

Walter Baade, 'Arguably the most influential observational astronomer of the 20th century'

Walter Baade: A Life in Astrophysics

Donald E. Osterbrock
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Reviewed by Norriss S. Hetherington

In the autumn of 1943, Walter Baade, at the Mount Wilson Observatory, managed to resolve into individual stars the inner amorphous region of the Andromeda galaxy and two of its companion galaxies. The brightest stars were yellow giants; he found no highly luminous blue or red stars. Baade called the types of stars he found in the central region of the spiral galaxy and in its elliptical companions "population II," as distinct from "population I" or "ordinary" stars near the Sun in our Galaxy.

The discovery of a second stellar population opened up the fields of stellar evolution, star formation, and the evolution of galaxies and made Baade arguably the most influential observational astronomer of the 20th century. It made him perhaps even more influential than his more famous colleague at Mount Wilson, Edwin Hubble, who had demonstrated both the existence of independent galaxies and the expansion of the universe, and in doing so made cosmology an empirical science.

Baade was born in Germany in 1893 and studied at the University of Göttingen, in Germany, from 1913 to 1919. (A congenital hip defect kept him out of the war.) He then joined the Hamburg Observatory, which possessed a one-meter reflector, the largest telescope in Germany. Assistance from the Rockefeller Foundation enabled Baade to visit North America in 1926, with stops at Harvard University, the Yerkes Observatory, the Dominion Astrophysical

Observatory, and the Lick Observatory and a six-month stay at the Mount Wilson Observatory. In *Walter Baade: A Life in Astrophysics*, Donald Osterbrock, a research astronomer turned historian of astronomy, meticulously documents Baade's life and work, with references to correspondence from more than 20 archives.

When documentary evidence is lacking—Baade was too diplomatic to express openly his impressions of American astronomy in 1926—Osterbrock guesses at Baade's thinking from his knowledge of the astronomy of the time and of Baade's attitudes. (The two were colleagues during the 1950s at the California Institute of Technology and the Mount Wilson and Palomar Observatories.) Osterbrock scrupulously warns readers of this necessary extrapolation and backs it up with reference to Baade's later and less guarded comments in lectures and colloquia.

At Hamburg, the industrious and meticulous Baade developed a wide observational experience with reflecting telescopes and showed great skill and resourcefulness. He was one of the most promising young astronomers in the world. Also, his personal characteristics had appealed to Mount Wilson astronomers. In 1931, Baade left Germany for a staff position at Mount Wilson—in the land of clear skies and big telescopes.

At Mount Wilson, Baade collaborated with Hubble in 1938 and 1939 on a study of the Sculptor and Fornax dwarf galaxies. The astronomers found neither blue nor red supergiant stars in the two systems and noted that "as a working hypothesis" it could be assumed that supergiants were lacking in elliptical galaxies. However, "discussion of the data now available would be largely speculative, and hence of little permanent value." Osterbrock attributes the hypothesis to Baade and the caution against speculation to Hubble, who was absent from Mount Wilson during World War II. Baade—a German citizen, excluded from the US war effort—was thus left free to prove that the same supergiant-free population of stars is pres-

ent in the dwarf elliptical companions of the Andromeda galaxy.

There is more to the advance of science than new observations and new theories; ultimately, people must be persuaded. Baade's subsequent work and talks at meetings convinced astronomers of the existence of two stellar populations.

Baade's discovery was a completely empirical result. A few theoretical discussions occurred during the early 1940s regarding the possibility of two stellar populations as manifestations of early and late stages of stellar evolution, but those discussions were not known to Baade. They did not, however, escape Osterbrock's thorough study. Also impressive is Osterbrock's exploration of the astronomical community's behind-the-scenes intervention to squelch Harlow Shapley's shameless attempt to claim credit for the doubling of the scale of the universe that followed from the recognition of two stellar populations.

Osterbrock has achieved his stated aspiration: to present known facts in interesting and readable form. Fortunately, he has exceeded his intention to leave readers to draw conclusions. He has focused on hitherto unknown or overlooked facts, shown why they are important, and created a new understanding. This is the essence of good history.

Project Orion: The True Story of the Atomic Spaceship

George Dyson
Henry Holt, New York, 2002.
\$26.00 (345 pp.).
ISBN 0-8050-5985-7

On 4 October 1957, the Soviet Union surprised the world by launching Sputnik. We are fortunate to have George Dyson's beautiful account of an episode that captures the spirit of America's successful response to this challenge. Project Orion—a proposed nuclear-energy-based space propulsion system—was never allowed to progress to any meaningful test.

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