Walter S. Adams, Observer of Sun and Stars

Born in Syria in 1876 of American parents, Walter Sydney Adams came to the United States at an early age. As a student he acquired a thorough knowledge of astronomy from several of the ablest scientists in the world: Frost at Dartmouth College; Moulton, Laves, and Bolza at the University of Chicago; and Schwarzschild and Seeliger at Munich, Germany. He spent the years 1901–04 at Yerkes Observatory, largely in the spectroscopic measurement of stellar motions. In 1904 when the Carnegie Institution of Washington established the Mount Wilson Observatory, George E. Hale brought Adams to Pasadena, California, as a charter member of the staff. For a few years, he worked with Hale on solar observations, but, after the 60-inch telescope was completed in 1909, virtually all his research was in stellar spectroscopy. After Hale's retirement in 1923, Adams became director of the Mount Wilson Observatory and served in that capacity until 1946. He received many honors for outstanding contributions to astronomy. He died at his home in Pasadena on 11 May 1956.

The sun, unlike the earth, does not rotate as a solid body. It has what might be called a current around the equator in the direction of rotation. Thus, on the equator the period of rotation is less than 25 days, while near the pole it is almost 34 days. Even at the equator, the speed of rotation is only 2 kilometers per second. Hence, in spectroscopic observations, the Doppler displacements to be measured are minute. Adams' numerous measurements at various solar latitudes, made from 1906 to 1908 with the powerful solar instruments on Mount Wilson, set a new standard of accuracy and remain of great value.

Adams took part with Hale in a detailed comparison of spectra of sunspots with spectra of the normal solar disk. The results of measurements of 11,000 spectrum lines made it possible to conclude that sunspots are characterized not only by temperatures lower than those of the surrounding solar surfaces but also by the presence of fairly strong magnetic fields.

In stellar spectroscopy, Adams' main contributions resulted from studies of stellar motions, of stellar spectral classifications and stellar absolute magnitudes and distances, and of gases in interstellar space.

If the spectrum of a star is photographed alongside a known comparison spectrum, the star's speed in the line of sight may be determined by measuring the displacements of the star lines from the positions of the lines in the laboratory spectrum. This method is widely used because it is the only way to measure velocities of distant stars with reasonable accuracy. In the programs carried out by Adams and his coworkers at Yerkes and Mount Wilson, the number of stars whose radial velocities have been measured is about 8000, or approximately half the total number measured by all observers.

In 1914, Adams, in collaboration with a visiting astronomer, Arnold Kohlschütter, found that the absolute magnitude (intrinsic brightness) of many stars can be determined from the relative intensities of certain lines in their photographed spectra. Absolute magnitudes are obviously of fundamental importance in physical studies of stars. Moreover, comparison of the absolute magnitude of a star with its apparent magnitude as seen from the earth yields stellar distances far beyond the reach of direct triangulation from opposite sides of the earth's orbit. The spectroscopic method, applied at Mount Wilson and elsewhere to many thousands of stars, has had extraordinary effectiveness in extending our knowledge of giant and dwarf stars and of galactic structure.

Adams' last extensive program was the detailed study with high dispersion of lines in stellar spectra introduced not by the star's own atmosphere but by the tenuous gases in the abysmal chasms of space traversed by the star's light on its way to the earth. His observations brought out important facts concerning the nature and motions of these interstellar gases. Virtually all the hundreds of spectrograms required for this program were taken and measured by Adams himself.

From these large programs Adams occasionally turned aside, but never for long, to make valuable studies of individual stars such as α Orionis, o Ceti, the companion to Sirius, novae, and many others.

As an observer, Adams was skillful and indefatigable. If he thought a program valuable, he was not deterred by the fact that it was long and arduous. Even when he was director, he spent nearly as much time at the telescope as did any other member of the staff. And he probably spent more time at the microscope, measuring his spectrograms, than he did at the telescope taking them. His industry and concentration on the task in hand resulted in the accumulation of masses of valuable data and in substantial progress toward a more complete comprehension of the starry universe. He had the use of powerful instruments and, as it were, multiplied the advantages by a sustained personal endeavor.

His emotions were not on the surface, but dealings with his associates were characterized by many acts of consideration and kindness. A quiet sense of humor is revealed in his delightful reminiscences, "Early days at Mount Wilson" [*Publ. Ast. Soc. Pacif.* **59**, 213, 285 (1947)].

PAUL W. MERRILL
Mount Wilson and Palomar Observatories, Pasadena, California

John Dalton was not a fluent speaker, and when, as president of the Manchester Literary and Philosophical Society, he had to make a few remarks when the reader of a paper stopped, he is reported to have sometimes contented himself by saying, "This paper will no doubt be found interesting by those who take an interest in it."—J. J. THOMSON, *Recollections and Reflections.*