Campbell, William Wallace

Born **Hancock County, Ohio, USA, 11 April 1862**
Died **San Francisco, California, USA, 14 June 1938**

William Campbell (Wallace to his friends), a spectroscopist and Lick Observatory director, designed spectrographs, measured a large number of radial velocities, and led a number of eclipse expeditions, one of which decisively confirmed the Einstein deflection of starlight.

After a childhood of poverty and hard work on an Ohio farm, Campbell earned enough by teaching school to enter the University of Michigan as a civil engineering student. In his third year he discovered **Simon Newcomb**'s *Popular Astronomy*, and it changed his life. He devoured the book in two days and two nights and decided to become an astronomer. Professor **John Schaeberle** taught him to observe and to calculate comet orbits, activities that continued to command his interest for several years. After graduation Campbell taught mathematics for 2 years at the University of Colorado, returning to the University of Michigan to replace his teacher when Schaeberle joined the initial Lick Observatory staff in 1888. During the summer of 1890, Campbell learned spectroscopy by assisting **James Keeler** as a volunteer observer at Lick.

Campbell's talent and willingness to work hard were noted by Lick Observatory director **Edward Holden**. When Keeler resigned to become director of the Alleghany Observatory in 1891, Campbell became a permanent member of the Lick Observatory staff. In 1892 he married Elizabeth Ballard Thompson, an English major who had taken an astronomy course from him at Colorado.

Working visually, Keeler had already achieved more precise measurements of wavelengths than the aging **William Huggins** (whose wife **Margaret Huggins** did most of the actual observing by this time) or Joseph Lockyer in England, but it was becoming clear that photography would be the method of the future. Campbell designed a superior spectrograph that would be rigid and temperature-controlled. Then, while Holden persuaded San Francisco financier Darius O. Mills to fund construction of the new instrument, Campbell attached a camera to Keeler's old spectroscope on the 36-in. Clark refractor, at that time the world's largest refractor.

Campbell quickly became the most successful spectroscopist in the world. By 1896, when the Mills instrument came into service, neither Keeler in cloudy Pennsylvania nor Huggins, Lockyer, or **Hermann Vogel** in Europe could compete with the much larger telescope, superior spectrograph, and excellent skies of Mount Hamilton Observatory. No diplomat, Campbell was quick to point out the errors of others; he won few friends in London or Potsdam. During the 1890s, Campbell made important studies of the spectra of Nebulae, Wolf–Rayet stars, comets, and the bright Nova Aurigae. He vigorously and correctly disputed Huggins's claim that there is a significant amount of water vapor in the atmosphere of Mars. Later, in 1909, Campbell took a 16-in. heliostat and spectrograph up 4,750 m to the top of Mount Whitney to compare the spectra of the Moon and Mars, setting a low limit for water vapor content in the Martian atmosphere.

When Holden was forced to resign in 1898 and Keeler was appointed Lick Observatory director, the latter, who was a diplomat, gave himself a job no one else wanted and left spectroscopy to Campbell. When Keeler died suddenly 2 years later, 12 of the world's leading astronomers recommended that Campbell succeed him. That same year Newcomb also nominated Campbell for the first Nobel Prize in physics. On 1 January 1901, Campbell became the third director of the Lick Observatory. He would retain the title for 30 years.

Following the examples of other major observatory directors like **George Airy** and **Edward Pickering**, Campbell the creative scientist became, in the words of Donald Osterbrock, John Gustafson, and W. J. Unruh, a "factory manager." One of the most hardworking and hard-driving scientist-managers of all time, Campbell organized the Lick Observatory staff and channeled most of the observatory's resources into his program of measuring radial velocities. By 1907, his efficient spectrograph could obtain usable spectrograms of sixth-magnitude stars with an exposure of 2.5 h under average atmospheric conditions. Several more hours of plate measurement and reduction were required for each star.

By 1914, the radial velocity survey was almost complete to stars of the ninth magnitude. Campbell's primary goal was to determine the motion of the Sun with respect to the average motion of the stars. The resulting value of the solar apex was published in 1925 and provided a basis for later elaboration of the structure of our Galaxy. Campbell's program also led to the discovery of a great many spectroscopic binary systems, as a result of which it gradually became clear that multiple-star systems are quite common.

In his first year as director, Campbell persuaded Mills to donate an additional $24,000 to obtain radial velocities of southern stars as well. The sum was sufficient to build a 36-in. Cassegrain reflector with a permanently mounted spectrograph, ship it to Chile, set up an observatory, and pay the two-man staff for 2 years. Campbell himself was seriously injured when the mounting fell on him during testing, so his assistant, **William**

Wright, led the first expedition. The Mills southern station of the Lick Observatory was a great success, so Mills and later his son extended its operation for many more years.

The consolidated Northern and Southern Hemisphere surveys yielded radial velocities for 2,771 stars, published in catalog form in 1928. By combining the data from Campbell's radial velocity catalog with proper motions derived by **Benjamin Boss**, **Frederick Seares** was able to compute statistical parallaxes for 1,200 stars grouped by apparent magnitude.

Campbell's other great specialty was solar eclipse expeditions. He traveled to India (1898), the state of Georgia (1900), Spain (1905), the South Pacific (1908), Russia (1914), Washington state (1918), and Australia (1922). He measured the wavelength of the green coronal radiation and used a moving plateholder to obtain a photographic record of the changing spectrum near the beginning and end of totality. The last eclipse expedition confirmed **Albert Einstein**'s prediction that starlight would be deflected by the Sun's gravity. Many scientists had accepted the results of **Arthur Eddington** and **Frank Dyson** at the 1919 eclipse, but **Robert Trumpler**'s measurements of the Australia plates made by him and Campbell 3 years later had much smaller uncertainties.

On six of the expeditions, Elizabeth Campbell was in charge of the commissary and managed most of the logistics. "Bess" was considered a great humanizing influence on a man who was often seen as inflexible and domineering.

When the Campbells returned from Australia, they were met at the dock by a delegation from the University of California regents insisting that he accept the presidency of the University. By this time he was 60 and a world-renowned scientist with five medals. He did not want the job of president, but he took it when the trustees met his conditions: he would retain the position of director of Lick Observatory and the regents would promise not to interfere in internal matters of the university. **Robert Aitken** would be associate director and run the day-to-day affairs on Mount Hamilton Observatory, but he would have to consult Campbell on all major decisions, and the Campbells would keep the director's house (by now a rather palatial one) for occasional visits and entertaining.

As a university regent said when Campbell retired from the presidency and the observatory directorship in 1930, "With a hand always gentle but always firm and never shirking, President Campbell ruled the University wisely and well." Faculty members who chafed under his authoritarian style conceded later that he had been the most effective president they had seen.

Even in retirement the Campbells kept the director's house on Mount Hamilton, but they were soon off to Washington, where Campbell served as president of the National Academy of Sciences from 1931 to 1935. These years were not happy ones for the septuagenarian astronomer, who was extremely conservative and frequently unhappy with President Franklin D. Roosevelt.

Campbell lived his last 3 years in San Francisco. Suffering from aphasia, blind in one eye and losing the sight of the other, and unwilling to become a burden to his family, he committed suicide in 1938.

Campbell's attitudes about women in the field of astronomy have been questioned by historians who have noted, for example, that he refused to endorse **Annie Cannon**'s participation in the First International Astronomical Union General Assembly as a representative of the United States. On the other hand, Campbell was the first major observatory director to allow women to undertake observational research. He directed the research of the first two woman Ph.D. astronomers who graduated from the University of California/Lick Observatory (Phoebe Waterman [Haas] and Anna Estelle Glancey).

Campbell was awarded the Lalande Medal in 1903 and the Janssen Medal in 1910 by the French Academy of Sciences, the Henry Draper Medal of the National Academy of Sciences in 1906, the Gold Medal of the Royal Astronomical Society in 1906, and the Catherine Wolfe Bruce Medal of the Astronomical Society of the Pacific in 1915. He served as president of the International Astronomical Union, 1922–1925; the American Association for the Advancement of Science, 1915; the American Astronomical Society, 1922–1925; and the Astronomical Society of the Pacific, 1895 and 1910. Campbell held numerous other offices in these and other societies.

Campbell's papers are in the Mary Lea Shane archives of the Lick Observatory, University of California, Santa Cruz.

Joseph S. Tenn

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