed more and more professionals with Physics and Astronomy skills.

Eliminating this program might reflect the retrograde thinking currently dominating the news and our popular culture... but the tide will turn! Retain this important and visionary program. The future will rely on space technology and materials science. These future needs are being met right now in real time by the graduates from the Physics and Astronomy Department from my generation. These skills will become even more important in the near future.

DON'T DRAIN THE PIPELINE!

Retain this vibrant program... It's part of what makes Sonoma State special!

Keith Waxman 1990

My name is Keith Waxman and I graduated with my BA in Physics from SSU in 1990. My experience at SSU was instrumental in me continuing on to get my MS from San Francisco State University. I was privileged to take classes from many wonderful physics and astronomy professors while attending SSU. I have had many friends that feel the same. Without my education at SSU, I would never have been able to attain my current position of full-time astronomy instructor at Santa Rosa Junior College. I teach over 400 students a semester and always recommend transferring to SSU for anyone wanting to go into physics and/or astronomy. I was shocked to hear about the cuts of so many programs a couple of weeks ago. Education, especially in the sciences, is the last hope to rectify the damages being done to our world. Money should be pouring into education, not the other way around. Please do not let our future suffer by a lack of foresight.

Katherine Rhode 1989

I earned a Bachelor of Arts in Physics from Sonoma State University in 1989. I had originally chosen a very different major, but after taking an introductory astronomy course taught by Professor Joe Tenn during my first semester at SSU, I became fascinated with Astronomy and Physics. I was captivated by what I learned in Professor Tenn's course, and the idea that we (as humans) could use physics as a tool to begin to comprehend the universe. Professor Tenn's positive comments on my final term paper prompted me to decide to switch my major to Physics. I came to see him in the Spring 1986 term to ask him how to make this happen, and although I'm sure he must have been surprised, he reacted with kindness, patience, and encouragement. He explained the steps I would need to take to become a physics major and he continued to actively mentor and support me throughout the rest of my time at SSU. He was honest with me about the challenges that lay ahead for me, but he conveyed a sincere faith in my abilities. All of the faculty who taught me at SSU - especially Joe Tenn, John Dunning, Lynn Cominsky, and Duncan Poland - were unfailingly reassuring and kind and they clearly cared about their students' educational and professional lives.

The coursework and training I had as an SSU Physics major prepared me for each of the next steps in my career. For example, the computer programming skills I learned in a required course at SSU were crucial to my landing a job after graduation. The "What Physicists Do" series at SSU opened my eyes to the enormous variety of careers and professional paths available to people with physics degrees and training. Professor Tenn encouraged me to apply to summer Research Experiences for Undergraduates (REU) programs, especially the astronomy REU at Maria Mitchell Observatory (MMO) on Nantucket Island. I had my first research experience at MMO and decided then that I wanted to become a professional astronomer. I worked for several years as a programmer-analyst at NASA and the Harvard-Smithsonian Center for Astrophysics and then eared a Ph.D. in Astronomy at Yale. I was hired as a faculty member in the Department of Astronomy at Indiana University (IU) in 2007. I have taught hundreds of students at IU and have supervised student researchers at all levels, from undergraduates to Ph.D. students; this summer, my 7th Ph.D. student will defend her dissertation.

When I teach my large introductory courses in astronomy for non-majors at IU, I try to convey the same excitement and enthusiasm that Professor Tenn and the other faculty at SSU conveyed to me so clearly. Every step of my academic and professional career was made possible by the Physics program at SSU and the unfailing support and mentoring that I received from the faculty in that program, especially Joe Tenn. I know that there are many other students with paths similar to mine - students who were inspired to consider a career in STEM by the faculty and instructors in the SSU Physics and Astronomy department, and who were taught and mentored by patient, kind, talented physics and astronomy faculty. I am heartbroken to hear that the Physics major may be discontinued at SSU; this is an enormous loss to the community, the larger CSU system, and to physics and astronomy as field I urge you to rethink this — SSU had an enormous impact on my life and career and my sincere hope is that the same opportunities afforded to me will continue to be available to others.

Katherine Rhode
Professor of Astronomy
Indiana University

Lauren J Novatne 1989

As a graduate of Sonoma State University with my Bachelor of Arts in Physics, I strongly disagree
with the consideration that it is no longer in the best interest of the University to continue funding it.
I chose to complete my bachelor's degree in Physics when I transferred from San Diego State University
as an Electrical Engineering major. The SSU Physics department was more than a refreshing change
because of its dedication to its students. It was my experience that the small, intimate program allowed
the professors to support students with the time and focus require to assist the learning that the
conceptual and mathematically demanding material requires.

As an Electrical Engineering major, I took the first semester of Engineering Physics at a community
college, with 30 students in the class. The professor didn't have the luxury of time to host meaningful
office hours, and the lab classes were not helpful in learning the concepts or mathematical applications
at all. When I transferred to San Diego State University as an Electrical Engineering major, I finished the
STEM physics core in even bigger classes. The professors had no time to answer questions, so graduate
students were tasked with trying to keep up with the constant requests for clarification to the ubiquitous
concerns of frustrated students.

It was this experience that led me to transfer to Sonoma State, and change my major to Physics. I
earned a Bachelor of Arts degree in Physics and worked in electronics and various other professions. My
career goal was to teach Physics and Astronomy at a small California Community College. My Bachelor of

Arts degree from Sonoma State was a wonderfully supportive and enriching experience. Many years later, I enrolled in CSU Fresno, and finished my Master of Science in Physics.

I was hired by Reedley College to teach Physics and Astronomy to the young adult children of agricultural workers, many of whom were immigrants from diverse countries escaping poverty and political persecution. It was a privilege to teach them, and some of them have attained great success.
One of my students transferred into the Sonoma State Physics program, earning his Bachelor of Science degree. He returned to the Central Valley, and is currently employed as a Laboratory Technician in a Community College in Parlier. He loved his experience with the Physics Department at Sonoma State, and his success as a lab technician is more evidence of the department's merit.

Daniel. Nottingham 1989

I am a proud graduate of the SSU Physics and Astronomy Department, earning my degree with distinction. During my time at SSU, I led the effort to create the university’s first radio telescope—what became known as the Very Small Array, a small interferometer. I was also honored to serve as President of the Society of Physics Students, fostering a community of curiosity and exploration among my peers.

Upon graduation, I secured a position at Boston University’s Center for Space Physics as a Night Assistant Data Analyst. Within a few years, I was promoted to Staff Scientist, overseeing the operations, image processing, and data analysis of the Mobile Ionospheric Observatory. Over the course of my career, I gathered over 1,000 nights of observations, tracking phenomena such as Stable Auroral Red Arches—beautiful and complex structures in the upper atmosphere caused by geomagnetic storms. I was also part of a small research team that discovered the Jovian Magneto Nebula, a vast cloud of sodium emissions originating from the volcanic activity of Jupiter’s moon, Io. Additionally, I captured the first images of the lunar sodium atmosphere, expanding our understanding of how the Moon interacts with the solar wind.

My work also extended to sounding rocket experiments, which provided insights into ionospheric airglow and Spread F, a phenomenon in which irregularities in the Earth's ionosphere disrupt radio signals, affecting global communications and GPS systems. Understanding Spread F is crucial for mitigating its impact on navigation and communication technologies.

All of these discoveries and contributions were made possible by the solid education, hands-on experience, and passion for learning that SSU instilled in me.

For the past 30 years, I have worked in software development for the healthcare industry, stepping away from the sciences. However, my passion for discovery never faded. Recently, I have had the opportunity to return to research as an independent cosmologist. Over the past several years, I have developed a new theoretical framework, The Spacetime-Energy Continuum (STEC). This model extends Einstein’s General Relativity by treating time progression as a fundamental quantity governed by energy density. STEC offers a natural explanation for cosmic inflation, late-time acceleration, and the Hubble Tension—one of the biggest unresolved issues in modern cosmology. It also provides insights into the unexpected discoveries made by the James Webb Space Telescope, including high-redshift galaxies that appear too mature for their age under standard models.

None of this would have been possible without the foundation I received from SSU's Physics and Astronomy Department. Eliminating this department would be a tremendous loss to the scientific community in California and beyond. SSU has a long history of producing graduates who go on to make meaningful contributions to science, technology, and industry. Future students deserve the same opportunities that I had—the ability to explore, to innovate, and to contribute to humanity's understanding of the universe.

I urge the decision-makers at SSU and the California State University system to reconsider the proposed cuts. Investing in physics and astronomy is an investment in the future—one that will pay dividends not only in scientific discoveries but also in the critical thinking and problem-solving skills that physics students bring to a wide range of industries.

Sonoma State University shaped my career and my passion for discovery. Let's ensure it continues to do the same for future generations.

Ken Ritley 1988

Don't Shut Down the Last Gas Station Before the Desert!

I was shocked to hear that SSU is shutting down its Physics & Astronomy degree program. While an introductory course will remain, the opportunity for students to pursue a full degree in these fundamental sciences will be gone.

This decision is like shutting down the last gas station before a long stretch of desert.

This leaves students in Northern California with no affordable pathway to study physics and astronomy at a public university. Without this program, countless students who dream of becoming scientists, engineers, or educators will have nowhere to turn—unless they can afford the steep costs of private institutions or relocate far from home.

SSU has been a lifeline for students like me. I needed a high-quality, low-cost education to pursue my career in STEM. Like ALL of my fellow students, SSU was our gateway to advanced careers in science and engineering. Eliminating the Physics & Astronomy degree doesn't just impact the university - it weakens the entire scientific and educational landscape of the region.

This program deserves support, not closure.

I urge SSU to reconsider before shutting down the program that is now -- and has long been -- guiding students in Northern California toward discovery, innovation, and a brighter future in science and engineering.

Doug Epperson 1988

I joined Sonoma State at junior level. I had been attending UC Santa Barbara and found the large school overwhelming and impersonal. On arrival at Sonoma State, I was welcomed and cared for. The close interact with faculty was what I needed to thrive, and thrive I did. The education I received put me at a step above. I was surprised at how much more strongly prepared I was than other entering grad students when I went off to grad school. In particular, the foundation I received at Sonoma State in Electricity & Magnetism, Statistical Physics, and Quantum Mechanics was extremely solid. I went on to research High Energy Particle Physics for my graduate work at UC Santa Cruz. I am now a tenured faculty teaching physics at West Valley College. The education and support I received then are now the education and support I am giving to another generation of students. I am very happy with where I am in life. I am not sure I would have made it here if not for the strong encouragement and powerful education I received while at Sonoma State.

Kurt Kruger 1988

My name is Kurt Kruger. I am the STEM coordinator/Instructor/SPARQ Center Director at Piner High School in Santa Rosa. Piner High School is a STEM school as we encourage our students to participate in the STEM fields. We have a STEM certificate program for our students and we are, in cooperation with SSU, encouraging our students to attend our local SSU including the Physics and Astronomy Department for their 4-year education. The default for our kids is the SRJC and many never make it past a two year degree due to a lack of a more affordable and local option for a 4-year degree. We are a Title 1 school so a local, more affordable option for our kids is imperative. SSU provides that for our kids. Without the Physics and Astronomy option at SSU our kids are less likely to pursue this important avenue into the STEM world. How can we encourage our young men and women to enter the STEM workforce when we keep narrowing options for those who are financially restricted? The ability to live at home and attend a university that support STEM/Physics is their only option. Please do not take that away from them.

Each year for the past decade we have had SSU come speak to our students about STEM fields including Physics/Engineering/Nursing/Biological Science fields. We take a bus load of our interested students to tour SSU including all the above departments. It inspires students who would not go to a 4-year program to pursue their local option at SSU.

On a personal note, I am a SSU Teaching Credential program graduate. Both my son and daughter (both went to Piner) entered the STEM world through SSU as they are both RN's. My son getting this Bachelors through SSU and my daughter graduating from SSU with her RN. Even for our middle class family, SSU has been an invaluable resource. Taking Physics/Astronomy away from SSU will limit anyone wishing to enter the STEM fields. Please do not take this away from my students looking to enter the world of Physics/Astronomy/STEM. This is about equity. My young students deserve SSU's resource as an affordable and local Physics/STEM school.

Respectfully,

Kurt Kruger

Testimonials

Piner High School
STEM Coordinator
SPARQ center Director

Bill Hinkle 1987

I graduated with a degree in physics from SSU in 1987. It has helped me in every aspect of my professional endeavors, from electrical engineering, software development, and even music and acoustics. More importantly, it taught me how to approach things analytically, using scientific method and empirical analysis. The faculty in that department sparked an interest and curiosity in me that continues to this day, and I would not be the person I am without it.

Greg Crawford 1987

I chose SSU Physics & Astronomy because it offered an excellent education with a great faculty and a department dedicated to my academic success. Joe Tenn, Sam Greene, Gordon Spear, John Dunning and Saeid Rahimi are several of the outstanding professors I took courses from. My degree in Physics prepared me well for service in the USMC as an Air Defense Control Officer during the Persian gulf conflict. And for the last 35 years, it contributed to a rewarding career in Pharmaceuticals. As a first-in-family university graduate, SSU Physics & Astronomy led to my lifelong professional and personal achievement.

Claude Plymate 1981

My wife Teresa and I received the very disturbing news that the SSU Physics Dept is planned to be defunded. We believe this would be a tragic mistake and fervently hope that you will reconsider. The SSU Physics Dept quite literally changed the course of both our lives and gave us opportunities that I couldn't imagine in my wildest fantasies. (Okay, perhaps not my wildest fantasies as I never got to actually pilot a star ship…)

We both started in other majors but happened to decide to take one astronomy course together which completely changed our lives' direction. That astronomy course led us to changing our majors to Physics and eventually to long, fulfilling careers for each of us – me in the field of solar astronomy while Teresa mostly focused on Earth- & Space-based astronomical instrumentation. It is also quite astonishing to us how many of our classmates also ended up working professionally in the field. Those associations started at SSU proved very important to all of us through our careers and we still remain in contact with several of them.

It pains us to think that such opportunities may disappear for future students. The 21st century will demand ever more high technology literate workers.

Respectfully,
Claude & Teresa Plymate

Dennis Goodrow 1978

I graduated with a B.S. in physics in 1977-1978. I immediately found a great job using my physics, math, and computing skills at a government research facility in Marina Del Rey   My career leveraged all the skills I developed at SSU. Most valuable of all was the skill of learning which prepared me to adapt to whatever problem I faced. I retire as chief architect of BigFix at IBM.

I attribute my success to the unique learning experience I had at SSU.

Doug Morris 1978

I graduated from Sonoma State University in 1978 with a BA in Physics and a minor in Astronomy. My only other attempt at a higher level degree was getting ~half way through the University of New Mexico MBA program in the mid-80's. So to be clear, although I only had a BA degree it proved sufficient for me to have a pretty fantastic career. Here are some of the highlights:
-A 21 year career with Motorola that included participation in component development and production (bandpass filters for transmit and receive functions) for Motorola's initial dominance of the cell phone market. My career advanced from engineer to engineering manager and director, and concluded with a role as Vice President of Engineering, Quality and Supply Chain for our $1B Energy Systems Division. Since leaving Motorola, I have consulted in battery technologies for ~10 years and then founded my current company, Polaris Laboratories, LLC (www.polarisbatterylabs.com), in 2012. Polaris is one of the only commercial battery R&D labs in the world and our clients include start up's, large chemical companies and OEM's interested in assessing and bringing to market new battery advances, Our lab has experience with all of the current lithium ion battery chemistries as well as next generation materials for consumer, electric vehicle, grid storage and drone applications.

In college, it was clear that in order for me to have any chance in a technical field that I would need a degree that would provide enough technical knowledge to be able to go into many different areas. For me, Sonoma States' Physics program was a perfect match and i have been able to realize a great career in technical fields that have been challenging and immensely satisfying. It's hard to imagine but the SSU Physics/astronomy degree was actually s key enabling program.

I urge you to reconsider your stance on keeping these science degree programs alive at Sonoma State. As an employer, I need physics, engineering and business managers and i don't think eliminating technical programs is going the right way.

If you would like to talk further about my experiences at SSU or any topics from above, I am happy to talk directly. You can reach me at 678 591-1171 or at dmorris@polarisbatterylabs.com

Doug Morris

One last very important note.My minor in astronomy became a real hobby for me and my kids. My 10" Meade telescope was used often when we lived in New Mexico and my kids were ~10 years old. My daughter was particularly interested and we spent a lot of time together star gazing (and seeing solar eclipses together) as she grew up. Rita finalized her Master's degree in Optics several years ago from the University of Arizona and is currently working at the Keck Telescope on Mauna Kea, Hawaii. She's an operator and has been working with scientists on every imaginable topic you can dream of. So just consider that in the grand scheme of things your physics program influenced two scientists in incredibly productive ways. Seems worth hanging onto the program doesn't it?

Bill Cabrall 1976

[Posted in support of Save Sonoma Physics]

Testimonials

Tony Alcocer

I first became involved with Sonoma State University, Physics and Astronomy Department and Lynn Cominsky in 2008. https://www.pressdemocrat.com/article/news/ssu-offers-high-school-students-chance-to-launch-their-own-craft-in-nevada/?ref=related This was the beginning of a long 18 year STEM outreach to teachers, parents and students around the bay area. This was accomplished by many NASA grants. We as parents and teachers are constantly trying to ignite that spark in the young people we come across. Some of the programs we've done are Small Satellites for Secondary Students (s4) https://s4.sonoma.edu/ This program is still ongoing at Piner High School. The Rising Data program (NASA) https://edeon.sonoma.edu/#about was aimed at students in grades 5-14 to pursue STEM careers. The current program is NASA's Neurodiversity Network (N3) https://n3.sonoma.edu/ . I've had the honor to help introduce STEM subjects to hundreds if not thousands of kids/young adults through Sonoma State's Physics and Astronomy Departments. It's unknown how many of these students have become Astronauts, teachers, Aerospace, Mechanical or Electrical engineers or or or! We do know that with out SSU Physics and Astronomy department there will be fewer kids and young adults to be introduced to the STEM opportunities that exist.

Tim Smith

Honorable California State University Board of Trustees Members -

Public Comment Remarks for delivery during Tuesday/28 January 2025 Board Meeting:

Tim Smith, Former Mayor of Rohnert Park, Former SSU faculty member, Father of SSU graduate, and SSU Nichols Legacy Society estate planning donor. Philosophy and Physics are at the traditional core of higher education, providing the foundation for all modern universities. Without these disciplines as degree granting departments Sonoma State University should simply consider itself a trade school; it would no longer be a university. Only advantage of this Chancellor chosen course of action would be strictly a personal financial one; SSU will no longer be among recipients of my charitable contributions. Thank you for your kind attention.

Tim Smith
Rohnert Park, CA

Saska Gjorgjievska

I am a Physics Instructor at Santa Rosa Junior College. My colleagues and I were stunned and deeply disheartened by the news of the planned elimination of Physics degrees at SSU. Physics is a core academic discipline, and it is difficult to believe that it is at risk of being removed from SSU's degree offerings.

Over my nine years at SRJC, we have consistently sent students to SSU to complete their Physics B.A. or B.S., participate in internship programs, and gain research experience. They have gone on to completing their degrees and building successful careers. Removing such opportunities for our students would have a significant negative impact on the broader scientific community.

I hope we see a reversal of this unprecedented decision.

Nicholas Suntzeff

The wealthiest man in the world, Elon Musk, was asked by a reporter what academic degree he felt was the most useful. His answer was simple - physics. Physics is the basis for engineering, nuclear medicine, microelectronics, quantum computers, and more. Musk said that physics allows you to see the underlying problem and gives you the experience to question the assumptions rationally. What is the secret to Space X? Partly reusable rockets, although NASA has been doing this for years with the Space Shuttle. No, the real secret was realizing that stainless steel could replace the lighter booster material made of titanium alloy. This made the rockets heavier but much more inexpensive to make and safe, as welding steel to withstand high temperatures and pressures required less work and would be less prone to burning through the welding seams.

It is this type of rethinking that makes physics unique in the physical sciences. Removing physics from a university is unwise. Instead, you need to make physics more interesting to the students by reviewing how it is taught. You need to find ways of encouraging students to major in physics. Look at your cell phone. Wifi? Invented by an astrophysicist. The camera? Both CCDs and CMOS optical detectors were invented by physicists. The microprocessor? That was a Nobel Prize in physics. The challenge to pack more memory onto a silicon wafer? Also physics. Many others contributed to the modern cell phone, but physicists made the fundamental discoveries.

Consider the rush to commercialize AI. Many of the leaders are from the field of physics. Quantum computing - both a theoretical and experimental physics technology. Chaos theory and algorithmic analysis in financial companies? They hire physicists.

I can go on and on about how vital physics is. I have taught over 3000 students at my large land-grant university, and many now work in industry—INTEL, TI, Google, Meta, Goldman-Sacks, etc. You are a 90-minute drive (if there is no traffic!) from Silicon Valley. Why would you eliminate one of the most important fields of expertise needed in SV? You want some of your graduates to go there, not just in computer programming jobs.

I urge you to reconsider. I fear many people who make decisions took physics in high school and hated it—I sure did. That is because physics is taught poorly. If we taught it better, we would have a much larger generation of scientists who could meet our future technological challenges.

Nicholas Suntzeff
Mitchell/Heep/Munnerlyn Chair
University Distinguished Professor and Regents' Professor of the Texas A&M University System
Department of Physics and Astronomy
Mitchell Institute for Fundamental Physics and Astronomy
Texas A&M University

Monty Mola

As chair of the Department of Physics & Astronomy at a sister campus of the CSU, I was shocked and disheartened to see that SSU was planning on eliminating the Physics degree as part of the budget reduction efforts. Having served on University budget committees during times of severe reductions, I understand the necessity of making difficult decisions. However, the proposal to eliminate the Physics program is both short sighted and does little to offset either the current budget deficit or the additional planned reductions.

As Physics service courses will still be needed to support the remaining curriculum, eliminating the courses associated with the major will generate little savings. Likewise, without a Physics degree there is little incentive or support for the SSU faculty to generate external funds through grants and contracts. Lastly, Physics is the foundation upon which all other sciences are built, and to be a true liberal arts institution, there must be a pathway for students to be able to explore that foundation. As can be seen in the many other testimonials, students have been served well by the SSU Physics department. They offer a high quality program that has clearly prepared their graduates for successful careers. It is shameful to eliminate such a valuable resource to the students of SSU and the greater community.

Autumn Gahagan

As a physics graduate from UC Irvine who now works as a staff member for Engineering and Computer Science, I am appalled that the administration has reduced such a valuable program to merely being a minor. Physics teaches many valuable skills beyond simply being a field unlike any other offered at this university. Moreover, as someone with a similar astrophysics concentration, I dreamed of having access to an on-campus observatory like SSU's. To make way for "necessary" budget cuts, students are going to be deprived the opportunity to truly learn the benefits of an observatory and how to appreciate the stars. So many valuable programs are being destroyed by this administration's choices, and my heart goes out to all the physics and astronomy students whose lives are being upended.

Testimonials

Bruce Macintosh

Sonoma State has particularly strong physics degree programs among Cal State Universities, offering exceptional research and learning opportunities e.g. through the Sonoma State Observatory as well as through connections to UC's Lick Observatory. Sonoma State regularly produces physics alumni who successfully complete graduate degrees at UC campuses; ~5 Sonoma State alumni are currently in our physics and astronomy graduate programs.

Sonoma State is uniquely positioned as the only public liberal arts university in California and as one of only four Cal State campuses north of San Francisco. Limiting education opportunities at this institution will have a large negative impact on our state, and the physics major should be especially highly valued because of the strong research, analytical, and problem-solving skills imparted by the program.

Please do not cut the physics degree programs at Sonoma State!

Bruce Macintosh
Director, University of California Observatories

Tucker Hiatt

"Science outreach" is important! I am grateful to the members of SSU's department of Physics & Astronomy for their numerous EXCELLENT public presentations for Wonderfest, the nonprofit Bay Area Beacon of Science. I also appreciate the long and rich history of their "What Physicists Do" lecture series; it is a North Bay treasure! In these ways, the SSU Physics & Astronomy Department has helped many thousands of citizens understand — and improve — California.

Laura Sparks

I have taught astronomy full time at SRJC for the past 15 years. So many of our best and brightest students have family responsibilities and financial realities that make it impossible for them to leave the area to continue their educations. When majors are cut at SSU, it doesn't mean that all potential students in those majors can simply go elsewhere. For many it means that they will have to study something else. Their futures will be limited to narrow range of majors offered at this more austere version of SSU. In the case of physics, this means that we are setting ourselves up for a future brain drain in Sonoma County in which those with the means will leave, and those without will not be able to attain the skills needed to confront the challenges posed by climate change in the coming decades. I already have multiple students telling me right now that they were planning to transfer to SSU, but now will go somewhere else because they wish to study physics. Preserving physics and as many other major programs as possible is absolutely essential to ensuring the long-term survival of SSU and the strength of our own community.

Alfia Wallace

Back in 2008 I started looking for local speakers for a science series at my son's high school. This was how I first learned about Sonoma State's Physics and Astronomy department, its fascinating research, and its many resources for both students and the community at large. Since then, multiple professors and graduate students from the department have come to present at the Marin Science Seminar, sharing their expertise, their research, and inspiring local youth to learn more. Every week during the academic year I have received the "What Physicists Do" email with information on the weekly free lecture (with cookies!) by an expert in physics and astronomy. It is simply mind-boggling that a field of such fundamental importance would be placed on the chopping block. Bring Physics and Astronomy back to Sonoma State!

Valton Smith

I was a physics lab instructor at Sonoma State University for two and a half years (2022-2024) and had a wonderful experience working with the department. Every semester was different because there was always a push for improvement.
For three of the semesters that I was there, we collaborated on either creating a new lab or transforming existing ones to make them more interactive and intuitive for the students. For example, we wanted to disrupt the typical lab process in which students blindly followed instructions to perform the experiment. To do this, we created a lab in which students designed, performed, and reported on their own experiments for a given topic. This required them to think more deeply about the topics as well as allowed them to be creative in their experimental design.
It's these kinds of qualities in the department that make the SSU physics degree a great program. The professors there are devoted, caring, and effective educators. A degree in physics opens the doors for students to enter a large variety of highly regarded professional careers, as can be seen in the SSU physics alumni records. In fact, I work with several SSU physics graduates in my primary career as an optical engineer.
I believe our society needs more opportunities to accel in STEM fields, and the physics degree at SSU offers this. I truly hope this decision is reconsidered.

Prof. Emily Rice, PhD

[Posted in support of Save Sonoma Physics]

Megan Donahue

I have had the privilege of working with SSU faculty and graduates of its astronomy program for the last thirty years. They have an excellent reputation for mentoring and outreach in our research community.

Astronomy remains as one of the most attractive “gateway sciences” for STEM students. Removing astronomy from a university makes the entire community poorer for it.

Robert Twiggs

Stanford Graduate, Faculty Aeronautics and Astronautics 1993-2008.

Worked with Dr. Cominsky on several Stem projects.

Eliminating a degree program is a BAD idea. Especially in physics because that is the important background for many future careers. You have one of the foremost professors with Dr. Cominsky.

If you want to be a second rate community college and lose Dr. Cominsky, then go

Toby Dodgen

[Posted in support of Save Sonoma Physics]

Dr. Kevin McLin

I worked in and with the Department of Physics at Sonoma State for more than a decade. For the first three years, I was a temporary visiting professor in the department. I taught a variety of physics and astronomy courses for both physics majors and non-majors. Then, for another ten years, I worked in the NASA Education and Public Outreach Group (NASA EPO), now called EdEon created by Professor Cominsky. In my roles as professor and Education Scientist I had an opportunity to develop a deep appreciation for the department and its students and faculty.

It would be a grave mistake for the university to discontinue the physics major. First and foremost this is because the department turns out graduates that go on to fill vital workforce needs for the State of California. They become scientists and engineers, certainly, but many also become teachers or journalists, fields for which people with a strong technical training are in desperately short supply. The absolute number of students who obtain a physics degree is small, it is true, but this is a common situation at many universities. The small numbers belie the fact that training in physics often provides a good basis for a successful career in many diverse fields. Because of the strong analytical skills training in physics develops, and because physics is the basis of most other scientific and technical fields, it can often be transferred to other disciplines with relative ease. And while the Physics Department creates graduates who go out and contribute in many different ways, the physics major at SSU has one unique and far-reaching benefit that should not be overlooked: the EdEon program.

I began working with Professor Cominsky in her education group the very first year I was hired onto the faculty. At first I was only there part time, with my primary contribution happening over the summers when I was not teaching. After three years I switched to working with The Group full time. In my position at the EPO Group I worked on many projects. These included running the group's robotic observatory, developing new curricular materials in science and math education and creating professional development programs for teachers and other educators.

In all my projects at EPO I had vital assistance from physics majors. They worked in The Group as assistants, programmers, web-developers, educational material testers, circuit designers and builders and so on. Their help was absolutely essential to the work of The Group. We had only a few full-time professional scientists and staff, so the students who worked with us allowed us to greatly increase the number and scale of the projects we could complete. And we were quite productive, creating educational materials and programs that radiated out to affect students and teachers all across Sonoma County, the State of California, and the United States; the group has even had impacts in some foreign countries. Without the work done by the many physics majors we employed over the years - and that the EdEon Group still employs - it simply would not have been possible to achieve the success we had with our products and programs.

I am deeply concerned that if the physics major goes away, then the EdEon Group will not be able to continue its work either. Most students on campus do not have the required set of background knowledge and skills needed for the projects undertaken by the EdEon Group, but the physics students do. Please reconsider the decision to terminate the physics major at SSU.

Dr. Kevin McLin
starwerk.net

Jennifer Ortiz

The Sonoma State Physics and Astronomy department has created an environment like no other physics department at other Universities. The way the professors engage and support students as well as the students united together creates a family that lasts a lifetime.

I already feel that my physics classmates and professors are like family to me, even though I've only been here since last semester (fall 2024) from transferred from Las Positas College in Livermore, CA. I first met Dr. Scott Severson before I transferred and he was so friendly to my mom and I and gave me a big picture on how life at Sonoma State is as a physics major. He said that although the department is small, we're all close and support each other, and that is exactly how the department is.

Before I became a student at Sonoma State, I came across Lynn Cominsky's EdEon STEM Learning as they were searching for new student employees. I ended up reaching out to Laura Peticolas and Dr. Cominsky, letting them know that I was interested in working for EdEon and they were so welcoming and were allowing me to try anything I put my mind to. Within a span of three months, I learned a new coding language, I put together circuits for their Learning by Making curriculum, I got to strengthen my Python skills to crop images of the Moon for their Eclipse Mega Movie, I got to learn how to solder, and most importantly, I got to learn how to operate a ground station by working on the 3Ucubed project. 3Ucubed is a Cubesat project through NASA's IMAP collaboration including Sonoma State, University of New Hampshire, and Howard University STEM students to build, operate, and launch a Cubesat to collect scientific data on electron precipitation in the aurora cusps. I was able to develop coding and engineering experience through EdEon, these skills have helped me get internships and expanded on my knowledge of physics.

During my first day at Sonoma State, my physics classes started off with all the physics students laughing and making jokes on the very first day of modern physics and mathematical physics. It was as if all the physics students knew each other and I never felt so comfortable being myself and being loud in a class room ever in my life, until I stepped into the modern physics and mathematical physics classroom. I've made so many friends from these physics classes right off the bat, and we all study together and support each other through our mistakes and achievements. Dr. Hongtao Shi was the main professor who kept me motivated and would stay at work an hour longer almost everyday to help me on questions I had in both modern physics and mathematical physics. Without Dr. Shi, I wouldn't have been able to achieve a high GPA and a well understanding of modern physics that I have today.

Dr. Alexandra Miller gave physics students at Sonoma State the opportunity to get involved in high energy physics research experience through her GROWTH-MSI program also ran by a Stanislaus physics professor Dr. Wing To. Through her, I got the chance to participate in this program and learn about particle physics, which is what I've been wanted to study in grad school after achieving my Bachelors of science in physics degree here at Sonoma State. Because of Dr. Miller, I got a jump start on understand why conservation laws obey certain symmetries and why certain standard model particles decay into other particles. After seeing Dr. Miller's work ethic, I've been inspired to work as hard as she does.

My life changed exponentially because of all the students and professors at Sonoma State that make up the Physics and Astronomy Department. Graduates from this program at Sonoma State have gone off to be CEOs, achieve PH.D's, and work in well known research facilities. Keeping the physics and astronomy department at Sonoma State benefits both education for STEM majors and the future for our community by allowing physics graduates to go off and accomplish discoveries, innovations, and research methods for our community as a whole.

Amelia Marshall

Between 1997 and 2003 I coordinated the Hands-On Universe program, based at U.C. Berkeley. It was a collaborative endeavor involving UCB Space Sciences Lab, Lawrence Berkeley National Lab, the Lawrence Hall of Science, and international partners.. The mission was curriculum development and grade 6 - 12 science teacher professional development programs.

On numerous occasions, program participants collaborated with the Sonoma State University physics department. This proved beneficial for Sonoma County high school teachers as well as academic researchers from the Third International Math and Science Study (TIMSS), in its evaluation of the efficacy of online, versus in-person, learning by science teachers. This was measured by improvements in student outcomes.

On numerous occasions, distinguished physicists and engineers were initially drawn to the SSU campus by the popular "What Physicists Do" lecture series - and then fruitful collaborations followed.

I was present for lectures and campus visits by Nobel laureates Saul Perlmutter and George Smoot, as well as Supernova Cosmology Project scientists Gerson Goldhaber and Hewlett Packard / LumiLEDs materials scientist William Imler. This outreach in turn led to jobs for SSU physics students in Berkeley and Silicon Valley.

In its early years, Sonoma State University was derided as "Granola U" - a second-tier state college. During its past three decades, however, innovative programs based in the Physics Department have propelled SSU into the ranks of internationally-acclaimed universities.

Eliminating the Physics Department as a means of saving money would be a false economy. The cost of supporting a few faculty to continue to offer physics baccalaureate degrees is well worth the investment. Preserving the physics department will aid SSU in maintaining its good reputation.

Robert Nemiroff

I am a colleague of Professor Lynn Cominsky and visited the Physics and Astronomy Department at Sonoma State University a few years ago, in part to meet with Dr. Cominsky's group, and in part to give a physics colloquium. I would like to say that my experience at Sonoma State was first rate. I quite admired both the impressive department and Prof. Cominsky's amazing outreach group. I have spoken with Dr. Cominsky several times in the past about topics in astrophysics and physics and can attest that her knowledge, outreach, and research skills are first rate and widely admired. In my opinion, Sonoma State has real excellence here which it should value highly.

- Robert Nemiroff
University Professor of Physics at Michigan Technological University
Fellow of the American Physical Society

Testimonials

Steven Anderson

SSU Physics and Astronomy is an excellent resource. Graduates are engineers and scientists working in our community. The Department has helped create Computer Science, Engineering Technology, and NASA EPO education programs. Physics is a qualifier for Bachelor of Science in Geology. Chemistry and Biology, needed for entry into medical school or doctorate. If there is no accreditation or programs why would students go to SSU?

Astronomy has brought in the most grants to SSU and has had so many talented students who practice and advance science and engineering.

We have graphs of successful student outcomes and career choices, if you like to know that sort of information, you need students with math and science skills to learn Physics. no Science, Athletics Art, will lower enrollment please save science at SSU.

Douglas B Clarke

I am a retired physicist currently volunteering as an advisor to the EdEon program in the Sonoma State Physics Department. I retired after 33 years at a US Energy Department laboratory. I have a Ph.D degree from the University of Wisconsin. I have been supporting the SSU Department of Physics and Astronomy and advising at EdEon for about ten years. At first I was working on Learning by Making, their science-enrichment program for high-school students. Later I contributed to the spectrometer design for a small earth satellite (Cubesat) called EdgeCube, which was launched into space in December 2019. More recently I have been advising on physics issues with another small satellite called 3UCube. Along the way I have had opportunities to talk and work with students, and I have been impressed with the students I encountered. I am very unhappy with the decision to terminate the Physics Major at SSU. My experience has been that the Universities Physics graduates were of excellent quality, well prepared (as their record shows) to go on to graduate school, or to succeed at a variety of jobs after graduation. I know what a productive, successful physics department is like, and the SSU Physics department deserves to be recognized and supported for its excellence.

Testimonials

Lynda Williams

I taught Physics at Santa Rosa junior college for over 20 years and during that time saw dozens of students transfer to SSU for their excellent program in physics and then go onto to complete PhDs and thrive. SSU physics is a critical program in our Sonoma County STEM community. It must not be sacrificed.

Anne Metevier

As an adjunct faculty member in the SSU physics and astronomy department from 2008-2023, I have had the opportunity to work directly with many talented SSU physics majors. I have been impressed with the successes of SSU physics alumni who have pursued different education and career pathways, from graduate work in physics and astronomy to leadership of local businesses.

I have also seen the SSU physics department get smaller, as some faculty have retired and fewer new faculty have been hired. The current physics faculty are deeply dedicated to SSU physics students' education. They have kept the physics degree programs strong and agile, and have increased the efficiency of the programs so that the high quality of physics education at SSU established by past faculty has not changed despite the fact that the department has gotten smaller.

Many unique and advanced undergraduate learning opportunities exist with the SSU Observatory, the EdEon STEM Learning group, the Keck Microanalysis Lab at SSU, and SSU's CubeSat programs, all led by SSU physics faculty and students. Faculty members' extended collaborations provide even more opportunities. In my current position, I collaborate with faculty from Bay Area colleges (including SSU faculty) to get students involved in working with Lick Observatory. Through this collaboration, SSU physics majors are conducting real-time telescope observations for labs in their courses and even leading astronomy observing programs with research telescopes at Lick Observatory. These are just a few examples of unique opportunities that add to the depth of SSU physics majors' training and are readily supported by SSU physics faculty, but would be severely limited if SSU cut its physics major programs.

Please do not limit SSU students' opportunities and training by cutting physics degree programs!

Anne Metevier
Director of Lick Observatory College Partnerships
University of California Observatories

Department of Physics & Astronomy
Program Review
Self-Study Report
2022-2023

Submitted by:

Scott Severson, *Chair & Lead Author*
Lynn Cominsky
Alexandra Miller
Hongtao Shi
Tom Targett

With Assistance by:

Ryan Meder
Marissa Reichenberg

SONOMA STATE UNIVERSITY

School of Science and Technology

Front Matter

1.1 Overview

This document presents the Department of Physics & Astronomy program in context with a complete discussion of the curriculum and its alignment with Sonoma State University's Strategic Priorities and Core Values. We provide the department's Program Learning Outcomes (PLOs) and present a Program Curriculum Map to connect these with our courses and degree programs. We present our program-specific pedagogical methods and discuss standards and trends in the discipline. Our academic programs all contain an integrated capstone research experience. The Department of Physics & Astronomy provides essential service to other programs and has a long history of providing popular courses for non-STEM majors including General Education courses. We provide a comprehensive list of our program achievements and changes since previous program review.

Our assessment includes our assessment plan and findings including our course-embedded assessment tools. An essential component of our assessment is the aforementioned capstone program. We close the loop by presenting a collection of proposed changes informed by our assessments.

We present a summary of our Department of Physics & Astronomy faculty, noting trends and presenting a summary of our specializations and accomplishments. A discussion of faculty support includes a discussion of workload and a hiring plan.

A survey of our program resources includes a section on student support, including advising and campus supports. Of particular interest are our technology resources and instructional spaces. Our support staffing is essential. We discuss our budgetary trends and needs.

Our section on Student Success presents a snapshot of the student population and declining enrollment campus-wide. Department of Physics & Astronomy trends show a much greater proportion of female-identifying physics students and Underrepresented Minority (URM) physics students than the national average, with remarkable growth in the number of First Generation students. The section on applications, admission and enrollments discussed the recent downturn while highlighting our placement in the top 25% of all bachelor's-only Physics departments for number of graduating majors.

We end our Program Review with a reflection and plan of action with summary tables of our challenges and proposed responses (some in-progress, some to do, and some requiring additional resources). We include a discussion of our resilience, strengths and challenges.

Additional matter is provided in an appendix, including a data summary prepared by Institutional Effectiveness, our online education policy, a link to our annual newsletter archive, prior program review summaries and faculty curricula vitae.

1.2 Preface

1.2.1 Context

This program review is taking place against a backdrop of significant challenges facing the university. The COVID pandemic disrupted academic activities and placed enormous pressure on the department and university's resources. The contemporaneous decline in campus enrollment has put pressure on the number of majors and course enrollments. The campus recently underwent a revision of its General Education program, which has led to increased administrative responsibilities in launching and recertifying courses. The Department of Physics & Astronomy has risen to these challenges, developing and implementing: online course policies, a website transition, launching the new Physical Science program, recruitment planning and implementation in addition to the customary conduct of our instruction, research and service.

1.2.2 What is Physics?

Physics and Astronomy are two related fields of science that explore the fundamental laws and principles that govern the universe. Physics is concerned with the behavior of matter and energy, while astronomy builds upon physics to incorporate on the study of celestial objects such as planets, stars, and galaxies. Both fields rely heavily on mathematics and experimentation to explain the workings of the natural world.

Physics encompasses multiple subfields, and astronomy is, in essence, one of these. The American Physical Society (APS) classifies the subfields in this manner:

1. General: Mathematical Methods, Quantum Mechanics, Relativity, Nonlinear Dynamics, Metrology
2. High Energy Physics: The Physics of Elementary Particles and Fields
3. Nuclear: Nuclear Structure and Reactions
4. Atomic and Molecular Physics
5. Classical: Electromagnetism, Optics, Acoustics, Heat Transfer, Classical Mechanics, and Fluid Dynamics
6. Plasma: Physics of Gases, Plasmas, and Electric Discharges
7. Condensed Matter: Structural, Mechanical, and Thermal Properties; Electronic Structure, Electrical, Magnetic, and Optical Properties
8. Interdisciplinary Physics and Related Areas of Science and Technology
9. Astrophysics, Astronomy, and Geophysics

Within a liberal arts tradition, physics and astronomy are often considered essential components of a well-rounded education. These fields provide opportunities for students to develop critical thinking skills and explore the philosophical implications of scientific discovery. Furthermore, the study of physics and astronomy intersect with other disciplines such as mathematics, education, engineering, chemistry, and computer science, making them interdisciplinary in nature. The Department of Physics & Astronomy provides service courses, most notably introductory sequences in physics that are required by such allied programs. The liberal arts approach also encourages students to develop skills in communication, collaboration, and creativity, which are highly valued in today's job market.

Career opportunities for students studying physics and astronomy are diverse and numerous. Graduates with degrees in these fields can pursue careers in academia, research, government, or private industry. In academia, they may become professors or researchers at universities, while in industry they may work for technology companies or research institutions. Some graduates may also choose to enter public service, working for government agencies such as NASA or the National Science Foundation. In physics, graduates can work in fields such as aerospace, optics, electronics, and materials science. In astronomy, opportunities range from academic research and teaching to data analysis for government agencies, observatories, and private companies. The skills developed through studying physics and astronomy can also be applied to fields such as medicine, finance, law, and business, where analytical thinking and problem-solving are highly valued. Overall, the study of physics and astronomy can open doors to a wide range of exciting and rewarding career opportunities.

→ ToC

1.3 Table of Contents

Note: These links work to place you at the selected section. The bottom right of most pages (excluding the CVs) has a link back to this Table of Contents (ToC).

The Faculty Curricula Vitae Section contains imported inline pdfs of faculty generated CVs. These are presented in their entirety. The Table of Contents above correctly links to cover pages for each of faculty CV, but the page numbering above does not account for the length of the CVs themselves.

Program Context and Curriculum

Let us begin by presenting a high-level snapshot of the Sonoma State University Department of Physics & Astronomy at the time of this review.
The Department of Physics & Astronomy:

- Offers degree programs aligned with Sonoma State University's Strategic Priorities and Core Values.
    - BS and BA degrees in Physics
    - BS Degree in Physics with a concentration in Astrophysics[1]
    - BA in Physical Science[2]
    - Offers minors in both Physics and Astronomy
- Supports allied degree programs (e.g. Biology, Chemistry, Engineering Science, Geology, Kinesiology, and Mathematics & Statistics) with required supporting courses.
- Provides General Education courses aligned with our Strategic Priorities and Core Values.
- Major/Minor Student Breakdown
    - 49 Majors
        - 35 B.S.
            - 16 Physics
            - 19 Astrophysics Concentration
        - 14 B.A.
            - 7 Physics
            - 7 Physical Science
    - 4 Minors
        - 3 Astronomy
        - 1 Physics
    - 1 additional Postbaccalaureate. Student taking undergraduate physics classes.
    - 9.7 graduates/year (2015-2021)
- Course offerings
    - 26 distinct physics courses, 8 including lab components
        - 11 lower division, 15 upper division
        - 8 satisfy General Education requirements
        - Introductory calculus and algebra/trigonometry sequences (2 semesters each) are also service classes to allied degree programs.
    - 9 distinct astronomy courses, 3 including lab components
        - 6 satisfy General Education Requirements
    - Majors required to complete capstone course
        - Research done under supervision of a faculty advisor
        - Students present a poster at SSU Research Symposium
        - Students give talk at Physics & Astronomy Symposium

---

[1] Completed as per 2015 Program Review Recommendation, coincided with the discontinuation of Applied Physics concentration

[2] Completed as per 2015 Program Review Recommendation, coincided with the discontinuation of the trigonometry-based BA Physics advising path.

        - Student research taken as special studies, and a popular seminar series round out our offerings
    - Students served in Academic Year 2021-2022:
        - Total Student headcount in P&A courses: 1493
        - 259 FTES[3]
            - 100 Astronomy (69 in Astronomy 100), 159 Physics
    - Faculty in Academic Year 2022-2023
        - 4 Tenure-Track Faculty and a 5th who has historically had no teaching responsibilities.
            - Currently two Full, one Associate, and one Assistant - Professors compose the teaching tenure-track faculty. Professor Lynn Cominsky, a fifth faculty member, does not teach, she runs the EdEon group (https://edeon.sonoma.edu) and serves the department in other ways.
            - Department topical specialties are Materials Science, Astronomy and Quantum Gravity.
            - 3.43 FTEF[4] among the tenured faculty with teaching responsibilities, with the balance of WTU (weighted teaching units) in grant-related and other release work. Calculated for 2021-2022, two faculty each had a one-semester sabbatical during this period, and an additional faculty had 6 WTU of family leave. Visiting Professor hire for replacing these semesters is included here.
        - 6 Part-Time Faculty (4 w/ Ph.D.)
            - 2.17 FTEF One is retiring after AY 22-23 (Ph.D.), one is declining work AY22-23 (Ph.D.), and we are adding one in AY 22-23 (M.S.).
    - SFR[5] = 25.5
    - Staff: 0.5 Administrative Coordinator, 1 Laboratory Technician
    - Operating Expenses Budget 2021-2022 Academic Year: $9,380
    - The Department of Physics & Astronomy is active in research and service. To briefly list a few of the ongoing or recent efforts: Department of Energy RENEW-HEP Grant (Growth & Research Opportunities With Traineeships in High Energy Physics at Minority Serving Institutions); NASA's Neurodiversity Network; National Science Foundation Engaging Community Colleges in Collaboration (EC3) Grant; Department of Education curriculum grant, "Learning by Making"; LIGO Outreach and course materials; public programs such as Observatory Viewing Nights and the 'What Physicists Do' public lecture series; Developing and launching multiple CubeSat Satellites; an active Society of Physics Students club; supporting Cal-Bridge Scholars and organizing the 'Science by Diverse Scientists' speaker series; leading efforts to create SSU Makerspace and develop SCI 220

[3] FTES - Full-time equivalent students. A student whose class schedule totals 15 units in a given term = 1.0 FTES

[4] FTEF - Full-time equivalent faculty. TT Faculty: 1 FTEF = workload of 12 weighted teaching units in class and 3 indirect WTU. Part-time faculty – 15 in class teaching WTU.

[5] SFR: Student to Faculty Ratio, the number of full-time equivalent students to full-time equivalent faculty (FTES per semester/FTEF), Fall 2022

→ ToC

Dream, Make, Innovate course; development of Virtual Reality Astronomical Labs; construction and development of new on-campus observatory; collaborative National Science Foundation grant award to purchase a new Scanning Electron Microscope in the Keck Microanalysis Laboratory.

2.1 Program Goals

The Mission of the Department of Physics and Astronomy is to provide excellent education to the diverse Sonoma State University student population through general education, support courses, and a strong major program with demonstrable quality of instruction and vibrant scholarship that first and foremost integrates student involvement.
Our program includes teaching three different, but aligned populations of students: the preparation of our majors for a broad array of pathways to careers in industry, research, and teaching; the training in the processes of physics of students in aligned STEM (Science, Technology, Engineering and Math) fields; and providing the student body with a rich set of General Education courses to serve as a lasting impression in how science works as part of our SSU tradition as a public Liberal Arts institution. We incorporate research-based instructional practices and inclusive pedagogy that supports our students' sense of belonging in in STEM.
Central to the education of the majors, and enriching the experience of the other two populations, is our goal to conduct student-centered authentic research directed by our faculty and incorporated in our degree programs via our intermediate and advanced laboratories, our special studies programs, and culminating in a senior Capstone research experience, which is frequently aligned with issues of sustainability.
Our final goal is centered upon sharing the processes and discoveries of physics and astronomy in ways that involve the broader campus and community and reflect our core values.

2.1.1 Connection to Sonoma State University's Strategic Priorities and Core Values

The Department of Physics & Astronomy is committed to the priorities and values of the institution and has a history of supporting actions. Presented below are the University's Strategic Priorities and Core Values as well as a ***selection*** of department efforts in these areas.

- SSU Strategic Priorities:
  - Student Success (SPSS)
    - Active departmental advising, including detailed 4-year and 2-year plans.
    - Recruitment efforts including connections to service-area Junior Colleges
    - Active use of the Care Team, LoboConnect, and Disability Services for Students mechanisms for supporting students
  - Academic Excellence (SPAE)
    - Clear and thoughtful Program Learning Outcomes (see Section 2.2)
    - Program-Specific Pedagogical Methods (see Section 2.3)
    - Two current faculty are recipients of the Excellence in Teaching Award (formerly the Outstanding Professor award).
  - Leadership Cultivation (SPLC)
    - Student professional development integrated into the curriculum by the Capstone requirement with students receiving one-on-one faculty mentoring and support through PHYS 491 – Capstone Preparatory Seminar

        - Routine professional development by faculty and staff. E.g., attendance and authorship at American Physical Society (APS) and American Astronomical Society (AAS) and other meetings, campus-based professional development on such topics as: Drupal (web publishing); Canvas (learning management system); diversity, equity, and inclusion
    - Transformative Impact (SPTI)
        - Professor Lynn Cominsky's EdEon is a well renowned STEM Learning Center that creates innovative experiences in formal and informal education for secondary and college students and has brought over $43 million in grant funding to SSU since its inception.
        - Professor Alexandra Miller, in partnership with Associate Professor Wing To of Stanislaus State was recently awarded a $950,000 grant from the Department of Energy for their proposal, Growth and Research Opportunities With Traineeships in High Energy Physics at Minority Serving Institutions (GROWTH-MSI).
        - Professor Hongtao Shi is the director of the Keck Microanalysis Laboratory, which opens new worlds of research on the molecular and atomic level for students, faculty, area junior colleges and high schools, and the local high-tech community.
- SSU Core Values:
    - Diversity & Social Justice (CVDS)
        - SSU EdEon's NASA's Neurodiversity Network is bringing new students to SSU, and EdEon's mission includes a special focus on underrepresented students. Rural students are another major EdEon focus.
        - Co-originator Cal-Bridge 'Science by Diverse Scientists' speaker series
        - Participating in Transformative Inclusion in Postsecondary STEM: Towards Justice (TIPS) – several members of P&A participated in this program
    - Sustainability & Environmental Inquiry (CVSE)
        - Astronomy 100 and Astronomy 303 to meet the Sustainability and Environmental Resilience Course Overlay
        - Members of Astronomers for Planet Earth
        - GORT (Gamma-ray Optical Robotic Telescope) located at the Pepperwood Preserve
    - Connectivity & Community Engagement (CVCE)
        - Public Programs: Observatory Public Viewing Nights, the 'What Physicists Do' Public lecture series
        - Developed and offering Science 220: Learning by Making service-learning course with community partnerships
        - EdEon STEM Learning center support for public outreach including citizen science observations of the upcoming eclipses (Eclipse Megamovie 2024, led by Associate Director Dr. Laura Peticolas)
    - Adaptability & Responsiveness (CVAE)
        - The department's response to the COVID-19 pandemic included a swift and effective move to online instruction and a nearly-as-rapid return to in-person instruction, integrating many new tools learned in the process.

- The department has responded to the challenge of the enrollment decline with extraordinary efforts in improving the departmental website, updating student 4-year plans, developing student 2-year transfer plans, and creating and distributing recruiting materials to junior colleges.
- The department has further responded to the enrollment decline with careful planning of course offerings and effective communication with the Dean and the School of Science and Technology office.

2.2 Program Learning Outcomes

The following are the program learning outcomes (PLOs) for the Physics and Astronomy courses and degree programs. These learning outcomes are found on our departmental website: http://phys-astro.sonoma.edu/current-students/advising/learning-objectives and our class syllabi reference these learning outcomes. As is our tradition, we break these 8 PLOs down into a group of 5 PLOs related to content, abilities and skills related to the discipline and 3 PLOs related to cross-cutting skills. These are listed below.

2.2.1 Learning Outcomes

Learning Outcomes Specific to the Physics and Astronomy discipline

Students are required to demonstrate:

1) Knowledge, understanding and use of the principles of physics and/or astronomy
2) Ability to use reasoning and logic to define a problem in terms of principles of physics
3) Ability to use mathematics and computer applications to solve physics and/or astronomy problems
4) Ability to design and/or conduct experiments and/or observations using principles of physics and/or astronomy and physics or astronomical instrumentation
5) Ability to properly analyze and interpret data and experimental uncertainty in order to make meaningful comparisons between experimental measurements or observation and theory

Essential Outcomes for Physics and Astronomy courses

Students are expected to acquire:

6) Critical Thinking Abilities
7) Quantitative Skills
8) Communication Skills

Since all courses are expected to incorporate these Essential learning outcomes, they are not indicated in the Curriculum Map below. We note the clear connection between our pre-existing “Essential Outcomes” and WASC “Core Competencies”

- WASC Core Competencies
    - Written Communication ⟷ Dept. PLO #8
    - Oral Communication ⟷ Dept. PLO #8
    - Critical Thinking ⟷ Dept. PLO #6
    - Quantitative Reasoning ⟷ Dept. PLO #7
    - Information Literacy*

* Information Literacy is not called out as a PLO and thus does not appear in our Curriculum Map. But it does appear in our finer-grained Skill Assessment & Academic Knowledge Base presented in the Assessment Chapter.

2.2.2 Aligning Courses with Program Learning Outcomes

We ensure alignment between our courses and the Program Learning Outcomes through the use of a Departmental Curriculum Map. This is presented on a single page in Section 8.1 Program Curriculum Map where it includes columns devoted to mapping to our degree programs and to General Education categories. It is summarized below in an abridged format to show the general nature of the alignment.

Key things to Note:

- Our curriculum contains Astronomy courses (denoted with ASTR) and Physics Courses (Denoted with PHYS)
- Program Learning Outcomes are addressed within our courses with one of three levels of intended student proficiency
    - Introduced
        - Students are introduced to important introductory concepts
    - Developed
        - Students will demonstrate learning beyond the Introductory level
    - Demonstrated
        - Students will demonstrate advanced proficiency with the Program Learning Outcome
- Our curriculum is designed to scaffold student development within these PLOs, shown by the lightly-shaded “PLO Introduced” courses transitioning to the medium-shaded “PLO Developed” courses and culminating in the darkly-shaded “PLO Demonstrated” courses.
    - The highest level of proficiency is mapped to our Student Capstone Experiences described in Section 2.5 Capstone Research Experience
- PLOs 1-3 and 6-8 are embedded throughout our curriculum. The experimental laboratory-based skills and deeper analysis of experimental measurements are concentrated within our laboratory experiences but also appear multiple times at the Introduced, Developed, and Demonstrated levels of proficiency.

Department of Physics & Astronomy Program Learning Outcomes

Prefix	Code	Name	PLO 1 Principles	PLO 2 Reasoning	PLO 3 Math & Computing	PLO 4 Experiment	PLO 5 Analysis	PLO 6 Critical Thinking	PLO 7 Quantitative	PLO 8 Commun.
ASTR	100	Descriptive Astronomy								
ASTR	121	How to Influence the World								
ASTR	150	Astronomy for Scientists								
ASTR	231	Intro. to Observational Astronomy								
ASTR	303	Life in the Universe								
ASTR	305	Frontiers in Astronomy								
ASTR	331	Astronomical Imaging								
ASTR	350	Cosmology								
ASTR	380	Astrophysics: Stars								
ASTR	390	Astrophysics: Galaxies and Cosmology								
ASTR	396	Selected Topics in Astronomy								
ASTR	482	Advanced Observational Astronomy								
ASTR	492	Instructional Design Project								
ASTR	495	Special Studies								
ASTR	497	Undergraduate Research in Astronomy								
PHYS	100	Descriptive Physics								
PHYS	102	Descriptive Physics Laboratory								
PHYS	107	Intro. to Physical Science for Teachers								
PHYS	114	Introduction to Physics I								
PHYS	114W	Physics I Workshop								
PHYS	116	Introductory Laboratory Experience								
PHYS	209A	General Physics Laboratory								
PHYS	209B	General Physics Laboratory								
PHYS	210A	General Physics								
PHYS	210B	General Physics								
PHYS	214	Introduction to Physics II								
PHYS	216	Introductory Laboratory								
PHYS	300	Physics of Music								
PHYS	304	The Strange World of Modern Physics								
PHYS	313	Electronics								
PHYS	313L	Electronics Laboratory								
PHYS	314	Introduction to Physics III								
PHYS	320	Analytical Mechanics								
PHYS	325	Introduction To Mathematical Physics								
PHYS	340	Light and Optics								
PHYS	342	Light and Color								
PHYS	366	Intermediate Experimental Physics								
PHYS	381	Computer Applications for Scientists								
PHYS	395	Community Involvement Program								
PHYS	396	Selected Topics in Physics								
PHYS	430	Electricity and Magnetism								
PHYS	445	Photonics								
PHYS	450	Statistical Physics								
PHYS	460	Quantum Physics								
PHYS	466	Advanced Experimental Physics								
PHYS	475	Physics of Semiconductor Devices								
PHYS	491	Capstone Preparatory Seminar								
PHYS	492	Instructional Design Project								
PHYS	493	Senior Design Project								
PHYS	494	Physics Seminar								
PHYS	495	Special Studies								
PHYS	497	Undergraduate Research in Physics								

PLO 1 - Knowledge, understanding and use of the principles of physics and/or astronomy
PLO 2 - Ability to use reasoning and logic to define a problem in terms of principles of physics
PLO 3 - Ability to use mathematics and computer applications to solve physics and/or astronomy problems
PLO 4 - Ability to design and/or conduct experiments and/or observations using principles of physics and/or astronomy and physics or astronomical instrumentation
PLO 5 - Ability to analyze and interpret data and experimental uncertainty to make meaningful comparisons between experimental measurements and theory
PLO 6 - Critical Thinking Abilities
PLO 7 - Quantitative Skills
PLO 8 - Communication Skills

Introduced
Developed
Demonstrated

* One of A100/150 Required
** One Capstone Project Course Required
*** Physics 381 or CS 115 Required

Section 8.1 Program Curriculum Map presents a more detailed version of this, including columns devoted to mapping to our degree programs and to General Education categories.

2.3 Program-Specific Pedagogical Methods

This section is an overview of the key pedagogical underpinnings of instruction within the Physics and Astronomy Department. We then discuss the mechanisms for formal and informal feedback on the quality of faculty instruction.

Pedagogy. Our classes fall mainly into two categories; lecture-based and laboratory-based. These distinctions occur both in courses for majors and in GE courses. Within these courses we employ a variety of teaching methods to support student-learning outcomes through the use of best practices. These include lecturing, small group activities, small and large group discussions, guided laboratory activities, and inquiry-based and project-based activities. Our faculty monitor and enhance student learning with appropriate choices in assessment. We employ formative assessment through the use of discussions, ongoing writing assignments, and question and answer sessions in order to give students feedback on their progress and to provide the instructor insight on what might be done to support student learning throughout a given course. We use summative tasks like exams, problem sets, student presentations and written reports to assess student achievement in reaching our learning objectives.

There are both subtle and striking differences between teaching courses within the major and to the General Education audience. The amount of mathematical rigor is the most obvious, but our learning goals for the students are another difference. Within courses in the major, we stress conceptual development to allow students to become capable practitioners of science. In a parallel fashion, we want GE students to become conversant in the mechanisms of the physical world, and stress an understanding of the general principles and processes of science. Our review of courses in the context of a skills matrix (discussed in Section 3 - Assessment) led to the development of our capstone program within the major. For both audiences, we stress the intertwining of process, content and attitudinal goals as we develop our courses and instruct our students.

Active Learning, and Online Learning.

The department of Physics and Astronomy has recently offered several of its most popular courses in non-traditional formats, such as the "flipped class" and fully online models. We had a head start on these modalities as Professor Lynn Cominsky and her EdEon group developed "Big Ideas in Cosmology", an online resource for teaching introductory and advanced astronomy, with a focus on student interaction with real data and critical thinking. Prior to the pandemic we had offered both "ASTR 100: Descriptive Astronomy" and "ASTR 350: Cosmology" in traditional classroom settings, as flipped classes, and as fully online courses. In a flipped class, students read and engage with material and mathematical exercises designed to teach them the core course learning objectives before scheduled class times. With this essential knowledge now in place, lectures no longer server as content delivery, but instead as interactive discussion sessions focused on connecting the basic factual knowledge to the large conceptual implications.

In the fully online classes, students based around the state were set material from the Big Ideas resource to be completed each week. As the participants were never in one place together, mentoring, guidance, and assessment were provided via email or message boards.

From the Spring of 2020 until Fall 2021 almost all of our instruction was online. The department's online offerings have been predominantly taught in the synchronous modality, where the instructor and the class meet via Zoom at the scheduled class time. A notable exception to this has been Astronomy 303 – Life in the Universe, and upper-division General Education course taught in an asynchronous way, with pre-recorded lectures, online assignments including message boards and weekly drop-in Zoom times. The department decided it was important to develop an Online Education Policy.

2.3.1 Standards and Trends in the Discipline

The physics curriculum at SSU is aligned with the common curriculum that has been developed by consensus throughout the US. We will present a couple of short summaries from two of the seminal efforts within our field to capture and enumerate the best practices for Physics Education. One is a special study funded by the NSF and conducted through the American Institute of Physics (http://www.aapt.org/Projects/upload/SPIN-UP-Final-Report.pdf) another is the Effective Practices for Physics Programs, led by the American Physical Society (APS), in collaboration with the American Association of Physics Teachers (AAPT) (https://ep3guide.org)

From the Spin-Up report:

> "The commonality among physics departments lies in the physics curriculum. Most college level introductory physics courses across the country cover a common set of standard topics, usually in a one-year course (two semesters or three quarters), including classical mechanics (roughly the first half of the course), and electricity and magnetism (roughly the second half). These courses are generally taught in the traditional lecture/lab/recitation format. A mix of "modern physics" topics, including special relativity and quantum physics, is often covered in an additional semester or quarter. The "core" upper-level courses (advanced mechanics, advanced electricity and magnetism, and quantum mechanics) are even more homogeneous with a relatively small number of standard textbooks used across the country. … The undergraduate physics program, at least for those students who are considering graduate work in physics, is remarkably uniform."

Survey data from the SPIN-UP report and presented in the American Association of Physics Teachers publication "Guidelines for Self-Study and External Evaluation of Undergraduate Physics Programs" (http://www.aapt.org/Resources/upload/Guide_undergrad.pdf has been added to corresponding information for our department in the following table:

Course Requirements and Undergraduate Degree Program

	National		SSU			
Required Course	BS	BA	BS	BS-A	BA	PHYSCI
Introductory classical physics	99%	99%	R	R	R	R
Intermediate classical mechanics	97%	88%	R	E	E	-
Introductory modern physics	95%	94%	R	R	R	R
Intermediate electromagnetism	96%	88%	R	R	E	-
Advanced laboratory	90%	74%	R	R	E	E
Quantum mechanics	88%	74%	R	R	E	-
Thermal and/or statistical physics	82%	57%	R	R	E	-
Mathematical physics	45%	38%	R	R	E	-
Optics	46%	24%	R	R	R	R*
Other physics courses	85%	82%	R	R	R	R
Number of survey respondents	387	92				

The survey data is presented in the first two columns as percentages of programs requiring this course. The last four columns represent the (R) required, (-) not required, and (E) elective courses for our BS Physics, BS-Astrophysics, BA Physics and BA Physical Science degree programs.

* Optics in the Physical Science degree is addressed in the General Education course: Physics 342 - Light and Color.

The "Effective Practices for Physics Programs (EP3) Initiative has produced a collection of knowledge, practical experience, and proven best practices for Physics Programs https://ep3guide.org. While more expansive than we present in this section on Pedagogy, our program is well-aligned with the guiding principles presented in the EP3 Guide regarding our major curriculum:

- Introductory Courses
  - Develop Program Level and course level student learning outcomes
  - Develop systems for staffing introductory course to ensure quality instruction
  - Incorporate research-based instructional practices and inclusive pedagogy
  - Support students with active learning in the classroom
- Upper-Level Physics Curriculum
  - Consider the needs of the majors and define student learning outcomes and content knowledge for your programs
  - Plan the structure and sequencing of the curriculum and ensure that students follow a reasonable progression
  - Incorporate research-based instructional practices and inclusive pedagogy
  - Design intermediate-level course that enable all students to make a smooth transition to upper-level curriculum
  - Include capstone research experiences
- Instructional Laboratories
  - Develop program level and course level student learning outcomes for experimental skills
  - Provide student with opportunities to engage in all aspects of the experimental physics process
  - Encourage student ownership of projects
  - Support students' engagement in collaborative work
  - Build students' communication skills
  - Use research-based instructional practices and inclusive pedagogy
  - Create and maintain a safety culture

2.3.1.1 Comparisons to Similar Programs at Comparable Universities

Comparing the courses required in our B.S. Physics major curriculum to several other roughly equivalent universities, we find:

University	First year course including Lab: Mechanics and E&M				Electronics & Lab		Modern Physics
SSU Course	P114	P116	P214	P216	P313	P313L	P314
Cal Poly Humboldt	R	R	R	R	R 2 semesters		R
CSU East Bay	R	R	R	R	R	R	R
College of Charleston	R	R	R	R	E	E	R
SUNY Geneseo (BS Appl.)	R	R	R	R	R	R	R

In the above table, "R" means required, "E" means elective, "-" means not required or elective.

These Universities were chosen because they are similar to SSU in size and mission, and SUNY Geneseo and College of Charleston are fellow COPLAC Universities with combined Physics and Astronomy Departments. SUNY Geneseo was studied by the NSF/AIP task force as an example of a “thriving department” and College of Charleston has a much higher percentage of physics majors compared to the nation-wide average with an average of 16 physics degrees conferred per year (2016-2018).

Introductory Sequence and Modern Physics: This is required across all institutions and is a de-facto standard within the field.

Electronics and intermediate laboratory work: Humboldt State requires two semesters of electronics and instrumentation work, with laboratory. At College of Charleston Electronics is an elective. Intermediate laboratory classes are required at all.

Mathematical Physics: Two of the four comparable universities do not offer a Mathematical Physics class within the department, but assume the students will obtain sufficient mathematical background through the co-curricular requirements in Mathematics. This has not been our

University	Adv. Mech.	Math. Phys.	Optics	Inter. Lab	Comp. Phys.	Adv. E&M	Stat. Mech.	Adv. QM
SSU Course	P 320	P325	P340	P366	P381	P430	P450	P460
Cal Poly Humboldt	R	R* Joint Comp	E	R	R* Joint Math	R 2 sem.	R	R
CSU East Bay	R	-	-	R	R* Adv Lab	R 2 sem.	R	R 2 sem.
College of Charleston	R	-	E* photonics	R	-	R	E	R
SUNY Geneseo (BS Appl.)	R	R	R	R	2 sem. Math	E	E	E

experience, which is why we moved the class to a 300-level several years ago – our students need the extra mathematics preparation in order to succeed in the upper division classes. Our class is available as an upper-division elective for Math majors. In 2015, six of twelve programs reporting to a CSU Physics Chairs meeting require a Mathematical Physics course.

Computational Skills: Three of the four universities require comparable courses to our Physics 381, Computer Programming for Scientists, and the other has no specific requirement. In our review of our curriculum for this review, we find that computing skills is among the top priorities for our graduates.

Advanced Electricity and Magnetism: Humboldt State and CSU East Bay require a two-semester sequence of Advanced E&M. College of Charleston requires one semester and does not appear to regularly offer the second semester, while SUNY Geneseo offers this class as an elective. SSU used to offer two semesters of Advanced E&M, however this was dropped many years ago as a result of pressure to lower the total number of units in the major.

Advanced Quantum Mechanics: Humboldt State requires one semester of Advanced QM, CSU East Bay requires two semesters of Advanced QM, College of Charleston requires one semester and offers the second semester every other year as electives, while SUNY Geneseo considers this course an elective for their BS Applied degree, and regularly offers the first semester of this class. SSU used to offer two semesters of Advanced QM, however this was also dropped several years ago as a result of pressure to lower the total number of units in the major.

2.4 Academic Programs

The Physics and Astronomy program offers four different degree programs and two minors. A general description of the goals for each program is given below. Details of the courses required for each degree program is available at http://phys-astro.sonoma.edu/degree-programs. Our *Advising Checklists* available there provide a one-page resource for students to refer to during departmental advising.

- **B.S. Physics degree:** The B.S. program is a thorough introduction to the principles of physics, providing a strong foundation for graduate study or industrial research. It is also intended for those students who wish to prepare for interdisciplinary studies on the graduate level in fields such as atmospheric science, biophysics, environmental science, geophysics, materials science, and physical oceanography.
- **B.S. Physics: Astrophysics Concentration**: [NEW- Result of prior Program Review] Students may earn a B.S. in physics with a concentration in Astrophysics. This program is intended for those students who are motivated to study physics through their interest in Astronomy, an area of growth in the major, and comparable in enrollment to the B.S. Physics degree. It provides a rigorous, yet astronomically themed, course of study. The selection of electives allows the student to choose physics classes to round out preparation for graduate study, or to focus on our upper division general education Astronomy electives for an emphasis on the classes that motivate their pursuit of a rigorous STEM program.
- **B.A. – Physics:** Students who choose this advisory plan have the prerequisites to take nearly all of the courses in the department. They find employment in scientific and engineering fields. Some go on to graduate school in interdisciplinary sciences. This degree program is appropriate for those who wish to earn a California Science Teaching Credential with a concentration in Physics. This is a "re-branding" of this degree to remove the awkward listing of the mathematical rigor "Calculus". [Name change - result of prior Program Review] It remains as a flexible but rigorous program that pairs well with multiple career pathways.
- **B.A. – Physical Science:** [BRAND NEW- Result of prior Program Review] This is an interdisciplinary STEM degree with a strong Liberal Arts basis that allows students to follow their individual interests via intentional pathways. Available without a concentration for maximum flexibility or in one of two concentrations: Teaching and Foundational Health. The concentration in Teaching satisfies the requirements for a Foundational Science CSET waiver for K-9 science teachers. The Foundational Health concentration is intended for students with a broad interest in science who want an emphasis in Health. The general program is appropriate for a variety of careers e.g., as science or technical writers, scientific sales personnel, technicians, or other technical specialists.
- **Minor in Physics:** The minor in physics is often combined with other B.S. degrees, such as Mathematics. It is useful for chemistry majors, health science majors, and business majors who wish to work in the high-tech industry. It also provides deeper insight into the physical world as well as enhanced quantitative reasoning and problem-solving skills.
- **Minor in Astronomy:** The Astronomy minor serves as a low-barrier entry into our program and we have seen it paired with an incredible array of major programs: business, psychology, theater arts just to name a few. Career fields for which an astronomy minor

would be beneficial include aerospace, astronomy, atmospheric science, education, planetary geology, and geophysics.

2.5 Capstone Research Experience

Students majoring in degrees within the Department of Physics & Astronomy at SSU are required to complete a Senior Capstone. This experience pairs a student with a faculty mentor and requires at least a semester-long research or teacher-training experience. For the B.S in Physics, Physics with a concentration in Astrophysics, and the B.A. in Physics these are structured as a contract-course and this is often preceded by at least an additional semester of such work. While mentoring plays a role in many faculty-student interactions, the Senior Capstone is built around it. The department has built structures within our capstone curriculum for all our majors. These include required poster presentations and culminating talks as well as a newly developed support course, PHYS 491- Capstone Preparatory Seminar.

Our Capstone experience is a designed STEM experience. Intentional "backward design" approaches led to designing each Capstone with the questions: "What do I want to see from the student's experience?" and "What does evidence of success look like?". Setting goals for the student is essential, and it has been helpful to consider the following types of goals: content we want students to learn; process skills we want students to master; and attitudinal goals such as student ownership of their Capstone experience.

Students are often confused as to the "Big Picture" reasons why their particular work is important; and students often have difficulty in identifying the importance of their contribution, even as they are making excellent progress. An important tool in addressing these issues is supporting student metacognition. Having students monitor what they are doing and why they are doing it, promotes their recognition and explicit ownership of the capstone process. A frequent prompt during weekly meetings of the Capstone Preparatory Seminar is to have students share why their work is important and what are their latest short-term goals. This is part of how we scaffold metacognitive practices and encourage student ownership of the Capstone experience.

Another support for student ownership and skill development is the use of inquiry, authentic engagement in STEM ideas and practices. Throughout the mentored research, we endeavor to have students make the following progression. Their early work should be exploratory, learning essential ideas in the field while they form research questions and goals. Their work then transitions to a focused investigation, where they become adept at essential research skills. Throughout, the students have support in developing competence in communication of their ideas and results. This includes the practice of explanation, so essential to collaboration and scientific argumentation. The final presentations, both a research poster and a talk, task them with providing a synthesis of their work and placing it within the broader scientific context.

It is important to situate the student's effort in a broader social setting. Fostering STEM identity and belonging in the STEM community is a specific goal of our undergraduate Capstone experiences. This occurs in two locales within our program. One is within an individual mentor's research group; another is in our Preparatory Seminar. Within the class or research group, we set norms, including framing a growth mindset and setting a collaborative esprit de corps. Students are expected to communicate via weekly progress reports and the use of question-and-answer sessions that are low stakes and supportive. Building this community of practice is integral to our Capstone program.

The active practice of STEM leads to persistence in the field (Graham et al., 2013). We include opportunities for student recognition. These include our scaffolded support as students produce tangible products such as weekly reports, a symposium poster, and ultimately our Student Research Symposium where each student presents their work in a 15-minute talk. We hold this event the day before Commencement and invite the department and the students' friends & family. It is a favorite moment of the academic year.

2.6 Service to other programs

The Physics and Astronomy Department teaches a variety of "service courses" that primarily serve other departments. The first introductory course in Physics or Astronomy described in this section also meet General Education (GE) course requirements in areas B1 (Physical Science) and/or B3 (Laboratory Experience).

***Introductory physics courses*:** We offer three levels of first-semester physics courses. *Introductory Physics* (PHYS 114) is our calculus-based first semester course, PHYS 210A is our algebra-trig based first semester course, and PHYS 100 is our Descriptive Physics course. All three of these courses meet the B1 General Education requirement, however PHYS 114 is taken primarily by physics, engineering science, and mathematics majors, plus a few B.S. chemists and biologists. It has an accompanying laboratory class, PHYS 116, which is not required for the mathematics majors. PHYS 114/116 are part of a year-long sequence with PHYS 214/216. We offer both PHYS 114/PHYS 116 and PHYS 214/216 each semester.

General Physics (PHYS 210A), which uses algebra and trigonometry, is taken by the bulk of the biology and geology majors, along with environmental studies majors, B.A. chemists, and kinesiology majors who intend to go into physical therapy. It has an accompanying laboratory course, PHYS 209A, which is required for most of the students who take PHYS 210A. These courses are part of a year-long sequence, with PHYS 210B and 209B. We offer both PHYS 210A/209A and PHYS 210B/209B each semester.

Descriptive Physics (PHYS 100) is taken by an assortment of majors, as a lower division GE requirement. We also offer the PHYS 102 laboratory, as a separate 1-unit course, which fulfills the GE lab requirement. This has proven to be a popular course for those who do not wish to take 3- or 5-unit classes to complete the one unit of required laboratory science.

2.7 Courses for non-STEM majors including General Education courses

Our department has a long-standing tradition of a rich array of popular courses for non-STEM majors including General Education courses. As stated at https://ge.sonoma.edu:

> *"The Sonoma State General Education and Seawolf Experience program provides students an intentional, coherent, inclusive undergraduate experience across multiple disciplinary perspectives, fostering broad transferable skills and integrated, engaged learning that position students to create and participate meaningfully and ethically in our interconnected and interdependent world."*

During the period since our last Program Review, Sonoma State University conducted a General Education Curricular Revision. Details are available most succinctly at https://ge.sonoma.edu/resources where one can find the GE Learning outcomes, curriculum map and a description of GE program assessment including the inclusion of GE Signature assignments, a real-world application of student knowledge that addresses two or more of the GE learning outcomes and accompanied by a student reflection. Members of the Department of Physics &

Astronomy have played important roles in the creation an implementation of the revision, serving on the Education Policies Committee and General Education and Overlay Subcommittees.
The Department of Physics & Astronomy has had a long tradition of offering courses in the areas currently denoted:

- B1 - Physical Science
- B3 - Laboratory
- Upper Division B - Scientific Inquiry & Quantitative Reasoning

With the GE revision, all such Department of Physics & Astronomy courses were resubmitted and recertified via the GE course approval process. https://ge.sonoma.edu/proposing-ge-course
The Department of Physics & Astronomy has also developed courses in a GE area we had not previously offered:

- A1 - Oral Communication
- E - Life Long learning & Self Development

and meeting the new GE Overlay:

- Sustainability and Environmental Resilience

These course offering are listed below in General Education Courses Offered

2.7.1 SSU General Education Learning Objectives

The complete listing of General Education Learning Objectives (GELOs) is available at https://ge.sonoma.edu/sites/ge/files/approved_2018-11-16_-_learning_outcomes.pdf
We provide a quick summary of a subset of GELOs here in the form appropriate for our offerings:
Area B1 - Physical Science Courses Include:

1. Disciplinary and Interdisciplinary Knowledge: Identify, interpret, ad apply methods, intellectual approaches, and fundamental concepts from disciplines within the social sciences, natural and physical sciences, arts, and humanities.
2. Quantitative Reasoning: Interpret, evaluate, and employ quantitative analysis and arguments.
3. Critical Reading: Actively analyze texts in a variety of forms, genres, and disciplines.

And Include Content Requirements to:

- Introduces students to how physical scientists think through evidence-based reasoning, how they do their work (and/or applications), and how they reach conclusions.
- Provides students with a fundamental understanding of current theory, concepts, knowledge, technology, and/or scientific methods in the discipline.
- Introduces students to how scientists have advanced or applied knowledge in the physical sciences.
- Includes activities or assignments that directly engage student with scientific disciplinary principles or processes.

ASTR 100 additionally meets the Sustainability Overlay and includes content requirements to:

- From the perspective of your discipline(s), explores the nature of sustainability and resilience through a consideration of the relationship between humans and the environment.

- Explores how experts from your discipline(s) have measured, assessed, and/or addressed less and more sustainable human-environment practices and interrelations.

Area B3 - Laboratory Courses Include:

1. Quantitative Reasoning: Interpret, evaluate, and employ quantitative analysis and arguments.

And Include Content Requirements to:

- Introduces students to acquisition of scientific data, standard techniques, and procedures of the discipline in physical or life sciences.
- Students will perform scientific experiments/observations and record and analyze data properly to reach and report conclusions.

Upper Division B - Scientific Inquiry & Quantitative Reasoning Courses Include:

1. Quantitative Reasoning: Interpret, evaluate, and employ quantitative analysis and arguments.
2. Integration: Synthesize and apply theoretical and practical perspectives from multiple disciplines to develop and understanding of complex issues
3. Creative Problem Solving: Apply knowledge, skills, and multiple perspectives in new situations to analyze and formulate solutions to complex problems with confidence and creativity

And Include Content Requirements to:

- Course activities or assignments will build upon and deepen material from previous courses
- Course activities or assignments will provide students with the opportunity to critically analyze real-world data related to physical science, natural science, mathematics, and/or technology
- Course activities or assignments will encourage appreciation and deepen understanding of how scientists think, how they do their work, and how they reach conclusions
- Course activities or assignments will provide students with a further understanding of current theory, concepts, knowledge, and scientific methods pertaining to the physical universe

And, specifically for our ASTR 305, a Writing Intensive Course:

- The overall assignments for the course will include a minimum of 6000 written words (roughly 20 pages) of instructor evaluated writing that demonstrates upper-division writing proficiency
- Includes substantive revision of at least one major written assignment in response to instructor feedback.
- Include a variety of writing assignments. These are to include:
    a. The use of writing as a learning tool in low-stakes writing (e.g., writing to demonstrate knowledge of course topics, completion-based grading, etc.), and
    b. Instructor evaluated writing projects which are to be "scaffolded" over time (divided into stages, e.g., proposal, working draft, reflection, final draft).

Area A1 - Oral Communication Courses Include:

1. Communication: Communicate clearly in written, oral, and/or performative forms in a variety of disciplines.
2. Information Literacy: Iteratively formulate questions for research by gathering diverse types of information; identifying gaps, correlations, and contradictions; and using sources ethically towards a creative, informed synthesis of ideas.

And, specifically for our ASTR 121 - How to Influence the World course:

3. Argument: Advance cogent and ethical arguments in a variety of genres with rigor and critical inquiry.

And Include Content Requirements to:

- Students will develop verbal and non-verbal skills required to give compelling oral presentations in English
- Students will develop the ability to prepare oral presentations based on students' own research and composition
- Students will develop active listening skills required to hear another's oral communication accurately
- Students have experiences offering oral presentations both individually and as members of collaborative groups
- Course content will consider a large variety of intellectual and cultural traditions

Area E - Life Long learning & Self Development Courses Include:

1. Disciplinary and Interdisciplinary Knowledge: Identify, interpret, and apply methods, intellectual approaches, and fundamental concepts from disciplines within the social sciences, natural and physical sciences, arts, and humanities.

And, specifically for our SCI 220:

2. Creative Problem Solving: Apply knowledge, skills, and multiple perspectives in new situations to analyze and formulate solutions to complex problems with confidence and creativity.
3. Creative Expression: Produce new work through performance, design, construction, art, or creative writing that is characterized by innovation, divergent thinking, and intellectual risk taking.

And Include Content Requirements to:

- Self-reflection assignments that cover both self-development and course content.
- Students engage with and reflect upon campus or community activities
- Integrates at least two of the following aspects of the self: social, physiological and psychological.
- Addresses how people are situated in the larger social context in terms of their different identities and societal positions

General Education Signature Assignments:

- Results in a piece of student work that demonstrates the relevant course GE learning outcomes.
- Is engaging in that it sparks student intellectual curiosity, is relevant to their lives, results in a product they can showcase, and is enjoyable.
- Involves student performance on something other than a test. Examples include essays, art galleries, projects, presentations, lab reports, service-learning journals, websites, posters, creative writing, creative combinations, etc.
- Includes a student reflection component

Details on Assessment of GE Learning Outcomes is available at:
https://ge.sonoma.edu/assessment

2.7.2 General Education Courses Offered

The following is a list of General Education or other general interest courses offered by the Department of Physics & Astronomy:

PREFIX/CODE	TITLE	GE AREA	GE STATUS
ASTR 100	Descriptive Astronomy	B1 & Sustainability	Recertified
ASTR 121	How to Influence the World	A1	New Course
ASTR 150	Astronomy for Scientists	B1	Recertified
ASTR 231	Intro. to Observational Astronomy	B3	Recertified
ASTR 303	Life in the Universe	UD B	Recertified
ASTR 305	Frontiers in Astronomy	UD B & Writing Intensive Course	Recertified
ASTR 350	Cosmology	UD B	Recertified
PHYS 100	Descriptive Physics	B1	Recertified
PHYS 102	Descriptive Physics Laboratory	B3	Recertified
PHYS 107	Intro. to Physical Science for Teachers	Of interest to prospective teachers	New Course Non-GE
PHYS 114	Introduction to Physics I	B1	Recertified
PHYS 116	Intro. Laboratory Experience	B3	Recertified
PHYS 209A	General Physics Laboratory	B3	Recertified
PHYS 210A	General Physics	B1	Recertified
PHYS 300	Physics of Music	UD B	Recertified
PHYS 304	The Strange World of Modern Physics	UD B	New Course
PHYS 340	Light and Optics	UD B Met-in-major	In-progress
PHYS 342	Light and Color	UD B	Recertified
PHYS 494	Physics Seminar	University Elective	Non-GE
SCI 220	Dream, Make and Innovate	E	Recertified

The rightmost column of the table of our General Education courses tells the story of our efforts in this area since the prior program review. Recertified courses are those that we launched and shepherded through the course approval process following the GE Revision. In one case, ASTR 100 – Descriptive Astronomy, the course has additionally been approved for the Sustainability and Environmental Resilience Overlay, a new categorization and part of the new graduation requirements. The department has plans to similarly propose for ASTR 303 – Life in the Universe for such a designation. The department has launched a proposal for PHYS 340 – Light and Optics to meet the UD B requirement as a Met-in-major course.

Introductory physics courses:

We offer three levels of first-semester physics courses. *Introductory Physics* (PHYS 114) is our calculus-based first semester course, PHYS 210A is our algebra-trig based first semester course, and PHYS 100 is our Descriptive Physics course. All three of these courses meet the B1 General Education requirement, however PHYS 114 is taken primarily by physics, engineering science, and mathematics majors, plus a few B.S. chemists and biologists. It has an accompanying laboratory class, PHYS 116, which is not required for the mathematics majors. *General Physics* (PHYS 210A), which uses algebra and trigonometry, is taken by the bulk of the biology and geology majors, along with environmental studies majors, B.A. chemists, and kinesiology majors who intend to go into physical therapy. It has an accompanying laboratory course, PHYS 209A.

Descriptive Physics (PHYS 100) is taken by an assortment of majors, as a lower division GE requirement. We also offer the PHYS 102 laboratory, as a separate 1-unit course, which fulfills the GE lab requirement. This has proven to be a popular course for those who do not wish to take 3- or 5-unit biology or chemistry classes to get that one unit of laboratory GE.

Introductory astronomy courses:

Descriptive Astronomy (ASTR 100) is our most popular course, accounting for the largest single course FTES (Full-time Equivalent Students). It meets the B1 General Education requirement, and the variations in enrollment reflect the number of sections that we have the budget and personnel to offer. Introductory Observational Astronomy (ASTR 231) is also a very popular course, but due to the laboratory component, has rather limited enrollment. This course satisfies the B3 GE laboratory requirement.

Upper Division GE courses:

ASTR 303 - Life in the Universe is an appraisal of the possibilities and prospects for life in the universe and travel to the stars. ASTR 305 - Frontiers in Astronomy presents a survey of recent developments in astronomy and explains how these breakthroughs are made. The course is constructed to enhance student's science literacy through a mix of reading and writing exercises that vary in format and difficulty and has been approved for a Writing Intensive Course (WIC) Overlay. ASTR 350 - Cosmology describes what we know about the large-scale Universe and how scientists have learned it. This course is taught in a flipped class format and uses the "Big Ideas in Cosmology" an online text developed by a team led by Professor Cominsky.

PHYS 300 - Physics of Music presents an introduction to physical principles encountered in the study of music; applicable laws of mechanics and acoustics; harmonic analysis; musical scales; sound production in musical instruments; and elements of electronic music/ PHYS 342 - Light and Color is a descriptive, nonmathematical, but analytical treatment of the physical properties of light, the camera, telescope, microscope and laser; holography, mirages, rainbows and the blue sky; colors in flowers, gems and pigments; human and animal vision and visual perception.

Additional new courses:

Beyond the recertifications of our pre-existing offerings, the department has developed: ASTR 121 – How to influence the world, and oral communication GE in the "Golden Four" category A1; PHYS 107 – Introduction to Physical Science for Teachers, while not a GE course, it is of general interest beyond STEM degree plans, and part of a Foundational Science CSET waiver for future middle school or 9th grade science teachers; Phys 304 - The Strange World of Modern Physics an Upper Division Area B class developed by Professor Miller; and SCI 220 - Dream, Make and Innovate a course developed within the Department of Physics & Astronomy, but taught more broadly within the School of Science and Technology until it returned to being regularly offered by Physics & Astronomy in 2023. PHYS 494 – Physics Seminar often attracts non-majors despite not being a GE course. It is structured around the long-running and popular *"What Physicists Do"* public lecture series and students that may have attended in earlier semesters for fun or extra-credit sometimes take the course as non-majors.

2.8 Program Achievements and Changes Since Previous Program Review

Recent History: To place the findings of this Program Review in context, we begin by reflecting on the period of time since the last Program Review in 2015. A Program Review serves different constituencies in different ways. For the department it serves as a reflective document on setting and adjusting goals, measuring progress and delineating resources necessary to achieve these goals. For the governance process it serves an assessment of the health of the department

→ ToC

focusing on evidence-based assessment of student learning outcomes; alignment of a program's mission and goals with those of the university; relation of curriculum to student learning; quality and diversity of faculty, staff, and curriculum; service and contributions to community; recruitment, retention and support for students and faculty; resource allocation; and administrative support. The process at SSU includes an external reviewer, a review by the Dean and school curriculum committee, then the University Program Review Subcommittee (UPRS), Academic Programs, and finally the Provost or designee.

The Department of Physics & Astronomy last underwent a program review in 2015. The Report of the External Reviewer (8.5.2) is in section and the Dean's Report (0) are provided in the Appendix. Both were very positive and contained specific recommendations.
The External Reviewer wrote about the department strengths:

> *A major strength I observed during my campus visit is the quality and cohesiveness of the faculty … Innovative curriculum: Some great ideas have been well-implemented here … Graduation Rates: Sonoma State's physics graduation rate of 9.6 graduates per year is excellent given the faculty to physics major ratio (here at Fresno State our average is about 6 graduates per year with 10 TT faculty) … In addition to the innovative and exciting opportunities for majors, this department offers a very strong contribution to general education at the university … Research: Over the period since the last program review that department has seen good success in obtaining external grants and Dr. Cominsky's EPO program remains strong.*

These sentiments are seconded in the Dean's Report:

> *I join the external reviewer in commending the impressive strengths of the department … In summary, the department is a stand out, high---achieving, steady, effective and trusted unit in the School.*

The External Reviewer continued on with identified challenges:

> *[O]ne paramount issue of concern is the workload taken on by the five tenured faculty, and by the technical staff …[S]eniors felt further preparation, including more structure in setting expectations early in the [Capstone] project, would have been beneficial … there are serious equipment renovation and replacement needs. … the distributed advising model (assignment of the pool of majors to tenured faculty) seems to be working but at a very high toll on faculty workload … only an increase in tenured faculty can address and relieve the workload issues that threaten the productivity and moral of the program.*

These sentiments are seconded in the Dean's Report:

> *I concur with the external reviewer's summary of department challenges. The faculty and staff are functioning at the highest level despite having limited resources.*

The External Reviewer's (1-5) and the Dean's (6-8) recommendations will now be enumerated and we will present a brief summary of the intervening events regarding these recommendations:

1. … the university should authorize at least one (or more) tenure track hires in the near future
2. The proposed changes to the degree program as discussed in detail in the program review binder are well thought and well documented and should be implemented.

3. The department should develop a prioritized list of equipment needs and submit this list on a semester basis to the administration.
4. A loss of [the department tech] for any unforeseen reason would result in dramatic setbacks to the program in delivering these crucial aspects of the undergraduate experience. [A succession plan should be put in place]
5. It is recommended that the department receive course release to support their academic advising.
6. The department should continue assessment processes including periodic review of student learning outcomes and closing of the loop on findings.
7. A seconding of the planned degree program changes in (2) above.
8. The development and implementation a reasonable plan for addressing equipment and instrument support and storage needs, related to (3) and (4) above.

Before we enumerate the grander scale of events over the period since the prior review, a quick look in of these specific recommendations:

1. The department is net neutral in Tenure-track Faculty. The department lost Professor Jeremy Qualls when he left to become Dean at University of Southern Maine in 2018. The department had two new hires in 2019. One, Dr. James Lee, left after one year due to family matters. The other, Assistant Professor Alexandra Miller is an integral member of the department
2. The department completed an ambitious plan of degree plan changes as outlined in the prior program review, which will be elaborated below.
3. The department has kept a prioritized list of equipment needs. Responding to specific opportunities has seen the department transform the campus observatory with a campus-funded new building and adding donor provided telescopes, using COVID related money to add a student success display and a "light-board" recording set-up, as well as other efforts.
4. The department responded to the retirement of our long-time laboratory tech with the hire of a department graduate to the role and a corresponding effort to streamline our equipment and instrument inventory.
5. Academic advising remains exemplary within the department, with our recently revamped 4-year and 2-year advising plans as well as our website updates and our shared advising plan. We have seen no course release to support advising, our advising plan updates, or our website renovation.
6. The department has continued our assessment process, reviewing our student learning outcomes and making changes based on our assessments. See Section 3, Assessment and Findings.
7. See (2) above.
8. See (3) and (4) above.

We now present a set of other Achievements and changes since the prior review. Note that we discuss assessment-driven Curricular Changes in Section 3.3.

2.8.1 Changes to degree plans:

The main result of the prior program review was our finding that our degree programs were in need of overhaul. We wanted to keep an arrangement of four degree-programs, but change the nature of two of them. The Department of Physics and Astronomy offered two BS degrees (with or without an Applied Physics Concentration) and two BA degrees (with or without calculus). The

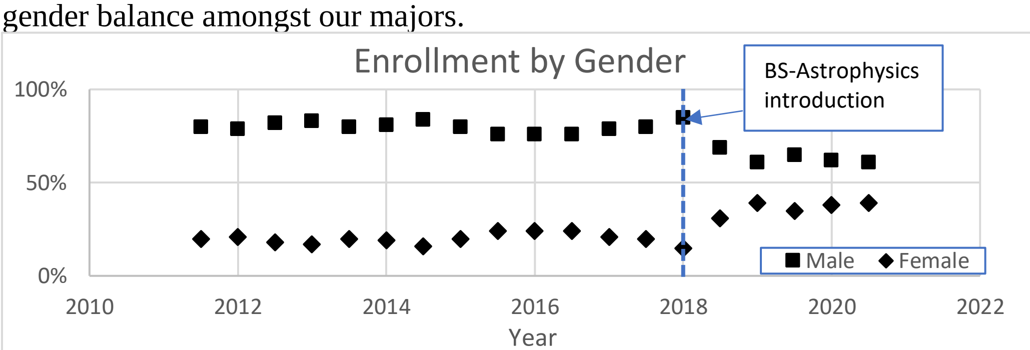
BA degrees were established to provide a broader background for students seeking a liberal arts education or those seeking to earn a California Teaching credential. As part of the prior program review these degrees were reexamined both for their then current use and for their potential. The BA calculus based and the BS Physics programs remained. The BS Physics – Applied was replaced with a BS Physics - Astrophysics concentration and the BA trigonometry (non-calculus) degree was replaced by a BA Physical Science degree.

Bachelor of Science in Physics	Bachelor of Science in Physics *(minimal change)*
Bachelor of Science in Physics with a concentration in Applied Physics	Bachelor of Science in Physics with a concentration in Astrophysics *(new)*
Bachelor of Arts in Physics with Advisory Plan C (Calculus)	Bachelor of Arts in Physics *(minimal change)*
Bachelor of Arts in Physics with Advisory Plan T (Trigonometry)	Bachelor of Arts in Physical Science *(new)*

The **B.S. in Physics** is a thorough introduction to the principles of physics, providing a strong foundation for graduate study, industrial research and the STEM workforce

The B.S. in physics with a concentration in applied physics was not sufficiently different enough from standard B.S. and in its place we developed **B.S. in Physics with a concentration in Astrophysics**. This program is intended for those students who are motivated to study physics through their interest in Astronomy, an area of growth. It has proven to be a popular degree plan with about half of our BS students opting for this degree plan. Further, the astrophysics program leverages our existing astronomy courses, including our intermediate and advanced labs, to create a course of study that requires offering two majors' courses, each offered in alternate years, ASTR 331 – Astronomical Imaging, and ASTR 380 – Astrophysics. These courses are available as electives for the standard BS in Physics. The ASTR 331 course is sometimes taken by non-majors and has a strong Data Science component.

The introduction of the B.S. Physics – Astrophysics degree is correlated with an improvement in gender balance amongst our majors.



There was little change in the Bachelor of Arts in Physics with Advisory Plan C (Calculus) other than its renaming it to simply the **Bachelor of Arts in Physics**. This change is a "re-branding" of this degree to remove the awkward listing of the mathematical rigor. It remains as a flexible but rigorous program that pairs well with multiple career pathways and is the degree plan for future High School Physics Teachers.

Finally, the Bachelor of Arts in Physics with Advisory Plan T (Trigonometry) was replaced by the **Bachelor of Arts in Physical Science**. This new degree addresses our push to produce more and better STEM educators while serving as a strong, yet flexible STEM-focused liberal arts degree.

Approved in 2021, this nascent program is growing, with 11 majors as of Spring 2024. Available without a concentration or in one of two concentrations: Teaching and Foundational Health. The concentration in Teaching satisfies the requirements for a Foundational Science CSET waiver for K-9 science teachers.
www.ctc.ca.gov/educator-prep/standards/SSMP-Foundational-Science.pdf
The Physical Science degree plan is efficient, leveraging existing courses and relying on the offering of only one newly developed course in Physics & Astronomy, PHYS 107 – Physical Science for Teachers, which is cross-listed with CHEM 107 and attracts students from Liberal Studies Hutchins (BA).

2.8.2 Other Program Achievements and Changes Since Previous Program Review

Since 2015, the department has seen a variety of changes and achievements beyond the net neutral changes in our tenure-track faculty composition, the degree plan changes, the aforementioned new courses and GE recertifications, and the laboratory tech and equipment inventory changes (further detailed in 5.5 Support Staffing). We present these in a list format below:

1. Aforementioned Curricular Revisions resulting in the:
    a. Physical Science degree program – 2021
    b. B.S. in Physics with a concentration in Astrophysics degree program – 2018
2. The department updated our Four-Year Advising plans in Curriculog and optimal for the new online General Catalog in 2022. We further created a set of two-year plans for our transfer students, following a change to scheduling our key prerequisite Physics 314 – Modern Physics to the Fall semester (implemented 2023) to improve time to graduation for transfer students.
3. Development of a new student recruitment effort: contacting our service area Junior Colleges by email and delivering them packets of resources including posters, newsletters and bookmarks; improving the Prospective Students web-landing page (promoted on the bookmarks); and planning once a semester open-houses for JC students and their STEM faculty. We also are active with the new campus-wide recruitment efforts including the new admitted student phone banking as well as our usual admitted student email messaging.
4. The department updated the website (https://phys-astro.sonoma.edu) during a conversion to Drupal in 2020. The work included a complete rework of the site, centered on content-rich landing sites for: Prospective Students, Current Students, Graduates and Alumni and for Public Events. The Internationally visited Bruce Medalists website (https://phys-astro.sonoma.edu/brucemedalists) a comprehensive encyclopedia of awardees of the prestigious Astronomical Society of the Pacific Bruce Medal is maintained by Professor-Emeritus Joe Tenn.
5. The department responded to the Covid pandemic with a transition to online instruction and subsequent staged return to in person instruction with upper division major courses and laboratory classes returning first.
6. Professor Lynn Cominsky left the role of Department Chair in 2019. Professor Cominsky's leadership of the EdEon STEM Learning Center (https://edeon.sonoma.edu) means that since relinquishing Chair duties, she has not had formal workload in the department except for rare emergency replacement instruction of individual courses that were critical to our operation. The Chair position has been held by Professor Severson since with Professor Shi serving as a sabbatical semester replacement in Spring 2022.

7. We replaced the campus observatory with a new building in 2017 and additionally integrated the donation of new telescopes and the purchase of new instrumentation. https://news.sonoma.edu/article/new-observatory-opens
8. The department developed an online course policy (see **Error! Reference source not found.** Department Online Education Policy). We currently offer one class in this modality – ASTR 303 – Life in the Universe.
9. Publication of the annual Department Newsletter – "*The Physics Majo*r", a comprehensive recording of the activities of the department, with articles written by each of our graduating students detailing their capstone research.
10. The department conducted Retention, Tenure, and Promotion (RTP) work including the annual reviews of Dr. Tom Targett through his 2019 promotion to Associate Professor, the review of Dr. Scott Severson for his 2016 promotion to full professor, and the annual reappointment reviews of Dr. Alexandra Miller to date as Assistant Professor.
11. The department conducting a tenure-track faculty search that led to the hiring of both Alexandra Miller and James Lee. James Lee's departure with the prior departure of Jeremy Qualls results in a net-zero change in our tenure-track faculty.
12. The department conducted Adjunct Faculty Pool refreshes in 2018, and 2021. Further discussion of our lecturer pool may be found in Section **Error! Reference source not found.**.
13. Continued excellence in physics education through the offering of GE, service and major courses, research-proven pedagogical techniques, and growth of the Senior Capstone research experiences with the development of the supporting PHYS 491 – Capstone Research Seminar.
14. The Launch of EdgeCube, SSU's second small satellite, 2020
15. Participation in the Cal-Bridge scholar program since 2019, where department faculty mentor our students in partnership with UC faculty to prepare them for successfully entering PhD programs. There have been 7 SSU Cal-Bridge scholars to date.
16. Hosting the 2018 LIGO-Virgo Collaboration bi-annual team meeting at SSU, 2018
17. The EdEon leadership in the Eclipse Megamovie project, spearheaded by Laura Peticolas, and resulting in 1,190 photographers contributing 50,016 DSLR photographs in a final open-source, public archive of the August 21, 2017 total solar eclipse that is 766 GB. Peticolas is leading a new NASA-funded effort to repeat this project for the April 2024 total solar eclipse, but with greater precision and expected scientific results.
18. Success in grant acquisition and fundraising:
    a. Department of Energy's Reaching a New Energy Sciences Workforce (RENEW) program support of Growth and Research Opportunities With Traineeships in High Energy Physics at Minority Serving Institutions (GROWTH-MSI) – Miller & Wing (Stanislaus State), 2023
    b. National Science Foundation funded Engaging Community Colleges Students through a Residential, Pre-transfer Summer Research Program – Targett, 2023
    c. NASA grant for 2024 Eclipse Megamovie – Peticolas and Targett, 2023
    d. NSF IUSE planning grant, Engaging Autistic STEM Undergraduates in Creating Supportive Learning Environments at California State Universities – Cominsky (Co-PI) 2023

e. NASA's Neurodiversity Network (N3), along with N3 partners, SSU is developing and redesigning science curriculum in astronomy, heliophysics and rocketry – Cominsky, 2022
f. National Science Foundation funded acquisition of a brand-new scanning electron microscope – Shi as part of an interdisciplinary collaboration of Geology, Chemistry, and Physics & Astronomy, 2021
g. Koret Scholars Awards supporting faculty and students - Miller, 2021
h. Teagle Foundation and College Futures support of Faculty-Led Curriculum Redesign for Student Success Program – Miller, 2020
i. CSU Lab Innovations with Technology (LIT) award to develop virtual reality educational experiences for astronomy students – Severson, 2020
j. SST Innovation and Strategic Priorities funds supporting our Student Success Display and 3-D printing station, 2020
k. Zygo Corporation, a unit of AMETEK Inc. donation of optical tables, 2020
l. Ongaro Family Scholarship funded Ongaro and Sons, led by recent alumnus, Ernest Ongaro, began 2020.
m. Department of Education for 9th grade Learning by Making curriculum in rural and high needs high schools – Cominsky, 2018
n. NASA funded revamp of Global Telescope Network website and program – Cominsky, 2019
o. Koret Scholars Awards supporting faculty and students - Shi, 2017
p. STEM Education Through Sophomore Innovation – Cominsky and Qualls, 2016. This grant created SSU's Makerspace and the Science 220 course.
q. NASA's Undergraduate Student Instrument Project (USIP) EdgeCube – Jernigan and Cominsky, 2016
r. LIGO: Detecting Gravitational Waves – Cominsky, 2015
s. NASA's Universe of Learning: An Integrated Astrophysics STEM Learning and Literacy Program – Cominsky, 2016
t. PhysTEC Teacher Recruitment Grant – Severson, 2015
u. Learning by Making: STEM – Cominsky, 2013
v. including the S3 STEM education grant, an NSF-MRI grant for the KAPAO Adaptive Optics System, and the continual excellence of Cominsky's EPO program including several NASA grants (e.g., as Co-Investigator on Swift, Fermi, and NuSTAR).

19. Awards and Honors:
a. SSU Excellence in Teaching award – Severson, 2021
b. Fellow, California State University STEM-Net – Cominsky, 2020 and 2021
c. Lynn Cominsky named one of the 200 initial "Legacy Fellows" by the American Astronomical Society, 2019
d. Yuri Milner Breakthrough Prize, Cominsky (as part of LIGO), 2017
e. International Aeronautics Foundation Frank J. Malina Educational award – Cominsky, 2017
f. Fellow, California Academy of Sciences – Cominsky, 2017
g. American Astronomical Society Education Award – Cominsky, 2016
h. SSU Excellence in Teaching award – Qualls, 2017
i. CSU Wang Family Excellence Award – Cominsky, 2016

j. American Astronautical Society Sally Ride Excellence in Education – Cominsky, 2015
k. SSU Presidential Award for Excellence in Scholarship – Cominsky, 2015

20. Active service efforts, including faculty service at the Departmental, School and University levels, as well as a diverse set of public programs: alumni outreach through an annual newsletter; an active SPS club chapter; contributions to Cal-Bridge, including the Science by Diverse Scientists lecture series; the public observing night program that involves multiple faculty members and a team of student assistants; and our revered public lecture series, 'What Physicists Do'.

Assessment and Findings

3.1 Department Assessment Plan

Our department uses a mixture of assessment methods to collect and analyze data on student performance in program learning outcomes (PLOs). Our PLOs are enumerated and discussed in Section 2.2 Program Learning Outcomes. Our intentionally-designed Program Curriculum Map is found in Section 8.1. This map illustrates the "Introduction", "Development", and "Demonstrated" level of student proficiency of these PLOs as structured within our programs. We additionally have a Skills Matrix that was originally developed in 2003, saw extensive revision in 2015 and small adjustments for this program review. We use Course-Embedded assessment tools and a robust faculty discourse in our weekly Department Meetings to identify and address issues related to student performance in our PLOs and our other goals. Central to our Assessment process is the required Senior Capstone Project that has students working closely with a faculty research advisor. Serving as a culminating experience where students are expected to display proficiency in our PLOs, the student capstones are our most important indicator of our programs.

We present an overview of all of our assessment efforts in the table below. An effort we have undertaken as part of this program review has been in the development of the Program Curriculum map to connect our PLOs to the portions of the curriculum where they are introduced, developed and demonstrated. A combination of well-delineated content and process goals with our accompanying Skills Matrices allows us to monitor student learning of the content and processes of physics. We supplement this with our support and monitoring of the student community (SPS, and other activities) to gauge student attitudes. As we discuss below, the capstone experience for every major is our culminating assessment of student learning. One outcome of this Program Review has been to focus us on returning to our historical use of alumni surveys, which allow us to track our students' persistence in STEM fields beyond their exit interviews.

Key Assessment Methods and Findings		
Direct Assessment		
Course-Embedded Assessment Tools	Student learning of content and processes of physics. Based on course embedded assessments: tests, assignments, writing, laboratories.	Students meet PLOs, but some lag behind early and require intervention. Identified challenges: math preparedness, study skills and effort, work in small groups, need for counseling and psychological services. Department interventions: early math assessments, scaffolded assignments, referrals to CAPS and CARE teams.
Capstone Portfolio Review – Direct Assessment	Culminating 'Portfolio' Assessment of student performance in PLOs	Students meet and exceed PLOs. Key areas of assessment-driven improvement (supported by PHYS 491): communication training, collaboration, scientific reasoning. Key challenges: developing data analysis skills.
Indirect Assessment		
Graduation chronicling	Students provide written summaries of their Capstone and of their future plans in articles for the department newsletter	Students are moving to graduate studies (e.g., UCSC, UC-Irvine, SJSU) and industry. We have identified resuming surveying our alumni as a priority and will build on our existing efforts.

3.2 Assessment Findings

Here we summarize findings from direct and indirect assessment of student learning, identifying particular areas of strength or challenge. As defined in the Program Review Self-Study Guide: Direct assessment may include departmental evaluation of capstone projects, pre-tests and exit tests for majors, exams, signature assignments, or other student evidence. Indirect assessment may include student evaluations of the program, student self-assessment of learning gains, exit surveys, focus groups, and employer, alumni, or other stakeholder surveys or focus groups.

3.2.1 Direct Assessment

Direct Assessment of the learning objectives of the Department of Physics & Astronomy is carried out primarily by two mechanisms; our course-based assessment tools and our required Senior Capstone project graduation requirement. We have a robust tradition of weekly Department Meetings and conduct formative assessment throughout the Academic Year. As we discuss below and in the latter sections of this chapter, our assessment findings drive changes to the curriculum and have informed our plans for longer term developments to our assessment strategies.

3.2.1.1 Course-embedded assessment tools

The Department of Physics & Astronomy routinely conducts formative assessment of student performance and identifies challenges and highlights successes via peer discussion of results from course-embedded indicators. In this section we list our assessment tools and included a discussion of our Skills Assessment Matrices.

The Department of Physics & Astronomy faculty regularly use the following course-embedded assessment tools to evaluate student learning:

- Tests and assignments to evaluate knowledge, understanding and use of the principles of physics and/or astronomy
- Tests and assignments to evaluate student ability to use reasoning and logic to define a problem in terms of principles of physics
- Tests and assignments to evaluate student ability to use mathematics and computer applications to solve physics and/or astronomy problems
- Assignments to evaluate student ability to design and/or conduct experiments and/or observations using principles of physics and/or astronomy and physics or astronomical instrumentation
- Assignments to evaluate student ability to properly analyze and interpret data and experimental uncertainty in order to make meaningful comparisons between experimental measurements or observation and theory
- Tests and assignments to evaluate student Critical Thinking Abilities
- Tests and assignments to evaluate student Quantitative Skills
- Assignments to evaluate student Communication Skills
- Signature Assignments in General Education courses, which must:
    - Result in a piece of student work that demonstrates the relevant course GE learning outcomes
    - Be engaging in that it sparks student intellectual curiosity, is relevant to their lives, results in a product they can showcase, and is enjoyable

- Involves student performance on something other than a test. Examples include essays, art galleries, projects, presentations, lab reports, service-learning journals, websites, posters, creative writing, creative combinations, etc.
- Include a student reflection component

To further specify and assess our program learning objectives, the Department of Physics & Astronomy developed Skills Assessment Matrices back in 2003. As part of our 2008, 2015, and now this self-study, we continue to revise the Skills Assessment Matrices to highlight skills important to produce employable physics graduates, or to develop research capabilities for those who wish to attend graduate school or work in highly technical fields. It was from the production of these matrices and the input from our Alumni Surveys that indicated how important presentation, speaking, and writing skills are. This played a role in the creation and development of supports for our Capstone program discussed in the next section.

The Skills Assessment charts below consist of individual skill listings, grouped according to thematic areas and showing where these skills are taught within the curriculum. For example, the Department has agreed to ensure that all lower division students are taught to use Excel/Sheets in both lecture and laboratory courses in the algebra-trig and calculus-based first year sequence. Laboratory interface, multimeter and oscilloscope skills, as well as error analysis, curve fitting and regression and graphics and plotting will be taught and used beginning in lower division laboratory courses. General programming and symbolic languages will be used in upper division physics major courses, and will be specifically taught in Physics 381 (Computer Applications for Scientists). Dimensional analysis as well as problem solving logic will be taught and used throughout the physics and astronomy curriculum, including general education classes. Our Intermediate Lab courses (PHYS 366 in physics, and ASTR 331 in astrophysics) are courses that heavily use research skills, including literature searches, annotated bibliographies, and data evaluation. These skills will also be required for the capstone courses in both physics and astronomy. Practical astronomy skills will be concentrated in Astronomy 231, 331 and 482 as well as the astronomy capstone courses. The table is broken into three portions for clarity: lower-division physics courses, upper division physics course and astronomy courses.
We also place importance on communications skills, to be developed through GE and majors' courses, so that by the time the students are doing their capstone experiences, they will have developed the ability to speak and write effectively. Of additional importance to the capstone projects is the ability to conduct independent research, literature searches, annotated bibliographies and data evaluation. These latter skills are key for the intermediate and advanced laboratory courses which lead up to the capstone experience.

And last but not least, the ability to solve second order differential equations analytically as well as numerically is an important proxy that represents the level of mathematical ability that we expect from our students, especially in the upper division theory courses.

Skills Assessment & Academic Knowledge Base – Lower Division Physics

Skill Assessment & Academic Knowledge Base Category	Skill	PHYS 100	PHYS 102	PHYS 107	PHYS 114	PHYS 116	PHYS 209A	PHYS 209B	PHYS 210A	PHYS 210B	PHYS 214	PHYS 216
Critical Thinking	Logic											
	Problem Solving											
Math	Statistics & Probability	0	0		1				0	0	0	
	Basic Analytical											
	Advanced Analytical	0	0		0	0	0	0	0	0		
	Computational & Numerical	0	0		0		0	0	0	0	0	
	Estimation & Order of Magnitude		1									
Basic Laboratory Skill	Lab Safety	0			0				0	0	0	
	Lab Notebook & Note Taking	0			0				0	0	0	
	Error Analysis	0			0				0	0	0	
	Electronic: Soldering	0	1		0	0	0	0	0	0	0	
	Electronic: Multimeter	0			0	0	0		0	0	0	
	Electronic: Function Generator	0	0		0	0	0		0	0	0	
	Electronic: Oscilloscope	0	0		0	0	0		0	0	0	
	Electronic: AC/DC Circuitry	0			0	0	0		0	0	0	
	Magnetism	0			0	0	0		0	0	0	
	Optics	0			0	0	0		0	0	0	
	Mechanics	0						1		0	0	1
Data Acquisition	Numerical - Basic: Excel/Sheets	0										
and Manipulation	Num. Advanced: Mathematica/Python	0	0		0	0	0	0	0	0	0	0
	Interfaces (PASCO, Labview)	0			0				0	0	0	
	Unit Analysis											
	Graphing & Data Plotting	0										
	Curve Fitting & Regression	0	0		0	1	0	1	0	0	0	
Information Literacy	Scientific Writing	0			0				0	0	0	
Social	Group Work Skills	1										
	Explaination Skills											
	Feedback Skills	1			1	0	0	1	0	0	0	
	Presentation Skills (Oral & Poster)	0			0	0	0	0	0	0	0	0

Skills Assessment & Academic Knowledge Base – Upper Division Physics

Skill Assessment & Academic Knowledge Base Category	Skill	PHYS 300	PHYS 304	PHYS 313	PHYS 313L	PHYS 314	PHYS 320	PHYS 325	PHYS 340	PHYS 342	PHYS 366	PHYS 381	PHYS 430	PHYS 445	PHYS 450	PHYS 460	PHYS 466	PHYS 475	PHYS 491	PHYS 492	PHYS 493	PHYS 494	PHYS 495	PHYS 497
Critical Thinking	Logic																							
	Problem Solving																							
Math	Statistics & Probability																							
	Basic Analytical																							
	Advanced Analytical																							
	Computational & Numerical																							
	Estimation & Order of Magnitude																							
Basic Laboratory Skill	Lab Safety																							
	Lab Notebook & Note Taking																							
	Error Analysis																							
	Electronic: Soldering																							
	Electronic: Multimeter																							
	Electronic: Function Generator																							
	Electronic: Oscilloscope																							
	Electronic: AC/DC Circuitry																							
	Magnetism																							
	Optics																							
	Mechanics																							
Data Acquisition and Manipulation	Numerical - Basic: Excel/Sheets																							
	Num. Advanced: Mathematica/Python																							
	Interfaces (PASCO, Labview)																							
	Unit Analysis																							
	Graphing & Data Plotting																							
	Curve Fitting & Regression																							
	Fourier Analysis																							
	Image Processing																							
Information Literacy	Literature Search																							
	Preparing Annotated Bibliographies																							
	Scientific Writing																							
Social	Group Work Skills																							
	Leadership Skills																							
	Explaination Skills																							
	Feedback Skills																							
	Presentation Skills (Oral & Poster)																							
Advanced Lab Skill	3D Printing																							
	AutoCAD & 3D Modeling																							
	Cryogenics																							
	Spectroscopy																							
	SEM-AFM																							
	X-ray Diffraction																							
	Semiconductor Principles																							
	Magnetometry																							
	Materials Processing																							
	Thin film coating/Masking/Etching																							
	Wavefront Sensing																							
	Wave Optics																							

Skills Assessment & Academic Knowledge Base –Astronomy

Skill Assessment & Academic Knowledge Base Category	Skill	ASTR 100	ASTR 121	ASTR 150	ASTR 231	ASTR 303	ASTR 305	ASTR 331	ASTR 350	ASTR 380	ASTR 482	ASTR 492	ASTR 495	ASTR 497
Critical Thinking	Logic													
	Problem Solving													
Math	Statistics & Probability													
	Basic Analytical													
	Advanced Analytical													
	Computational & Numerical													
	Estimation & Order of Magnitude													
Basic Laboratory Skill	Lab Safety													
	Lab Notebook & Note Taking													
	Error Analysis													
	Optics													
Data Acquisition and Manipulation	Numerical - Basic: Excel/Sheets													
	Num. Advanced: Mathematica/Python													
	Interfaces (PASCO, Labview)													
	Unit Analysis													
	Graphing & Data Plotting													
	Curve Fitting & Regression													
	Fourier Analysis													
	Image Processing													
Information Literacy	Literature Search													
	Preparing Annotated Bibliographies													
	Scientific Writing													
Social	Group Work Skills													
	Leadership Skills													
	Explaination Skills													
	Feedback Skills													
	Presentation Skills (Oral & Poster)													
Advanced Lab Skill	Telescope Control													

3.2.1.2 Capstone

The requirement for all of our majors to complete a senior capstone dates back to planning in 2003, and has seen important improvements and revisions through our Program Review process. This includes the introduction of PHYS 491 – Capstone Preparatory Seminar support course in Spring 2019. The senior capstone project is our most important summative assessment tool, and it has been used to determine how well our graduating seniors have met our discipline-specific learning objectives. Each senior physics major (in both the BA and BS degree programs) has been required to enroll in one of the following (2-unit) courses contract courses with a faculty advisor:

- Physics or Astronomy 492: Instructional Design Project
- Physics 493: Senior Design Project
- Physics or Astronomy 497: Undergraduate Research

as well as co-enroll in the 1-unit PHYS 491 support course.
Students are encouraged to enroll in Physics or Astronomy 495, Special Studies in the semester(s) prior to enrolling in the capstone course, in order to get a jump start on developing their project, in consultation with their faculty advisor. The capstone courses require both oral and poster presentation of the project to their peers and the department faculty, prior to graduation. (Oral presentations were first required in May, 2005. Poster presentations have been required since May 2013.)

Our new (approved 2021) Bachelor of Arts Physical Science degree requires enrollment in the PHYS 491 – Capstone Preparatory Seminar without a corresponding contract course with a separate faculty advisor. For these students, with their different preparation and career goals, the focus of the capstone project is constructed within the course and supported by the PHYS 491 instructor. As you will see in our Capstone project table below, we have had one such Physical

Science student graduate to date, but expect to see their participation grow in PHYS 491 to comprise approximately 50% of the course enrollment.

We use our capstone projects as a portfolio-type assessment to evaluate each student's ability to achieve our five Program Learning outcomes (Section 2.2). Demonstrating a thorough knowledge of physics principles, experimental design, research methods and conducting an independent "hands-on" project is a culminating experience for Physics majors who are bound for graduate school or for careers in industry. Demonstrating the ability to contribute to the design of a lecture or laboratory course is a culminating experience for the educationally-oriented Physics major. Competency in our Learning Objective Areas is measured by student performance in the capstone.

The table (split over two pages) below summarizes the year, student, course number, faculty advisor, and project title, for each student in the self-study period of review (2015-2023). For every group of graduating students, the faculty meet to review the capstone experience and performance of the students. This serves as a formative assessment to the operation of the capstone program and allows us to assess the PLOs.

The capstone seminar is held the day before the graduation ceremony on the Friday of Final Exam week. Friends and family of the students are invited, and the talks are recorded. It is a highlight of the year for the department, and is followed by a reception with the students, attendees, staff, and the faculty. The recordings are made available on our website and may be accessed directly at the following links:

Watch our most Current Senior Capstone Presentations (Spring 2021 - Current)

Watch our Archived Senior Capstone Presentations from graduates prior to 2021

We present a table of our student capstone projects since our last Program Review.

Department of Physics & Astronomy Capstones - Part 1 of 2

Year	Student	Course Number	Advisor	Capstone Research Title
2023	Bish, Erazmus	ASTR 497	Targett	Performing Non-parametric Tests on Model JWST Galaxies
2023	Evans, Andrew	PHYS 497	Miller	A Conformal Field Theory Primer
2023	Quinonez, Pedro Jesus	ASTR 497	Targett	Simulating High Redshift Galaxies for JWST
2023	Toman, Katie	ASTR 492	Cominsky	Neurodiversity in STEM Education
2023	Vasquez, Kevin	PHYS 492	Shi	Instructional Design: How to Improve the Collisions Lab
2022	Batterton, Lindsey	PHYS 497	Miller	General Relativity: Deriving the Kerr Metric for Black Holes
2022	Bean, Zoie	PHYS 492	Cominsky	Accessibility in STEM
2022	Cervantes, Lorena	PHYS 491	Miller	Understanding concepts in cosmology with in-person vs online instruction
2022	Corletto, Angel	PHYS 497	Koh	Studying Aerosols in the Air
2022	Dawson-Trujillo, David	PHYS 497	Koh	Analyzing Airborne Particles in a Local Environment Using DLS and WIBS
2022	Dobar, Jack	PHYS 497	Shi	An Analysis of Carbon Deposition
2022	Karwowski, Austin	PHYS 497	Miller	The Black Hole Information Paradox
2022	Rhodes Ousley, Trent	PHYS 497	Shi	Computational Methods for Ray-Based Optics
2022	Sanborn, Natalie	ASTR 497	Targett	Simulating Data for James Webb Space Telescope
2022	Steinbeck, Allison	ASTR 497	Severson	Studying Exoplanets with TESS
2022	Watkins, Jacob	PHYS 497	Shi	Physics of Gyroscopes and Their Applications
2021	Allen, Kathryn	ASTR 497	Severson	Exoplanets: Transit Method and Characteristics
2021	Braun, Jordan	PHYS 497	Shi	Coupled Oscillators and Waves: Presenting Complicated Interactions
2021	Griswold, Janelle	PHYS 492	Shi	From Wheatstone Bridge to Planck's Constant
2021	Heins, Loren	ASTR 497	Targett	Measuring Morphological Parameters of Rapidly Star Forming Galaxies
2021	Marshall, Elizabeth	ASTR 497	Severson	Mapping Io with Cross Correlation
2021	Marshall, Jacob	ASTR 497	Severson	Modeling supernova as a fireball
2021	Miller, Meghan	ASTR 492	Cominsky	Dome to Home Efficacy Survey
2021	Nelson, Jesse	ASTR 492	Cominsky	Multi-Messenger Astronomy Master Class
2021	Reedy, Jeffrey	PHYS 497	Jones	Experimental Characterization and FEA of Single Coil Guitar Pickup
2021	Saxon, Gage	PHYS 497	Jones	The Physics of Dangerous Illusions that Pilots May Encounter
2021	Stephens, Michael	PHYS 497	Shi	Infrared Scanning, Object Classification, and Safety Screening
2021	Stobba, Bradley	PHYS 497	Shi	Schottky Diode Current vs Voltage Curves Using Zinc Oxide (ZnO) and Gold
2021	Vasquez, Alex	ASTR 497	Cominsky	Particle Detector Safeguard for a Solar CubeSat
2020	Bautista Martinez, Jorge	PHYS 493	Jernigan	Camera board schematic and code for the 1U CubeSat Edgecube
2020	Hofer, Logan	PHYS 497	Lee	Investigating Structural Color and Iridescence in Blue Morpho Butterflies
2020	Johnson, Kyle	PHYS 497	Shi	Impact of Gold Nanoparticles on ZnO Nanowires
2020	McGuire, Joseph	PHYS 497	Miller	General Relativity: Motion in Black Hole Spacetimes
2020	McNatt, Courtney	PHYS 492	Cominsky	Developing a High School STEM Curriculum
2020	Powell, Earl	PHYS 497	Miller	Implementing GR in Mathematica
2020	Sellite, Christopher	PHYS 497	Miller	Visualizing Special Relativity
2019	Allred, Scott	PHYS 497	Shi	Synthesis of Nanopore Templates for Nickel Nanowires
2019	Amyx, Isabella	PHYS 497	Shi	The Effectiveness of Headgear in Soccer
2019	Bernard, André	ASTR 497	Cominsky	Eclipse MegaMovie Project
2019	Castellanos-Vasquez, Erik	ASTR 497	Targett	Determining Galaxy Size through Photometry
2019	Davidson, Jacob	PHYS 497	Severson	Dual Wavelength Laser Photometry of Particulate Matter
2019	Garner, James	PHYS 497	Shi	Fabrication and Characterization of Zinc Oxide Nanorods
2019	Henry, Weston	PHYS 497	Jones	Sound Absorption from Acoustic Metamaterials
2019	Kimberly, Tanner	PHYS 497	Shi	Imaging Protein and RNA Complexes
2019	Kojima, Cody	PHYS 492	Targett	Creating Better Worksheets for PHYS 114: Intro to Physics 1

Watch our most Current Senior Capstone Presentations (Spring 2021 - Current)

Watch our Archived Senior Capstone Presentations from graduates prior to 2021

Capstone table continues …

Department of Physics & Astronomy Capstones - Part 2 of 2

Year	Student	Course Number	Advisor	Capstone Research Title
2019	Lessard, Shannon	PHYS 492	Cominsky	Dream, Make, Innovate
2019	O'Reilly, Spencer	PHYS 493	Jones	3-D Printing of Metamaterials with Negative Thermal Expansion
2019	Ongaro, Ernest	PHYS 497	Shi	Analyzing the Properties of Solid-state Refrigeration Technology
2019	Tweedy, Zackary	ASTR 497	Severson	Simulating LIGO: Wavefront Sensing using Interferometry
2018	Brown, Ryan	ASTR 492	Cominsky	LIGO and General Relativity
2018	de Leuze, Ryan	PHYS 497	Shi	Fabrication and Characterization of Titania Nanotubes
2018	Diel, Erich	PHYS 493	Qualls	Adaptive Virtual Reality
2018	Hawkins , Chance	PHYS 497	Shi	Reduction in Thin Film Curvature Post Deposition
2018	Hoijer , Justin	PHYS 493	Qualls	New Method for Measuring CO2 Infiltration
2018	Kurland , Zachary	PHYS 493	Shi	Constructing and Testing a Homemade Vibrating Sample Magnetometer
2018	Shudde , Claire	ASTR 492	Cominsky	False Color Imaging for High School Students
2018	Smith , Daniel	ASTR 497	Severson	Black Hole Growth
2018	Sylvester, Shane	PHYS 497	Shi	Condensed Magnetic Memory
2017	Arbaugh, Henry	ASTR 497	Severson	Variable Stars at SSUO
2017	Dobbs, Michael	PHYS 497	ATLAS	Particle Physics at CERN
2017	Jaskela, Wayde	PHYS 493	Qualls	Infrared Detection in Biological Tissue
2017	Lewiston, Casey	ASTR 492	Cominsky	Rising Data Curriculum Development
2017	Lukas, Patrick	PHYS 497	Qualls	The Physics of Ski Design
2017	Lynch, Cody	PHYS 493	Qualls	Harvesting Water from Thin Air
2017	Nichols, Jacob	PHYS 497	Jones	The Response of the Ear to Over the Ear Headphones
2017	Nolan, Michael	PHYS 497	Gee	Exploring Objects with Electronic Speckle Pattern Interferometry
2017	Schwartz, Michael	PHYS 497	Jones	The Physics of Guitar Tuning
2017	Smith, KB	ASTR 497	Severson	Measuring an Exoplanet Transit
2017	Smithson, Adam	PHYS 497	Shi	Fabrication and Characterization of Aluminum Oxide Nanopores
2017	Watkins, Christopher	PHYS 497	Gee	Speckle Interferometry
2017	Watson, Wesley	PHYS 493	Jernigan	Aerospace power system for a 1U CubeSat built by SSU Students
2017	Wayland, Sean	ASTR 492	Cominsky	Classical Tests of General Relativity
2016	Arguelles, Angelica	ASTR 492	Severson	Minority Female Students in the Physics Field
2016	Call, Demitri	ASTR 497	Targett	Size-Mass Relations of Galaxies at Redshifts 3-4
2016	Miller, Zachariah	ASTR 492	Targett	Connecting Students' Real-world Experience with Astronomy Lab Skills
2016	Ordoñez, Rosita	PHYS 497	Shi	Fabrication and Characterization of Highly Ordered Titania Nanotubes
2016	Peyko, Nicola	PHYS 497	Shi	Fabrication and Characterization of ZnO Thin Films Doped with Mg and In
2016	Winningham, Stephanie	ASTR 497	Severson	Volcanism on Io
2015	A, Peter	PHYS 497	Severson	The Laws of Thermodynamics Through Dance
2015	Brubaker, Dylan	PHYS 493	Qualls	Adsorption Chiller Protoype
2015	DesPerrier, Felix	PHYS 497	Shi	Luminescence Spectroscopy for Minerals
2015	Gill, Amandeep	PHYS 493	Cominsky	Design and Testing of A3 PocketQube Prototype
2015	Johnson, Cody	PHYS 497	Qualls	Liquid Armor
2015	Kohlmeyer, Thomas	PHYS 497	Jones	Acoustic Analysis of Schroeder Hall
2015	Mariano, Julian	ASTR 497	Severson	A Spectrographic Study of Io
2015	Maurer, Maxwell	PHYS 493	Qualls	Atmospheric Water Harvesting
2015	McCowan, Anna	PHYS 493	Targett	A Ballon-Borne Payload for Measuring Stratospheric CO2
2015	Piatt, Clayton	PHYS 493	Qualls	Improving the Efficiency of Algae Based Carbon Capture
2015	Torke, Maxfield	PHYS 497	Jernigan	Torquing SSU's Spin-LCube Satellite

Watch our most Current Senior Capstone Presentations (Spring 2021 - Current)

Watch our Archived Senior Capstone Presentations from graduates prior to 2021

3.2.1.3 *Findings from Direct Assessment*

Our two primary methods of Direct Assessment: course-embedded tools with our supporting skills matrices; and our student capstones show that students meet and exceed our PLOs, but identify areas for department response. As our process is continuous, we will discuss both past and future interventions in 3.3 Closing the Loop – Curricular Changes.
Findings include:

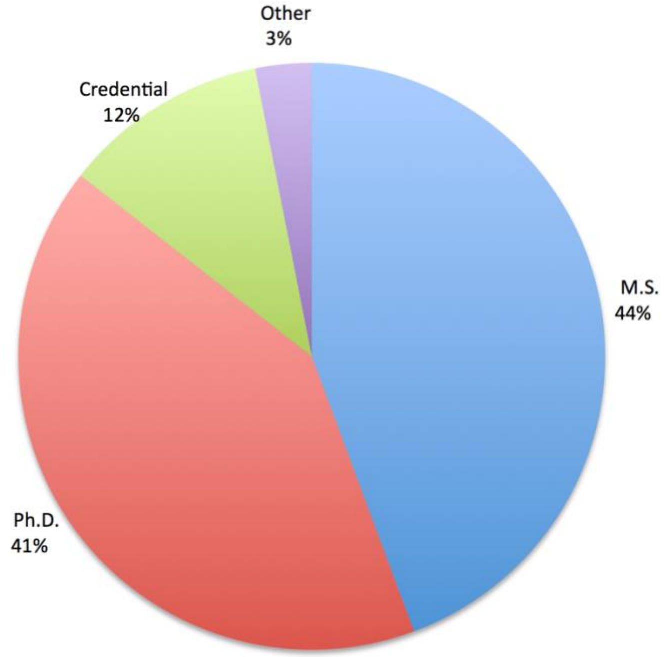
- PLOs are met by the vast majority of students
- Some students show lack of math preparedness in early courses:
  - Difficulties with algebra
  - Difficulties with introductory integration and differentiation
- Some students have difficulty with completing original and timely homework assignments
- Some students have difficulty forming study groups and/or accessing tutoring
- We have noticed an increase in students in need of supports such as:
  - counseling and psychological services
- Some students show a need for support with computing skills around data analysis
- Capstones demonstrate students meet our PLOs and projects display
  - Originality and independent thinking and effort
  - Skills in Critical thinking, Mathematics, basic and advanced laboratory techniques, data acquisition and processing, information literacy, group work, explanations, and science communication (written and oral)
- Students show need for supports around public speaking

3.2.2 Indirect Assessment

The primary way we collect indirect assessment is by the informal interactions we have with our capstone advisees enroute to graduation and the articles these seniors produce for the department newsletter. For examples, please see 8.4 Physics Newsletter, or https://phys-astro.sonoma.edu/newsletter for our list of annual issues dating to 1974. These graduation chronicle artifacts provide written summaries of the student experience of their capstone and of their future plans. Recent Graduate Schools our students have attended: UC Irvine, San Diego State University, UC Davis, Colorado State University, UMass Lowell. Students also pursue careers in teaching and industry. Some companies employing recent alumni: Alluxa, Ametek, L3Harris Technologies, SLAC National Accelerator Laboratory, Griffith Observatory.

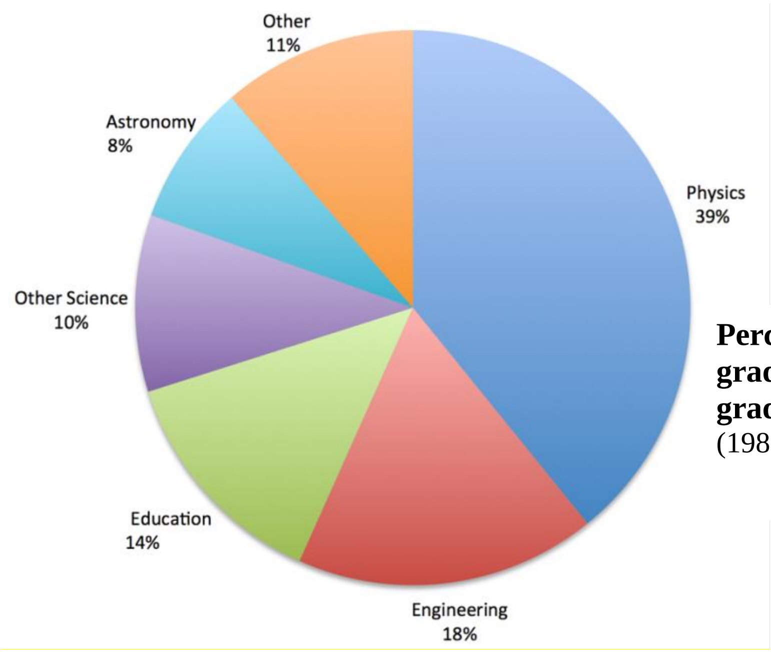
Additionally, we have a Graduates and Alumni section to our website which includes the data we have collected about our alumni including post-graduation updates which we solicit via a web-form. The form has questions about current employment, skills in their jobs that they attribute to their education or which they found lacking, and other comments. The department no-longer receives any dedicated advising release which was instrumental to the origination of this impressive array of alumni records. We present a brief set of data from our alumni records demonstrating what our surveys have shown.

The figure below shows the types of graduate programs entered by SSU's physics graduates. During 1986-2014, 97 of 271 grads (36%) started graduate school.



Percentage of SSU Physics graduates entering different types of graduate programs
(1987-2014)

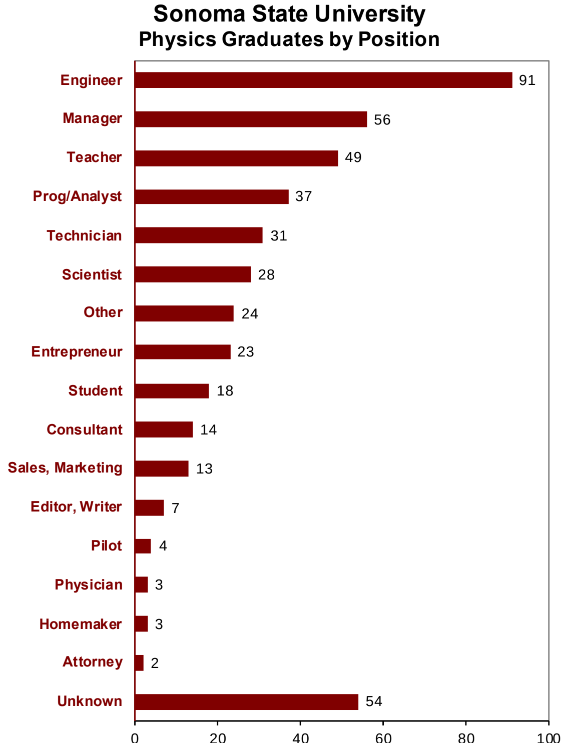
The figure below shows what types of graduate programs entered by SSU's physics graduates. Other includes medicine, math, geography, acting, aging & medical facilities.



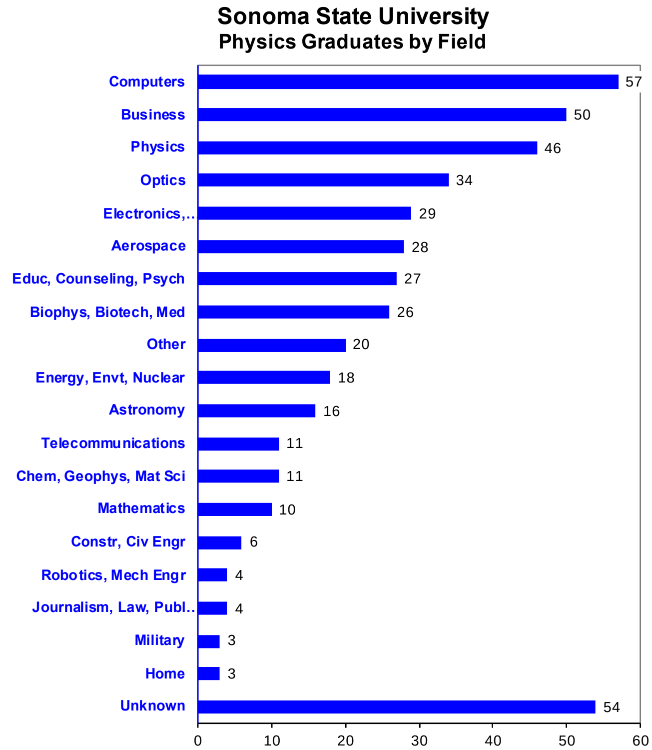
Percentage of SSU Physics graduates entering different graduate fields of study
(1987-2014)

→ ToC

The figures above describe the approximately one-third of our graduates who attend graduate school. For the other two-thirds who do not enter graduate school, most seek work as engineers or programmers or technicians.



SSU graduates by position held.



SSU graduates by field of work.

In the plots above, we present data on the careers of 403 out of our first 457 graduates (through our prior program review). The success we have had in tracking our graduates in their careers has been due to the efforts of Professor Emeritus Joe Tenn, who started this tracking decades ago, and received advising release time. The most common fields for our alumni are computing, business and physics and the post common positions held are engineer, manager, and teacher. These data and short alumni career descriptions and links are presented at our Graduates and Alumni page.

3.2.2.1 Findings from Indirect Assessment

The Department of Physics & Astronomy conducts indirect assessment in the form of: student-advisor communication, the Physics Major newsletter articles written by our graduating seniors, and our Alumni tracking including the form on our website. One important finding is that students have success in pursuing further academic study in graduate school and in attaining employment in the breadth of fields a physics degree enables. Two additional findings of this program review are that students spend time following graduation conducting their job search, and that our response rate from students to our post-graduation survey has been low in the years since our previous program review. Though we have the infrastructure to collect these data, there are not strong mechanisms in place to promote completion of the survey amongst our alumni.

3.3 Closing the Loop - Curricular and Other Changes

In this section we present a collection of changes informed by our assessments. We present these in the summary table below. As our department uses assessment in a formative way, some of these changes have been implemented or are underway (Ongoing), and some are planned (To Do).

Challenge	Curricular Changes	Status
Math Preparedness	ALEKS Math preparation as support for intro courses	Ongoing
	Develop intro-course math assignments and set high-frequency low-stakes assignments	Ongoing
Study Skills and Group Work	Encourage Society of Physics Students (SPS) to set drop-in study hours	Ongoing
	Encourage students to form course specific study-groups / Discord channels	Ongoing
	Learning and Academic Resource Center (LARC) – Supplemental Instruction, tutors	Ongoing
Student Mental Health	Refer students to Counseling and Psychological Services (CAPS)	Ongoing
	Inclusion of CAPS resources in Syllabi	Ongoing
	Use of Care Team & Students of Concern reporting	Ongoing
Communication Training	Support student oral communication by increased cadence of low-stakes oral presentations in PHYS 491 and elsewhere where appropriate	Ongoing
Data Analysis Skills	Changes to PHYS 381 – Computer Applications for Scientists to highlight numerical methods via Python	Ongoing
	Inclusion of more small-scale computer assignments post PHYS 381 in curriculum	To Do
Elective Offerings	Consider making PHYS 313/313L (electronics) an elective, to allow other electives to be offered	To Do
	Develop PHYS 360 Particle Physics, as part of Dr. Miller's DoE grant	To Do
	Consider plans for prudent offerings of PHYS 466 and PHYS 475 when sensible*	To Do
	Consider other options to free up elective units	To Do
Career Search Skills	Include alumni panels within PHYS 494 – Physics Seminar	To Do
	Include Careers Toolbox and CV/Resume/Cover-letter prep in PHYS 494	Ongoing
	Investigate alumnus – student mentorship pairings *	To Do
	Refer students to Sonoma State Career Center	To Do
Improve Alumni Response	Assess and update alumni contact list *	To Do
	Update Physics Newsletter distribution with updated alumni contact information *	To Do
	Request a new round of survey responses from our updated alumni list *	To Do
	Update our alumni statistics based on survey responses *	To Do

* Subject to resources.

3.4 Assessment Strategy Plans

We have delineated our assessment strategies and plan on continue these over the next review period. A potential area we identified as a worthwhile change is the resumption of the detailed graduate/alumni surveying we have conducted in the past. It is notable that those surveys were conducted and analyzed during a time where the department had dedicated release for advising. It is not clear if there are the resources required to make these changes (See also Section 4.3.1.)

Faculty

The Mission of the Department of Physics and Astronomy is to provide excellent education to the Sonoma State University student population through general education, support courses and a strong major program. Successful faculty must contribute to this mission with demonstrable quality of instruction, and vibrant scholarship that first and foremost integrates student involvement. Faculty are expected to contribute to the Department, School of Science and Technology, University and Community through service that supports and promotes this mission. In this section we describe the scholarship and service of the members of our Department.

4.1 Faculty Overview and Trends

Tenure Track (TT) Faculty (5): Lynn Cominsky (Professor), Alexandra Miller (Assistant Professor), Scott Severson (Professor), Hongtao Shi (Professor), Thomas Targett (Associate Professor)

Adjunct or Part-Time (PT) Faculty (5), Wes Farris (M.S.), Sara Kassis (Ph.D.), Anne Metevier (Ph.D.), Karen Targett (M.S.), Valton Smith (M.S.)

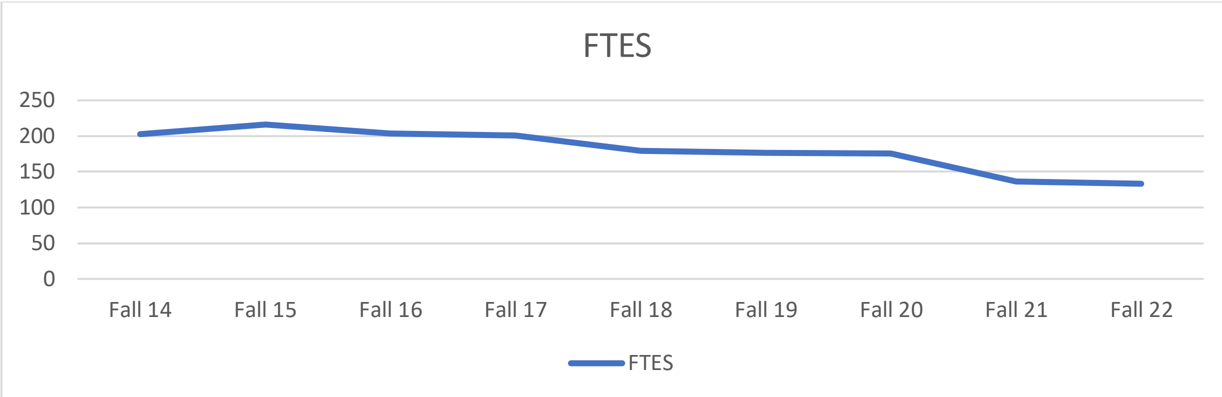
The composition of our department faculty is five TT Faculty and five PT faculty. We present below a table and chart of our FTES, FTEF, and SFR (consult the table for a glossary) In terms of the relative breakdown of instructional workload, we may examine the recent Fall 2022 semester. The teaching workload for Fall 2022 consisted of 43.9 WTU of instruction taught by 4 TT faculty, and 23 WTU of instruction by 4 PT faculty. This is 3.7 TT FTEF and 1.5 PT FTEF. It is predominately the case that the TT faculty involved in instruction consists of the following 4 faculty: Miller, Severson, Shi, and Targett. Lynn Cominsky has predominately bought-out her instructional workload to oversee EdEon, but has notably come to the aid of the department during semesters of great instructional need, as in Spring 2023 when she instructed ASTR 380 – Astrophysics.

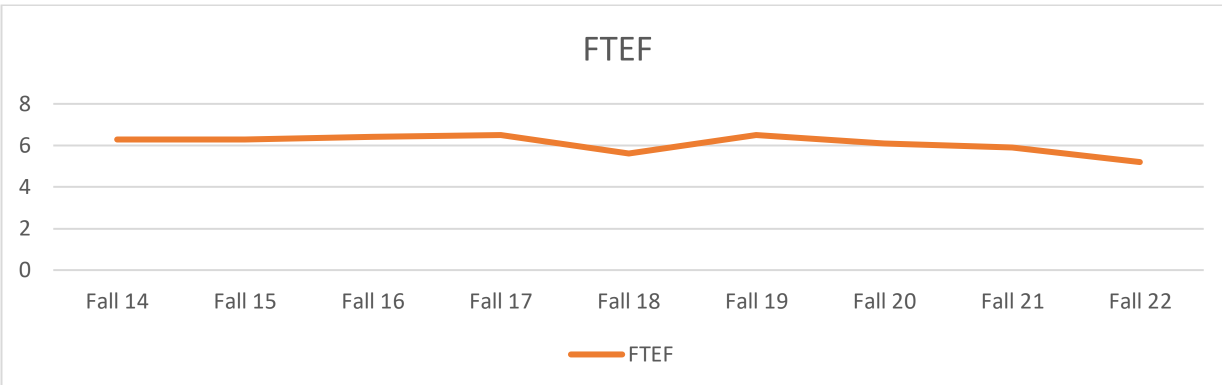
Table: FTES, FTEF, SFR

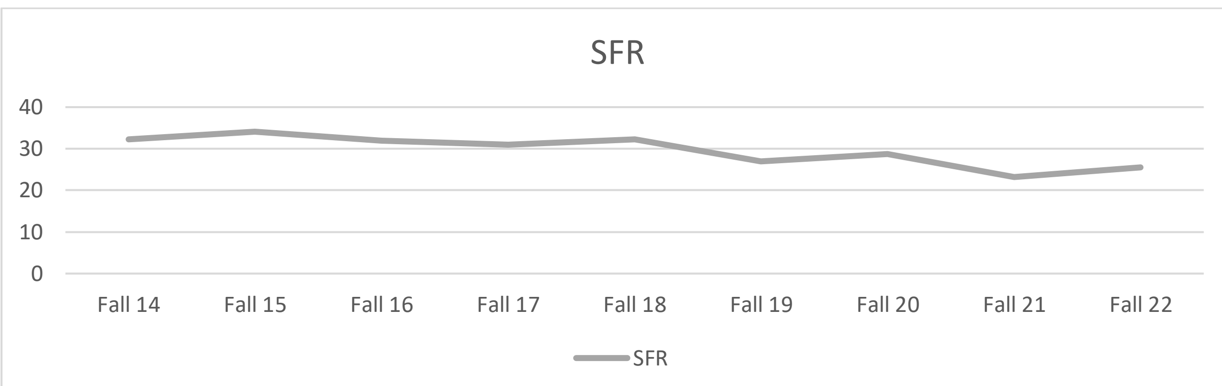
Measure	Fall 14	Fall 15	Fall 16	Fall 17	Fall 18	Fall 19	Fall 20	Fall 21	Fall 22
FTES	202.5	216.2	203.6	201.1	179.5	176.3	175.3	136.3	133.3
FTEF	6.3	6.3	6.4	6.5	5.6	6.5	6.1	5.9	5.2
SFR	32.3	34.1	31.9	30.9	32.3	27.0	28.7	23.2	25.5

Glossary:
FTES - Full-time equivalent students. A student whose class schedule totals 15 units in a given term = 1.0 FTES
FTEF - Full-time equivalent faculty.
TT Faculty: 1 FTEF = workload of 12 weighted teaching units (WTU) in class and 3 indirect WTU.
Part-time faculty – 1 FTEF = workload of 15 WTU in class.
SFR: Student to Faculty Ratio, the number of full-time equivalent students to full-time equivalent faculty (FTES per semester/FTEF)
Sources:
F 14 – F 19 from Academic Resource Dashboard (Tableau)
F 20 – F22 from Mike Ogg – Budget & Planning

→ ToC







These plots illustrate the following changes during the period of review:

- FTES is down, this is due to the following factors:
  - SSU Enrollment is down from a headcount of 9290 in Fall 2015 to 6483 in Fall 2022 (https://tableau.calstate.edu) and this has impacted class sizes.
  - We have offered fewer General Education courses, lower and upper division, due to our lack of either TT or PT faculty availability to offer additional sections. This has been received well by an administration looking to lower the number of course offerings during the enrollment downturn.
- FTEF is down. Following the loss of one TT faculty in 2020 and recent loss of two PT faculty we are currently using our TT and PT pool at maximum capacity. We are seeing the retirement of another mainstay PT faculty after Fall 2023, Wes Farris.

- SFR is at 25.5. Between Fall 2014 and Fall 2018 it was over 30. This is down due to the aforementioned enrollment reductions. For example, our ASTR 100 – Descriptive Astronomy courses, which bolstered our SFR due to the large class sizes has been reduced from 5 offerings a year to 3. Our SFR, while reduced, is still healthy for a program that supports laboratories, and small but robust and course efficient major programs.

4.2 Faculty Description and Specialization

The Department of Physics & Astronomy Tenure Track Faculty have specializations that are aligned with the programs we offer. The physics degrees we offer, the BS, BA, and the BS Astrophysics prepare students for graduate study, work in local industry, and in careers in education. All TT faculty have robust programs of scholarship and support students in capstone work. Our specialties fall in several broad areas: astrophysics (Cominsky, Severson, Targett), material science (Shi), optics (Severson), theory (Miller), and education (Cominsky, Miller, Severson). These align with the specific areas of preparation above, with optics and material science being disciplines connected to much of the local physics careers. Adding Dr. Miller during our most recent TT hiring cycle was essential in supporting our students pursuing theoretical physics. Historically, some of our Ph.D. part-time faculty have also supported student capstone work, but with the retirement of Dr. Mike Jones and his specialization in music and electronics this will suffer a setback.

Our TT faculty Curricula Vitae are available in the Appendices, and Section 2.8.2 includes a tabular summary of recent achievements, grants and awards. We present brief summaries of our faculty below.

Professor Lynn Cominsky

Lynn Cominsky is an award-winning Professor in the Physics and Astronomy Department at Sonoma State University (SSU), where she has been on the faculty for over 35 years. She is an author on over 225 research papers in refereed journals, and the Principal or Co-Investigator on over $43 million of grants to SSU. Prof. Cominsky is the founder and director of SSU's Education and Public Outreach Group (now renamed EdEon STEM Learning), which develops educational materials for NASA, NSF and the US Department of Education. The group excels at K-12 teacher training, curriculum development, and the development of interactive web activities for students that teach math and science. In 1993, Prof. Cominsky was named SSU's Outstanding Professor, and the California Professor of the Year by the Council for the Advancement and Support of Education. In 2007, she was named a Fellow of the California Council on Science and Technology, in 2009, a Fellow of the American Physical Society and in 2013, a Fellow of the American Association for the Advancement of Science. Recent awards include the 2016 Education Prize from the American Astronomical Society, the 2016 Wang Family Excellence Award from the California State University and the 2017 Frank J. Malina Education Medal from the International Astronautical Federation. In 2019, she was selected as one of the first 200 Legacy Fellows named by the American Astronomical Society. Cominsky's most recent project is: NASA's Neurodiversity Network (N3): Creating Inclusive Informal Learning Opportunities Across the Spectrum. N3 is part of NASA's Science Activation 2.0 program, which began in January 2021.

→ ToC

N3's goal is to provide a pathway to NASA participation and STEM employment for neurodiverse learners, with a focus on those on the autism spectrum. B.A. 1975 Brandeis University, Ph. D. 1981 MIT in Physics. Dr. Cominsky's grant work supports her work at (more than) full time, so it is rare for her to instruct courses. Lecture and Laboratory courses during period of review [due to staffing emergencies]: ASTR 380, PHYS 102, SCI 220.

Assistant Professor Alexandra Miller

Dr. Miller's research is in the field of Quantum Gravity, which aims to answer one of the biggest open questions in physics today: How can one consistently unite Einstein′s theory of General Relativity with Quantum Mechanics? This is imperative to our understanding of the universe at its most fundamental level and is especially important in finding a complete description of black holes and the universe right after the big bang. Her primary tool in helping to find a complete theory of Quantum Gravity is the AdS/CFT correspondence, which says that a theory of quantum gravity is mathematically dual to a conformal field theory living in fewer dimensions. Dr. Miller is Co-PI on a Department of Energy RENEW-HEP Grant (Growth & Research Opportunities With Traineeships in High Energy Physics at Minority Serving Institutions). Her other notable achievements in the period of review is completing the approval of the Physical Science degree plan, including receiving a Teagle Foundation grant for the work; serving on the Cal-Bridge Steering Committee, Cal-Bridge is a CSU-UC partnership designed for CSU students interested in pursuing a PhD in physics, astronomy, computer science, computer engineering, or related fields; and her research, including authoring the first of a series of technical primers for undergraduate and graduate students: "A Conformal Field Theory Primer in $D \geq 3$". She received her B.S. in Physics with minors in Theatre and Philosophy from San Francisco State University. She earned both an M.A. and a Ph.D. in Physics at UC Santa Barbara. Lecture and Laboratory courses during period of review: PHYS 100, 114, 209A, 214, 216, 304, 320, 430, 460, 491, 494.

Professor Scott Severson

Dr. Severson is Professor and Chair of the Physics and Astronomy Department, and a recent recipient of Sonoma State University's Excellence in Teaching Award. Dr. Severson works in the field of astronomical instrumentation, most recently as Co-PI on the KAPAO Adaptive Optics System for Table Mountain Observatory. His scientific research emphasizes high resolution, near-infrared, high-speed photometry to measure transient phenomena in the universe. He serves as an external advisor for the Institute of Science and Engineer Educators (UC Santa Cruz), leading a recent paper on applying their professional development principles to mentoring student research. He is an inaugural consortium member of the Astronomy/STEM Alliance with Lick Observatory (ASTRAL) (nee STARS), working to bring access to this historic and productive observatory to undergraduates throughout the bay-area. He has mentored nearly one-hundred student-semesters of undergraduate research and originated the department's Capstone Research Seminar. Dr. Severson is the director of the campus observatory, and runs the popular Public Viewing Night series which regularly draws over 100 students and members of the public. He received his B.S. from University of Wisconsin-Madison and his Ph.D. from University of Chicago. Lecture and Laboratory courses during period of review: ASTR 100, 150, 231, 305, 331, 380, 482, PHYS 102, 214, 340, 450, 466, 491, 494.

→ ToC

Professor Hongtao Shi

Dr. Shi's research is in Condensed Matter Physics, specifically the fields of Nanoscience and nanotechnology, magnetic thin films and magnetism, semiconductors, self-assembly, and photovoltaics. Hongtao Shi has worked extensively with local industry through his role as the Director of SSU's Keck Microanalysis Laboratory. Dr. Shi was instrumental in the successful NSF MRI Proposal that acquired a Variable Pressure Scanning Electron Microscope with Integrated EBSD, EDS and CL in 2020. Hongtao Shi has over 30 papers in refereed journals for his work in studying the magnetic properties of new types of materials in journals such as the Journal of Applied Physics and Physical Review B. Dr. Shi's degrees and institutions: Ph.D. West Virginia University, M.S. West Virginia University, M.S. Nanjing University, B.S. Nanjing University. Lecture and Laboratory courses during period of review: PHYS 100, 114, 116, 210B, 214, 216, 314, 320, 325, 366, 430, 450, 460.

Associate Professor Thomas Targett

Tom Targett is an author on 38 (15 while at SSU) refereed papers on the properties distant of distant galaxies in journals such as Astrophysical Journal and Monthly Notices of the Royal Astronomical Society. His work focuses on galaxy Evolution including the study of active galaxies and the first galaxies - their origin and properties. Dr. Targett is a member of several international astronomy collaborations and recent work includes James Webb Space Telescope (JWST) studies of the most distant galaxies, as well as crowd-sourcing solar eclipse data for solar coronal research. Dr. Targett leads the NSF-funded Engaging Community Colleges in Collaboration (EC3) program which implements residential research experiences (REUs) for local community college students at SSU. He is a frequent speaker on astronomical topics to schools, clubs and the media. He has an extensive record of service across department, school and university levels, and most recently served as the Faculty Co-Chair of the Academic Master Plan - Learning Spaces & Technologies Group. Dr. Targett's degrees and institutions: Ph.D. University of Edinburgh, M.Phys. Cardiff University. Lecture and Laboratory courses during period of review: ASTR 100, 150, 231, 305, 331, 350, PHYS 114, 381, 491, 494.

Adjunct Faculty

Wes Farris (M.S.) (Retiring at end of Fall 2023)

Long-time instructor of the Introductory College Physics Series. Mr. Farris is invaluable in assisting the Department of Physics & Astronomy Observatory Viewing Nights. Courses during period of review: ASTR 100, 231, PHYS 209A, 209B, 210A, 210B.

Sara Kassis (Ph.D.)

Dr. Kassis received her PhD in Condensed Matter Physics from Kent State University. Her experience includes over 10 years of teaching physics and engineering at various universities. Her research interests include materials engineering and characterization, nanomaterials, and low temperature physics. Courses during period of review: PHYS 107, 214, 342, 450

Anne Metevier (Ph.D.)

Dr. Metevier received her Ph.D. in Astrophysics from University of California-Santa Cruz, and her B.S in Physics from Northwestern University. She is now the Director of College Partnerships at UC Observatories. Courses during period of review: ASTR 231, 303.

Bernadette Smith (Ph.D.)

Dr. Smith received her Ph.D. in Physics from University of Colorado, Bolder, and her B.S. in Physics from California Institute of Technology. Courses during period of review: PHYS 116, 209A, 209B, 216.

Valton Smith (M.S.)

Valton Smith received his M.S. in Physics from San Francisco State University, and his B.S in Physics from Pepperdine University. Courses during period of review: PHYS 209B, 210B.

Karen Targett (M.Phys.)

Karen Targett received her Master of Physics (Hons.) Astrophysics from Cardiff University of Wales. Courses during period of review: ASTR 231, SCI 220

Significant Faculty Departures During Period of Review

TT Faculty: Professor Jeremy Qualls (2018), Assistant Professor James Lee (2020)

PT Faculty: Joanne Del Corral (B.S.) (2018), So Young Han (Ph.D.) (2018), Mike Jones (Ph.D.) (2023), Wes Farris (M.S.) will be leaving us following the Fall 2023 semester, Anne Metevier is in a new position at UCSC and unlikely to instruct for us in the future.

4.3 Faculty Support

4.3.1 Workload

The TT faculty have a workload basis of 12 Weighted Teaching Units of instruction and 3 units of Service and Scholarship a semester. As we have mentioned, Dr. Cominsky oversees the EdEon STEM learning center, and her impressive array of grant-sponsored projects supports a complete release of her 12 WTU of instruction. Recent grants support modest semester releases of ~ 1-3 WTU/semester for Drs. Targett and Miller for 2023-2024. The release for the position of Department Chair (currently Dr. Severson) is 4 WTU. As stated at the beginning of the Chapter, the teaching workload for Fall 2022 consisted of 44 WTU of instruction taught by 4 TT faculty, and 23 WTU of instruction by 4 PT faculty. This consists of full time 12 WTU instruction for the 3 non-chair TT faculty and 8 WTU for the chair. The TT faculty are teaching at full capacity. As stated in the prior section, we have had substantial departures both in our TT and our PT faculty ranks. With the imminent loss of Wes Farris and his up to 12 WTU of instruction for us per semester, a reasonable estimate of PT workload available to us is 15-18 WTU. This is following two recent Pool Refresh PT faculty searches. This is a perilous decrease in PT WTU for our department, for example our PT workload in AY12019-2020, was 27.5 WTU/semester.

During the period of review the TT faculty have undertaken program and course development. These are discussed elsewhere, but as a summary, we have: changed our degree plans by discontinuing the BS-Applied Physics and BA-Physics with Trigonometry, and introduced the BS-Physics with Astrophysics Concentration and the BA-Physical Science degrees (Section 2.8.1); developed and introduced new courses (ASTR 121, PHYS 107, PHYS 304, and SCI 220) and recertified our General Education curriculum including development of Signature Assignments (Section 2.7.2); developed our Program Curriculum Map (Section 8.1); developed our Capstone requirement with the inclusion of a support course: PHYS 491 (Section 3.2.1.2); and other efforts (Section 2.8.2).

The balance of the 3 units of Tenure Track faculty workload dedicated to service and scholarship is augmented by grant-sponsored release. As seen in the faculty descriptions in the prior section, 4.2, the collected Curricula Vitae in Section 8.6, or summarized in the Program Achievements and Changes Since Previous Program Review in Section 2.8, the faculty are active in scholarship and service. Professor Cominsky's work building EdEon has earned countless awards; Assistant Professor Alexandra Miller's work in Quantum Gravity includes productive research collaborations and recent grant funding; Professor Severson's work in experimental astrophysics includes bringing access to impressive observatory facilities to our students and commensurate research in planetary science and the study of supernovae; Professor Shi's work studying the properties of innovative materials forms the basis of our material science program for our students; and Associate Professor Tom Targett's work connects our students with the frontiers of cosmology including JWST imaging of distant galaxies. Another excellent way to see a summary of the intellectual life of the department and the scholarship of the faculty is the Student Capstone Table in Section 3.2.1.2. These scholarship efforts and the corresponding student research form the central pillar of our student recruitment and retention efforts. Our scholarship efforts are complemented by a strong record of Service, as we describe below.

The Physics and Astronomy Department is actively involved in all levels of service. We hold department meetings on weekly basis and all faculty, staff and lecturers are invited to attend. Most departmental planning is completed via these meetings, but occasionally sub-committees are formed to do additional work on some issue. Work for the department includes scheduling, advising, recruiting, program and course development and revision, and the general course of supporting a thriving department. Department faculty are active in School-level governance, including the School of Science & Technology's Curriculum; Retention, Tenure and Promotion; and Professional Development Committees. The Department Chair attends the School Chairs' meetings. Areas of University Service for members of the department have included the Faculty Senate, Educational Policies Committee, the General Education subcommittee, the graduation Overlay Subcommittee, the current Academic Master Plan committee, the Scholarship committee, the Laboratory Safety committee, the previous School of Science and Technology Dean hiring committee, and others.

Service does not end with these committees. Each member of the department has an exemplary history of service to the community in a variety of ways. Dr. Cominsky has given over hundreds of invited lectures to scientific and public audiences on topics in high-energy astrophysics. For more than a decade, she served as the Deputy Press Officer for the American Astronomical Society, and as the Press Officer for the Swift and Fermi missions and LIGO. She also has served on a number of Federal Advisory committees. Dr. Shi has and currently Dr. Miller does advise the SSU SPS (Society of Physics Students) chapter. Dr. Shi coordinates with local industry through his role as the Director of SSU's Keck Microanalysis Laboratory. The Department runs two popular public programs, the Public Viewing Nights at the SSU Observatory and the venerable "What Physicists Do" (WPD) public lecture series. The Viewing Nights are supported by Dr. Severson (Observatory Director), Dr. Targett, and adjunct faculty Wes Farris. The WPD lecture series rotates among the faculty, being organized in recent semesters by, Dr. Targett, Dr. Miller, and currently Dr. Severson. Dr. Miller works extensively with the CSU-UC partnership, Cal-Bridge, including originating their Science by Diverse Scientists lecture series.

There are multiple ways in which the workload for completing the routine business of the department has increased. Many campus services have been suspended or cut back. Our large-lecture courses have contained scanning-form assessments, there is no campus service for these ,formerly handled by Information Technology (IT), and faculty must score these via self-service at the Center for Teaching & Educational Technology (CTET). Our public lecture series was recorded via a service of IT that was recently discontinued. Disability Services for Students (DSS) used to return accommodated student exams to the department. These are now collected by the faculty themselves at the DSS suite. Just as this report is being finished, summer Advising and Orientation has changed and now the Physics & Astronomy Chair is the point of contact with incoming FTFY and Transfer students as they enroll in their courses. Beyond the advising of their major, faculty are now serving as the first point of contact for students as they interact with the processes of registration. Other ways in which the workload of faculty have increased is the increased incidence of student mental health issues. Counseling and Psychological Services (CAPS) provides important counseling support for students, but faculty are often the first line of assistance to direct students to the services. Additional workload takes the form of the multiple new processes and the increasing number of trainings required to complete faculty tasks. These includes the areas of curriculum development and recertification (https://sonoma.curriculog.com), travel certification and reimbursement (SAP Concur), Learning Management Systems (Canvas), textbook adoption (https://seawolfbundle.sonoma.edu), advising (LoboConnect, My SSU), etc.

Faculty workload regarding our advising practice is addressed in Section 5.1.1.

4.3.2 Professional Development and Mentoring

Faculty in our department are engaged in professional development opportunities. An example is the NSF-funded Transformative Inclusion in Postsecondary STEM: Towards Justice (TIPS Towards Justice) which aims to increase the participation and success of Latinx students in STEM by transforming STEM department cultures to become truly "Hispanic-Serving." Run out of the Math department, Physics & Astronomy Professors Miller, Severson, and Shi, along with lab manager Ryan Meder and adjunct faculty Valton Smith are engaged in a multi-year process of participating in the program and collaboratively develop activities for our introductory laboratory classes that increase student belonging in STEM fields. Professor Cominsky is collaborating with Dr. Matthew Paolucci from Psychology to develop in-class workshops related to combatting sexual harassment and implicit gender bias, supported by a grant from NSF to

Paolucci and Cominsky. Professor Severson has served as an external advisor and was an invited session lead for the Institute of Science and Engineer Educators program (out of UC Santa Cruz) Advancing Inclusive Leaders in STEM: 20 Years of the PDP conference in 2022. The campus provides workshops, trainings and drop-in assistance via the Center for Teaching & Educational Technology (CTET). Another component for professional development within the department is our process of mentoring through the RTP Process.

4.3.2.1 Departmental Mentoring Through RTP Process

Feedback and Development. There are formal and informal mechanisms for instructional feedback within the Physics and Astronomy Department. The development of faculty teaching effectiveness begins with the Retention Tenure and Promotion process and its annual reviews. During this process we are evaluated on our teaching by students and by our peers. Student evaluation is conducted in the form of both standardized effectiveness survey (the Student Evaluation of Teaching Effectiveness, or SETE) and by the submission of written comments. These are reviewed by the faculty member undergoing the RTP process and by the various department, school and university wide RTP committees. This method of student input followed by faculty review and response is an effective way to inform teaching practice. The other formal component of teaching evaluation during the RTP process is peer evaluation. Twice in each annual RTP review, a fellow faculty member observes a class period of instruction. The resulting written comments form an excellent resource for self-reflection on teaching practice and provide the RTP committees an accurate picture of faculty instructional performance. It is important to note that this visit and evaluation by peers provides an invaluable resource by making the broader Department aware of the teaching styles in use by the individual faculty members.
As the RTP process is completed, much of the formal mechanism for faculty assessment and feedback is ended. The SETE surveys are available for faculty self-assessment and full and interim program reviews form a structure during which discussions of best practices and pedagogy occur. On a less formal basis, our department has a supportive and collaborative attitude towards instruction. Our faculty frequently share syllabi, course materials and specific teaching modules. Our regular department meetings may contain a discussion of successes in classes or the sharing of particular instructional problems. The Department of Physics and Astronomy places a strong emphasis of monitoring and developing teaching practices during the impressionable early portion of a faculty member's career, but the reflective nature of that process informs our practices throughout our careers

4.4 Department Faculty Hiring Plan

Overall Summary of Workload Issues: From the above, we conclude that the TT faculty contribute full teaching workload outside of grant-funded release and the chair release. TT Faculty teach core upper-division major courses, key service courses for allied majors (the calculus-based intro series), and the occasional GE course. PT faculty workload has decreased due to budgetary pressures and a pool reduced by recent retirements. Increased instructional capacity through an additional TT faculty member or additional PR faculty would very easily be directed to courses unique to the department and attractive to students: PHYS 210A and 210B the algebra/trig-based intro series (predominately for those in the biological scienced), PHYS 300 – The Physics of Music, ASTR 303 – Life in the Universe, PHYS 313/313L – Electronics, etc. Our department has been very creative in trying to make the most of what we have, and we are proud of our efforts to maintain the close interactions between students and faculty, and hands-on laboratory experiences that make our program distinctive. However, due to our recent loss of TT faculty James Lee in 2020 and our shrinking PT faculty pool, expansion of our instructional capacity is essential for us to maintain our core offerings. Our recent Pool searches have yielded only small gains to offset the losses, as potential hires are not attracted by piecemeal work. TT faculty positions and full-time adjunct work is what can attract vital new members to our faculty.

Program Resources

This section addresses whether the program has the resources it needs to deliver its curriculum and achieve its goals. Following the Program Review Self-Study Guide, we place our discussion of advising below. Please note that this includes an additional component of faculty workload that supplements the discussion of faculty efforts related to instruction and departmental, school, and university service from the prior section.

5.1 Student Support

There are several student support programs at Sonoma State University that we use to enhance our ability to fulfill student-learning objectives. These include a strong emphasis on assistance outside the classroom. Tutoring and small group instruction is available from several resources listed below. We are also aware that achieving our instructional goals is impacted by events in our students' lives outside the classroom and we rely on and direct students to the counseling and special assistance opportunities the campus provides (see below).

5.1.1 Advising

The faculty of the Department of Physics and Astronomy are seriously invested in the role that faculty have in guiding and advising students within and outside the major. The advising of students within the major makes up the bulk of this work and is described in greater detail below. For students outside of the major or minor, the majority of advising from our faculty comes in the form of interactions with students in office hours and before, during, and after class periods. The SSU advising policies are available at: https://www.sonoma.edu/policies/advising. Campus-wide support for academic advising can be found at: https://advising.sonoma.edu.
The Department has a long-standing tradition of providing excellent web-accessible resources for students:
Descriptions of our Degree Programs including Advising Checklists we have developed:
https://phys-astro.sonoma.edu/degree-programs
A landing page for Prospective Students including sub-pages for Transfer Students and for students to plan their first year:
https://phys-astro.sonoma.edu/prospective-students
A landing page specifically designed for our current students:
https://phys-astro.sonoma.edu/current-students
This includes how we assign our students their advisors:
https://phys-astro.sonoma.edu/current-students/advising/advisors
BS Physics (excluding Astrophysics) and BA Physics:
Alexandra Miller - Student Last Names (A-M)
Hongtao Shi - Student Last Names (N-Z)
BS Physics with Astrophysics concentration:
Scott Severson - Student Last Names (A-M)
Tom Targett - Student Last Names (N-Z)
BA Physical Science:
Alexandra Miller - Student Last Names (A-G)
Scott Severson - Student Last Names (H-M)
Hongtao Shi - Student Last Names (N-S)
Tom Targett - Student Last Names (T-Z)

The page for current students goes further by including our recently updated Four-Year Plans:
https://phys-astro.sonoma.edu/current-students/advising/four-year-plans/bs-physics
Our pre-requisite map:
https://phys-astro.sonoma.edu/current-students/advising/key-prerequisites
our learning objectives:
https://phys-astro.sonoma.edu/current-students/advising/learning-objectives
course offerings
https://phys-astro.sonoma.edu/current-students/course-offerings
scholarships and opportunities
https://phys-astro.sonoma.edu/current-students/scholarships-opportunities
the Society of Physics Students Student Club:
https://phys-astro.sonoma.edu/current-students/clubs
and a collection of recent student research to help students navigate choosing their capstone research:
https://phys-astro.sonoma.edu/current-students/research

Our model for sharing advising duties has been in place since approximately 2013. Prior to this, the we had a single department advisor, that was supported by 3 WTU of release, historically by the Dean, and then by released time from the indirect grant funding of Dr. Cominsky. Her generosity allowed that modality to continue for a few extra years, but with no administrative release time dedicated to advising we have moved to the shared advising model

Our current advising process is streamlined to help students prepare materials to monitor their degree process and make the scheduled advising sessions as productive as possible. Students are directed to the variety of resources above including: the degree requirements and course listings from the General Catalog; the Academic Requirements Report available through the students MySSU login; and our custom advising forms for their course pathway preparation.

Facilitating students to be involved in authentic scientific research at the undergraduate level is a major emphasis of our advising program. Students are encouraged to apply for research opportunities both within and outside of the Department. The development of our capstone project program and the PHYS 491- Capstone Preparatory Seminar are all part of our effort to give our students the experience graduate programs and employers value.

5.1.2 Campus Supports

Learning and Academic Resource Center (LARC) – Our faculty reinforce in class the availability of tutoring through LARC. Our majors (and others) are employed through the center to provide tutoring support. This program provides instructional support and has the benefit of providing financial support for these tutors. Tutors are provided training in assisting students in a friendly, but rigorous manner. Reinforcing active engagement with the course material, tutors help students learn more efficiently. According to the program's philosophy, tutoring methods emphasize the sharing of concepts, problem solving strategies, and feature small group discussions. LARC further supports our students through its Supplemental Instruction (SI) program. This provides an alternate learning environment for students to actively engage the course material with student mentoring. These organized and regular "study groups" can be attached to certain SSU courses with high faculty-to-student ratios ("parent courses"). This program is most often used by the following courses: ASTR 100, PHYS 114, PHYS 210A, and PHYS210B. PHYS 114, with a common class size of 30, is below the usual size of supported SI courses, and therefore is less frequently supported in this matter, despite its nature as a key first course in physics. LARC works diligently to have tutors to support this course and others unsupported by an SI section.

Society of Physics Students (SPS): The SPS club at Sonoma State University is very active and has the strong support of the Department of Physics and Astronomy. There is a faculty advisor to the group and faculty often attend the bi-weekly meetings of the organization. The SPS club provides a social and support network for the students in the major. In addition, SPS members provide invaluable services to the broader student population through tutoring and outreach. The SPS tutoring program is on the upswing following a period of lower activity during the COVID pandemic.

Disability Services for Students (DSS) assists in making Sonoma State University's programs accessible to students with disabilities. DSS provides services such as testing accommodation, advising, and assistive technology to students with disabilities. The faculty of the Department of Physics and Astronomy respond to requests from students and DSS to provide educational materials in a variety of accessible formats. We are also proactive in designing accessible instructional materials and encouraging students to seek the services DSS provides. DSS has been a primary support in Cominsky's work developing programs to support neurodiverse students, and continues to work closely with Cominsky as her NASA Neurodiversity program begins to bring new students to SSU.

Counseling & Psychological Services (CAPS): Counseling & Psychological Services attends to the mental health needs of students by offering consultation and counseling. The emotional well-being of our students is critical to their happiness and their pursuit of educational goals. We are sensitive to the needs of our students and remain alert for signs of emotional distress. Counseling & Psychological Services is an important resource for our faculty, and we do not hesitate to direct at-risk students there.

Sonoma State Career Center, assisting students with choosing their major, exploring career interests, gaining work experience, and providing guidance in students' professional job search.

Cal-Bridge: Creating opportunities for traditionally underrepresented groups to participate and advance in STEM fields.

5.1.3 Supporting Student Work and Research

Support for student research comes from a variety of sources. At the department level, student support has come from primarily three sources: grant funding, predominately Professor Cominsky's EdEon work; support from the Instructionally Related Activity funds for the department's observatory programs and the 'What Physicists Do' speaker series; funds from private donors that supports research awards. These efforts are augmented by the available funds for research (e/g Koret Scholars Program) and scholarships (https://scholarships.sonoma.edu) at the university-level.

5.1.4 Additional Campus Support Services Needed

As we discussed in Section 3.3, we have identified the following areas where campus student support services will be most helpful: Math Preparedness, Study Skills and Group Work, Student Mental Health, and Career Search Skills. Several of these have existing campus supports, e.g., LARC, CAPS, the Career Center. We will coordinate with these programs to improve student use of these services and to see that the specific needs of our students are communicated.

5.2 Library and Information Resources

The Sonoma State University Library provides a wide range of services to help students achieve your academic goals. The library is used by students writing papers for upper and lower division general education courses, by advanced students conducting research in capstone courses, and by faculty for both their courses and their research. While funds for ordering books are limited, they appear to be adequate for the Department's needs at the present time. Journal access is limited, and faculty predominately make use of open-access archives, e.g., https://arxiv.org. At all times the library personnel have been extremely helpful.

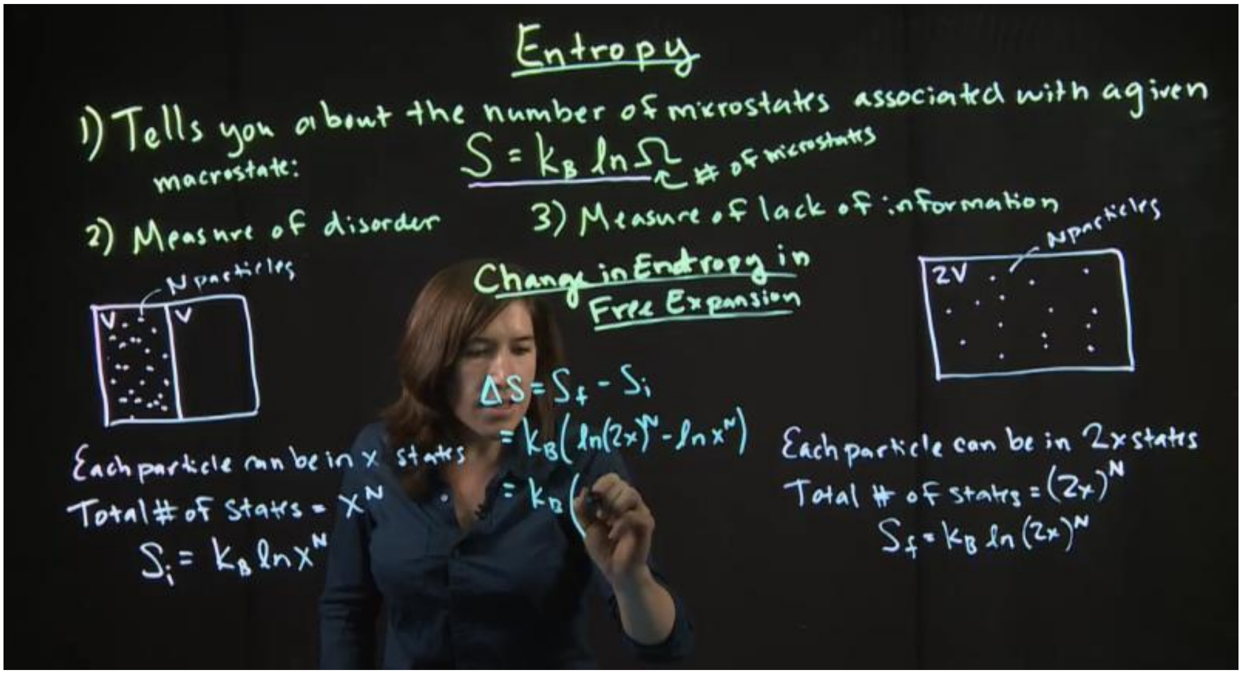
5.3 Technology Resources

In the disciplines of Physics and Astronomy, the role of computers is essential. In our program, computer technology has become crucial in providing tools for data analysis, controlling and interfacing data acquisition instruments, simulations and computations, as well as general tools such as word processing and presentations. We discuss classroom and research technology in Section 5.4 below.

The campus is undergoing a transition of technology support moving from Information Technology to the Center for Teaching & Educational Technology. The campus Learning Management System is Canvas, faculty have access to a Refresh program that provides either a laptop or desktop computer replacement every four or five years. Access to administration accounts on these machines requires IT approval. Software available includes the Google suite, Adobe Suite, and Mathematica. Access to the Microsoft Suite has proven challenging in the past, with some faculty paying out of pocket due to IT policies. Our departmental website is administered via Drupal.

There are no dedicated department funds to keeping the hardware or software of the two laboratory classrooms up to date. The current vintage of the computers in the instructional spaces are a collection of 12 iMac Retina 4k, 21.5-inch, 2017 computers in Darwin 308 and 12 iMac Retina 4k, 21.5-inch, 2017 computers in Darwin 311. The department has done an admirable job of managing the existing computers and uses Capstone for control of Pasco lab equipment, and python for advanced scientific computing. We will require a laboratory computing refresh in the near future. Research spaces have computing older than the instructional spaces. Our typical process has been to make available the outgoing instructional lab computers available for faculty to replace their research space computing.

The department used some one-time COVID funds to purchase a lightboard for the production of videos for online and flipped-classroom instruction. Shown below is Assistant Professor Alexandra Miller using the lightboard during video instruction.



5.4 Instructional Spaces

The Department of Physics and Astronomy is housed on the third floor of Darwin Hall. The resources are focused on undergraduate education and in engaging students from GE courses to advanced research. Departmental facilities include basic resources such as faculty offices as well as research laboratories.

With the exception of some advanced courses, the bulk of the department lectures are taught in multimedia University classrooms. To enhance the effectiveness of lectures, a number of lecture demonstrations have been developed. Our stockroom Darwin 309 has demonstration equipment to cover the entire range of courses offered. A full-time technician, Ryan Meder, provides expertise in maintaining equipment as well as developing new infrastructure when needed.

The department facilities include faculty offices, a conference room, a student study room (shared with the Chemistry Department), two lower-division teaching labs, a stock room, several advanced research labs, and an on-campus observatory (Dr. Severson, director). The Keck Microanalysis Lab and Rolf Illsley photonics labs in the Cerent Engineering Science Complex (Salazar 2nd floor) are available for use by students as well. Dr. Shi from the Department of Physics and Astronomy is the director of the Keck Microanalysis Lab.

5.4.1 Classrooms

Most campus instructional spaces contain whiteboards, an instructor computer (or use of video input), projectors and a screen. Some larger classrooms contain voice amplification. When the

Department of Physics & Astronomy requires instructional space with student computing, we use one of our laboratory classroom spaces.

Lower-division Labs: The two lower-division teaching labs support 24 seats each (Darwin 308 & 311). These rooms provide eleven to twelve lab stations. The Darwin 308 lab is well equipped for classical mechanics experiments and the Darwin 311 is equally well equipped with test equipment for Electricity & Magnetism. The labs include individual Mac workstations with data acquisition software such as Capstone from PASCO as well as analytical software such as Mathematica and Python installations. The equipment provides both breadth for descriptive courses and depth for the upper divisional courses.

Upper-division Labs: The north side of Darwin Hall houses the advanced and research labs. These labs are equipped for upper division students and include experiments like: the Hall Effect measurement of metals and semiconductors (D305A); the CubeSat, satellite development lab and 3-d printer (D305B); theoretical physics and student groupwork space (D304); astronomical imaging lab (D-305C); super-conducting magnet & magnetometer and lightboard studio (D-303); adaptive optics and wave optics laboratory (D-302) and nano-materials engineering (D-301). These research labs are not only utilized by faculty, but by the students working with them and their collaborators. Students are introduced to the advanced labs in the courses PHYS 366 and PHYS 466 and then continue to use the labs in the form of senior research and capstone courses.

5.4.2 Research Laboratories

Darwin 301 and 305A are operated by Dr. Shi. Physics 366 students use these facilities to learn how to make their own samples in vacuum systems and then characterize them. Students who do capstone courses with Dr. Shi use these facilities to conduct research related to thin film fabrication and transport property measurement. Other students, staff, faculty, and a few local companies also use them to work on their research projects. The frequency of use depends on the nature of the project. These facilities are crucial to gain hands-on experience and complete capstone projects in the areas of thin films deposition and analysis. Significant instrumentation includes Varian VE-10 thermal evaporator and an Agilent Hall system.

Darwin 302 is operated by Dr. Severson: This laboratory is intended to host student and faculty experiments in the fields of astronomical optical systems and interdisciplinary optical research such as for interferometric measurement systems. The laboratory is the home of an Adaptive Optics testbed. This system, funded by an $85,000 grant from the Mt. Cuba Astronomical Foundation, consists of a Shack-Hartmann wavefront sensor and Micro-Electro- Mechanical Systems (MEMS) deformable mirror for wavefront correction run with a closed loop control system. The laboratory is well outfitted with two Newport Optical Tables (4' x 8' x 12") and vibration isolating legs to support these experiments.

Darwin 303 is operated by Dr. Targett: This laboratory has two uses: one as the site of our Lightboard Multi-Purpose Studio; and another as an investigatory space with a focus on electronic and magnetic properties. It is equipped with a 17 Tesla superconducting magnet system, SQUID magnetometer, and infrastructure for measuring transport and magnetic properties, including a Helium recovery system and workstation with data acquisition and analysis capabilities.

The CubeSat Laboratory occupies space within the department facilities on the third floor of Darwin Hall. The lab includes a solar simulator station, and a small vacuum chamber. Additional instrumentation includes a vibration stand and a thermal vacuum system. SSU students have also constructed a Yagi antenna array 435 MHz ground station that is located on the roof of SSU's Student Center. SSU's first CubeSat, T-LogoQube was built in these facilities in Darwin Hall. SSU's second satellite EdgeCube, was funded by NASA and launched in January 2020. EdEon STEM Learning is part of a team building a CubeSat in conjunction with NASA's IMAP (Interstellar Mapping and Acceleration Probe) mission, led by EdEon Associate Director Dr. Laura Peticolas.

Darwin 304 is operated by Dr. Miller: This space serves as a vital resource for the theoretical physics efforts of Dr. Miller and her students. Populated with chalkboards and configurable table workspaces, this space is central to the work for the recent Department of Energy Reaching a New Energy Sciences Workforce (RENEW) program in support of Growth and Research Opportunities with Traineeships in High Energy Physics at Minority Serving Institutions (GROWTH-MSI).

Darwin 305c Astronomical Imaging Lab is operated by Dr. Targett: This laboratory contains computers of various types for controlling telescopes: the NASA/GLAST Optical Robotic Telescope (GORT) and, in the future, the UC Observatory Nickel 1-m telescope at Mt. Hamilton. The space is also used for analyzing astronomical data from these telescopes, the SSU Observatory, and JWST.

Cerent Engineering Science Complex: This multi-laboratory facility in Salazar Hall contains over $8 million worth of equipment. Of specific interest is the Keck Microanalysis Laboratory that can be utilized by physics students in intermediate and advanced laboratory courses, and for experience in undergraduate research, design projects, or special studies. The Keck Microanalysis Laboratory includes a Tescan VEGA3: GMU Variable Pressure SEM with a large sample chamber, equipped with a large-area mapping, motorized stage, Low Vacuum Secondary Electron (SE) detector, and a motorized and retractable Back-Scattered Electron (BSE) detector; a Pelco Model 3 Sputter coater (Keck), Pacific Nanotechnology Atomic force (AFM) and magnetic force microscope; a Rigaku D-Max 1000 Powder X-ray diffractometer; a PHI 540A Auger electron spectrometer; an Olympus Confocal microscope; and a Janis Cryostat with low temperature measuring capabilities.

Students and faculty at SSU have access to multiple observatories. The on-campus observatory (SSUO) is a sliding roof structure on the south-east corner of the campus. Rebuilt in 2017, the observatory houses two permanently mounted 0.36-meter f/11 Schmidt-Cassegrain optical telescopes. Both telescopes are computer controlled and can point to within a few arcminutes of a specified target on the sky. The telescope instrumentation includes multiple CCD cameras and an SBIG Spectrograph. The on-campus observatory is very convenient for introducing students to what can be seen in the sky, for demonstrating and providing instruction in the use of astronomical telescopes and instrumentation, and for introducing students to the nature of the work done by astronomers. SSUO continues to be adequate and extremely convenient for these purposes. Our campus observatory has greatly benefited from donations of telescope and computerized mounting equipment.

GORT: EdEon STEM Learning operates an off-campus observatory that is used for a wide variety of research projects by SSU students, as well as students across the globe. GORT (Gamma-ray Optical Robotic Telescope) and its dome are located at the Pepperwood Preserve, outside northeast Santa Rosa, CA at an elevation of about 1500 feet. This location is less foggy and darker than the SSU campus. The observatory consists of a 0.36-meter f/11 Schmidt-Cassegrain optical telescope with CCD camera inside a 12-foot Astrohaven clamshell dome.

5.4.3 Office Space

The Tenure-Track faculty have individual offices in the office suite on the third floor of Darwin. The Part-Time faculty share offices within this suite. Dr. Cominsky maintains an office in Schulz Information Center as part of her EdEon STEM learning center.

5.5 Support Staffing

Our department shares an Administrative Coordinator with the Chemistry Department. The current Administrative Coordinator for Chemistry and Physics & Astronomy is Marissa Reichenberg, who has done an admirable job since joining us in 2016.

Our department has one full-time laboratory technician, Ryan Meder, who has served us ably since joining us in that role in 2019. Ryan is an alumnus from the Department of Physics & Astronomy, and is called upon to: prep our lab sections; cover all aspects of equipment invention, maintenance and repair; support student and faculty research laboratory requirements; and ensure laboratory safety.

5.6 Budgetary Trends and Needs

Operating Expenses: Our department receives $9380 per year to cover all expenses related to the normal operation of the department. It is clear that we do not receive adequate funding on a regular basis from the University to maintain our laboratories or facilities. We try to be creative, maintain and refurbish equipment, and to raise funds privately to make up for what the University cannot provide.

Indirect Cost (IDC) rebates: We receive a rebate based on a combination of grant volume and IDC accrual. Dr. Cominsky routinely uses some of hers each year to pay for the CubeSat program as well as student salaries and matching funds required by the Department of Education grant.

Public Programs: We raise some private funds to support our department's weekly physics colloquium, "What Physicists Do", but now get most of the funding through the Instructionally Related Activities funds (via a competitive grant process: $7265/yr). This program uses the money to provide honoraria for the speakers, pay for the speaker's dinners, fund a student assistant and print the posters advertising the series. IRA also supports the printing, snacks and student assistants for the Public Viewing Nights at the SSU Observatory ($3914/yr).

Student Research Support: We receive annual donations to support undergraduate student research from two different donors. This year we received funds from Diane Hichwa, widow of emeritus faculty Bryant Hichwa, and from an endowment setup by Nadenia Newkirk. These funds are no longer enough to fund two summer research assistantships, but we are often able to combine other general fund donations to support two students in research with a faculty advisor. We implement a competitive application process in the spring for these assistantships.
https://phys-astro.sonoma.edu/current-students/scholarships-opportunities/department-specific

Foundation Accounts:
The following table summarizes the Department's current Foundation accounts as of 01-26-2023:

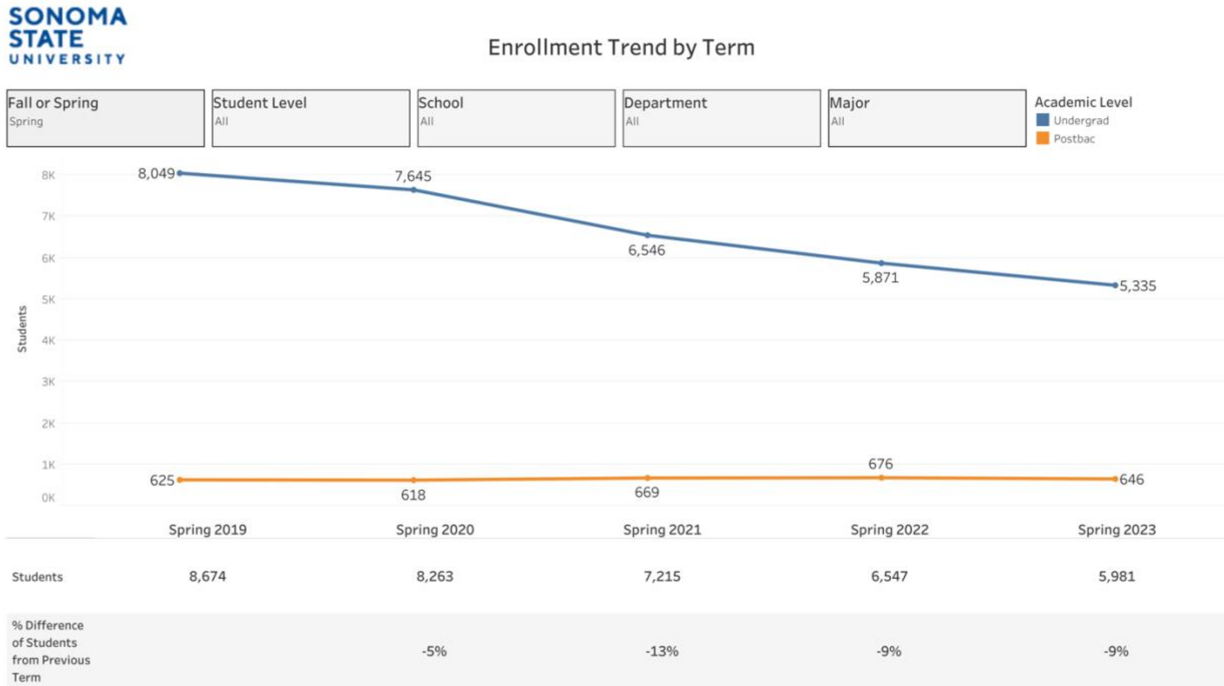
Number	Name	Balance 01-26-2023
C0020	Horace Newkirk Fund	$9407
C0141	P&A Public Programs	$10,866
C0142	P&A Equipment & Supplies	$6993
C0144	Student Development Fund	$8507

Travel and Professional Development: In recent years, there has been a small amount of travel money (recently up to $1500/person/year) available on a competitive basis through the School of Science and Technology to support faculty travel.

Summary: We actively work to augment the extremely meager funding provided by the University, by raising funds to support our Public Programs, undergraduate research, and equipment needs. We do not have guaranteed access to funding for faculty or staff professional development, and we have no regular supply of replacement equipment for instruction.

Student Success

The Department of Physics and Astronomy serves students in the major and in the broader general education community of Sonoma State University. The University is a campus of the California State University system, is accredited by the Western Association of Schools and Colleges and is a member of the Council of Public Liberal Arts Colleges. Sonoma State University has an enrollment of about 6,000 students (5,300 undergraduates) [Spring 2023] with 90 percent of the freshman class and 37 percent of all undergraduate students choosing to live on campus. The campus is seeing declining enrollments, dropping 31% from the enrollment in Spring 2019 as illustrated in the graphic below.



The Spring 2023 student population is comprised of 27.8% First Generation Students. Underrepresented Minorities comprise 43.1% of the student body of which 39.6% are Hispanic/Latinx. Sonoma State University is designated a Hispanic Serving Institution (HSI). Female-identifying students comprise 62.4% of the student body. For further details on Sonoma State University, please see: http://sonoma.edu/about/facts/

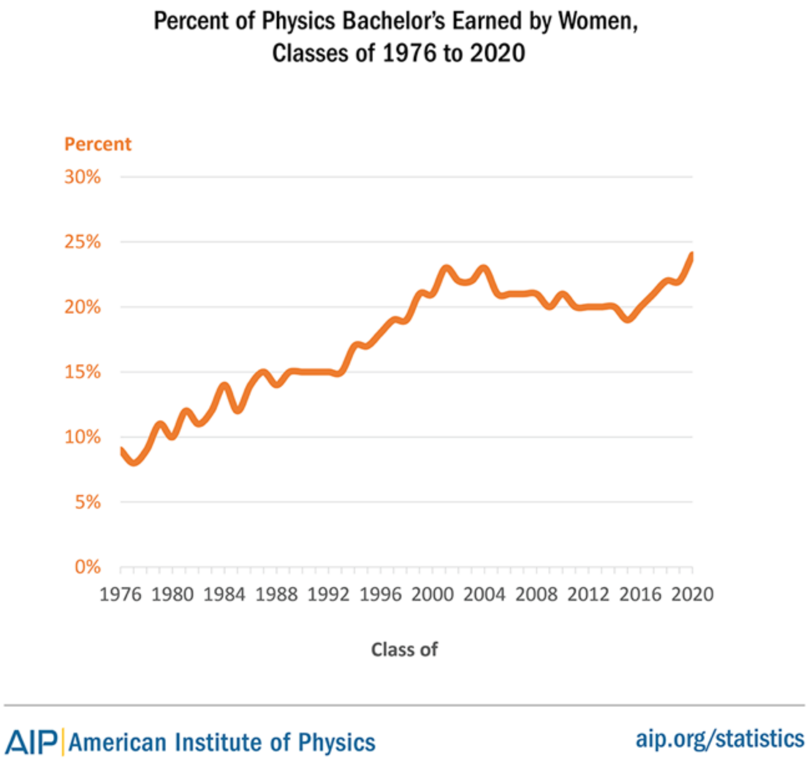
As we demonstrate below, the Department of Physics & Astronomy shows several trends with its student population: the percentage of female-identifying students is substantially above the national average for the discipline and increasing, the percentage of Underrepresented Minority (URM) is substantially above the national average for the discipline and increasing, and the percentage of First-Generation physics students has more than doubled in the past 5 years. The department is committed to Diversity, Equity and Inclusion (DEI) and these are the results.

Examples of our efforts in Student Success and DEI include: our advising program; our capstone mentoring; our Society of Physics Students; EdEon's NASA's Neurodiversity Network; participation in Cal-Bridge – which provides opportunities for traditionally underrepresented groups to participate and advance in STEM fields, including the 'Science by Diverse Scientists' speaker series, co-created by Dr. Miller; participation in the NSF-funded Transformative Inclusion in Postsecondary STEM: Towards Justice (TIPS Towards Justice) which aims to increase the participation and success of Latinx students in STEM; our continued relationship (and the initial establishment of) the local MESA chapter, part of a nation-wide program that provides co-curricular support, tutoring, activities, competitions and other activities to support under-represented STEM students; Dr. Cominsky's collaboration with Dr. Matthew Paolucci from Psychology to develop in-class workshops related to combatting sexual harassment and implicit gender bias; our use of the Care Team, LoboConnect, and Disability Services for Students mechanisms for supporting students; Dr. Targett's NSF-funded Engaging Community Colleges in Collaboration (EC3) program; Dr. Severson's membership in the Astronomy/STEM Alliance with Lick Observatory (ASTRAL); and Dr. Miller's Department of Energy RENEW-HEP Grant (Growth & Research Opportunities With Traineeships in High Energy Physics at Minority Serving Institutions).

6.1 Student Population Trends

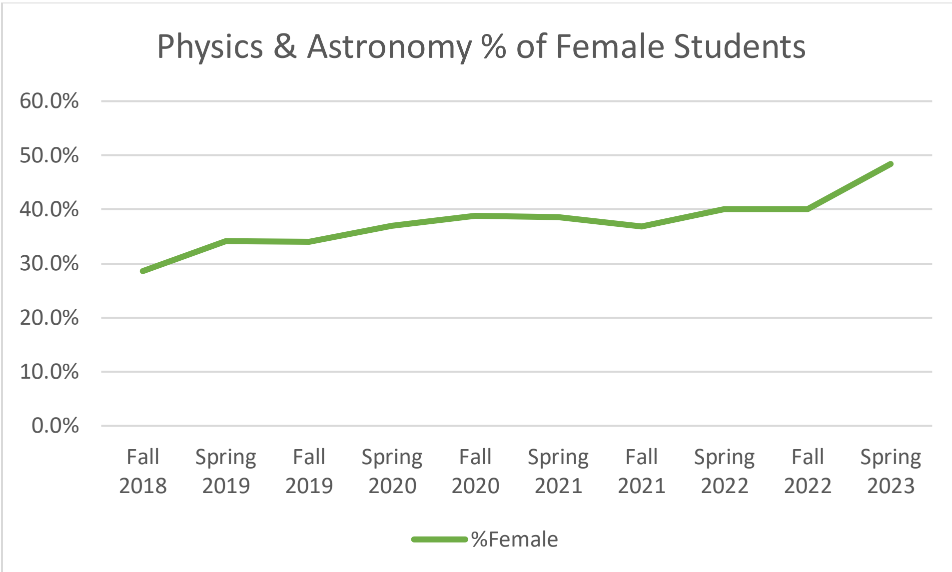
6.1.1 Gender Balance

The Department of Physics & Astronomy at Sonoma State University has a much greater proportion of female-identifying physics students than the national average. To make the comparison, let us begin with the national statistics. According to the American Institute of Physics, the percentage of women earning Bachelor's degrees in physics has risen through the years, and in 2020 was approximately 24%. See the figure below from http://www.aip.org .



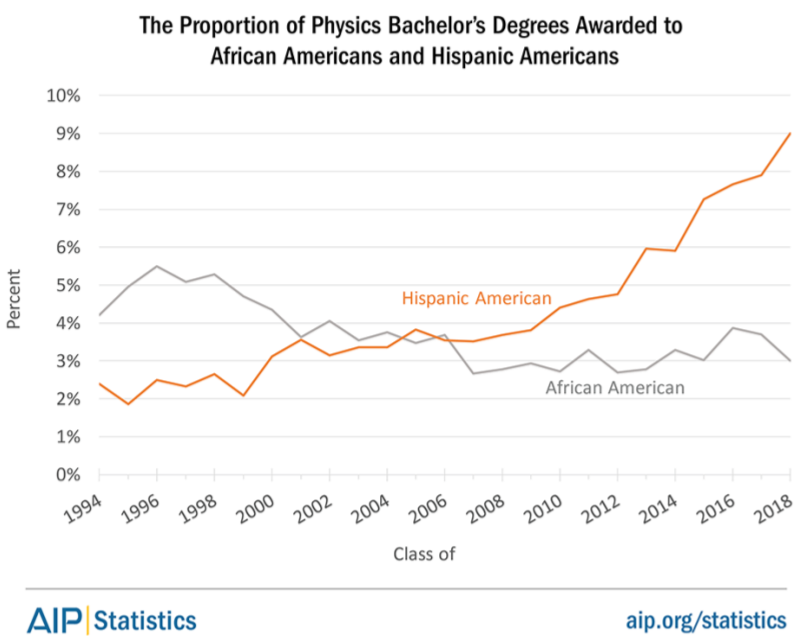
The Sonoma State University Department of Physics & Astronomy has seen growth in the percentage of female-identifying students as seen in the figure below. At all times between Fall

2018 and Spring 2023, our percentage of such students is greater than the national average, and growing from about 30% to nearly 50% in the latest data.

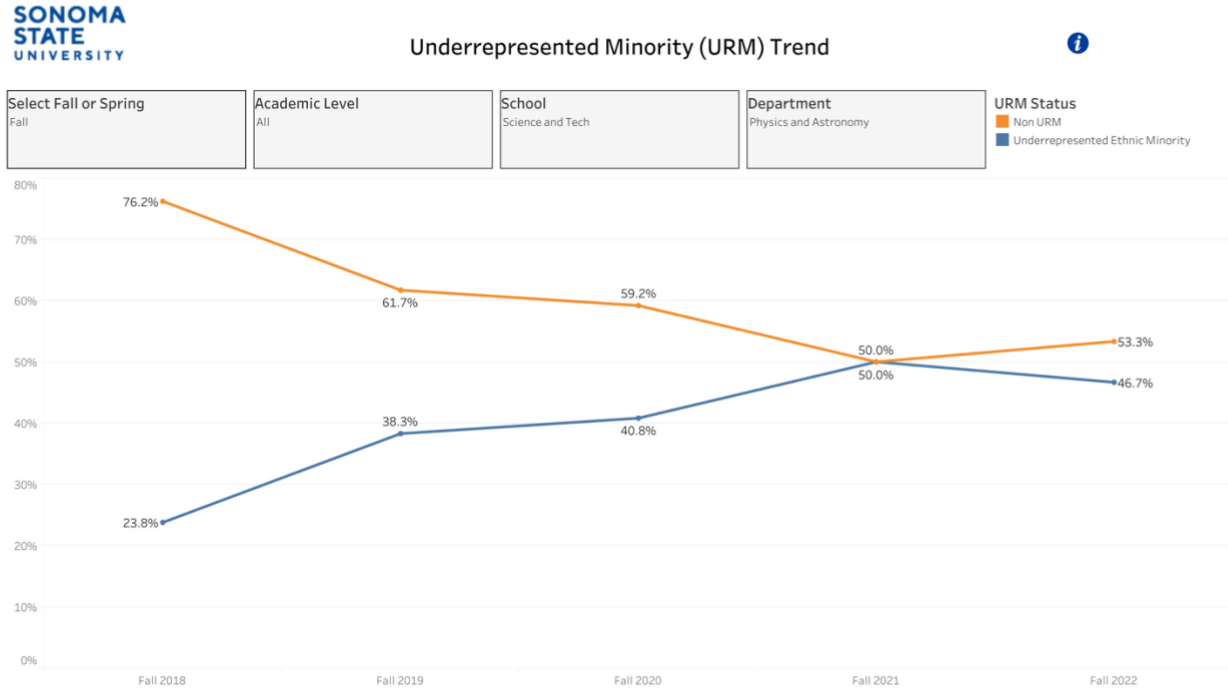


6.1.2 Underrepresented Students

The Department of Physics & Astronomy at Sonoma State University has a much greater proportion of Underrepresented Minority (URM) physics students than the national average. To make the comparison, let us begin with the national statistics. According to the American Institute of Physics, the percentage of Bachelor's degrees awarded to Hispanic Americans and African American is between 2% and 9% each between the years 1994 and 2018. (These are their designations, and we have no access to data summarized specifically as URM). See the figure below from http://www.aip.org .



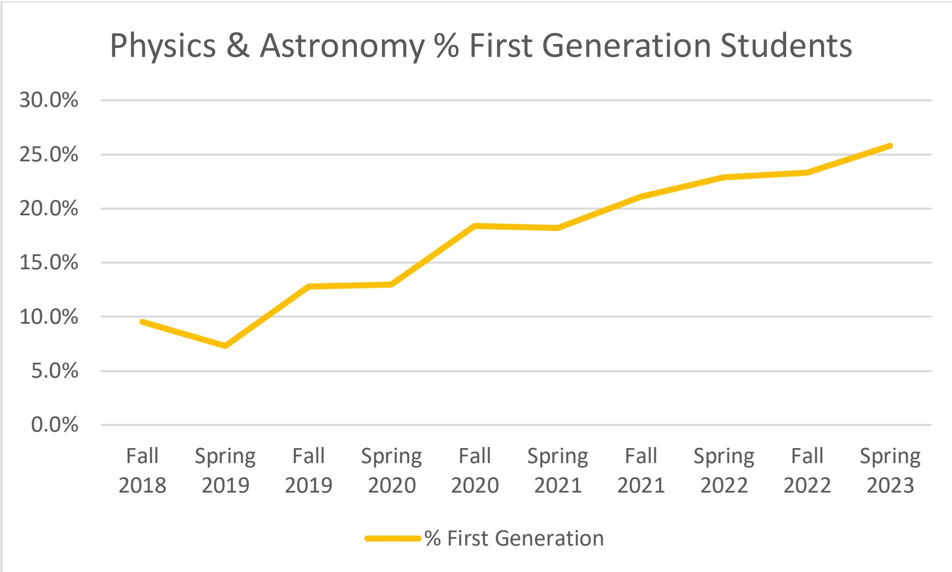
The Sonoma State University Department of Physics & Astronomy has seen growth in the percentage of URM students as seen in the figure below. This percentage begins at 24% in Fall 2018 and grows to 47% in Spring 2023. Our percentage of URM students is greater than the national average implied by the AIP data, and showed remarkable growth.



6.1.3 First Generation Students

While we have no national data on the percentage of First-Generation physics students, we do show remarkable growth in this demographic in the Department of Physics & Astronomy here at Sonoma State University. Between Fall 2018 and Spring 2023 this population has risen from about 10% of our students to about 25%.

→ ToC



6.2 Applications, Admits, and Enrollment

For Fall 2022[6], Sonoma State University saw 15,846 applications, admitted 13,716 for an 87% Acceptance Rate and produced enrollment of 2,008 for a Yield of 15%. Campus enrollment data was shown at the beginning of if this Section, Student Success and demonstrates enrollment declined of 31% between Spring 2019 and Spring 2023. This decline has had an impact on the enrollment in the Department of Physics & Astronomy and the Data Summary Prepared by Institutional Effectiveness shown in Section 8.2 and shows a commensurate drop of approximately 40% during the analogous period. This downturn in enrollment is concerning and a top priority of the department. It should be noted that our department has a history of graduating approximately ten majors a year, placing us in the top 25% of all bachelor's-only Physics departments (see below).

[6] https://tableau.calstate.edu/

→ ToC

Number of Bachelor's-Only Departments by the Average Number of Physics Bachelor's Conferred per Year, Classes 2018, 2019, and 2020

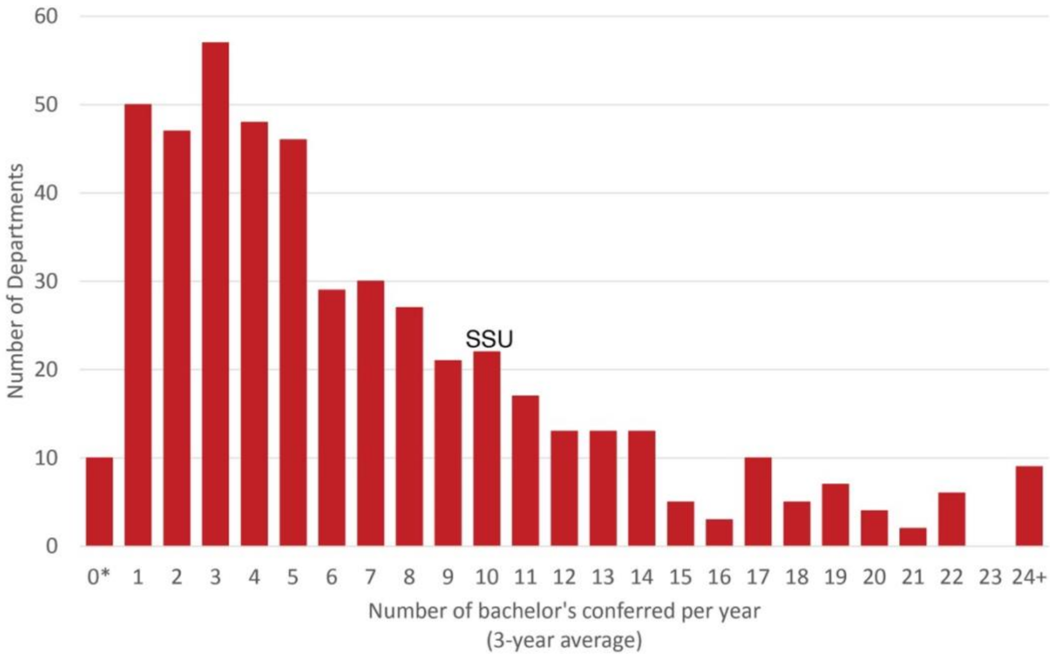


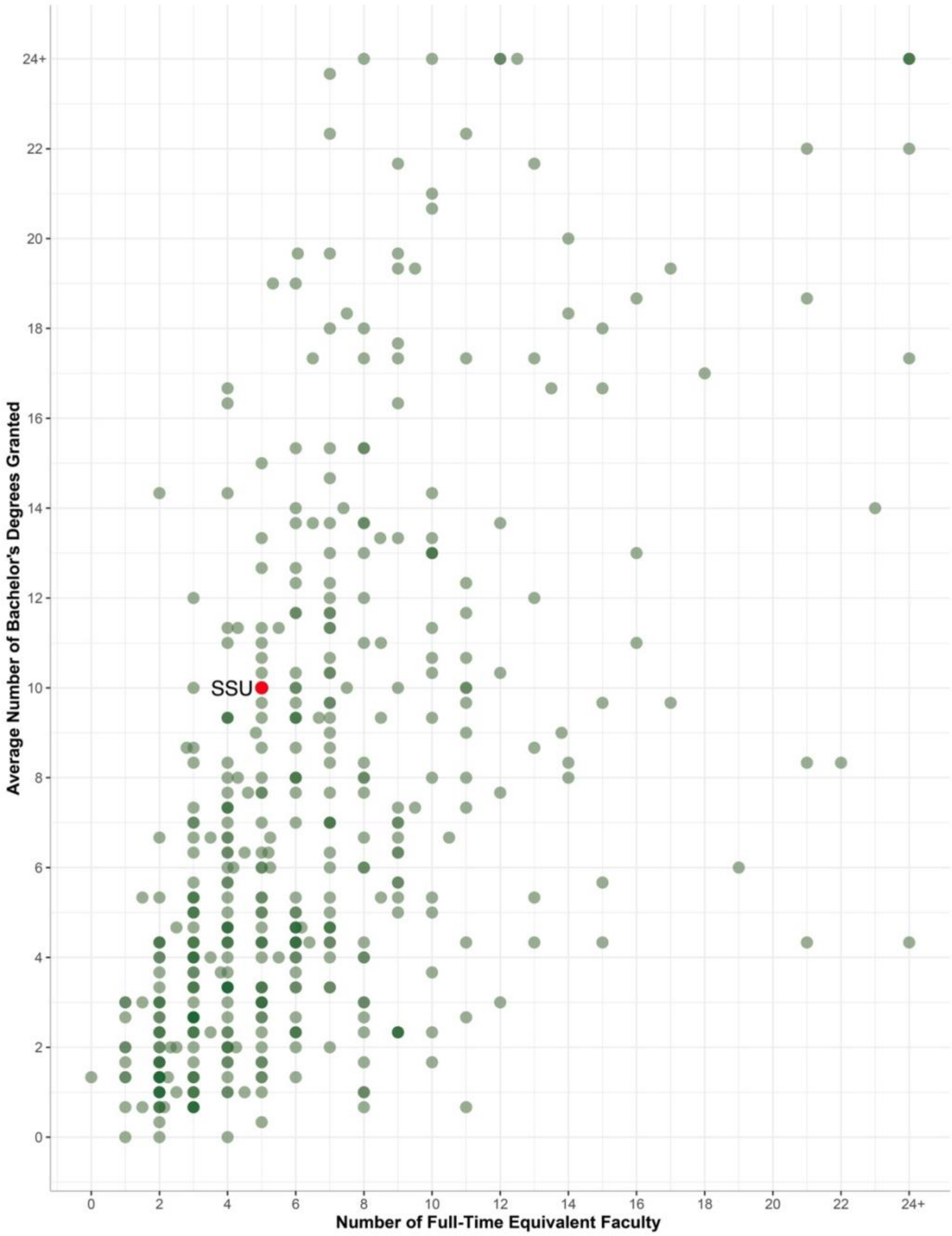
Figure includes 502 departments where the bachelor's was the highest physics degree offered in 2020. Data were estimated for nonresponding departments.

* Includes three departments who conferred one bachelor's degree during the three year period.

AIP | American Institute of Physics

aip.org/statistics

Average Number of Bachelor's Conferred by the Number of FTE Faculty Members at Physics Departments Offering a Bachelor's as Their Highest Degree, 2018 to 2020



Departments falling along the 24+ axis have at least 24 FTE or average bachelor's degrees granted, respectively.
Darker dots represent two or more departments at that location in the graphic.
The average number of bachelor's degrees granted is a three-year average from the classes of 2018, 2019, and 2020. The number of full-time equivalent (FTE) faculty is from the 2019–20 academic year.

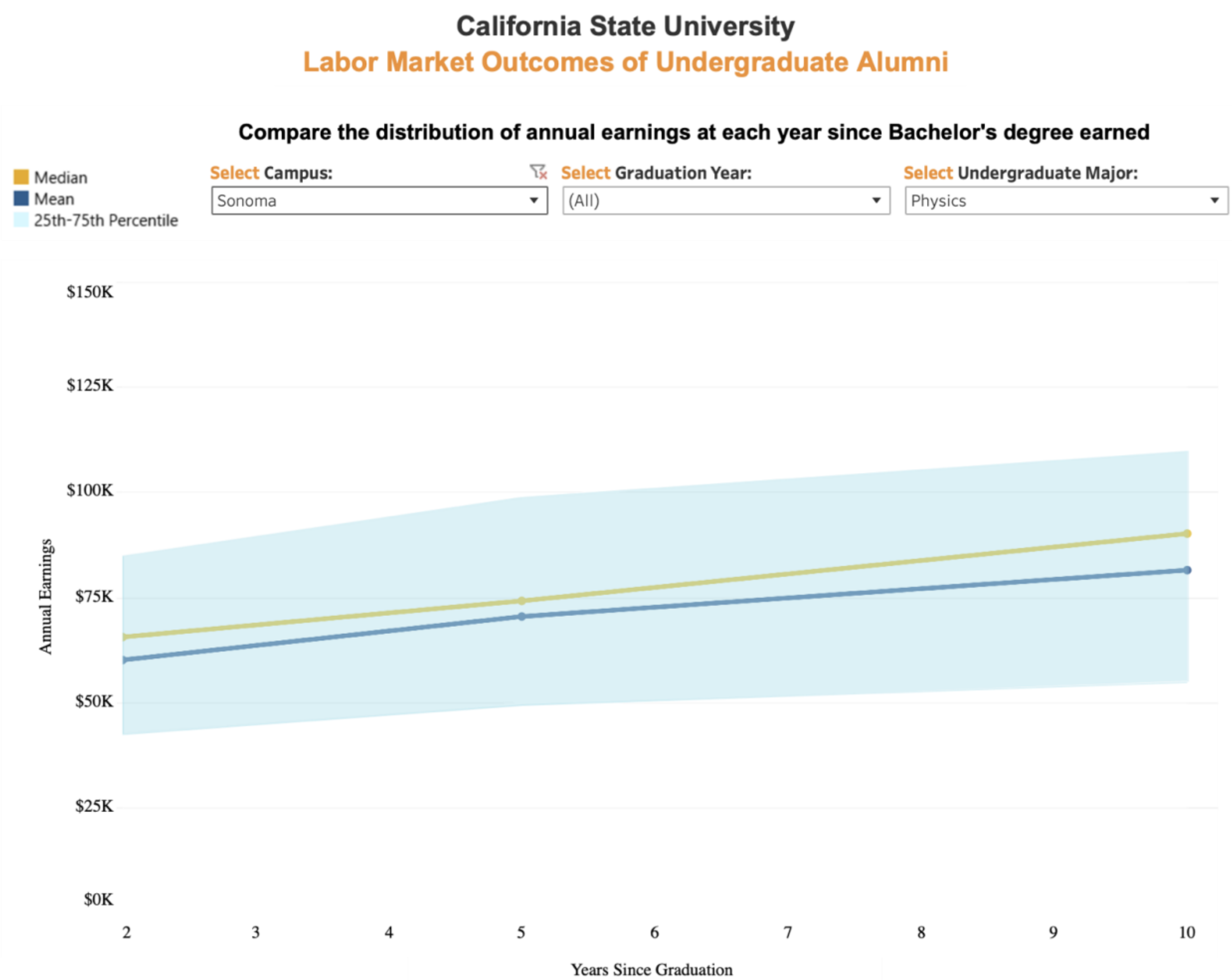
AIP Statistics aip.org/statistics

6.3 Student Post-Graduation Pathways

Department of Physics & Astronomy graduates are successful in finding employment of pursuing graduate study Approximately one-third of our students pursue graduate studies, with recent institutions including: UC Irvine, San Diego State University, UC Davis, Colorado State University, UMass Lowell. We provide a detailed summary of our data in our Assessment and Findings in Section 3.2.2. Here are a few resources on Physics careers:

- https://www.aps.org/careers/index.cfm
- https://www.aip.org/career-resources
- https://www.spsnational.org/sites/all/careerstoolbox/
- https://www.usnews.com/education/best-graduate-schools/articles/what-can-you-do-with-a-physics-degree
- https://www.indeed.com/career-advice/finding-a-job/jobs-for-physics-majors
- https://www.iop.org/careers-physics/your-future-with-physics/career-paths

Here we will relay the Labor Market Outcomes of our undergraduates from the CSU student success dashboard.



Reflection and Plan of Action

7.1 Departmental Action Plan

Throughout the Program Review process, the Department has identified priority items for an action plan. This section provides this evidence-based plan for program improvement. Some of these action items were summarized in Section 3.3, and that table is copied below. We will follow up with some additional items that arise from the Sections Faculty, Program Resources, and Student Success.

Challenge	**Curricular Changes**	**Status**
Math Preparedness	ALEKS Math preparation as support for intro courses	Ongoing
	Develop intro-course math assignments and set high-frequency low-stakes assignments	Ongoing
Study Skills and Group Work	Encourage Society of Physics Students (SPS) to set drop-in study hours	Ongoing
	Encourage students to form course specific study-groups / Discord channels	Ongoing
	Learning and Academic Resource Center (LARC) – Supplemental Instruction, tutors	Ongoing
Student Mental Health	Refer students to Counseling and Psychological Services (CAPS)	Ongoing
	Inclusion of CAPS resources in Syllabi	Ongoing
	Use of Care Team & Students of Concern reporting	Ongoing
Communication Training	Support student oral communication by increased cadence of low-stakes oral presentations in PHYS 491 and elsewhere where appropriate	Ongoing
Data Analysis Skills	Changes to PHYS 381 – Computer Applications for Scientists to highlight numerical methods via Python	Ongoing
	Inclusion of more small-scale computer assignments post PHYS 381 in curriculum	To Do
Elective Offerings	Consider making PHYS 313/313L (electronics) an elective, to allow other electives to be offered	To Do
	Develop PHYS 360 Particle Physics, as part of Dr. Miller's DoE grant	To Do
	Consider plans for prudent offerings of PHYS 466 and PHYS 475 when sensible*	To Do
	Consider other options to free up elective units	To Do
Career Search Skills	Include alumni panels within PHYS 494 – Physics Seminar	To Do
	Include Careers Toolbox and CV/Resume/Cover-letter prep in PHYS 494	Ongoing
	Investigate alumnus – student mentorship pairings *	To Do
	Refer students to Sonoma State Career Center	To Do
Improve Alumni Response	Assess and update alumni contact list *	To Do
	Update Physics Newsletter distribution with updated alumni contact information *	To Do
	Request a new round of survey responses from our updated alumni list *	To Do
	Update our alumni statistics based on survey responses *	To Do

* Subject to resources.

We now summarize in the following table the additional items that arise from the Sections Faculty, Program Resources, and Student Success.

Challenge	Action Plan	Status
Enrollment Declines	Create recruitment materials (e.g., Transfer bookmarks with links)	Done
	Contact Bay-Area Community Colleges	Done
	Connect specifically with Santa Rosa Junior College department faculty	Done
	Routinely connect to Community Colleges with recruitment materials	IP
	Student Recruitment-centered Website changes (Including highlighting DEI efforts)	IP
	Community College connections: course cross-enrollments, talks	To Do
	Admitted Student recruitment efforts (email, text, phone)	IP
	Connect with Administration: admissions and recruiting	IP
Faculty Workload	Seek new TT Hire to prevent cancellation of core offerings (support courses, general education, and program)*	To Do
	Re-open pool and seek to rebuild a source of sufficient staffing for courses offsetting losses	IP
Instructional Laboratory Issues	Replace/Repair damaged laboratory tables *	To Do
	Replace missing/broken laboratory set-ups for key labs *	To Do
	Replace outdated lab computers *	To Do

* Subject to resources. IP = In Progress

7.2 Discussion

The Department of Physics & Astronomy has demonstrated resilience in the face of the challenges of COVID, wildfires, and campus enrollment declining. The existing strengths of the department are: a long standing tradition of excellence in teaching, scholarship, and service; strong faculty and staff; an exemplary program of student capstone research; top-notch grant acquisition (exemplified by Dr. Cominsky's well renowned EdEon program); laudable efforts in diversity, equity, and inclusion; robust alignment with SSU's core values and strategic priorities; well-defined and efficient programs that adhere to trends in the discipline while integrating student involvement; Program Learning Outcomes that are aligned with courses and provide insightful assessment; a strong site of service courses; popular general education courses; and the long-running and well-regarded public programs. The department is addressing current challenges: student preparedness and well-being; student communication and data analysis skills; student support for the abundant career pathways; decreased connection to the alumni base; enrollment declines; increasing faculty workload with reduced overall faculty; and aging laboratory computing and deteriorating laboratory furniture, fixtures and equipment. In our preceding summary tables, we have highlighted the impact of resources on our plans. With our current resources, there are items that cannot be addressed, but not due to the lack of care, ingenuity, or industriousness of our department.

Appendices

8.1 Program Curriculum Map

Discussion: 2.2.2 Aligning Courses with Program

Department of Physics & Astronomy Program Learning Outcomes

Prefix	Code	Name	GE Category	BS-ASTR	BS-PHYS	BA-PHYS	BA-PHYSCI	PLO 1 Principles	PLO 2 Reasoning	PLO 3 Math & Computing	PLO 4 Experimenting	PLO 5 Analysis	PLO 6 Critical Thinking	PLO 7 Quantitative	PLO 8 Communication
ASTR	100	Descriptive Astronomy	B1 - Physical science	Required*			Required*								
ASTR	121	How to Influence the World	A1 - Oral Communication												
ASTR	150	Astronomy for Scientists	B1 - Physical science	Required*			Required*								
ASTR	231	Introduction to Observational Astronomy	B3 - Laboratory Activity												
ASTR	303	Life in the Universe	Upper Division B	Elective		Elective	Elective								
ASTR	305	Frontiers in Astronomy	Upper Division B	Elective		Elective	Elective								
ASTR	331	Astronomical Imaging		Required											
ASTR	350	Cosmology	Upper Division B	Elective		Elective	Elective								
ASTR	380	Astrophysics: Stars		Required	Elective	Elective									
ASTR	390	Astrophysics: Galaxies and Cosmology		Elective	Elective	Elective									
ASTR	396	Selected Topics in Astronomy		Elective	Elective	Elective									
ASTR	482	Advanced Observational Astronomy		Elective	Elective	Elective									
ASTR	492	Instructional Design Project		Required**	Required**	Required**	Elective								
ASTR	495	Special Studies		Elective	Elective	Elective	Elective								
ASTR	497	Undergraduate Research in Astronomy		Required**	Required**	Required**	Elective								
PHYS	100	Descriptive Physics	B1 - Physical science												
PHYS	102	Descriptive Physics Laboratory	B3 - Laboratory Activity												
PHYS	107	Introduction to Physical Science for Teachers				Required	Required								
PHYS	114	Introduction to Physics I	B1 - Physical science	Required	Required	Required									
PHYS	114W	Physics I Workshop													
PHYS	116	Introductory Laboratory Experience	B3 - Laboratory Activity	Required	Required	Required									
PHYS	209A	General Physics Laboratory	B3 - Laboratory Activity				Required								
PHYS	209B	General Physics Laboratory					Required								
PHYS	210A	General Physics	B1 - Physical science				Required								
PHYS	210B	General Physics					Required								
PHYS	214	Introduction to Physics II		Required	Required	Required									
PHYS	216	Introductory Laboratory		Required	Required	Required									
PHYS	300	Physics of Music	Upper Division B				Elective								
PHYS	304	The Strange World of Modern Physics	Upper Division B				Elective								
PHYS	313	Electronics		Elective	Required	Elective	Elective								
PHYS	313L	Electronics Laboratory		Elective	Required	Elective	Elective								
PHYS	314	Introduction to Physics III		Required	Required	Required	Elective								
PHYS	320	Analytical Mechanics		Elective	Required	Elective									
PHYS	325	Introduction To Mathematical Physics		Required	Required	Elective									
PHYS	340	Light and Optics		Required	Required	Required	Elective								
PHYS	342	Light and Color	Upper Division B				Required								
PHYS	366	Intermediate Experimental Physics		Elective	Required	Elective	Elective								
PHYS	381	Computer Applications for Scientists		Required	Required	Required**	Required***								
PHYS	395	Community Involvement Program		Elective	Elective	Elective	Elective								
PHYS	396	Selected Topics in Physics		Elective	Elective	Elective									
PHYS	430	Electricity and Magnetism		Required	Required	Elective									
PHYS	445	Photonics		Elective	Elective	Elective									
PHYS	450	Statistical Physics		Required	Required	Elective									
PHYS	460	Quantum Physics		Required	Required	Elective									
PHYS	466	Advanced Experimental Physics		Elective	Elective	Elective									
PHYS	475	Physics of Semiconductor Devices		Elective	Elective	Elective									
PHYS	491	Capstone Preparatory Seminar		Required	Required	Required	Required								
PHYS	492	Instructional Design Project		Required**	Required**	Required**	Elective								
PHYS	493	Senior Design Project		Required**	Required**	Required**	Elective								
PHYS	494	Physics Seminar		Elective	Elective	Elective	Elective								
PHYS	495	Special Studies		Elective	Elective	Elective	Elective								
PHYS	497	Undergraduate Research in Physics		Required**	Required**	Required**	Elective								

PLO 1 - Knowledge, understanding and use of the principles of physics and/or astronomy
PLO 2 - Ability to use reasoning and logic to define a problem in terms of principles of physics
PLO 3 - Ability to use mathematics and computer applications to solve physics and/or astronomy problems
PLO 4 - Ability to design and/or conduct experiments and/or observations using principles of physics and/or astronomy and physics or astronomical instrumentation
PLO 5 - Ability to properly analyze and interpret data and experimental uncertainty in order to make meaningful comparisons between experimental measurements or observation and theory
PLO 6 - Critical Thinking Abilities
PLO 7 - Quantitative Skills
PLO 8 - Communication Skills

Introduced
Developed
Demonstrated

* One of A100/150 Required
** One Capstone Project Course Required
*** Physics 381 or CS 115 Required

→ ToC

8.2 Data Summary Prepared by Institutional Effectiveness

Majors in Physics and Astronomy by Gender

			Fall 2014	Fall 2015	Fall 2016	Fall 2017	Fall 2018	Fall 2019	Fall 2020	Fall 2021	Fall 2022
Physics and Astronomy	PHYS-BA	F	1	2		2	2	2	3	2	3
		M	7	4	3	9	9	9	8	3	3
	PHYS-BS	F	7	11	14	7	11	14	17	11	5
		M	31	33	36	28	26	24	25	21	13
	PHYS-OBS	M	1	2	2	2	1	1			1
	PHYSSCI-BA	F								1	4
		M									1
Grand Total			47	52	55	48	49	50	53	38	30

Majors in Physics and Astronomy by Race/Ethnicity

Department	Plan	IPEDS Ethnicity	Fall 2014	Fall 2015	Fall 2016	Fall 2017	Fall 2018	Fall 2019	Fall 2020	Fall 2021	Fall 2022
Physics and Astronomy	PHYS-BA	Asian Only	2	1			1				
		Hisp/Lat		1		1	1	3	4	2	2
		Mult races	1			1	1	2	1		
		Unknown				1	1		1		
		White Only	5	4	3	8	7	6	5	3	4
	PHYS-BS	Asian Only	2		1	1			1		
		Black Only						2	3	2	
		Hisp/Lat	6	9	11	10	10	14	15	14	9
		Mult races	1	3	4	2	1		1		
		Unknown	5	6	6	4	5	2	1		
		White Only	24	26	28	18	21	20	21	16	9
	PHYS-OBS	Unknown		1	2	2	1	1			
		White Only	1	1							1
	PHYSSCI-BA	Hisp/Lat								1	3
		White Only									2
Grand Total			47	52	55	48	49	50	53	38	30

Majors by Academic Plan and Academic Level (First Year to Pbac/Grad)

School	Department	Plan	Academic Level	Fall 2014	Fall 2015	Fall 2016	Fall 2017	Fall 2018	Fall 2019	Fall 2020	Fall 2021	Fall 2022
SCIENCE & TECHNOLOGY	Physics and Astronomy	PHYS-BA	Senior	5	3	1	5	8	4	3		1
			Junior	1	2	1	3	1	1	1	2	2
			Sophomore	1			1	1		4	1	3
			First Year	1	1	1	2	1	6	3	2	
		PHYS-BS	Senior	18	20	22	17	20	13	16	13	6
			Junior	9	10	13	9	5	7	6	9	6
			Sophomore	7	5	6	3	7	6	9	7	4
			First Year	4	9	9	6	5	12	11	3	2
		PHYS-OBS	Postbaccalaureate	1	2	2	2	1	1			1
		PHYSSCI-BA	Senior								1	1
			Junior									2
			First Year									2
Grand Total				47	52	55	48	49	50	53	38	30

Majors in Physics and Astronomy by Plan Sequence (first, second major...)

Department	Plan	Plan Sequence	Fall 2014	Fall 2015	Fall 2016	Fall 2017	Fall 2018	Fall 2019	Fall 2020	Fall 2021	Fall 2022
Physics and Astronomy	PHYS-BA	10	7	6	2	9	8	10	8	5	6
		20	1		1	2	3	1	3		
	PHYS-BS	10	35	40	47	32	34	36	41	32	18
		20	3	4	3	3	3	2	1		
	PHYS-OBS	10	1	2	2	2	1	1			1
	PHYSSCI-BA	10								1	5
Grand Total			47	52	55	48	49	50	53	38	30

Minors in Physics and Astronomy

Department	Plan	Fall 2014	Fall 2015	Fall 2016	Fall 2017	Fall 2018	Fall 2019	Fall 2020	Fall 2021	Fall 2022
Physics and Astronomy	ASTR-MIN	10	15	19	22	19	6	3	4	2
	PHYS-MIN	3	7	5	4	3	1		1	2
Grand Total		13	22	24	26	22	7	3	5	4

→ ToC

Table: FTES at Census, FTEF, SFR (Student Faculty Ratio)

Measure	F 14	F 15	F 16	F 17	F 18	F 19	F 20	F 21	F 22
Census FTES	202.5	216.2	203.6	201.1	179.5	176.3	175.3	136.3	133.3
FTEF	6.3	6.3	6.4	6.5	5.6	6.5	6.1	5.9	5.2
SFR	32.3	34.1	31.9	30.9	32.3	27.0	28.7	23.2	25.5

Sources for Table 7:
F 14 – F 19 from archived Academic Resource Dashboard (Tableau)
F 20 – F22 from Mike Ogg – Budget & Planning

8.3 Department Online Education Policy

Policy Description

The Department of Physics & Astronomy at Sonoma State University recognizes the value of select use of online education in advancing its mission to provide rigorous and student-centered courses within its major, service, and general education course offerings. This Policy serves to state the Department's position on online education, delineate a set of priorities in consideration of when and how to offer online education, and provide guiding principles for their implementation.

The Department of Physics & Astronomy reaffirms its commitment to offering a majority of courses through in-person instruction (outside of times of extraordinary crisis e.g., wildfires and pandemics). The judicious use of online education may, in some instances, provide increased access for students. For example: online courses offered during intersessions may provide more opportunities for students to complete courses in GE, required Lower Division service or major courses that have constraints in enrollment during in-person offerings in the Fall and Spring semesters.

The departmental Online Education Policy applies to all faculty engaged in the delivery of online courses. The responsibility and authority for adherence to this departmental policy resides with the Department of Physics & Astronomy. No portion of this policy is meant nor allowed to circumvent policies put in place at the School or University level.

The Department Chair, in consultation with the department faculty (via the normally scheduled departmental meetings), will consider whether a particular course offering may be scheduled with an online (full or hybrid) modality as part of the routine class scheduling process. Such consideration must consider the following Department of Physics & Astronomy priorities:

- The majority of course offerings must be in-person (excluding crisis related considerations).
- The Department of Physics & Astronomy strongly prefers that online instruction contain a regular synchronous component.
- The relative order of course categories, in order from less permissible to more permissible to offer via online instruction, is: upper-division courses for majors, laboratory courses with normal offerings of physical experiments, service courses for aligned majors, lower-division courses for majors, upper-division GE courses, lower-division GE courses.
- Courses offered in online modality must meet the Guiding Principles that follow in the next section.

Guiding Principles for Online Education

Education in the Department of Physics & Astronomy is built upon a fundamental commitment to academic quality.To deliver online education that maintains the academic rigor expected of our campus-based offerings, the Department of Physics & Astronomy commits to the following guiding principles:

Student-Centered Experience

The Department of Physics & Astronomy is committed to providing a student-centered university experience. Quality online education requires individualized student attention, which is reflected in class size, opportunities for interaction and collaboration with faculty and peers, rigorous coursework, and responsive support

Support for Faculty

The Department of Physics & Astronomy is committed to facilitating faculty support for effective and pedagogically sound online instruction through a variety of approaches. Faculty teaching in online modalities are expected to have either or both: prior experience teaching in such modalities, and/or specialized training in online course design and teaching as made available by campus support bodies such as CTET. The Department of Physics & Astronomy is aware that there may be variations in measurement of faculty efficacy (e.g. SETEs) depending on course modality. When courses are offered in online modalities and are used in RTP evaluation, the impact of modality on diagnostic measurements will be considered.

Assessment of Online Education

The Department of Physics & Astronomy is committed to assessing the efficacy of our online offerings. This may include evaluation of student performance in such classes (DFW rates, GPA, and learning objective artifacts as available) and evaluation of the classroom environment (SETES, faculty and student feedback).

Policy Author(s)

Department of Physics & Astronomy

Effective Date

August 2021

8.4 Physics Newsletter

We present the front page of our most recent Physics Newsletter (12-pages total). This newsletter and the archives dating back to 1974 are available at https://phys-astro.sonoma.edu/newsletter .

THE PHYSICS MAJOR

Department of Physics and Astronomy

SONOMA STATE UNIVERSITY

Physics & Astronomy Department About to Experience GROWTH

Courtesy of SSU NewsCenter

Sonoma State Professor Alexandra Miller, in partnership with Associate Professor Wing To of Stanislaus State was awarded a $950,000 grant from the Department of Energy's Reaching a New Energy Sciences Workforce (RENEW) program to teach high energy physics and engage students in research and internship opportunities.

It is the first Department of Energy Grant ever awarded to either University.

The nearly $1 million for the pair's proposal, Growth and Research Opportunities With Traineeships in High Energy Physics at Minority Serving Institutions (GROWTH-MSI), will support 10 students per year beginning in January 2024. Each student will receive up to $19,000 in scholarship and stipend support during their junior and senior years.

"College life is especially challenging for many students at CSUs because they need to work many hours in addition to going to school in order to support themselves," Miller said. "Our traineeship is designed to pay students to complete professional development activities and start research, setting themselves up for success in the future. Ideally, our students will not need to work at all in addition to the traineeship."

To and Miller expect to find participants, not only from their own campuses, but also from students of Marteen Golterman at San Francisco State, Kathryn Grimm at Cal State East Bay, Yongsheng Gao at Fresno State and Anna Nierenberg at UC Merced. All four provided input to the GROWTH-MSI proposal.

Applications will be accepted in the fall and the program will launch with a gathering in January 2024, likely at Stanislaus State, where students, faculty mentors and industry scientists, who will serve as mentors and research leaders, will meet for the first time.

"Having these consortiums, with students from different universities who are in the same place as them, gives them a sense of belonging, a physics identity and structure and other support," To said.

Students will receive up to $3,000 for each of their last three semesters and $6,400 for their summer research coupled with a $3,600

housing allowance. In return, students are required to commit 15 hours per week to the program.

During the first semester of the program, students will attend 12 to 15 sessions with professionals sharing virtual presentations on work they are doing at various labs. Those will help students determine their interests as they select a summer project at either Lawrence Berkeley National Laboratory, Lawrence Livermore National Laboratory, SLAC National Accelerator Laboratory, UC Berkeley or UC Santa Barbara.

They'll also be required to take an introduction to particle physics course during that first semester. To and Miller will co-teach it, with To teaching it in person at Stanislaus State and other students participating on Zoom. Future courses may be offered as well.

Once they've done their summer internship, students will likely spend more time working on their project during their senior years and will write a capstone paper to present at a public event.

Miller and To modeled GROWTH-MSI on Cal Bridge, a program offered to students in Science, Technology, Engineering and Math fields and funded by the National Science Foundation and the State of California.

Serving as mentors and members of Cal Bridge's steering committee is how Miller and To met.

(Continues on p.2)

8.5 Prior Program Review Summaries

8.5.1 Prior Program Review Department Executive Summary

The Sonoma State University Department of Physics & Astronomy (P&A) has a small well-functioning faculty led by its well renowned Chair, Dr. Lynn Cominsky. Remarkable for graduating approximately ten Physics majors a year, it ranks in the 88th percentile of bachelor's granting institutions. Counting the AY 2015-2016 hire of Dr. Tom Targett, it has five faculty members and 6 part-time lecturers. Hosting a popular series of Astronomy general education courses, Physics service courses, and a strong major curriculum, the department serves an annual headcount of over 1,000 students. This results in 200 Full Time Equivalent Students (FTEF) per semester, and a Student to Faculty Ratio (SFR) of 34.

The P&A program offers 34 distinct courses: 11 include lab components, and 13 satisfy GE requirements. The department's degree programs include two BS and two BA programs. It is the recommendation of the self-study to replace the Applied BS with an Astrophysics BS to leverage the strength of the department in this area. It is also recommended to replace the BA-Trig with a BA-Physical Science, addressing the STEM teacher shortage and providing another degree program with growth potential. The Department of Physics & Astronomy uses teaching methods based on Physics Education Research, including think-pair-share, the flipped classroom, clickers, inquiry, peer-mentoring, the Skills Lab, and Supplemental Instructors in a Learning Assistant model. The department has an unparalleled connection to alumni, with survey data of 88% of our graduates and our production of a popular annual Newsletter. See: http://www.phys-astro.sonoma.edu/ourgraduates.shtml and http://www.phys-astro.sonoma.edu/newsletter.

The defining educational element of our program is the skill-based growth of our students. The curriculum nurtures a set of student real-world experimental and communication skills. This culminates in the Senior Capstone which includes research with a faculty advisor, and the preparation of a talk for the department's Senior Seminar and a poster for the school's Science Symposium. The Capstone serves as the final assessment of our students' learning and an ongoing one of the department. A robust 36% of our students enter graduate study. Many of them go on in physics and astronomy, but an equal number in in a wide variety of disciplines including: engineering, education, and other science fields. Ours is an inclusive department, addressing diversity in multiple ways including: the selection of diverse voices in our popular public lecture series (http://www.phys-astro.sonoma.edu/wpd); the historically strong inclusion of female leadership of the active Society of Physics Students (SPS) and the department; and the many allied programs of the university including MESA, DSS, McNair etc.

The Department is active in research (materials science and astrophysics), service, and grants acquisition. Examples include: an NSF STEM Talent Expansion Program (STEP) grant and its freshman Science 120 course; a $3M Department of Education curriculum grant, "Learning by Making"; an NSF LIGO outreach grant; the EPO programs for the NuSTAR, Fermi, Swift and XMM-Newton spacecraft; "Big Ideas in Cosmology", an online Astronomy and Cosmology curriculum; a PhysTEC teacher education grant; the development of an NSF-funded astronomical adaptive optics system; an active satellite (CubeSat) program; popular public observatory and lecture programs; and the supervision of a multiple grant-winning Society of Physics Students club.

8.5.2 Prior Program Review External Reviewer Report

FRESNO STATE
College of Science and Mathematics

Report of Outside Reviewer, Program Review for the Department of Physics, Sonoma State
Raymond E. Hall, PhD
Department of Physics, Fresno State

August 20, 2015

Introduction

This review of the Sonoma State Physics and Astronomy program is based on a careful review of the provided self-study document dated April 20, 2015, and a one day visit to the CSU Sonoma Campus on April 24. During my one-day on campus visit, I followed the schedule as provided to me by Dr. Severson, which included meetings with all tenured/tenure-track faculty members, the department chair, instructional and administrative staff, undergraduate physics majors, and administrators. The dean and I spoke by phone shortly after my visit, as she was not on campus during my visit. It is clear that opportunities had been arranged for me to talk to all relevant personnel and the feedback I received from meeting with the undergraduate students (7 students, 5 female, 4 male) was also very helpful.

I greatly appreciate the abundant hospitality I received- everyone I met at Sonoma State was friendly, welcoming, and helpful.

Strengths

Collaboration: A major strength I observed during my campus visit is the quality and cohesiveness of the faculty. I came away with a firm impression of a hardworking and committed faculty, who were cohesive, collegial, and displayed excellent working relationships. From the vantage point of my one-day visit, I was struck by the camaraderie and excellent morale of the tenured faculty. In addition I feel the recent tenure track hire of Dr. Targett was a success as he demonstrates a strong record of excellence in teaching with research that strongly complements and strengthens that of the department. The curriculum of the program also reflects the cohesiveness of a strong faculty emphasizing the specific strengths and expertise of the current faculty, producing a program unique in its emphasis on astronomy and astrophysics.

Innovative curriculum: Some great ideas have been well-implemented here. I was impressed with the initial physics courses for all physics majors (P100, A100) with the particular emphasis on conveying the fascination of the cutting edge research (why physics is fun) that keeps students motivated and excited in their initial years while they get mathematically prepared for the upper-division coursework. I found the upper division labs to have excellent resources and the curriculum very strong; every student gets exposed to instrumentation including a scanning electron microscope and other well-maintained high-level equipment. A mandatory senior project (capstone) for all physics majors is a well thought culminating experience prior to graduation, and I encourage further development of structure for this requirement (more on this below).

Department of Physics
California State University, Fresno
2345 E. San Ramon M/S MH37 • Fresno, California 93740

P 559.278.2371 **F** 559.278.7741 *www.FresnoState.edu/physics*

Alumni Connection: The willingness of graduates to stay in touch and keep the department updated about their work seems to be a reflection of a department in which students feel nurtured and guided. The documentation provided in the appendices of the report titled "Graduates and Their Career Pathways" containing current information on 350 graduates is beyond anything I've ever seen in terms of maintain connection with alumni and data for career outcomes and is an outstanding achievement.

Graduation Rates: Sonoma State's physics graduation rate of 9.6 graduates per year is excellent given the faculty to physics major ratio (here at Fresno State our average is about 6 graduates per year with 10 TT faculty).

Contribution to GE: In addition to the innovative and exciting opportunities for majors, this department offers a very strong contribution to general education at the university. In the past academic year more than 1000 students enrolled in Astronomy 100 (from Appendix A), given the student population of about 9000 for the university as a whole it seems that more than a third of all students at the university take the introductory astronomy class for GE! This is an amazing accomplishment and wholly appropriate in the eyes of this reviewer.

FYE participation: Very good effort in the area, especially noted is Dr. Qualls' development of a first year STEM experience centered on Science 120. Increasing retention is correlated to improvement in diversity in STEM graduates and this work is important.

Research: Over the period since the last program review that department has seen good success in obtaining external grants and Dr. Cominsky's EPO program remains strong.

Challenges

Given the level of commitment by all parties in the physics program, documented in the program review binder and observed during my visit, one paramount issue of concern is the workload taken on by the five tenured faculty, and by the technical staff. In my role as reviewer I noted a sense that the faculty were at the upper limit in terms of commitment and productivity- they are giving it there all, and by all appearances this means many hours beyond a normal work week in the line of duty. I applaud the sense of mission and dedication, and I strongly advocate for the requested increase in resources detailed in the program review. Maintaining research in the face of heavy teaching loads is indeed currently being accomplished, but further support is needed to make the important curriculum element (the requirement of all seniors to complete a research project) sustainable in the long run.

Specifically, I received feedback from seniors that I met with over dinner that spoke highly of the senior research projects, and the requisite research presentation, but also mentioned that they felt further preparation, including more structure in setting expectations early in the project, would have been beneficial. This kind of mentoring instruction is what provides real research experience and is a main source of excellence in the program- but it comes at the cost of tenured professor workload, a cost that is fully warranted and worth investment at a high priority.

Another area that can be a sink on professional time is antiquated and worn-out equipment. The physics and astronomy program involves the utilization of specialized equipment in engineering and science related service courses as well as upper division labs for majors. Here the relevant staff and faculty told me there are serious equipment renovation and replacement needs, and that maintaining malfunctioning equipment is taking a toll on the technical staff in terms of time and productivity. It was brought to my attention that lower division labs need a renovation of the physical space- the labs as designed do not allow a line-of-sight to the whiteboard and instructor, a situation clearly out of synch with current best practices.

Academic Advising: The distributed advising model (assignment of the pool of majors to tenured faculty) seems to be working but at a very high toll on faculty workload. On my campus it is a considered a given that good academic advising leads to higher pass rates, higher graduation rates, and higher retention. The model where advising is central and supported by course release should be reinstated. The program has taken its role seriously: the advising handout describing the program curriculum is detailed and well thought and in my interview with Andrea (department administrative coordinator) she reported that by comparison physics majors seem well informed and ask fewer curriculum related questions of her on the whole. Again, the current success is due to the conviction and dedication of the faculty, but has come at the price of increased workload that sacrifices (and threatens to sacrifice) other important areas of the program.

Finally, although I saw evidence of a very strong temporary faculty pool, this resource of talent cannot make up for the lack of tenured faculty. The program had seven tenured faculty for many years but most recently the program has had to make do with the heroic efforts of just four faculty. Just this year the program added Dr.

Targett, and although this recent hire is a step in the right direction, only an increase in tenured faculty can address and relieve the workload issues that threaten the productivity and moral of the program.

Recommendations

Given the quality of the program and its major contributions to student success and the university as a whole, it is strongly recommended that the university should authorize at least one (or more) tenure track hires in the near future. It is important to restore the tenured faculty density back to a level that will ensure the continued excellence of the program, to allow the preservation of high moral and productivity of the existing dedicated and collaborative faculty and staff, and to address the challenges outlined in the previous section.

The proposed changes to the degree program as discussed in detail in the program review binder (section H.2.i) are well thought and well documented and should be implemented. This reviewer supports all curriculum changes recommended by the program. The proposed BS in physics with a concentration in Astrophysics is an excellent renovation to the former BS in Applied Physics; this recommended new degree option would showcase the strong expertise and history of excellence in Astrophysics and Astronomy unique to Sonoma, but would avoid the perception of a lack of rigor sometimes associated with a BS in Astronomy alone. It is wise to still offer a BA in physics (with the rigor of calculus prerequisites), and the proposal to change the former degree of a BA (but without calculus) to a BA in Physical Science is completely in-line with many physics programs in the CSU system and beyond.

The department should develop a prioritized list of equipment needs and submit this list on a semester basis to the administration. The list should be detailed with cost estimates provided, and with clear statements of need, foremost detailing the impact on student learning outcomes, and secondly on impact towards faculty and staff productivity. Given the current needs of the program (and future needs as all equipment has a halflife), such a well-documented and substantiated list may be used to argue for a multi-year investment plan that would hopefully entail an equipment budget line item in the program's overall budget allocation each year.

One of the many highlights of the program is the upper-division laboratories where students get to interface with cutting edge equipment (such as the Scanning Electron Microscope (SEM), in Dr. Shi's courses). Currently Mr. Steve Anderson has the expertise to maintain this (and many other) delicate pieces of equipment and this expertise is crucial to the longevity of these lab experiences. A loss of Mr. Anderson for any unforeseen reason would result in dramatic setbacks to the program in delivering these crucial aspects of the undergraduate experience. To emphasize this point; at the reviewer's institution we do not have staff with such expertise and our model is to pay for expensive maintenance contracts with external vendors, and often these funds run out with consequences that negatively impact our program (currently Fresno State does not have a functioning SEM). Given this situation I recommend that detailed logbooks be kept on all equipment with high overhead (such as the SEM) and that further staff are allocated to support Mr. Anderson to the extent that he has time and resources to produce sufficient documentation, and optimally, to train additional staff in these sensitive high-expertise areas such that the unique technical experience on these specific machines should not be lost. In addition, professional development funds should be allocated to staff on an annual basis- at least enough to attend a conference and workshop each year.

Academic advising should be recognized for its importance in savings to the university and to students. It is recommended that the department receive course release to support their academic advising.

8.5.3 Prior Program Review Dean's Report

School of Science and Technology
1801 East
Cotati Avenue
Rohnert Park,
California
94928
www.sonoma.edu/scitech

Date: February 17, 2016

To: Educational Policies Committee

From: Lynn Stauffer, Dean Lynn Stauffer

Re: Department of Physics and Astronomy Program Review

The Physics and Astronomy (P&A) Department submitted its comprehensive self---study report and external reviewer's report to me in November 2015. The self---study report thoroughly and systematically examines the department programs and priorities. The report also provides a detailed action plan in response to the self---study and external review findings. From my review of these documents, it is clearly evident that the department embraces program review and meaningful assessment as part of its commitment to effective teaching and learning. It is also very clear that the P&A Department is doing an incredible job educating the next generation of physicists, astronomers, scientists, and science---literate college graduates.

The high---caliber of the P&A Department faculty and curriculum is evident throughout the self---study report and further substantiated by the external reviewer's findings. It's ranking in the 88th percentile of bachelor's granting institutions and its record of graduating ten majors a year further distinguish this small yet mighty department. I join the external reviewer in commending the impressive strengths of the department: collaboration, curricular innovation, alumni connection, graduation rates, contribution to general education, and research. I also applaud the dedication of the faculty and staff to the quality of their program and the success and achievement of their students. The department embraces innovative pedagogies including academic technology approaches that support student engagement and learning. The faculty members are also productive scholars with active research labs. The department's extensive community of faculty, students, P&A alumni, faculty emeriti, donors, participants in the What Physicists Do colloquium series, Public Viewing Night attendees, and many other partners is truly outstanding. In summary, the department is a stand out, high---achieving, steady, effective and trusted unit in the School.

I concur with the external reviewer's summary of department challenges. The faculty and staff are functioning at the highest level despite having limited resources. I agree with the department and external reviewer that any significant addition to the department's load will require additional support. I also agree that an additional tenure track faculty member is needed as soon as resources become available. In the meantime, if changes are anticipated, such as an increase in majors, I encourage the department to reassess how best to deploy and utilize their current resources to match their curricular, research and other

THE CALIFORNIA STATE UNIVERSITY

goals. The maintenance, repair and replacement of equipment are also a challenge in the department. They do an incredible job stretching their resources and I will continue to work with them to try to address these needs. The $100K repair/replacement of the SSU observatory is currently the most pressing and has been brought to the attention of the Provost and AVP of Facilities, Operations and Planning who have recently identified the resources for the project. It will be helpful to have a prioritized list of equipment needs as recommended by the external reviewer.

Going forward, I encourage the department to also consider the following:

- The department uses multiple assessment instruments and strategies that are analyzed and discussed as part of a continuous cycle of program review. A robust set of learning objectives is at the core of these evidence-based efforts. The department should continue assessment processes including periodic review of student learning outcomes and closing of the loop on findings.
- The department currently offers two B.S. and two B.A. programs. In this review cycle, the department identified degree changes to better align with student interests and their program strengths. Included are efforts to develop degree pathways for Physics and Middle School Science teachers. I look forward to these changes being implemented and to the department's leadership in STEM teacher preparation pathways.
- The Department Technician (Steve Anderson), the SST Administrative Manager (Julie Barnes), and other members of the P&A Department work together to develop and implement a reasonable back-up plan for addressing equipment and instrument support and storage needs.

In summary, based on a thorough and evidence-based review, the P&A Department is highly effective and productive academic unit. I commend the department for their ongoing commitment to advancing the teaching and learning excellence of their programs with limited budget and other resources.

Cc: Lynn Cominsky, Department Chair, Physics & Astronomy

→ ToC

8.6 Faculty Curricula Vitae

8.6.1 Professor Lynn Cominsky

Professor Lynn R. Cominsky
Curriculum Vitae

Address:

Department of Physics and Astronomy
Sonoma State University
Rohnert Park, CA 94928
(707) 664-2655 FAX: (800) 848-6369
e-mail: lynnc@universe.sonoma.edu
http://universe.sonoma.edu/~lynnc
http://edeon.sonoma.edu

Personal:

Born November 19, 1953

Education:

Massachusetts Institute of Technology
Ph. D. in Physics awarded September 1981
Thesis: *X-ray Burst Sources*,
advisors W. H. G. Lewin and P. C. Joss

Brandeis University
B.A. in Physics awarded January 1975
(magna cum laude, with honors in chemistry)

Employment:

Department of Physics and Astronomy
Sonoma State University
Chair, August 2004 – August 2019
Professor, September 1991 – present
Associate Professor, September 1986 – August 1991
Department of Chemistry, Chair August 2005- January 2007, and August 2018-January 2019.

Space Sciences Laboratory
University of California, Berkeley
NASA's Extreme Ultraviolet Explorer Satellite Project
Systems Development Manager, October 1985 – September 1986
Science Operations and Data Analysis Administrator
September 1984 – October 1985

Space Sciences Laboratory
University of California, Berkeley
Assistant Research Physicist I, September 1982 – August 1984
Post-graduate Research Physicist, September 1981 – August 1982

Data Aide
Smithsonian Astrophysical Observatory
January 1975 – August 1977

Professor Lynn R. Cominsky

Professional Societies

- American Astronomical Society 1975 – present
- American Physical Society 1977 – present
- Association of Women in Science 1978 – present
- Sigma Xi 1981 – present
- American Association of Physics Teachers 1986 – present
- Graduate Women in Science 1991 – 2001
- American Association for the Advancement of Science 1999 – present
- California Science Teacher's Association 2000 – present
- National Science Teacher's Association 2002 – present
- National Council for Teachers of Mathematics 2002 – present
- Tripoli Rocketry Association 2008 – present. Level 1 achieved in 2010. Level 2 achieved in September, 2011.
- American Geophysical Union 2016 - present

Honors and Awards (Individual)

- Fellow, California State University STEM-Net 2020 and 2021
- Legacy Fellow, American Astronomical Society 2019
- Fellow, California Academy of Sciences October 2017
- Frank J. Malina Astronautics Medal, International Astronautical Federation, April 2017
- CSU Wang Family Excellence Award, January 2016
- American Astronomical Society Education Prize January 2016
- American Astronautical Society Sally Ride Education Award, December 2015
- SSU Presidential Award for Excellence in Scholarship, March 2015
- Aerospace Awareness Award from the Women in Aerospace organization, October 2014
- Women Honoring Women award from the Sonoma County Commission on the Status of Women, 2013
- AAAS Fellow (Astronomy), 2013
- APS/CSWP Woman Physicist of the Month September 2012
- Fellow, American Physical Society (Education) 2009
- Fellow, California Council on Science and Technology, 2008
- Wang Family Excellence Award Nomination 1999, 2000, 2001, 2002, 2006
- Sonoma State University Faculty Merit Increase Award 1998, 1999, 2000
- Sonoma State University Difference-in-Pay Sabbatical Leave 1997 – 1998, 2001-2002
- Sonoma State University Performance Salary Step Increase Award (3 steps) 1995
- Sonoma State University Sabbatical Leave 1993 – 1994
- Council for Advancement and Support of Education California Professor of the Year Award 1993
- Sonoma State University Outstanding Professor Award 1992
- Excellence in Education Award (from the Santa Rosa Chamber of Commerce) 1991
- CSU Meritorious Performance and Professional Promise Awards 1987, 1988, 1989, 1990
- Zonta International Amelia Earhart Graduate Fellowships 1977, 1978, 1979
- Elihu Silver Undergraduate Research Award in Chemistry (Brandeis University) 1974

- National Science Foundation Undergraduate Research Award 1973
- National Merit Scholar 1971

Honors and Awards (Team)

- Einstein Medal to the LIGO and Virgo Scientific Collaborations (June 2017)
- Princess of Asturias Award for Technical and Scientific Research to Rainer Weiss, Kip S. Thorne and Barry C. Barish and LIGO Scientific Collaboration (LSC) 2017
- HEAD/AAS Rossi Prize Gabrielle Gonzalez and the LIGO Scientific Collaboration 2017
- Gruber Prize in Cosmology to Rai Weiss, Kip Thorne and Ronald Drever and the LIGO Scientific Collaboration 2016
- Breakthrough Prize in Physics to Rai Weiss, Kip Thorne and Ronald Drever and the LIGO Scientific Collaboration 2016
- HEAD/AAS Rossi Prize Bill Atwood, Peter Michelson, and the Fermi Gamma Ray Space Telescope LAT team 2011
- NASA Group Achievement Award for Fermi Science Team 2010
- NASA Goddard Space Flight Center Exceptional Achievement Award for Fermi Large Area Telescope Science Team 2008
- HEAD/AAS Rossi Prize to Neil Gehrels and the Swift Team 2007
- NASA Goddard Space Flight Center Exceptional Achievement Award for Swift Science Team 2005
- NASA Goddard Space Flight Center Outstanding Teamwork Award for Swift Phase A 2000

EDUCATIONAL ACTIVITIES

EdEon STEM Learning

EdEon was originally named the SSU Education and Public Outreach (E/PO) group when it was founded by Prof. Cominsky in 1999. Until 2020, Cominsky was the Project Director, Principal Investigator or Co-investigator on all grants to the group. In 2017, Dr. Laura Peticolas joined the group as Associate Director. With more than 15 years of experience at UC Berkeley leading E/PO programs for NASA's Heliophysics Division and its missions, Peticolas has greatly increased the scope of activities that EdEon can support to include space and earth science topics, and is bringing her own projects into EdEon. EdEon's mission is to develop exciting formal and informal educational materials that inspire students in grades 5-14 to pursue STEM careers, to train teachers nation-wide in the classroom use of these materials, and to enhance science literacy for the general public, with a special focus on increasing the numbers of under-represented students.

The SSU E/PO group currently consists of Dr. Laura Peticolas (Associate Director), Aurore Simonnet (Scientific Illustrator), Jeffery Reedy (Education Technologist), Troy Wilson (Systems Administrator), Aline Fromme (Academic Support Coordinator), Hannah Hellman (Writer) and Robert Martinez (Project Support Coordinator) plus a minimum of six SSU undergraduate students and many special consultants. Since 1999, the group has received over $27 million in

NASA grants, including the newest award, NASA's Neurodiversity Network (2021 – 2025). In the past, NASA grants have primarily supported the education and public outreach programs for several different space science missions, including XMM-Newton (launched in 1999), Swift (launched in 2004), the Fermi Gamma-ray Space Telescope (formerly known as GLAST and launched in 2008) and the Nuclear Spectroscopic Telescope Array (NuSTAR, launched in 2012). We have also received funding from NASA for the development of an online course in Cosmology for general education college students, the development of formal curriculum for secondary students to build small satellite payloads for launch on high-powered rockets or tethered weather balloons, and for community college students to build payloads for launches on rockets or unmanned aerial vehicles. From 2015-2020, Cominsky was a Co-investigator in NASA's Universe of Learning Astrophysics Learning and Literacy program. She continues as a scientific co-investigator on NASA's Swift, Fermi, and NuSTAR missions and also acts as press officer for both Swift and Fermi. Programs funded by the US Department of Education total $14 million and include "Scaling an innovative STEM And Computing Education Support (STEMACES) Model for Improved Science Learning," "Developing a Student-Driven STEM and Computer Science Curriculum for Rural Students" and "Learning by Making: STEM Success for Mendocino County". She was also the Principal Investigator for "Teaching Einstein's Universe at Community Colleges" from the National Science Foundation. A brief summary of some of EdEon's educational activities is given below.

Formal Education Units developed by the SSU E/PO group and subcontractors.

Each guide contains original, well-tested and externally evaluated classroom ready educational activities, as well as background material and information on alignment with National Science Education Standards and/or National Mathematics Standards. These guides are distributed through hundreds of workshops at national, regional and local teachers' conferences each year. If not otherwise noted, the guides below can be downloaded from NASA Wavelength: http://nasawavelength.org

1) Invisible Universe: from Radio Waves to Gamma Rays (grades 6-8) – subcontract to Lawrence Hall of Science GEMS group (© 2002) In this 125 page GEMS guide, intriguing activities deepen student understanding of the electromagnetic spectrum, enabling students to detect and consider wavelengths other than visible light. One of the greatest mysteries of all is what causes gamma ray bursts. These bursts are the most powerful explosions in the Universe and occur about once a day! Their origin is unknown, although there are several theories. Students learn about NASA's Swift mission, a specially-equipped satellite to further explore the causes of gamma ray bursts. This is in use by over 6000 teachers nation-wide. Order online at: http://www.lhsgems.org/gemsInvUniv.html

2) Far Out Math – subcontract to Ron Marson, TOPS Learning System (© 2003) Far Out Math! is an inquiry-based math/science curriculum that explores the conceptual tools which have enabled scientists and engineers to launch satellites like GLAST into space, and to make sense of the data received. In this curriculum, students measure, scale, graph and problem solve, using examples derived from GLAST. They compare quantities as orders of magnitude, become familiar with scientific notation, and develop a concrete understanding of exponents and logarithms; all skills needed to understand the very large and very small quantities characteristic of astronomical observations. Far Out Math! instructs students in logarithms, preparing them for further physical and space science studies, and is in use by over 4000 teachers nationwide. Download from: http://fermi.sonoma.edu/teachers/topsmod1.pdf

3) Scale the Universe (grades 5-12) – subcontract to Ron Marson, TOPS Learning System (© 2005) TOPS learning systems created this 64 page educator unit with support from the GLAST mission.

This guide covers scientific notation, orders of magnitude, and plotting using both linear and log scales. Students determine the relative scales of objects in the Universe from the very small to the very large. This guide is in use by over 2500 teachers nationwide. Download from: http://fermi.sonoma.edu/teachers/scale_universe.pdf

4) Pi in the Sky (grades 5-12) – subcontract to Ron Marson, TOPS Learning System (© 2005) TOPS learning systems created this 80 page educator unit with support from the GLAST mission. This guide covers angular measure, including the meaning of Pi, radians to degrees conversion and the dependence of apparent angular size on distance. The angular sizes of astronomical objects are presented as extensions to learning about the angular sizes of every-day objects. This guide is in use by over 2500 teachers nationwide. Download from: http://fermi.sonoma.edu/teachers/pi_in_the_sky.pdf

5) Active Galaxies (grades 9-12) – SSU E/PO group (2002) This guide accompanies an educational wallsheet that uses Active Galaxies as an engagement to each selected topics in physical science and mathematics. It was developed as part of the GLAST E/PO program. The AGN Educator Guide features three curriculum enhancement activities, background information, assessment information, student worksheets, extension and transfer activities, and detailed information about the physical science and mathematics content standards. This guide is in use by over 5000 teachers nationwide. See all the materials and download from: http://fermi.sonoma.edu/teachers/agn.php

6) Gamma-ray Bursts (grades 9-12) – SSU E/PO group (2004) This guide accompanies an educational wallsheet that uses Gamma-ray Bursts as an engagement to teach selected topics in physical science and mathematics. It was developed as part of the Swift E/PO program. The GRB Educator Guide features four curriculum enhancement activities, background information, assessment information, student worksheets, extension and transfer activities, and detailed information about the physical science and mathematics content standards. This guide is in use by over 5000 teachers nationwide. See all the materials and download from: http://swift.sonoma.edu/education/index.html

7) Dying Stars and the Birth of the Elements (grades 9-14) – subcontract to Project CLEA, Gettysburg College (2005). This interactive computer-based laboratory simulates the observation of a supernova remnant using an imaging X-ray telescope. Students explore the effects of changing the abundances of elements on the emergent x-ray spectrum, to try to match the observed data. Teacher and student manuals are provided, including background information, assessment information and detailed standards information. Download from: http://xmm.sonoma.edu/edu/clea/index.html

8) Active Galaxies Pop-up Book (grades 3-8) – SSU E/PO group (2006) The Active Galaxies pop-up book is a very large rectangular pop-up book with foldouts that was developed for use in classrooms for grades 3 and up and for special needs audiences. Active galaxies, a major scientific target for the Fermi mission, contain super-massive black holes at their cores, and sometimes emit jets of particles and light. When opened, a model of an active galaxy with jets pops up out of the center. One foldout contains explanatory information for the parts of the galaxy depicted in the central pop-up as well as a glossary, while the other contains a well-tested classroom activity “Tasty Active Galaxy.” The back of the book features a whimsical cartoon story “How the Galaxy Got Its Jets.” See illustrations and download text from: http://fermi.sonoma.edu/teachers/popup.php

9) Eyes Through Time (grades 5-8) – subcontract to Pennsylvania State University © 2007. These six activities use the Swift mission as a basis to teach the evolution of scientific thought and scientific processes. The activity set is available through download from the Internet (http://teachersdomain.org) , along with accompanying narrated video segments that use Swift and Swift scientists to illustrate the lessons.

10) Newton’s Laws of Motion and Gravitation Educational Wallsheet Set (grades 6-8) – SSU E/PO group (2007) This is a set of 4 posters depicting and explaining Newton's laws of motion and gravitation. A set of classroom activities accompanies each poster. The activities were created to complement each other as an overall unit, whether in science or math. These activities are in use by over 5000 teachers nationwide. See all four posters and download from: http://swift.sonoma.edu/education/index.html

11) Supernovae (grades 9-12) – SSU E/PO group (2008). This guide accompanies an educational wallsheet that uses Supernovae as an engagement to teach selected topics in physical science and mathematics. It was developed as part of the XMM-Newton and Fermi E/PO programs. The Supernova Educator Guide features four curriculum enhancement activities, background information, assessment information, extension and transfer activities, and detailed information about the physical science and mathematics content standards. Download from: http://xmm.sonoma.edu/edu/supernova/index.html

12) Big Ideas in Cosmology (GE college) – Coble, McLin, Bailey, Metevier, Peruta and Cominsky (2014). This two-semester college curriculum is published by Great River Learning, for adoption nation-wide. Read more about it:
http://contentbuilder.merlot.org/toolkit/html/snapshot.php?id=16711931691237
And here: http://www.greatriverlearning.com/Cosmology

13) NuSTAR Educator's Guide: X-rays on Earth and from Space – SSU E/PO group (2014). This guide includes two curriculum enhancement activities, two scientific literacy activities , background information, assessment information, extension and transfer activities, and detailed information about the physical science and mathematics content standards.
http://www.nustar.caltech.edu/system/media_files/binaries/34/original/NustarGuide14b508.pdf?1442355944

14) Direct Observation of Gravitational Waves – SSU E/PO group (2016). This guide is intended for students in grades 6 and higher and includes background information as well as two classroom activities and standards alignment. The guide explains LIGO's 2015 discovery of gravitational waves from merging black holes.

15) Learning by Making Integrated STEM Curriculum (2018). Download the latest lesson plans and more for this innovative and effective 9th-grade curriculum, funded by the US Department of Education. http://lbym.sonoma.edu

Informal Educational Materials developed by the SSU E/PO group.

These informal materials have been externally reviewed and tested for use as supplementary classroom materials or by the general public. Most of the materials below can be downloaded from: `https://science.nasa.gov/learners/wavelength` We distribute these products through our exhibit booths at national, regional and local educator and science conferences to thousands of participants each year.

1) Swift Brochure: Catching Gamma Ray Bursts on the Fly (2002) The Swift Brochure informs the public about the Swift mission. It describes in detail the science that Swift will do and how it will do it. The description includes the three on-board instruments and their parameters, background information on gamma ray bursts and detection methods. It also describes current thinking about the origin of the still-mysterious gamma-ray bursts - the biggest explosions in seen in the Universe today.

2) Seeing and Exploring the Universe Resource Guide (2002) This Resource Guide provides an overview of 16 current and near-future Structure and Evolution of the Universe theme missions. A description of the science and E/PO program for each mission is provided, along with a list of other relevant resources and mission and E/PO websites. The guides also provide an educator response form.

3) Active Galaxies Wallsheet (2002) The Active Galaxies Wallsheet was developed to illustrate the properties of distant galaxies with supermassive black holes in their cores. Active Galaxies are a major scientific target for the GLAST mission. The back of the wallsheet has one of the three activities in the accompanying Educator Guide.

4) GLAST Tri-Fold Brochure (2003) The GLAST Tri-Fold Brochure provides an overview of the GLAST mission. The brochure highlights the science goals of the mission: the investigation of gamma-ray sources from Active Galactic Nuclei to Pulsars.

5) Gamma-ray Burst Wallsheet (2004) The Gamma-ray Burst Wallsheet was developed to illustrate the properties of light emanating from a gamma-ray burst as seen by three distant satellites, including Swift. The back of the wallsheet has one (Angling for Gamma-ray Bursts) of the three activities in the accompanying Educator Guide.

6) Swift Model Booklet (2004) This booklet contains information on the Swift Gamma-ray Burst Explorer mission, its scientific objectives and its detectors and other hardware. It includes pages of printed parts that can be assembled into a paper model.

7) Swift Launch Fact Sheet (2004) This color brochure describes the science of NASA's Swift mission, as well as providing tables that summarize the instrumental parameters and the follow-up team participants. It was produced in September 2004 for distribution at the Swift launch.

8) GLAST Brochure: Exploring the High Energy Universe (2004, updated for launch in 2008) The GLAST Brochure informs the public about the Gamma-ray Large Area Space Telescope mission. It describes in detail the science that GLAST will do and how it will do it. The description includes the instruments, background information on gamma ray astronomy and detection methods. It also describes current thinking about active galaxies, gamma-ray bursts, solar flares, gamma-rays from dark matter and other highly energetic sources seen in the Universe.

9) XMM-Newton Mission Ruler (2004) This English/metric ruler showcases some of the X-ray images obtained using XMM-Newton, and provides descriptive captions on the reverse side. It inspired a middle-school teacher to develop classroom activities that are featured on the mission website.

10) Swift Fact Sheet - July 2004 (2004) This 2-page color fact sheet briefly describes the Swift mission, its instruments, and ground system. Also included are tables listing the instrument parameters and a listing of the major institutions involved.

11) Swift Launch Lithograph (2004) The Swift launch lithograph is a one-page litho that describes the science of NASA's Swift mission, as well as providing an activity for students to do on the back. It was produced in September 2004 for distribution at the Swift launch.

12) Swift Launch Sticker (2005) The Swift launch sticker features a colorful image of the satellite on the front along with text describing the mission on the back.

13) GLAST mission sticker (2005) The GLAST sticker features a colorful image of the satellite on the front along with text describing the mission on the back.

14) GLAST Tasty Active Galaxy Litho (2005) This one-page handout provides a short activity for students to do using food products to model an active galaxy. The goal is to eat the black hole before it eats you! It is adapted from the Active Galaxies Education Unit, and it also appears in the pop-up book.

15) Swift Glider (2005) A model airplane designed to resemble the Swift bird, which conveys information about NASA's Swift gamma-ray burst Explorer mission.

16) GLAST Mission Poster (2005) The GLAST Mission poster shows an artist's conception of the Gamma-ray Large Area Space Telescope in space, exploring the high-energy Universe.

17) Fermi Race Card Game (2005) The Fermi Race Card game challenges two teams of players to strategically maneuver to be the first to assemble the parts of the Gamma-ray Large Area Space Telescope satellite and then use it to observe five astronomical objects. As players build their telescopes they must overcome hurtles and obstacles thrown at them by their opponents while doing the same in order to slow their opponents down. To win, players must successfully have their operational GLAST satellite observe five mysterious, deep space, phenomena.

18) Magnetic Globe Demonstration Litho (2005) This one page lithograph explains how to use the foam earth globes with rare-earth magnets to model the magnetic field of both the Earth and a neutron star pulsar in three dimensions. It is adapted from the Supernovae Education Unit.

19) Black Holes Fact Sheet (2006) This illustrated fact sheet answers eight of the most commonly asked questions about black holes, and was created to distribute with the Black Hole planetarium show. It also highlights the potential observations by a future Black Hole Finder Probe – the Energetic X-ray Imaging Survey Telescope (EXIST). It is also available in Spanish.

20) Fermi Paper Model (2007) The GLAST paper model provides a short description of the scientific instruments on board the Gamma-ray Large Area Space Telescope, as well as links to other resources about the GLAST instruments. There is also a short description of how GLAST detects gamma-rays with the Large Area Telescope as well as the GLAST Burst Monitor detectors. The product includes three pages of parts that can be cut out and easily assembled using common household items.

21) Fermi Gamma-ray Space Telescope Launch Lithograph (2008) The Fermi Gamma-ray Space Telescope (previously called GLAST) launch lithograph is a one-page litho that describes the science of NASA's Fermi Gamma-ray Space Telescope mission, as well as providing an activity for students to do on the back. It was produced in April 2008 for distribution at the Fermi launch.

22) Fermi Gamma-ray Space Telescope Launch Fact Sheet (2008) The Fermi Gamma-ray Space Telescope (previously called GLAST) launch fact sheet is a four-page color brochure that describes the science of NASA's Fermi Gamma-ray Space Telescope mission, as well as providing tables that summarize the instrumental parameters and the mission participants. It was produced in April 2008 for distribution at the Fermi Gamma-ray Space Telescope launch.

23) Fermi Skymap with four years of discovery (2012) Ten major discoveries by the Fermi Gamma-ray Space Telescope are called out from the iconic image of the high-energy gamma-ray sky. This poster was created and distributed at the Fermi Symposium in 2012.

24) NuSTAR Fact Sheet (2012). This factsheet is a two-page color brochure that describes the science of NASA's NuSTAR mission, as well as providing tables that summarize the instrumental parameters and the mission participants. It was produced in 2012 for distribution with the NuSTAR launch.

Professor Lynn R. Cominsky

NASA-supported Educational Web Sites Created and Maintained by EdEon

1) EdEon website (2020) has now replaced the SSU E/PO group Web Site (2000).
http://edeon.sonoma.edu This web site includes links to all current and some legacy EdEon projects and contact information.

2) Fermi Education and Public Outreach Website (2001, updated in 2020)
http://fermi.sonoma.edu
This Education and Public Outreach web site provides information on the Fermi Gamma-Ray Space Telescope mission. Fermi is a joint effort of NASA, the Department of Energy, and several different international partners. The main objective of the Fermi mission is to study the Universe at high-energy gamma-ray energies. The Fermi E/PO site explains the scientific objectives and the instruments for the mission, has downloadable classroom materials and other interesting information about the mission.

3) Swift Education and Public Outreach Website (2001, updated in 2020)
http://swift.sonoma.edu
This Education and Public Outreach website provides information on the NASA gamma-ray burst explorer mission, Swift. The purpose of Swift is to study gamma-ray bursts, the most energetic explosions seen in the Universe today. The web site contains downloadable classroom materials, as well as a description of the Swift E/PO program and the Swift satellite and science objectives.

4) Astronomy from Home http://afh.sonoma.edu (has now replaced the Global Telescope Network Website (2003) http://gtn.sonoma.edu)
The Astronomy from Home (AfH) website contains information on how to use small telescopes to obtain ground-based observations of objects of interest to NASA missions, as well as background information on variable objects and observing suggestions.

5) XMM-Newton Education and Public Outreach Web Site (2003) http://xmm.sonoma.edu
This web site is designed to inform the education community and the general public about the XMM-Newton mission and its scientific discoveries. XMM is an ESA (European Space Agency) mission with NASA instrumentation and support. The XMM-Newton satellite is named after Isaac Newton and for its X-ray Multi-Mirror design. The site is aimed at the non-scientist and educator and contains information about the mission, x-ray astronomy, and discoveries resulting from XMM-Newton data. It also features standards-based classroom educational materials useful for teaching astronomical concepts. As of 2016, this site is no longer supported.

6) Epo's Chronicles (2008, updated in 2020) https://epos.lbym.org/
Join Epo, a sentient spaceship and its humanoid companion, Alkina, in this weekly webcomic as they explore the galaxy and try to discover their origins. Each weekly "eposode" is accompanied by links to resources, multi-media and scientific background information.

7) **Small Satellites for Secondary Students** (2013) http://s4.sonoma.edu This website contains information as to how to build the S4 Arduino-based payload that includes environmental sensors, as well as information about S4 rocketry competitions held in 2015 at Black Rock. Details of hardware, software and building instructions are included with the educator's guide.

8) Rising Data (2018) https://risingdata.lbym.org/ Rising Data is a NASA MUREP program that developed a model rocketry, drone and payload building program for under-represented college students. Details of the required hardware, software downloads and how to videos are included with the educator's guide.

Professor Lynn R. Cominsky

Other projects developed and supported by the SSU E/PO group during 1999-2015

1) GLAST Robotic Optical Telescope (GORT) at the Pepperwood Preserve. The SSU E/PO group has constructed a fully robotic 14-inch telescope, located at a dark site about 30 minutes north of campus. Entirely funded by NASA, this telescope is used within the Global Telescope Network by high-school and SSU college students to acquire ground-based visible-light data that will be used in conjunction with space-based x-ray and gamma-ray data acquired by the XMM-Newton, Swift and Fermi missions. Since 2020, this telescope has been used for observations with the Astronomy from Home program.

2) Global Telescope Network (GTN). The SSU E/PO group coordinates over a dozen different partners, including amateurs, high school observatories, and small college observatories who obtain data on scientific targets of interest to the XMM-Newton, Swift and Fermi missions. We provide archiving for all GTN data, in partnership with the American Association of Variable Star Observers (AAVSO.) The goal of the GTN is to partner space scientists and students to obtain multi-wavelength data suitable for use in scientific publications. (See Astronomy from Home.)

3) Educator Ambassador (EA) Program. The SSU E/PO group originated and coordinated this program, which now consists of 18 master educators in 17 different states and Canada. The EAs work with the science and E/PO teams from five different Astrophysics missions to help develop, test, and disseminate materials to achieve our educational goals of developing NSES-aligned educational materials, reaching underrepresented students, and encouraging STEM learning. Since the initial selection of EAs in a nation-wide competition in 2001 and together with SSU E/PO staff, we have directly trained over 68,000 teachers and students and members of the public.

4) What's in the News? was a news program, developed through a subcontract to Penn State University, that was seen by five million middle-school children across the country. It was accompanied by online classroom activities and other supplementary material. Swift E/PO supported the creation of 12 features for WITN. In 2004, the funding for WITN was eliminated by WPSX, the Penn State public television station. All the Swift segments are archived at http://swift.sonoma.edu/program/witn.html.

5) Black Holes: The Other Side of Infinity. This full-dome digital planetarium show was directed by Tom Lucas, with seed funding from GLAST E/PO, primary funding from the National Science Foundation, in association with the PBS science series NOVA. Prof. Cominsky was one of two science directors for the show which premiered 1/31/06 at the Denver Museum of Nature and Science. Narrated by actor Liam Neeson, this show provides a groundbreaking scientifically accurate perspective on black holes.

6) Monster of the Milky Way. The companion PBS NOVA show to the Black Holes planetarium show described above, this television program uses many of the same supercomputer simulations. It premiered 10/31/06. Prof. Cominsky also served as science director for this show, which was also directed by Tom Lucas.

7) Black Hole Rescue Game. This interactive game improves the science literacy of students in grades 4-12. After reading an article about black holes, the students "rescue" letters to form a vocabulary word that appears in a list, before the letters fall into a black hole. It was developed by NASA's JPL Space Place team, under subcontract from the SSU E/PO group, as part of the XMM-Newton E/PO program. It was available in both English (http://spaceplace.nasa.gov/en/kids/blackhole/) and Spanish (http://spaceplace.nasa.gov/sp/kids/blackhole/index.shtml#) but is no longer active.

8) NASA Exhibit Booths. We have created three exhibit booths: two are used at scientific conferences to represent Swift and Fermi. The third features Swift, Fermi and XMM-Newton and NuSTAR, and is used at educator conferences. These booths are staffed at several conferences each year, and are used to distribute various informal educational products, as well as to conduct demonstrations.

9) Cosmology Workshop for Teachers. This three-day course was developed in partnership with Prof. Caty Pilachowski and was piloted at Indiana University in June 2007. It was partly funded by SNAP E/PO. It is available for download from: http://www.astro.indiana.edu/darkuniverse.shtml It was reprised during the Educator Ambassador training in the Summer of 2008, with assistance from Chicago State University Prof. Kim Coble. Updated materials can be downloaded from: http://epo.sonoma.edu/ea/training2008/index.php

10) Roseland University Prep Summer Experience. This three-day college experience was organized and sponsored by the Fermi E/PO program to introduce the rising seniors of this predominantly low-income, first-generation college Hispanic public charter high school to college life. Included GLAST activities and telescope viewing. July 29-31, 2007. This was repeated during June 15-17, 2008.
11) Small Satellites for Secondary Students Educator Training. This week-long training involved 18 teachers and Girl Scout leaders. They learned how to build the S4 payloads, and launched them on high-powered rockets in July 2013.

Teacher Training Programs

Prof. Cominsky was the Faculty Advisor and Principal Investigator for the California Subject Matter Project called the North Bay Science Project. NBSP was active during 1999-2005, and taught over 100 teachers each year. It was merged with the Redwood Empire Science Project in 2005 due to lack of state funding. Prof. Cominsky also developed the following California-standards aligned courses to teach grade 3-9 teachers through the following workshops:

The Atom's Family regional workshop (November 3, 2001)
A one-day workshop focusing on the constituents of the atom, primarily aligned with science standards for grades 3 through 5: http://nbsp.sonoma.edu/resources/teachers_materials/county_regionals/11-03-01/atoms.htm

Electricity and Magnetism Summer Institute (July 2002)
Conducted Physical Science weeklong training institute focusing on the properties of electricity and magnetism, primarily aligned with science standards for grades 4 and 8, with special focus on English Language Learners. Workshop materials are online at: http://nbsp.sonoma.edu/resources/teachers_materials/index2002.html

Physical Science Leadership Institute (July 2003)
Conducted two week long training institute focusing on the California State Science standards, primarily for grades 3, 5 and 8 about the properties of matter, the periodic table of the elements, and basic physical chemistry. Special focus on English Language Learners. Workshop materials are online at: http://nbsp.sonoma.edu/resources/teachers_materials/index2003.html#physical

Other notable Teacher Training programs:
Learning by Making Teacher Training. This week-long training for 12 teachers is also accompanied by five in-service days each year for teachers from rural high-needs high schools in California counties. Repeated every year from 2014 through 2023.

Rising Data Teacher Training. This week-long training for 5 community college instructors provides instruction in how to build the latest version of the payload, plus rockets and Unmanned Aerial Vehicles (UAVs), which are then flown, and acquired data are analyzed. Piloted in 2016 and repeated in 2017.

Professor Lynn R. Cominsky

RESEARCH ACTIVITIES

Publications in Refereed Journals, Conference Proceedings and Encyclopedia Articles

1) “Uhuru Observations of the Globular Cluster X-ray Source NGC6712”, Cominsky, L., Forman, W., Jones, C., and Tananbaum, H., *Astrophysical Journal*, **211**, L9 (1977)

2) “Transient X-ray Sources in the Galactic Plane”, Cominsky, L., Jones, C., Forman, W., and Tananbaum, H., *Astrophysical Journal*, **224**, 46 (1978) Also reprinted in *X-ray Astronomy, Selected Reprints*, ed. Claude R. Canizares, American Association of Physics Teachers, 1986.

3) “The Fourth Uhuru Catalog of X-ray Sources”, Forman, W., Jones, C., Cominsky, L., Julien, P., Murray, S., Peters, G., Tananbaum, H., and Giacconi, R., *Astrophysical Journal (Supplements)*, **38**, "No. 4" (1978)

4) “Discovery of 3.6 Second X-ray Pulsations from 4U0115+63”, Cominsky, L., Clark, G. W., Li, F., Mayer, W., and Rappaport, S., *Nature*, **273**, 367 (1978)

5) “Orbital Elements of 4U0115+63 and the Nature of the Hard X-ray Transients”, Rappaport, S., Clark, G. W., Cominsky, L., Joss, P. C., and Li, F., *Astrophysical Journal*, **211**, L1 (1978)

6) “Discovery of Optical Bursts from an X-ray Burst Source, MXB1735-44”, Grindlay, J. E., McClintock, J. E., Canizares, C., van Paradijs, J., Cominsky, L., Li, F., and Lewin, W. H. G., *Nature*, **274**, 567 (1978)

7) “A 3-s Delay in an Optical Burst from X-ray Burst Source MXB1735-44”, McClintock, J. E., Canizares, C., van Paradijs, J., Cominsky, L., Li, F. K., Lewin, W. H. G., and Grindlay, J. E., *Nature*, **279**, 47 (1979)

8) “The Steady Emission from MXB1730-335 (Rapid Burster)”, van Paradijs, J., Cominsky, L., and Lewin, W. H. G., *Monthly Notices of the Royal Astronomical Society*, **189**, 387 (1979)

9) “On the Persistent Emission from X-ray Burst Sources and the Nature of the Galactic Bulge X-ray Sources”, van Paradijs, J., Joss, P. C., Cominsky, L., and Lewin, W. H. G., *Nature*, **280**, 375 (1979)

10) “Detection of an Optical Burst Coincident with an X-ray Burst from MXB1837+05 (Ser X-1),
Hackwell, J. A., Grasdalen, G. L., Gehrz, R. D., van Paradijs, J., Cominsky, L., and Lewin, W. H. G., *Astrophysical Journal*, **223**, L115 (1979)

11) “X-ray Observations of 4U/MXB1735-44”, Lewin, W. H. G., van Paradijs, J., Cominsky, L., and Holzner, S., *Monthly Notices of the Royal Astronomical Society*, **193**, 15 (1980)

12) “A Search for Pulsations and Eclipses from X-ray Burst Sources”, Cominsky, L., Jernigan, J. G., Ossmann, W., Doty, J., van Paradijs, J., and Lewin, W. H. G., *Astrophysical Journal,* **242**, 1102 (1980)

13) “A Simultaneous Infrared and X-ray Burst Observation of Ser X-1”, Lewin, W. H. G., Cominsky, L. R., Walker, A. R., and Robertson, B. C., *Nature,* **287**, 27 (1980)

14) “Repeatable Multiple-Peaked Structure in Type I X-ray Bursts”, Hoffman, J. A., Cominsky, L., and Lewin, W. H. G., *Astrophysical Journal,* **240**, L27 (1980)

15) “Very Long Type II X-ray Bursts from the Rapid Burster”, Basinska, E., Lewin, W. H. G., Cominsky, L., van Paradijs, J., and Marshall, F. J., *Astrophysical Journal,* **241**, 787 (1980)

16) “A Search for Apsidal Motion in 4U0115+63, Kelley, R., Rappaport, S., Brodheim, M. J., Cominsky, L., and Stothers, R., *Astrophysical Journal,* **251,** 630 (1981)

17) “X-ray Observations of the Cygnus X-1 ‘High State’”, Ogawara, Y., Mitsuda, K., Masai, K., Vallerga, J., Cominsky, L., Grunsfeld, J., Kruper, J., and Ricker, G., *Nature,* **295,** 675 (1982)

18) “Simultaneous Optical and X-ray Bursts from the 1980 Outburst of 4U/MXB1635-53”, Pedersen, H., Lub, J., Inoue, H., Koyama, K., Makishima, K., Matsuoka, M., Mitsuda, K., Murakami, T., Oda, M., Ogawara, Y., Ohashi, T., Shibazaki, N., Tanaka, Y., Hayakawa, S., Kuneida, H., Makino, F., Masai, K., Nagase, F., Tawara, Y., Miyamoto, S., Tsunemi, H., Yamashita, K., Kondo, I., Jernigan, J., van Paradijs, J., Beardsley, A., Cominsky, L., Doty, J., and Lewin, W. H. G., *Astrophysical Journal,* **263**, 325 (1982)

19) “Optical Bursts from 4U/MXB1636-53”, Pedersen, H., van Paradijs, J., Motch, C., Cominsky, L., Lawrence, A., Lewin, W. H. G., Oda, M., Ohashi, T., and Matsuoka, M., *Astrophysical Journal,* **263**, 340 (1982)

20) “The 1980 Outburst of 4U0115+63 (V635 Cassiopeiae)”, Kriss, G. A., Cominsky, L. R., Remillard, R. A., Williams, G., and Thorstensen, J. R., *Astrophysical Journal,* **266**, 806 (1983)

21) “X-ray, Radio, and Infrared Observations of the Rapid Burster (MXB1730-335) During 1979 and 1980”, Lawrence, A., Cominsky, L., Lewin, W. H. G., Oda, M., Ogawara, Y., Inoue, H., Koyama, K., Makishima, K., Matsuoka, M., Murakami, T., Ohashi, T., Shibazaki, N., Tanaka, Y., Kondo, I., Hayakawa, S., Kuneida, H., Makino, F., Masai, K., Nagase, F., Tawara, Y., Miyamoto, S., Tsunemi, H., Yamashita, K., Dashido, T., Oka, R., Ohkawa, T., Maruyama, T., Yokoyama, T., Nicholson, G., Balonek, T., Dent, W., Glass, I., Carter, B., Jones, A. W., Selby, M., Martenez Roger, C., Sanchez Magro, C., Giles, A. B., Duldig, M., Pramesh Rao, A., Venugopal, V., Haynes, R., Jauncey, D., Okuda, H., Sato, S., Kobayashi, Y., Jugaku, J., Backman, D., Pogge, R., Hodge, P., Aller, H., and van Paradijs, J., *Astrophysical Journal,* **267**, 301 (1983)

22) “X-ray Burst Observations of Serpens X-1”, Sztajno, M., Basinska, E., Cominsky, L., Marshall, F. J., and Lewin, W. H. G., *Astrophysical Journal,* **267**, 713 (1983)

23) “Irregular X-ray Variability from the Transient X-ray Burst Source MXB1659-29”, Cominsky, L., Ossmann, W., and Lewin, W. H. G., *Astrophysical Journal*, **270,** 226 (1983)

24) “Simultaneous U, B, V, and X-ray Measurements of a Burst from 4U/MXB1636-53”, Lawrence, A., Cominsky, L., Engelke, C., Jernigan, J., Lewin, W. H. G., Matsuoka, M., Mitsuda, K., Oda, M., Ohashi, T., Pedersen, H., and van Paradijs, J., *Astrophysical Journal,* **271**, 793 (1983)

25) “Optical Radiation Associated with γ-ray Bursts”, London, Richard A., and Cominsky, Lynn R., *Astrophysical Journal,* **275**, L59 (1983)

26) “Discovery of Eclipses from the X-ray Burst Source MXB1659-29”, Cominsky, L. R., and Wood, K. S., in *High Energy Transients in Astrophysics, Santa Cruz,* ed. Stanford E. Woosley, American Institute of Physics: New York, p. 139 (1984).

27) “X-ray Observations of the Burst Source MXB1728-34”, Basinska, E. M., Lewin, W. H. G., Sztajno, M., Cominsky, L. R., and Marshall, F. J., *Astrophysical Journal,* **281**, 337 (1984)

28) “Discovery of a 7.1h Period and Eclipses from MXB1659-29”, Cominsky, L. R., and Wood, K. S., *Astrophysical Journal,* **283**, 765 (1984)

29) “Delays of Optical Bursts in Simultaneous Optical and X-ray Observations of MXB 1636-53”,
Matsuoka, M., Mitsuda, K., Ohashi, T., Inoue, H., Koyama, K., Makino, F., Makishima, K., Murakami, T., Oda, M., Ogawara, T., Shibazaki, N., Tanaka, Y., Tsuno, K., Miyamoto, S., Tsunemi, H., Yamashita, K., Hayakawa, S., Kunieda, H., Masai, K., Nagase, F., Tawara, Y., Kondo, I., Cominsky, L., Jernigan, J. G., Lawrence, A., Lewin, W. H. G., Pedersen, H., Motch, C., and van Paradijs, J., *Astrophysical Journal,* **283**, 774 (1984)

30) “An Absorption Event from NGC6624”, Cominsky, L., Simmons, J., and Bowyer, S., *Astrophysical Journal,* **298**, 581 (1985)

31) “Time-dependent X- and γ-ray Reprocessing”, Cominsky, L., London, R. A. and Klein, R. I., *Astrophysical Journal,* **315,** 162 (1987)

32) “Further Observations of the Eclipsing Transient X-ray Burst Source MXB1659-29”, Cominsky, L., and Wood, K., *Astrophysical Journal,* **337,** 485 (1989)

33) “Multi-mission Observations of 4U1538-52”, Cominsky, L., and Moraes, F., *Astrophysical Journal,* **370**, 670 (1991)

34) “Detection of X-ray Emission from the PSR 1259-63/SS 2883 Binary System”, Cominsky, L., Roberts, M., and Johnston, S., *Astrophysical Journal,* **427**, 978 (1994) (SLAC Pub #6404)

35) “Detection of X-ray Emission from the PSR 1259-63/SS 2883 Binary System”,

Cominsky, L., Roberts, M., and Johnston, S., in the *Proceedings of the Astronomical Society of the Pacific Conference on Interacting Binary Stars*, ed. A. Shafter, Astronomical Society of the Pacific: San Francisco, p. 424 (1994)

36) "An April, 1991 Outburst from 4U0115+63 observed by BATSE", Cominsky, L., Roberts, M., and Finger, M., in the *Proceedings of the Second Compton Gamma Ray Observatory Symposium*, eds. C.E. Fichtel, N. Gehrels, and J. P. Norris, American Institute of Physics: New York, p. 294 (1994) (SLAC Pub #6406)

37) "The Evolutionary Status of PSR1259-63", Cominsky, L., in the *Proceedings of the 4th Annual Astrophysics Conference in Maryland*, eds. Stephen S. Holt and Charles S. Day, American Institute
of Physics: New York, p. 291 (1994) (SLAC Pub #6405)

38) "ROSAT Measurement of the Evolving Orbital Period in the Low Mass X-ray Binary EXO0748-676", Hertz, P., Ly, Y., Wood, K. S., and Cominsky, L. R., in *the Proceedings of the 4th Annual Astrophysics Conference in Maryland*, eds. Stephen S. Holt and Charles S. Day, American Institute of Physics: New York, p. 363 (1994)

39) "Hard X-ray Observations of A0535+262", Finger, M. H., Cominsky, L. R., Wilson, R. B., Harmon, B. A., and Fishman, G. J., in the *Proceedings of the 4th Annual Astrophysics Conference in Maryland*, eds. Stephen S. Holt and Charles S. Day, American Institute of Physics: New York, p. 459 (1994)

40) "Evidence Against Secular Evolution in the Orbital Period of the Low Mass X-ray Binary EXO0748-676", Hertz, P., Ly, Y., Wood, K. S., and Cominsky, L. R., in *the Proceedings of the ROSAT Science Symposium*, eds. E. M. Schlegel and R. Petre, American Institute of Physics: New York, p. 80 (1994)

41) "The X-ray Emission of the Pulsar-Be Star Binary PSR 1259-63", King, Andrew and Cominsky, Lynn, *Astrophysical Journal,* **435**, 411 (1994) (SLAC Pub #6446)

42) "Eclipse Timings of the Low Mass X-ray Binary EXO 0748-676: Statistical Arguments against Orbital Period Changes", Hertz, Paul, Wood, Kent S. and Cominsky, Lynn, *Astrophysical Journal,* **438**, 385 (1995)

43) "Observations of 4U1700-37 with BATSE", Rubin, B. C., Finger, M. H., Harmon, B. A., Paciesas, W. S., Fishman, G. J., Wilson, R. B., Wilson, C. A., Brock, M. N., Briggs, M. S., Pendleton, G. N., Cominsky, L. R. and Roberts, M. S., *Astrophysical Journal*, **459**, 259 (1996)

44) "Black Hole Astrophysics", Bender, Peter, Bloom, Elliott, Cominsky, Lynn, Ford, Holland, Harmon, Alan, Michelson, Peter, Novikov, Igor, Postnov, Konstantin, Scargle, Jeffrey, Swank, Jean, Wheeler, J. Craig, and Wood, Kent, in the *Proceedings of the 1994 Snowmass Summer Study on High Energy Physics: Particle and Nuclear Astrophysics and Cosmology in the Next Millenium*, eds. E. W. Kolb and R. D. Peccei, World Scientific: Singapore, p. 277 (1995) (SLAC Pub 95-6915)

45) “Eclipse Timing of the Low-Mass X-ray Binary EXO 0748-676: II. Detection of an Apparent Orbital Period Change and of Orbital Period Noise”, Hertz, Paul, Wood, Kent S., and Cominsky, Lynn R., *Astrophysical Journal*, **486**, 1000 (1997)

46) “Complex Outburst Behaviour from the Black Hole Candidate 4U 1630-47”, Kuulkers, E., Parmar, A. N., Kitamoto, S., Cominsky, L. R. and Sood, R. K., *Monthly Notices of the Royal Astronomical Society*, **291**, 81 (1997)

47) “X-ray Emission from Compact Sources”, Cominsky, L., in the Proceedings of the Stanford Linear Accelerator Center XXVI Summer Institute on Particle Physics, *“Gravity, from the Hubble Length to the Planck Length*” 55, (2001)

48) “X-ray/Gamma-ray Observations of the PSR B1259-63/SS2883 System near Apastron”, Hirayama, M., Cominsky, L. R., Kaspi, V. M., Nagase, F., Tavani, M., Kawai, N. and Grove, J. E., *Astrophysical Journal*, **521**, 718 (1999)

49) “A Search for Aperiodic Millisecond Variability in Cygnus X-1”, Chaput, C., Bloom, E., Cominsky, L., G. Godfrey, Scargle, J., Shabad, G., Wen, H., Wood, K., and Yentis, D., **541**, 1026 (2000).

50) “Astronomy and the News Media”, S. P. Maran, L. R. Cominsky and L. A. Marshall, in *Information Handing in Astronomy*, ed. A. Heck, (Dordrecht:Kluwer), 13, (2000).

51) “Phase Dependent Spectral Variability in 4U1907+09”, Roberts, M. S. E., Michelson, P. F., Leahy, D. A., Hall, T. A., Finley, J. P., Cominsky, L. R., and Srinivasan, R., *Astrophysical Journal*, **555**, 967 (2001).

52) “How X-ray Experiments See Black Holes: Past, Present and Future”, L. Cominsky, in Cosmology and Elementary Particle Physics, Proceedings of the 30th Coral Gables Conference, ed. V. Kursonoglu, Steven L. Mintz, and Arnold Perlmutter, (AIP), p.112 (2002)

53) “Communicating Astronomy to the Media” S. P. Maran, L. R. Cominsky and L.A. Marschall, in "Astronomy Communication," ed. A. Heck and C. Madsen, (Dordrecht:Kluwer), p.19-29 (2003)

54) “The Swift Gamma-Ray Burst Mission” N. Gehrels and 72 authors including L. Cominsky, *Astrophysical Journal*, **611**, 1005 (2004)

55) “A short gamma-ray burst apparently associated with an elliptical galaxy at redshift z = 0.225”, N. Gehrels and 77 authors including L. Cominsky, *Nature*, **437**, 851 (2005).

56) “Swift Panchromatic Observations of the Bright Gamma-Ray Burst GRB 050525a,”A. J. Blustin and 65 authors, including L. Cominsky, *Astrophysical Journal*, **637**, 901 (2006)

57) Articles on Fermi, Swift and XMM-Newton for *Space Exploration and Humanity: An Historical Encyclopedia*, published by ABC-CLIO and the American Astronomical Society, ed. Stephen B. Johnson. Published August, 2010. For more information, see: http://www.abc-clio.com/products/overview.aspx?productid=109018&priceid=103202

ISBN: 978-1-85109-514-8

58) Article on Gamma-ray Bursts for the McGraw Hill Encyclopedia of Science & Technology, 10th Edition, (2007). Updated in 2012 and 2018. Now called Access Science. https://www.accessscience.com/content/gamma-ray-burst/801000.

59) "Gamma-ray bursts: Huge explosions in the early Universe" G. Cusamano and 32 authors, including L. Cominsky, *32*, *Nature*, **440**, pp. 164 (2006).

60) "Swift observations of the prompt X-ray emission and afterglow from GRB050126 and GRB050219A" M. R. Goad and 35 authors, including L. Cominsky, A&A, **449**, pp.89-100 (2006)

61) "Swift and XMM-Newton observations of the dark GRB 050326" A. Moretti and 33 authors, including L. Cominsky, A&A, **451**, pp.777-787 (2006)

62) "The association of GRB 060218 with a supernova and the evolution of the shock wave" S. Campana and 39 authors, including L. Cominsky, *Nature*, **442**, pp. 1008-1010 (2006).

63) "Swift X-Ray Telescope Observations of the Deep Impact Collision" R. Willingale and 17 authors, including L. Cominsky, Ap. J., **649**, pp. 541-552 (2006)

64) "Swift observations of GRB 050904: the most distant cosmic explosion ever observed" G. Cusamano and 33 authors, including L. Cominsky, A&A, **462**, pp.73-80 (2007)

65) "The Fermi Gamma-Ray Space Telescope Discovers the Pulsar in the Young Galactic Supernova Remnant CTA 1" A. A. Abdo and 185 authors, including L. Cominsky, *Science,* **322**, pp. 1218-1221. (2008)

66) "Fermi Observations of High-Energy Gamma-Ray Emission from GRB 080916C" A. A. Abdo and 253 authors, including L. Cominsky, *Science,* **323**, pp. 1688- (2009)

67) "Discovery of Pulsed γ-Rays from the Young Radio Pulsar PSR J1028-5819 with the Fermi Large Area Telescope" A. A. Abdo and 172 authors, including L. Cominsky, Ap. J.L., **695**, pp. L72-L77 (2009)

68) "Fermi Large Area Telescope Observations of the Vela Pulsar" A. A. Abdo and 234 authors, including L. Cominsky, Ap. J., **696**, pp. 1084-1093 (2009)

69) "Measurement of the Cosmic Ray $e^{+}+e^{-}$ Spectrum from 20GeV to 1TeV with the Fermi Large Area Telescope" A. A. Abdo and 188 authors, including L. Cominsky, Phys. Rev. Let., 1**02**, , issue18, id. 181101 (2009)

70) "Fermi Discovery of Gamma-ray Emission from NGC 1275" A. A. Abdo and 169 authors, including L. Cominsky, Ap. J., **699**, pp. 31-39 (2009)

71) "Early Fermi Gamma-ray Space Telescope Observations of the Quasar 3C 454.3" A. A. Abdo and 180 authors, including L. Cominsky, Ap. J., **699**, pp. 817-823 (2009)

72) "Pulsed Gamma Rays from the Millisecond Pulsar J0030+0451 with the Fermi Large Area Telescope" A. A. Abdo and 171 authors, including L. Cominsky, Ap. J., **699**, pp. 1171-1177 (2009)

73) "Bright Active Galactic Nuclei Source List from the First Three Months of the Fermi Large Area Telescope All-Sky Survey" A. A. Abdo and 192 authors, including L. Cominsky, Ap. J., **700**, pp. 597-622 (2009)

74) "Fermi/Large Area Telescope Bright Gamma-Ray Source List" A. A. Abdo and 209 authors, including L. Cominsky, Ap. J. Supp., **183**, pp. 46-66 (2009)

75) "Pulsed Gamma-rays from PSR J2021+3651 with the Fermi Large Area Telescope" A. A. Abdo and 186 authors, including L. Cominsky, Ap. J., **700**, pp. 1059-1066 (2009)

76) "Fermi LAT Observations of LS I +61°303: First Detection of an Orbital Modulation in GeV Gamma Rays" A. A. Abdo and 182 authors, including L. Cominsky, Ap. J. Lett., **701**, pp. L123-L128 (2009)

77) "A Population of Gamma-Ray Millisecond Pulsars Seen with the Fermi Large Area Telescope" A. A. Abdo and 201 authors, including L. Cominsky, *Science,* **325**, pp. 848- (2009).

78) "Fermi LAT Discovery of Extended Gamma-Ray Emission in the Direction of Supernova Remnant W51C" A. A. Abdo and 176 authors, including L. Cominsky, Ap. J. Lett., **706**, pp. L1-L6 (2009)

79) "Fermi/LAT observations of LS 5039" A. A. Abdo and 186 authors, including L. Cominsky, Ap. J. Lett., **706**, pp. L56-L61 (2009)

80) "Fermi Observations of GRB 090902B: A Distinct Spectral Component in the Prompt and Delayed Emission" A. A. Abdo and 205 authors, including L. Cominsky, Ap. J. Lett., **706**, pp. L138-L144 (2009)

81) "A limit on the variation of the speed of light arising from quantum gravity effects" A. A. Abdo and 208 authors, including L. Cominsky, Nature, **462**, pp. 331-334 (2009)

82) "Fermi Observations of High-energy Gamma-ray Emission from GRB 080825C" A. A. Abdo and 180 authors, including L. Cominsky, Ap. J., **707**, pp. 580-592 (2009)

83) "Fermi Observations of TeV-Selected Active Galactic Nuclei" A. A. Abdo and 179 authors, including L. Cominsky, Ap. J., **707**, pp. 1310-1333 (2009)

84) "Modulated High-Energy Gamma-Ray Emission from the Microquasar Cygnus X-3" A. A. Abdo and 179 authors, including L. Cominsky, *Science,* **326**, pp. 1512- (2009)

85) “Fermi Large Area Telescope Observations of the Crab Pulsar And Nebula” A. A. Abdo and 191 authors, including L. Cominsky Ap.J., **708**, pp. 1254-1267 (2010)

86) “Gamma-ray and Radio Properties of Six Pulsars Detected by the Fermi Large Area Telescope” A. A. Abdo and 191 authors, including L. Cominsky, Ap.J., **708**, pp. 1254-1267 (2010)

87) “Fermi Observations of Cassiopeia and Cepheus: Diffuse Gamma-ray Emission in the Outer Galaxy” P. Weltevrede and 153 authors, including L. Cominsky, Ap.J., **708**, pp. 1426-1441 (2010).

88) “A change in the optical polarization associated with a γ-ray flare in the blazar 3C279” The Fermi LAT Collaboration and 265 authors, including L. Cominsky, *Nature*, , **463,** 7283, pp. 919-923 (2010).

89) “Gamma-Ray Emission from the Shell of Supernova Remnant W44 Revealed by the Fermi LAT” A. A. Abdo and 181 authors, including L. Cominsky, *Science*, **327**, pp. 1103- (2010).

90) “Observations of the Large Magellanic Cloud with Fermi” A. A. Abdo and 179 authors, including L. Cominsky, Astronomy and Astrophysics, Volume 512, id.A7 (2010)

91) “PSR J1907+0602: A Radio-Faint Gamma-Ray Pulsar Powering a Bright TeV Pulsar Wind Nebula” A. A. Abdo and 180 authors, including L. Cominsky, Ap. J., **711**, pp. 64-74 (2010).

92) “Observation of Supernova Remnant IC 443 with the Fermi Large Area Telescope” A. A. Abdo and 172 authors, including L. Cominsky, Ap. J., **712**, pp. 459-468 (2010)

93) “Fermi Detection of Delayed GeV Emission from the Short Gamma-Ray Burst 081024B” A. A. Abdo and 208 authors, including L. Cominsky, Ap. J., **712**, pp. 558-564 (2010).

94) “Spectrum of the Isotropic Diffuse Gamma-Ray Emission Derived from First-Year Fermi Large Area Telescope Data” A. Abdo and 183 authors, including L. Cominsky, Phys. Rev. Lett., **104**, id. 101101 (2010).

95) “The First Fermi Large Area Telescope Catalog of Gamma-ray Pulsars” A. Abdo and 217 authors, including L. Cominsky, Ap. J. Supp., **187**, pp. 460-494 (2010).

96) “Constraints on dark matter annihilation in clusters of galaxies with the Fermi large area telescope” M. Ackermann and141 authors, including L. Cominsky, Journal of Cosmology and Astroparticle Physics, Issue 05, pp. 025 (2010).

97) “Fermi Gamma-Ray Imaging of a Radio Galaxy” A. Abdo and 182 authors, including L. Cominsky, Science, **328**, Issue 5979, pp. 725- (2010).

98) “The Spectral Energy Distribution of Fermi Bright Blazars” A. Abdo and 257 authors including L. Cominsky, Ap.J., **716**, pp. 30-70 (2010).

99) "GeV Gamma-ray Flux Upper Limits from Clusters of Galaxies" M. Ackermann and 169 authors, including L. Cominsky, Ap.J.L., **717**, pp. L71-L78 (2010).

100) "Fermi Large Area Telescope View of the Core of the Radio Galaxy Centaurus A" A. Abdo and 198 authors, including L. Cominsky, Ap.J., **719**, pp. 1433-1444 (2010).

101) "Gamma-ray Light Curves and Variability of Bright Fermi-detected Blazars " A. Abdo and 171 authors, including L. Cominsky, Ap.J., **722**, pp. 520-542 (2010) .

102) "Fermi Large Area Telescope Observation of a Gamma-ray Source at the Position of Eta Carinae" A. Abdo and 168 authors, including L. Cominsky, Ap.J. **723**, pp. 649-657 (2010).

103) "Discovery of High-energy Gamma-ray Emission from the Binary System PSR B1259–63/LS 2883 around Periastron with Fermi" A. Abdo and 171 authors, including L. Cominsky, Ap.J., **736**, p. L15 (2011).

104) "Fermi Detection of a Luminous γ-Ray Pulsar in a Globular Cluster," P. Freire and 151 authors, including L. Cominsky, Science, Volume 334, Issue 6059, pp. 1107- (2011)

105) "Fermi Large Area Telescope Second Source Catalog" P. Nolan and 226 authors, including L. Cominsky, Ap. J. Supp., **199,** p. 31 (2012)

106) "A Multi-Institutional Investigation of Students' Preinstructional Ideas About Cosmology" Janelle M. Bailey, Roxanne Sanchez , Kim Coble, Donna Larrieu, Geraldine Cochran & Lynn R. Cominsky, Astronomy Education Review, 2012, AER, 11 (1), 010302, doi: http://dx.doi.org/10.3847/AER2012029

107) "Detection of the Characteristic Pion-Decay Signature in Supernova Remnants" Ackermann, M. and 168 authors, including L. Cominsky, Science, Volume 339, Issue 6121, pp. 807-811 (2013)

108) "Investigating Student Ideas about Cosmology I: Distances, Structure, and Composition of the Universe" Kim Coble, Carmen T. Camarillo, Melissa D. Nickerson, Laura E. Trouille, Janelle M. Bailey, Geraldine L. Cochran, & Lynn R. Cominsky, Astronomy Education Review, 2013, AER, 12 (1), 010102, doi:http://dx.doi.org/10.3847/AER2012038

109) "The Nuclear Spectroscopic Telescope Array (NuSTAR) High-energy X-Ray Mission" Fiona Harrison and 80 authors, including L. Cominsky, Ap.J. **770**, 103, 19 (2013).

110) "Investigating Student Ideas about Cosmology II: Composition of the Universe" Kim Coble, Melissa D. Nickerson, Carmen T. Camarillo, Janelle M. Bailey, Laura E. Trouille, Geraldine L. Cochran, & Lynn R. Cominsky, Astronomy Education Review 2013, AER, 12 (1), 010111, doi:http://dx.doi.org/10.3847/AER2012039

111) "Investigating Student Ideas about Cosmology III: Big Bang Theory, Expansion, Age and History of the Universe" Laura E. Trouille, Kim Coble, Carmen T. Camarillo, Melissa D.

Nickerson, Geraldine L. Cochran, Janelle M. Bailey, & Lynn R. Cominsky, Astronomy Education Review 2013, AER, 12 (1), 010110, doi:http://dx.doi.org/10.3847/AER2013016

112) “Associating Long-term γ-Ray Variability with the Superorbital Period of LS I +61°303” Ackermann, M.. and 128 co-authors including L. Cominsky, The Astrophysical Journal Letters, Volume 773, Issue 2, article id. L35, 7 pp. (2013)

113) “The Second Fermi Large Area Telescope Catalog of Gamma-Ray Pulsars” Abdo, A. and 154 co-authors including L. Cominsky, The Astrophysical Journal Supplement, Volume 208, Issue 2, article id. 17, 59 pp. (2013).

114) “The First Fermi-LAT Catalog of Sources above 10 GeV” Ackermann, M. and 158 co-authors including L. Cominsky, The Astrophysical Journal Supplement, Volume 209, Issue 2, article id. 34, 34 pp. (2013)

115) “The First Pulse of the Extremely Bright GRB 130427A: A Test Lab for Synchrotron Shocks” Preece, R. and 158 co-authors including L. Cominsky, Science, Volume 343, Issue 6166, pp. 51-54 (2014).

116) “Fermi-LAT Observations of the Gamma-Ray Burst GRB 130427A” Ackermann, M. and 181 co-authors including L. Cominsky, Science, Volume 343, Issue 6166, pp. 42-47 (2014)

117) “Search for gravitational wave ringdowns from perturbed intermediate mass black holes in LIGO-Virgo data from 2005-2010” Aasi, J. and 853 coauthors including L. Cominsky, Physical Review D, Volume 89, Issue 10, id.102006 (2014)

118) “The NINJA-2 project: detecting and characterizing gravitational waveforms modelled using numerical binary black hole simulations” Aasi, J. and 888 coauthors including L. Cominsky, Classical and Quantum Gravity, Volume 31, Issue 11, article id. 115004 (2014)

119) “Search for gravitational radiation from intermediate mass black hole binaries in data from the second LIGO-Virgo joint science run” Aasi, J. and 850 coauthors including L. Cominsky, Physical Review D, Volume 89, Issue 12, id.122003 (2014)

120) “Impulsive and Long Duration High-energy Gamma-Ray Emission from the Very Bright 2012 March 7 Solar Flares” Ajello, M. and 159 co-authors including L. Cominsky, The Astrophysical Journal, Volume 789, Issue 1, article id. 20, 15 pp. (2014).

121) “Methods and results of a search for gravitational waves associated with gamma-ray bursts using the GEO 600, LIGO, and Virgo detectors” Aasi, J. and 893 co-authors including L. Cominsky, Phys. Rev. D., Volume 89, Issue 12, id.122004 (2014)

122) “Search for Gravitational Waves Associated with γ-ray Bursts Detected by the Interplanetary Network” Aasi, J. and 901 co-authors including L. Cominsky, Phys. Rev. Lett., Volume 113, Issue 1, id.011102 (2014)

123) “Implementation of an F-statistic all-sky search for continuous gravitational waves in Virgo VSR1 data” Aasi, J. and 848 co-authors including L. Cominsky, Classical and Quantum Gravity, Volume 31, Issue 16, article id. 165014 (2014)

124) “First all-sky search for continuous gravitational waves from unknown sources in binary systems” Aasi, J. and 851 co-authors including L. Cominsky, Phys. Rev. D., Volume 90, Issue 6, id.062010 (9/2014)

125) “Narrow-band search of continuous gravitational-wave signals from Crab and Vela pulsars in Virgo VSR4 data” Aasi, J. and 898 co-authors including L. Cominsky, Phys. Rev. D, Volume 91, Issue 2, id.022004 (1/2015)

126) “Advanced LIGO” Aasi, J. and 702 co-authors including L. Cominsky Classical and Quantum Gravity, Volume 32, Issue 7, article id. 074001 (4/2015).

127) “Directed Search for gravitational waves from Scorpius X-1 with initial LIGO data” Aasi, J. and 901 co-authors including L. Cominsky, Physical Review D, Volume 91, Issue 6, id.062008 (3/2015)

128) “The LIGO Scientific Collaboration” Aasi, J. and 702 co-authors including L. Cominsky, Classical and Quantum Gravity, Volume 32, Issue 7, article id. 074001 (2015) 2015CQGra..32g4001T (4/2015)

129) “Fermi Large Area Telescope Third Source Catalog” Acero, F. and 171 co-authors including L. Cominsky, The Astrophysical Journal Supplement, Volume 218, Issue 2, article id. 23, 41 pp. (6/2015)

130) “The Third Catalog of Active Galactic Nuclei Detected by the Fermi Large Area Telescope” Ackermann, M. and 147 co-authors including L. Cominsky, The Astrophysical Journal, Volume 810, Issue 1, article id. 14, 34 pp. (8/2015).

131) “Searches for Continuous Gravitational Waves from Nine Young Supernova Remnants”, Aasi, J. and 893 co-authors including L. Cominsky, Ap. J., 813, Issue 1, article id. 39, 16 pp. (10/2015).

132) “2FHL: The Second Catalog of Hard Fermi-LAT Sources,” Ackermann, M. and 153 co-authors including L. Cominsky, Ap. J. Suppl. Volume 222, Issue 1, article id. 5, 19 pp. (1/2016)

133) “Astrophysical Implications of the Binary Black-hole Merger GW150914” Abbott, B.P. and 964 co-authors including L. Cominsky, Ap. J. Volume 818, Issue 2, article id. L22, 15 pp. (2/2016)

134) “Observation of Gravitational Waves from a Binary Black Hole Merger” Abbott, B. P. and 1003 co-authors including L. Cominsky, Phys. Rev. Lett., Volume 116, Issue 6, id.061102 (2/2016)

135) “Fermi-LAT Observations of High-Energy Gamma-Ray Emission toward the Galactic

Center" Ajello, M. and 113 co-authors including L. Cominsky, Ap. J. V olume 819, Issue 1, article id. 44, 30 pp. (2/2016).

136) "GW150914: Implications for the Stochastic Gravitational-Wave Background from Binary Black Holes" Abbott, B. P. and 949 co-authors including L. Cominsky, Phys. Rev. Lett., Volume 116, Issue 13, id.131102 (3/2016)

137) "GW150914: The Advanced LIGO Detectors in the Era of First Discoveries" Abbott, B. P. and 951 co-authors including L. Cominsky, Phys. Rev. Lett., Volume 116, Issue 13, id.131103 (3/2016)

138) "Resolving the Extragalactic γ -Ray Background above 50 GeV with the Fermi Large Area Telescope" Ackermann, M. and 128 co-authors including L. Cominsky, Physical Review Letters, Volume 116, Issue 15, id.151105 (4/2016)

139) "Fermi-LAT Observations of the LIGO Event GW150914" Ackermann, M. and 166 co-authors including L. Cominsky, Ap. J. L., Volume 823, Issue 1, article id. L2, 13 pp. (5/2016).

140) "The First Fermi LAT Supernova Remnant Catalog", Acero, F. and 160 co-authors including L. Cominsky, Ap. J. S., Volume 224, Issue 1, article id. 8, 50 pp. (5/2016)

141) "GW150914: First results from the search for binary black hole coalescence with Advanced LIGO" Abbott, B. P. and 981 co-authors including L. Cominsky, Physical Review D, Volume 93, Issue 12, id.122003 (6/2016)

142) "Observing gravitational-wave transient GW150914 with minimal assumptions" Abbott, B. P. and 969 co-authors including L. Cominsky, Physical Review D, Volume 93, Issue 12, id.122004 (6/2016)

143) "Search for transient gravitational waves in coincidence with short-duration radio transients during 2007-2013" Abbott, B. P. and 999 co-authors including L. Cominsky, Physical Review D, Volume 93, Issue 12, id.122008 (6/2016)

144) "High-energy neutrino follow-up search of gravitational wave event GW150914 with ANTARES and IceCube" Adrián-Martínez, S.. and 1400 co-authors including L. Cominsky, Physical Review D, Volume 93, Issue 12, id.122010 (6/2016)

145) "Tests of General Relativity with GW150914" Abbott, B. P. and 981 co-authors including L. Cominsky, Physical Review Letters, Volume 116, Issue 22, id.221101 (6/2016)

146) "Properties of the Binary Black Hole Merger GW150914" Abbott, B. P. and 989 co-authors including L. Cominsky, Physical Review Letters, Volume 116, Issue 24, id.241102 (6/2016)

147) "GW151226: Observation of Gravitational Waves from a 22-Solar-Mass Binary Black Hole Coalescence" Abbott, B. P. and 978 co-authors including L. Cominsky, Physical Review Letters, Volume 116, Issue 24, id.241103 (6/2016)

148) “Localization and Broadband Follow-up of the Gravitational-wave Transient GW150914” Abbott, B. P. and 1573 co-authors including L. Cominsky, Ap. J. L., Volume 826, Issue 1, article id. L13, 8 pp. (7/2016)

149) “Supplement: “Localization and Broadband Follow-up of the Gravitational-wave Transient GW150914” (2016, ApJL, 826, L13)” Abbott, B. P. and 1573 co-authors including L. Cominsky, Ap. J. S., Volume 225, Issue 1, article id. 8, 15 pp. (7/2016).

150) “Characterization of transient noise in Advanced LIGO relevant to gravitational wave signal GW150914” Abbott, B. P. and 965 co-authors including L. Cominsky, Classical and Quantum Gravity, Volume 33, Issue 13, article id. 134001 (7/2016).

151) “Comprehensive all-sky search for periodic gravitational waves in the sixth science run LIGO data” Abbott, B. P. and 965 co-authors including L. Cominsky, Physical Review D, Volume 94, Issue 4, id.042002 (8/2016)

152) “Binary Black Hole Mergers in the First Advanced LIGO Observing Run” Abbott, B. P. and 974 co-authors including L. Cominsky, Physical Review X, Volume 6, Issue 4, id.041015 (10/2016)

153) “First targeted search for gravitational-wave bursts from core-collapse supernovae in data of first-generation laser interferometer detectors” Abbott, B. P. and 968 co-authors including L. Cominsky, Physical Review D, Volume 94, Issue 10, id.102001 (11/2016)

154) “Results of the deepest all-sky survey for continuous gravitational waves on LIGO S6 data running on the Einstein@Home volunteer distributed computing project” Abbott, B. P. and 957 co-authors including L. Cominsky, Physical Review D, Volume 94, Issue 10, id.102002 (11/2016)

155) “Upper Limits on the Rates of Binary Neutron Star and Neutron Star-Black Hole Mergers from Advanced LIGO’s First Observing Run” Abbott, B. P. and 959 co-authors including L. Cominsky, Astrophysical Journal Letters, Volume 832, Issue 2, article id. L21, 15 pp. (12/2016)

156) “The Rate of Binary Black Hole Mergers Inferred from Advanced LIGO Observations Surrounding GW150914” Abbott, B. P. and 966 co-authors including L. Cominsky, Astrophysical Journal Letters, Volume 833, Issue 1, article id. L1, 8 pp. (12/2016)

157) “Supplement: “The Rate of Binary Black Hole Mergers Inferred from Advanced LIGO Observations Surrounding GW150914” (2016, ApJL, 833, L1) Abbott, B. P. and 966 co-authors including L. Cominsky, Astrophysical Journal Supplement, Volume 227, Issue 2, article id. 14, 11 pp. (12/2016)

158) “Exploring the sensitivity of next generation gravitational wave detectors” Abbott, B. P. and 722 co-authors including L. Cominsky, Classical and Quantum Gravity, Volume 34, Issue 4, article id. 044001 (2/2017)

159) “All-sky search for short gravitational-wave bursts in the first Advanced LIGO run”

Exploring the sensitivity of next generation gravitational wave detectors" Abbott, B. P. and 987 co-authors including L. Cominsky, Physical Review D, Volume 95, Issue 4, id.042003 (2/2017)

160) "Upper Limits on the Stochastic Gravitational-Wave Background from Advanced LIGO's First Observing Run" Abbott, B. P. and 996 co-authors including L. Cominsky, Physical Review Letters, Volume 118, Issue 12, id.121101 (3/2017)

161) "Directional Limits on Persistent Gravitational Waves from Advanced LIGO's First Observing Run" Abbott, B. P. and 997 co-authors including L. Cominsky, Physical Review Letters, Volume 118, Issue 12, id.121102 (3/2017)

162) "First Search for Gravitational Waves from Known Pulsars with Advanced LIGO" Abbott, B. P. and 1005 co-authors including L. Cominsky, Ap. J., Volume 839, Issue 1, article id. 12, 19 pp. (4/2017)

163) "Effects of waveform model systematics on the interpretation of GW150914" Abbott, B. P. and 1003 co-authors including L. Cominsky, Classical and Quantum Gravity, Volume 34, Issue 10, article id. 104002 (5/2017)

164) "Search for Gravitational Waves Associated with Gamma-Ray Bursts during the First Advanced LIGO Observing Run and Implications for the Origin of GRB 150906B" Abbott, B. P. and 1005 co-authors including L. Cominsky, Ap. J., 841, article id. 89, 18 pp., (6/2017)

165) "GW170104: Observation of a 50-Solar-Mass Binary Black Hole Coalescence at Redshift 0.2" Abbott, B. P. and 1050 co-authors including L. Cominsky, Physical Review Letters, Volume 118, Issue 22, id.221101 (6/2017)

166) "Search for intermediate mass black hole binaries in the first observing run of Advanced LIGO" Abbott, B. P. and 1042 co-authors including L. Cominsky, Physical Review D, Volume 96, Issue 2, id.022001, (7/2017)

167) "Search for high-energy neutrinos from gravitational wave event GW151226 and candidate LVT151012 with ANTARES and IceCube" Albert, A.. and 1416 co-authors including L. Cominsky, Physical Review D, Volume 96, Issue 2, id.022005, (7/2017)

168) "Fermi Observations of the LIGO Event GW170104" Goldstein, A. and 148 co-authors including L. Cominsky, Ap. J. L. Volume 846, Issue 1, article id. L5, 6 pp. (9/2017)

169) "Upper Limits on Gravitational Waves from Scorpius X-1 from a Model-based Cross-correlation Search in Advanced LIGO Data" Abbott, B. P. and 1048 co-authors including L. Cominsky, Ap. J., Volume 847, Issue 1, article id. 47, 14 pp. (9/2017)

170) "All-sky search for periodic gravitational waves in the O1 LIGO data" Abbott, B. P. and 1048 co-authors including L. Cominsky, Physical Review D, Volume 96, Issue 6, id.062002 (9/2017)

171) "Gravitational Waves and Gamma-Rays from a Binary Neutron Star Merger: GW170817

and GRB 170817A" Abbott, B. P. and 1155 co-authors including L. Cominsky, Ap. J. (Lett), Volume 848, Issue 2, article id. L13, 27 pp/ (10/2017)

172) "Multi-messenger Observations of a Binary Neutron Star Merger" Abbott, B. P. and 3673 co-authors including L. Cominsky, Ap. J. (Lett), Volume 848, Issue 2, article id. L12, 59pp. (10/2017)
173) "GW170817: Observation of Gravitational Waves from a Binary Neutron Star Inspiral"Abbott, B. P. and 1125 co-authors including L. Cominsky, Physical Review Letters, Volume 119, Issue 16, id.161101 (10/2017)

174) "GW170814: A Three-Detector Observation of Gravitational Waves from a Binary Black Hole Coalescence"B. P. and 1109 co-authors including L. Cominsky, Physical Review Letters, Volume 119, Issue 14, id.141101 (10/2017)

175) "A gravitational-wave standard siren measurement of the Hubble constant" Abbott, B. P. and 1313 co-authors including L. Cominsky, Nature, Volume 551, Issue 7678, pp. 85-88 (11/2017).

176) "Investigating Undergraduate Students' Ideas About the Fate of the Universe" Conlon, M., Coble, K., Bailey, J. M., and Cominsky, L. R. 2017. Physical Review Physics Education Research, Volume 13, Issue 2, id.020128 (12/2017)

177) "Search for High-energy Neutrinos from Binary Neutron Star Merger GW170817 with ANTARES, IceCube, and the Pierre Auger Observatory" Albert, A. and 1944 co-authors including L. Cominsky, 2017ApJ...850L..35A (12/2017)

178) "Estimating the Contribution of Dynamical Ejecta in the Kilonova Associated with GW170817" Abbott, B. P. and 1102 co-authors including L. Cominsky, 2017ApJ...850L..39A (12/2017)

179) "On the Progenitor of Binary Neutron Star Merger GW170817" Abbott, B. P. and 1097 co-authors including L. Cominsky, 2017ApJ...850L..40A (12/2017)

180) "Search for Post-merger Gravitational Waves from the Remnant of the Binary Neutron Star Merger GW170817" Abbott, B. P. and 1107 co-authors including L. Cominsky, 2017ApJ...851L..16A (12/2017)

181) "GW170608: Observation of a 19 Solar-mass Binary Black Hole Coalescence" Abbott, B. P. and 1104 co-authors including L. Cominsky, 2017ApJ...851L..35A (12/2017)

182) "First low-frequency Einstein@Home all-sky search for continuous gravitational waves in Advanced LIGO data" Abbott, B. P. and 1041 co-authors including L. Cominsky, 2017PhRvD..96l2004A (12/2017)

183) "First narrow-band search for continuous gravitational waves from known pulsars in advanced detector data" Abbott, B. P. and 1098 co-authors including L. Cominsky, 2017PhRvD..96l2006A (12/2017)

184) "Education and public outreach in astronomy and beyond" Lynn R. Cominsky, Nature Astronomy, Volume 2, p. 14-15 (1/2018)

185) "First Search for Nontensorial Gravitational Waves from Known Pulsars" Abbott, B. P. and 1053 co-authors including L. Cominsky, 2018PhRvL.120c1104A (1/2018)

186) "All-sky search for long-duration gravitational wave transients in the first Advanced LIGO observing run" Abbott, B. P. and 990 co-authors including L. Cominsky, 2018CQGra..35f5009A (3/2018)

187) "Effects of data quality vetoes on a search for compact binary coalescences in Advanced LIGO's first observing run" Abbott, B. P. and 959 co-authors including L. Cominsky, 2018CQGra..35f5010A (3/2018)

188) "Prospects for observing and localizing gravitational-wave transients with Advanced LIGO, Advanced Virgo and KAGRA" Abbott, B. P. and 1099 co-authors including L. Cominsky, Living Reviews in Relativity, Volume 21, Issue 1, article id. 3, 57 (4/2018)

189) "Constraints on cosmic strings using data from the first Advanced LIGO observing run" Abbott, B. P. and 1044 co-authors including L. Cominsky, Physical Review D, Volume 97, Issue 10, id.102002, 2018PhRvD..97j2002A (5/2018)

190) "Full band all-sky search for periodic gravitational waves in the O1 LIGO data" Abbott, B. P. and 1044 co-authors including L. Cominsky, Physical Review D, Volume 97, Issue 10, id.102003 2018PhRvD..97j2003A (5/2018)

191) "Search for Tensor, Vector, and Scalar Polarizations in the Stochastic Gravitational-Wave Background" Abbott, B. P. and 1100 co-authors including L. Cominsky, Physical Review Letters, Volume 120, Issue 20, id.201102 2018PhRvL.120t1102A (5/2018)

192) "Fermi-LAT Observations of LIGO/Virgo Event GW170817" Ajello, M. and 135 co-authors including L. Cominsky, The Astrophysical Journal, Volume 861, Issue 2, article id. 85, 10 pp. 2018ApJ...861...85A (7/2018)

193) "Search for Subsolar-Mass Ultracompact Binaries in Advanced LIGO's First Observing Run" Abbott, B. P. and 1138 co-authors including L. Cominsky, Physical Review Letters, Volume 121, Issue 23, id.231103 2018PhRvL.121w1103A (12/2018)

194) "Search for Multimessenger Sources of Gravitational Waves and High-energy Neutrinos with Advanced LIGO during Its First Observing Run, ANTARES, and IceCube" Albert, A. and 1593 co-authors including L. Cominsky, The Astrophysical Journal, Volume 870, Issue 2, article id. 134, 16 pp. 2019ApJ...870..134A (1/2019).

195) “A Fermi Gamma-Ray Burst Monitor Search for Electromagnetic Signals Coincident with Gravitational-wave Candidates in Advanced LIGO's First Observing Run” Burns, E. and 1163 co-authors including L. Cominsky, The Astrophysical Journal, Volume 871, Issue 1, article id. 90, 12 pp. 2019ApJ...871...90B (1/2019)

196) “Constraining the p -Mode-g -Mode Tidal Instability with GW170817” Abbott, B. P. and 1140 co-authors including L. Cominsky, Physical Review Letters, Volume 122, Issue 6, id.061104, 10.1103/PhysRevLett.122.061104 (2/2019)

197) “Search for Transient Gravitational-wave Signals Associated with Magnetar Bursts during Advanced LIGO’s Second Observing Run” Abbott, B. P. and 1120 co-authors including L. Cominsky, The Astrophysical Journal, Volume 874, Issue 2, article id. 163, 14 pp. 2019ApJ...874..163A (4/2019)

198) “Searches for Continuous Gravitational Waves from 15 Supernova Remnants and Fomalhaut b with Advanced LIGO” Abbott, B. P. and 1132 co-authors including L. Cominsky, The Astrophysical Journal, Volume 875, Issue 2, article id. 122, 15 pp. 2019ApJ...875..122A (4/2019).

199) “Search for Gravitational Waves from a Long-lived Remnant of the Binary Neutron Star Merger GW170817” Abbott, B. P. and 1141 co-authors including L. Cominsky, The Astrophysical Journal, Volume 875, Issue 2, article id. 160, 19 pp. 2019ApJ...875..160A (4/2019).

200) “Low-latency Gravitational-wave Alerts for Multimessenger Astronomy during the Second Advanced LIGO and Virgo Observing Run” Abbott, B. P. and 1131 co-authors including L. Cominsky, The Astrophysical Journal, Volume 875, Issue 2, article id. 161, 20 pp. 2019ApJ...875..161A (4/2019).

201) “First Measurement of the Hubble Constant from a Dark Standard Siren using the Dark Energy Survey Galaxies and the LIGO/Virgo Binary–Black-hole Merger GW170814” Abbott, B. P. and 1204 co-authors including L. Cominsky, The Astrophysical Journal Letters, Volume 876, Issue 1, article id. L7, 15 pp. 2019ApJ...876L...7S (5/2019).

202) “All-sky search for long-duration gravitational-wave transients in the second Advanced LIGO observing run” Abbott, B. P. and 113 co-authors including L. Cominsky, Physical Review D, Volume 99, Issue 10, id.104033, 10.1103/PhysRevD.99.104033 (5/2019)

203) “Narrow-band search for gravitational waves from known pulsars using the second LIGO observing run” Abbott, B. P. and 1137 co-authors including L. Cominsky, Physical Review D, Volume 99, Issue 12, id.122002, 10.1103/PhysRevD.99.122002 (6/2019)
204) “Searches for Gravitational Waves from Known Pulsars at Two Harmonics in 2015-2017 LIGO Data” Abbott, B. P. and 1153 co-authors including L. Cominsky, The Astrophysical Journal, Volume 879, Issue 1, article id. 10, 28 pp. (7/2019).

205) "All-sky search for continuous gravitational waves from isolated neutron stars using Advanced LIGO O2 data" Abbott, B. P. and 1141 co-authors including L. Cominsky, Physical Review D, Volume 100, Issue 2, id.024004 doi:10.1103/PhysRevD.100.024004 (7/2019)

206) "All-sky search for short gravitational-wave bursts in the second Advanced LIGO and Advanced Virgo run" Abbott, B. P. and 1141 co-authors including L. Cominsky, Physical Review D, Volume 100, Issue 2, id.024017 10.1103/PhysRevD.100.024017 (7/2019)

207) "Tests of General Relativity with GW170817" Abbott, B. P. and 1149 co-authors including L. Cominsky, Physical Review Letters, Volume 123, Issue 1, id.011102, doi:10.1103/PhysRevLett.123.011102 (7/2019)

208) "GWTC-1: A Gravitational-Wave Transient Catalog of Compact Binary Mergers Observed by LIGO and Virgo during the First and Second Observing Runs" Abbott, B. P. and 1150 co-authors including L. Cominsky, Physical Review X, Volume 9, Issue 3, id.031040 10.1103/PhysRevX.9.031040 (7/2019)

209) "Binary Black Hole Population Properties Inferred from the First and Second Observing Runs of Advanced LIGO and Advanced Virgo" Abbott, B. P. and 1140 co-authors including L. Cominsky, The Astrophysical Journal Letters, Volume 882, Issue 2, article id. L24, 30 pp. (9/2019)

210) "Search for the isotropic stochastic background using data from Advanced LIGO's second observing run" Abbott, B. P. and 1135 co-authors including L. Cominsky, Physical Review D, Volume 100, Issue 6, id.061101 10.1103/PhysRevD.100.061101 (9/2019)

211) "Directional limits on persistent gravitational waves using data from Advanced LIGO's first two observing runs" Abbott, B. P. and 1134 co-authors including L. Cominsky, Physical Review D, Volume 100, Issue 6, id.062001 10.1103/PhysRevD.100.062001 (9/2019)

212) "Search for intermediate mass black hole binaries in the first and second observing runs of the Advanced LIGO and Virgo network" Abbott, B. P. and 1198 co-authors including L. Cominsky, Physical Review D, Volume 100, Issue 6, id.064064 10.1103/PhysRevD.100.064064 (9/2019)

213) "Search for Eccentric Binary Black Hole Mergers with Advanced LIGO and Advanced Virgo during Their First and Second Observing Runs" Abbott, B. P. and 1185 co-authors including L. Cominsky, The Astrophysical Journal, Volume 883, Issue 2, article id. 149, 10 pp. (10/2019).

214) "Search for Subsolar Mass Ultracompact Binaries in Advanced LIGO's Second Observing Run" Abbott, B. P. and 1189 co-authors including L. Cominsky, Physical Review Letters, Volume 123, Issue 16, id.161102 10.1103/PhysRevLett.123.161102 (10/2019)

215) "Search for Gravitational-wave Signals Associated with Gamma-Ray Bursts during the Second Observing Run of Advanced LIGO and Advanced Virgo" Abbott, B. P. and 1198 co-

authors including L. Cominsky, The Astrophysical Journal, Volume 886, Issue 1, article id. 75, 15 pp. (11/2019)

216) “Tests of general relativity with the binary black hole signals from the LIGO-Virgo catalog GWTC-1” Abbott, B. P. and 1144 co-authors including L. Cominsky, Physical Review D, Volume 100, Issue 10, id.104036, 10.1103/PhysRevD.100.104036 (11/2019)

217) “Search for gravitational waves from Scorpius X-1 in the second Advanced LIGO observing run with an improved hidden Markov model” Abbott, B. P. and 1136 co-authors including L. Cominsky, Physical Review D, Volume 100, Issue 12, id.122002 10.1103/PhysRevD.100.122002 (12/2019)

218) “Model comparison from LIGO─Virgo data on GW170817's binary components and consequences for the merger remnant” Abbott, B. P. and 1199 co-authors including L. Cominsky, Classical and Quantum Gravity, Volume 37, Issue 4, id.045006 (2/20)

219) “A guide to LIGO-Virgo detector noise and extraction of transient gravitational-wave signals” Abbott, B. P. and 1137 co-authors including L. Cominsky, Classical and Quantum Gravity, Volume 37, Issue 5, id.055002 (3/20)

220) “Fermi Large Area Telescope Fourth Source Catalog” Abdollahi, S. and 168 co-authors including L. Cominsky, The Astrophysical Journal Supplement Series, Volume 247, Issue 1, id.33 (3/20)

221) “GW190425: Observation of a Compact Binary Coalescence with Total Mass $\sim 3.4\ M_\odot$” Abbott, B. P. and 1199 co-authors including L. Cominsky, The Astrophysical Journal Letters, Volume 892, Issue 1, id.L3 (3/20)

222) “Utilizing Small Telescopes Operated by Citizen Scientists for Transiting Exoplanet Follow-up” Zellem, R. and 43 co-authors including L. Cominsky, PASP, Volume 132, Issue 1011, id.054401 (5/20)

223) “Prospects for observing and localizing gravitational-wave transients with Advanced LIGO, Advanced Virgo and KAGRA” Abbott, B. P. and 1321 co-authors including L. Cominsky, Living Reviews in Relativity, Volume 23, Issue 1, article id.3, (9/20)

224) “Gamma-Ray Universe” by Lynn Cominsky, Sky and Telescope, Vol. 140, No. 4, p.22, (10/20).

225) “A Gravitational-wave Measurement of the Hubble Constant Following the Second Observing Run of Advanced LIGO and Virgo” Abbott, B. P. and 1182 co-authors including L. Cominsky, The Astrophysical Journal, Volume 909, Issue 2, id.218, 18 pp (3/21).

226) VizieR Online Data Catalog: Search for GW signals associated with GRBs Abbott, B. P. and 1190 co-authors including L. Cominsky,VizieR On-line Data Catalog: J/ApJ/886/75. Originally published in: 2019ApJ...886...75A (4/21)

227) “Using Scientific and Engineering Practices with Education Technology in the Science Classroom” Cominsky, L., Lewiston, C., Peticolas, L. and Hellman, H. (2023) https://stem.educationtechnologyinsights.com/cxoinsights/using-scientific-and-engineering-practices-with-education-technology-in-the-science-classroom-nid-2265.html

228) “Teaching for Tomorrow: Science Literacy in The Classroom” The Science Teacher (2024), Hellman, H., Peticolas, L., and Cominsky, L. (2024) in press.

Invited Talks or Colloquia to Scientific or General Audiences

1) Baltimore, Maryland (1981), *Recent Observations of X-Ray Burst Sources*, invited talk presented at the Symposium of the American Physical Society, Division of Cosmic Physics and American Astronomical Society High Energy Astrophysics Division on Cosmic X-ray sources, April 21, 1981.

2) Berkeley, California (1981), *X-Ray Bursts and the Eddington Limit Problem*, Theoretical Astrophysics Seminar, University of California, Berkeley, October 20, 1981.

3) San Francisco, California (1981), *X-Ray Bursts and the Eddington Limit Problem*, Physics Colloquium, San Francisco State University, November 23, 1981.

4) Rohnert Park, California (1982), *X-Ray Bursts and the Eddington Limit*, invited lecture in the What Physicists Do public lecture series, Sonoma State University, March 8, 1982.

5) Sacramento, California (1982), *X-Ray Bursts and the Eddington Limit*, Physics and Astronomy Department Colloquium, California State University at Sacramento, March 1982.

6) San Francisco, California (1982), *X-Ray Astronomy*, invited lecture to the San Francisco Amateur Astronomers, California Academy of Sciences, August 18, 1982.

7) Rohnert Park, California (1983), *Galactic X-Ray Sources*, guest lecture in Astronomy 305 Sonoma State University, April 11, 1983.

8) Sacramento, California (1983), *X-Ray Astronomy*, invited lecture to the Sacramento Valley Astronomical Society, June 18, 1983.

9) Greenbelt, Maryland (1983), *Periodic Intensity Dips from the X-ray Burst Source MXB1659-29*, invited lecture at the NASA Goddard Space Flight Center Laboratory for High Energy Astrophysics, August 8, 1983.

10) Berkeley, California (1983), *Remote Observing with the U. C. Ten Meter Telescope*, invited lecture to the Astronomy Journal Club, University of California, Berkeley, September 9, 1983.

11) Berkeley, California (1983), *Eclipses and Physical Parameters of an X-ray Burst Source*, Astronomy Department Colloquium, University of California, Berkeley, September 29, 1983.

12) La Jolla, California (1983), *A Low Cost Approach to EUVE Mission Operations*, invited lecture at the California Space Institute Conference on “Low Cost Approaches to Space Exploitation", October 4, 1983.

13) Seattle, Washington (1983), *Eclipses and Physical Parameters of the X-ray Burster MXB1659-29,* Astronomy Department Colloquium, University of Washington, November 16, 1983.

14) Cambridge, Massachusetts (1984), *Discovery of Periodicity in the X-ray Burster MXB1659-29*, High Energy Astrophysics Division Colloquium, Harvard-Smithsonian Center for Astrophysics, February 8, 1984.

15) Davis, California (1984), *Eclipses and Physical Parameters of an X-ray Burst Source,* Physics Department Colloquium, University of California, Davis, May 1, 1984.

16) Davis, California (1985), *X-ray Burst Sources,* guest lecture in Astronomy class at University of California, Davis, May 13, 1985.

17) Rohnert Park, California (1986), *Extreme Ultra-Violet Astronomy,* invited lecture in the What Physicists Do public lecture series, Sonoma State University, February 10, 1986.

18) Rohnert Park, California (1986), *Black Holes and Quasars: X-ray Visions from the Edges of the Universe,* Sonoma State University Science Night, November 5, 1986.

19) Rohnert Park, California (1987), *Visions of the Universe from Space: X-ray Astronomy,* Association of North Bay Scientists Annual Meeting, Sonoma State University, May 2, 1987.

20) Rohnert Park, California (1987), *Basic Physics of Nuclear Bombs and Missiles*, invited lecture in the War and Peace public seminar series, Sonoma State University, September 29, 1987.

21) Santa Rosa, California (1987), *X-ray Astronomy,* invited lecture to the Sonoma County Astronomical Society, December 8, 1987.

22) Huntsville, Alabama (1988), *Observations and Calculations of X-ray and γ-ray Burst Reprocessing*, High Energy Astrophysics Colloquium, NASA Marshall Space Flight Center, January 15, 1988.

23) Noordwijk, Holland (1988), *The Eclipsing X-ray Burst Source MXB1659-29,* EXOSAT Colloquium, European Space Agency ESTEC, March 29, 1988.

24) Santa Rosa, California (1988), *Arms Control and Disarmament,* United Nations Day, Santa Rosa Junior College, May 7, 1988.

25) Rohnert Park, California (1988), *Basic Physics of Nuclear Bombs and Missiles*, invited lecture in the War and Peace public seminar series, Sonoma State University, September 27, 1988.

26) Fresno, California (1988), *X-ray Visions from the Edge of the Universe*, invited lecture for the California State University Fresno Open House, CSU Fresno, October 16, 1988.

27) Fresno, California (1988), *Arms Control and Disarmament*, Physics Department Colloquium, California State University Fresno, October 16, 1988.

28) Santa Rosa, California (1989), *SSU Radio Interferometer Telescope*, invited lecture to the Sonoma County Astronomical Society, December 13, 1989.

29) Foster City, California (1989), *X-ray Visions of the Universe*, invited lecture to the San Mateo County Astronomical Society, April 6, 1989.

30) Rohnert Park, California (1989), *Basic Physics of Bombs and Missiles*, invited lecture in the War and Peace public seminar series, October 3, 1989.

31) Oakland, California (1989), *X-ray Visions of the Universe*, invited lecture to the East Bay Astronomical Society, Chabot Observatory, December 2, 1989.

32) Moscow, Idaho (1990), *An Overview of X-ray Binary Systems*, Leonard Halland Guest Lecturer, Physics Department Colloquium, University of Idaho, January 25, 1990.

33) Mount Tamalpais, California (1990), *X-ray Visions of the Universe*, invited lecture to the Mount Tamalpais Astronomical Society public lecture series, June 23, 1990.

34) Rohnert Park, California (1990), *Nuclear Weapons Systems*, invited lecture in the War and Peace public seminar series, Sonoma State University, October 16, 1990.

35) Rohnert Park, California (1990), *Binary X-ray Pulsars*, invited lecture in the What Physicists Do public lecture series, Sonoma State University, October 29, 1990.

36) Rohnert Park, California (1991), *Nuclear Weapons Systems*, invited lecture in the War and Peace public seminar series, Sonoma State University, October 22, 1991.

37) San Francisco, California (1992), *X-ray Visions of the Universe*, invited lecture in the Exploring the Universe public seminar series, Morrison Planetarium, May 19, 1992.

38) Rohnert Park, California (1992), *Nuclear Weapons Systems*, invited lecture in the War and Peace public seminar series, Sonoma State University, October 6, 1992.

39) Huntsville, Alabama (1992), *What We Can Learn about High Energy X-ray Transients Using BATSE*, invited lecture at the Space Sciences Laboratory, NASA Marshall Space Flight Center, October 29, 1992.

40) Pasadena, California (1993), *What We Can Learn about High Energy X-ray Transients Using BATSE*, invited lecture at the California Institute of Technology, January 12, 1993.

41) Stanford, California (1993), *An X-ray Emitting Radio Pulsar in a Be-binary system*, Center for Space Sciences and Astrophysics Colloquium, Stanford University, November 11, 1993.

42) Berkeley, California (1993), *An X-ray Emitting Radio Pulsar in a Be-binary system*, invited lecture at the Center for Extreme Ultra-violet Astrophysics, University of California, Berkeley, November 12, 1993.

43) Stanford, California (1994), *X-ray Binary Pulsars*, Stanford Linear Accelerator Center Colloquium, Stanford University, February 7, 1994.

44) Snowmass, Colorado (1994), *Dynamic Measurements of Stellar Mass Black Hole Candidates*, invited lecture at the Snowmass Summer Institute on Particle Physics, Astrophysics and Cosmology, July 8, 1994.

45) Stanford, California (1994), *X-ray Emission from Be-binaries*, invited lecture at the 7th annual
Marcel Grossman Conference on General Relativity, July 26, 1994.

46) San Francisco, California (1995), *Astrophysics at the Stanford Linear Accelerator Center*, invited lecture to the Physics and Astronomy department of San Francisco State University, February 10, 1995.

47) Rohnert Park, CA (1995), *Nuclear Weapons, Nuclear Power and the Environment*, invited lecture in the War and Peace public seminar Series, Sonoma State University, October 10, 1995.

48) Rohnert Park, CA (1996), *X-ray and Gamma-ray Visions of the Universe*, invited lecture to the
Sonoma County Superintendents of Schools, Sonoma State University, May 9, 1996.

49) Stanford, CA (1996), *The Gamma-ray Large Area Space Telescope*, invited lecture to the Stanford Linear Accelerator Center User's Organization Annual Meeting, Stanford University, June 6, 1996.

50) Rohnert Park, CA (1996), *Nuclear Weapons, Nuclear Power and the Environment*, invited lecture in the War and Peace public seminar Series, Sonoma State University, October 8, 1996.

51) Rohnert Park, CA (1997), *GLAST: a Keener Eye for the Gamma-ray Sky*, invited lecture in the
What Physicists Do public lecture series, Sonoma State University, September 22, 1997.

52) Santa Rosa, CA (1997), *Tapestry of Women's Lives*, invited presentation to the Sonoma County
Commission on the Status of Women and the League of Women Voters, November 20, 1997.

53) Berkeley, CA (1998), *GLAST: the Quest for the Ultimate Sources of Energy in the Universe*, invited lecture at the Lawrence Berkeley National Laboratory, March 6, 1998.

54) Stanford, CA (1998), *X-ray Emission from Compact Sources*, XXVI SLAC Summer Institute on Particle Physics, *Gravity: From the Hubble Length to the Planck Length,* two invited lectures on August 3 – 4, 1998.

55) Rohnert Park, CA (1998), *Using X-ray Emission from Compact Objects to Study Gravity,* two lectures in the What Physicists Do public lecture series, September 21 and 28, 1998.

56) Rohnert Park, CA (1998), *Weapons of Mass Destruction,* invited lecture in the War and Peace public seminar series, Sonoma State University, October 13, 1998.

57) Mt. Tamalpais, CA (1998), *The New Gamma-ray Astronomy*, invited lecture in the Mt. Tamalpais Astronomical Society public lecture series, October 17, 1998.

58) Santa Rosa, CA (1998), Women in Tapestry Project, invited lecture to Sonoma County Commission on the Status of Women, October 28, 1998.

59) San Francisco, CA (1999) *The New Gamma-ray Astronomy,* invited lecture at the San Francisco Amateur Astronomers, August 18, 1999.

60) Stanford, CA (1999), *Gamma-ray Visions of the Universe,* invited lecture to the Women's Interchange at SLAC, September 28, 1999.

61) Rohnert Park, CA (1999), *Nuclear, Biological and Chemical Weapons,* invited lecture in the War and Peace public seminar series, Sonoma State University, October 5, 1999.

62) Rohnert Park, CA (1999) *NASA Education and Public Outreach at Sonoma State University*, invited talk in the EPO session at Cosmic Genesis and Fundamental Physics Conference, October 28, 1999.

63) Sacramento, CA (1999), *Using X-ray Emission from Compact Objects to Test General Relativity,* invited lecture to the CSUS Physics Department, November 11, 1999

64) Greenbelt, MD (1999) *NASA Education and Public Outreach at Sonoma State University*, invited talk in the SEU Forum Town Meeting, December 14, 1999.

65) Rohnert Park, CA (2000) *Nuclear, Biological and Chemical Weapons*, invited lecture in the War and Peace public seminar series, Sonoma State University, October 3, 2000.

66) Eugene, OR (2001) *GLAST: Exploring the High Energy Universe where Particle Physics and Astrophysics Collide,* physics colloquium at the University of Oregon, February 22, 2001

67) Santa Rosa, CA (2001) Keynote address to Sonoma County Office of Education's Astronomy and Space Symposium, March 2, 2001.

68) Berkeley, CA (2001) *Gamma-ray Astronomy Missions and their use of a Global Telescope Network*, invited lecture at the Global Hands On Universe conference, July 27, 2001

69) Rohnert Park, CA (2001) *Nuclear, Biological and Chemical Weapons*, invited lecture in the War and Peace public seminar series, Sonoma State University, October 9, 2001.

70) Bowling Green, KY (2001) *GLAST: Exploring the High Energy Universe where Particle Physics and Astrophysics Collide*, physics colloquium at Western Kentucky University, November 9, 2001

71) Los Altos, CA (2001) *Exploding Stars, Blazing Galaxies and Giant Black Holes: the Extreme Universe of Gamma-ray Astronomy,* invited lecture in the Silicon Valley Astronomy Lecture Series, Foothill College, November 14, 2001

72) Coral Gables, FL (2001) *How X-ray Experiments See Black Holes: Past, Present and Future,* invited lecture at the 30th Coral Gables Conference on Cosmology and Particle Physics, December 14, 2001.

73) Santa Rosa, CA (2002) *Exploding Stars, Blazing Galaxies and Giant Black Holes: the Extreme Universe of Gamma-ray Astronomy,* invited lecture to the Sonoma County Astronomical Society, February 13, 2002

74) San Francisco, CA (2002) *Exploding Stars, Blazing Galaxies and Giant Black Holes: the Extreme Universe of Gamma-ray Astronomy,* invited lecture to the San Francisco Amateur Astronomers, August 21, 2002

75) Rohnert Park, CA (2003) *Physics of Nuclear Weapons*, invited lecture to the Northern California-Nevada section of the American Association of Physics Teachers, April 4, 2003

76) Rohnert Park, CA (2003) *Weapons of Mass Destruction*, invited lecture in the War and Peace public seminar series, Sonoma State University, September 30, 2003.

77) Rohnert Park, CA (2003) “The Extreme Universe of Gamma-ray Astronomy” public lecture at Sonoma State University, October 3, 2003.

77) Rohnert Park, CA (2003) “Things My Mother Never Told Me About the Universe” invited focus lecture in the What Physicists Do Series, October 6, 2003.

78) Long Beach, CA (2003) “Things My Mother Never Told Me About the Universe” invited focus lecture at the California Science Teacher’s Association Meeting, October 11, 2003.

79) Gilbert, Arizona (2004) “Einstein’s Universe and Beyond” invited lecture in the Mission and Technology Series, Spectrum Astro Inc., January 15, 2004.

80) San Francisco, CA (2005) “Exploding Stars, Blazing Galaxies and Monstrous Black Holes: The Extreme Universe of Gamma-ray Astronomy” Benjamin Dean Lecture for California Academy of Sciences, January 24, 2005

81) San Francisco, CA(2005) “A Swift View of the Universe” invited physics colloquium at University of San Francisco, February 23, 2005

82) Las Cruces, NM (2005) “A Swift View of the Universe” invited keynote address at the Third HEA/AAVSO Workshop, March 20, 2005

83) Holton, Kansas (2005) “Exploding Stars, Blazing Galaxies and Monstrous Black Holes: the Extreme Universe of Gamma-ray Astronomy” public lecture at Holton High School, Kansas, April 16, 2005.

84) San Francisco, CA (2005) “A Swift View of the Universe” invited physics colloquium at San Francisco State University, April 25, 2005.

85) San Francisco, CA (2005) “A Swift View of the Universe” invited talk to San Francisco Amateur Astronomers meeting at the Randall Museum, (June 15, 2005)

86) Santa Rosa, CA (2005) “Swift View of the Universe” invited talk to Santa Rosa Kiwanis Club, (July 5, 2005)

87) Santa Rosa, CA (2005) “Einstein’s Universe and Beyond” Invited lecture at Santa Rosa Junior College Arts and Lecture Series, (October 10, 2005)

88) Rohnert Park, CA (2005) “Weapons of Mass Destruction”
Invited lecture in the War and Peace seminar series, Sonoma State University, (October 18, 2005)

89) Rohnert Park, CA (2006) “A High-Energy Life” Invited lecture at Osher Lifelong Learning Institute course on Notable Women Scientists of the 20th Century and Beyond, (January 18, 2006)

90) Rohnert Park, CA (2006) “Einstein’s Universe and Beyond” What Physicists Do lecture series (March 13. 2006)

91) Rohnert Park, CA (2006) “Weapons of Mass Destruction” Invited lecture in the War and Peace seminar series, Sonoma State University, (October 17, 2006)

92) Santa Cruz, CA (2006) “High-Energy Education and Public Outreach” at the Santa Cruz Institute for Particle Physics, UC Santa Cruz, (November 28, 2006)

93) San Francisco, CA (2006) “Bringing Real-time Astronomical Observations into the Classroom,” invited lecture at the American Geophysical Union Conference, (December 11, 2006)

94) Napa, CA (2007) “A High-Energy Life,” invited lecture to Zonta International (April 28, 2007)

95) Rohnert Park, CA (2007) “Weapons of Mass Destruction and Global Climate Change,” invited lecture in “On Common Ground” lecture series, Sonoma State University, (May 10, 2007)

96) Sebastopol, CA (2007) “Black Holes: Up Close and Personal.” invited lecture/demonstration at the Science Buzz Café, (July 19, 2007)

97) Chicago, IL (2007) “Making of Black Holes: The Other Side of Infinity” invited lecture at the Adler Planetarium during the Astronomical Society of the Pacific Education and Public Outreach conference, (September 7, 2007)

98) Rohnert Park, CA (2007) “Physics of Nuclear Weapons,” Invited lecture in the War and Peace seminar series, Sonoma State University, (October 2, 2007)

99) Portland, Oregon (2007) “Einstein’s Universe and Beyond” Invited lecture at Reed College, (October 3, 2007)

100) Santa Rosa, CA (2007) “Einstein’s Universe and Beyond” Invited lecture to the Sonoma County Astronomical Society (December 12, 2007)

101) Mountain View, CA (2008) **“**Exploring the Extreme Universe with ~~GLAST~~ Fermi” Invited lecture to the SETI Institute (August 27, 2008)

102) Palo Alto, CA (2008**)** **“**Exploring the Extreme Universe with ~~GLAST~~ Fermi” Invited lecture to the Women’s Interchange at SLAC (September 24, 2008)

103) Rohnert Park, CA (2008) “Weapons of Mass Destruction” Invited lecture in the War and Peace seminar series, Sonoma State University (October 7, 2008)

104) Santa Rosa, CA (2009) **“**Exploring the Extreme Universe with Fermi” Invited lecture to the Santa Rosa Kiwanis Club (March 17, 2009)

105) San Francisco, CA (2009) “Exploring the Extreme Universe with Fermi” Invited lecture in Astronomy Lecture Series: City College of San Francisco (March 18, 2009)

106) Rohnert Park, CA (2009) “Exploring the Extreme Universe with Fermi” Invited lecture in What Physicists Do Colloquium Series: Sonoma State University (March 23, 2009)

107) Santa Rosa, CA (2009) **“**Exploring the Extreme Universe with Fermi” Invited lecture to the Sons in Retirement (Oakmont) Club (April 22, 2009)

107) Mill Valley, CA (2009) “Exploring the Extreme Universe with Fermi” Invited lecture in Mt. Tamalpais Lecture Series (June 27, 2009)

108) Sebastopol, CA (2009) “Exploring the Extreme Universe with Fermi” Invited lecture in “Women of Science & Culture” series (August 13, 2009)

109) Venice, Italy (2009) “Exploring the Extreme Universe with Fermi” Invited public lecture following the “Shocking Universe meeting” (September 19, 2009)

110) “Weapons of Mass Destruction” invited lecture in the War and Peace seminar series, Sonoma State University (October 9, 2009)

111) San Francisco, CA (2009) “Exploring the Extreme Universe with Fermi” Benjamin Dean lecture at the California Academy of Sciences (October 19, 2009)

112) Healdsburg, CA (2010) “Exploring the Extreme Universe with Fermi” invited lecture at Healdsburg High School (March 29, 2010)

113) San Quentin, CA (2010) “Seeing the Invisible” invited lecture to New Leaf program, San Quentin Prison (May 28, 2010).

114) Rohnert Park, CA (2010) “How do we know?” invited lecture to the Hutchins School, Sonoma State University (September 17, 2010)

115) Rohnert Park, CA (2010) “Weapons of Mass Destruction” invited lecture in the War and Peace seminar series, Sonoma State University (October 5, 2010)

116) San Francisco, CA (2010) “Exploring the Extreme Universe with Fermi” invited lecture at San Francisco Amateur Astronomers, Randall Museum (November 17, 2010)

117) Santa Rosa, CA (2010) “What do we know about the Universe?” invited lecture to the Oakmont Sunday Symposium Series, (December 12, 2010)

118) San Francisco, CA (2011) “Exploring the Extreme Universe with Fermi” invited lecture at University of San Francisco (February 9, 2011)

119) Santa Rosa, CA (2011) “Exploring the Extreme Universe with Fermi” invited lecture at Sonoma County Amateur Astronomers (April 13, 2011)

120) Petaluma, CA (2011) “Exploring the Extreme Universe with Fermi” invited lecture at Petaluma Historical Museum BEYOND exhibit (June 11, 2011)

121) Santa Rosa, CA (2011) “Things my mother never told me about the Universe” invited lecture to the No Name Women’s group (June 15, 2011)

122) Rohnert Park, CA (2011) “What do we know about the Universe?” invited lecture to the Hutchins School, Sonoma State University (September 2, 2011)

123) Rohnert Park, CA (2011) “Weapons of Mass Destruction” invited lecture in the War and Peace seminar series, Sonoma State University (October 11, 2011)

124) Fresno, CA (2011) “Exploring the Extreme Universe with Fermi” invited lecture at CSU Fresno Physics Colloquium (December 2, 2011)

125) Santa Rosa, CA (2011) “Things My Mother never told me about the Universe”
Benefit lecture for the Children’s Museum of Sonoma County (December 8, 2011)

126) Stanford, CA (2012) Panel on Communicating Science to the Public, invited participation at Undergraduate Women in Physics conference (January 14, 2012)

127) Rohnert Park, CA (2012) “Weapons of Mass Destruction” invited lecture in the War and Peace seminar series, Sonoma State University (September 25, 2012)

128) Rohnert Park, CA (2012) “NASA Education and Public Outreach at SSU” invited lecture in the What Physicists Do series, Sonoma State University (October 8, 2012)

129) Santa Clara, CA (2013) “Small Satellites for Secondary Students” invited lecture at the West Coast National Association of Rocketry conference (Feb. 22, 2013)
http://www.youtube.com/watch?v=eAfH1QC7VFQ

130) Terra Linda, CA (2013) **“**Exploring the Extreme Universe with Fermi” invited lecture as part of the Marin Science Seminar Series, (March 6 , 2013)

131) Corte Madera (2013) **“**Exploring the Extreme Universe with Fermi” invited lecture as part of the “Read Marin” series (March 7, 2013)

132) Santa Rosa, CA (2013) “Extreme X-ray Astronomy with NuSTAR” invited lecture to the Sonoma County Astronomical Society (May 7, 2013)

133) Rohnert Park, CA (2013) “Leadership of Complex Organizations” invited talk to University 238 class, SSU, (March 11, 2013)

134) Online (2013) “High Energy Astronomy” invited webinar to the Night Sky Network (May 21, 2013)

135) Rohnert Park, CA (2013) “Weapons of Mass Destruction” invited lecture in the War and Peace seminar series, Sonoma State University (September 23, 2013)

136) Concord, CA (2013) “S4: Small Satellites for Secondary Students”
Keynote talk at AAPT/NCN section at Carondelet High School, Concord, (November 16, 2013)

137) San Francisco, CA (2013) “NuSTAR’s Sharp View of the Universe” invited talk to San Francisco Amateur Astronomers (December 18, 2013).

138) Washington, DC (2014) “Blazars and Gamma Rays” invited talk to Amateur astronomers at the Winter AAS meeting (Jan. 7, 2014)

139) Mountain View, CA (2014) “Rockets, Balloons and Satellites” invited talk at the California Space Grant Consortium meeting at NASA Ames Research Center (March 28, 2014)

140) Rohnert Park, CA (2014) “Learning by Making: Rockets, Satellites and More” invited talk at the Osher Lifelong Learning Institute Science Club (April 15, 2014)

141) Sebastopol, CA (2014) “Learning by Making: Rockets, Satellites and More” invited talk at the Science Buzz Cafe (April 17, 2014)

142) Santa Rosa, CA (2014) “Blazing Galaxies, Exploding Stars and Monstrous Black Holes: High Energy Visions of the Universe” invited talk at the Oakmont Symposium (May 8, 2014) http://www.oaksunsym.org/2014/140508_cominsky/cominsky.html

143) Internet lecture “Learning by Making: Rockets, Satellites and More” invited talk at the AAPT-AOK meeting, Arkansas (September 26, 2014)

144) Mt. Tamalpais, CA (2014) “NuSTAR’s Sharper View of the Universe” invited lecture in the Mt. Tamalpais Astronomy program series (September 27, 2014)

145) Rohnert Park, CA (2014) “Science of War (and Peace)” invited lecture in the War and Peace seminar series, Sonoma State University (September 30, 2014)

146) Terra Linda, CA (2014) “NuSTAR’s Sharper View of the Universe” invited lecture in the Marin Science Seminar series (November 12, 2014)

147) Greenbelt, MD (2015) “Learning by Making: Rockets, Satellites and More” invited talk at NASA Goddard Space Flight Center (February 18, 2015)

148) Santa Rosa, CA (2015) “Next Generation Science Standards and Learning by Making” invited talk at “No-Name” Women’s group (March 12, 2015)

149) Rohnert Park, CA (2015) “Science of War (and Peace)” invited lecture in the War and Peace seminar series, Sonoma State University (September 29, 2015)

150) Rohnert Park, CA (2015) “High Energy Life” invited lecture in the Outstanding Women in Science course for Osher Lifelong Learning Institute (October 6, 2015)

151) San Francisco, CA (2015) “High Energy Visions of the Universe” invited physics colloquium at University of San Francisco (October 8, 2015)

152) Santa Rosa, CA (2015) “High Energy Visions of the Universe” invited talk at Evening Rotary Club of Santa Rosa (October 13, 2015)

153) New Orleans, LA (2016) “Big Ideas and Big Science in the Classroom” invited talk at AAPT (January 12, 2016).

154) Sacramento, CA (2016) “Gravitational Waves from Merging Black Holes” invited talk at CSU Sacramento (February 25, 2016).

155) Rohnert Park, CA (2016) “Gravitational Waves from Merging Black Holes” invited talk at What Physicists Do (March 21, 2016).
https://www.youtube.com/watch?v=5TpKXeTYBMg&t=1472s

156) Santa Rosa, CA (2016) “High Energy Life” invited lecture at the Star Seekers STEAM awards presentation at the Sixth Street Playhouse, Santa Rosa, CA (April 1, 2016)

157) Santa Rosa, CA (2016) “Art and Science of the Environment” invited panel discussion at the Sonoma County History Museum, Santa Rosa, CA (April 19, 2016)

158) Hayward, CA (2016) “Gravitational Waves from Merging Black Holes” invited talk at CSU East Bay (April 22, 2016).

159) Ukiah, CA (2016) “Extreme Visions of the Universe” invited talk at the Ukiah Civic Center, (May 6, 2016) – advertised in the Ukiah Daily Journal http://www.ukiahdailyjournal.com/lifestyle/20160503/sonoma-state-astronomers-bring-science-to-ukiah

160) Newport, RI (2016) “Exploring Gravitational Waves in the Classroom” invited talk at the Gordon Research and Education Conference (June 6, 2016)

161) Santa Rosa, CA “Learning by Making”, invited talk at reMake Education conference (August 4, 2016)

161) Santa Rosa, CA – “Spacetime Symphony: Gravitational Waves from Merging Black Holes,” invited talk to Sonoma County Amateur Astronomers (September 14, 2016)

162) San Francisco, CA – “Spacetime Symphony: Gravitational Waves from Merging Black Holes,”invited talk to San Francisco Amateur Astronomers (September 20, 2016) https://slideslive.com/38898414/spacetime-symphony-gravitational-waves-from-merging-black-holes

163) Rohnert Park, CA (2016) “Science of War (and Peace)” invited lecture in the War and Peace seminar series, Sonoma State University (September 27, 2016)

164) Los Altos Hills, CA (2016) “Spacetime Symphony: Gravitational Waves from Merging Black Holes” Invited lecture in the Silicon Valley Lecture Series (November 2, 2016) https://www.youtube.com/watch?v=mbiCbBXVD-U&list=PLeZsNwyz9KyG5zY2GTzrBGgul55f_cNnL

165) “Spacetime Symphony: APOD and Gravitational Waves” Cominsky, Lynn R., Simonnet, Aurore and the LIGO-Virgo Scientific Collaboration, American Astronomical Society, Invited lecture in special APOD session, AAS Meeting #229, id.421.04, 2017AAS...22942104C (1/2017)

166) Oakland, CA (2017) “ Gravitational Waves from Merging Binaries: Invited talk at the East Bay Astronomical Society, Chabot Space Center, (February 11, 2017)

167) Boston, MA (2017) “Exploring Gravitational Waves in the Classroom” Invited talk at the AAAS meeting in the “Communicating the Wonder and Excitement of LIGO” session (February 19, 2017) https://aaas.confex.com/aaas/2017/meetingapp.cgi/Paper/18866

168) Santa Barbara (2017) “Exploring Gravitational Waves in the Classroom” Invited talk at the Kavli Institute for Theoretical Physics (March 25, 2017)

169) Santa Rosa, CA “Learning by Making”, invited talk at reMake Education conference (August 3, 2017)

170) Adelaide, Australia, "Building the STEM Pipeline with Rockets, UAVs and CubeSats" Frank J. Malina Education prize lecture at the International Astronautical Congress (September 14, 2017)

171) Rohnert Park, CA (2017) “Nuclear Weapons and North Korea” invited lecture in the War and Peace seminar series, Sonoma State University (September 19, 2017)

172) Cotati, CA (2017) “Gravitational Waves from Merging Binaries” invited lecture at the sitting room, (November 11, 2017)

173) Chico, CA (2018) “Gravitational Waves from Merging Binaries” invited lecture at Chico State University (Feb 23, 2018)

174) Ukiah, CA (2018) “Gravitational Waves from Merging Binaries” invited lectures to four classes at Ukiah High School State (March 1, 2018)

175) Rohnert Park, CA (2018) “Gravitational Waves from Merging Binaries” invited lecture at Sonoma State (March 26, 2018)

176) Arcata, CA (2018) “Gravitational Waves from Merging Binaries” invited lecture at Humboldt State University (April 19, 2018)

177) Walnut Creek, CA (2018) “Gravitational Waves from Merging Binaries” invited lecture at Mt. Diablo Astronomical Society (April 24, 2018)

178) Taipei, Taiwan, "Learning by Making, Rockets, Satellites and More", invited public lecture at the Academia Sinica Institute for Astronomy and Astrophysics (May 15, 2018).

179) Kinmen, Taiwan, "High Energy Views of the Universe", invited education keynote lecture at the annual meeting of the Astronomical Society of the Republic Of China (May 20, 2018)

180) Santa Rosa, CA “Learning by Making”, invited talk at reMake Education conference (August 2, 2018)

181) Pacific Grove, CA “Spacetime Symphony: Gravitational Waves from Merging Compact Binaries” invited talk at Phi Beta Kappa Northern California meeting (Feb. 16, 2019)

182) Washington, DC “How Working on Uhuru Changed My Life” invited talk at the Riccardo Giacconi Memorial Symposium in DC, May 30, 2019

183) Greenbelt, MD "XMM-Newton Education and Public Outreach" invited talk at the 20th anniversary celebration of the launch of XMM-Newton (October 21, 2019)

184) Rohnert Park, CA "An Introduction to the Science of Nuclear Weapons" keynote lecture at the Northern California MENSA annual meeting (November 23, 2019)

185) Online: "Spacetime Symphony: Gravitational Waves from Merging Compact Binaries**"** invited and recorded talk for the National Science Olympiad https://chandra.harvard.edu/edu/olympiad.html (August 2020)

186) Online: "How Working on Uhuru Changed My Life" invited talk at the Uhuru 50th Anniversary Symposium (December 11, 2020)

187) Online: "Spacetime Symphony: Gravitational Waves from Merging Compact Binaries**"** for the Robert Ferguson Observatory/Valley of the Moon Observing Association (July 9, 2021)

188) Jamestown, NY "Spacetime Symphony: Gravitational Waves from Merging Compact Binaries**"** for the Martz/Kohl Observatory (October 16, 2021)

189) Online: Gravitational Waves:The Discovery that won the 2017 Nobel Prize, for the University of San Francisco (February 16, 2022)

190) Online: Gravitational Waves: The Discovery that won the 2017 Nobel Prize, for the Mt. Tam Astronomical Society via zoom on June 4, 2022.

191) Online: Video presentation in session: Innovations in Rural Education: EIR Grants at Work in a Community Near You, Cominsky, L., Peticolas, L. and Rohde, C., National Rural Educators Association, October 2022 https://youtu.be/KPCjhTXKN78

192) Online: Panelist in STEM for All Multiplex Webinar "Embracing Neurodiversity in STEM" January 24, 2023 archived at: https://multiplex.videohall.com/month_themes/24

193) Online: Presenter in Stanford University's Neurodiversity Network for Education and Advocacy Seminar series, February 9, 2023, archived at: https://youtu.be/6_R7cZy3gfs

194) Online: "Gravitational Waves: The Discovery that won the 2017 Nobel Prize", for the University of Michigan Osher Lifelong Learning Institute via zoom on April 6, 2023.

195) Online: Presenter to Astronomers without Borders "Learning about Neurodiversity and NASA's Neurodiversity Network, April 19, 2023, archived at: https://youtu.be/tvk_3gG0nXk

196) Online: Presenter to the Wisconsin Multi-messenger Diversity Network "Neurodiversity in the Workplace" April 21, 2023, archived at: https://drive.google.com/file/d/1Ag--EX8iUCYJbMQy084VoB7i0A_UcFPf/view

197) Online: Presenter to Peer One-to-one Network, "NASA's Neurodiversity Network" July 17, 2023

198) Online: “Science of War and Peace” for the University of Michigan Osher Lifelong Learning Institute via zoom on November 30, 2023. https://drive.google.com/file/d/1y2AVj9wD3JBlpRfl-0Ro9tYGixJhEuAE/view?usp=drive_link

199) Sebastopol, CA “Gravitational Waves: The Discovery that won the 2017 Nobel Prize”, for the Science Buzz Café, January 15, 2024.

Conference Presentations

1) “Transient X-ray Sources in the Galactic Plane”, L. Cominsky, C. Jones, and W. Forman, *Bulletin of the American Astronomical Society*, **9**, 318, 1977.

2) “SAS-3 Observations of 4U0115+63”, S. Rappaport, G. W. Clark, L. Cominsky, P. Joss, and F. Li, *Bulletin of the American Astronomical Society*, **10**, 434, 1978.

3) “Recent Observational Results on X-Ray Burst Sources”, H. Marshall, L. Cominsky, J. van Paradijs, J. Hoffman, G. Jernigan, W. Wheaton, and W. H. G. Lewin, *Bulletin of the American Astronomical Society*, **10**, 420, 1978.

4) “Search for Eclipses and Periodicities in the ‘Steady’ Emission from X-ray Sources”, L. Cominsky, H. Marshall, F. Li, J. van Paradijs, and W. H. G. Lewin, *Bulletin of the American Astronomical Society*, **10**, 516, 1978.

5) “Search for Spectral Changes in the ‘Steady’ Emission of X-ray Burst Sources”, J. van Paradijs, L. Cominsky, and W. H. G. Lewin, *Bulletin of the American Astronomical Society*, **10**, 515, 1978.

6) “SAS-3 Observations of the Transient X-ray Burst Source MXB1659-29”, W. H. G. Lewin, J. van Paradijs, L. Cominsky, and W. Ossmann, *Bulletin of the American Astronomical Society*, **10**, 515, 1978.

7) “Discovery of Optical Bursts from an X-ray Burst Source, MXB1735-44”, J. McClintock, J. Grindlay, C. Canizares, J. van Paradijs, L. Cominsky, F. Li, and W. H. G. Lewin, *Bulletin of the American Astronomical Society*, **10**, 514, 1978.

8) “Optical/X-ray Bursts from MXB1636-53”, L. Cominsky, W. H. G. Lewin, J. G. Jernigan, J. Doty, H. Pedersen, M. Oda and the Hakucho Team, and J. van Paradijs, *Bulletin of the American Astronomical Society*, **11**, 720, 1980.

9) “Extremely Similar Multiple Peaked Burst Structure from Three X-ray Burst Sources”, J. Hoffman and L. Cominsky, *Bulletin of the American Astronomical Society*, **11**, 719, 1980.

10) “Very Long Type II Bursts from the Rapid Burster”, E. Basinska, W. Lewin, L. Cominsky, J. van Paradijs, and F. Marshall, *Bulletin of the American Astronomical Society*, **11**, 720, 1980.

11) “The 1980 Optical Outburst of 4U0115+63”, L. Cominsky, G. Kriss, S. Rappaport, R. Remillard, G. Williams, and J. Thorstensen, *Bulletin of the American Astronomical Society*, **13**,

900, 1982.

12) "Optical Radiation Associated with Cosmic γ-ray Bursts", R. A. London and L. R. Cominsky, *Bulletin of the American Astronomical Society*, **14**, 867, 1982.

13) "Simultaneous Optical and X-ray Burst Observations from 4U/MXB1636-53", H. Inoue et al., *Bulletin of the American Astronomical Society*, **14**, 891, 1982.

14) "Calculations of Time-dependent X-ray and γ–ray Reprocessing", L. Cominsky, R. I. Klein, and R. A. London, *Bulletin of the American Astronomical Society*, **16**, 468, 1984.

15) "Science Operations and Data Analysis for the Extreme Ultra-Violet Explorer" L. R. Cominsky, H. L. Marshall and C. A. Dobson, *Bulletin of the American Astronomical Society*, **17**, 900, 1986.

16) "Further Observations of MXB 1659-29", L. R. Cominsky and K. S. Wood, *Bulletin of the American Astronomical Society*, **18**, 919, 1987.

17) Taos, New Mexico (1987), "Applications of the Reprocessing Code to X-ray and Optical Bursts", presented at the Conference on Multi-wavelength Astrophysics, sponsored by the Los Alamos National Laboratory, August, 1987.

18) "Virtual Microprocessor Applications", presented at the Northern California Section meeting of the American Association of Physics Teachers, October 29, 1988.

19) "Multi-mission Observations of 4U1538-52", L. Cominsky, *Bulletin of the American Astronomical Society*, **20**, 1044, 1989.

20) "The Sonoma State University Very Small Array", G. Sprehn and L. Cominsky, *Bulletin of the American Astronomical Society*, **23**, 1451, 1991.

21) "Motorization and Computer Control of the Sonoma State University Very Small Array", G. Sprehn, B. Owen and L. Cominsky, *Bulletin of the American Astronomical Society*, **25**, 810, 1993.

22) "An April 1991 Outburst from 4U0115+63 Observed by BATSE", M. Roberts, L. Cominsky, and M. Finger, *Bulletin of the American Astronomical Society*, **25**, 911, 1993.

23) "Detection of X-rays from the Be-star/Radio Pulsar PSR 1259-63", L. Cominsky, M. Roberts and S. Johnston, *Bulletin of the American Astronomical Society*, **25**, 912, 1993.

24) "Observations of Neutron Stars with EUVE", H. Marshall, and L. Cominsky, *Bulletin of the American Astronomical Society*, **25**, 918, 1993.

25) "The Orbital Period of EXO0748-676: Secular Change or Stochastic Jitter? ", P. Hertz, K. Wood and L. R. Cominsky, *Bulletin of the American Astronomical Society*, **25**, 1380, 1993.

26) “Yes, There Are Jobs in Astronomy”, J. S. Tenn, L. R. Cominsky and G. G. Spear, *American Assocation of Physics Teachers Announcer*, **23**, 50, 1993.

27) “The Very Small Array Sky Survey”, M. Roberts, N. Owen, G. Spear and L. Cominsky, *Bulletin of the American Astronomical Society*, **26**, 859, 1994.

28) “HEAO A-1 Archival Observations of Galactic X-ray Binaries”, L. Cominsky, M. Roberts, A. Lee and D. Segel, *Bulletin of the American Astronomical Society*, **26**, 872, 1994.

29) “The 1994 Large Outburst from 4U0115+63 Observed with BATSE”, L. Cominsky, M. Roberts and M. Finger, *Bulletin of the American Astronomical Society*, **27**, 1434, 1995.

30) “Detection of an Apparent Orbital Period Change in the Low Mass X-ray Binary EXO 0748-676”, P. Hertz, K. Wood and L. Cominsky, *Bulletin of the American Astronomical Society*, **28**, 1328, 1996.

31) “ASCA Observations of 4U 1907+09”, M. Roberts, P. Michelson and L. Cominsky, *Bulletin of the American Astronomical Society*, **29**, 731, 1997.

32) “ASCA observations of the radio pulsar/be star binary system PSR B1259-63”, V. M. Kaspi, M. M. Hirayama, F. Nagase, L. Cominsky and M. Tavani, *Advances in Space Research*, Volume **21**, 223, 1998.

33) “Initial Results from the USA Experiment on ARGOS”, K. S. Wood, G. Fritz, P. L. Hertz, W. N. Johnson, M. N. Lovellette, P. S. Ray, M. T. Wolff, R. Bandyopadhyay, E. D. Bloom, C. Chaput, G. Godfrey, P. Saz Parkinson, G. Shabad, P. Michelson, M. Roberts, D. A. Leahy, L. Cominsky, J. Scargle, J. Beall, D. Chakrabarty, and Y. Kim, *Bulletin of the American Astronomical Society*, **31**, 740 and 1001, 1999.

34) “Early Science Results from the USA Experiment”, P. Hertz, K. S. Wood, G. Fritz, M. Kowalski, W. N. Johnson, M. N. Lovellette, P. S. Ray, M.T. Wolff, D. Yentis, R. M. Bandyopadhyay, E. D. Bloom, B. Giebels, G. Godfrey, K. Reilly, P. Saz Parkinson, G. Shabad, P. Michelson, M. Roberts , D.A. Leahy (Calgary), L. Cominsky, J. Scargle, J. Beall, and D. Chakrabarty, Y. Kim, *Bulletin of the American Astronomical Society*, **32**, 1425, 1999.

35) “The Swift MIDEX Education and Public Outreach Program”, E. D. Feigelson, L. R. Cominsky and L. A. Whitlock, *Bulletin of the American Astronomical Society*, **32**, 1526, 1999.

36) “The Teacher Ambassador Program for NASA’s GLAST Mission”, Lynn R. Cominsky & Laura A. Whitlock, *AAPT Announcer*, **30**, 89, 2000

37) “Space Mysteries for Science Education”, Lynn R. Cominsky, Laura A. Whitlock, Tim Graves and Sarah Silva, *AAPT Announcer*, **30**, 89, 2000

38) “High-energy Bursts of Math and Science,” Laura A. Whitlock, Eric Feigelson, Lisa Brown and Lynn Cominsky, *AAPT Announcer*, **30**, 89, 2000

39) “Space Mysteries: Making Science and Astronomy Learning Fun,” P. Plait, T. Graves and L. Cominsky, *Eos Trans. AGU, 82*(47), Fall Meet. Suppl., Abstract ED32A-02, 2001

40) “The GLAST Telescope Network,” John Mattox, Gordon Spear and Lynn Cominsky, *Bulletin of the American Astronomical Society*, **33**, 1222, 2001

41) “Space Mysteries: Innovative Web-based Games for Teaching Math and Science,” Lynn Cominsky and Philip Plait, presented at the National Science Teacher’s Association Meeting, March 29, 2002.

42) “GLAST Educator Ambassadors” Lynn Cominsky and Philip Plait, presented at the NASA Office of Space Science Education Conference, June 11-14, 2002

43) “Space Mysteries: Innovative Web-based Games for Teaching Math and Science,” Lynn Cominsky, presented at the California Science Teacher’s Association Meeting, October, 2002.

44) “GEMS Invisible Universe from Radio Waves to Gamma Rays,” L. Cominsky, S. Silva and T. Graves, presented at the AAPT-NCN meeting, November 2, 2002

45) “The GTN-AAVSO Blazar Program,” G. Spear, J. Mattei, A. Price, T. Graves, T. Borders, G. Slater, and L. Cominsky, *Bulletin of the American Astronomical Society*, 2002AAS...201.5309S

46) “NASA GLAST EPO,” L. Cominsky and S. Silva, presented at the AAPT-NCN meeting, April 5, 2002

47) “Far Out Math,” L. Cominsky and M. Ford, presented at the National Council for Teachers of Mathematics, April 12, 2003

48) “NASA’s Swift Education and Public Outreach Program,” P. Plait, S. Silva, T. Graves, A. Simonnet, and L. Cominsky, *Bulletin of the American Astronomical Society*, 2003AAS...202.1017P

49) “GEMS: Invisible Universe from Radio Waves to Gamma-rays” workshop at the California Science Teacher’s Association Meeting, October 11, 2003 (with Sarah Silva.)

50) “Sorting Out the Cosmic Zoo” workshop at the California Science Teacher’s Association Meeting, October 11, 2003 (with Phil Plait.)

51) “The Utilization of the RCT Telescope for Studies of Blazar Continuum Emission during the GLAST Gamma-Ray Mission,” J. R. Mattox, L. Cominsky, G. Spear, M. Carini, R. Gelderman, C.H. McGruder, E. Guinan, S. Howell, D. R. Davis, M. Everett, and D. K. Walter, *Bulletin of the American Astronomical Society*, 2003AAS...202.4305M

52) “XMM-Newton Education and Public Outreach Program,” P. Plait, S. Silva, T. Graves, A. Simonnet, G. Spear, G. Slater, T. Borders, and L. Cominsky, *Bulletin of the American Astronomical Society*, 2003AAS...20311812P

53) “Observing Blazar Variability: The GTN-AAVSO Collaboration,” G. Spear, A. Price, P. Plait, T. Graves, L. Cominsky, J. Mattei, *Bulletin of the American Astronomical Society*, 2004AAS...204.3513S

54) “Swift and the GTN” at the Swift team meeting, held in New Orleans in conjunction with the HEAD meeting,

55) “NASA’s Swift Education and Public Outreach Program” Lynn Cominsky, Phil Plait, Tim Graves, Sarah Silva, and Aurore Simonnet. *Bulletin of the American Astronomical Society*, 2004HEAD....8.2703C

56) “The SEU Educator Ambassador Program.” S. Silva, L. Cominsky, P. Plait, J. Lochner, and N. Leon, *Bulletin of the American Astronomical Society*, 2004HEAD....8.2707S

57) “The GTN-AAVSO Blazar Program” L. R. Cominsky, G. G. Spear, T. Graves, G. Slater and A. Price, *Bulletin of the American Astronomical Society*, 2004HEAD 8.2702C

58) “XMM-Newton Education and Public Outreach Program” P. Plait, S. Silva, T. Graves, A. Simonnet and L. Cominsky, *Bulletin of the American Astronomical Society*, 2004HEAD 8.2701P

59) “DUO: the Dark Universe Observatory” R. Griffiths and 35 co-authors including L. Cominsky, Proceedings of the SPIE, Volume 5488, pp. 209-221 (2004).

60) “ The GLAST Education and Public Outreach Program” P. Plait, T. Graves, S. Silva, A. Simonnet, G. Spear and L. Cominsky, *Bulletin of the American Astronomical Society,* 2004AAS...205.9606P

61) “A Comparison of several commonly available software systems for aperture photometry with applications to photometry of blazers” T. Graves, G. Spear, K. McLin, P. Plait, L. Cominsky, GLAST Education and Public Outreach Team, *Bulletin of the American Astronomical Society,* 2005AAS...207.2904G

62) “GRB 050904: the oldest cosmic explosion ever observed in the Universe” G. Cusamano and 32 authors including L. Cominsky in Gamma-Ray Bursts in the Swift Era, Sixteenth Maryland Astrophysics Conference, held 29 November - 2 December, 2005 in Washington, DC. Edited by S.S. Holt, N. Gehrels, and J.A. Nousek. AIP Conference Proceedings, Vol. 836. Melville, NY: American Institute of Physics, 2006., p.564-569

63) “Dying Stars And The Birth Of The Elements: A Laboratory Exercise From Project Clea And XMM-Newton” L. Marschall, G. Snyder, P. Cooper, P. Plait, L. Cominsky, T. Graves and S. Silva, *Bulletin of the American Astronomical Society*, 2006AAS...208.1701M

64) “The SNAP Education and Public Outreach Program” L. Cominsky, P. Plait, S. Silva on behalf of the SNAP Collaboration, *Bulletin of the American Astronomical Society*, 2006AAS...209.9406C

65) “The eXtreme Universe: A Portable Planetarium Program”, P. Plait, S. Silva, T. Graves, J. Reed and L. Cominsky, *Bulletin of the American Astronomical Society*, 2006AAS...209.9604P

66) “Beyond the Event Horizon: Education with Black Holes,” S. Silva, P. Plait and L. Cominsky, *Bulletin of the American Astronomical Society,* 2006AAS...20915314S

67) “Teaching In-Service and Pre-Service Teachers Modern Cosmology, Part I: A Concept Inventory”, Kevin M. McLin, & L. R. Cominsky, *Bulletin of the American Astronomical Society*, 2007AAS...211.3106M

68) “High School Observations of AGN Using the GTN,” Kevin M. McLin, R. Jordon, A. Perkins, J. Adkins & L. Cominsky, *Bulletin of the American Astronomical Society,* 2008HEAD...10.2631M

69) “The Global Telescope Network,” K. McLin, G. Spear & L. Cominsky, in *EPO and a Changing World: Creating Linkages and Expanding Partnerships ASP Conference Series, Vol. 389,* proceedings of the conference held 5-7 September 2007, in Chicago, Illinois, USA. Edited by Catharine Garmany, Michael G. Gibbs, and J. Ward Moody. San Francisco: Astronomical Society of the Pacific, 2080., p.89, 2008ASPC..389...89M

70) “A Proposed Student Built and Operated Satellite: The Gamma Ray Burst Polarization Observer (PolOSat),” B. Malphrus et al. including L. Cominsky and 12 other co-authors, *Bulletin of the American Astronomical Society,* 2009AAS...21347603M

71) “Epo's Chronicles: A Weekly Webcomic That Teaches Space Science,” L. Cominsky, K. Prasad, A. Simonnet, K. John, K. McLin & L. Hill, *Bulletin of the American Astronomical Society*, 2009AAS...21346407C

72) “Transforming Introductory Astronomy in the Urban University,” Kimberly A. Coble, M. Sabella, D. Larrieu, J. McDowell, R. Orlanzino, L. Cominsky & K. McLin, *Bulletin of the American Astronomical Society,* 2009AAS...21346206C

73) “Undergraduate Research Experiences with the Global Telescope Network,” K. McLin, K. Wyman, N. Broughton, K. Coble, & L.R. Cominsky, *Bulletin of the American Astronomical Society,* 2009AAS...21346102M

74) “Photometry Of The Semi-regular Variable Tx Tau” Katherine Wyman, G. Spear, K. McLin, L. Cominsky, L. Mankiewicz, D. Reichart & K. Ivarsen, *Bulletin of the American Astronomical Society,* 2009AAS...21360205W

75) “Probing Student Understanding of Cosmology,” Kimberly A. Coble, G. Cochran, D. Larrieu, J. Bailey, R. Sanchez, L. Cominsky, & K. McLin, *Bulletin of the American Astronomical Society*, 2010AAS...21546614C

76) “The NuSTAR Education and Public Outreach Program” L. Cominsky, K. McLin and the NuSTAR team, *Bulletin of the American Astronomical Society,* 2010AAS...21546506C

77) “The NuSTAR Education and Public Outreach Program” L. Cominsky, K. McLin and the NuSTAR team, *Bulletin of the American Astronomical Society,* 2010AAS...HEAD

78) “Using the Big Ideas in Cosmology to Teach College Students” K. Coble, J. Bailey, G. Cochran, V. Hayes, D. Larrieu, R. Sanchez, K. McLin and L. Cominsky, *Bulletin of the American Astronomical Society,* 2010AAS...21641605C.

79) “The Nuclear Spectroscopic Telescope Array (NuSTAR)” Fiona Harrison, and 33 authors including L. Cominsky, Space Telescopes and Instrumentation 2010: Ultraviolet to Gamma Ray. Edited by Arnaud, Monique; Murray, Stephen S.; Takahashi, Tadayuki. Proceedings of the SPIE, Volume 7732, pp. 77320S-77320S-8 (2010).

80) “Using Telescopic Observations to Explore the Science of AGN with High School Students” K. M. McLin & L.R. Cominsky, American Geophysical Union Fall Meeting, 2010AGUFMED53A0528M.

81) “Investigating Student Understanding of the Universe: Perceptions of Astronomical Sizes and Distances” C. Camarillo, K. Coble, V. Hayes, M. Nickerson, G.L. Cochran, J. M. Bailey, K. M. McLin & L. R. Cominsky, *Bulletin of the American Astronomical Society,* 2011AAS...21833305C.

82) “Investigating Student Understanding of the Universe: Structure” V. Hayes, K. Coble, M. Nickerson, G. Cochran, C.T. Camarillo, J. M. Bailey, K. M. McLin, & L. R. Cominsky, *Bulletin of the American Astronomical Society,* 2011AAS...21833304H.

83) “Investigating Student Understanding of the Universe: Age and Expansion” K. Coble, G. Cochran, V. Hayes, M. Nickerson, C. Camarillo, J. M. Bailey, K. M. McLin & L. R. Cominsky, *Bulletin of the American Astronomical Society,* 2011AAS...21833303C.

84) “Investigating Student Understanding of the Universe: Dark Matter” M. Nickerson, K. Coble, G. Cochran, V. Hayes, C. Camarillo, J. M. Bailey, K. M. McLin, & L. R. Cominsky, *Bulletin of the American Astronomical Society,* 2011AAS...21833302N.

85) “Dark Energy is "Dying” and Other Student Ideas About Cosmology” J. M. Bailey, K. Coble, G. Cochran, R. Sanchez, D. Larrieu, V. L. Hayes, M. Nickerson, L. R. Cominsky, L. R. & K. M. McLin, *Bulletin of the American Astronomical Society,* 2011AAS...21833301B.

86) “The Big Ideas in Cosmology: a Curriculum for College Students” K. Coble, K. M. McLin, A. Metevier, J. M. Bailey, & L. R. Cominsky, *Bulletin of the American Astronomical Society,* 2011AAS...21821507C .

87) “Using the Big Ideas in Cosmology to Teach College Students” L. R. Cominsky, K. M. McLin, K. Coble, J. M. Bailey, & A. J. Metevier, *Bulletin of the American Physical Society,* BAPS.2011.APR.R12.4.

88) “Dark energy is “dying,” and other student ideas about cosmology” Bailey, J. M., Coble, K., Cochran, G., Sanchez, R., Larrieu, D., Hayes, V. L., Nickerson, V., McLin, K. M., & Cominsky, L. R., Invited talk at the 2011 Winter Meeting of the American Association of Physics Teachers, Jacksonville, FL, 10 January 2011.

89) “The big ideas in cosmology: a curriculum for college students” Coble, K., McLin, K. M., Metevier, A. J., Bailey, J. M., & Cominsky, L. R. Invited talk at the 2011 Winter Meeting of the American Association of Physics Teachers, Jacksonville, FL, 10 January 2011.

90) “Investigating student understanding of the universe: Age and expansion” Cochran, G. L., Coble, K., Hayes, V. L., Nickerson, M., Bailey, J. M., McLin, K. M., & Cominsky, L. R. Poster at the 2011 Winter Meeting of the American Association of Physics Teachers, Jacksonville, FL, 10 January 2011.

91) “Investigating student understanding of the universe: Structure” Hayes, V. L., Coble, K., Nickerson, M., Cochran, G. L., Bailey, J. M., McLin, K. M., & Cominsky, L. R., Poster at the 2011 Winter Meeting of the American Association of Physics Teachers, Jacksonville, FL, 10 January 2011.

92) “Investigating student understanding of the universe: Dark Matter,” Nickerson, M., Coble, K., Cochran, G. L., Hayes, V. L., Bailey, J. M., McLin, K. M., & Cominsky, L. R., Poster at the 2011 Winter Meeting of the American Association of Physics Teachers, Jacksonville, FL, 10 January 2011.

93) “Investigating student understanding of cosmology,” Coble, K., Bailey, J. M., Cochran, G. L., Hayes, V. L., Nickerson, M. D., Larrieu, D., Sanchez, R., Metevier, A. J., McLin, K. M., & Cominsky, L. R., Poster at the 4th IUPAP International Conference on Women in Physics, Stellenbosch, Western Cape, South Africa, 4-8 April 2011

94) “Investigating student understanding of the universe: Age and expansion” Cochran, G. L., Coble, K., Hayes, V. L., Nickerson, M., Bailey, J. M., McLin, K. M., & Cominsky, L. R., Poster at the American Association of Physics Teachers Chicago Section Spring Meeting, Niles West High School, Skokie, IL 60077, 9 April 2011

95) “Investigating student understanding of the universe: Structure,” Hayes, V. L., Coble, K., Nickerson, M. D., Cochran, G. L., Camarillo, C. T., Bailey, J. M., McLin, K.M., & Cominsky, L. R., Poster at the American Association of Physics Teachers Chicago Section Spring Meeting, Niles West High School, Skokie, IL 60077, 9 April 2011

96) “Investigating student understanding of the universe: Dark Matter” Nickerson, M. D., Coble, K., Cochran, G. L., Hayes, V. L., Camarillo, C. T., Bailey, J. M., McLin, K.M., & Cominsky, L. R., Poster at the American Association of Physics Teachers Chicago Section Spring Meeting, Niles West High School, Skokie, IL 60077, 9 April 2011

97) “Investigating student understanding of the universe: Age and expansion” Cochran, G. L., Coble, K., Hayes, V. L., Nickerson, M., Bailey, J. M., McLin, K. M., & Cominsky, L. R., Poster at the National Society of Black Physicists/National Society of Hispanic Physicists joint meeting, Austin, TX, 21 - 24 Sept 2011

98) “Investigating student understanding of the universe: Perceptions of astronomical sizes and distances,” Camarillo, C. T., Coble, K., Hayes, V. L., Nickerson, M. D., Cochran, G. L., Bailey, J. M., McLin, K.M., & Cominsky, L. R., Poster at the National Society of Black Physicists/National Society of Hispanic Physicists joint meeting, Austin, TX, 21 - 24 Sept 2011

99) “Investigating student understanding of the universe: Structure,” Hayes, V. L., Coble, K., Nickerson, M. D., Cochran, G. L., Camarillo, C. T., Bailey, J. M., McLin, K.M., &

Cominsky, L. R., Poster at the National Society of Black Physicists/National Society of Hispanic Physicists joint meeting, Austin, TX, 21 - 24 Sept 2011

100) “Investigating student understanding of the universe: Dark Matter,” Nickerson, M. D., Coble, K., Cochran, G. L., Hayes, V. L., Camarillo, C. T., Bailey, J. M., McLin, K.M., & Cominsky, L. R., Poster at the National Society of Black Physicists/National Society of Hispanic Physicists joint meeting, Austin, TX, 21 - 24 Sept 2011.

101) The NuSTAR Education and Public Outreach Program, American Astronomical Society, Cominsky, Lynn R.; McLin, K. M.; NuSTAR Science Team; 2011HEAD...12.4301C

102) Using Telescopic Observations to Mentor High School Students in STEM, McLin, K. M.; Cominsky, L. R., in *Earth and Space Science: Making Connections in Education and Public Outreach*. Proceedings of a conference held at the University of Colorado, Boulder, Colorado, USA 31 July-4 August 2010. Edited by Joseph B. Jensen, James G. Manning, and Michael G. Gibbs. San Francisco: Astronomical Society of the Pacific, 2011., p.284, 2011,

103) “Using the Big Ideas in Cosmology to Teach College Students,” Coble, K., Bailey, J., Cochran, G., Hayes, V., Larrieu, D., Sanchez, R., McLin, K., & Cominsky, L. Poster at the American Association of Physics Teachers Chicago Section/ Prairie Section of the American Physical Society Joint Fall Meeting, Illinois Institute of Technology, Chicago, IL 60616, 18-20 Nov. 2011

104) “Student Ideas About Cosmological Concepts: Age, Expansion, and the Big Bang,” Trouille, Laura; Coble, K.; Camarillo, C.; Bailey, J.; Nickerson, M.; Cochran, G.; Hayes, V.; McLin, K.; Cominsky, L., *Bulletin of the American Astronomical Society,* 2012AAS...22010803C

105) “Student Ideas about Cosmological Concepts: Structure and Distances” Camarillo, Carmelita; Coble, K.; Trouille, L. E., Bailey, J. M.; Nickerson, M. D.; Cochran, G. L.; Hayes, V. L.; Hayes, V. L.; McLin, K. M.; Cominsky, L. R., *Bulletin of the American Astronomical Society,* 2012AAS...22010802C

106) “Investigating Undergraduate Student Ideas about Cosmological Concepts,” Coble, Kimberly A.; Trouille, L. E.; Bailey, J. M.; Camarillo, C. T.; Nickerson, M. D.; Cochran, G. L.; Hayes, V. L.; McLin, K. M.; Cominsky, L. R., *Bulletin of the American Astronomical Society*, 2012AAS...22010801C

107) “The *NuSTAR* Education and Public Outreach Program,” Cominsky, Lynn R., McLin, K.M., Boggs, S., Christensen, F., Craig, W., Hailey, C.J., Harrison, F., Stern, D., Zhang, W. and the NuSTAR Team, *Bulletin of the American Astronomical Society,* 2013AAS...22124425C

108) “From Uhuru at CfA to SAS-3 at MIT: Looking for X-Ray Binaries in all the Right Places,” Cominsky, L., *Bulletin of the American Astronomical Society,* 2013AAS...22111303C

109) “Twelve Years of the Fermi Education and Public Outreach Program” Cominsky, Lynn,

McLin, Kevin, Simonnet, Aurore and the Fermi E/PO team
arXiv:1303.0042
110) Using the Big Ideas in Cosmology to Teach College Students, McLin, Kevin M., Cominsky, Lynn R., Metevier, Anne J., Coble, Kimberly, Bailey, Janelle M. in the 2012 Fermi Symposium proceedings - eConf C121028, arXiv:1303.1768

111) “The *NuSTAR* Education and Public Outreach Program,” Cominsky, Lynn R., McLin, K.M., Boggs, S., Christensen, F., Craig, W., Hailey, C.J., Harrison, F., Stern, D., Zhang, W. and the NuSTAR Team, American Astronomical Society, HEAD meeting #13, #123.05

112) “Twelve Years of the Fermi Education and Public Outreach Program” Cominsky, Lynn, McLin, Kevin, Simonnet, Aurore and the Fermi E/PO team, American Astronomical Society, HEAD meeting #13, #123.04

113) “Fourteen Years of the Swift Education and Public Outreach Program” Cominsky, Lynn R., McLin, Kevin, Simonnet, Aurore and the Swift E/PO team, GRB 2013, Nashville, TN, April 2013. http://arxiv.org/abs/1405.2104

114) “Using the Big Ideas in Cosmology to Teach College Students” McLin, K. M., Coble, K., Metevier, A.J., Bailey, J. M., & Cominsky, L. R., in “Communicating Science: A National Conference on Science Education and Public Outreach”. Proceedings of a Conference held at Tucson, Arizona, USA 4-8 August 2012. Edited by J. Barnes, C. Shupla, J.G. Manning and M.G. Gibbs. San Francisco: Astronomical Society of the Pacific, 2013., p.109”

115) “Astro4Girls and Their Families: Sharing Science via Public Libraries” Sharma, M.; Smith, D.; Eisenhamer, B.; Ryer, H.; Dussault, M.; Braswell, E.; Cominsky, L.; Apple, N.; Della, T.; Whiffen, P., Harman, P., Mitchell, S., Eyermann, S., Brandehoff, S.& Dominiak, J.in “Communicating Science: A National Conference on Science Education and Public Outreach”. Proceedings of a Conference held at Tucson, Arizona, USA 4-8 August 2012. Edited by J. Barnes, C. Shupla, J.G. Manning and M.G. Gibbs. San Francisco: Astronomical Society of the Pacific, 2013., p.385

116) “The PockeQube T-LogoQube: a Prototype Approach for Future Spaced Based Astronomy Experiments” Owen, Aaron, Zack, Kevin, Jernigan, J. Garrett, Twiggs, Bob James, Cominsky Lynn R., Malphrus, Benjamin K., McNeil, S., Roach-Barrette, W., American Astronomical Society, AAS Meeting #224, #122.23, 2014AAS...22412223O

117) “NASA Astrophysics Educator Ambassador Program” McLin, K. M. and Cominsky, L. R., in *Ensuring Stem Literacy: A National Conference on STEM Education and Public Outreach*. ASP Conference Series, Vol. 483, proceedings of a conference held 20-24 July 2013 at San Jose State University, San Jose, California, USA. Edited by James G. Manning, Mary Kay Hemenway, Joseph B. Jensen, and Michael G. Gibbs. San Francisco: Astronomical Society of the Pacific, 2014., p.401

118) “Fermi Communications and Public Outreach” Cominsky, L., Simonnet, A. and the Fermi E/PO team. Presented at the Fifth International Fermi Symposium, Nagoya Japan, Oct 20-22, 2014. http://arxiv.org/abs/1502.07284

119) “Swift Communications and Public Outreach” Cominsky, L., Simonnet, A. and the Swift E/PO team. Presented at Swift: 10 Years of Discovery, Rome Italy, Dec. 3-5, 2014. http://pos.sissa.it/archive/conferences/233/130/SWIFT%2010_130.pdf

120) “NASA Astrophysics E/PO Impact: The Astrophysics Educator Ambassador Program” Cominsky, L., McLin, K. and the SSU E/PO team, American Astronomical Society, AAS Meeting #225, #410.07, 2015AAS...22541007C

121) ”Investigating Student Ideas About the Fate of the Universe” Conlon, Mallory; Coble, Kimberly A.; Bailey, Janelle M.; Cominsky, Lynn R., American Astronomical Society, AAS Meeting #225, #327.01, 2015AAS...22532701C

122) “Preliminary Evaluation of a New Cosmology Curriculum” Coble, Kimberly A.; Martin, Dominique; Hayes, Patrycia; Targett, Tom; Bailey, Janelle M.; Cominsky, Lynn R, American Astronomical Society, AAS Meeting #225, #245.04, 2015AAS...22524504C

123) “Big Ideas in Cosmology: A Digital First Curriculum for College Students” Cominsky, Lynn, Coble, Kim, McLin, Kevin, Bailey, Janelle, Metevier, Anne, Peruta, Carolyn, IAU General Assembly, Meeting #29, #2245310, 2015IAUGA..2245310C

124) “Exploring Gravitational Waves in the Classroom” Cominsky, Lynn R.; McLin, Kevin M.; Peruta, Carolyn; Simonnet, Aurore, American Astronomical Society, HEAD meeting #15, id.113.04, 2016HEAD...1511304C (4/2016)

125) “NASA’s Universe of Learning: Engaging Learners in Discovery”, Smith, Denise A., Lestition, Kathleen, Squires, Gordon, Greene, Michael T., Cominsky, Lynn R., and Eisenhamer, Bonnie, and the Universe of Learning Team, American Astronomical Society, AAS Meeting #228, id.112.04, 2016AAS…22811204S (6/2016)

126) “NASA's Universe of Learning: Engaging Learners in Discovery” Meinke, Bonnie K., Smith, Denise A., Lestition, Kathleen, Greene, Michael T., Squires, Gordon, and the Universe of Learning Team, DPS meeting #48, id.#406.09, 2016DPS....4840609M (10/2016)

127127) “NASA's Universe of Learning: Engaging Learners in Discovery” Cominsky, Lynn R., Smith, Denise A., Lestition, Kathleen, Greene, Michael T., and Squires, Gordon AGU Fall 2016, abstract
ED43B-0864 (12(12/16)

128) “NASA’s Universe of Learning: Connecting Scientists, Educators, and Learners” Smith, Denise A.; Lestition, Kathleen; Squires, Gordon K.; Greene, W. M.; Biferno, Anya A.; Cominsky, Lynn R.; Goodman, Irene; Walker, Allyson; Universe of Learning Team, American Astronomical

Society, AAS Meeting #229, id.411.04, 2017AAS...22941104S (1/2017)

129) "Learning by Making for STEM Success" Lynn Cominsky, Carolyn Peruta, Susan Wandling, Betsy McCarthy, Linlin Li, Proceedings of the 2017 Conference on Interaction Design and Children, Stanford, California, June 27-30, 2017, ACM, New York, NY, ISBN: 978-1-4503-4921-5, doi 10.1145/3078072.3081315, Pages 773-776, 2017.

130) "NASA's Universe of Learning: Girls STEAM Ahead" Marcucci, Emma, Meinke, Bonnie K., Smith, Denise, A., Ryer, Holly, Slivinski, Carolyn, Kenney, Jessica, Arcand, Kimberly K., Cominsky, Lynn R., Girls STEAM Ahead with NASA Team, American Astronomical Society, DPS meeting #49, id.101.05 (10/2017)

131) "Learning by Making" workshop at the California STEAM Symposium, December 10, 2017.

132) "Overview of NASA's Universe of Learning: An Integrated Astrophysics STEM Learning and Literacy Program" Smith, Denise; Lestition, Kathleen; Squires, Gordon; Biferno, Anya A.; Cominsky, Lynn; Manning, Colleen; NASA's Universe of Learning Team, 2018AAS...23113103S (1/2018)

133) "NASA's Universe of Learning: Providing a Direct Connection to NASA Science for Learners of all Ages with ViewSpace", Lawton, Brandon, L; Rhue, Timothy; Smith, Denise A., Squires, Gordon K; Biferno, Anya A., Lestition, Kathleen; Cominsky, Lynn R;, Godfrey, John; Lee, Janice C; Manning, Colleen, American Astronomical Society, AAS Meeting #232, id. 115.01, 2018AAS...23211501L (6/2018)

134) "NASA's Universe of Learning: Engaging Subject Matter Experts to Support Museum Alliance Science Briefings" Marcucci, Emma, Slivinski, Carolyn; Lawton, Brandon, L; Smith, Denise A., Squires, Gordon K; Biferno, Anya A., Lestition, Kathleen; Cominsky, Lynn R;, Lee, Janice C; Rivera, Thalia; Walker, Allyson; Spisak, Marilyn; American Astronomical Society, AAS Meeting #232, id. 115.02, 2018AAS...23211502M (6/2018)

135) "Evaluation of an Interactive Undergraduate Cosmology Curriculum" White, Aaron; Coble, Kimberly Al., Martin, Dominique; Hayes, Patrycia; Targett, Tom, Cominsky, Lynn R., American Astronomical Society, AAS Meeting #232, id. 209.04, 2018AAS...23220904W (6/2018)

136) "Impacts of a Course-based Undergraduate Research Experience in Introductory Astronomy Using Robotic Telescopes" Dobaria, Archana S.; Coble, Kimberly A.; Alejandra, Le; Berryhill, Katie, McLin, Kevin M.; Cominsky, Lynn R. American Astronomical Society, AAS Meeting #232, id. 118.04 2018AAS...23211804D (6/2018)

137) "NASA's Universe of Learning: Enabling Learners to Explore Exoplanets" Marcucci, Emma; Rivera, Thalia; Smith, Denise A., Biferno, Anya A., Squires, Gordon K; Lestition, Kathleen; Cominsky, Lynn R;, and the NASA's Universe of Learning Team,; American Astronomical Society, DPS meeting #50, id.202.02 2018DPS....5020202M (10/2018)

138) "Learning by Making" workshop at the California STEAM Symposium, October 29, 2018

139) “Learning by Making” short course at the California Science Teachers Association annual meeting, November 30, 2018

140) “The Universe of Learning's Authentic Ground-based Observing and Research Experience” Zellem, Robert Thomas; Dussault, Mary E.; Lawton, Brandon; Peticolas, Laura; Zimmerman-Brachman, Rachel; Smith, Denise; Squires, Gordon K.; Biferno, Anya A.; Lestition, Kathy; Cominsky, Lynn, American Astronomical Society, AAS Meeting #233, id.#352.11, 2019AAS...23335211Z(1/2019)

141) “Engaging General Education Astronomy Students with Internet-Based Robotic Telescopes” Coble, Kimberly; Dobaria, Archana; Le, Alejandra; Katie, Berryhill; McLin, Kevin; Cominsky, Lynn, American Astronomical Society, AAS Meeting #233, id.#214.01, 2019AAS...23321401C (1/2019)

142) “NASA's Universe of Learning: Connecting Learners with the Discoveries and Scientists of NASA Astrophysics” Lee, Janice; Lawton, Brandon; Marucci, Emma; Smith, Denise; Squires, Gordon; Manning, Colleen; Cominsky, Lynn; Lestition, Kathy; Biferno, Anya A., American Astronomical Society, AAS Meeting #233, id.#212.07, 2019AAS...23321207L (1/2019)

143) “Engaging Learners in Astrophysics via NASA's Universe of Learning Online Engagement, Partnerships, and Pathways” Peticolas, Laura and 11 coauthors including L. Cominsky, American Astronomical Society, AAS Meeting #233, id.#212.06, 2019AAS...23321206P (1/2019)

144) “Dream, Make and Innovate: A service-learning class” Lynn Cominsky and Edward Lyon, CSU Teaching and Learning Symposium, March 9, 2019

145) “Dream, Make and Innovate: A service-learning class” Lynn Cominsky, Maker Convening, SSU, May 31, 2019.

146)” Engaging Citizen Scientists to Keep Transit Times Fresh and Ensure the Efficient Use of Transit Exoplanet Characterization Missions”, Zellem, Robert and 11 coauthors including L. Cominsky, Amer Astronomical Society white paper, May 2019.

147) “NASA's Universe of Learning: Connecting Learners to the Subject Matter Experts of NASA Astrophysics” Marcucci, E. E., Lawton, B., Lee, J., Smith, D. A., Squires, G., Biferno, A., Lestition, K. and Cominsky, L., American Astronomical Society Meeting #234, id. 224.01. Bulletin of the American Astronomical Society, Vol. 51, No. 4 (6/2019)

148) “Connecting the Great American Eclipse to NASA Astrophysics” Lawton, B. and 11 other authors including L. Cominsky, Celebrating the 2017 Great American Eclipse: Lessons Learned from the Path of Totality. ASP Conference Series, Vol. 516. Edited by Sanlyn R. Buxner, Linda Shore, and Joseph B. Jensen. San Francisco: Astronomical Society of the Pacific, 2019, p.307 (6/2019)

149) “Enabling Science Learning: Effectively Providing a Direct Connection to the Science” Smith, D., Marcucci, E., Squires, G., Lee, J., Lestition, K., Biferno, A. and Cominsky, L., American Astronomical Society white paper, September 2019.

150) “NASA's Pre-Service Teacher Faculty Support by SSU” Bartolone, L., Cominsky, L., Peticolas, L., Biferno, A., Lestition, K., Smith, D., and Squires, G., Advancing Astronomy for All: ASP 2018 ASP Conference Series, Vol. 524, proceedings of a conference held (10-13 October 2018) in the California Wine Country, Sonoma Valley, California, USA. Edited by Greg Schultz, Jonathan Barnes, and Linda Shore., p.147, (11/2019)

151) “Authentic Research Pathways with Robotic Telescopes: Observing Objects That Go Bump in the Night” Spear, G., Cominsky, L., Peticolas, L., Bartolone, L., Dussault, M. and NASA’s Universe of Learning Team, Advancing Astronomy for All: ASP 2018 ASP Conference Series, Vol. 524, proceedings of a conference held (10-13 October 2018) in the California Wine Country, Sonoma Valley, California, USA. Edited by Greg Schultz, Jonathan Barnes, and Linda Shore., p.315 (11/2019)

152) “Aliens and Habitable Planets: Engaging the Public in scientific practices characterizing exoplane orbits” Peticolas, L. M., Spear, G., Cominsky, L. and 9 other authors. American Geophysical Union, Fa Meeting 2019, abstract #ED11B-0859

153) “Utilizing Small Telescopes Operated by Citizen Scientists for Transiting Exoplanet Follow-up” Zellem, R. T. and 33 coauthors including L. Cominsky, American Astronomical Society meeting #235, id. 337.07. Bulletin of the American Astronomical Society, Vol. 52, No. 1 (1/2020)

154) “Authentic Research with NASA's Universe of Learning Global Telescope Network” Cominsky, L. R.; Peticolas, L.; Spear, G.; Lawton, B.; Dussault, M.; Zellem, R.; Zimmerman-Brachman, R.; Smith, D.; Squires, G.; Biferno, A.; Lestition, K.. American Astronomical Society meeting #235, id. 337.06. Bulletin of the American Astronomical Society, Vol. 52, No. 1 (1/2020)

155) “NASA's Astrophoto Challenges: Experiences with real data for lifelong science learners” Dussault, M. and 10 coauthors including L. Cominsky, American Astronomical Society meeting #235, id. 337.04. Bulletin of the American Astronomical Society, Vol. 52, No. 1 (1/2020)

156) “Authentic Experiences Using Data with NASA's Universe of Learning” Lawton, B. and 9 coauthors including L. Cominsky, American Astronomical Society meeting #235, id. 337.04. Bulletin of the American Astronomical Society, Vol. 52, No. 1 (1/2020)

157) “NASA's Universe of Learning: Connecting Historically Underserved Audiences with NASA Astrophysics” Marcucci, E., Smith, D., Lestition, K., Squires, G., Biferno, A., Cominsky L. and NASA’s Universe of Learning, American Astronomical Society meeting #235, id. 33 7.03. Bulletin of American Astronomical Society, Vol. 52, No. 1 (1/2020)

158) “The Integral Role of Research Astronomers in NASA's Universe of Learning: Broadening the Network of Connections between Subject Matter Experts and Learners” Lee, J. C. and 12 coauthors including L. Cominsky. American Astronomical Society meeting #235, id. 33 7.03. Bulletin of the American Astronomical Society, Vol. 52, No. 1 (1/2020)

159) “NASA's Universe of Learning: Framework and Evaluation Findings” Smith, D., Squires, G., Lestition, K., Biferno, A., Cominsky L., Marcucci, E. and NASA’s Universe of Learning Team,

American Astronomical Society meeting #235, id. 337.01. Bulletin of the American Astronomical Society, Vol. 52, No. 1 (1/2020)

160) “NASA's Universe of Learning: Explore Exoplanets with ViewSpace” Marcucci, E., Rhue, T., Smith, D., Squires, G., Biferno, A., Lestition, K., Cominsky, L., Godfrey, J. and the ViewSpace Team, AAS Division of Planetary Science meeting #52, id. 410.05. Bulletin of the American Astronomical Society, Vol. 52, No. 6 e-id 2020n6i410p05 (10/20)

161) “Astronomy from Home: Informal Learning with Robotic Telescopes” Cominsky, L., Peticolas, L Bartolone, G.S.L., Dussault, M., Zellem, R., Smith, D., Squires, G., Biferno, A., and Lestition, K., ASI Embracing the Future: Astronomy Teaching and Public Engagement ASP Conference Series, Vol. 531, proceedings of a virtual conference held 3-December 2020. Edited by Greg Schultz, Jonathan Barnes, Andrew Fraknoi, and Linda Shore. San Francisco: Astronomical Society of the Pacific, (11/21)

162) “NASA’S Neurodiversity Network (N3)” Cominsky, L., Riccio, A., Martin, W., Peticolas, L., Mendez, B., Perez, S., Williams, G., Grillo-Hill, A., and Valcarcel, J., Proceedings of the Second Workshop on Astronomy Beyond the Common Senses for Accessibility and Inclusion (2WAI) Virtual Conference, Editors: Santiago Vargas, Beatríz García, Gery Hemming, Sonia Duffau, Nicolas Vázquez and Angela Pérez, pp. 34-38 (11/21)

163) "3U3: The IMAP Student Collaboration CubeSat Project Evaluation Strategies and Early Findings", Bartolone, L. and 34 additional authors including L. Cominsky, AGU Fall Meeting 2021, held in New Orleans, LA, 13-17 December 2021, id. ED25B-0582 (12/21)

164) "3U3 CubeSat Electronics Designs to Study Oxygen Upwelling in the Cusp", Foster, W. and 12 other authors including L. Cominsky, AGU Fall Meeting 2021, held in New Orleans, LA, 13-17 December 2021, id. SA35G-1959 (12/21)

165) "NASA's Neurodiversity Network (N3): Creating Inclusive Learning Activities Across the Spectrum", Cominsky, L., Peticolas, L., Riccio, A., Martin, W., Mendez, B., Perez, S., Grillo-Hill, A., and Valcarcel, J., ASP 2021: Sharing Best Practices – Astronomy Teaching and Public Engagement ASP Conference Series, Vol. 533, Proceedings of a virtual conference held 18-20 Nov 2021. Edited by Greg Schultz, Joseph B. Jensen, and Linda Shore. San Francisco: Astronomical Society of the Pacific, 2022, p.173 (2022)

166) "Multi Multi-messenger Astrophysics Master Class: Gamma Rays", Cominsky, Lynn, Gill, Holden, Maheso, D.J., and Simonnet, Aurore. Poster at the 10th International Fermi Symposium, October 11, 2022.

167) "NASA's Neurodiversity Network (N3): Creating Inclusive Learning Activities Across the Spectrum", Cominsky, L. Mendez, B., Peticolas, L., Martin, W., Riccio, A., Williams, G., Grillo-Hill, A., and Valcarcel, J., American Astronomical Society Meeting #241, id. 221.07. Bulletin of the American Astronomical Society, Vol. 55, No. 2 e-id 2023n2i221p07, (1/23).

Professor Lynn R. Cominsky

Grant Funding

1) March 1980, “World Wide Coordinated Observations of X-ray Sources”, National Science Foundation, W. H. G. Lewin (P. I.), C. Canizares, L. Cominsky, G. Jernigan, J. McClintock, S. Rappaport (Co-I.), $50,342 for 24 months.

2) September 1982, “Studies of Highly Variable Galactic X-ray Sources with HEAO-1”, NASA Space Astrophysics Data Analysis Program, NAG 8-446, P. B. Price (P. I.), L. Cominsky (Lead Experimenter), $10,200 for 12 months.

3) April 1982, “Feasibility Study for an Space Sciences Laboratory-Based Project Operations Control Center for the Extreme Ultraviolet Explorer Satellite”, California Space Institute, P. B. Price (P. I.), L. Cominsky (Project Manager), $25,000 for 12 months.

4) June 1983, “Time Dependent Radiative Transfer Calculations of the Reprocessing of X-ray and γ-ray Bursts”, Institute for Geophysics and Planetary Physics, P. B. Price (P. I.), L. Cominsky (Project Manager), and R. A. London (Lawrence Livermore National Laboratory Collaborator), $8,000 for 12 months.

5) March 1984, “Studies of Highly Variable Galactic X-ray Sources with HEAO-1”, NASA Space Astrophysics Data Analysis Program, continuation of NAG 8-446, C. McKee (P. I.), L. Cominsky (Lead Experimenter), $20,100 for 12 months.

6) September 1986, “Visiting Scholar for the Sonoma State University Radio Telescope Project”, SSU Lottery Funding, L. Cominsky, Project Advisor, $500 for 12 months.

7) October 1986, “The Sonoma State University Radio Telescope Project”, Society of Physics Students Allied Awards Program, L. Cominsky, Project Advisor, $1600 to purchase dishes and other miscellaneous parts.

8) December 1987, “The Eclipsing X-ray Burst Source MXB1659-29”, American Astronomical Society Small Research Grants Program, L. Cominsky, Principal Investigator, $1955 for 12 months

9) June 1987, “Multi-mission Studies of Massive X-ray Binaries”, NASA Space Astrophysics Data Analysis Program, NAG8-649, L. Cominsky, Principal Investigator, $53,000 for 24 months

10) June 1987, “Motors for the SSU Radio Telescope Project”, Parker-Hannifin Foundation, D. Poland, Department Chair and L. Cominsky, Project Advisor, $3816 to purchase stepper motors and encoders.

11) October 1987, “Cable for the SSU Interferometer Radio Telescope Project”, Sonoma State University Enterprises, Inc., L. Cominsky, Project Advisor and Gordon Spear, SSU Observatory Director, $1674 to purchase low loss cable.

12) December 1988, “High Time Resolution Studies of Binary X-ray Pulsars”, NASA Astrophysics Data Program, NAG 5-1260, L. Cominsky, Principal Investigator, $116,020 for three years.

13) January 1989, “Teaching with Sun Computers at Sonoma State University", Sun Microsystems, Inc., L. Cominsky, Principal Investigator and Gordon Spear, Co-investigator, $27,800 equipment grant for Sun 3/60 Workstation.

14) April 1989, CSU High School/ University Research Collaboration Initiative, L. Cominsky, Principal Investigator, $1200 for Sonoma State University, $2600 to Analy High School collaborators Jay Goldberg and Sarah Hurley.

15) May 1989, “ROSAT Observations of MXB1659-29 and EXO 0748-676”, NASA ROSAT Guest Investigator Program, NAG 5-1684, K. Wood, Principal Investigator, L. Cominsky, Co-investigator, $7200 for Sonoma State University for 12 months.

16) December 1989, “Microprocessor Applications Laboratory Development”, Instructional Development and Technology Program, Sonoma State University Lottery Funds, L. Cominsky, Project Director, $5652 for released time and equipment.

17) December 1990, “The Sonoma State University Interferometer Radio Telescope” , SSU Enterprises, Inc., L. Cominsky, Project Advisor and Ildgoz Modeer, Student Manager, $2820 to purchase disk drive for Sun Workstation to support Radio Telescope project.

18) October, 1991, “Motorization and Computer Control of the Very Small Array Radio Interferometer at Sonoma State University”, National Society of Physics Students, L. Cominsky, Advisor and H. Jessop, SPS President, $2000 for motorizing dishes of Very Small Array project.

19) July, 1992, “Tracking Observations with the Very Small Array”, National Science Foundation Research Experiences for Undergraduates, L. Cominsky Principal Investigator, and Greg Sprehn, $4470 for student stipend and travel expenses to American Astronomical Society Meeting to present work.

20) August, 1992, “Long Term Monitoring of Neutron Star Binary Systems using BATSE”, NASA Gamma Ray Observatory Guest Observer Program, NAG 5-2032, L. Cominsky, Principal Investigator, $58,000 for 12 months.

21) October, 1992, “ROSAT Observations of the Binary Be-star/Radio Pulsar PSR1259-63”, NASA ROSAT Guest Observer Program, continuation of NAG 5-1684, L. Cominsky, Principal Investigator, $20,000 for 12 months.

22) March, 1993, “Improving Research and Educational Opportunities at the SSU Observatory”, CSU Research, Scholarship and Creative Activities Program, L. Cominsky, Principal Investigator, $3192.

23) April, 1995, “Periastron Observations of A0535+26 = GRO J0542+26?”, NASA CGRO Guest Investigator Program, Cycle 4, continuation of NAG 5-2032, L. Cominsky, Principal

Investigator, K. Wood and P. Hertz, Co-investigators, $35943 for SSU, $10,000 for NRL for 12 months.

24) May, 1995, “Magnetospheric Accretion in PSR 1259-63”, NASA ASCA Guest Investigator Program, Cycle 3, NAG 5-2948, L. Cominsky, Principal Investigator, $16476 for 12 months.

25) September, 1995, “OSSE Observations of PSR 1259-63 near Apastron”, NASA CGRO Guest Investigator Program, Cycle 5, continuation of NAG 5-2032, L. Cominsky, Principal Investigator, J. Eric Grove, Co-investigator, $30,000.

26) August, 1996, “Investigation of X-ray Variability from 4U1755-33”, NASA RXTE Guest Investigator Program, Cycle 1, NAG 5-3324, P. Michelson, Principal Investigator, M. Roberts, L. Cominsky, Co-investigator, $4000 for SSU for 12 months.

27) August, 1996, “Lack of Orbital Period Evolution in EXO0748-676”, NASA RXTE Guest Investigator Program, Cycle 1, NAG 5-3324, Paul Hertz, Principal Investigator, Kent Wood, L. Cominsky, Co-investigators, $5009 for SSU for 12 months.

28) September, 1996, “Probing the Matter Distribution in the 4U1907+09 System”, NASA ASCA Guest Investigator Program, Cycle 4, continuation of NAG 5-2948, P. Michelson, Principal Investigator, M. Roberts and L. Cominsky, Co-investigators, $5656 for SSU for 12 months.

29) February, 1997, “XTE Observations of PSR 1259-63 at Apastron”, NASA RXTE Guest Investigator Program, Cycle 2, NAG 5-3702, L. Cominsky, Principal Investigator, V. Kaspi, F. Nagase, B. Giles, Co-investigators, $23,000 for SSU, $3000 for V. Kaspi for 12 months.

30) February, 1997, “A Test of Spin-Orbit Coupling in the 4U0115+63 System”, NASA RXTE Guest Investigator Program, Cycle 2, NAG 5-3702, L. Cominsky, Principal Investigator, V. Kaspi, Co-investigator, $13,000 for SSU, $3000 for V. Kaspi for 12 months.

31) May, 1997, “Continued Eclipse Timing of EXO 0748-676”, NASA RXTE Guest Investigator Program, Cycle 2, NAG 5-4403, P. Hertz, Principal Investigator, K. Wood and L. Cominsky, Co-investigators, $5000 for SSU for 12 months.

32) September, 1997, “High Energy Physics with the Gamma-ray Large Area Space Telescope”, NSF Career Advancement Award Program, PHYS-9722126, L. Cominsky, Principal Investigator, $57,420 for 12 months.

33) May, 1998, “GLAST Mission Concept Studies and Public Outreach”, NASA Goddard Space Flight Center, NAG5-7267, L. Cominsky, Principal Investigator, $45,000 for 9 months.

34) June, 1999, “Swift Education and Public Outreach”, NASA Goddard Space Flight Center, NAG5-8603, L. Cominsky, Principal Investigator, $10,000 for 6 months. Supplemented in October, 1999 by $31,950, and in January, 2000 by $20,000.

35) October, 1999, "Space Mysteries: Inquiry-driven Web Explorations that Teach Physical Science and Mathematics Standards", NASA LEARNERS Program, NCC5-429, L. Cominsky, Principal Investigator, $665,802 for three years.

36) January, 2000, "Swift Education and Public Outreach", NASA Goddard Space Flight Center, L. Cominsky, Principal Investigator, $920,782 for 6 years. Supplemented to total $2.2 million.

37) April, 2000, "*GLAST Education and Public Outreach*", NASA through Stanford University, L. Cominsky, Principal Investigator. Total allocated: $7,071,272 through 8/10/2013.

38) May, 2000, *North Bay Science Project*, State of California Subject Matter Program through the UC President's Office, $179,332 for 1 year (annually renewable)

39) July, 2000, *Swift Public Relations Grant*, NASA GSFC, L. Cominsky, Principal Investigator, $27,898 through 9/30/01.

40) April, 2001, *Structure and Evolution of the Universe Educational Forum Support*, NASA through Harvard-Smithsonian Center for Astrophysics, L. Cominsky, Principal Investigator, $95,737 through 12/31/01. Augmented by $87,271 in January, 2002.

41) May 2001, *North Bay Science Project*, State of California Subject Matter Program through the UC President's Office, $195,000 for 1 year (annually renewable), L. Cominsky Faculty Advisor.

42) November, 2001, *Augmentation to Swift and GLAST Public Relations*, NASA GSFC, L. Cominsky, Principal Investigator, $209,853 through 9/30/06.

43) June, 2002, Change of PI on *Swift Education and Public Outreach Program*, NASA GSFC, to L. Cominsky, Principal Investigator, $1,429,683 for 5/1/00-1/31/07 (included in 36 above)

44) August, 2002, *XMM-Newton Education and Public Outreach Program*, NASA GSFC, L. Cominsky, Principal Investigator, $597,000 for 9/1/02- 9/30/06

45) October 2002, *North Bay Science Project*, State of California Subject Matter Program through the UC President's Office, L. Cominsky Principal Investigator and Faculty Advisor, awarded $207,550 for July 1, 2002-June 30, 2003.

46) February 2004, *Educator Ambassador Support*, NASA's Goddard Space Flight Center L. Cominsky Principal Investigator, $78,000 through 9/30/06.

47) February 2004, *Educator Ambassador Support*, Jet Propulsion Laboratory, L. Cominsky, Principal Investigator, $ 13,095 from 10/01/2003 to 09/30/2004 for GALEX, and $ 13,095.00 from 10/01/2003 to 9/30/2004 for LISA.

48) February 2004, *Phase A SMEX Studies*, L. Cominsky Principal Investigator E/PO portion, $10,000 for NuSTAR

49) February 2004, *Phase A SMEX Studies*, L. Cominsky Principal Investigator E/PO portion, $10,000 for DUO.

50) May 2004, *North Bay Science Project*, State of California Subject Matter Program through the UC President's Office, L. Cominsky Principal Investigator and Faculty Advisor, awarded $180,000 for July 1, 2003 - September 30, 2004.

51) October 2004, *EXIST Concept Study for Black Hole Finder Probe*, NASA through Harvard University, L. Cominsky, Principal Investigator, $30,000 through 9/30/2006.

52) January 2005, Beaumont Foundation of America, 30 laptops, 12 digital cameras, and 2 printers for Roseland University Prep Charter School. Estimated value: $65,000, L. Cominsky led NASA partnership effort with RUP, helped write proposal and letter of support. SSU's E/PO Group is a member of Roseland University Prep's Project Team. The E/PO Group is providing technical assistance to Roseland's Project Team members, including the Science Teacher implementing the Beaumont Technology Project. We also provide curricula instruction materials that support GLAST investigation, such as "Far Out Math" and "Scale the Universe" available for use in the classroom. We are providing limited in-class staff support to the Science Teacher as this staff person is learning to teach the project materials. We will also direct the Project Team to on-line resources that support students' participation in GLAST.

53) April 2005, *NuSTAR Education and Public Outreach*, NASA through California Institute of Technology, L. Cominsky, Principal Investigator, $45,000 through 2/30/2006.

55) October 2005, *Supernova Acceleration Probe Education and Public Outreach*, University of California, Berkeley, L. Cominsky, Principal Investigator, $15,000 through 9/30/2006.

56) January 2007, *GLAST and Swift Public Relations*, NASA, L. Cominsky, Principal Investigator, $48,929 through January 2011. Augmented by $56,364 in January 2008 and by $71,142 in August, 2008. Augmented by $58,000 in December, 2008; $59,658 in February 2010, and $60,000 in April 2011.

57) March 2007, *XMM-Newton Education and Public Outreach (extended mission)*, NASA, L. Cominsky, Principal Investigator, $158,778 through March 2011. Augmented by $159,900 in June 2008, $153,222 in April 2009, $152,870 in September 2009, $74,704 in December 2010, and $78,296 in April 2011.

58) June 2007, *Swift Education and Public Outreach (extended mission)*, NASA, L. Cominsky, Principal Investigator, $188,094 through June 2011. Augmented by $189,286 in May 2008, $177,237 in June 2009, $184,391 in June 2010 and $160,000 in July 2011

59) September 2007, *SNAP Education and Public Outreach*, UC Berkeley, L. Cominsky, Principal Investigator, $30,004 through January, 2008.

60) March 2008, *NuSTAR Education and Public Outreach*, NASA through CalTech, L. Cominsky, Principal Investigator, $70,000 through November 2009. Augmented by $47,000 through January 2012. Augmented by $350,000 through August 2013.

61) March 2009, *Visions of the Universe exhibits in conjunction with the International Year of Astronomy 2009*, NASA HQ, L. Cominsky, Principal Investigator, $10,000 through February 2010.

62) March 2010, *Using The Big Ideas In Cosmology To Teach College Students: Curriculum Development*, NASA EPOESS, L. Cominsky, Principal Investigator, $499,596, 3/1/2010-2/28/2014 (one year no-cost extension).

63) March 2011, *Improving the STEM Pipeline at Sonoma State University*, California Space Grant, L. Cominsky, Principal Investigator, $8000, through August 26, 2011. Augmented by $10,000 in May 2012, augmented by $10,000 in May 2013.

64) September 2011, *S^3: STEPping up STEM at SSU*, NSF-STEP, L. Stauffer Principal Investigator, L. Cominsky Co-PI, $987,153 for five years

65): January 2012, *S^4: Small Satellites for Secondary Students*, NASA EPOESS, L. Cominsky Principal Investigator. $549,308 for three years.

66) January 2012, *Fermi and Swift Public Relations*, NASA, L. Cominsky, Principal Investigator, $180,000 through January 2016.

67) May 2012, *XMM-Newton Education and Public Outreach (extended mission),* NASA, L. Cominsky, Principal Investigator, $120,000 through May 2016

68) May 2012, *Swift Education and Public Outreach (extended mission),* NASA, L. Cominsky, Principal Investigator, $240,000 through May 2016

69) July 2013, *Promising Course Redesign for Astro 100*, Chancellor's Office, L. Cominsky, Principal Investigator, $40,268 for AY13-14.

70) August 2013, *Fermi Education and Public Outreach (extended mission)*, NASA, L. Cominsky, Principal Investigator, $200,000 in 12/2013, augmented by $166,865 in 6/2014, by $197,000 in 2/2015 and by $170,000 in 6/2015.

71) November 2013, *Learning by Making: STEM Success for Mendocino County*, Department of Education i3 program, Susan Wandling PI and L. Cominsky Co-PI, 1/1/14 – 12/31/18, $2,930,459 plus $454,500 in required matching funds.

72) October 2013, *Teaching Einstein's Universe at Community Colleges*, National Science Foundation, L. Cominsky, Principal Investigator, $210,000 for 7/1/14 – 6/30/17 and supplement of $29,836 in February 2016.

73) April 2014, *Rockets and CubeSats in the STEM Pipeline*, California Space Grant, L. Cominsky Principal Investigator, $9975. Additional funding of $9979 in February 2015, $3000 in 2017.

74) June 2015, *Fermi and Swift Communications and Outreach*, NASA, L. Cominsky, Principal Investigator, $300,000 for 6/1/2015 – 5/31/2018

75) October 2015, *Rising Data: Flight Project Curriculum for Community College Students*, NASA Minority University Research and Education Program Community College Curriculum Improvement, E. Quealy, Principal Investigator (Napa Valley College), L. Cominsky Co-investigator, $749,922 total for three years, including $268,645 to SSU.

76) January 2016, *NASA's Universe of Learning*, NASA Science Mission Directorate Cooperative Agreement, D. Smith, Principal Investigator (Space Telescope Science Institute), L. Cominsky Co-investigator, $1,564,824 to SSU for five years.

77) April 2016, *EdgeCube: A 1U Global Monitor for Earth's Ecosystem,* SMD and SpaceGrant, L. Cominsky Principal Investigator, $200,000 for two years.

78) July 2016, *STEM Education Through Sophomore Innovation (SETSI),* Jeremy Qualls, Principal Investigator, L. Cominsky, Co-PI, NSF IUSE program, $584,705 for three years. Cominsky became PI after Qualls left SSU in July 2018. One year NCE.

79) July 2018, *Fermi Gamma-ray Space Telescope and Neil Gehrels Swift Observatory Communications and Outreach*, 7/23/2018 -7/22/2021, $260,000 for three years.

80) October 2018, *Developing a Student-Driven STEM and Computer Science Curriculum for Rural Schools*, L. Cominsky, Principal Investigator, Department of Education - Education Innovation and Research program, 10/01/2018 - 09/30/2023, $3,927,476.00 for five years plus $400,000 in matching funds.

81) September 2020, *Expanding STEM Ethics Education to Reduce Gender Bias and Sexual Harassment*, M. Paolucci, PI, L. Cominsky, Co-PI, NSF Ethical and Responsible Research, 9/1/2020 – 8/31/2023, $320,803 for three years.

82) January 2021, *NASA's Neurodiversity Network,* L. Cominsky, Principal Investigator, NASA's Science Activation Program, 1/1/2021 – 12/31/2025, $4,962,523 for five years. Augmented in January 2023: additional $523,521.

83) January 2022, *Communications and Outreach for the Fermi Gamma-ray Space Telescope and Neil Gehrels Swift Observatory*, 10/1/2021 – 9/30/2024, $300,000 for three years.

84) May 2023, *Engaging Autistic STEM Undergraduates in Creating Supportive Learning Environments at California State Universities*, 5/18/2023-5/31/2025. Ariana Riccio (EDC) PI, L. Cominsky, Co-PI, NSF IUSE, $359,877 for two years.

85) January 2024, *Scaling an innovative STEM And Computing Education Support (STEMACES) Model for Improved Science Learning,* Laura Peticolas PI, L. Cominsky, Co-PI, Department of Education - Education Innovation and Research program, , 1/1/2024 – 12/31/2029, $7,904,722.

Professor Lynn R. Cominsky

SERVICE ACTIVITIES

Professional Activities Outside Sonoma State University

- Sigma Xi Distinguished Lecturer 2023-2024
- Member of NSF Third Generation GW Detector Advisory Committee - 2023
- NASA Bridge Program DEIA Committee Co-Chair 2022
- Reviewer for NASA Student Collaborations – 2022, 2024
- Ombudsperson, LIGO Scientific Collaboration, 2019 - December 2021
- Roseland District Charter Board member, June 2019 – December 2021
- External Reviewer, Humboldt State University Physics Department, April 2018
- Hosted LIGO-Virgo Scientific Collaboration Meeting at SSU, March 2018
- Scientific Organizing Committee for IAU Symposium 338 Gravitational Wave Astrophysics, October 2017
- External Reviewer, Cal Poly San Luis Obispo Physics Department, February 2017
- External Reviewer, San Jose State Physics Department, November 2016
- Advisory Board, NASA Aerospace Academy at CSUF, 2016
- Board of Directors, Astronomical Society of the Pacific, 2016 - 2019
- Board of Directors, Contemporary Physics Education Project, 2016 - present
- AAAS/PHYS division Executive Committee member, 2015 – 2019
- Vice Chair, NSF Committee of Visitors to Astronomical Sciences Division, 2014
- External Reviewer, CSU San Bernardino Physics Department, February 2014
- Nominating Committee, HEAD 2013
- Chair, Local Organizing Committee, Far West Section of APS annual meeting, November 2013
- Past Chair, California-Nevada Section of the American Physical Society, 2013-2014
- Chair, California-Nevada Section of the American Physical Society, 2012-2013
- Chair, Formal Education Working Group, LIGO Scientific Collaboration 2012-present
- LIGO Scientific Collaboration, Member 2011 - present
- Chair Elect, California-Nevada Section of the American Physical Society, 2011-2012
- External Reviewer, CSU East Bay Physics Department, March 2011
- Executive Committee member, Astrophysics Division, American Physical Society, Feb. 2010 – April, 2012.
- External Reviewer, Northern Arizona University Physics & Astronomy Department, March 2010
- Vice Chair, California Section of the American Physical Society, 2010-2011
- Education Prize Committee, American Astronomical Society, January 2009 – 2012, Chair 2010-2011
- Member, E/PO Infrastructure Study Group for Astro2010, 2009
- External Reviewer, SUNY Geneseo Physics and Astronomy Department, April 2008
- Nominating committee, Astronomy Division of the AAAS, February 2008 - Feb. 2010
- Symposium Organizer, “World-Wide Hunt for Gamma-ray Bursts” AAAS, February 2008
- LIGO Program Advisory Committee member, December 2007 – December 2010

- External Physics Department Program Review, St. Mary's College, March 2007
- Friends of the Federated Indians of the Graton Rancheria Board Member, 2006 -2010
- Roseland University Prep High School Advisory Board Member, 2006 – December 2021
- Symposium Organizer, "A Giant Flare from a Magnetar: Blitzing the Earth from Across the Galaxy" AAAS, February 2006
- Sonoma County Women's "No Name" group, member, 2005 - 2020
- NASA Education and Public Outreach Lead, Supernova Acceleration Probe (SNAP) Mission Concept, October 2005 – September 2008
- NASA Scientific Co-investigator and Education and Public Outreach Lead, Nuclear Spectroscopic Telescope Array (NuSTAR), October 2005 - present
- NASA Education and Public Outreach Lead, Energetic X-ray Imaging Space Telescope (EXIST) Mission Concept, October 2004 -2010
- Scientific Organizing Committee and Teacher's Workshop, Beyond Einstein meeting at Stanford University, May 2004
- Independent reviewer for QuarkNet Program, DOE/NSF, March 2004
- Symposium Co-organizer, "New Findings on the Evolution of the Universe," AAAS, February 2004
- Scientific Organizing Committee and Session Co-organizer, ISMD 2004, December 2003 – August 2004 http://physics.ucr.edu/ismd2004/
- NASA Education and Public Outreach Lead, XMM-Newton mission, October 2002 – present
- Main Scientific Organizer "Quarks to the Cosmos" Session, COSPAR, October 2002
- Education and Public Outreach Lead, NASA Swift Mission, June 2002 – January 2015
- NASA Structure and Evolution of the Universe sub-committee Member, December 2001 – 2004
- Stanford University Kavli Institute Director Search Committee, September 2001 – April 2002
- Press Officer, Chandra Science Symposium, September, 2001
- Press Officer, Gamma 2001 Symposium, April, 2001
- SLAC Experimental Program Advisory Committee November 2000 – November, 2002
- Chair, Schramm Award for HEA Science Journalism Committee, 2000
- SLAC Communications Committee, Spring 2000
- Director, NASA Education and Public Outreach at SSU 1999 – present (renamed to EdEon in 2017.
- Organizing Committee, Cosmic Genesis and Fundamental Physics, October 1999 http://www.quarkstothecosmos.org/history.html
- Connections: Quarks to the Cosmos Interdisciplinary Study Group, 1999 – 2001
- Press Officer, scientific co-investigator and Education and Public Outreach Lead, NASA's Gamma-ray Large Area Space Telescope (Fermi) mission 1999 – present
- Press Officer and co-investigator, NASA Swift Mission 1999 – present
- Deputy Press Officer, American Astronomical Society 1998 – 2008
- Chair, Gamma-ray Large Area Space Telescope Public Affairs Working Group 1997 – 1999
- Press Officer, Fourth CGRO Symposium April 1997
- SLAC User's Organization Executive Committee 1996 – 1999, Secretary 1997 – 1998

- Press Officer, HEAD/AAS 1996 – 2002
- NASA Gamma-ray Large Area Space Telescope Facility Science Team Member 1996 – 1999
- Executive Committee, AAS High Energy Astrophysics Division 1995 – 1997
- Local Organizing Committee, High Energy Astrophysics Division meeting 1994
- Organizing Committee, Towards the Next Generation High Energy Gamma Ray Telescope 1994
- NASA Science Operations/Mission Operations Working Group 1994 – 1995
- NASA Peer Review Committee for ASCA Guest Observer Proposals 1994
- Scientific Organizing Committee, Second Compton Gamma Ray Observatory Symposium 1993
- NASA Advanced X-ray Astronomy Facility User's Group 1993 – 1998
- Nominating Committee for the High Energy Astrophysics Division of the American Astronomical Society (HEAD/AAS) 1993
- Visiting Professor, Stanford Linear Accelerator Center 1993 – 1999
- NASA Senior Review Committee for Mission Operations and Data Analysis 1992
- Consultant to the Astrogravity Group at Stanford Linear Accelerator Center 1992
- President, Sonoma State Chapter of Sigma Xi 1991 – 2000
- Co-investigator on the Unconventional Stellar Aspect experiment 1991 – 2000
- NSF Peer Review Committee for Undergraduate Course and Curriculum Program 1991
- Chair, NASA Peer Review panel for Gamma Ray Observatory Proposals 1990
- Secretary/Treasurer, Sonoma State Chapter of Sigma Xi 1990 – 1991
- NASA Peer Review Committee for ROSAT Guest Observer Proposals 1989
- NASA Peer Review Committee for Ginga Guest Observer Proposals 1987, 1988
- NASA Extreme Ultra-Violet Explorer Project Software Review Board 1986 – 1991
- Co-investigator on the NASA Extreme Ultraviolet Explorer 1985 – 1991
- NASA High Energy Astrophysical Observatory A-1 Guest Observer 1982 – 1985

Sonoma State University Service Activities

- Host, Women in Conversation with Astronaut Nicole Mann, September 20, 2023.
- Disability Services Advisory Committee: Fall 2022 -
- Search Committee member, CIO, SSU Spring 2020
- Member, Physics & Astronomy RTP committee, Fall 2019 – Fall 2021, Fall 2022 - present
- Engineering Science Task Force Committee member Fall 2015- Spring 2016
- University RTP Committee member Fall 2015 – December 2018, Fall 2021 semester
- SSU Academic Foundation Advisory board member, Fall 2011 – June 2018
- Chair, Physics & Astronomy RTP Committee 2013-2014
- Member, School of Science and Technology RTP Committee 2010 – 2013, 2014-2015
- Physics and Astronomy Tenure-track Search Committee, Chair for two searches, Fall 2006
- Chemistry Tenure-track Search Committee, Chair for two searches, Fall 2005
- Chair, Department of Chemistry, August 2005 – January 2007, and August 2018-January 2019.

Professor Lynn R. Cominsky

- Member, University RTP appeals committee, August 2004 – 2008
- Chair, Department of Physics and Astronomy, August 2004 – May 23, 2019
- RTP Committee, Engineering Science Department, member 2004 - 2007
- Vice President's Budget Advisory Committee member, 2003-2005
- RTP Committee, Computer Science Department, member 2002
- RTP Committee, Physics and Astronomy Department, member 2001- 2002, Chair 2002-2010
- Physics and Astronomy Tenure-track Search Committee Chair, 2000-2001, member 2002-2003
- Chair, FMI Appeals Panel 2, Spring 2000
- RTP Evaluation for Alexandra von Meier, December 1999
- RTP Evaluation for Michael Litle, November 1999
- Sabbatical Review committee for Robert Plantz, November 1999
- Chair, Post-tenure Review Committee for Joseph Tenn, Spring 1999
- School of Natural Sciences Retention, Tenure and Promotion Committee 1999
- Engineering Sciences study committee 1998 – 2002
- University Retention, Tenure and Promotion Committee 1997 – 1998
- Board of Directors, Sonoma State University Enterprises, Inc. 1997 – 2001
- Commencement Committee, 1994 – 1995
- Scholarship Committee, 1994 – 1995
- Presidential Search Advisory Committee 1991 – 1992
- Computer and Information Science Department Search Committee 1990 – 1991
- Advisor to Society of Physics Students organization 1991 – 2001
- Vice President's Budget Advisory Committee 1989 – 1992
- Chair, Fund Raising Drive for School of Natural Sciences 1989 – 1991
- Women's Resource Center Advisory Board, 1989 – 1995
- CSU Women's council member, 1988 – 1995
- Faculty Mentor 1988 – 1990
- Advisor to Women in Science student organization 1989 – 1990
- Task Force on Women and Minorities in Science and Engineering member 1988 – 1989
- WASC Task Force on Active Involvement in Learning member 1987 – 1988
- Faculty Affirmative Action Committee member 1986 – 1989, chair 1987 – 1988
- Advisor to Radio Telescope Project 1986 – 1994

Media Outreach Activities

1) April, 1989. Hour-long KSRO Radio Interview about Venus Magellan mission and SSU Physics and Astronomy program (with Prof. Gordon Spear).

2) February, 1992. Television Interview about research activities in the California State University system, for The Learning Channel.

3) April, 1993. KRCB-TV Co-host during Membership Drive Space Segment.

4) March, 1996. Three items in consecutive weeks during KRON-TV news: the bursting pulsar, and two on upcoming observations of Comet Hyakutake (with Brian Hackney).

5) April, 1996. High Energy Astrophysics Division Meeting in San Diego, CA. Many radio and print media interviews regarding the discovery of the fastest oscillations from neutron stars using the Rossi X-ray Timing Explorer satellite. Organized the press activities for this meeting.

6) April, 1997. Compton Gamma-ray Observatory Symposium in Williamsburg, VA. Many radio and print media interviews regarding the discovery of an anti-matter fountain north of the Galactic Center. Organized the press activities for this meeting.

7) November, 1997. High Energy Astrophysics Division Meeting in Estes Park, CO. Many radio and print media interviews regarding the discovery of a diffuse halo of high energy gamma-rays around the Galaxy, and evidence for relativistic frame-dragging near black holes and neutron stars. Arranged CNN coverage of the frame-dragging story. Organized the press activities for this meeting.

8) December, 1997. Half-hour radio interview show on KRCB-FM, regarding gamma-ray bursts and the new Gamma-ray Large Area Space Telescope (GLAST) mission.

9) January, 1998. “Astronomy Update", National Public Radio Science Friday. News from the Washington, DC American Astronomical Society Meeting (with Ira Flatow, and Dr. Eli Dwek), as part of the AAS meeting's press activities.

10) March, 1998. Acting press officer for the American Astronomical Society, while Steve Maran was away observing the total solar eclipse.

11) June, 1998. Television interview about Transition Region Active Coronal Experiment (TRACE) observations of very fast and energetic flares in the solar corona, for San Diego independent channel 41, as part of the American Astronomical Society meeting's press activities.

12) December, 1998. Released outreach web site for the Gamma-ray Large Area Space Telescope Facility Science Team: http://www-glast.sonoma.edu

13) January, 1999. Assisted in AAS press activities, including planning and moderating 8 press briefings, including those on superflares on sun-like stars, superclusters, and cave paintings in Guam. Participated in several media interviews.

14) April, 1999. High Energy Astrophysics Division Meeting in Charleston, SC. Many radio and print media interviews regarding the discovery of "medium-sized" black holes, exotic photon bubbles and hypernova remnants. Organized the press activities for this meeting. Originated "virtual press conference technique" written up in SW (Science Writing) magazine, Spring 1999 issue, by Charles Petit (US News and World Report).

15) September, 1999. Discovery Channel one-hour webcast on Science Live! "The Future of Astronomy" – panel discussion with Mario Livio and Phil Platt. See the link at http://www.discovery.com/past/sciencelive/morespace.html

16) October, 1999. Organized press activities for Cosmic Genesis and Fundamental Physics conference, at Sonoma State University. Coverage included two television stations, and several reporters from science magazines. See *Science* **286**, p. 1266 and p. 2060.

17) January, 2000. Assisted in AAS Press activities in Atlanta, including planning and moderating 8 press briefings, including those on the discovery of an isolated black hole, and the nearest black hole. Participated in several media interviews. Quoted in Reuters news article by Deborah Zaborenko entitled "Cosmic Glass Ceiling Limits Women Astronomers" http://www.space.com/people/women_astronomers_000111_wg.html

18) March 22, 2000. Commentator in NASA Space Science Update, a televised press briefing on a new class of unidentified gamma-ray sources.

19) July 21, 2000. Interviewed for article in Press Democrat on North Bay Science Project summer teacher training institute at SSU. Read the archived article at: http://www.newslibrary.com/download.asp?DBLIST=sa00&DOCNUM=9076&TERMV=62233:4:62237:8:67399:8:

20) Moderated Deep Space Scientists Online Web Chats for NASA Quest, monthly from September, 2000 throughout the academic year.

21) Organized 4 press briefings for AAS High Energy Astrophysics Division meeting held in Honolulu, Hawaii, November 5-10, 2000. See http://perry.sonoma.edu/head2000

22) January 19, 2001. Appeared as part of a panel on Digital West (KQED-TV) discussing the *State of the Skies*. See links at http://dw.kqed.org/archives.html#47

23) April 4-6, 2001. Press Officer for Gamma 2001 Symposium, organized four press briefings. See http://perry.sonoma.edu/gamma2001

24) June 3-7, 2001. Deputy press officer for AAS Summer meeting in Pasadena, CA. Appeared on NPR's Talk of the Nation/Science Friday on 6/8/01. Hear it at: http://search.npr.org/cf/cmn/cmnpd01fm.cfm?PrgDate=06/08/2001&PrgID=5

25) Author of article “Living Science Fiction: Black Holes, Exploding Stars and Distant Galaxies”, which appeared in Sonoma County Women’s Voices newspaper (June/July 2001)

26) September 5–6, 2001: Press officer for Chandra Science Symposium. Organized 2 press briefings, and moderated NASA Television broadcast of the discovery of X-ray flares from our Galactic Center.

27) October 9 – 13, 2001: Provided several radio and print media interviews regarding biological weapons and anthrax.

28) January 6–10, 2002: Moderated five press briefings at the AAS Winter Meeting in Washington DC, including the Q&A with newly appointed Presidential Science Advisor John Marburger III.

29) April 20-23, 2002: Moderated one press briefing and assisted with two others at HEAD meeting in Albuquerque, NM.

30) January 4-8, 2003: Acting Press Officer for the American Astronomical Society at the AAS Winter Meeting in Seattle, WA. Moderated 6 press briefings. Provided radio interview with station in San Antonio, TX regarding the “speed of gravity”

31) May 26-29, 2003: Deputy Press Officer for the American Astronomical Society at the AAS Summer Meeting in Nashville, TN. Moderated 3 press briefings. Provided radio interview with NPR’s Science Friday on the highlights of the meeting. Hear it at: http://www.sciencefriday.com/pages/2003/May/hour2_053003.html

32) September 2, 2003: Radio Interview on SciFi Overdrive Program on Gamma-ray Bursts, GLAST and Swift.

33) May 14, 2004: BBC radio interview on Beyond Einstein program, also LA Times interview.

34) May 31 – June 3, 2004: Deputy Press Officer for the American Astronomical Society at the AAS Summer Meeting in Denver, CO. Moderated 6 press briefings.

35) July 22, 2004: Radio interview on NPR’s Connections with Dick Gordon, discussing Stephen Hawking’s new ideas about black hole information. Hear it at: http://www.theconnection.org/shows/2004/07/20040722_b_main.asp

36) January 12, 2005 - Cover story “Black Hole Beacons” in North Bay Bohemian (weekly Sonoma County newspaper), also online at: http://www.metroactive.com/papers/sonoma/01.12.05/blackholes-0502.html

37) April 17, 2005 - Press Democrat feature article “Explaining The Universe: SSU Professor Lynn Cominsky's Life Work Is To Try To Understand The Mysteries Of Space” also online at: http://www.phys-astro.sonoma.edu/news/CominskyPD20050417.pdf

38) June 11, 2005 - Static Limit one hour radio interview on KUSF with David Reffkin.

39) November 29, 2005 – Organized press activities for "Gamma-ray Bursts in the Swift Era" symposium, held in Washington DC.

40) January 8-12, 2006 – Deputy Press Officer for American Astronomical Society at the AAS Winter meeting in Washington, DC. Moderated 6 press briefings.

41) February 1, 2006 – quoted in two articles about premiere of planetarium show "Black Holes: the Other Side of Infinity" – Denver Post http://www.denverpost.com/search/ci_3462638 and Rocky Mountain News
http://www.rockymountainnews.com/drmn/local/article/0,1299,DRMN_15_4431713,00.html

42) January 4-7, 2007 Deputy Press Officer for American Astronomical Society at the AAS Winter meeting in Seattle, WA. Moderated 4 press briefings, was interviewed by local television.

43) Feb. 4-7, 2007 Press Officer for GLAST Science Symposium. Organized and moderated two press conferences.

43) May 27-30, 2007 Deputy Press Officer for American Astronomical Society at the AAS Summer meeting in Honolulu, Hawaii. Moderated 3 press briefings and helped organize press tour.

44) September 19, 2007 GLAST Media Day at NASA/Goddard Space Flight Center. Organized, rehearsed and moderated panel that presented to 16 reporters.

45) January 7-11, 2008 Deputy Press Officer for American Astronomical Society at the AAS Winter meeting in Austin, Texas. Moderated 4 press briefings.

46) May 5-14, 2008 Acting AAS Press Officer while Maran was out of the country. Helped organize activities at St. Louis Summer meering.

47) June 1-12, 2008. GLAST Press Officer for launch. Helped organize pre-launch briefings, and also appeared on camera for Orlando television stations. Was quoted in several news articles.

48) January 4-9, 2009. Helped organize two press conferences for American Astronomical Society meeting reporting results from Swift and Fermi.

49) June 2009. Helped organize a press conference for American Astronomical Society meeting reporting results from Swift.

50) October 30 2009. Helped organized Fermi media telecon from NASA Headquarters reporting first year results.

51) November 4, 2009. Organized press conference at Fermi Science Symposium meeting in DC.

52) January 5, 2010. Helped organize a press conference for American Astronomical Society meeting reporting results from Fermi about millisecond pulsars.

53) February 15, 2010. Helped organize a press conference for American Physical Society meeting reporting results from Fermi about supernova remnants.

54) March 2, 2010. Helped organize a press conference for High Energy Astrophysics Division meeting reporting results from Fermi about extragalactic background.

55) March, 2010. Book Review for Physics Today of "*Gamma-Ray Bursts: The Brightest Explosions in the Universe"* by Gilbert Vedrenne and Jean-Luc Atteia

56) November, 2010. Helped organize a NASA media telecon: Fermi's discovery of "Giant Gamma-ray Bubbles near the center of our Galaxy."

57) January, 2011. Helped organize two press conferences with results from Fermi at the American Astronomical Society meeting in Seattle, WA. Moderated the press conference on "Thunderstorms Hurling Anti-matter into Space."

58) November, 2011. Helped organize NASA Media telecon: Fermi's Discovery of the Newest Millisecond Pulsar."

59) December, 2011. Radio Interview for KRCB Northbay Report.
http://krcb.org/201112072405/north-bay-report/lynn-cominsky

60). January, 2012. Helped organize Fermi and NuSTAR press conference at American Astronomical Society meeting in Austin, TX. Fermi press conference was on the 10 GeV sky.

61) April 2012. Helped organize Fermi press conference at the American Physical Society meeting in Atlanta, GA on dwarf galaxy limits for dark matter.

62) November 2012 – Ancient starlight fog press conference at Fermi Symposium in Monterey, CA

63) January 2013. Helped organized Fermi, Swift and NuSTAR press conferences at the American Astronomical Society meeting in Long Beach, CA. Fermi press conference on

64) March 2013. Organized and moderated press conference at the GRB 2013 meeting in Nashville, TN

65) July/August 2013. Article in Sport Rocketry magazine about Small Satellites for Secondary Students by Prof. Lynn Cominsky, Kevin John, Logan Hill and Kevin Zack.

66) December, 2013. Press Democrat interview about SSU's First Satellite, T-LogoQube.
http://www.pressdemocrat.com/article/20131210/articles/131219961

67) January 2014. Helped organize Press conference at AAS with Fermi's gravitational lens observation.

68) April, 2014. Press Democrat interview about dark sky locations in Sonoma County http://www.pressdemocrat.com/article/20140421/news/140429934

69) May, 2014. KRCB-radio interview about upcoming lecture about black holes. http://radio.krcb.org/post/peeking-inside-distant-galaxies

70) June, 2014. Comcast Newsmaker interview about Learning by Making program http://comcastnewsmakers.com/video/sonoma-state-university-4/

71) June 2014. AAS Seminar for Science writers about CubeSats. Participated as panelist, discussing educational uses of CubeSats and high-powered rocketry.

72) December 2014. Article for Zonta newsletter and GRL blog on WIA award

73) March 2015. AAAS member spotlight "Five Things About Me: Astronomer Lynn Cominsky" http://membercentral.aaas.org/blogs/member-spotlight/5-things-about-me-astronomer-lynn-cominsky

74) June 2015. North Bay Biz "People You Should Know: Dr. Lynn Cominsky, Furthering Science and Inspiring Young Minds" http://www.northbaybiz.com/General_Articles/General_Articles/People_You_Should_Know_Dr_Lynn_Cominsky.php

75) October 2015, North Bay Business Journal "Napa Valley College receives multiple NASA grants" L. Cominsky interviewed and quoted. http://www.northbaybusinessjournal.com/northbay/napacounty/4580861-181/napa-valley-college-receives-multiple#biTPOVgx3tZMBYSS.99

76) October 2015, Press Democrat "SSU's High Energy Professor"(print title) or "Sonoma State astrophysicist outlines her 'high energy life' (online title) http://www.pressdemocrat.com/lifestyle/4611430-181/sonoma-state-astrophysicist-outlines-her?page=1

77) November 2015. Organized and moderated press conference for Sixth International Fermi Symposium about the first extragalactic gamma-ray only pulsar, held 11/12/15.

78) January 2016: "Cominsky Receives $20,000 Wang Family Excellence Award" http://www.sonoma.edu/newscenter/2016/01/cominsky-receives-20000-wang-family-excellence-award.html

79) February 2016. "Lynn Cominsky Receives Wang Family Excellence Award http://www.sonoma.edu/workplace/2016/02/02/wang.html

80) February 2016. "Gravitational Waves Detected 100 Years after Einstein's Prediction" http://www.sonoma.edu/newscenter/2016/02/gravitational-waves-detected-100-years-after-einsteins-prediction.html

81) March 2016. "Cominsky Honored by State for Work on Gravitational Waves Discovery" www.sonoma.edu/workplace/2016/03/15/cominsky.html . This story was chosen as one of SSU's top ten stories for 2016 http://www.sonoma.edu/newscenter/2016/12/top-10-ssu-news-stories-of-2016.html

82) May 2016. "Another Tiny Satellite: NASA Awards Sonoma State $200,000 for Tiny Satellite Measuring Earth's Ecosystems" http://news.sonoma.edu/article/another-tiny-satellite

83) July 2016. "Drones and Rockets: New Program Trains Community College Teachers on Drones and Rockets" http://news.sonoma.edu/article/drones-and-rockets

84) December 2016. "Makerspace Comes to Library: New Maker Program and Makerspace Coming to SSU Thanks to $580,000 NSF Grant" http://news.sonoma.edu/article/makerspace-comes-library

85) October 2017 "Making the Future: New Makerspace Opens in University Library" http://news.sonoma.edu/article/making-future

86) October 2018 – organized and moderated press conference at 8th International Fermi Symposium: A) Blazar's Brightness Cycle Confirmed by NASA's Fermi Mission and B) NASA's Fermi Mission Energizes the Sky with Gamma-ray Constellations.

87) December 2019 – EdgeCube launch publicity including Press Democrat article https://www.pressdemocrat.com/news/10411762-181/spacex-rocket-launch-puts-sonoma, SSU news article http://news.sonoma.edu/article/cube-satellite-built-ssu-students-set-orbit-earth-and-collect-data-vegetation-health and Univision television feature http://uni.vi/OZZJ1023D12 .

88) May 2020 – Quoted in Nature magazine article about online conferencing in the age of COVID - https://www.nature.com/articles/d41586-020-01489-0

89) October 2020 – "Extreme Universe of Gamma-ray Astronomy" commissioned article published in Sky & Telescope magazine (see refereed journal articles).

90) February 2021 – "SSU professor secures $5 million NASA grant to develop new programs for students with autism", article in Press Democrat newspaper https://www.pressdemocrat.com/article/news/ssu-professor-secures-5m-nasa-grant-to-develop-new-programs-for-students-w/

91) September 2023 – "Astronaut Nicole Mann, a Sonoma County native, captivates with tales from space and lessons for life," article in Press Democrat newspaper https://www.pressdemocrat.com/article/news/astronaut-nicole-mann-a-sonoma-county-native-captivates-with-tales-from-s/

Professor Lynn R. Cominsky

TEACHING AND MENTORING ACTIVITIES

Courses Taught at Sonoma State University (1986 – present)

Physics 116 – Introductory Laboratory Experience
Physics 209A/B and 210A/B – Physics by Inquiry version of General Physics and Laboratory
Physics 214 – Introduction to Physics II
Physics 216 – Introductory Laboratory
Physics 312 and 312L – Elements of Digital Electronics and Laboratory
Physics 314 – Introduction to Physics III
Physics 325 – Mathematical Physics
Physics 375 – Physics for the Nuclear Age
Physics 412 and 412L – Microprocessor Applications and Laboratory
Physics 425 – Introduction to Mathematical Physics
Physics 445 – Theory of Signal Processing
Physics 450 – Statistical Physics
Physics 494 – What Physicists Do public lecture series
Astronomy 305 – Frontiers in Astronomy
Astronomy 350 – Cosmology
Astronomy 380 – Astrophysics of Stars
Education 490/800 – NASA's Multi-wavelength Universe – a two-week online professional development course for teachers sponsored by several different NASA projects and offered through Extended Education for academic or continuing education credit.
https://universe.sonoma.edu/cosmo/course/view.php?id=5
Physics 495/800 – LIGO: Waves and Gravity – a three week online professional development course for community college and AP high school physics teachers sponsored by NSF grant, and offered through Extended Education for academic or continuing education credit.
http://universe.sonoma.edu/cosmo/course/view.php?id=3
Physics 495/800 – LIGO: Detecting Gravitational Waves – an 8 week online online professional development course for community college and AP high school physics teachers sponsored by NSF grant, and offered through Extended Education for academic or continuing education credit.
https://universe.sonoma.edu/cosmo/course/view.php?id=6
Science 220: Dream, Make and Innovate- taught the lecture part of the course during AY2018/19.
Physics 100: Descriptive Physics – taught 2/3 of the course due to leave by lecturer.

Activities with High School or College Students

1) "X-ray Astronomy Research", Society of Physics Students lecture, Sonoma State University, September 19, 1986.

2) "Cosmology", lecture for the Hutchins School of Liberal Studies, Sonoma State University, October 6, 1986.

3) "Discovery of X-ray Eclipses from an X-ray Burster", Society of Physics Students lecture, Sonoma State University, December 5, 1986.

4) “How I Finally Learned Physics”, lecture for Re-entry Program, Sonoma State University, December 5, 1986.

5) “Strategic Defense Initiative”, lecture to Campus Peace Action Coalition, Sonoma State University, October 28, 1987.

6) “SSU Radio Telescope”, lecture to Upward Bound high school students, Sonoma State University, July 17, 1988.

7) “X-ray Visions from Space”, lecture to high school students at Lawrence Academy through the Women and Mathematics program, Santa Clara, CA, December 15, 1988.

8) “X-ray Astronomy Research”, lecture to Society of Physics Students, Sonoma State University, February 14, 1989.

9) “X-ray Visions from Space”, lecture to students at El Cerrito High School, through the Women and Mathematics program, El Cerrito, CA, March 9, 1989.

10) “Careers in Physics”, lecture to students at Redwood High School, through the Women and Mathematics program, Larkspur, CA, November 16, 1989.

11) “Astronomy Research”, lecture to students at Analy High School, through the California State University/High School Research Collaboration, Sebastopol, CA, January 16, 1990.

12) “How I Finally Learned Physics”, lecture and discussion at Women's Resource Center, Sonoma State University, April 24, 1990.

13) “X-ray Visions of the Universe”, lecture to potential freshman students on Preview Day, Sonoma State University, April 29, 1990.

14) “Professors were once Freshmen too”, lecture and panel discussion for Summer Bridge Students, Sonoma State University, August 1, 1990.

15) Judge at St. Barnabas Middle School Science Fair, February 1991.

16) Judge at Healdsburg School District Science Fair, March 1991.

17) Participating Scientist in Science by Mail Program, 1991, 1992

18) Lecture to Upward Bound Students about Careers in Science, Sonoma State University, July 1, 1992.

19) Judge at Healdsburg School District Science Fair, March 24, 1993.

20) Expanding Your Horizons Workshop “Here Comes the Sun”, Sonoma State University, March 20, 1993.

21) Panelist, Take Your Daughters to Work Day, Stanford Linear Accelerator Center, April 28, 1994

22) Faculty Mentor to Palo Alto High School Student Martin Flom-Millman, Spring 1994

23) Faculty Mentor to Fresno Central High School Teacher Marc Afifi, Stanford Linear Accelerator Center Summer High School Teachers Institute 1994

24) “Astrophysics at the Stanford Linear Accelerator Center”, lecture to the SLAC Summer Science Undergraduate Program, July 27, 1994.

25) Judge at Healdsburg School District Science Fair, March 15, 1995.

26) Activity Group Leader at Take Your Daughters to Work Day, Stanford Linear Accelerator Center, April 27, 1995.

27) “X-ray and Gamma-ray Visions of the Universe”, lecture to NOVA high school assembly, Novato, CA, September 2, 1997

28) Westinghouse science project advisor to Sommerfield-Waldorf High School student Daniel Mazeau, Fall, 1997

29) “X-ray and Gamma-ray Visions of the Universe”, lecture to students at St. Vincent's High School, Petaluma, CA, December 11, 1997.

30) Judge at Healdsburg School District Science Fair, March 11, 1998.

31) “GLAST, the Gamma-ray Large Area Space Telescope”, lecture to students from Willits High School, April 30, 1998.

32) “GLAST, the Gamma-ray Large Area Space Telescope”, lecture to students in Physics 482, November 30, 1998.

33) “Gamma-ray Astronomy”, lecture to students in Physics 482, November 27, 2000

34) Supervised volunteer work by Dakota Decker, Fall 2003 – Spring 2004

35) Expanding Your Horizons workshop - April 2004

36) Judge at Sonoma County Office of Education Science Fair – May 2004

37) “You Are Here” mini-course at Roseland University Prep, May 2005

38) “After the Big Bang” lecture to Hutchins students, September 23, 2005

39) Roseland University Prep student field trip to SSU Pepperwood Observatory, January 20, 2006

40) Expanding Your Horizons Workshop – April 2006

41) Cosmology lecture to Hutchins Students, October 13, 2006

42) Roseland University Prep career Day, May 2007

43) Roseland University Prep Summer Experience, August 2007

44) Expanding your Horizons Workshop – April 2008

45) Roseland University Prep portfolio Day, May 2008

46) Roseland University Prep Summer Experience, June 2008

47) Expanding Your Horizons workshops – March 2010

48) Mini-Maker's Faire – March 2011

49) Roseland University Prep portfolio Day, May 2011

50) Expanding Your Horizons workshops – March 2012

51) Roseland University Prep portfolio Day, May 2012

52) Expanding Your Horizons workshops – April 2014

53) Advisory Committee, Deer Valley High School, Robotics Engineering Pathway Development – 2014 – 2016

54) Partnerships with four autism-serving high schools for the N3 project: Oak Hill, Orion Academy, Stanbridge Academy, Anova - 2021 - 2025

Supervised Student Research Awards

1) Francis Moraes, "Geometric Modeling of X-ray Pulsations", SSU Sigma Xi Undergraduate Research Award, May 30, 1990. ($200)

2) Holly Jessop, "Optical Monitoring of an Important X-ray Binary Pulsar at the Sonoma State University", Sonoma State University Pre-pre-doctoral Award, Spring 1991. ($200)

3) Holly Jessop, SSU Associate Students award for presentation of paper at the AAVSO Meeting, "Updated Periods for CG and GY Coma Berenices", Spring 1991. ($100)

4) Holly Jessop, California State University Pre-doctoral Fellowship, August, 1991. ($3000)

5) Holly Jessop, “CCD Photometry of BY Cam”, National Sigma Xi Grant-in-Aid Research Award, 1991. ($500)

6) Holly Jessop, California State University Summer Fellowship, 1992. ($1500)

7) Greg Sprehn, “The Sonoma State University Very Small Array”, SSU Sigma Xi Undergraduate Research Award, May 18, 1992. ($100)

8) Greg Sprehn, National Science Foundation Research Experiences for Undergraduates/American Astronomical Society Award, “Tracking Observations using the Sonoma State University Very Small Array”, August 1992. ($4470)

9) Daniel Mazeau, Sommerfield-Waldorf High School student, Westinghouse Science Talent Search Semi-finalist, “Constraints on Super-symmetric Models of Dark Matter from High Energy Gamma-ray Observations”, January, 1998.

10) Kevin Zack – Steven Chu award at Far West Annual Meeting, Nov. 2013

11) Kevin Zack – Sigma Pi Sigma Research Award ($2000) for “Ground Station for Small Satellites” Spring 2014.

12) Kevin Zack – second place in SST Science Symposium, May 2014

13) Anna McCowan, Amandeep Gill and Alyssa Afa’ese - $600 in IRA funding for the development of “A^3Sat: All Women CubeSat payload development” October 2014

14) Demitri Call – Green Music Center Academic Integration Fund - “Microbial Fuel Cells for the Classroom”, $1500, May 2015

15) Claire Shudde, Demitri Call and Michael Schwartz – Provost Undergraduate Research SOURCE award “CubeSat Development” $1000, Spring 2016

16) David House, Arturo Ramos, Jorge Bautista, Victoria Yrigollen/Yiting Hsieh – Koret Foundation Award, $8000, Fall 2016

Supervised Student Research Talks

1) Daniel Nottingham, “Evolution of the Sonoma State University Radio Telescope”, May 2, 1987, at the Association of North Bay Scientists annual meeting.

2) M. Richard Mayer, “Data Acquisition System for the SSU Radio Telescope”, May 2, 1987, at the Association of North Bay Scientists annual meeting.

3) Daniel Nottingham, “SSU Radio Telescope”, July 1987 at the Astronomical Society of the Pacific meeting at Pomona College.

4) Francis Moraes, "Geometric Modeling of X-ray Pulsations", April 29, 1989 at the Association of North Bay Scientists annual meeting.

5) Joan Ghiglieri, "SSU Radio Interferometer", April 29, 1989 at the Association of North Bay Scientists annual meeting.

6) Francis Moraes, "Geometric Modeling of X-ray Pulsations", May 5, 1990 at the California State University Undergraduate Research Competition.

7) Ildgoz Modeer, "The Sonoma State University Radio Interferometer", November 3, 1990 at the Northern California Section of the Society of Physics Students Conference.

8) Holly Jessop, "Revision and Update for V1176 Sagittarii", March, 1991 at the Association of North Bay Scientists Annual meeting.

9) Greg Sprehn, "The Sonoma State University Very Small Array", November 4, 1991 in the What Physicists Do public lecture series at Sonoma State University

10) G. Sprehn and L. Cominsky, "The Sonoma State University Very Small Array", presented at the 179th meeting of the American Astronomical Society, *Bulletin of the American Astronomical Society*, **23**, 1451 (1991).

11) Holly Jessop, "A Revision and Update for the Period of V1176 Sagittarii", presented at the 179th meeting of the American Astronomical Society, *Bulletin of the American Astronomical Society*, **23**, 1379 (1991).

12) Greg Sprehn, "The Sonoma State University Very Small Array", presented at the California State University Research Competition, May, 1992.

13) Greg Sprehn,"The Sonoma State University Very Small Array", an invited lecture to the Stockton Astronomical Society, July 8, 1992.

14) G. Sprehn and L. Cominsky, "The Very Small Array Radio Telescope", presented at the Undergraduate Research Poster Session of the Sigma Xi National Meeting, held in San Francisco, February 25, 1993.

15) G. Sprehn, B. Owen and L. Cominsky, "Motorization and Control of the Sonoma State University Very Small Array", presented at the 182nd meeting of the American Astronomical Society, *Bulletin of the American Astronomical Society*, **25**, 810 (1993).

16) M. Roberts, L. Cominsky, and M. Finger, "An April 1991 Outburst from 4U0115+63 Observed by BATSE", presented at the 182nd meeting of the American Astronomical Society, *Bulletin of the American Astronomical Society*, **25**, 911 (1993).

17) M. Roberts, "X-ray Outbursts from Neutron Stars in Binary Systems", April 18, 1994 in the *What Physicists Do* public lecture series at Sonoma State University.

18) M. Roberts, N. Owen, G. Spear, L. Cominsky, “The Very Small Array Sky Survey”, presented at the 184th meeting of the American Astronomical Society, *Bulletin of the American Astronomical Society*, **26**, 859 (1994)

19) Kevin Zack, J. Garrett Jernigan and Lynn Cominsky – “The Development of a 3P PocketQube” presented at the Far West sectional meeting of the American Physical Society, http://meetings.aps.org/Meeting/CAL13/Session/H4.8 (2013)

20) Kevin Zack – “Satellites at SSU” SST Science Symposium, May 2014

21) Amandeep Gill, Kevin Zack, Hunter Mills, Ben Cunningham, & Stephan Jackowski, “Undergraduate Skills Laboratories at Sonoma State University” American Astronomical Society, AAS Meeting #223, #160.02 2014AAS...22316002G

22) Casey Lewiston “Rising Data” SST Science Symposium, May 2017

23) Shannon Lessard “Dream, Make and Innovate: SST Science Symposium, May 2019

Supervised Senior Design Projects in Applied Physics (Physics 493)

1) Daniel Wilcox, Programmable Robot (1987).

2) David Marshall, Computer Controlled Greenhouse Environment (1987).

3) Daniel Nottingham, Motorized Drives for the SSU Radio Interferometer Telescope (1987).

4) Phillipe Argouarch, Radiation Hazard Monitoring with a Microcomputer (1988).

5) Michael McClendon, Photographic Enhancement through Unsharp Masking (1988).

6) Nancy Kunnari, Light Harp (1989).

7) Francis Moraes, Digital Determination of Muon Lifetime (1990).

8) Gregory Davis, Fiberoptics Laser Interference Detection (1990).

9) Marie-Christine Raude, Interferometric Measurement of Thermal Expansion (1990).

10) Jason Alexander, Turbo-Jet Engine (1991).

11) Tina Rosenberg, Diode Array Spectrophotometer (1992).

12) Nicko Melville, Regenerative Braking (1992).

13) Mark Lenhart, Digi-talk (1993).

14) Alon Katz, Heliostat (1993).

15) Greg Sprehn, Motorization of the Very Small Array (1993).

16) Cherie Copeland, Voice Control of a Robot Arm (1995).

17) Paul Bauer, Remote Infrared Multiplexed Controller (1995)

18) Scott Demorest, Heliostat (1997)

19) Kevin Zack, Satellites at SSU (2014)

Supervised Special Studies, Undergraduate Research or Instructional Design Projects (Physics or Astronomy / 492, 495 or 497)

1) Daniel Nottingham, Radio Telescope Alignment and Sun Acquisition (1986)

2) Philip Cullen, 13 inch Newtonian Telescope (1986)

3) Robin Scheppes, Massive X-ray Binaries (1986)

4) Mark Feldman, Bird Call Signal Processing (1988)

5) Joan Ghiglieri, Radio Telescope Receiver (1989)

6) Stephen Wallace, Motors for the Radio Telescope (1989)

7) Francis Moraes, Neutron Star Pulsar Beam Modeling (1990)

8) Fausto Morales, Numerical Astrophysics Diffusion Modeling (1990)

9) Mak Rusli, Microprocessor Applications using FORTH (1990)

10) Greg Sprehn, Radio Telescope and Heliostat Observations (1990)

11) Ildgoz Modeer, Detection of Interference from Radio Telescope (1990)

12) Andrew Peri, Weapons Proliferation in the Third World (1990)

13) Greg Sprehn, Radio Telescope (1991)

14) Mark Robinson, Music Signal Processing using the Motorola DSP 56000 (1991)

15) Greg Sprehn, Radio Telescope (1992)

16) Daniel Hale, Susan Webster and Siana Hurwitt, Astronomy Data Analysis (1995)

17) Amy Weber, Physics by Inquiry (1995)

18) John Hayes, Astronomical Data Analysis (1997)

19) Hank Carter, Scott Demorest and Barnell Hampton, Microprocessor Applications (1997)

20) Dan Goldman, Dan Hogan and Al Witten, Astronomical Data Analysis (1998)

21) Tim Graves, Astronomical Data Analysis (1999)

22) J. Scott Berry, Radio Telescope (1999)

23) Marsha Barrows, Gamma-rays from Solar Flares (2000)

24) Cristhyan Alfaro, Standard Model of Particle Physics (2012)

25) Kevin Zack Ion Engine Design (2012)

26) Ben Cunningham, Ion Engines (2012)

27) Kevin Zack, T-LogoQube (2013)

28) Aaron Owen, CubeSat (2014)

29) Aman Gill (2014) A3Sat

30) Anna McCowan (2014) A3Sat

31) Maxfield Torke (2014) Torquing TRL6 Satellite

32) Maxfield Torke, (2015) TRL6 Satellite Magnetic Torquing system

33) Aman Gill (2015) A3Sat Prototype development

34) Wes Watson (2015) CubeSat Power System

35) Demitri Call (2015) Lunar Orbit Simulation

36) Sean Wayland (2017) Classical Tests of General Relativity

37) Casey Lewiston (2017) Rising Data

38) Ryan Brown (2018) LIGO Course Materials Development

39) Shannon Lessard (2018) Dream, Make and Innovate

40) Earl Powell (2018) General Relativity

41) Jorge Bautista (2019) Star Camera for EdgeCube

42) Courtney McNatt (2020) Developing a High School STEM Curriculum

43) Jesse Nelson (2020-2021) Multi-messenger Astrophysics Master Class

44) Alex Vasquez (2021) Particle Sensor for CubeSat

45) Meghan Miller (2021) Dome to Home show

46) Zoie Bean (2022) Accessibility in STEM for N3

47) Katie Toman (2023) Heliophysics Activity Codesign for N3

48) Emily Uhrich (2024) Revising Learning by Making for Eighth Grade

8.6.2 Assistant Professor Alexandra Miller

ALEXANDRA P. M. MILLER

(707) · 664 · 3639 ⋄ millerale@sonoma.edu
Department of Physics and Astronomy, Sonoma State University
Rohnert Park, CA 94928

EMPLOYMENT

Assistant Professor **Sonoma State University** *Fall 2019 - Present*

Visiting Lecturer **Wellesley College** *Fall 2018 - Spring 2019*

Teaching Associate **University of California, Santa Barbara** *Summer 2017*

EDUCATION

University of California, Santa Barbara, Santa Barbara, CA, USA *September 2012 - June 2018*
PhD in Physics awarded Summer 2018
Certificate in College and University Teaching awarded Summer 2018
MA in Physics awarded Fall 2015

PhD Thesis: "Conformal Perturbation Theory and LLM Geometries"
Advisor: David Berenstein

San Francisco State University, San Francisco, CA, USA *September 2006 - June 2011*
B.S. in Physics with minors in Drama and Philosophy
Graduated Summa Cum Laude and as Physics and Astronomy Department Honoree

SSU TEACHING, SCHOLARSHIP AND SERVICE HIGHLIGHTS

This page highlights **major accomplishments and key activities** from my four years at SSU.

Teaching

- Taught **12 different courses**. These include both **lecture and lab courses**; and **GE and majors** courses. Specifically: PHYS 100, 114, 209A, 214, 216, 304, 320, 430, 460, 491, 494, 495
- Developed entirely **new curriculum** for PHYS 100, created PHYS 304 from scratch, and currently proposing PHYS 465 (new course in Particle Physics)
- Participated in Transformative Inclusion in Postsecondary STEM: Towards Justice
- Participated in Identity-Informed and Pandemic-Informed Teaching Faculty Groups
- Completed SSU Canvas Design Summer Institute and Online Facilitation Fundamentals Course

Scholarship

- **$247,000 Grant from the Department of Energy**, first DOE Grant ever awarded to SSU!
- Awarded **three RSCAP Summer Fellowships**
- **Publication**: A. Evans, A. Miller, and A. Russell "A Conformal Field Theory Primer in $D \geq 3$," (2023) [arxiv:2309.10107[hep-th]] **A. Evans and A. Russell are SSU students!**
- **Publication**: D. Berenstein and A. Miller, "Logarithmic Enhancements in Conformal Perturbation Theory and Their Real Time Interpretation," Int.J.Mod.Phys.A **35** (2020) 29, 2050184 [arXiv:1607.01922 [hep-th]].
- Advised **eight students** in research and Captsone projects
- Given **nine invited talks** and have one more coming up this Fall

University Service

- Served on University Scholarship Committee for one year
- Served on SST Curriculum Committee for three years, chaired for one year
- Served as Society of Physics Students Club Advisor for four years
- Developed new degree program in Physical Science

Community Service

- Organized What Physicists Do seminar for four semesters
- Served as Cal-Bridge Steering Committee Representative for four years
- Served as Cal-Bridge Summer (CAMPARE) Committee Member for three years
- Served as CUWiP (Conference for Undergraduate Women in Physics) Consortium Representative for one year
- Founding Member of Science by Diverse Scientists: A Cal-Bridge Physics and Astronomy Seminar for two years

TEACHING EFFECTIVENESS

Summary: Instruction of students across all stages of their undergraduate academic career: 100, 200, 300, and 400-level courses since my last review. This includes both GE and majors courses, as well as lecture and laboratory classes. Strong focus on **Diversity, Equity, and Inclusion**, as well as incorporating **active learning techniques** in the classroom, especially Think-Pair-Share and use of low-stakes multiple choice questions. Use of Canvas in all courses to share general course documents, lecture notes, videos, etc.

SSU Courses

PHYS 100: Descriptive Physics — *Fall 2023*

- Modern Physics for non-scientists, Satisfies GE Area B1
- Enrollment: 17
- Zero cost course
- Major course assignments revamped in response to the growth of ChatGPT and other AI tools. Midterm essays replaced with Poster Session and in-class Presentation.

PHYS 114: Introduction to Physics I — *Fall 2023*

- First semester of calculus-based general physics, primarily aimed at students in the hard sciences, Satisfies GE Area B1
- Enrollment: 28
- Zero cost course

PHYS 495: Special Studies — *Fall 2023*

- Quantum Mechanics Independent Study Course
- Enrollment: 4
- Low enrollment in PHYS 460 led to its cancellation and replacement with independent study units
- Course taught as flipped classroom, where students watch pre-recorded lectures and then we work on active learning assignments together

PHYS 214: Intro to Physics II ***New Prep*** — *Spring 2023*

- Second semester of calculus-based general physics, primarily aimed at students in the hard sciences
- Enrollment: 15
- Entirely new prep
- Created all of my own lecture notes, homework assignments, homework solutions, and exams

PHYS 216: Introductory Laboratory ***New Prep*** — *Spring 2023*

- Lab course associated with PHYS 214
- Enrollment: 12
- Entirely new prep
- Made several changes to the standard way of teaching this course as a part of Teagle Course Redesigns for Student Equity Grant

PHYS 304: The Strange World of Modern Physics ***New Course*** — *Spring 2023*

- Relativity and Quantum Mechanics for non-scientists
- Enrollment: 30
- Entirely new prep
- First time offering of this brand new course that I created from scratch

PHYS 491: Capstone Preparatory Seminar ***New Prep*** *Spring 2023*

- Course for graduating seniors to go hand-in-hand with their senior Capstone projects
- Enrollment: 9
- Entirely new prep
- Led all graduating students in creating a presentation on their Senior Capstone Project

PHYS 494: Physics Seminar *Spring 2023*

- Physics and Astronomy department colloquium (What Physicists Do) course
- Enrollment: 10
- The teacher of this course organizes and invites all speakers for the colloquium and is in charge of advertising all talks
- Students required to submit weekly pre-lecture write-ups and participate in post-lecture Canvas discussion forums

PHYS 460: Quantum Mechanics *Fall 2022*

- Upper division course for physics majors
- Enrollment: 5

PHYS 100: Descriptive Physics *Fall 2022*

- Modern Physics for non-scientists, Satisfies GE Area B1
- Enrollment: 29
- Zero cost course
- This was not an entirely new prep, but I made several changes. The last two times I taught this course, it was taught as a bisynchronous fully online course. I had to change it a great deal to adapt it for an entirely in-person modality.

PHYS 495: Special Studies ***New Prep*** *Fall 2022*

- Particle Physics Independent Study Course
- Enrollment: 4 (three taking it for one unit and one taking it for two units)
- High level of demand for Particle Physics Independent Study resulted in me transforming it into a mini-course, with all students registering for independent study unit(s)
- Helping me with early stages of developing a full 3-unit elective course on Particle Physics
- Consists of weekly one-hour meetings where students present concepts and calculations related to the assigned readings

PHYS 114: Introduction to Physics I *Fall 2022*

- First semester of calculus-based general physics, primarily aimed at students in the hard sciences, Satisfies GE Area B1
- Enrollment: 16
- Zero cost course
- Course revamped in order to transition from fully online, bisynchronous modality to fully in-person, synchronous modality

PHYS 494: Physics Seminar *Fall 2022*

- Physics and Astronomy department colloquium (What Physicists Do) course
- Enrollment: 7
- First time teaching course in-person
- The teacher of this course organizes and invites all speakers for the colloquium and is in charge of advertising all talks
- Students required to submit weekly pre-lecture write-ups and participate in post-lecture Canvas discussion forums

PHYS 430: Electricity and Magnetism ***New Prep*** *Spring 2022*

- Enrollment: 8
- Entirely new prep
- Recorded 11 videos on background mathematics using the Physics and Astronomy Department's Learning Glass
- Used new edition of textbook relative to previous instructor, wrote nine homework sets, homework solutions, two midterms, and a final

PHYS 320: Analytic Mechanics *Spring 2022*

- Advanced Newtonian Mechanics and Introduction to Lagrangian Mechanics
- Enrollment: 5
- Not an entirely new prep, but had to adjust much of the course content for new modality

PHYS 460: Quantum Mechanics *Fall 2021*

- Upper division course for physics majors
- Enrollment: 9
- In-person
- This was not an entirely new prep, but it was my first time teaching this course in-person, which required making several changes to the course format and schedule
- Wrote three new midterm exams and final

PHYS 100: Descriptive Physics *Fall 2021*

- Modern Physics for non-scientists
- Enrollment: 20
- Satisfies GE Area B1
- Zero cost course
- Bisynchronous modality, where all new content was presented in pre-recorded videos to be watched asynchronously and students were required to attend weekly Zoom discussion sessions
- This was not an entirely new prep, but I made several changes (to the material covered and to my assessments) in order to respond to the needs of SSU students

PHYS 495: Special Studies ***New Prep*** *Fall 2021*

- General Relativity Independent Study Course
- Enrollment: 6 (five taking it for one unit and one taking it for two units)
- In-person
- High level of demand for General Relativity Independent Study resulted in me transforming it into a mini-course, with all students registering for independent study unit(s)
- Helped with early stages of developing a full 3-unit elective course on General Relativity
- Consists of weekly one-hour meetings where students present concepts and calculations related to the assigned topic

PHYS 114: Introduction to Physics I *Spring 2021 and Fall 2021*

- First semester of calculus-based general physics, primarily aimed at students in the hard sciences
- Enrollment: 18 (Spring), 18 (Fall)
- Satisfies GE Area B1
- Zero cost course
- Bisynchronous modality, where all new content was presented in pre-recorded videos to be watched asynchronously and students were required to attend weekly Zoom discussion sessions
- Wrote all new exams for both semesters, as exams cannot be re-used without fear of student cheating in the online environment
- Continued to utilize Canvas quizzes and discussion forums to promote active learning, community building, and accountability in online environment

PHYS 494: Physics Seminar ***New Prep*** *Spring 2021 and Fall 2021*

- Physics and Astronomy department colloquium (What Physicists Do) course
- Enrollment: 7 (Spring), 5 (Fall)
- Synchronous Online course
- The teacher of this course organizes and invites all speakers for the colloquium and is in charge of advertising all talks
- Students required to submit weekly pre-lecture write-ups and participate in post-lecture Canvas discussion forums

PHYS 320: Analytic Mechanics *Spring 2021*

- Advanced Newtonian Mechanics and Introduction to Lagrangian Mechanics
- Enrollment: 9
- Bisynchronous modality, where all new content was presented in pre-recorded videos to be watched asynchronously and students were required to attend weekly Zoom discussion sessions
- Recorded 60 NEW short (generally $<$ 15 min) lecture videos on Zoom, uploaded to Yuja, and shared on Canvas (used in addition to previously recorded videos)
- Wrote all new exams, as exams cannot be re-used without fear of student cheating in the online environment

PHYS 100: Descriptive Physics *Winter 2021*

- Modern Physics for non-scientists
- Enrollment: 6
- Satisfies GE Area B1
- Bisynchronous modality, where all new content was presented in pre-recorded videos to be watched asynchronously and students were required to attend weekly Zoom discussion sessions
- Adjusted course content from previous teaching in order to fit into accelerated pace of Winter Intersession
- Utilized Canvas groups and discussion forums for building classroom community
- Adopted ideas from the Universal Design for Learning for students' final projects

PHYS 460: Quantum Mechanics ***New Prep*** *Fall 2020*

- Upper division course for physics majors
- Enrollment: 9
- Online course with Hybrid modality
- Wrote new weekly homework sets, with a combination of problems from course textbook and those I wrote myself
- Wrote own solutions for all homework sets
- Wrote two new midterm exams and final
- Pre-recorded short (approx. 10 min) lecture videos, covering all necessary course content (55 videos recorded as of September 9, 2020)
- Held weekly synchronous Zoom discussions

PHYS 114: Introduction to Physics I *Fall 2020*

- First semester of calculus-based general physics, primarily aimed at students in the hard sciences
- Enrollment: 26
- Satisfies GE Area B1 or B3
- Zero cost course
- Online course with Hybrid modality
- Utilized Canvas groups and discussion forums for building classroom community
- Pre-recorded (approx. 10 min) short lecture videos, covering all necessary course content (55 videos recorded as of September 9, 2020)
- Held weekly synchronous Zoom discussions

PHYS 100: Descriptive Physics *Fall 2020*

- Modern Physics (especially Special Relativity and Quantum Mechanics) for non-scientists
- Enrollment: 27
- Satisfies GE Area B1 or B3
- Online course with Hybrid modality
- Adjusted course content from previous teaching in order to be at a more appropriate level for the SSU student body
- Introduced use of Electronic Journals for constant reflection on course content
- Utilized Canvas groups and discussion forums for building classroom community
- Pre-recorded short (approx. 10 min) lecture videos, covering all necessary course content (19 videos recorded as of September 9, 2020)
- Held weekly synchronous Zoom discussions

PHYS 320: Analytic Mechanics ***New Prep*** *Spring 2020*

- Advanced Newtonian Mechanics and introduction to Lagrangian Mechanics
- Enrollment: 8
- Introduced use of small whiteboards for individual problem solving during class
- Utilized multiple choice cards for advanced problem solving (methods learned at AAPT Workshop)
- Wrote ten new homework sets, with a combination of problems from course textbook and those I wrote myself
- TeXed own solutions for all ten homework sets
- Recorded 44 short (< 25 min) lecture videos on Zoom, uploaded to Yuja, and shared on Canvas during period of Remote Instruction

PHYS 114: Introduction to Physics I *Spring 2020*

- First semester of calculus-based general physics, primarily aimed at students in the hard sciences
- Enrollment: 28
- Satisfies GE Area B1 or B3
- Zero cost course
- Introduced pre-lecture multiple choice and free response quizzes on Canvas in the spirit of Just-in-Time teaching
- Introduced use of small whiteboards for individual problem solving during class
- Wrote fourteen new homework sets (ten problems each), sourcing from several textbooks to deter cheating
- TeXed own solutions for all fourteen homework sets
- Recorded 86 short ($<$ 25 min) lecture videos on Zoom, uploaded to Yuja, and shared on Canvas during period of Remote Instruction

PHYS 114: Introduction to Physics I ***New Prep*** *Fall 2019*

- First semester of calculus-based general physics, primarily aimed at students in the hard sciences.
- Enrollment: 19
- Satisfies GE Area B1 or B3
- Used open-access text book and multiple choice cards (instead of clickers) to keep cost of course down

PHYS 100: Descriptive Physics ***New Prep*** *Fall 2019*

- Modern Physics (especially Special Relativity and Quantum Mechanics) for non-scientists. Course designed from scratch and taught in entirely new way compared to previous instances at SSU
- Incorporated ideas from Universal Design for Learning
- Enrollment: 32
- Satisfies GE Area B1 or B3

PHYS 209A: General Physics Laboratory ***New Prep*** *Fall 2019*

- Newtonian Mechanics lab course, primarily intended for students in the soft sciences
- Collaborated with other PHYS 209A instructors (James Lee and Bernadette Smith) on updating laboratory materials to reflect change in lab computer software (from Data Studio to Capstone)
- Enrollment: 24
- Satisfies GE Area B1 or B3, and GE laboratory requirements

Professional Development

Transformative Inclusion in Postsecondary STEM: Towards Justice *Summer 2022 - Present*
NSF-funded, multi-year program aimed at increasing the participation and success of Latinx students in STEM by transforming STEM department cultures to become truly "Hispanic-Serving". I participated in this in several ways over the last year:

- Three-day workshop in January 2023, which led to many changes in my courses
- Spring 2023 lesson study completed, where our department transformed two lessons in PHYS 209A
- Presented in 2023 TIPS Lesson Study Conference
- One-day workshop in August 2023
- Fall 2023 lesson study initiated. I am serving as the Lesson Study Facilitator
- Participation in '23-'24 academic year task force on Upper Division Student Success

Identity-Informed Teaching Faculty Group *Spring 2023*

- SSU Faculty Group aimed supporting faculty from various underrepresented groups
- Discussed how underrepresented faculty are differentially impacted in the classroom and built practices that help these faculty to thrive
- Participants met for one hour per week for six weeks

American Physical Society (APS) Career Mentoring Fellow *Fall 2023 - Present*

- The APS Career Mentoring Fellows program designed to help physicists to be better mentors to undergraduate students.
- In this program, I will learn about diverse career paths for physics degree holders, and establish a stronger connection with the physics community.
- I applied to this program over the summer and was just admitted!

Workshops on Best Practices *Fall 2022 - Present*

- Trauma Responsive Teaching SSU CTET Workshop

Transformative Inclusion in Postsecondary STEM: Towards Justice *Summer 2022 - Present*

- Year-long program aimed at increasing the participation and success of Latinx students in STEM by transforming STEM department cultures to become truly "Hispanic-Serving"
- Funded by NSF grant awarded to SSU Math Department
- Includes four-day worksop that took place in Summer 2022
- Includes bi-weekly check-ins for participating faculty during Fall 2022
- Further workshops and check-ins planned beyond Fall 2022

Pandemic Informed Teaching Faculty Working Group *Spring 2022*

- SSU Faculty Working Group aimed at reflecting on the differential impact on SSU students through the lens of inclusive pedagogy
- Examined how to best support students, especially those most vulnerable, in the midst and wake of the pandemic
- Participants were assigned weekly readings and met for one hour per week for six weeks

Workshops on Diversity, Equity, and Inclusion *Fall 2021 - Present*

- Gender Inclusive Teaching SSU CTET Workshop
- An Honest Conversation about Race and Systemic Oppression SSU Faculty Exchange
- A Walk-Through of So You Want to Talk about Race SSU Lecture
- "Teaching About Race" SSU Lecture
- Fostering Wellbeing in Racialized Mentoring Environments Cal-Bridge Workshop

Online Facilitation Fundamentals Course *Winter 2021*

- Asynchronous online 40-hour course on online teaching strategies
- Follow up to Canvas Course Design Foundations Course
- Reviewed Universal Design for Learning framework
- Developed Student Learning Outcomes to align with digital assessments
- Identified methods for increasing instructor presence and student success in the online environment

SSU Workshops, Faculty Exchanges, and Forums *Fall 2020 - Present*

- Increasing Equity in the Classroom Faculty Exchange
- So You Want to Talk About Race Faculty Exchange
- CTET Teaching in person workshop
- August 2021 Academic Continuity Open Forum
- Planning for Fall Faculty Exchange
- Inclusive Classroom strategies faculty exchange
- Faculty Exchange: Inclusive Syllabi as Tools for Change
- CTET Zoom Breakout Rooms Workshop
- 2021 Faculty Retreat
- Systemic Equity at SSU Faculty Exchange

Non-SSU Workshops on Diversity, Equity, and Inclusion *Fall 2020 - Present*

- Cal-Bridge Webinar on the Science of Mentoring
- COAST and CSUPERB: A Conversation on Power, Structural Racism, and Perceptions of Normality in STEM Through a Lens of Critical Race Theory
- Culturally Sensitive Teaching in STEM Workshop
- CFA "Interrupting Racism" Workshop (both parts 1 and 2)
- APS Team Up Webinar
- AAPT Addressing inequity in physics and astronomy: why is now the time for a SEA Change? Workshop

SSU Canvas Design Summer Institute

- A fast-paced, two-week, intensive course on effective use of Canvas
- Topics covered included: basic course layout, assessment options, course engagement tools, resources for student success, and the accessibility of course materials
- Activities completed in course included: developing a Content Map, developing an accessible page, utilizing Ally, and adding content to course Canvas pages

American Association for Physics Teachers (AAPT) New Faculty Workshop, College Park, MD

- Four-day workshop for new Physics and Astronomy Faculty from across the country
- Focused primarily on best practices when utilizing active learning techniques, including: Just-in-Time Teaching, Think-Pair-Share, Interactive Lecture Demonstrations, PhET simulations, and use of whiteboards

SSU Faculty Center Workshops

- Empower Student Engagement: Going Beyond Canvas with TopHat
- Re-Imagining your Course for Online Instruction Workshop
- How Students Learn: Lessons from Cognitive Psychology Part II
- Faculty Student Equity Workshop Pt. 2

STEM-NET Webcast Workshops

- Major Institutional Grants
- Assessing Student Learning Outcomes in Undergraduate STEM Courses

Inclusive Teaching: Supporting All Students in the College Classroom (ongoing)

- Self-paced online course consisting of 6 modules, put on by Columbia University
- Geared toward helping instructors to create more equitable learning environments that support all students' learning

SSU Faculty Center Workshops

- How Students Learn: Lessons from Cognitive Psychology
- Faculty Orientation. Included: Panel for Tips and Advice from Last's Year's New Faculty, Presentation - Starting Strong: How students learn, Supporting Student Success, Student Panel, Canvas Power Hour
- Canvas 101 and Canvas Intermediate

Learning Glass Videos

- Utilized the SSU Faculty Center to record supplementary videos to be used in a variety of physics courses.
- Videos topics: Scientific Notation, Unit Conversions, and Dimensional Analysis.
- Videos shared on Canvas and posted on my YouTube channel: "Super Awesome Fun Times with Physics"

RESEARCH AND SCHOLARSHIP

Summary: Research in the field of Quantum Gravity, Conformal Field Theory, and Quantum Chaos. Focus on including students in research, which is reflected in work on Primer Articles, which are co-authored by SSU students and designed to help future students enter the field. Awarded both external grants from DOE and internal grants.

- Total number of publications: 12
- Total number of citations: 222
- h-index: 9

SSU Publications

- A. Evans, A. Miller, and A. Russell "A Conformal Field Theory Primer in $D \geq 3$," (2023) [arxiv:2309.10107[hep-th]]. A. Evans and A Russell are SSU Students!
- D. Berenstein and A. Miller, "Logarithmic Enhancements in Conformal Perturbation Theory and Their Real Time Interpretation," Int.J.Mod.Phys.A **35** (2020) 29, 2050184 [arXiv:1607.01922 [hep-th]].

Research Grants

Department of Energy RENEW-HEP Grant (Growth & Research Opportunities With Traineeships in High Energy Physics at Minority Serving Institutions) *AWARDED, May 1, 2023 Start*

- First Department of Energy Grant ever awarded to SSU!
- Dr. Alexandra Miller and Dr. Wing To (Stanislaus State) are the two PIs on the grant
- Seven Co-Is at partnering CSUs, UCs, and National Labs
- **$950,000** total award amount to be divided among participating CSUs, to be spent over three years
- **$247,000** of total award amount is exclusively for Sonoma State University
- Funds three SSU students to complete 1.5 year traineeships in High Energy Physics, including one summer research experience spent at a partnering national lab or research institution
- Funds release time, summer salary, and travel for Dr. Miller to complete proposed research project

SSU Summer RSCAP Fellowship *Summer 2023*

- Proposed Project: A Conformal Field Theory Primer
- Grant funded ten days of summer salary to be spent working on research project

Koret Scholars Award *Fall 2021 - Present*

- Proposed Project: "Research and Advanced Projects on General Relativity"
- $7,600 Grant to fund research projects with four SSU students during the '21-'22 academic year

SSU Summer RSCAP Fellowship *Summer 2021*

- Proposed Project: A Study of Folded LLM Geometries
- Grant funded ten days of summer salary to be spent working on research project

Spring/Summer 2021 SSU Faculty Professional Development Award *Spring 2021 - Summer 2021*

- Grant awarded in order to fund travel to Strings 2021, an annual international conference in my field of research
- Award was not used because of pandemic (conference was moved online and there was no registration fee)

SSU Summer RSCAP Fellowship

- Proposed Project: A Study of the Universal Properties of Nearly Scale Invariant Systems
- Grant funded ten days of summer salary to be spent working on research project

Winter/Spring 2020 SSU Faculty Professional Development Award

- Grant awarded in order to fund travel to Strings 2020, an annual international conference in my field of research
- Award was not used because of pandemic (SSU travel halted and conference moved online)

<u>Talks</u>

Department of Physics and Astronomy Colloquium, San Jose State University *Spring 2023*

- "The Chaos that Ensues from Perturbing a Conformal Field Theory"
- Invited hour-long research presentation at San Jose State State department of Physics and Astronomy Colloquium

American Physical Society April Meeting *Spring 2023*

- "Tracking Chaos in Conformal Perturbation Theory"
- Poster Presentation at annual meeting of High Energy Physicists

Department of Physics and Astronomy Colloquium, Sacramento State *Fall 2021*

- "How Hole-y is your Spacetime? aka How to Measure Topology in Quantum Gravity"
- Hour-long virtual research presentation at Sacramento State department of Physics and Astronomy Colloquium

Department of Physics and Astronomy Colloquium, Chico State *Spring 2021*

- "How Hole-y is your Spacetime? aka How to Measure Topology in Quantum Gravity"
- Hour-long virtual research presentation at Chico State department of Physics and Astronomy Colloquium

Spitzer Seminar, CSU East Bay *Spring 2021*

- "How Hole-y is your Spacetime? aka How to Measure Topology in Quantum Gravity"
- Hour-long virtual research presentation at CSU Easy Bay department of Physics and Astronomy Colloquium

Virtual Research Gallery, Sonoma State University *Spring 2020*

- "Measurements of Topology in Quantum Gravity"
- Five-minute pre-recorded presentation
- Here is a link to the talk

Department of Mathematics Colloquium, Sonoma State University *Fall 2019*

- "Applications of Group Theory in Physics"
- Invited hour-long talk to students and faculty in the SSU Mathematics department

Department of Physics and Astronomy Colloquium, San Francisco State University *Fall 2019*

- "On Symmetry"
- Invited hour-long talk to students and faculty in the SFSU Physics and Astronomy department

Department of Physics and Astronomy Colloquium, San Jose State University *Fall 2019*

- "Measuring Topology in Quantum Gravity"
- Invited hour-long talk to students and faculty in the SJSU Physics and Astronomy department

What Physicists Do, Sonoma State University *Fall 2019*

- "On Symmetry"
- Invited hour-long talk to students, faculty, and the broader Sonoma County community

Conferences Attended

American Physical Society April Meeting *Spring 2023*

- Annual Meeting of High Energy Physicists
- Four day conference in Minneapolis, MN

Strings 2021, Virtual Conference *July 2021*

Strings 2020, Virtual Conference *July 2020*

Complexity from Quantum Information to Black Holes, Virtual Conference *June 2020*

Geometry from the Quantum, KITP at UCSB *January 2020*

Work with SSU Students

Conformal Field Theory Independent Research *Fall 2023*

- Advising Aaron Russell in Conformal Field Theory research project
- PHYS 495 Independent Study

Hichwa and Newkirk Summer Research Students *Summer 2023*

- Advised Aaron Russell and Andrew Evans in Conformal Field Theory research project
- This work resulted in publication

Conformal Field Theory Primer Capstone Project *Spring 2023*

- Advised Andrew Evans in his senior Capstone project
- Project presented in SSU Science Symposium, **Andrew was awarded Bright Idea Award**

Conformal Field Theory Independent Study *Fall 2022*

- Advising Andrew Evans in Conformal Field Theory research project
- PHYS 495 Independent Study

Characteristics of a Black Hole *Spring 2022*

- Advised Lindsey Batterton on an analytic project where she analyzed the Event Horizon Telescope's image of a Black Hole, utilizing the mathematics of General Relativity
- Project presented in SSU Science Symposium
- Used as her Physics and Astronomy Capstone Project
- Funded by Koret Scholars Program

The Black Hole Information Paradox *Spring 2022*

- Advised Austin Karwowski on analyzing a simplified model of Black Hole Evaporation and the Black Hole Information Paradox, utilizing the mathematics of General Relativity
- Project presented in SSU Science Symposium
- Used as his Physics and Astronomy Capstone Project
- Funded by Koret Scholars Program

A Symbolic Python Based Computational Tool for General Relativity *Spring 2022*

- Advised Pedro Jesus Quiñonez on writing a program in Python that computes Riemann tensor components and Christoffel Symbols, which are fundamental components of any system in General Relativity
- Project presented in SSU Science Symposium
- Funded by Koret Scholars Program

A Toy Model of Scattering of Higgs-like Particles *Spring 2022*

- Advised Andrew Evans in computing scattering amplitudes of scalar fields in Quantum Field Theory
- Project presented in SSU Science Symposium
- Funded by Koret Scholars Program

General Relativity Koret Scholars Project *Fall 2021 - Present*

- This semester, I am leading six students in an independent study on General Relativity
- Next semester, four of these students will continue to work with me as Koret Scholars and ultimately will complete individual research projects related to the field of General Relativity.

Capstone

- Coupled Oscillators and Waves with Jordan Braun *Spring 2021*
- PHYS 497 (Overload Units)
- Student made poster for SSU Virtual Research Gallery (link to the poster)

Capstone

- General Relativity Simulations of Black Holes with Joseph McGuire
- PHYS 497 (Overload Units)
- Student presented work in SSU Virtual Research Gallery (link to the talk)

Independent Study

- General Relativity with Joseph McGuire
- PHYS 495 (Overload Units)
- In preparation for Capstone Project to be completed in Spring 2020

Capstone Project

- Gravitational Waves Project with Earl Powell Jr
- PHYS 497 (Overload Units)
- Student will compute numerical simulation of gravitational waves

Professional Development

SSU SWAG: Summer Writing Accountability Group *Summer 2023*

- Met virtually with SSU colleagues weekly throughout the Summer in order to help support each other in accomplishing our Summer research goals

High Energy Theory Journal Club *Summer 2020 - Present*

- Weekly Zoom meeting with colleagues from other institutions to discuss both foundational and recent articles in our subfield

2019 Cohort Faculty Research Writing and Professional Development Support Group *Summer 2020 - Present*

- Cross-departmental communication, shared support for teaching, research, writing, and professional development
- Met two times per week on Zoom during Summer 2021

High Energy Theory Journal Club

- Weekly Zoom meeting with colleagues from other institutions to discuss both foundational and recent articles in our subfield
- Initiated during Summer 2020, currently ongoing

Snowmass Theory Frontier Participant

- Project organized by the Division of Particles and Fields (DPF) of the American Physical Society
- A professional organization with intent to articulate the recent advances and future opportunities in all aspects of theory relevant to HEP, including particle theory, formal/string theory, cosmological and astro-particle theory, and quantum information science
- My Topical Groups: String theory, quantum gravity, black holes; and CFT and formal QFT
- Attended Snowmass Kick-off (virtual) Town-Hall meeting with more meetings to come in the future

Cohort 2019 Faculty Research Writing and Professional Development Support Group

- Cross-departmental communication, shared support for teaching, research, writing, and professional development
- Met four times per week on Zoom during Summer 2020

SERVICE

Summary: Student-focused service in the SSU Department of Physics and Astronomy, in the School of Science and Technology, across the SSU campus, throughout the whole Cal State system, and beyond.

Department of Physics and Astronomy

Developed New Elective Course in Particle Physics *Fall 2023*

- Developed new Particle Physics course to be offered through CSUFullyOnline
- Course will serve as elective to SSU students, as well as interested students from across the CSU
- Course currently being reviewed by SSU committees
- Particle Physics is an important topic that is generally not a part of the standard undergraduate curriculum

Society of Physics Students Club Advisor *Fall 2019 - Present*

- Club for Physics and Astronomy Department majors, as well as other students interested in physics
- Meets biweekly and hosts other events throughout the semester

Department Advising *Fall 2021 - Present*

- Official academic advising for upper division Physics and Physical Science majors

Teagle Course-redesign for student equity Grant *Spring 2023*

- Re-designed PHYS 216 lab with student equity in mind
- Altered pre-lab assignments
- Removed course worksheets and replaced them with lab journals
- End-of-semeter survey showed all changes were favorable
- Decreased course DFW rate to zero!

Articles Written for "The Physics Major," Department of Physics and Astronomy Newsletter *Spring 2023*

- "Breaking News: Physics and Astronomy Department Students Win Big at SST Science Symposium!"

Teagle Faculty-Led Curriculum Redesign Grant Activities *Awarded Winter 2020*

- Wrote Final Report for Teagle Grant

Articles Written for "The Physics Major," Department of Physics and Astronomy Newsletter *Spring 2022*

- "Four SSU Juniors are Awarded Cal-Bridge Scholarship"
- "Students in the SSU Theoretical Physics Group Earn Koret Scholarship"
- "New Degree in Physical Science"
- "Science by Diverse Scientists"

Foundational Science CSET Waiver Approval *Approved Fall 2021*

- Worked with Ed Lyon and Kristen Boland to respond to waiver proposal comments from reviewing committee
- Submitted two waiver proposal revisions
- Foundational Science CSET Waiver for Physical Science with concentration in Teaching program approved August 2021

Development of New Degree Program in Physical Sciences *Fall 2019 - Fall 2021*

- Development of new B.A. in Physical Science with three concentrations: Teaching, Foundational Health, and Physical Science (general degree with no listed concentration)
- Worked with Jennifer Lillig to create final documents in proper formatting needed for full approval of degree program, including: an assessment plan, a list of course offerings, a curriculum map, and a table of learning outcomes
- Degree first appeared in Fall 2021 catalog

Teagle Faculty-Led Curriculum Redesign Grant Activities *Awarded Winter 2020*

- Participated in Faculty Learning Community, which includes faculty from five CSU campuses
- Presented at All-CSU Faculty Learning Community meeting and Cohort 2 launch
- Presented at 2021 CSU Redesigning Our Majors Symposium

GE Course Proposals *Spring 2021*

- Submitted GE Course Proposal for PHYS 114
- Submitted GE Course Proposal for PHYS 100

Department of Physics and Astronomy Website Redesign *Spring 2021 - Summer 2021*

- Created the following pages: Planning your first year and Quantum Gravity Research Space
- Reviewed and edited the following pages: Suggested Minors, Current Students, Course Offerings, Class Schedule, Scholarships and Opportunities, and Lightboard Studio

Visiting Assistant Professor Hiring Committee Member *Spring 2021 - Summer 2021*

- Interviewed eight first-round candidates and six second-round candidates
- Reviewed 48 Applications
- Hired Dr. Christine Koh in August 2021

Department Program Review *Fall 2020*

- Participated in Physics and Astronomy Program Review Self-Study

Teagle Faculty-Led Curriculum Redesign Grant *Awarded Winter 2020*

- Grant awarded for use use in development of new Physical Science Degree
- Participated in Faculty Learning Community, which includes faculty from five CSU campuses
- Organized half-day faculty charrette to help finalize Physical Science Degree details

Development of New Upper Division GE Area B Course *Ongoing*

- PHYS 304: The Strange World of Modern Physics
- Entirely new course on Modern Physics for non-scientists
- Developed syllabus and signature assignment for course
- Submitted proposal to Curriculog
- Awarded stipend from SST to support this endevor

Course Revisions *Ongoing*

- Submitted Course Revision form to Curriculog for PHYS 320, which adds MATh 241 as a prerequisite
- Submitted Course Revision form to Curriculog for PHYS 460, which adds MATh 241 as a prerequisite

School of Science and Technology

SST Curriculum Committee *Fall 2020 - Present*

- Meets bi-weekly to review new curriculum proposals within the School of Science and Technology
- **Chaired committee** for '22-'23 academic year

Articles Written for SST Newsletter *Spring 2022*

- "Students in the SSU Theoretical Physics Group Earn Koret Scholarship"
- "New Degree in Physical Science"

Articles Written for SST and Department of Physics and Astronomy Newsletters

- The Physics Major Newsletter - "Science by Diverse Scientists" and "Four SSU Juniors are awarded Cal-Bridge Scholarship" Articles *Fall 2021*
- SST Newsletter - "Science by Diverse Scientists" Article *Spring 2021*

Work with SSU MESA

- Mathematics, Engineering, Science, Achievement (MESA) at Sonoma State University is part of a nationally recognized California academic support program that provides a resilient learning community and strong base to students in the School of Science and Technology
- Panelist at "Meet the School" MESA event *Fall 2020 and Fall 2021*
- Panelist at "Women in STEM Networking Lunch" MESA event *Spring 2021*

SST Weekly Check-in Meetings *Spring 2021*

- Organized bi-weekly School of Science and Technology check-ins with Martha Byrne
- Aim of meetings was to bring SST faculty together to discuss remote teaching and troubleshoot problems that are especially common in online STEM courses

Sonoma State University

SSU Scholarship Committee *Fall 2022 - Present*

- Presidential Appointee
- Meets twice per semester to review SSU student scholarships
- Reviewed 92 Scholarship Applications in Spring 2023

Work with SSU STEM Teacher Education Pathways (STEP)

- STEM Pathways Meeting *Fall 2021*
- STEP Strategic Planning Meeting Meeting *Summer 2021*
- STEP Center and School of Science and Technology Partnership Meeting *Summer 2021*
- STEP and STEM teacher recruitment at SSU Meeting *Spring 2021*

Pet the Earth Club Advisor *Fall 2019 - Present*

- Newly created club, formed pre-remote instruction. Most activities on hold until we resume face-to-face instruction
- Working on organizing activities that can be safely completed during the pandemic
- Ultimately, students will go on hiking trips together and ultimately will organize fundraisers to support various environmental organizations

CSU-wide and Beyond

Cal-Bridge Mentor *Fall 2020 - Present*

- CSU mentor for three students
- Requirements involve meeting with each scholar on a bi-weekly basis throughout their final two years at SSU to give them support and advice, especially in regard to helping them to achieve their ultimate goal of being admitted to a PhD program in Physics or Astronomy
- Advising of senior Cal-Bridge Scholars means that I assist in all of their graduate school application procedures: applying for the NSF GRFP, creating a list of schools to apply to, studying for the GRE, reviewing all application materials, etc.

SSU CUWiP Consortium Institutional Board Representative *Fall 2021 - Present*

- The Conference for Undergraduate Women in Physics (CUWiP) is an annual conference put on for the American Physical Society (APS). The conference has several locations all over the USA.
- CUWiP is generally hosted by large institutions. The Northern California CUWiP Consortium aims to involve smaller institutions, like SSU, in both helping to organize CUWiPs at other institutions and possibly supporting these smaller institutions in eventually hosting themselves.
- As a board member, I am required to attend meetings every other month.

2023 CUWiP Panelist *January 2023*

- The Conference for Undergraduate Women in Physics (CUWiP) is an annual conference put on for the American Physical Society (APS).
- Served on two panels: Minorities in Physics and Introduction to Physics Research Areas
- UC Merced location

Cal-Bridge Steering Committee Member *Fall 2019 - Spring 2023*

- Cal-Bridge is a bridge program supported by the National Science Foundation to connect undergraduate California State University (CSU) students with Ph.D. programs within the University of California (UC) system as well as other partner institutions. The Cal-Bridge program's mission is to advance undergraduate physics and astronomy research and education among traditionally underrepresented groups and to increase the number who earn PhDs in those, and related, fields.
- The Cal-Bridge program's primary purpose is to help CSU Physics and Astronomy students (especially those from underrepresented groups) get into PhD programs at UCs or other institutions.
- Assisted in reviewing all scholar applicants from Northern California, including holding Skype interviews
- Attended all Steering Committee Meetings. These are to discuss the direction of Cal-Bridge generally, to review scholar progress reports, to review graduate school lists, and more.

Science by Diverse Scientists: A Cal-Bridge Physics and Astronomy Seminar Series *Summer 2020 - Spring 2022*

- The Science by Diverse Scientists Series aims to highlight the scientific contributions of minoritized members of the physics and astronomy community (including Cal-Bridge alumni), showcase future career paths for Cal-Bridge scholars, discuss anti-racism and experiences of scientists of color, and provide seminar experiences for campuses that don't have seminar series
- (See seminar website here)
- Founding committee member with four other CSU and UC faculty
- Responsibilities involve helping to choose speakers, inviting and coordinating with them, advertising the talks, and hosting the talks
- Series is currently on hold, but will hopefully continue in the future

Cal-Bridge Summer (CAMPARE) Selection Committee Member *Spring 2021 - Present*

- The Cal-Bridge Summer (CAMPARE) program is a network of California State Universities and California community colleges from which students are recruited to participate in undergraduate research projects for 8-10 weeks in the summer
- Assisted in reviewing all applications to the Cal-Bridge Summer Program
- Offered position as **Program Director of Cal-Bridge Summer Program**, which will come with funded release time. Currently in negotiations with regard to this

Cal-Bridge Workshops

- Co-Organizer and Facilitator of Workshop on Imposter Syndrome for Cal-Bridge Scholars *Fall 2021*
- Co-Organizer and Facilitator of Workshop on Growth Mindset for Cal-Bridge Scholars *Spring 2021*

Cal-Bridge Workshops *Fall 2020*

- Co-Organizer and Facilitator of Workshop on Time Management and Organization for Cal-Bridge Scholars
- Created original content on Time Management and Organizational Skills

TEACHING EFFECTIVENESS (PRE-SSU)

Summary: Instruction of students across all stages of their academic career. Both lecture and laboratory classes. Strong focus on incorporating active learning techniques in the classroom. Class sizes ranging from small 16-student labs to larger 75-person lectures.

Wellesley College

Visiting Lecturer *Fall 2018 - Spring 2019*

- Courses: two sections of PHYS 104 (first semester calculus-based general physics for non-majors), one lab section of PHYS 104, one section of PHYS 106 (second semester calculus-based general physics for non-majors), and three lab sections of PHYS 106
- Had almost complete freedom in developing courses, including choosing a textbook, setting up a course web presence through Google Groups and Slack, designing new demonstrations, writing weekly homework, quizzes, and exams, holding five to six office hours per week, collaborating with campus Senior Laboratory Instructor to update experiments, and managing four student graders.

University of California, Santa Barbara

Teaching Associate *Summer 2017*

- Courses: PHYS 2 (second in a calculus-based general physics series for non-majors)
- Crafted syllabus, prepared and presented sixteen 80-minute lectures, recorded and posted eight supplemental videos using the Learning Glass, used Gauchospace to create course webpage, used iClicker technology, assigned homework on Mastering Physics, presented various physics demonstrations to class, supervised teaching assistant, and wrote weekly two-stage quizzes, midterm, and final.

Teaching Assistant *Fall 2014 - June 2018*

- Courses: PHYS 21 twice (General Physics for Physics Majors), PHYS 22 (second quarter General Physics for Physics Majors), PHYS 219 (Graduate Statistical Mechanics), PHYS 115B (Quantum Mechanics), PHYS 221A twice (Quantum Field Theory)
- Held weekly teaching discussion sections, wrote homework solutions, graded weekly quizzes, midterm, and final, held office hours, and gave midterm and final review sessions.

Grader for PHYS 231A (General Relativity) and PHYS 230B (AdS/CFT) *Winter 2014 - Spring 2018*

San Francisco State University

Math and Physics Tutor for the Campus Academic Resource Program at SFSU *August 2008 - October 2009*

- Primary responsibility was to tutor students on a drop-in basis in various physics and mathematics courses
- Helped to design and present workshops to address particular topics, such as on effective problem solving strategies in physics

Grader positions: Modern Physics I and II, Stars and the Milky Way *Spring 2010 - Spring 2011*

Professional Development

Universal Design for Learning Workshop *Summer 2019*

- Two day workshop at Wellesley College
- Universal Design for Learning aims to address the diversity of students present in every classroom.

Certificate in College and University Teaching (CCUT) *Summer 2018*

- The CCUT program is designed for doctoral students who wish to demonstrate superior competence and experience in preparation for teaching at the university or college level.
- Requirements include: teaching a course as the instructor of record, completing project involving the use of technology in the classroom, and preparing a teaching portfolio

Summer Teaching Institute for Associates (STIA) *Summer 2017*

- The STIA program provides graduate student instructors (Associates) with an orientation to teaching, based on principles of interactive, collaborative learning, and designed to assist Associates with the planning, conduct, and assessment of summer undergraduate courses at UCSB.
- Requirements include: attending workshops on teaching pedagogy and providing teaching materials (such as a syllabus, lesson plan, and exam) to be be reviewed by peers and instructional development staff

College and University Teaching: From Theory to Practice (GRAD 210) *Spring 2017*

- Course designed to introduce graduate students to the current research in the field of Education and to expose them to a variety of teaching pedagogies utilizing this research, especially in a university setting

UCSB Instructional Development Workshops *Fall 2016-Summer 2018*

- Crafting your Syllabus
- The Importance of Ignorance in Teaching and Learning (TALES series)
- iClicker
- Gauchospace online training
- The Learning Glass

Teaching Assistant Seminar (PHYS 500) *Fall 2012*

- Course designed to train graduate student teaching assistants

RESEARCH AND SCHOLARSHIP (PRE-SSU)

Summary: 10 peer reviewed publications. Note that in High Energy Physics it is conventional to list authors' names alphabetically (there is no first author distinction).

Publications

- V. Balasubramanian, D. Berenstein, A. Lewkowycz, A. Miller, O. Parrikar, and C. Rabideau, "Emergent classical spacetime from microstates of an incipient black hole," JHEP **1901** 197 (2019) [arXiv:1810.13440 [hep-th]].

- D. Berenstein and A. Miller, "Code Subspaces for LLM Geometries," Class.Quant.Grav. **35**, no.6, 065003 (2018) [arXiv:1708.00035 [hep-th]].

- D. Berenstein and A. Miller, "Superposition Induced Topology Changes in Quantum Gravity," JHEP **1711**, 121 (2017) [arXiv:1702.03011 [hep-th]].

- D. Berenstein and A. Miller, "Can Topology and Geometry be Measured by an Operator Measurement in Quantum Gravity?," Phys. Rev. Lett. **118**, 261601 (2017) [arXiv:1605.06166 [hep-th]].

- D. Berenstein and A. Miller, "Reconstructing Spacetime from the Hologram, Even in the Classical Limit, Requires Physics Beyond the Planck Scale," Int. J. Mod. Phys. D **25**, 1644012 (2016) [arXiv:1605.05288 [hep-th]]. Received honorable mention in 2016 Gravity Research Foundation essay contest.

- D. Berenstein and A. Miller, "Conformal Perturbation Theory, Dimensional Regularization, and AdS/CFT," Phys. Rev. D **90**, 086011 (2014) [arXiv:1406.4142 [hep-th]].
- J. Yang, D. Gallardo, A. Miller, and Z. Chen, "Elimination of Transverse Instability in Stripe Solitons by One-Dimensional Lattices," Opt. Lett. **37**, 1571-1573 (2012) [arXiv:1205.0767 [physics]].
- J. Wang, N.K. Efremidis, A. Miller, C. Lu, P. Zhang, and Z. Chen, "Nonlinear Beam Deflection in Photonic Lattices with Negative Defects" Phys. Rev. A **83**, 033836 (2011).
- P. Zang, N.K. Efremidis, A. Miller, P. Ni, and Z. Chen, "Reconfigurable 3D Photonic Lattices by Optical Induction for Optical Control of Beam Propagation" Appl. Phys. B **104**, 553 (2011).
- P. Zang, N.K. Efremidis, A. Miller, Y. Hu, and Z. Chen, "Observation of Coherent Destruction of Tunneling and Unusual Beam Dynamics due to Negative Coupling in Three-Dimensional Photonic Lattices" Opt. Lett. **35**, 3252 (2010).

Talks

Physics Department Colloquium, Wellesley College *Fall 2018*

- "How Hole-y is your Spacetime?"
- Hour long introduction to Quantum Gravity for undergraduate students

Strings poster, Okinawa Institute of Science and Technology *Summer 2018*

- "Code Subspaces for LLM Geometries"
- Poster presentation at annual international conference on String Theory

High Energy Theory Seminar, CalTech *Winter 2018*

- "Code Subspaces for LLM Geometries"
- Invited hour-long seminar to experts in the field

Skype Seminar, International Center for Theoretical Sciences *Winter 2017*

- "Measuring Topology in Quantum Gravity"
- Hour-long powerpoint presentation over Skype to theorists in various fields

String Theory Seminar, Imperial College *Fall 2017*

- "Code Subspaces for LLM Geometries"
- Lunchtime blackboard hour-long talk to experts in the field

High Energy and Gravity Seminar, UC Santa Barbara *Fall 2017*

- "Code Subspaces for LLM Geometries"
- Lunchtime blackboard hour-long talk to experts in the field

Student and Faculty Lunch, San Francisco State University *Spring 2017*

- "Measuring Topology in Quantum Gravity"
- Invited colloquium level hour-long talk

Grad Slam, UC Santa Barbara *Spring 2017*

- "Measuring Topology in Quantum Gravity"
- UCSB Graduate Division Competition to give 3 minute talk on research to a general audience

SoCal Grad Strings and Fields, UC San Diego *Spring 2017*

- "Superposition Induced Topology Changes in Quantum Gravity"
- 50-minute blackboard talk at annual meeting of graduate student researchers in string theory and related fields

Pacific Coast Gravity Meeting, UC Santa Barbara *Winter 2017*

- "Measuring Topology in Quantum Gravity"
- 10-minute talk at annual meeting of researchers in the field of gravitational physics (both theoretical and observational)

SoCal Grad Strings and Fields, CalTech *Spring 2016*

- "Topology Cannot be Measured by an Operator Measurement in Quantum Gravity"
- 10-minute talk at annual meeting of graduate student researchers in string theory and related fields

SoCal Strings and Fields, UC Santa Barbara *Spring 2016*

- "Topology Cannot be Measured by an Operator Measurement in Quantum Gravity"
- 5-minute Gong Show talk at annual meeting of researchers in string theory and related fields

New Frontiers in Fields and Strings, Theoretical Advanced Study Institute, CU Boulder *Summer 2015*

- "Conformal Perturbation Theory, Dimensional Regularization, and AdS/CFT"
- 7-minute blackboard talk for audience of graduate students in theoretical high energy and gravitational physics

Research and Creative Works Showcase, San Francisco State University *Spring 2011*

- "Unusual Beam Dynamics in 3-D Photonic Lattices"
- Poster Presentation at annual exhibition of research and creative projects in all fields

Frontiers in Optics, Rochester, NY *Fall 2010*

- "Coherent Destruction of Tunneling and Unusual Beam Dynamics in 3D"
- 10-minute presentation at annual meeting of the Optical Society of America

Physics and Astronomy Colloquium, San Francisco State University *Fall 2010*

- "Coherent Destruction of Tunneling and Unusual Beam Dynamics in 3D"
- 30-minute presentation at department colloquium

Conference on Lasers and Electro-Optics, San Jose, CA *Spring 2010*

- "Beam Reflection by Negative Defects in Photonic Lattices"
- Poster Presentation at annual conference and exhibition on scientific and technical optics

Research and Creative Works Showcase, San Francisco State University *Spring 2010*

- "Beam Reflection by Negative Defects in Photonic Lattices"
- Poster Presentation at annual exhibition of research and creative projects in all fields, received honorable mention

Physics and Astronomy Colloquium, San Francisco State University *Spring 2010*

- "Beam Reflection by Negative Defects in Photonic Lattices"
- 30-minute presentation at department colloquium

Other Conferences, Workshops, and Schools Attended

- SoCal Strings and Fields, UCLA, *November 2017*
- Postdoc to Primarily Undergraduate Institution Professor Workshop, Trinity University, *March 2017*
- Recent Developments in Fields, Strings, and Gravity, UC Davis, *December 2016*

- Conformal Field Theories and Renormalization Group Flows in Dimensions $D > 2$, Galileo Galilei Institute for Theoretical Physics (Florence, IT), *June - July 2016*

- New Frontiers in Fields and Strings, Theoretical Advanced Study Institute, CU Boulder, *June 2015*

Awards and Fellowships

- Broida-Hirschfelder Fellowship, *2017*: An award given to two UCSB STEM graduate students each year

- UCSB Graduate Division Dissertation Fellowship, *2017*: An award given to graduate students who are entering the final year of their PhD

- National Science Foundation Fellowship, *2012*

- Soroptimist Award, *2010*: For promising female students in the sciences

- David G.C. Cassa Memorial Award, *2010*: For academically outstanding San Fransisco residents in the College of Science and Engineering

- Eden Academic Excellence Award, *2010*: For physics and chemistry students who received exceptional marks in upper division classes (received the allowed maximum of two times)

- Math and Science Teaching Initiative Fellowship, *2009*: For math and science students considering a career in K-12 teaching

- SFSU Presidential Scholar, *2006*: A four year college scholarship program for students who did well academically and participated in extra-curricular activities in high school

SERVICE (PRE-SSU)

Summary: Strong record of service to community, both as a student and continuing into professional career.

Wellesley College

- Led General Relativity Independent Study Group (overload units, PHYS 250H), *Fall 2018 - Spring 2019*
- Assisted Physics Department in completely revamping curriculum, *Fall 2018 - Spring 2019*

University of California, Santa Barbara

- Undergraduate Mentor for UCSB Women in Science and Engineering, *Fall 2016 - Spring 2018*
- Organizer of the High Energy/Gravity Theory Journal Club, *Fall 2014 - Spring 2017*
- Organizer of Summer Lecture Series for Graduate Students, *Summer 2013 and Summer 2014*
- Member of the Physics GradLife committee, *Fall 2013 - Summer 2014*

San Francisco State University

- President of Optical Society of America SFSU Student Chapter, *Fall 2010 - Spring 2011*
- President of SFSU Physics and Astronomy Club, *Fall 2009 - Spring 2010*

8.6.3 Professor Hongtao Shi

Curriculum Vitae

Hongtao Shi

Professor, Department of Physics and Astronomy — Phone: (707) 664-2013
Sonoma State University, Rohnert Park, CA 94928 — Fax: (707) 664-3378
URL: phys-astro.sonoma.edu/faculty-staff/dr-hongtao-shi — Email: hongtao.shi@sonoma.edu

---

Position Description:
I joined the faculty in the Physics and Astronomy Department at Sonoma State University in Fall 2004. I have been teaching a wide spectrum of undergraduate physics courses that the Department offers, such as Descriptive Physics, Introduction to Physics I, II, III, Electronics, Modern Physics, Analytical Mechanics, Mathematical Physics, Intermediate Experimental Physics, Statistical Physics, Quantum Physics, Electricity and Magnetism, and Physics of Semiconductors. Between 2008 and 2015, I served as advisor of SSU SPS (Society of Physics Students) chapter. Since 2004, I have been director of the Keck Microanalysis Laboratory, training students in the field of nanoscience and nanotechnology, supervising capstone projects, helping SSU faculty and students, as well as local industry with their sample measurement and data analysis. I chaired the Department RTP (Retention, Tenure and Promotion) committee from 2009 to 2016, working with members on the committee to evaluate probationary faculty and part time lecturers. I have been serving on the School RTP Committee since 2016. I have also chaired the Radiation and Safety Committee for many years (still chairing). In 2013 and 2014, I participated in an NSF supported WIDER program which was a project conducted by SSU and UC Berkeley, learning about and implementing "flipped" classroom science pedagogies. Since summer 2022, I have been participating in the TIPS project (Transformative Inclusion in Postsecondary STEM) funded by NSF, which aims to increase the participation and success of Latinx students at SSU in STEM.

Previous Positions:
- Professor, Department of Physics and Astronomy, SSU — 08/2014 – present
- Assistant Professor, Department of Physics and Astronomy, SSU — 08/2004 – 07/2009
- Postdoctoral Associate, Department of Physics, West Virginia University — 01/2003 – 07/2004
- Assistant Professor, Department of Physics, Nanjing University, China — 08/1992 – 07/1996

Education:
- Doctor of Philosophy, Physics, West Virginia University — 2002
- Master of Science, Physics, West Virginia University — 1998
- Master of Science, Physics, Nanjing University, China — 1992
- Bachelor of Science, Physics, Nanjing University, China — 1989

Research Interests:
My research focuses on semiconducting and magnetic thin film fabrication and characterization. In the last few years, I have been studying how to use electrochemistry to prepare zinc oxide (ZnO) thin films and probe the light emission from these samples since ZnO is a wide band gap

semiconductor with great potential in solar applications. In November 2013, one of my students presented his research at the APS California-Nevada session meeting, and won second place for the Steven Chu Undergraduate Research Award. Over the years, I have also been working with physics majors to develop instrumentation for physics experiments. Since 2014, I have been working on self-assembly to fabricate large scale ordered nanostructures for various applications.

Major Projects and Awards:

- Sonoma State University Research, Scholarship and Creative Activity Program (RSCAP) Award: 2004-05, 2007-08, 2011
- 2011- 2019 School of Science and Technology Faculty Development Funds, multiple times
- Fall 2016: SSU SOURCE Funds
- SSU Koret Award: 2017-18, 2018-19
- 2020: Funded NSF MRI Proposal: Acquisition of a Variable Pressure Scanning Electron Microscope with Integrated EBSD, EDS and CL. Matty Mookerjee, Hongtao Shi, Owen Anfinson, Bogdan Negru, and James Lee. $439,132.00.

Selected Presentations and Publications:

1. Fabrication and structural characterization of highly ordered titania nanotube arrays Hongtao Shi and Rosie Ordonez
   Presented at the 2016 American Physical Society (APS) Meeting, March 14-18, 2016, Baltimore, MD
2. Correlation between ferromagnetism and superconductivity at interfaces of $La_{2/3}Ca_{1/3}MnO_3/YBa_2Cu_3O_{7-\delta}/La_{2/3}Ca_{1/3}MnO_3$ trilayers grown by DC sputtering
   F. Perez, E. Baca, W. Saldarriaga, O. Morn, H. Shi, and D. Lederman
   J. Supercond. Nov. Magn., **26**, 2289 (2013)
3. Influence of Mg-doping on the optical properties of ZnO thin films prepared via electrochemical deposition
   Hongtao Shi, Cristhyan F. Alfaro, Kalie R. Barrera, Timothy L. Hessong, and Stephanie R. Halbert
   Phys. Status Solidi A, **210**, 1163 (2013) / DOI 10.1002/pssa.201228569
4. Interface biquadratic coupling and magnon scattering in exchange-biased ferromagnetic thin films grown on epitaxial FeF_2
   David Lederman, Prasanta Dutta1, Mohindar S Seehra and Hongtao Shi
   J. Phys.: Condens. Matter, **24**, 186001 (2012)
5. Mg-induced enhancement of ZnO optical properties via electrochemical processing Hongtao Shi, Kalie R. Barrera, Timothy L. Hessong, and Cristhyan F. Alfaro
   Materials Research Society (MRS) Proceedings, **1449**, mrss 12-1449-bb03-07 doi:10.1557/opl.2012.958 (2012)

8.6.4 Professor Scott Severson

Scott A. Severson

Curriculum Vitae

Printed: October 24, 2023

General Information

Address:

Department of Physics & Astronomy
Sonoma State University
Rohnert Park, CA 94928
Phone: (707) 664-2376 Fax: (707) 664-3378
Email: scott.severson@https://SonomaState.zoom.us/j/81732692467sonoma.edu
http://www.phys-astro.sonoma.edu/people/faculty/severson/

Education:

- Ph.D., Astronomy and Astrophysics, 2000, *University of Chicago*
- S.M., Astronomy and Astrophysics, 1992, *University of Chicago*
- B.Sc., Astronomy, 1990, *University of Wisconsin-Madison*

Employment:

- Chair, Department of Physics & Astronomy — 2019-Present
  Professor — 2016-Present
  Associate Professor — 2011-2016
  Assistant Professor — 2007-2011
  Department of Physics & Astronomy Sonoma State University
- Associate Research Astronomer — 2002-2007
  Postdoctoral Researcher — 1998-2002
  UCO/Lick Observatory University of California, Santa Cruz

Education and Outreach Interests:

- Enriching the academic lives of Sonoma State University students through courses, co-curricular programs, mentoring, and research
- Recruiting, educating and retaining a diverse population of scientists
- Enhancing the scientific literacy of society
- Innovative and effective teaching practices

Research Interests:

- Development of Sonoma State University observational capabilities, including next-generation adaptive optics (AO) systems
- Astronomical instrumentation with particular emphasis on the high resolution, near-infrared, high-speed photometry to measure transient phenomena in the universe

Professional Memberships:

- American Astronomical Society
- Physics Teacher Education Coalition
- International Astronomical Union

Teaching and Mentoring Effectiveness

Selected Teaching Activities:

- Recipient: SSU Excellence in Teaching Award, 2021.
- Designed and instructed courses a range of physics and astronomy courses at Sonoma State University (SSU), both upper and lower division, for physics majors and for general education population. Course list (total # of times taught shown in parentheses):

  ASTR 100 – Descriptive Astronomy (25)
  ASTR 150 – Astronomy for Scientists (1)
  ASTR 231 – Observational Astron. (12)
  ASTR 305 – Frontiers in Astronomy (8)
  ASTR 331 – Astronomical Imaging (3)
  ASTR 350 – Cosmology (5)
  ASTR 380 – Stellar Astrophysics (4)
  ASTR 482 – Adv. Obs. Astronomy (1)
  PHYS 102 – Descriptive Physics Lab (1)
  PHYS 214 – Intro.to Physics II (1)
  PHYS 216 – Intro. Physics Lab (1)
  PHYS 340 – Light and Optics (12)
  PHYS 450 – Thermal Physics (5)
  PHYS 466 – Adv. Experimental Phys.(3)
  PHYS 491 – Capstone Seminar (1)
  PHYS 494 – Phys. Seminar "What Physicists Do" (18)
  ASTR 492, 495, 497, PHYS 492, 493, 495 & 497 – Supervision of student special studies (research) course (total: 97 student-semesters)

- Exemplary student responses to the Student Evaluation of Teaching Effectiveness (SETE) for courses taught at SSU, scoring an average of 4.74 on a five-point scale for the ten courses presented for the promotion to full Professor.
- Invited lecturer, Caltech/Pomona Undergraduate Astronomy Institute at Pomona College Summer 2015.

Academic Advising and Mentoring Activities:

- Student research mentorship

  Mentored students a combined 97 student-semesters. Advised 32 students in senior Capstone research with culminating Senior Research Seminar presentations. Student first-authorship of seven bibliography items (papers and conference posters), student co-authorship on four additional items. Three student advisees awarded SSU Undergraduate Research Program grants. Another selected to represent SSU at the CSU Research Competition. Served twice as McNair program research advisor. Serving as Cal-Bridge mentor for two students Fall 2021
- Invited Participant: Institute for Scientist and Engineer Educators Leadership Institute 2: Reinvigorating the Professional Development Program (PDP), Monterey CA, 2023.
- Invited Panel Chair on Mentoring at the "Advancing Inclusive Leaders in STEM: 20 Years of the PDP" Conference, Hilo HI, 2022.
- Academic advising of a proportionate share of SSU Department of Physics & Astronomy majors and minors, Spring 2008 – present.
- Career and graduate school preparation for SSU majors through an annual curriculum vita/resume preparation seminar, 2008 – present.
- Developed changes to SSU senior capstone program with first an informal bi-weekly lunch series for students on preparing research seminar talks and then development of PHYS 491 – Capstone Seminar.

Capstone projects advised:

Student	**Title** ***(Where available includes link to presentation)***	**Year**
Kathryn Allen	Trends in Transiting Extrasolar Planets	2021
Elizabeth Marshall	Cross-correlation Mapping of Io's Surface	2021
Jacob Marshall	Applying a "Fireball" model to Supernovae	2021
Jacob Davidson	Dual Wavelength Laser Photometry of Particulate Matter	2019
Zack Tweedy	Simulating LIGO	2019
Nathan Morse	Measuring a Transiting Extrasolar Planet	2018
Daniel Smith	Black Hole Growth	2018
Henry Arbaugh	Observation and Characterization of a Contact Binary Star	2017
KB Smith	Imaging Transiting Exoplanets	2017
Angelica Arguelles	Minority Female Students in the Physics Field	2016
Stephanie Church	Monitoring Io Volcanism	2016
Peter A	The Dance in Thermodynamics	2015
Julian Mariano	Spectroscopy of Io and other Celestial Objects	2015
Jessica Campion	Kepler Objects of Interest with Adaptive Optics	2014
John Blumert	Our Galactic City	2013
Jack Horowitz	Rotation Curves and Spectroscopy	2013
Katie Badham	Wavefront Sensing in Adaptive Optics	2013
Brandon Baker	Measuring the Earth's Albedo	2013
Chuck Neely	Investigating the Eclipsing Binary Star V* V1848 Ori	2013
Kalie Miller	Teaching in an Astronomy Course	2012
Bryce Terrell	Danjon Project	2012
Jason Cassell	Simulating Waves	2011
Luke Haley	Alternate Approaches To Teaching Physics	2011
Kathy Morrison	An Interactive Cosmological Timeline	2011
Josh Stortz	Special Relativity Exhibit	2011
Daniel Kelley	Meade DS-16 Reflecting Telescope	2011
Blaine Gilbreth	Testing Optical Components in an Adaptive Optics System	2010
Mike Anderson	High Speed Photometry at SSU Observatory	2010
Ryan Young	Atmospheric Seeing at the Galbreath Wildlife Preserve	2009
Adam Dye	Adaptive Optics System Calibration	2009
Kevin Bransford	Meaningful Learning in Modern Physics Classrooms	2009
Orion Leland	Solar Concentrator for Photovoltaics	2008

Selected Leadership Activities Improving Teaching Effectiveness:

- Invited participant: STARs Planning Meeting - Developing a Lick Observatory College Consortium, Monterey, 2023.
- Transformative Inclusion in Postsecondary STEM (TIPS) : Towards Justice participant, implementing culturally responsive pedagogies in introductory physics classes, 2022-present.
- Invited CSU PhysTEC workshop Co-Chair: "Sharing Ideas for Supporting Physics Department's Efforts to Recruit and Support Physics Teachers" 2021.
- Educational Experience Enhancement Award, SSU. Development and refinement of the student experience at the SSU Observatory, 2019
- Invited presentation: "Virtual Reality: The Power of Student Immersion and Agency", Virtual Immersive Teaching and Learning (VITaL) Professional Learning Community (PLC), 2018.
- Invited presentation: PhysTEC Annual Conference, Site Leader Meeting. The nation's largest conference on physics teacher preparation "The Sonoma State University Physics Teacher Pipeline", 2017.
- Led an effort that reconstituted a partnership between the Department of Physics & Astronomy and local High School and Junior College Physics Teachers, named PION – Physics in our Neighborhood. 2015 – present.Faculty Participant of 'WIDER: Redefining the College Lecture' faculty development program, 2014.
- Invited presentation at PhysTEC Regional Conference of MSTI and CalTeach, a series of workshops and panel discussions on topics including physics and chemistry teacher preparation and an overview of California PhysTEC programs, February 2015.
- Faculty Research Associate of the U.S. Department of Education-supported EnACT~PTD faculty development program in support of students with disabilities, 2008 – 2011.
    - Lead facilitation of Faculty Learning Community (FLC) meetings at SSU.
    - Support the Universal Design for Learning (UDL)-inspired changes in 10 course instances (5 participants by 2 years) across multiple disciplines.
    - Disseminated EnACT~PTD accomplishments as presenter at events such as: the EnACT Culminating Event CSU-San Francisco, September 2011; "Reach More without Doing More" CSU-San Francisco April 2011; Lilly Conferences on College and University Teaching, Pomona, CA, March 2011; "Reach More without Doing More" CSU-San Francisco April 2010; and a California State University "Ask the Experts" webinar, April 2010.
- Efforts in the scholarship of teaching and learning resulting in *five* papers appearing in the Astronomical Society of the Pacific Conference Series, Volume 436, *Learning from Inquiry in Practice*, 2010.
- Staff member of the NSF Science and Technology Center for Adaptive Optics Professional Development Program; development and implementation of workshops supporting inquiry-based science and engineering teaching in post-secondary venues, 2003-2007.

Research and Scholarship

Selected Research Activities:

- Director SSU Campus Observatory, 2008 – present. Proposed, coordinated and oversaw the wholesale upgrade of the campus observatory with the construction of a new observatory building and the installation of new telescope and computer hardware, 2015 – 2018. Organize and conduct Observatory's Viewing Nights (*see Service*)
- Co-PI KAPAO Adaptive Optics System for Table Mountain Observatory 2010 – present. This ongoing collaboration began with a National Science Foundation grant award to a consortium consisting of Pomona College, Sonoma State University (SSU sub-award $118,345 from 2010-2013), Harvey Mudd College and the California Institute of Technology. The grant has supported the development, deployment and use of a state-of-the-art astronomical adaptive optics system for the Table Mountain Observatory 1-meter telescope. This Adaptive Optics system is *unique in the world* in being built by and for undergraduate research, and provides imaging capability that would otherwise require a space telescope or a flagship research observatory.

Selected Grant Funding and Awards:

- Instructionally Related Activities (IRA) Funding for SSU Physics Seminar Series, 2010 – present**,** 14-year total: **$94,000.**
- Instructionally Related Activities (IRA) Funding for SSU Observatory Viewing Nights, 2010 – present, 14-year total: **$54,000.**
- Lab Innovations with Technology (LIT) grant, CSU, Virtual Reality in ASTR100, Descriptive Astronomy, **$7,374**, 2019.
- Co-investigator, Teagle Foundation Faculty-Led Curriculum Redesign for Student Success Program, Physical Science Degree Program **$10,500**.
- PI, Sonoma State University PhysTEC Teacher Recruitment grant (**$29,889**). Program to increase the number of High School Physics Teachers, focused on recruitment effort, 2014 – 2017.
- Co-PI Sonoma State University Robert Noyce Scholarship Program (NSF: **$899,842)**. The program encourages talented Science, Technology, Engineering, and Mathematics (STEM) majors to become teachers through a program that supports students while they pursue their STEM degree and their teaching credential, 2010 – 2015.
- Co-PI, National Science Foundation AST – Major Research Instrumentation grant for KAPAO (née CCAO-Cam): A Remote-Access, Dual-Band (Optical/NIR) Adaptive Optics System for the Table Mountain 1-meter telescope, 2010-2013**, $637,138** (multiple institution grant, SSU sub-award: **$118,345)**.
- Adaptive Optics Testbed for Galbreath Wildlands Preserve Observatory, Mt. Cuba Astronomical Foundation grant, 2007 – 2009, **$85,000**.
- Antarctic Service Medal presented by the National Science Foundation and the U. S. Navy, 1998.

University Service

School and University – Level Service:

- Member of the School of Science and Technology Chairs Council, 2019 – present.
- Member of the SSU School of Science and Technology Faculty Development (formerly Travel) Committee, 2008 – present.
- Member and former Chair of the Overlay Subcommittee of EPC. 2020 – 2023.
- Member School of Science and Technology Strategic Plan Implementation Team 2019 – 2021.
- Member of the School of Science and Technology Dean Search Committee 2019 – 2020.
- Member of the School of Science and Technology Curriculum Committee, 2018 – 2020.
- Led effort for Upper Division GE Area B approval for 6 Department of Physics & Astronomy courses. 2019 – 2020.
- Frequent contributor to Campus-wide GE revision 2018 – 2019.
- Member of the SSU Structure and Functions subcommittee of the Executive Committee of the Academic Senate, Fall 2014 – 2018.
- Co-Principal Investigator of the SSU Robert Noyce Scholarship Program. The National Science Foundation Science-funded program encourages talented Science, Technology, Engineering, and Mathematics (STEM) majors to become teachers through a program that supports students while they pursue their STEM degree and their teaching credential, 2010 – 2015.
- Served as SSU Campus Planning Committee Faculty Representative, 2008-2010, 2015 – 2016.
- General Marshal for Commencement, 2013 – 2018.
- School of Science and Technology Newsletter articles: . (Available at: http://www.sonoma.edu/scitech/newsletter/)
- Contribution to SSU web site on solar energy use and research on campus, 2010.
- Presented talk at SSU Parent and Family Weekend, October 2009.

Activities in Support of the Department of Physics and Astronomy:

- Organize SSU Department of Physics & Astronomy lecture series "What Physicists Do" (~12 talks per semester), serving students and the public, 18 semesters between Fall 2009 – present. http://www.phys-astro.sonoma.edu/wpd
- Organize and conduct SSU Observatory's Viewing Nights (~ 4 public and ~ 3 course events per semester), serving students and the public, Fall 2009 – present. http://www.phys-astro.sonoma.edu/publicviewingnight.shtml
- Chair, Department of Physics & Astronomy Program Review, 2023.
- Assisted Physical Science degree program design through approval, 2019 – 2021.

- Chair, Department of Physics & Astronomy Visiting Professor search, 2021.
- Chair, Department of Physics & Astronomy Tenure Track search, 2018-2019.
- Member, Department of Physics & Astronomy Instructional Support Tech search, 2019.
- Attended CSU Department Chairs Workshop, CSU-LB, 2019.
- Curriculum Proposal: SSU Astrophysics Concentration for Physics Bachelor of Science Degree 2015 – 2018.
- Lead the BS-Astrophysics degree program design through approval, 2017.
- Won approval of ASTR 305 as a Writing-Intensive Course, 2017.
- Led SSU to join the Physics Teacher Education Coalition (PhysTEC), run by the American Physical Society, and led subsequent recruiting grant award proposals and award (2014-2017).
  http://www.phystec.org/institutions/institution.cfm?ID=697
- Lead Author of the Department of Physics & Astronomy Program Review**,** 2014 – 2015**.**
- Attended joint PhysTEC Conference and "Building a Thriving Undergraduate Physics Program" workshop February 2015 in Seattle, WA.
- Organization and oversight of SSU Department of Physics & Astronomy Seawolf Day activities, which includes recruitment and orientation tabling, a department presentation, and lab tours, 2008 – present.
- Department service through weekly SSU Department Meetings. With the small Physics & Astronomy department, most department-level service is handled through these meetings and outside work. 2007 – present.

  Some examples of such service:
  1. Contribute articles for department newsletter at SSU, The Physics Major, 2008 – present. http://www.phys-astro.sonoma.edu/newsletter
  2. Serve on Department of Physics & Astronomy RTP committee, 2015 – present
  3. Served on Tenure-Track Hiring Committee, 2014 – 2015.
  4. Led and Served on multiple cumulative reviews of lecturers.
  5. Response to department inquires such as annual American Physical Society physics program survey.

Community Service

Service/Presentations to the Professional Community:

- "Applying Principles of the PDP Towards Mentoring", Panel Chair, "Advancing Inclusive Leaders in STEM: 20 Years of the PDP" Conference, Hilo HI, 2022.
- "Volcanic Moons, Planet Transits, and the SSU Observatory" - Faculty Research Exposition Poster 2017.

- "Building Support with your Departmental Colleagues" - Invited Panel Presentation, 2017 PhysTEC Annual Conference, Atlanta GA.
- Invitation to serve as External Reviewer for the Department of Physics & Astronomy Program Review at University of Hawaii at Hilo, 2015.
- Colloquium – University of San Francisco Department of Physics & Astronomy September 2015
- ISEE (Institute of Scientist & Engineer Educators) External Advisory Committee Member, 2012 – present.
- National Science Foundation Science, Technology, and Society Program proposal review, Spring 2010.
- Participation at Science with Giant Telescopes, a National Science Foundation hosted forum, June 2008.
- National Science Foundation Advanced Technologies and Instrumentation program proposal review panelist, Washington DC, Spring 2008.
- W. M. Keck Foundation proposal reviewer, Spring 2008.
- Director, Center for Adaptive Optics (CfAO) Summer School Summer, 2007.
- Conducted tours of the Laboratory for Adaptive Optics for external foundations, donors and guests, 2002 – 2007.
- Assisted in preparation and support of CfAO National Science Foundation site visits, 2001 – 2006.

Service to the Local Community:

- Organize SSU Department of Physics & Astronomy lecture series "What Physicists Do" (~12 talks per semester), serving students and the public, 18 semesters between Fall 2009 – present.
- Organize and conduct SSU Observatory's Viewing Nights (~ 4 public and ~ 3 course events per semester), serving students and the public, Fall 2009 – present.
- "Science and Society II" - a presentation in the "What Physicists Do" public lecture series. https://www.youtube.com/watch?v=0CBjl8iXXYI
- Organized and hosted an on-campus Space Science Badge Event for the Girl Scouts of Northern California, 2018, 2019.
- "Science and Society" - a presentation in the "What Physicists Do" public lecture series. https://www.youtube.com/watch?v=0CBjl8iXXYI
- Run an astronomical viewing for "StarWatch and Wine" a charity event at Ravenridge Cottages benefitting the Yorkville fire station. November 2015.
- Host lab tour for Piner High school STEM day on SSU campus, 2015, 2017.
- Organize and host Solar Eclipse Viewing, SSU, October 2014.
- Presentation to the Osher Lifelong Learning Science Club, April 2014.
- Co-host Transit of Venus viewing, Claremont CA, June 2012.

- Invited speaker, TedX Santa Rosa, August 2011. Talk entitled “Science Education: Or How I Learned to Stop Worrying and Love a National Crisis” https://www.youtube.com/watch?v=08lLv2KILn4
- Organized, hosted and gave public lecture as part of the Bay Area Science Festival, November 2011.
- Invited talk, North Marin Breakfast Club, March 2011.
- Conducted public interviews resulting in five Press-Democrat, two Sonoma West and three Sonoma State Star articles.

  “Gazing at the stars” – Sonoma West Times & News, September 7, 2011.

  “Santa Rosa labor rally backs Wisconsin workers” – Santa Rosa Press-Democrat, March 4, 2011.

  “Lunar eclipse meets winter equinox” – Santa Rosa Press-Democrat, December 19, 2010.

  “Meteor shower to brighten night sky” – Santa Rosa Press-Democrat, November 12, 2009.

  “Man on the Moon: Why it matters today” – Santa Rosa Press-Democrat, July 18, 2009.

  “Professor Joe Tenn retires after serving 39 years to physics and astronomy students” – Sonoma State Star, May 12-18, 2009.

  “Physics Lecture Series creates unique opportunities for interested students” – Sonoma State Star, May 5-11, 2009.

  “‘100 Hours of Astronomy’ SSU participates in worldwide celebration” – Sonoma State Star, March 24-30, 2009.

  “Spending a Scientific Summer at SSU” – Sonoma West Newspaper, July 30, 2008.

  “SSU student boosting power of the sun” – Santa Rosa Press-Democrat, December 24, 2007.
- Organized a presentation for the Chester Jr./Sr. High School and GATE Program, November 2010.
- Organized and hosted SSU campus and public activities as part of the 2009 International Year of Astronomy event “100 Hours of Astronomy”.
- Recruited renowned astrophysicist Alex Filippenko to give a public presentation at SSU on his work, which indicates accelerating expansion of the Universe. Hosted Prof. Filippenko during his visit. Led public viewing night at SSU campus observatories as part of the event.
- Invited talk, Sonoma County Astronomical Society, March 2008.
- Invited talk, North Marin Breakfast Club, March 2008.
- Adler Planetarium, Planetarium Volunteer, 1993 – 1994.

Bibliography

Key:

- *Italicized Author Name* denotes undergraduate student authorship.

1. "Applying Principles of the PDP Towards Mentoring", **Severson, S.**, Dunkin, R. and Walker, S., pp. 371–380 in S. Seagroves, A. Barnes, A.J. Metevier, J. Porter, & L. Hunter (Eds.), Leaders in effective and inclusive STEM: Twenty years of the Institute for Scientist & Engineer Educators. UC Santa Cruz: Institute for Scientist & Engineer Educators, 2022. https://escholarship.org/uc/item/0mb4644g

2. "Modeling Supernovae as an Optically Thick Fireball", *Marshall, J.* and **Severson, S.**, Submitted - Journal of Undergraduate Reports in Physics, 2022. https://doi.org/10.48550/arXiv.2212.06942

3. "Evaluating Virtual Reality as a Tool for Astronomy Education", **Severson, S.**; Kassis, S.; Windmiller, G.; SSU VR Team; SDSU VR Team, American Astronomical Society meeting #235, id. 202.04. Bulletin of the American Astronomical Society, Vol. 52, No. 1, 2020.

4. "World-wide deployment of Robo-AO visible-light robotic laser adaptive optics systems", Baranec, C., Riddle, R., Law, N., Lu, J., Tonry, J., Tully, R., Wright, S., Kulkarni, S., **Severson, S.**, Choi, P., Ramaprakash, A., Chun, M., Connelley, M., Tokunaga, A., and Hall, D., IAU General Assembly, Meeting #29, #2255576, 2015.

5. "KAPAO first light: the design, construction and operation of a low-cost natural guide star adaptive optics system", **Severson, S. A.**, Choi, P., *Badham, K., Bolger, D., Contreras, D., Gilbreth, B., Guerrero, C., Littleton, E., Long, J., McGonigle, L., Morrison, W, Ortega, F., Rudy, A., Wong, J.,* Spjut, E., Baranec, C., and Riddle, R., Adaptive Optics Systems IV, Edited by Marchetti, E.; Close, L.; Véran, J-P., Proceedings of the SPIE, Volume 9148, 2014.

6. "Assembly and First-Light of KAPAO, a Low-Cost Natural Guide Star Adaptive Optics System", *Badham, K.*, **Severson, S.**, Choi, P., *Bolger, D., Guerrero, C., Long, J., Ortega, F. and Wong, J.*, American Astronomical Society 223, #148.10, 2014.

7. "Performance Characterization of KAPAO, a Low-Cost Natural Guide Star Adaptive Optics Instrument", *Long, J.*, Choi, P., **Severson, S.**, *Littleton, E., Badham, K., Bolger, D., Guerrero, C., Ortega, F., Wong*, J., Baranec, C. and Riddle, R., American Astronomical Society 223, #148.09, 2014.

8. "KAPAO: a MEMS-based natural guide star adaptive optics system", **Severson, S. A.**, Choi, P., *Contreras, D., Gilbreth, B., McGonigle, L., Morrison, W, Rudy, A., Xue, A.,* Spjut, E., Baranec, C., and Riddle, R., MEMS Adaptive Optics VII, Edited by Olivier, S.; Bifano, T.; Kubby, Proceedings of the SPIE, Volume 8617, 2013.

9. "On-sky Characterization of KAPAO-Alpha, A Prototype Adaptive Optics Instrument", *Contreras, D., Littleton, E.,* Choi, P., **Severson, S.**, *Morrison, W. and Wong, J.*, American Astronomical Society 221, #345.26, 2013.

10. "KAPAO Prime: Design and Simulation", *McGonigle, L.*, Choi, P., **Severson, S.** and Spjut, E., American Astronomical Society 221, #345.25, 2013.

11. "MEMS practice: from the lab to the telescope", Morzinski, K., Norton, A., Evans, J., *Reza, L.*, **Severson, S.**, Dillon, D., Reinig, M., Gavel, D., Cornelissen, S., Macintosh, B., Max, C., MEMS Adaptive Optics VI. Edited by Olivier, S.; Bifano, T.; Kubby, J. Proceedings of the SPIE, Volume 8253, 2012.

12. "KAPAO: A Natural Guide Star Adaptive Optics System for Small Aperture Telescopes", **Severson, S.**, Choi, P., Spjut, E., *Contreras, D., Gilbreth, B., McGonigle, L., Morrison, W, Rudy, A., Xue, A.,* Baranec, C., and Riddle, R., American Astronomical Society 220, #135.03, 2012.

13. "KAPAO-Alpha: An On-The-Sky Testbed for Adaptive Optics on Small Aperture Telescopes", *Morrison, W*., Choi, P., **Severson, S.**, Spjut, E., *Contreras, D., Gilbreth, B., McGonigle, L., Rudy, A., Xue,* A., Baranec, C., and Riddle, R., American Astronomical Society 220, #135.04, 2012.

14. "An EnACT~PTD Multiyear Faculty Learning Community Focused on Universal Design for Learning", **Severson, S.**, Bozeman-Moss, D., Ely, K., Kroll, C., Rivoire, S., and Wilson, B. Poster - Sonoma State University 2012 Faculty Exposition of Scholarship and Sponsored Programs, March 16, 2011.

15. "KAPAO: A Pomona College Adaptive Optics Instrument", Choi, P., **Severson, S.**, *Rudy, A., Gilbreth, B., Contreras, D., McGonigle, L., Chin, R., Horn, B., Hoidn,* O., Spjut, E., Baranec, C., and Riddle, R., American Astronomical Society 217, #433.14, 2011.

16. "Designing Effective Undergraduate Research Experiences", **Severson, S.**, 2010, Astronomical Society of the Pacific Conference Series 436, Learning from Inquiry in Practice, eds. L. Hunter & A. J. Metevier, San Francisco, CA.

17. "The Adaptive Optics Summer School Laboratory Activities", Ammons, S. M., **Severson, S.**, and 18 others, 2010, Astronomical Society of the Pacific Conference Series 436, Learning from Inquiry in Practice, eds. L. Hunter & A. J. Metevier, San Francisco, CA.

18. "A Fourier Optics and Wavefront Sensing Laboratory Activity", Do, T., Fitzgerald, M., Ammons, S. M., Crossfield, I., Yelda, S., Armstrong, J.D, and **Severson, S.**, 2010, Astronomical Society of the Pacific Conference Series 436, Learning from Inquiry in Practice, eds. L. Hunter & A. J. Metevier, San Francisco, CA.

19. "The COSMOS Optics Inquiry: An Inquiry Activity for High School Students on Geometric Optics", Raschke, L., **Severson, S.**, Seagroves, S., and Porter, J., 2010, Astronomical Society of the Pacific Conference Series 436, Learning from Inquiry in Practice, eds. L. Hunter & A. J. Metevier, San Francisco, CA.

20. "The CfAO's Astronomy Course in COSMOS: Curriculum Design, Rationale, and Application", Cooksey, K., Seagroves, S., Porter, J., Raschke, L., **Severson, S.**, and Hinkley, S., 2010,Astronomical Society of the Pacific Conference Series 436, Learning from Inquiry in Practice, eds. L. Hunter & A. J. Metevier, San Francisco, CA.

21. "Development and Testing of Optical Components in an Adaptive Optics System", *Contreras, D., Gilbreth, B.,* Choi, P., and **Severson, S.**, Poster - Society of Mexican American Engineers and Scientists (MAES) Symposium, September 29 – October 2, 2010, Anaheim, CA.

22. “Advanced Wavefront Sensing for Adaptive Optics”, **Severson, S.**, Poster - Sonoma State University 2010 Faculty Exposition of Scholarship and Sponsored Programs, March 10, 2010.

23. “CCAO-Cam: A Remote-Access, Dual-Band (Optical/NIR) Adaptive Optics System for the Table Mountain 1-meter telescope”, Choi, P., Penprase, B., **Severson, S.**, and Spjut, E., Proposal to the National Science Foundation AST - Major Research Instrumentation, Submitted: Aug 10 2009, Funded 2010.

24. “GWPO: A One Meter Telescope Project at Sonoma State University”, **Severson, S.**, Presented Talk - The Alt-Az Initiative for Lightweight Research Telescopes Workshop, June 6-7 2009 Pasadena, CA.

25. “CUCAO-Cam: The Claremont Undergraduate Colleges Adaptive Optics Camera”, Choi, P., *Rudy, A., Horn, B.,* **Severson, S.**, *Beeler, D., Gurman, Z.,* Ammons, M., *Chin, R., and Hoidn, O*., American Astronomical Society 214, #409.17, 2009.

26. “Adaptive Optics at Sonoma State University”, **Severson, S.**, Poster - Sonoma State University 2009 Faculty Exposition of Scholarship and Sponsored Programs, March 18, 2009.

27. “ViLLaGEs: opto-mechanical design of an on-sky visible-light MEMS-based AO system”, Grigsby, B., Lockwood, C., Baumann, B., Gavel, D., Johnson, J., Ammons, S. M., Dillon, D., Morzinski, K., Reinig, M., Palmer, D., **Severson, S.**, and Gates, E., Advanced Optical and Mechanical Technologies in Telescopes and Instrumentation. Edited by Atad-Ettedgui, E., Lemke, Dietrich. Proceedings of the SPIE, Volume 7018, pp. 701841-701841-12 (2008).

28. “Visible light laser guidestar experimental system (Villages): on-sky tests of new technologies for visible wavelength all-sky coverage adaptive optics systems”, Gavel, D., Ammons, M., Bauman, B., Dillon, D., Gates, E., Grigsby, B., Johnson, J., Lockwood, C., Morzinski, K., Palmer, D., Reinig, M., and **Severson, S.**, Adaptive Optics Systems. Edited by Hubin, N; Max, C.; Wizinowich, P., Proceedings of the SPIE, Volume 7015, pp. 70150G-70150G-11 (2008).

29. “Villages: an on-sky visible wavelength astronomy AO experiment using a MEMS deformable mirror”, Gavel, D., **Severson, S.**, Bauman, B., Dillon, D., Reinig, M., Lockwood, C., Palmer, D., Morzinski, K., Ammons, M., Gates, E., and Grigsby, B., MEMS Adaptive Optics II. Edited by Olivier, Scot S.; Bifano, Thomas G.; Kubby, Joel A. Proceedings of the SPIE, Volume 6888, pp. 688804 - 688804-7 (2008).

30. “P1 Actuator Prototype for the TMT: Tests”, Cowley, D., Dupraw, B., Kupke, R., Mast, T., Peck, M., Pfister, T., **Severson, S.**, and Wallace, V. 2007, Thirty Meter Telescope Report No. 82, Docushare TMT.CTR.TEC.07.028.REL01.

31. “Visible and Near-IR Observations of the 2007 March 18 Occultation by Pluto”, Young, L., and 29 coauthors including **Severson, S.**, 2007, American Astronomical Society, DPS meeting #39, #62.04.

32. “Pluto's Atmospheric Activity, Ephemeris Offset and Satellite Detections from Observations in 2007”, Sicardy, B., and 29 coauthors including **Severson, S.,** 2007, American Astronomical Society, DPS meeting #39, #62.02.

33. "Demonstrating sub-nm closed loop MEMS flattening", J. W. Evans, B. A. Macintosh, L. Poyneer, K. Morzinski, **Severson, S.**, D. Dillon, D. Gavel, and L. Reza, Optics Express 14, pp. 5558–5570, 2006.

34. "The extreme adaptive optics testbed at UCSC: current results and coronographic upgrade", **Severson, S. A.** and 8 colleagues 2006, proc. SPIE Vol. 6272 pp. 62722J, Advances in Adaptive Optics II. Edited by Ellerbroek, Brent L.; Bonaccini Calia, Domenico.

35. "Characterizing the Potential of MEMS Deformable Mirrors for Astronomical Adaptive Optics" Morzinski, K., Macintosh, B.A., **Severson, S. A.**, Evans, J. W., Dillon, D., Max, C., Gavel, D., and Palmer, D. 2006, proc. SPIE Vol. 6272 pp. 627221, Advances in Adaptive Optics II. Edited by Ellerbroek, Brent L.; Bonaccini Calia, Domenico.

36. "Wavefront control for the Gemini Planet Imager" Poyneer, L. A., Véran, J-P., Dillon, D., **Severson, S.**, and Macintosh, B. A. 2006, proc. SPIE Vol. 6272 pp. 62721N, Advances in Adaptive Optics II. Edited by Ellerbroek, Brent L.; Bonaccini Calia, Domenico.

37. "Experimental demonstration of phase correction with a 32 x 32 MEMS mirror and the spatially filtered wavefront sensor", Poyneer, L. A., Bauman, B., Macintosh, B. A., Dillon, D. and **Severson, S. A.** 2006, Optics Letters 31, pp. 293–295, 2006.

38. "Effect of Wavefront Error on 10^{-7} Contrast Measurements", Evans, J. W., Sommargren, G., Macintosh, B. A., **Severson, S. A.**, and Dillon, D. 2006, Optics Letters 31, pp. 565–567, 2006.

39. "Extreme adaptive optics testbed: high contrast measurements with a MEMS deformable mirror", Evans, J. W. and 10 coauthors including **Severson, S.**, 2005, proc. SPIE Vol. 5905 pp. 303-310, Cryogenic Optical Systems and Instruments XI. Edited by James B. Heaney and Lawrence G. Burriesci.

40. "Extreme adaptive optics testbed: results and future work", Wilhelmsen Evans, J., and 9 coauthors including **Severson, S.**, 2004, proc. SPIE Vol. 5490 pp. 954-959, Advancements in Adaptive Optics. Edited by Domenico B. Calia, Brent L. Ellerbroek, and Roberto Ragazzoni.

41. "eXtreme Adaptive Optics Planet Imager: overview and status", Macintosh, B. A., and 21 coauthors including **Severson, S.**, 2004, proc. SPIE Vol. 549 pp. 359-369, Advancements in Adaptive Optics. Edited by Domenico B. Calia, Brent L. Ellerbroek, and Roberto Ragazzoni.

42. "Extreme adaptive optics planet imager: XAOPI", Macintosh, B. A., and 18 coauthors including **Severson, S.,** 2003, proc. SPIE Vol. 5170 pp. 272-282, Techniques and Instrumentation for Detection of Exoplanets. Edited by Coulter, Daniel R.

43. "Recent science and engineering results with the laser guidestar adaptive optic system at Lick Observatory", Gavel, F.T., and 12 coauthors including **Severson, S.,** 2003, proc. SPIE Vol. 4839 pp. 354-359, Adaptive Optical System Technologies II; Edited by Wizinowich, Peter L.; Bonaccini, Domenico.

44. "Direct detection of extrasolar planets with the eXtreme Adaptive Optics Planet Imager", Macintosh, B. A., and 16 coauthors including **Severson, S.,** 2003, American Astronomical Society, DPS meeting #35, #07.07.

45. "Characterizing the Adaptive Optics Off-Axis Point-Spread Function. I. A Semiempirical Method for Use in Natural Guide Star Observations", Steinbring, E., and 13 coauthors including **Severson, S.,** 2002, PASP, 114, 1267.

46. "Science with laser guide stars at Lick Observatory", Gavel, D. T., and 12 coauthors including **Severson, S.,** 2002, Proc. SPIE Vol. 4494, p. 336-342, Adaptive Optics Systems and Technology II, Robert K. Tyson; Domenico Bonaccini; Michael C. Roggemann; Eds.

47. "Extreme Adaptive Optics Imager", Macintosh, B. A., and 15 coauthors including **Severson, S.,** 2002, American Astronomical Society Meeting 201, #21.01.

48. "Experimental Design for the extreme Adaptive Optics Planet Imager (XAOPI)", Graham, J. R., and 15 coauthors including **Severson, S.,** 2002, American Astronomical Society Meeting 201, #21.02.

49. "Lick Adaptive Optics Observations of Early-Type Galaxy Centers", Raschke, L. M., Jonsson, P., **Severson, S.**, Faber, S. M., and Macintosh, B. A. 2001, American Astronomical Society Meeting 197, #52.04.

50. "IRCAL: the infrared camera for adaptive optics at Lick Observatory", Lloyd, J. P., Liu, M. C., Macintosh, B. A., **Severson, S. A.**, Deich, W. T., and Graham, J. R., 2000, Proc. SPIE Vol. 4008, p. 814-821, Optical and IR Telescope Instrumentation and Detectors, Masanori Iye; Alan F. Moorwood; Eds.

51. "Death of a comet: SPIREX observations of the collision of SL9 with Jupiter", **Severson, S.**, Thesis (PhD). THE UNIVERSITY OF CHICAGO, Source DAI-B 61/02, p. 893, Aug 2000, 149 pages.

52. "The First Light of the World's First Silicon Grisms", Ge, J., and 11 coauthors including **Severson, S.,** 1999, American Astronomical Society Meeting, 195, 8715.

53. "Near Infrared Halo Emission in the Edge-on Spiral Galaxy ESO 240-G11", Rauscher, B. J., Lloyd, J. P., Barnaby, D., Harper, D. A., Hereld, M., Loewenstein, R. F., **Severson, S. A.**, and Mrozek, F. 1998, ApJ, 506, 116.

54. "A New View of the SL9-Jupiter Impacts Based on the SPIREX Results", **Severson, S. A.** 1998, AAS/Division of Planetary Sciences Meeting, 30, 4005.

55. "Optical/Near-Infrared Observations of GRO J1744-28", Cole, D. M., Vanden Berk, D. E., **Severson, S. A.**, Miller, M. C., Quashnock, J. M., Nichol, R. C., Lamb, D. Q., Hurley, K., Blanco, P., Lidman, C., and Glazebrook, K. 1997, ApJ, 480, 377.

56. "South Pole near infrared astronomy: Site characteristics and deep spiral galaxy imaging", Bernard J. Rauscher, David Barnaby, Doyal A. Harper, Mark Hereld, James P. Lloyd, Robert F. Loewenstein, **Severson, S.**, and Fred Mrozek, proceedings of *XXXIInd RENCONTRES DE MORIOND -- Extragalactic Astronomy in the Infrared*, 1997 March 15-22, Les Arcs, Savoie, France.

57. "The South Pole Observatory Exhibits Photometric Conditions in the Near-infrared", Barnaby, D., Loewenstein, R. F., Harper, D. A., Lloyd, J. P., Rauscher, B. J., Hereld, M.,

Severson, S. A., and Mrozek, F., 1997 American Astronomical Society Meeting 191, #41.16.

58. "The South Pole Near Infrared Sky Brightness", Nguyen, H. T., Rauscher, B. J., **Severson, S. A.**, Hereld, M., Harper, D. A., Loewenstein, R. F., Mrozek, F., and Pernic, R. J. 1996, PASP, 108, 718.

59. "High Spectral Resolution Imaging of Venus' Night Side using the GSFC Near-IR AOTF Camera", Hillman, J. J., Glenar, D. A., Bjoraker, G., Chanover, N., **Severson, S. A.**, and Blass, W. E. 1996, BAAS, DPS meeting #28, #14.05.

60. "Evidence of 2.36 μm halo emission in the edge-on spiral galaxy ESO/Uppsala 240-G11", Bernard J. Rauscher, James P. Lloyd, Mark Hereld, David Barnaby, **Severson, S.**, R.F. Loewenstein, D.A. Harper, and Fred Mrozek 1996, *Dark and Visible Matter in Galaxies and Cosmological Implications -- Pub. A.S.P. Conference Series*, 117, 274, eds. M. Persic and P. Salucci.

61. "Optical and Near-Infrared Observations of GRO J1744-28", Cole, D. M., Vanden Berk, D. E., **Severson, S. A.**, Nichol, R. C., Quashnock, J. M., Miller, M. C., and Lamb, D. Q., 1996, BAAS, 188, #84.03.

62. "GRO J1744-28: Detailed Optical Astrometry in the Vicinity of the VLA source", Cole, D. M., Vanden Berk, D. E., Nichol, R. C., Quashnock, J. M., **Severson, S. A.**, Miller, M. C., and Lamb, D. Q. 1996, IAU Circular No. 6356.

63. "GRO J1744-28: r-band Photometry; Identification of stars A-D and 'a'", Vanden Berk, D. E., **Severson, S. A.**, Cole, D. M., Lamb, D. Q., Miller, M. C., Nichol, R. C., Quashnock, J. M., Bergeron, E., Gloria, K. and Long, D. 1996, IAU Circular 6315.

64. "GRO J1744-28: Optical Measurements and Possible Brightening in R of IAUC 6309 Optical Source", Cole, D. M., Vanden Berk, D. E., **Severson, S. A.**, Nichol, R. C., Miller, M. C., Quashnock, J. M., Lamb, D. Q., Bergeron, E., Gloria, K., and Long, D. 1996, IAU Circular 6310.

65. "The South Pole Infrared Explorer (SPIREX): Near infrared astronomy at the South Pole", Rauscher, B., Hereld, M., Nguyen, H., and **Severson, S.** in Robotic Telescopes -- Pub. A.S.P. Conference Series, 79, 195, Phoenix, Arizona, ed. Russell M. Genet, 1994.

66. "SPIREX -- The first winter", Hereld, M., Rauscher, B., Hereld, M., Nguyen, H., and **Severson, S.** 1994, in *CAM94 -- AIP Conference Series,* Cancun, Mexico, ed. Arnulfo Zepeda.

67. "Near Infrared Imaging of Cooling Flow Galaxies", **Severson, S. A.**, Smetanka, J. J., Rauscher, B. J., and Hereld, M., 1994, in *Infrared Astronomy with Arrays: The Next Generation*, ed. I. S. McLean.

8.6.5 Professor Thomas Targett

CURRICULUM VITAE

Promotion to Full Professor

THOMAS ANDREW TARGETT

Telephone:	707 664 2256
Email:	targett@sonoma.edu
Date of Birth:	24 September 1980
Nationality:	USA and UK
Address:	Department of Physics and Astronomy Sonoma State University 1801 East Cotati Avenue Rohnert Park, CA 94928-3609

RESEARCH INTERESTS

Galaxy evolution: (sub)millimeter galaxies, AGN hosts, radio galaxies, ULIRGS

Coupled black hole and spheroid growth

The first galaxies: origin and properties

EMPLOYMENT

Sonoma State University	*Associate Professor*	*Sep 2019 – Present*
	Assistant Professor	*Sep 2015 – Aug 2019*
	Visiting Professor	*Sep 2013 – Aug 2015*
University of Edinburgh	*Postdoctoral Research Fellow*	*Apr 2010 – Aug 2013*
University of British Columbia	*Postdoctoral Fellow*	*Apr 2008 – Mar 2010*
University of Birmingham	*Postdoctoral Research Fellow*	*Sep 2007 – Mar 2008*
California Institute of Technology	*Postdoctoral Scholar*	*Jan 2007 – Aug 2007*

EDUCATION

University of Edinburgh, UK *Oct 2003 – Dec 2006*
Ph.D., Astrophysics

Thesis: "Coupled Black Hole and Spheroid Formation in the Early Universe"
Advisor: Prof. James Dunlop

Cardiff University, UK *Sep 1999 – Jun 2003*
M.Phys. (Honors), Astrophysics (2:1)

Master's dissertation: "Hidden Hydrogen Disks in the HIPASS 21-cm Survey"
Advisor: Prof. Michael Disney

GRANTS AND APPOINTMENTS

National Science Foundation Engaging Community Colleges in Collaboration (EC3) Grant
*(**$375,540** award over four semesters)* *Sep 2022 – Present*

- Plan, implement, and assess summer REUs to bring high-unit returning SRJC and Mendocino community college students to Sonoma State University for residential research experiences. Aims to encourage movement towards transfer and 4-year STEM degree completion.
- With a focus on equity and diversity, the project increases representation of historically underrepresented populations by fostering a sense of belonging in STEM.
- Outcomes to measure the impact of a pre-transfer research experience on community college students towards transfer rates and persistence in STEM fields.

School of Science and Technology Outreach Coordinator *Sep 2022 – Present*
(1 WTU per semester for a total of six semesters) *Sep 2018 – Aug 2020*

- Coordinated visits to local schools promoting SSU, and their reciprocal campus visits.
- Co-organized SST Science Symposium, directed judging of work from hundreds of students.
- Represented the Dean's Office at various school, university, and community events.

The Koret Scholars Award *Sep 2018– Aug 2019*
*(**$10,000** award over two semesters)*

- Koret-funded students contributed to the construction, data analysis, and public outreach efforts for an undergraduate-built satellite launched in 2020.

RESEARCH AND SCHOLARSHIP

SUMMARY: 15 published peer-reviewed articles while at SSU, all in high-impact astronomy journals. 4 conference proceedings at national/international events.

The following is based on data from NASA/ADS, retrieved on 08/01/2023

- Total refereed papers: 38; citation count: 4363
- H-index: 32
- Refereed papers with ≥ 100 citations: 16
- Refereed first-author papers: 3

PUBLICATIONS & PROCEEDINGS

2022/2023

- **Published Paper:** Donnan, C.T., **Targett, T.A.**, et al. (2023), The evolution of the galaxy UV luminosity function at redshifts $z \simeq 8$ - 15 from deep JWST and ground-based near-infrared imaging, Monthly Notices of the Royal Astronomical Society, 2023MNRAS.518.6011D **(https://adsabs.harvard.edu/abs/2023MNRAS.518.6011D)**
- **Conference Proceeding:** Kallman, G., **Targett, T.A.**, et al. (2023), Validating Eclipse Megamovie Crowd-Sourced Data for Solar Coronal Research, AGU Fall Meeting 2022, 2023MNRAS.518.6011D **(https://adsabs.harvard.edu/abs/2023MNRAS.518.6011D/abstract)**

2019/2020

- **Conference Proceeding: Targett, T.A.**, et al. (2020), The host galaxy properties of SCUBA-2 450μm selected sources as revealed by CANDELS HST WFC3/IR imaging in COSMOS, American Astronomical Society meeting #235, 2020AAS...23511101T **(https://ui.adsabs.harvard.edu/abs/2020AAS...23511101T/abstract)**

2018/2019 (PY 06) (TT 04)

- **Data Product:** Geach, J.E., **Targett, T.A.**, et al. (2018), VizieR Online Data Catalog: SCUBA-2 Cosmology Legacy Survey, 2018yCat..74651789G **(https://ui.adsabs.harvard.edu/abs/2018yCat..74651789G/abstract)**

2017/2018 (PY 05) (TT 03)

- **Conference Proceeding:** White, A., **Targett, T.A.**, et al. (2018), Evaluation of an Interactive Undergraduate Cosmology Curriculum, American Astronomical Society, 2018AAS...23220904W **(http://adsabs.harvard.edu/abs/2018AAS...23220904W)**
- **Published Paper:** Zavala, J.A., **Targett, T.A.**, et al. (2018), The SCUBA-2 Cosmology Legacy Survey: The EGS deep field - II. Morphological transformation and multi-wavelength properties of faint sub-millimeter galaxies, Monthly Notices of the Royal Astronomical Society, 475.5585Z **(http://adsabs.harvard.edu/abs/2018MNRAS.475.5585Z)**

2016/2017 (PY 04) (TT 02)

- **Published Paper:** Dunlop, J.S., **Targett, T.A.**, et al. (2017), A deep ALMA image of the Hubble Ultra Deep Field, Monthly Notices of the Royal Astronomical Society, 466.861D **(http://adsabs.harvard.edu/abs/2017MNRAS.466..861D)**
- **Published Paper:** Geach, J.E., **Targett, T.A.**, et al. (2017), The SCUBA-2 Cosmology Legacy Survey: 850μm maps, catalogues and number counts, Monthly Notices of the Royal Astronomical Society, 465.1789G **(http://adsabs.harvard.edu/abs/2017MNRAS.465.1789G)**

2015/2016 (PY 03) (TT 01)

- **Published Paper:** Curtis-Lake, E., **Targett, T.A.**, et al. (2016), Non-parametric analysis of the rest-frame UV sizes and morphological disturbance amongst L_* galaxies at $4 < z < 8$, Monthly Notices of the Royal Astronomical Society, 457.440-464 **(http://adsabs.harvard.edu/abs/2016MNRAS.457..440C)**
- **Published Paper:** McLeod, D. J., **Targett, T.A.**, et al. (2015), New redshift z~9 galaxies in the Hubble Frontier Fields: implications for early evolution of the UV luminosity density, Monthly Notices of the Royal Astronomical Society, 450.3032M **(http://adsabs.harvard.edu/abs/2015MNRAS.450.3032M)**

2014/2015 (PY 02)

- **Published Paper:** Sommariva, V., **Targett, T.A.**, et al. (2014), A mass threshold in the number density of passive galaxies at z~2, Astronomy and Astrophysics, 571A.99S **(http://adsabs.harvard.edu/abs/2014A%26A...571A..99S)**
- **Published Paper:** Bruce, V.A., **Targett, T.A.**, et al. (2014), The decomposed bulge and disc size-mass relations of massive galaxies at $1 < z < 3$ in CANDELS, Monthly Notices of the Royal Astronomical Society, 444.1660B **(http://adsabs.harvard.edu/abs/2014MNRAS.444.1660B)**
- **Published Paper:** Bruce, V.A., **Targett, T.A.**, et al. (2014), The bulge-disc decomposed evolution of massive galaxies at $1 < z < 3$ in CANDELS, Monthly Notices of the Royal Astronomical Society, 444.1001B **(http://adsabs.harvard.edu/abs/2014MNRAS.444.1001B)**
- **Published Paper:** Nayyeri, H., **Targett, T.A.**, et al. (2014), A Study of Massive and Evolved Galaxies at High Redshift, Astrophysical Journal, 794.68N **(http://adsabs.harvard.edu/abs/2014ApJ...794...68N)**
- **Published Paper:** Fontana, A., **Targett, T.A.**, et al. (2014), The Hawk-I UDS and GOODS Survey (HUGS): Survey design and deep K-band number counts, Astronomy and Astrophysics, 570A.11F **(http://adsabs.harvard.edu/abs/2014A%26A...570A..11F)**
- **Conference Proceeding:** Coble, K., **Targett, T.A.**, et al. (2015), Preliminary Evaluation of a New Cosmology Curriculum, American Astronomical Society, 2015AAS...22524504C **(http://adsabs.harvard.edu/abs/2015AAS...22524504C)**

2013/2014 (PY 01)

- **Published Paper:** Wiklind, T., **Targett, T.A.**, et al. (2014), Properties of Submillimeter Galaxies in the CANDELS GOODS-South Field, Astrophysical Journal, 785, 111W **(http://adsabs.harvard.edu/abs/2014ApJ...785..111W)**
- **Published Paper:** Roseboom, I.G., **Targett, T.A.**, et al. (2013), The SCUBA-2 Cosmology Legacy Survey: demographics of the 450-μm population, Monthly Notices of the Royal Astronomical Society, 436, 430R **(http://adsabs.harvard.edu/abs/2013MNRAS.436..430R)**
- **Published Paper:** Koekemoer, A., **Targett, T.A.**, et al. (2013), The 2012 Hubble Ultra Deep Field (UDF12): Observational Overview, The Astrophysical Journal Supplement Series, 209, 3K **(http://adsabs.harvard.edu/abs/2013ApJS..209....3K)**
- **Published Paper:** Ivison, R.J., **Targett, T.A**., et al. (2013), Herschel-ATLAS: A Binary HyLIRG Pinpointing a Cluster of Starbursting Protoellipticals, Astrophysical Journal, 772.137I **(https://adsabs.harvard.edu/abs/2013ApJ...772..137I/abstract)**

PROFESSIONAL PRESENTATIONS

- Sacramento State Physics and Astronomy Colloquium Series, "Coupled Black-Hole and Galaxy Growth or: How I Learned to Stop Worrying and Love Super-Massive Singularities" - audience of 30 faculty, students, and community members. One presentation in 2015
- University of Edinburgh Coffee Talk, "The ALMA deep field" - audience of 50 faculty and graduate students. One presentation in 2015
- CANDELS team meeting, Santa Cruz, CA - audience of 150 international faculty and graduate students. One presentation in 2015
- Astronomical Society of the Pacific, San Francisco, CA - audience of 40 international faculty and graduate students. One presentation in 2015
- National Astronomy Meeting, St. Andrews, Scotland - audience of 90 international faculty and graduate students. Two Presentations in 2013.

AWARDS AND PROFESSIONAL ACTIVITIES

- Sabbatical Awarded Fall 2012 Semester - led to publication of Donnan, C. T., **Targett, T.A.**, et al. (2023)
- SSU SST Professional Development Award ($2,500) – Poster Presentation at 235th meeting of the American Astronomical Society, Hawaii.
- SSU Affordable Learning Grant for implementation of OER materials in ASTR-100 ($3,000) - ~400 students per semester, now in zero-cost GE classes.
- SSU RSCAP Summer Fellowship Award, funded work on SCUBA-2 publication ($5,000) - led to publication of Zavala, J.A., **Targett, T.A.**, et al. (2018).
- Gemini Telescope Time Allocation Committee, reviewed proposals for use of telescope time valued at ~$165,000.
- SSU SST Professional Development Award ($2,103) - attended 228th meeting of the American Astronomical Society, San Diego.
- SSU RSCAP Summer Fellowship Award, funded work on SCUBA-2 publication ($5,000) - led to publication of Dunlop, J.S., **Targett, T.A.**, et al. (2017).
- Advanced Research Opportunities Undergraduate Research Fund, SSU ($900) - purchase of software licenses currently in use supporting undergraduate research.

TEACHING EFFECTIVENESSS

SUMMARY: Instruction across Physics and Astronomy major and GE classes at upper- and lower-division levels. Designed new degree programs and classes. Instruction delivered via traditional, flipped, and online formats. Nominated for SSU Excellence in Teaching Award several times. Consistently outstanding SETE scores (average >4.5/5 in all categories) and peer evaluations.

NEW DEGREE PROGRAMS DESIGNED

- **B.S. Astrophysics –** co-designed and implemented B.S. in physics with a concentration in astrophysics. Program is a calculus-based degree providing a strong foundation in physics with emphasis on theoretical and observational studies of planets, stars and galaxies.
- **B.A. Physical Science –** co-designed and implemented interdisciplinary program, with concentrations in STEM teaching and Foundational Health. Incorporates classes spanning STEM programs with emphasis in the physical sciences.

NEW COURSES DESIGNED

- **ASTR-150: Astronomy for Scientists –** A lecture survey course designed primarily for science majors. Created as a Descriptive Astronomy alternative for STEM-focused students, integrating more advanced mathematics. Area B1 GE class.
- **ASTR-121: How to Influence the World –** Discussion class prepares students for effective oral communication via modern and traditional modalities, with a focus on influence though argument, debate, and demonstrated competence. Area A1 GE class.
- **PHYS-396: The Physics of Distilling –** Course details the physics/chemistry of the distilling and production of Scotch whisky, and reviews its history, culture, and business significance. Upper-Division area B GE class.

CLASSES TAUGHT

- **ASTR-100: Descriptive Astronomy**

  GE lecture course, covers the composition and nature of the universe in a descriptive modality - from the solar system, to stars, stellar evolution, and galaxies.
    - Instructor of Record: 23 instances
    - Class Size: 125-250 students
    - Instruction Modalities: Traditional, Flipped, Online
- **ASTR-150: Astronomy for Scientists**

  GE lecture course, covers the composition and nature of the universe in a mathematical modality - from the solar system, to stars, stellar evolution, and galaxies.
    - Instructor of Record: 1 instance
    - Class Size: 40 students
    - Instruction Modalities: Traditional
- **ASTR-231: Introduction to Observational Astronomy**

  GE laboratory class, focused on astronomical measurement techniques with field and laboratory studies of astronomical objects.
    - Instructor of Record: 16 instances
    - Class Size: 24 students
    - Instruction Modalities: Traditional, Online

- **ASTR-305: Frontiers in Astronomy**

GE lecture and Writing Intensive Class, a survey of recent breakthroughs in astronomy and how they are made, including the James Webb Space Telescope, neutrino astrophysics, and gravitational wave astronomy.
  - Instructor of Record: 11 instances
  - Class Size: 24 students
  - Instruction Modalities: Traditional, Online

- **ASTR-331: Astronomical Imaging**

Majors laboratory class, focused on astronomical measurement techniques, programming, and statistics used professionally in astrophysical data processing.
  - Instructor of Record: 1 instance
  - Class Size: 10 students
  - Instruction Modalities: Traditional

- **ASTR-350: Cosmology**

GE lecture class, a survey of the early Universe and how scientists have understood it. Topics include the Big Bang, cosmic inflation, surveys of galaxies, the origin and evolution of structure in the Universe, dark matter, and dark energy.
  - Instructor of Record: 11 instances
  - Class Size: 40 students
  - Instruction Modalities: Traditional, Flipped, Online

- **PHYS-114: Introduction to Physics I**

Majors lecture class, the first of three basic sequential courses in physics for science and mathematics majors. A calculus-based introduction to classical mechanics, including vector analysis, laws of motion, conservation laws, and rotational motion.
  - Instructor of Record: 7 instances
  - Class Size: 25-40 students
  - Instruction Modalities: Traditional, Flipped, Online

- **PHYS-381: Computer Applications for Scientists**

Majors laboratory class, teaches coding first principals using problem-solving techniques and computer modeling/simulation for physical systems using the programming language Python
  - Instructor of Record: 2 instances
  - Class Size: 10 students
  - Instruction Modalities: Traditional

- **PHYS-396: The Physics of Distilling**

Majors lecture class, details the physics/chemistry of the distilling and production of Scotch whisky, and reviews its history, culture, and business significance.
  - Instructor of Record: 1 instances
  - Class Size: 6 students
  - Instruction Modalities: Traditional

- **PHYS-491: Capstone Preparatory Seminar**

Majors elective class, supports students conducting their capstone research projects, presenting key concepts such as managing and scheduling large projects and presenting research through written, visual, and verbal means.
  - Instructor of Record: 2 instances
  - Class Size: 10 students
  - Instruction Modalities: Traditional, Online

- **PHYS-494: Physics Seminar**

Majors elective class, a lectures series on topics of interest in physics, astronomy, and related fields. Additionally, includes development of students' oral presentation skills.
  - Instructor of Record: 4 instances
  - Class Size: 10 students
  - Instruction Modalities: Traditional, Online

STUDENT RESEARCH PROJECTS

ASTR-497 (2-unit) Spring 23 – Erazmus Bish – Non-Paramedic Galaxy Size Measurement
ASTR-497 (2-unit) Spring 23 – Pedro Quinonez – Modelling the High-Z Universe with JWST

ASTR-495 (1-unit) Fall 22 – Pedro Quinonez – JWST Data Analysis

ASTR-475 (2-unit) Spring 22 – Natalie Sanborn – An Introductory Solar System
PHYS-493 (2-unit) Spring 22 – Jacob Watkins – Angular Momentum as a Stabilizer

ASTR-495 (1-unit) Spring 21 – Natalie Sanborn – An Introductory Solar System
ASTR-497 (2-unit) Spring 21 – Loren Heins – The Size-Mass Relation of Galaxies at $3<z<4$

ASTR-495 (1-unit) Fall 20 – Andrew Evans – Neutron Star Visualization
ASTR-495 (1-unit) Fall 20 – Meghan Miller – A Census of Exoplanets
ASTR-497 (2-unit) Fall 20 – Jeffery Reedy – The Physics of Guitar Pickups

ASTR-495 (1-unit) Fall 19 – Karli Martin – Earth Orbit Satellite
ASTR-495 (1-unit) Fall 19 – Lauren Knowles – Earth Orbit Satellite

ASTR-492 (2-unit) Spring 19 – Cody Kojima – PHYS-114 pedagogical material design
ASTR-495 (1-unit) Spring 19 – Andrew Kalich – AV materials to augment public observing nights
ASTR-497 (2-unit) Spring 19 – Erik Castellanos-Vasquez – Non-parametric Galaxy Sizes

ASTR-495 (1-unit) Fall 18 – Erik Castellanos-Vasquez – Non-parametric Galaxy Sizes
ASTR-495 (1-unit) Fall 18 – Janelle Griswold – Lecture Slide Archive and Research

ASTR-495 (1-unit) Spring 18 – Joseph Magill – Pub. Obs. and WPD AV Guide Development
ASTR-495 (1-unit) Spring 18 – Jordan Alvarenga – Lecture Slide Archive and Research

ASTR-495 (1-unit) Fall 17 – Pengteda Cheng – Lecture Slide Archive and Research
ASTR-495 (1-unit) Fall 17 – Daniel Cabrera – ASTR-231 lab redesign

ASTR-495 (1-unit) Spring 17 – Zachary Kurland – Galaxy Evolution
ASTR-495 (1-unit) Spring 17 – Tyler Whitmarsh – Visual Morphology

ASTR-495 (1-unit) Fall 16 – Zachary Kurland – Visual Morphology of Galaxies in CANDELS EGS
ASTR-495 (1-unit) Fall 16 – Claire Shudde – Visual Morphology of Galaxies in CANDELS EGS

ASTR-492 (2-unit) Spring 16 – Zachariah Miller – ASTR-231 Pedagogical Development
ASTR-495 (1-unit) Spring 16 – Henry Arbaugh – Black Hole to Bulge Mass Ratio
ASTR-495 (1-unit) Spring 16 – Steven Woodall – Star Collisions in Galaxy Mergers
ASTR-497 (2-unit) Spring 16 – Demitri Call – The Size-Mass Relation of Galaxies at $3<z<4$

ASTR-495 (1-unit) Fall 15 – Henry Arbaugh – Black Hole to Bulge Mass Ratio
ASTR-495 (1-unit) Fall 15 – Demitri Call – The Size-Mass Relation of Galaxies at $3<z<4$
ASTR-495 (1-unit) Fall 15 – Delia Hanes – Historical Lecture Archive
ASTR-495 (1-unit) Fall 15 – Zachariah Miller – Development of Teaching and Laboratory Exercises
ASTR-495 (1-unit) Fall 15 – Wesley Watson – Detection and Classification of $z=7$ Galaxies

ASTR-495 (1-unit) Spring 15 – Henry Arbaugh – Black Hole to Bulge Mass Ratio
ASTR-495 (1-unit) Spring 15 – Demitri Call – The Size-Mass Relation of Galaxies at $3<z<4$
ASTR-495 (1-unit) Spring 15 – Delia Hanes – Historical Lecture Archive
ASTR-495 (1-unit) Spring 15 – Aaron Owen – The Galaxy Luminosity Function at $z=7$
ASTR-495 (1-unit) Spring 15 – Erika Perkins – Historical Lecture Archive
ASTR-497 (2-unit) Spring 15 – Anna McCowan – A CO_2 Sensor for Pocket-Cube Satellites

ASTR-495 (1-unit) Fall 14 – Demitri Call – The Size-Mass Relation of Galaxies at $3<z<4$
ASTR-495 (1-unit) Fall 14 – Amandeep Gill – The Size-Mass Relation of Galaxies at $3<z<4$
ASTR-495 (1-unit) Fall 14 – Aaron Owen – The Galaxy Luminosity Function at $z=7$

ASTR-495 (1-unit) Spring 14 – Amandeep Gill – The Size-Mass Relation of Galaxies at $3<z<4$
ASTR-495 (1-unit) Spring 14 – Anna McCowan – The Size-Mass Relation of Galaxies at $3<z<4$
ASTR-495 (1-unit) Spring 14 – Aaron Owen – The Galaxy Luminosity Function at $z=7$

ASTR-495 (1-unit) Fall 13 – Amandeep Gill – The Size-Mass Relation of Galaxies at $3<z<4$
ASTR-495 (1-unit) Fall 13 – Anna McCowan – The Size-Mass Relation of Galaxies at $3<z<4$

DEVLOPEMNT

- Contributed to the NASA-funded SSU EPO group's development of the "Big Ideas in Cosmology" online learning platform.
- Participated in the NSF WIDER project collaboration "Redefining the College Lecture" (faculty professional development program).
- Complete redesign of PHYS-381: Computational Methods for Scientists to align with current programming languages and curricular needs.
- Developed new materials to convert PHYS-114: Introduction of Physics I to a zero-cost class.
- Served as local SSU faculty liaison for Sacramento State online particle physics course.
- Designed new labs (50% of total materials) for the ASTR-231: Introduction to Observational Astronomy course.
- Editor for W. W. Norton & Company textbook *Understanding Our Universe*, 4th edition; feedback for one chapter ($300 honorarium).
- Editor for W. W. Norton & Company textbook *Understanding Our Universe*, 3rd edition; feedback for two chapters ($500 honorarium).
- Editor for W. W. Norton & Company textbook *Understanding Our Universe*, 2nd edition; feedback for one chapter ($300 honorarium).

SERVICE

SUMMARY: Comprehensive and extensive service across department, school, and university-wide levels. Strong community presence and excellent outreach to local schools.

CAMPUS

Academic Master Plan – Steering Committee *Jan 2023 – Present*
Appointed At-Large Member

- Faculty representative overseeing campus-wide reorganization.
- Developed charges and reviewed work of sub-committees.

Academic Master Plan - Learning Spaces & Technologies Group *Sep 2023 – Present*
Faculty Co-Chair

- In progress.

Academic Master Plan – Liberal Arts Identity Working Group *Jan 2023 – May 2023*
Appointed At-Large Member

- Developed identity statement to guide campus reorganization and curricular development.

General Education Subcommittee *Sep 2019 – May 2022*
Elected School of Science and Technology Representative

- Developed content criteria for all GE areas as part of campus-wide GE revision.
- Reviewed and approved classes applying for GE status.

Overlay Subcommittee *Sep 2019 – May 2020*
Elected School of Science and Technology Representative

- Developed content criteria for the three overlay graduation requirements.
- Reviewed the approved classes applying for overlay status.

Educational Policies Committee *Sep 2018 – May 2019*
Elected School of Science and Technology Representative

- Revised, developed, and approved campus-wide revision to general education program.
- Supervision of revisions to campus policies.

School of Science and Technology Curriculum Committee *Sep 2015 – May 2018*
Committee Chair

- Reviewed proposed curriculum changes and program reviews from SST departments.

Oral Communication Core Competency Committee *Sep 2017 – May 2018*
Appointed Faculty Representative

- Developed campus-wide oral communication assessment rubric to ensure compliance with accreditation core competencies requirement.

Commencement Ceremony Revision Committee *Sep 2017 – May 2018*
Appointed Member

- Completely redesigned university graduation ceremony (university and school levels)

Secretary to Academic Senate *Jan 2015 – May 2017*
Elected Executive Committee Member

- Faculty leadership position, liaison between faculty governance and university administration.
- Oversaw meeting minutes, vote counting, and procedural order.

SSU California Faculty Association *Sep 2014 – May2016*
Elected Junior Faculty Representative & Delegate-at-Large

- Represented junior faculty at CFA meetings, organized social events for new faculty.

Campus Other

- *Faculty advisor, Sonoma State eSports group (80 student members)* - organized chartering, meetings, facilities, and campus-wide events hosted by the group: 2013-Present
- *Numerous contributions to other SSU Departments* – Includes serving on hiring committees, RTP committees, and guest presentations in lecture/seminar series: 2013 Present
- *Organized campus-wide games tournament on LoboVision* (400 attendees) - planned, organized, and implemented open games tournament on campus: 2017
- *OLLI presentation at SSU, "Myths of Astronomy"* (50 attendees) - talk detailing the scientific method and pervasive misunderstandings disseminated via entertainment media: 2016
- *Organized campus-wide Ceilidh* (*Scottish dance social event*) (50 attendees) - with live music and dance instruction: 2015-2016
- *Faculty advisor, SSU Society of Physics Students* (30 student members), awarded "Outstanding Chapter" status by national SPS organization 16/17 - organized chartering, meetings, facilities, and campus-wide events hosted by the group: 2015-2017

DEPARTMENT

Department RTP Chair *Sep 2019 – Present*
Elected Member

- Chaired department Reappointment, Tenure, and Promotion committee.
- Oversaw tenure-track faculty RTP process, conducted periodic reviews of adjunct faculty, ran several adjunct pool-refresh recruitment cycles.

Department Other

- *Co-led replacement and re-opening of SSU campus observatory* - oversaw complete rebuild of campus observatory, refurbishment of telescopes and infrastructure, organized campus-wide opening event: 2017
- *Co-lead organizer and docent, SSU Public Observing Nights (average 3 per semester)* – hosted students, staff, faculty, and community members at the SSU observatory, including presentations, discussion, and guided exploration of the night sky: 2013-Present
- *Editor of "The Physics Major" department newsletter*: 2016, 2017, 2018, 2019, 2022, 2023
- *Organized campus-wide solar eclipse viewing event* - attended by ~300 students/faculty/staff observing the partial solar eclipse: 2014
- *Presentation at SSU's "What Physicists Do"* - seminar presentational on a citizen-science-based research-project (now most-viewed SSU faculty presentation on the SSU YouTube channel with >10,000 views): 2013

COMMUNITY & SCHOOLS

- Numerous interviews with local newspapers and radio stations (e.g. *Press Democrat*, *Sonoma State Star,* KRCB 91-FM) - topics including SSU observatory rebuild/reopening, solar eclipses, meteor showers, comets, and super-moons: Ongoing
- STLV 2022, invited science speaker at the Las Vegas Star Trek Convention (audience of 150): 2022.
- SRJC, "Myths of Astronomy" presentation to introductory physics and astronomy classes (audience of 100): 2019, 2022, 2023.
- Piner High School STEM Cafe, "Myths of Astronomy" public presentation (audience of 50): 2013, 2018, 2022.
- Marin Science Seminar, "Myths of Astronomy" presentation (audience of 50): 2016, 2018
- StarCraft II AI Workshop, Blizzcon 2017, presentation on AI in gaming (audience of 150): 2017.
- Public presentation at Wonderfest, "Myths of Astronomy" (audience of 300): 2017
- Presentation to the students at Cloverdale High, "Myths of Astronomy" (audience of 40): 2017
- Physics and Astronomy presentation to Girl Scouts of America SSU campus visit, "Myths of Astronomy" (audience of 40): 2016
- Public presentation at Bay Area Sceptics event, "Myths of Astronomy" (audience of 40): 2016
- Public presentation at Atheist Community of San Jose event, "Myths of Astronomy" (audience of 80): 2016
- Physics and Astronomy presentation to the Hayward High School (audience of 70) - represented Physics and Astronomy Department to potential SSU applicants: 2016
- Presentation to the students at Roseland University Prep, "Myths of Astronomy" (audience of 40): 2015, 2016
- Presentation to the students at Piner Academy, "Myths of Astronomy" (audience of 80): 2015
- Invited speaker at "Tech Trek" - summer program designed to encourage female middle-school students to pursue careers in STEM (audience of 80): 2014, 2017
- Invited speaker, SPS-organized joint SSU/SRJC visit to Ferguson Observatory (audience of 40): 2013
- Presentation of a citizen-science-based research project to Blizzard Entertainment Blizzcon 2013 games convention (audience of ~15,000): 2013

PRE-SSU TEACHING/RESEARCH/SERVICE

Observing
- United Kingdom InfraRed Telescope, Hawaii [3.8-m] – 34 nights
- James Clark Maxwell Telescope, Hawaii [15-m] – 6 nights
- William Herschel Telescope, La Palma [4.2-m] – 5 nights
- W. M. Keck Observatory, Hawaii [10-m] – 4 nights
- Palomar Observatory, California [200-inch] – 3 nights

Teaching
- Joint lecturer: Astronomy 101 and 310, University of British Columbia
- Course organizer and lecturer, graduate-level "SUPA Galaxies" course, University of Edinburgh
- Wrote, set, and graded graduate- and undergraduate-level examinations
- All categories from official student evaluation of instruction > 4.5/5

Referee
- Gemini telescope time-allocation committee
- Scientific referee, MNRAS and ApJ journals

Supervision
- Several publications with undergraduate co-authors
- Project supervisor for numerous Master's and undergraduate-level students
- Project supervisor for Caltech SURF and summer research students
- Thesis committee for Masters and Ph.D. students, UBC, and Edinburgh

International collaborations
- Member, international astronomy collaborations: CANDELS, HUGS, and UDF12

Presentations
- Speaker, presenter, and session chair at numerous international conferences

Organization
- Organizing committee – CANDELS team meeting, University of Edinburgh
- Organizing committee – PPARC summer school, University of Edinburgh
- Seminar and colloquium series organizer, University of Edinburgh

Outreach
- Public astronomy correspondent, University of Edinburgh
- Guest speaker, BBC Radio Scotland
- Appearances on astronomy outreach podcasts, University of Manchester
- Frequent guest speaker at primary and secondary schools
- Strong media presence with outreach projects
    - Articles in national newspapers and mainstream internet pages
    - Significant public response via Facebook and Twitter

College of Natural Sciences
Office of the Dean

CALIFORNIA STATE UNIVERSITY, SAN BERNARDINO
5500 University Parkway, San Bernardino, CA 92407

909.537.3384
cns.csusb.edu

Dr. Carol Hood 5/24/24
Associate Dean, College of Natural Sciences
Professor of Physics & Astronomy
California State University, San Bernardino

External Reviewer Report for Sonoma State Physics & Astronomy Program Review

Introduction

During my one day visit (March 6-7, 2024), and through the self-study report (2022-23), I found the Department of Physics & Astronomy at Sonoma State University to embody a collaborative atmosphere, student-focused approach, and commitment to academic excellence. As part of my visit, I met with all tenure-line faculty, the department chair, dean, instructional and administrative staff, and a selection of students. Everyone was friendly, helpful, and presumably candid about their experiences within and with the department and its associated programs. The department has taken multiple measures to provide individualized and structured support to all its students. Recent enhancements, such as the new degree programs and concentrations and innovative general education courses, underscore the department's adaptability and dedication to meeting evolving educational needs. However, despite its successes, the department faces challenges such as declining enrollments, budget constraints, reduced instructional capacity, and potential curriculum changes. This report offers an overview of the department's achievements and obstacles, along with potential recommendations to navigate these challenges and continue its tradition of excellence in education.

Strengths

The faculty members within the department exhibit congeniality, collaboration, and a strong commitment to student success. Faculty ensure tailored advising to help students develop optimal graduation plans based on their unique circumstances for all majors. And as part of their weekly department meetings, they engage in discussions on individualized student support strategies for those students who may be struggling. Additionally, the Society of Physics Students chapter offers students further opportunities to engage in the department's supportive community.

The department boasts a diverse range of degree options, catering to students with varied interests and levels of preparedness. These options include a Physics BS degree, featuring an astro concentration tailored for those aspiring to pursue graduate studies in physics or astronomy; a Physics BA degree offering increased flexibility for students interested in industry roles; and a Physical Science degree with multiple concentrations designed to provide graduates with a comprehensive scientific foundation for careers in healthcare, education, or industry.

Central to all degree programs is the Capstone course, which I had the opportunity to observe during my visit. I was highly impressed by the supportive atmosphere cultivated within this course, where discussions among faculty and students, as well as among peers, fostered a growth mindset, ensuring that learning was collaborative and supportive. Furthermore, the course projects were thoughtfully designed to resonate with students' real-life experiences and future career aspirations, facilitating one-on-one interactions with faculty across various fields. Leveraging a robust array of experimental equipment and strong collaborations in observational astronomy and science education, faculty members provide students with invaluable hands-on learning experiences. The culmination of the semester is marked by the Capstone course's final showcase and celebration, which not only engages the department but also involves students' families, effectively bridging the gap between educational endeavors and home life.

Additionally, the department has expanded its service courses, developing General Education offerings beyond the traditional Area B science courses. These initiatives, including courses in Oral Communication, the Sustainability and Environmental Reslience Overlay, Writing Intensive Overlay, and Area E, contribute to the department's Full-Time Equivalent Student (FTES) count. Since the previous program review, the department has observed a significant uptick in enrollment among women, first-generation students, and underrepresented minorities, underscoring its commitment to diversity and inclusivity.

Challenges

From speaking with faculty and reading the self-study, there are some current challenges facing the department. Declining enrollments across the CSU and especially at Sonoma State have lead to budget issues that have precipitated a planned structural reorganization of colleges and departments, which has increased uncertainty for faculty and staff. Recent retirements of a few long-time lecturers has resulted in fewer instructors available to teach the needed courses. And the implementation of the new Cal-GETC General Education package may result in the loss of the department’s popular Area E course (SCI 220), depending on how the university decides to implement the mandated changes and if the department attempts to reconfigure it for another GE Area.

Recommendations

In response to the above changes and capitalizing on the strengths of the department, the following are some recommendations for the department to consider adopting.

1. Submitting the Upper-Division GE asynchronous course to CSU Coursematch. For courses that hold at least 10 seats for CSU students from other campuses to enroll, the Chancellor’s Office pays a few thousand dollars. This can provide much needed funds for department and college activities during tight budget times.
2. Potentially requiring the Oral Communication course of all physics or physical science incoming first-year students. This would allow these students to meet one of the Golden Four General Education requirements, while also getting to meet these new students in their first semester or year, regardless of their incoming math preparation. Efforts can be made in this course to help students get to know the physics faculty and each other, thereby integrating them into department life sooner than if they waited until their first physics course.
3. Presumably the college reorganization will increase interactions between various STEM programs. This could be a great opportunity to capitalize on those interactions and increase the interdisciplinary work. Interdisciplinary research might require more synergy between individual faculty, but there could be room for more interdisciplinary courses that could appeal to students in a broader range of programs, such as a Planetary Astronomy courses between astronomy and geology faculty, a Materials Science

course between physics and chemistry faculty, or some applied courses between physics and engineering faculty.

4. If the budget and enrollment situation worses, the department may need to consider temporarily switching the frequency of some course offerings from once a semester to once a year, or from once a year to once every other year. While not ideal, a creative alternating two year schedule can be designed to both support student learning and temporarily meet budget constaints.
5. When the budget and enrollment allows, hire more faculty to replace the retirements and reduce the existing workload.
6. Continue the recruitment efforts to local community colleges and future first-year students and consider joining forces with other programs. Given increased workloads, examine the return on investment of current recruitment efforts (phone banking, marketing packets, etc.) and focus on those with more success.

To address the aforementioned challenges and capitalize on the department's strengths, several recommendations are proposed for consideration:

1. **Creation of GE Asynchronous Courses for CSU Coursematch:** By creating an asynchronous version of any General Education course previously taught online (i.e. ASTR 100, ASTR 350), the department submit them as CSU Coursematch courses and therefore can tap into additional funding opportunities. Courses with a minimum of 10 seats reserved for CSU students from other campuses can yield financial support from the Chancellor's Office. This infusion of funds can help to alleviate budgetary strains and support departmental and college activities during periods of financial constraint.

2. **Potential Requirement of Oral Communication Course for Incoming Physics or Physical Science First-Year Students:** Introducing a requirement for incoming physics or physical science first-year students to complete the AST 121 Oral Communication course can serve multiple purposes. Not only would this fulfill one of the Golden Four General Education requirements, but it would also facilitate early engagement with new students. By acquainting students with the physics & astronomy faculty and fostering peer interaction, this initiative can integrate students into departmental life from the outset, irrespective of their incoming math preparation.

3. **Capitalization on Interactions Arising from College Reorganization:** Anticipated increases in interactions between various STEM programs due to the college reorganization presents an opportunity for interdisciplinary collaboration. Leveraging this opportunity could enhance interdisciplinary work within the department. Exploration of interdisciplinary courses, such as a Planetary Astronomy course facilitated by collaboration between astronomy and geology faculty, a Materials Science courses led by physics and chemistry faculty, or applied courses involving physics and engineering faculty, can cater to students across a broader spectrum of programs while also increasing the majors electives available to students in a given year.

4. **Adaptation of Course Frequency to Budget and Enrollment Constraints:** In response to worsening budget and enrollment situations, the department may need to temporarily adjust the frequency of course offerings. Consideration could be given to transitioning some courses from once a semester to once a year, or from once a year to once every other year. Although not ideal, implementing a creative alternating two-year schedule can support student learning while addressing short-term budget constraints.

5. **Faculty Hiring to Address Retirements and Workload Reduction:** As budgets and enrollments permit, prioritizing the hiring of additional faculty to replace retirees and alleviate existing workload pressures is essential. Increasing faculty numbers can ensure continuity in course offerings and maintain teaching quality, thereby supporting student success.

6. **Continuation and Evaluation of Recruitment Efforts:** Sustaining recruitment efforts targeting local community colleges and prospective first-year students remains crucial. Within the new college and departmental structures, it might be useful to explore opportunities for collaboration with other programs to enhance recruitment efforts and amplify outreach efforts. It would also be useful to develop an assessment plan around the various recruitment strategies, such as phone banking and marketing packets. Focusing resources on initiatives that demonstrate higher success rates can optimize recruitment outcomes.

Finally, the department self-study also contained a list of items as part of their action plan moving forward. As resources allow, these tasks and strategies all seem well thought-out and beneficial to the department and its programs moving forward. I endorse them all as part of this external review report.

Thanks to everyone for a lovely visit to your beautiful campus. I look forward to hearing more great things from Sonona State’s Physics and Astronomy program.

Sincerely,

Carol Hood

SSU | COLLEGE OF SCIENCE, TECHNOLOGY & BUSINESS

Date: August 22, 2024
To: University Programs Review Subcommittee
From: Elisabeth Wade, Dean, College of Science, Technology, and Business
Re: Department of Physics and Astronomy Program Review Response

CC: Tom Targett, Scott Severson, Stacey Bosick

The Department of Physics and Astronomy submitted its program review self-study document and external reviewer's report. The department has done an excellent job of documenting the work they have done around their learning goals, and relating those learning goals to the campus strategic plan, and I want to commend their attention to detail. They have also done an exceptional job of creating a supportive environment for students and a collaborative environment for faculty, as noted by the external reviewer.

The outside reviewer, Dr. Carol Hood of CSU San Bernadino, had six recommendations for the department. I am generally in agreement with Dr. Hood, and will respond to these six recommendations individually here:

1. Develop an asynchronous GE course for CSU Coursematch – I believe that this recommendation is reasonable, but would need the support of the department to move forward.

2. Potential requirement of Oral Communication course for first year students – I agree this is potentially a way to connect first year students with the department, as well as a mechanism to give incoming physics and physical science students the oral communication skills that are most important to their major.

3. Capitalizing on reorganization interactions – I am supportive of the proposals for interdisciplinary offerings, which is also in alignment with the Academic Master Plan, as budget and resources allow.

4. Adaptation of Course Frequency to Budget and Enrollment – The department has begun analysis of course frequency and has moved to offering some courses once a year or every three or four semesters, based on student demand. I appreciate their efforts in this area, and agree that this will continue to be necessary for the next several years.

5. Faculty Hiring to Address Retirements and Workload Reduction – The department has had several faculty retirements and resignations, including the loss of two long term lecturers. While I agree that ideally we would hire in these areas, and while I support the hiring of

lecturers in order to support the curriculum, I do not anticipate being able to justify a Visiting or Tenure Track hire in the next 2-3 years.

6. Continuation and Evaluation of Recruitment Efforts – Given the current enrollment picture, it is very hard to justify new hiring other than lecturers in Physics and Astronomy. I agree with the outside reviewer that recruitment needs to remain a priority in the department, but also that the recruitment needs to be cost efficient given the limited resources within the department.

I also agree with Dr. Hood that the department's proposed action plan is appropriate, and support the steps forward that can be taken with current resources.

Thank you again to the department, and especially to Dr. Severson who prepared the self-study, for a careful and deliberate analysis of the state of the department.

Date: October 28, 2024

To: University Programs Review Subcommittee
From: Curriculum Committee, College of Science, Technology, and Business
Re: Department of Physics and Astronomy Program Review Response

CC: Scott Severson, Elisabeth Wade, Stacey Bosick

Introduction

The Department of Physics and Astronomy submitted its program review self-study document and external reviewer's report. The Curriculum Committee of College of Science, Technology, and Business has reviewed those documents and reports the committee's review results as follows, in accordance with the UPRS suggestions.

UPRS Suggestions for the College Curriculum Committee Letter

The committee's letter should focus on the four areas below: curriculum, assessment, staffing and resources, and students. The role of the curriculum committee is to provide a peer review of the program, in terms of the larger context of the college. The analysis should address strengths and challenges/gaps the program faces in this context and relative to other programs in the college.

Curriculum

The Physics and Astronomy program very clearly supports the core values of the university, with multiple courses, events, lectures, and learning experiences that speak to each specific value. An example of this is Astronomy 100 and 303 fulfill the Sustainability and Environmental Resilience course overlay. Also, the program holds Observatory Public Viewing Nights to support connectivity and community engagement.

The program has very strong learning outcomes that culminate in the ability to properly analyze and interpret data and experimental uncertainty in order to make meaningful comparisons between experimental measurements or observation and theory. Essentially, students who complete the program will be well-prepared for careers in the field. Among its 50+ courses offered, the program has very clearly identified where each of the core program learning outcomes are introduced, reinforced, and mastered. When compared with the curriculum maps, it becomes clear that the progression of courses in the different concentrations are thoughtfully and clearly planned. The concepts from the initial courses are necessary for subsequent courses where they are further expanded upon. The curriculum appears to be well-scaffolded

The courses themselves are interesting and accessible with flipped classes, online learning, experiential learning, and hands-on research. This encourages students with various interests and strengths to be successful in the program. The department has a very clear online education policy that defines approaches to asynchronous learning, pre-recorded lectures, message boards, and Zoom drop-ins. Again, their approach is thoughtful and reasonable.

The program also does a good job of aligning their courses with the common curriculum in the US that has been developed by consensus. They have made sure their program is capturing the best practices for physics education, determined by the American Institute of Physics. The curriculum in the Physics and Astronomy department also compares favorably to other Northern California universities and beyond. The program offers 4 major concentrations – B.S. Physics, B.S. Physics: Astrophysics Concentration, B.A. Physics, and B.A. Physical Science – and 2 minors – Minor in Physics and Minor in Astronomy. While sharing greater than 50% of the core courses, each concentration has a unique focus for students with a variety of interests. The B.A. in Physical Science is an especially original program that is collaborative between multiple departments, including biology, chemistry, business, and health science. This program gives students from diverse backgrounds an opportunity to explore and thrive in the physical sciences.

Beyond the courses for majors, the physics and astronomy program also offers a GE course, Astronomy 100, in which 1000 students enrolled this past year. That means around one out of every nine students on campus took this intriguing course that introduced them to the fundamentals and fun of physics and astronomy.

The external reviewer also reported being impressed with the curriculum of the program, noting faculty cohesiveness, strong entry-level courses that convey the fun of physics and astronomy, and the excellent high-level lab courses and capstone projects that utilize the labs and quality resources. Although the reviewer did note that many of the labs and resources available were dated and wearing down. More funding for resources and upgraded spaces would make these courses even more beneficial since these real research experiences effectively prepare students for future careers in the field.

The STB Curriculum Committee is impressed with the strong curriculum of the Physics and Astronomy Program and feel that, with improved support and resources, the real research experiences provided could be even more beneficial.

Assessment

The five program learning outcomes (PLOs) are addressed at all levels in the curriculum. The department employs direct and indirect assessment methods. Direct assessment is accomplished through course-embedded assessment tools and capstone portfolio review. Indirect assessment is accomplished through graduation chronicling. At a course level, the department relies heavily on tests and assignments to assess student learning progress. In capstone assessment, the capstone projects are used as a portfolio-type assessment to evaluate each student's ability to achieve our five Program Learning outcomes. In indirect assessment, data is collected through the informal interactions with capstone advisees enroute to graduation and the articles the senior students produce for the department newsletter.
Key findings from the direct assessments indicate that all PLOs are met by the vast majority of the students, yet some students may need support in various areas, such as math courses, computing skills, and time and resource management. Key findings from indirect assessment include that graduates successfully pursue further studies and find jobs in diverse fields. However, it was noted that graduates often spend time job hunting and that the response rate to post-graduation surveys has been low. It was noted that there are insufficient strategies to encourage alumni to complete the surveys.

The department developed several curricular change strategies to address the following areas of challenge: Math preparedness, study skills and group work, student mental health, communication training, data analysis skills. The department is planning to implement further changes to address the following areas of challenge: Elective offerings, career search skills, and improving alumni responses.

Staffing and Resources

The Department of Physics and Astronomy (DPA) cites the university's enrollment decline as a key factor in its staffing and resource challenges. Its Action Plan includes eight steps: three are "done," four are "in progress," and one is "to do." These focus on improving connections with community colleges, potential students, and the university administration regarding recruitment and admissions. While the enrollment decline has somewhat eased faculty staffing and workload pressures, it has led to increased workloads for tenured/tenure-track faculty as university services shrink. The DPA also struggles to attract and retain adjunct faculty due to inconsistent full teaching loads.

A. Human Resources: Faculty:

Tenure/Tenure-Track. The Department of Physics and Astronomy (DPA) has five tenured or tenure-track faculty members. At the time of the self-study, four were tenured, and one was on the tenure track. Three faculty members have workloads of 12 Weighted Teaching Units (WTUs) plus 3 units of service and scholarship per semester. The chair (Dr. Severson at the time, now Dr. Targett) receives a 4 WTU/semester release for administrative duties. Dr. Cominsky, who directs the EdEon program, is fully released from her 12 WTUs. The tenured faculty contribute 44 WTUs per semester and remain active in research and service despite increased departmental workloads due to reduced campus support services.

Adjunct/Part-time. At the time of the self-study, the DPA had six adjunct faculty, but only four had WTUs (a total of 23) in Fall 2022. Longtime adjunct Wes Farris retired after Fall 2023, and Dr. Anne Metevier's role as director of the Lick Observatory College Partnerships has limited her availability to teach at Sonoma State. The self-study notes that fewer adjunct faculty have reduced the number of WTUs the department can cover.

The self-study advocates for an additional tenure-track position and full-time adjunct hires to maintain the diversity of course offerings (for majors, minors, non-DPA requirements, and GE) and uphold the department's distinction. **The curriculum committee agrees and supports expanding faculty resources in Physics and Astronomy.**

The DPA has support from an administrative coordinator shared with the Chemistry Department. It also has a full-time lab manager and technician maintaining laboratories and equipment and supporting instructional and research use of labs and equipment.

B. Other Resources

Student-focused services. The self-study highlights a strong commitment to student-focused services that promote success. The department has developed an innovative advising system, actively collaborates with LARC, supports an active Society of Physics Students (SPS) chapter, and encourages students to utilize DSS, CAPS, and the Career Center. It also participates in the statewide Cal-Bridge program to improve

STEM access and offers substantial student research opportunities. The department acknowledges areas for improvement and pledges to work with LARC, CAPS, and the Career Center to address student needs.
Library resources. The self-study affirms that library resources are adequate and that library personnel are "extremely helpful."
Technology resources. General campus-wide technological resources provide essential support for faculty, department administration, and students. Some services are transitioning from IT to CTET, and faculty report spending considerable time adapting to these changes.

Importantly, the self-study notes there are no dedicated department funds to keep the two instructional labs' hardware and software up to date. **A general laboratory computing refresh is required in the near future (and the curriculum committee notes this was identified more than a year ago).** Research spaces have even older computing equipment.

Department facilities. The DPA has dedicated faculty offices, a conference room, two teaching labs, "several" advanced research labs, an on-campus observatory, and faculty/student access to the Keck Microanalysis Lab (directed by Physics faculty Dr. Hongtao Shi) and the Rolf Illsley Photonics Lab (shared with Engineering), both in the Current Engineering Science Complex.
Budgeting. The DPA self-study identifies an allocation of $9380 per year (reported in 2023) to cover all normal departmental operational expenses. **The curriculum committee concurs with the DPA that this is not adequate institutional funding to maintain departmental laboratories and facilities.**

Students

The Department of Physics and Astronomy has carefully evaluated the demographics of their students since its last review, noting how the population of their majors and minors has changed. In particular, the department has identified an uptick in the proportion of their students that are traditionally underrepresented in the field, including:

(a) those that identify as women (30% in 2018 to nearly 50% in 2023, which is also tracking at significantly above the national average of 24% in 2020),

(b) URM students (24% in 2018 to almost 47% in 2023), and

(c) First Generation college students (10% in 2018 to 25% in 2023).

The department has credited these increases to the faculty's commitment to advancing Diversity, Equity, and Inclusion efforts as well as overall Student Success initiatives related to their advising and mentoring practices, collaboration with related institutional initiatives (EdEon's Neurodiversity Network, MESA, and the Transformative Inclusion in Post-Secondary STEM grant, et al), development of a "Science by Diverse Scientists" speaker series, and ongoing faculty development in issues that are important for advancing equitable outcomes. The dedication of departmental faculty to these efforts should not be understated; this work is critical in promoting a positive student experience, and often this work is uncompensated.

Since its last program review, the department revised its four degree offerings to better meet the needs of students seeking each major. Among other outcomes, these changes have resulted in a better balance between the number of men and women seeking a degree within the department.

The overall institutional decline in students has had a profound impact on the number choosing to study Physics and Astronomy. While the campus saw a 31% decline in its headcount between 2019 and 2023, the Department of Physics and Astronomy saw a corresponding 40% decline in its numbers. This continues to be a top concern and priority of the departmental faculty. It should be noted that many departments within the College of Science, Technology, and Business (STB) have observed similar decreases in their numbers of students.

To combat this decline, the department has developed a multi-faceted strategy that includes creating recruitment materials; establishing stronger relationships with local community colleges, including specific discussions about cross-enrollment opportunities; and being more actively involved in the university's admissions and recruiting efforts. The STB Curriculum Committee suggests that the Physics and Astronomy department collaborate with other departments within the college to share best practices and combine efforts when reasonable to do so -- for example, utilizing existing templates for promotional materials. We also encourage the administration to consider how this important work can be formally acknowledged, either through mini-grants, release time, or explicit inclusion in RTP reviews.

Despite the concerning decline in number of physics and astronomy students, it is worth applauding the department for continuing to graduate enough students to be within the top 25% of all bachelor's-only physics programs in the nation. Roughly a third of these graduates pursue a master's or doctoral degree after leaving Sonoma State.

UPRS Findings and Recommendations Report

Professor Scott Severson visited UPRS on Dec 4, 2024 to discuss the Physics and Astronomy Department self-study. This FAR is based on UPRS committee review of the documents submitted by the department, including their self-study, the external reviewer's report, the Curriculum Committee letter, the Dean's letter, and the discussion between Professor Severson and UPRS members during his visit.

Curriculum

In this Program Review, the Department clearly delineated the work it has conducted in extensively revising its curriculum based on the results of its prior Program Review (e.g., introduction of a BA in Physical Science and a BS in Physics with Astronomy concentration), the requirements of several other allied programs, and the GE requirements. The program review clearly outlines the department's centrality in laying a strong foundation in Physics for incoming students, in supporting several other STEM and non-STEM programs, and in its contribution to the COPLAC identity of SSU.

The program faculty are very mindful of the university's strategic priorities and the core values of SSU. The alignment of the program's courses, methodologies, student support, and advising with these strategic priorities and core values is very clearly explained in the self-study document. As the external reviewer and the curriculum committee note, the program exemplifies high academic standards and is highly student-centered. Additionally, Professor Severson mentioned that the department launched a 1-unit course in Physics, in response to the graduation initiative, to allow students from various disciplines, e.g., pre-Nursing, to complete their degree requirements.

Assessment

The department is very advanced in presenting very clear curriculum maps, with courses mapped to specific degrees and program learning outcomes. The department has a detailed understanding of assessment methods and uses evaluation techniques suited to particular courses and programs. A combination of direct and indirect methods and formative and summative assessments, extensive use of skill matrices, and a capstone course to evaluate overall development of the student provides the faculty with high-quality assessment data. The department effectively closes the assessment loops with departmental discussions and making required adjustments/refinements. It has been noted that the department wants to return to alumni surveys as a method of assessment, following this round of program review. In fact, Physics and Astronomy is among the most sophisticated departments in their understanding and implementation of assessment methods, as can be seen from the section in their program review. This department could serve as a resource to other departments in crafting and implementing assessments.

Staffing and Resources

As with most departments in the university, this department has serious faculty and staff shortages. The external reviewer and the Dean both note and agree that there are dire shortages of faculty and staff and yet the faculty are committed to give the maximum to their department, despite being highly stretched. While acknowledging this deficit, the Dean is very pragmatic in mentioning that the College is strapped in terms of bringing new visiting/tenure track hires in the near future. The Dean recommended hiring lecturers to meet the requirements for the next few years. In terms of other resources, this department has an important laboratory component for delivery of its programs. The program review clearly emphasizes the need to have an equipment update (and computer refresh) and this was also emphasized by Dr. Severson in the visit. The department is looking for ways to be able to raise funds to support their labs. They are also looking at the most feasible avenues for making these upgrades.

Students

The department is facing student declines. This seems to be closely tied to the declining enrollment rates at the University level. Nevertheless, the department attracts and serves more individuals identifying as female, underrepresented minorities, and first-generation students in physics. This demonstrates the department's adaptability and leadership in addressing the need to attract students from different demographics into STEM disciplines. Despite the recent downturn, the program review notes that they are still placed in the top 25% of all bachelor's-only Physics departments for the number of graduating majors. The program review also outlines the various approaches the department adopts to reach out to potential students to increase enrollments.

Commendations

The Physics and Astronomy Department is commended for a thoughtful and engaged review process, particularly involving all of its faculty members. This is also among the top few program reviews that is very thorough in presenting their curricular improvements following previous program review and plans for future. It is clear that the faculty have engaged in meticulous work with regard to curriculum matrix and program learning outcomes, and their action plan demonstrates their implementation of multiple, well-suited assessment methods. They can be a model and resource for other departments in this regard.

Recommendations

1. The Dean's suggestions regarding the direction for each of the points made by the external reviewer are very specific and may provide a roadmap for action.
2. The department should request the Dean/Development team/Provost work with faculty in a targeted fund raising effort to find a suitable source for refreshing and updating the computing and other laboratory equipment.
3. Explore synergies between BA and BS programs based on the assessments/evaluations, if that can help in increasing FTES per program.