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### **Herbig, George Howard**

Born Wheeling, West Virginia, USA, 2 January 1920  
Died Honolulu, Hawaii, USA, 12 October 2013

George Herbig was a spectroscopist who made major contributions to astronomers' understanding of stellar birth and early evolution, peculiar stars, nebulae associated with young stars, chemical abundances, and molecules in the interstellar medium. His name is attached to Herbig-Haro Objects (with **Guillermo Haro**) and to the Herbig Ae/Be Stars.

The son of George Albert Herbig, a tailor, and his wife Glenna, George Herbig became interested in astronomy at an early age. By the time he finished high school he was secretary of the Los Angeles Astronomical Society, and he had built and used his own 8-inch reflector, joined the American Association of Variable Star Observers, and enjoyed a memorable night at Mount Wilson Observatory, where **Alfred Joy** allowed him to help take a spectrogram of Mira. To the end of his life he considered Joy to be one of his most important mentors, along with Frederick Leonard, who taught him as an undergraduate at the University of California, Los Angeles (BA, 1943), and **Otto Struve**, with whom he worked as a postdoctoral fellow.

Herbig earned his Ph.D. in 1948 at the University of California, Berkeley, with a dissertation on *A Study of Variable Stars in Nebulosity*, under Harold Francis Weaver. By then he had already spent five years working at the Lick Observatory, where he started as a wartime assistant, carrying out projects such as the comet and asteroid photography usually performed by

**Hamilton Jeffers**, in place of astronomers who were away on war work. Upon finishing his Ph.D. he was immediately hired by director **Charles Shane** to the Lick staff, with the first year on leave as a National Research Council Fellow, visiting Mount Wilson and Yerkes Observatories and observing with the McDonald 82-inch (2.1-m) telescope.

Herbig remained at Lick until 1987, moving rapidly up the ranks and becoming noted as a hard-working, ambitious, and skillful observer. He received the American Astronomical Society's Warner Prize in 1955, and he was elected to the U. S. National Academy of Sciences in 1964.

Herbig's early results were achieved despite the second-rate telescopes and instruments available at Lick in the 1940s and 1950s. He started out by following Joy in investigating T Tauri stars and the small, faint nebulosities with bright emission lines associated with them. Learning that Mexican astronomer Guillermo Haro was studying some of the same objects, he initiated cooperation between the two, and the nebulae came to be known as Herbig-Haro Objects. Initially it was thought likely that the T Tauri phenomenon was due to accretion as stars moved through the interstellar medium. Eventually observations by Herbig and others convinced the scientific community that T Tauri stars are very young stars of approximately solar mass that are still contracting toward the main sequence, and that the H-H objects are nebulae formed by matter ejected from them along their rotational axes and colliding with the interstellar medium. Important theoretical ideas on the subject came from the Armenian astrophysicist **Viktor Ambartsumian**.

In 1959 Lick Observatory returned to the first rank when the 120-inch (3-m) reflector, then the world's second largest telescope, went into operation. Later it was named for Shane, whose efforts led to its construction, although its successful completion was primarily due to **Albert Whitford**, who became Director in 1958. Its instruments included a high-resolution coude spectrograph designed by Herbig, who had previously designed other instruments, including a slitless spectrograph used on the antiquated 36-inch (0.9-m) Crossley reflector.

The following year Herbig published an important paper on the spectra of Be and Ae stars associated with nebulosity, and these came to be known as HAeBe (Herbig Ae/Be) stars. They are somewhat similar to T Tauri stars but of greater mass, and they remain objects of intense study. Herbig and his students made many observations of lithium abundances and isotope ratios, finding the greatest lithium abundances in the youngest stars. This fit into his overall goal of determining how stars form, which stars are still forming, and how they move from their birthplaces.

In 1966 the Lick staff moved down from Mount Hamilton to the recently-founded University of California, Santa Cruz [UCSC], and Herbig acquired the title of Professor as well as that of Astronomer. He had already supervised six Berkeley graduate students, all of whom became noted astronomers: Robert Paul Kraft, Elizabeth Roemer, George Worrall Preston, Leonard Vello Kuhl, Ann Merchant Boesgaard, and Beverly Turner Lynds. He would direct five more students at UCSC.

Not long after the move he and his first wife, Delia, divorced. They had raised four children on the somewhat-isolated mountaintop. Herbig was married to Hannelore Tillmann from 1968 until his death.

Herbig made important studies of diffuse interstellar bands, absorption lines whose origin was long unknown. They are now thought to be at least partially due to long organic molecules, including polycyclic aromatic hydrocarbons [PAHs].

In 1987 Herbig retired from UCSC and took a research position at the University of Hawaii. Though formally retired from there after 2001, he continued to work with Bo Reipurth, Scott Dahm, and other colleagues on spectroscopy of very young stars and associated nebulosity. He published two papers in 2012 at age 92.

Herbig received the Henry Norris Russell lectureship of the American Astronomical Society (1975), the Catherine Wolfe Bruce gold medal of the Astronomical Society of the Pacific (1980), and the Robert M. Petrie Prize lectureship of the Canadian Astronomical Society (1995). He was widely regarded as a meticulous observer and careful researcher as well as the designer of highly successful spectrographs.

*Joseph S. Tenn*

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