Adams, Walter Sydney

Born **Kessab, Syria, 20 December 1876**
Died **Pasadena, California, USA, 11 May 1956**

Walter Adams directed the greatest observatory on the Earth for a quarter of a century, supervising a staff that included productive astronomers such as **Walter Baade**, **Harold Babcock**, **Edwin Hubble**, **Milton Humason**, **Alfred Joy**, **Paul Merrill**, **Rudolph Minkowski**, **Seth Nicholson**, **Frederick Seares**, and **Olin Wilson**, while devoting most of his time to research. He codiscovered the method of determining a star's luminosity from its spectrum and contributed significantly to the design and construction of three successive world's largest telescopes—the 60- and 100-in. at Mount Wilson and the 200-in. Hale telescope on Palomar Mountain, California.

Adams was born in the Middle East, where both of his New England-born, college-educated parents, Lucien Harper Adams and Dora Francis Adams, were serving as Congregational missionaries. Home-schooled, Adams was far ahead in Greek and Roman history and theology but rather ignorant of his own country when he first entered an American school at the age of 8. 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 astronomy course at Dartmouth, Adams found that his professor, **Edwin Frost**, was an admirable teacher who gave the subject a strong appeal both on the mathematical and the physical side. In 1898, when Adams completed his AB, **George Hale** hired Frost as one of the first professors of astrophysics at the new University of Chicago. Adams went along as one of Frost's first graduate students. Adams reported that his employment as an astronomer was an interesting illustration of the effect of relatively small events on the course of individual lives in which a very slight change in circumstances might equally well have led him to follow the teaching of Greek as a profession.

After 2 years of studying at Chicago and apprenticing at its Yerkes Observatory, in 1901 Adams went to Munich with the intention of earning a Ph.D. under **Hugo von Seeliger** and **Karl Schwarzschild**. However, Hale, whom Adams idolized, called him back to Yerkes after 1 year. Adams remained an associate of Hale for the remainder of the latter's 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 to 1945.

Adams worked with Frost and others on radial velocities of stars at Yerkes, but in the early years at Mount Wilson he joined Hale in solar investigations. Adams showed 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-ft tower telescope that Hale had built, the group obtained high-dispersion spectra of sunspots as well as interspot regions. Adams helped measure some 11,000 spectral lines and showed that the lines enhanced in sunspots were precisely those that were stronger in the cooler parts of a laboratory flame. Some lines in the sunspot spectrum are from neutral atoms, which survive at cooler temperatures, while others in surrounding areas are from ions, which are more abundant in hotter regions. Thus it was shown that sunspots are cooler than their surroundings.

This work led directly to Adams' greatest achievement. Starting in 1914, Adams and a German visitor to Mount Wilson, **Arnold Kohlschütter**, found that some spectral lines are stronger in luminous stars (giants) while other lines are stronger in stars that are intrinsically dimmer (main sequence stars). 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. This allowed stellar distances to be determined with the spectrograph, a procedure now known as spectroscopic parallax. By 1935, when Adams, Joy, Humason, and Ada M. Brayton published their monumental *Spectroscopic Absolute Magnitudes and Distances of 4179 Stars*, the number of stars of known distance was increased a 100-fold.

It was Adams who discovered, in 1914, that 40 Eridani B (also designated Omicron Eridani 2B) and Sirius B were low-luminosity stars of spectral class A. **Arthur Eddington** pointed out a decade later that these stars, now known as white dwarf stars, must be stars of extraordinary density. In 1925, following Eddington's suggestion that the Einstein effect might be measurable in white dwarf stars, Adams reported that he had detected a gravitational redshift in the spectrum of Sirius B. At least one later historian criticized Adams for coming up with **Albert Einstein's** predicted value. Observations made with much better equipment many decades later did not agree with Adams' value. However, the very astronomers who made the later measurements defended Adams; they believed Adams' error was due to contamination by light from Sirius A.

Adams collaborated with other Mount Wilson spectroscopists, especially Joy, and he shared data with many others. Theodore Dunham recalled that they were working on stars one night when Adams suggested that they take a shot at the infrared spectrum of Venus, which was easily observable at the time. Using new infrared-sensitive plates developed at Eastman Kodak, they found some extraordinary band structure. The bands, which had not yet been seen from the Earth, turned out to be due to carbon dioxide, as Dunham proved empirically by filling a 70-ft-long pipe with the gas and obtaining the same spectrum, and for which **Arthur Adel** soon provided the theoretical basis. It was the first indication that Venus has an enormous amount of carbon dioxide in its atmosphere.

For years Mount Wilson had the world's only coudé spectrograph, and the staff took full advantage of its high dispersion. Between 1939 and 1941, 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. By 1949, Adams had used very high dispersion to show that there are lines produced by several different clouds along the line of sight to some stars.

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' "(Shapley, 1956).

Adams was proud to be related to two US 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-W 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. Adams 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 Baade, he usually offered to find the necessary funds in his own budget.

As director, Adams 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-in. Hale telescope on Palomar mountain. He spent his retirement years at the Hale Solar Observatory in Pasadena, where he reduced data from previous observations.

Adams married Lillian Wickham in 1910. She died in 1920, and in 1922 he married Adeline L. Miller, from whom he had two sons. Adams was awarded the Gold Medal of the Royal Astronomical Society in 1917, the Henry Draper Medal of the National Academy of Sciences in 1918, the Janssen Prize of the French Astronomical Society in 1926, the Catherine Wolfe Bruce Gold Medal of the Astronomical Society of the Pacific in 1928, the Janssen Medal of the French Academy of Sciences in 1935, and the Henry Norris Russell Lectureship of the American Astronomical Society in 1947. Although he never completed graduate training, Adams was awarded honorary Ph.D., Sc.D., or LLD degrees by seven universities and colleges.

Joseph S. Tenn

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