Walter S. Adams

The Twenty-Third Bruce Medalist

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Walter Sydney Adams

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1928 Bruce Medalist

(photograph courtesy Yerkes Observatory, University of Chicago)

Walter Adams directed the greatest observatory on Earth for a quarter of a century. He supervised a staff so rich that it sometimes included ten Bruce medalists at one time. Today's astronomers may find it astonishing, but he was able to do so and still devote most of his time to research. He contributed significantly to the design and construction of three successive world's largest telescopes.

Born in Syria to missionaries from New England, Adams was far ahead in Greek and Roman history and theology when he first entered an American school at the age of eight. At Dartmouth College he noted that he "had a strong preference for exact subjects with definite answers as compared with those involving alternatives and the exercise of considerable judgment."

When he took the only astronomy course offered, he found that Edwin Frost "was an admirable teacher and the subject made a strong appeal both on the mathematical and the physical side. The Yerkes Observatory had just been established and Frost had been asked by Dr. George E. Hale [see *Mercury*, May/June 1992] to consider an appointment as professor of astrophysics. ... Frost suggested that I take graduate work at the University of Chicago and later gain experience in practical observing at the Yerkes Observatory. ... it is an interesting illustration of the effect of relatively small events upon the course of individual lives to realize that a very slight change in circumstances might equally well have led me to follow the teaching of Greek as a profession."

He was studying under Hugo von Seeliger and Karl Schwarzschild in Munich when "... I received the offer of a minor appointment at the Yerkes Observatory and decided to return, partly because of interest in astrophysics, and partly because of the strong influence of Dr. Hale's remarkable personality. No one could be associated in any way with this brilliant and inspiring leader in American science without being deeply and permanently affected. ...my association with Hale, begun in 1901, lasted almost forty years until his death in 1938, and formed one of the greatest privileges I enjoyed in life."

Adams became an expert spectroscopist, and when Hale went to Pasadena in 1904 to establish what would become the Mount Wilson Observatory of the Carnegie Institution of Washington, Adams went along as his right-hand man. Adams served as acting director during Hale's many illnesses, and as director from 1923-45.

Adams worked with Frost and others on radial velocities of stars at Yerkes, but at Mt. Wilson he joined Hale in investigations of our nearest star. Adams showed, from the tiny Doppler shifts in the spectra, that the Sun's equatorial regions rotate in about 25 days, while near the poles the period is almost 34 days. Using large spectrographs with the horizontal Snow telescope and later with the 60-foot tower telescope that Hale built, the group obtained high dispersion spectra of sunspots as well as interspot regions. Adams helped measure some 11,000 lines and showed that the lines enhanced in sunspots were precisely those that were stronger in the cooler parts of a laboratory flame. Sunspots are cooler than their surroundings! Some spectral lines are from neutral atoms, which survive at cooler temperatures, while others are from ions, which are more abundant in hotter regions.

This work led directly to Adams' greatest achievement. Starting in 1914 Adams and a German visitor to Mt. Wilson, Arnold Kohlschütter, found that some spectral lines are stronger in luminous stars (giants) while others are stronger in stars which are intrinsically dimmer (main sequence stars, sometimes called dwarfs). Calibrating the measurements with a few stars close enough to have their distances measured directly by trigonometric parallax, Adams and Kohlschütter were able to determine a star's luminosity directly from measurement of its spectral lines. Since apparent brightness, which can be measured for any detectable star, falls off as the square of the distance, this meant that stellar *distances* could be determined with the spectrograph. By 1935, when Adams, Alfred H. Joy, Milton Humason, and Ada M. Brayton published their monumental "Spectroscopic Absolute Magnitudes and Distances of 4179 Stars," the number of stars of known distance had increased a hundredfold.

Adams collaborated with other Mt. Wilson spectroscopists, especially Joy, and he shared data with many others. Theodore Dunham, Jr. recalled fifty years later that when he was a graduate student at Princeton, Professor Henry Norris Russell returned from a Mt. Wilson visit and handed him some Adams spectrograms of Alpha Persei, saying "Here is your thesis." When Dunham finished the analysis, Russell arranged for him to go to Mt. Wilson to work with Adams.

Dunham recalled that they were working on stars one night when "I'm sure it was Adams who said, 'Why don't we take a shot at the infrared of Venus? It's bright up there in the West, and easy to get at.'" Using new infrared-sensitive plates developed at Eastman Kodak, they found "some extraordinary features, that looked like a funny band structure... " The bands, which had not yet been seen on earth, turned out to be due to carbon dioxide, as Dunham proved by filling a seventy-foot-long pipe with the gas and obtaining the same spectrum. It was the first indication that Venus has an enormous amount of carbon dioxide in its atmosphere.

For years Mt. Wilson had the world's only coudé spectrograph, and the staff took full advantage of its high dispersion. Adams and Dunham discovered several absorption lines produced in interstellar gas clouds, including some produced by molecules of CN and CH, the first molecules detected in interstellar space. Later Adams used very high dispersion to show that there are lines produced by different clouds along the line of sight to some stars, with each cloud exhibiting its own Doppler shift according to its radial velocity.

Harlow Shapley recalled that Adams "strove to excel in everything he undertook—in endurance at the business end of a telescope, in quality of spectrum plates, in hiking speed up the mountain trail from Sierra Madre, in tennis, golf, billiards, bridge—and he did excel. But I never heard him call attention to his excellence. I remember complimenting him once on his designing the series of powerful and tricky spectrographs that were used in the Mount Wilson stellar and solar work. 'It is a very low form of cunning,' he replied."

Adams took a dim view of those he thought of as seekers of publicity, most notably Edwin Hubble, who wanted to be his successor. Regarding theorists, he wrote Charles Abbott in 1921, "We have had a strenuous summer with Russell who has just gone. He is a tremendously able fellow but I sometimes think that the man who secures none of the results upon which theories have to be based has rather an unfair advantage. It is possible to think of many schemes in the time it takes to secure and study a few stellar or solar spectra. However, he was full of suggestions and we enjoyed his visit greatly while he himself had a grand time."

Adams was proud to be related to two U.S presidents, and many of his traits were attributed to his New England heritage. These qualities included his reserve and his legendary frugality. He used 25-watt light bulbs in the domes and insisted that observers could take no more than two slices of bread, two eggs, and coffee for the midnight meal. He raised salaries only when absolutely necessary, and often returned part of his budget to the Carnegie Institution. When he asked to be allowed to spend a bit to obtain or retain the services of an outstanding astronomer like Walter Baade, he usually offered to find the necessary funds in his own budget.

As director he quietly led by example, preserving the dignity and eminence of the observatory he had inherited from Hale. He hired excellent men, and he helped enormously in the design and construction of Caltech's 200-inch Hale telescope on Palomar mountain. ◗

Acknowledgements: Quotations from Dunham are from interviews by David DeVorkin, 1977 and 1978, American Institute of Physics. Adams' letter is quoted by permission of the Huntington Library, San Marino, California. Other Adams statements are from autobiographical sketches at the AIP and in the Huntington. Shapley's anecdote appeared in *Sky & Telescope* in 1956.