Dorrit Hoffleit Lecture
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Dorrit Hoffleit: Meticulous, Indefatigable, Prolific Astronomer

Hoffleit began her astronomical career in 1929 at Harvard University where she was employed to work on photographic variables and spectral classification. She took courses part time to obtain her M.A., which she received in 1932. By 1938, with the strong encouragement of Harlow Shapley and Bart Bok, she had received her PhD in astronomy from Radcliffe College; she continued to work at the Harvard College Observatory until 1956, at which time she became Director of the Maria Mitchell Observatory on Nantucket Island, Mass. and obtained a position in the Department of Astronomy at Yale University, splitting her time between the two institutions. In her own view, her most original work was her early paper on light curves of meteor trails [Hoffleit 1933], but her most well-known publications include the several editions of the Yale Bright Star Catalogue, The General Catalogue of Trigonometrical Parallaxes, and several of the Yale Zone Catalogues of Positions and Proper Motions. With a strong interest in variable stars, she has worked closely with the AAVSO over many decades, publishing many articles on variable stars. Additionally she has written several historical works on astronomy, including Women in the History of Variable Star Astronomy, Astronomy at Yale, 1701-1968, and The Education of American Women Astronomers Before 1960. With an extraordinary record of astronomical publications over six decades, she is an example of a scientist with a love for astronomy and the skill and patience to bring long-term plans to fruition.

She received the Annenberg and George Van Biesbroeck Prizes of the American Astronomical Society and the Nantucket Maria Mitchell Association Women in Science Award, and is a member of the Connecticut Women's Hall of Fame. This lecture is named in her honor for her many and significant achievements.

Cecilia Payne-Gaposchkin: A Stellar Pioneer

In a world of Newtonian mechanics and Darwinian evolution, we also have Paynian composition of the stars and universe. While Payne, later Payne-Gaposchkin, did not extend her data and conclusions to the universe, her 1925 monograph, described by Otto Struve as "the most brilliant PhD thesis ever written in astronomy," is a pioneering landmark that for the first time combined astronomical observations of stellar spectra with the then new atomic theories of Bohr and Saha. Her conclusions were suppressed by her advisor, H.N. Russell, but she wisely published her data with a disclaimer. Though facing overt gender discrimination throughout her career, and suffering the "pink paycheck" so well known to many women, she persevered and, towards the end of her working lifetime at Harvard University, became Chairman of the Department of Astronomy, a department she had helped to establish with the exuberant director Harlow Shapley in the 1920s and 1930s. One colleague, who called her "An Astronomer's Astronomer," admired her as a person of great kindness, graciousness, humor and

humility, who conveyed her love for the science "lucidly and enthusiastically." She never lost her love and enthusiasm for astronomy and astrophysics and made innumerable contributions to these sciences. Her work continues to inspire and provoke those working in the field, and she remains a model for all scientists to follow.

She had many firsts in her scientific career: the first woman to ask her own questions and to answer some of those questions; discovered that hydrogen is the main constituent in the stars; demonstrated that all stars have roughly the same composition; observed the Stark Effect in stars in 1925 (but this publication, like that of her discovery of the importance of hydrogen was suppressed, as Shapley and Russell would not permit her to publish it). She was the first PhD in astronomy from Harvard College Observatory, and was instrumental in running the department and educating its students over the next decades. She was the first to receive the Annie Cannon Prize and the first woman to receive the Russell Prize of the American Astronomical Society. She continued to ask new astronomical questions throughout her life. She received several awards and honorary degrees, including the Rittenhouse Medal of the Franklin Institute, Philadelphia. Her publications spanned astrophysics, spectroscopy, variable stars, photometry, and the history of astronomy, and included numerous book reviews and obituaries of astronomers. The annual Cecilia Payne-Gaposchkin Distinguished Lecture has been established in her honor at the Harvard-Smithsonian Center for Astrophysics.

Eldest of the three children of Edward Payne, Oxford don, and Emma Pertz Payne, artist, Cecilia is a good example of the fulfillment of the Five Suns of Development as articulated by Jane Piirto [Piirto]: genes, gender, family and community, school, and chance. Her mother, widowed when Cecilia was four, brought up her children "by a miracle of courage and self-sacrifice." Among her role models were a botanist great aunt, Dora Pertz, who worked at the Darwin Laboratory at Cambridge, and a professional pianist aunt, Florence Pertz. Dora had been an early graduate of Newnham College at Cambridge University; Cecilia Payne may be its most distinguished graduate. There is something to be said for an institution that can produce a Cecilia Payne and a Rosalind Franklin, whose x-ray photographs were instrumental in the discovery of the DNA double helix.

Cecilia's schooling included the Wendover, Bucks, Grammar School, and, in London after the age of 12, St. Mary's School or College and St. Paul's School for Girls. She paid tribute to the teachers of these schools in her autobiography, dedicating it to them; she considered the last two to be scientists. She spent four years at Newnham College where her professors from Cambridge University were Alfred Fowler, E.A. Milne, and A. Eddington. She entered Newnham in a program of botany and chemistry but soon switched to astronomy, inspired by a public lecture given by Eddington.

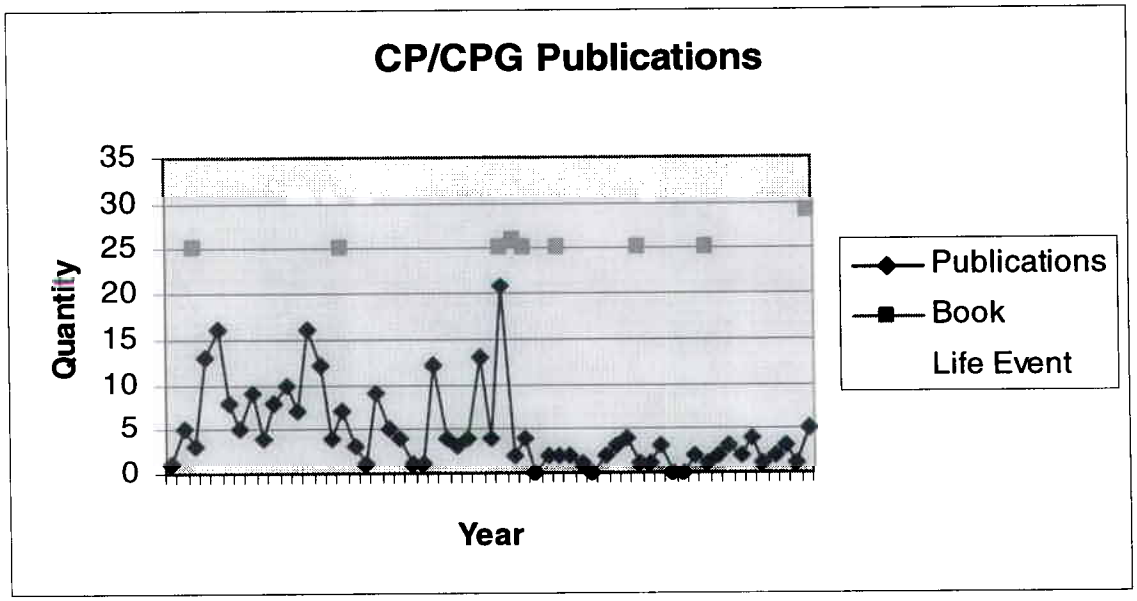
Understanding that there were better opportunities for a research program in the United States, she obtained a scholarship and graduate stipend to study under Harlow Shapley at Harvard University, Cambridge, Mass. A look at her log books from the photographic plate stacks shows a person who hit the ground running as she searched the cumbersome and voluminous archive for plates suitable for the program of study she had set for herself. The logs, often written in pen, sometimes containing diagrams for preliminary

analysis, show a systematic and comprehensive search for the data of interest. Early logs in her handwriting, and with her name on the flyleaf, give way after two or three years to evidence that she organized the work of many students and assistants. Some logs can be identified as referring to plates likely used in her thesis as they contain notes on stars she included.

Her doctoral thesis was her first book and the first monograph from the Harvard Observatory. After receiving her degree, she obtained a position at the Observatory, and helped to teach the many students who came after her. Of the next four graduates of this program, three were women.

Over the next decade she continued to teach and do research, and in 1933 traveled to Europe, where, at a meeting of the Astronomisches Gesellschaft, she met Sergei Gaposchkin, a Russian astronomer trained in Germany, who had lost his position due to the rise of Hitler. She was instrumental in bringing him to the United States; they were married in 1934. They had a long and fruitful collaboration. She continued to publish, teach, and do research, though her research output was slowed during the period when she became Chairman of the Department of Astronomy in the 1950s; at about this time she also received the DSc from Cambridge University. Of her many books, *The Galactic Novae* was her most cited work [Trimble], *Stars in the Making*, her most popular, and *Stars and Clusters* her last, dedicated to her husband, "That bright, particular star."

The following figure shows the track of her publications and life events. Papers are diamonds, books are squares, and triangles are life events (marriage, birth of her three children, World War II (four highest triangles), and retirement from Harvard University. Retirement clearly had no effect on her publications.



What did others say about her? (on her autobiography): "...a chronicle of affirmation and hope, a near-poetic witness to a burst of profound discovery insufficiently recognized" [P. Morrison]; "...a life of unusual achievement" [Wayman]; "...one of the truly great

astronomers of the Twentieth Century" [W.Morgan]; "One of the greatest astronomers of the first half of this century..." [Goldsmith]; "Meteoric brilliance of the life track of this genius of an English girl... excelling in pioneering astronomical research." [Öpik].

What did she say?
"How Not to Do Research: divide and conquer";
"...reward [for a scientific career is] the widening of the horizon as you climb. And if you achieve that reward you will ask no other."

The following photo shows her with "the vision splendid" look on her face, in the vein of "nature never did betray the heart that loved her," a concept that endured throughout her scientific work.

J. Piirto, "Why Are There So Few? (Creative Women: Visual Artists, Mathematicians, Scientists, Musicians)." Roeper Review, 13(3), 142-147, 1991; also at http://personal.ashland.edu/~jpiirto/why_are_there_so_few.htm

Other references are to obituaries or the CPG autobiography: Haramundanis, K., ed., *Cecilia Payne-Gaposchkin, An Autobiography and Other Recollections*, Cambridge University Press, 1996.

D. Hoffleit, "A Study of Meteor Light Curves," Proc. Nat. Acad. Sci. 19, 212, Harvard Reprint No. 88, 1933