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JOEL STEBBINS

1878—1966

A Biographical Memoir by

A. E. WHITFORD

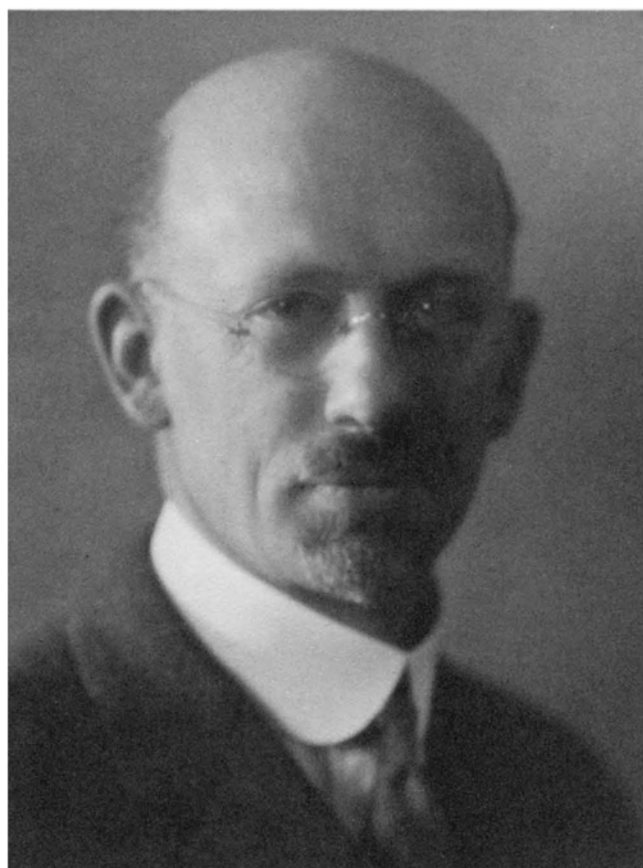
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Biographical Memoir

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July 30, 1878–March 16, 1966

BY A. E. WHITFORD

JOEL STEBBINS was a pioneer in the development of photoelectric methods for measuring the light of the stars. He started with a device that could not even detect first-magnitude objects, patiently improved it, and showed that measurements of a new degree of precision could be obtained. Further refinements and exploitation of technological advances gradually brought a larger and larger share of the quantitative measurement of astronomical radiation within the photoelectric domain. By the time of Stebbins' retirement, the revolution in astronomical photometry was nearly complete—photoelectric methods were well on the way to being generally used as the fundamental reference standard. Throughout the whole development, however, his primary interest remained fixed on the end and not the means. He used the advantages of the photoelectric technique to break new ground in several fields of observational astrophysics.

Joel Stebbins was born on July 30, 1878, in Omaha, Nebraska, the only son of Charles Sumner and Sara Ann (Stubbs) Stebbins. Charles Stebbins, an official in the accounting department (and later General Passenger Agent) of the Union Pacific Railroad, had come from Kennett Square, Chester County, Pennsylvania, and had been a teacher in his earlier years. Joel's grandfather, Sumner Stebbins, was a physician in Chester County. Sara Ann, Joel's mother, grew up on a farm in nearby

Lancaster County. The Omaha family included Joel's two sisters, Eunice and Millicent, who later became high school teachers.

Joel Stebbins' career in astronomy grew out of a boyhood enthusiasm. At age twelve, the study of physical geography at an Omaha elementary school gave him a brief introduction to the sun, moon, and stars. Seized by an intense curiosity, he went to the public library for all the books about astronomy he could find and in the end put together a telescope by attaching lenses to a tube made of rolled-up newspapers. The family dictionary stand was pressed into service as a support. His parents then encouraged him by providing the objective and eye lens for a much better telescope. During the following year he made a tube and tripod as a high school manual training project. Scientific subjects held the strongest attraction for him during the high school years. Sports, such as baseball, were not neglected, and he thriftily saved the money he earned from a newspaper delivery route toward college expenses.

In 1895 Joel entered the University of Nebraska in Lincoln. His astronomy teacher was Professor G. D. Swezey. There was time for other pursuits: fraternity life and a place on the basketball team. A summer job on a railway survey crew in western Nebraska contributed to what was to be a lifelong fascination with trains and railroading. After receiving the B.S. degree in 1899, he remained in Lincoln for a year of graduate work. In 1900 Professor Swezey sent him to the University of Wisconsin to study under Professor G. C. Comstock.

Stebbins' first weeks at the Washburn Observatory on the Wisconsin campus placed him in the midst of a variety of astronomical activities. He lived in a room at the observatory, tended to the clocks and time signals, and took up his assigned task of reducing meridian-circle observations for Professor A. S. Flint. The most important part of his training was Comstock's personal introduction to the use of telescopes and the solution

of practical astronomical problems. Comstock also introduced him to bicycling on the lanes along the shores of Lake Mendota, thus implanting an affection for the Wisconsin scene that was to be important in later years.

Stebbins' first publication (with Comstock) dealt with the light curve of Nova Persei in 1901, as derived by the Argelander visual-interpolation method. He was an apt pupil, and Comstock encouraged him to continue his training at a larger observatory where there was greater emphasis on "the new astronomy," i.e., astrophysics. The Yerkes Observatory of the University of Chicago was considered, but in the end Stebbins accepted a fellowship at the University of California's Lick Observatory, on Mount Hamilton.

The training on Mount Hamilton, which began in July 1901, quickly involved Stebbins in the use of stellar spectrographs and the analysis of spectra. Under the leadership of W. W. Campbell, Director of Lick Observatory, both the 36-inch refractor and the 36-inch Crossley reflector—two of the most powerful telescopes in existence at the time—were being used extensively for spectrographic work.

Stebbins devoted the second semester of each academic year, when observing conditions were less favorable on Mount Hamilton, to more formal studies in Berkeley. Here he came under the influence of Professor Armin O. Leuschner, a master of celestial mechanics and orbit theory. He participated in one of Leuschner's legendary cometary orbit races. The computation could not begin until the position of the comet on at least three separate occasions was known. Hence news of the discovery was followed by a wait at the telegraph office for a report of the third observed position. Then followed a round-the-clock calculating session and a dash back to the telegraph office with what was hoped would be the first reported orbit and accompanying predictions of future positions.

Stebbins' Ph.D. thesis, done under Campbell, was an exten-

sive study of the spectrum of Omicron Ceti (Mira), the prototype star of the long-period variables. By long exposures he obtained the first observations of the spectrum through the minimum of the cycle and was able to follow the remarkable changes in the intensities of the bright hydrogen lines and other features as the star's light declined more than a hundredfold. His thesis (published in the *Astrophysical Journal* in 1903) remained the principal source of information on the spectra of long-period variables for almost twenty years. In May 1903, Stebbins became the third person to be granted a Ph.D. degree in astronomy by the University of California.

Well before the award of the degree, Stebbins had through his own initiative secured an appointment as instructor in astronomy at the University of Illinois, in Urbana. The observatory on the campus housed a 12-inch refractor equipped with a polarizing photometer for comparison of stars in the same field of view. President Draper assured him that the path to advancement was open to a young man who "had the stuff" to make something of the observatory.

His first year in Urbana saw the launching of a program for photometric comparison of the components of double stars with the polarizing photometer. Teaching duties included classes in mathematics as well as astronomy, since astronomy was considered a part of the Mathematics Department. In 1904–1905 Stebbins made preparations to join an eclipse expedition to Cartwright, Labrador, under an arrangement made with W. W. Campbell before leaving Lick Observatory. The elaborate preparations came to naught, since it was totally cloudy over Cartwright at eclipse time on August 30, 1905. Nonetheless, Dr. Heber D. Curtis, leader of the Labrador expedition, paid tribute to the "skilled assistance and fertility of resource" contributed by Stebbins. Successful observations, however, were obtained at two other Lick-occupied sites farther down the eclipse track, in Spain and Egypt.

On June 27, 1905, shortly before leaving for Labrador, Joel Stebbins and May Louise Prentiss were married in Lincoln, Nebraska. It had been a college romance begun when the two were classmates at the University of Nebraska. May Stebbins and Mary Curtis accompanied their husbands on the expedition to the Labrador eclipse camp.

Upon Stebbins' return to Urbana, observations with the polarizing photometer were resumed. May Stebbins played a role in this, as Joel Stebbins later recalled:

The photometric program went along well enough for a couple of years until we got a bride in our household, and then things began to happen. Not enjoying the long evenings alone, she found that if she came to the observatory and acted as a recorder, she could get me home earlier. She wrote down the numbers as the observer called them, but after some nights of recording a hundred readings to get just one magnitude, she said it was pretty slow business. I responded that someday we would do all this by electricity. That was a fatal remark. Thereafter she would often prod me with the question: "When are you going to change to electricity?" It happened that within two or three months the department of physics gave an open house, and one of the exhibits was in charge of a young instructor, F. C. Brown. He showed how when he turned on a lamp to illuminate a selenium cell, a bell would ring; when the lamp was off, the bell would stop. Here was the idea; why not turn on a star to a cell on the telescope and measure a current? . . .

I soon made friends with Brown, and in due time we had a selenium cell on the 12-inch refractor; I operated the telescope and a shutter while Brown looked after the battery, galvanometer, and scale. The first trial was on Jupiter—no response; several more trials, still no response. I said to myself, "I'll fix him." The moon was shining through a window; I took the cell with attached wires off the telescope and exposed it to the moon. The galvanometer deflection was measurable with plenty to spare. Result: We spent a couple of months measuring the variation of the moon's light with phase. . . . Our resulting light curve turned out to be the first since the time of Zöllner in the 1860's. ["Early Photometry at Illinois," *Publications of the Astronomical Society of the Pacific*, 69(1957):506–10]

A patient investigation of ways of increasing the response and reducing the fluctuations succeeded in bringing the brightest stars above the threshold of detectability and then went on to make second-magnitude objects measurable with good accu-

racy. By the summer of 1909, two years after the lunar observations, selenium photometry began in earnest.

The first result was Stebbins' classic light curve of Algol, the prototype star of a major class of eclipsing binaries. The light curve showed two features that had been missed by the visual observers. The first was a 6 percent dip midway between the long-known deep primary eclipses. This secondary eclipse proved that the star that was in front during the primary eclipse was not a dark body, but simply cooler than the primary star. The second new feature was the "reflection effect," a continuous variation between eclipses with a maximum just before and after the secondary minimum. Stebbins showed that this could be explained by the warming of the cool star on the side toward the primary. The mean error of the normal points on the curve, only 0.4 percent of the uneclipsed light, demonstrated a precision several times better than had previously been obtained by any other method.

The new standard of accuracy turned attention to the opportunity that eclipsing variables offered for the direct determination of the diameter, mass, and density of stars. In 1913 Professor H. N. Russell developed an extensive theory of the geometry of eclipses, including allowance for the ellipsoidal shapes produced by mutual gravitational distortion. Stebbins reasoned that among the known spectroscopic binaries there must be many showing eclipses of small range that had gone undetected. He developed criteria for selecting the most favorable cases. The first two bright stars tested—Beta Aurigae and Delta Orionis—showed eclipses at the predicted times of about 10 percent of the light at constant phase. A systematic campaign over the following years turned up many more.

The important change from selenium to an alkali-cathode photoelectric cell had its inception in the autumn of 1911. Dr. Jakob Kunz of the Physics Department at Illinois offered to make a rubidium cell that would be suitable for the low inten-

sities encountered in stellar photometry. Observations with the selenium photometer continued, with the limitation that stars beyond the third magnitude were too faint for accurate measurement.

During the academic year 1912–1913, while Stebbins was in Munich on sabbatical leave, Kunz and W. F. Schulz carried out the first successful trial of the photoelectric cell on the 12-inch telescope. Stebbins' year in Germany came at a time when P. Guthnick in Berlin and H. Rosenberg in Tübingen were making successful observations with alkali-cathode photoelectric cells. Following Rosenberg's report at the meeting of the *Astronomische Gesellschaft* in Hamburg in the summer of 1913, Stebbins congratulated the author and drew upon his experience to comment on the considerable advantage of the alkali-cathode over selenium in the photoelectric measurement of starlight.

Upon his return to Urbana, Stebbins' major effort went into the assembly of a photometer incorporating a photoelectric cell and Wulf string electrometer. The skill and perseverance that Kunz brought to the making of superior photoelectric cells was an important factor in success. These laboratory-made cells were prized for their excellent response and extremely low dark-current; they held their place in astronomical photometry for many years after commercial cells became commonplace because of industrial applications.

In the summer of 1915, Stebbins used the new photometer on the 12-inch refractor at Lick Observatory to obtain a light curve of Beta Lyrae, a prototype example of an eclipsing binary with marked ellipsoidal distortion of the components. Photoelectric precision gave definite proof of unsymmetrical eclipses, a harbinger of the atmospheric streaming from one component to the other that was in later years to play so large a role in evolutionary models of close binaries. The work on eclipsing stars at Urbana was extended to fainter stars that had come within range of the more sensitive equipment.

Kunz and Stebbins made the first photoelectric measurement of the total light of the solar corona during the eclipse of June 8, 1918, from a station near Rock Springs, Wyoming. They joined forces for a similar measurement at three later eclipses: Catalina Island, California, in 1923; Middletown, Connecticut, in 1925; and Lancaster, New Hampshire, in 1932. The 1923 and 1932 eclipses were cloudy, but Stebbins made a third successful measurement with a Kunz cell in 1937 from a station just south of Cerro de Pasco in the Peruvian Andes.

Recognition and honors began coming to Stebbins while he was still in his thirties. He received the Rumford Medal of the American Academy of Arts and Sciences in Boston in 1914 and the Draper Medal of the National Academy of Sciences in 1915. From 1918 to 1927 he was secretary of the American Astronomical Society. In 1919 he was a member of a delegation of eight American astronomers chosen to represent the National Research Council of the National Academy of Sciences in the organizing meeting of the International Astronomical Union, held in Brussels. W. W. Campbell was the chairman of the delegation; Stebbins, the secretary. In 1920 Stebbins was elected to the National Academy of Sciences.

Stebbins moved to the University of Wisconsin in 1922, where he succeeded G. C. Comstock as Director of the Washburn Observatory. The Stebbins family, which now included a son, Robert, fifteen, and a daughter, Isabelle, twelve, moved into the Observatory Residence, adjacent to the observatory. This house, which had a commanding view of Lake Mendota, was the scene of much gracious hospitality within the university community.

C. M. Huffer, a former student at Illinois, joined Stebbins as the second member of the staff. Teaching duties were scheduled for the afternoon hours, and a fixed schedule of assigned nights at the telescope was set up, following the custom at West Coast observatories where readiness to use all clear night-hours was a

cardinal principle. Even though the percentage of useful nights in the Madison climate was not very favorable, the observations accumulated. Stebbins and Huffer completed work on an impressive number of eclipsing binaries over the next few years.

From 1925 onward, Stebbins turned his attention increasingly to other fields of astronomical photometry. Work on the light curves of eclipsing systems was continued by members and alumni of the Washburn group, and later by many others. In the end this type of star was to provide a large fraction of the modern knowledge of the masses and diameters of stars. Proper evaluation of the orbital velocity from the spectra often proved to be rather complex. The more straightforward information from the light curves universally depended on the type of photoelectric observation instituted by Stebbins.

The short-term variability of the sun was investigated by comparing the reflected sunlight from Jupiter's moons and the planet Uranus with the light of adjacent stars. Stebbins made the observations in 1926 and 1927 at Lick Observatory; T. S. Jacobsen was a collaborator. No variability was detected. A more extended program in Madison tested the constancy of the light of cool red stars. Irregular variability was found to be a frequent trait, the likelihood increasing with decreasing temperature; all stars cooler than spectral type M3 proved to be variable.

Space reddening in the galaxy attracted Stebbins' attention in 1930. R. J. Trumpler had found from his study of open star clusters at Lick Observatory that there was evidence for a widespread general absorption and reddening of distant objects near the central plane of the Milky Way. For more detailed investigation of this phenomenon, the photoelectric technique had obvious advantages over photography. The ensuing research had a strong influence on the general understanding of the scale and structure of the galaxy.

Stebbins adopted the O and B stars as the test objects for the first investigation and determined their colors by photoelectric

measurements through a pair of glass filters. The method had previously been worked out by Guthnick and Bottlinger in Berlin. Within two years, data on about 700 stars had been accumulated at Washburn Observatory by Stebbins and Huffer. There was strong evidence of reddening. Inside Hubble's "zone of avoidance," where no external galaxies are observed, the colors of distant O and B stars were much redder than the intrinsic color expected from their spectral types. The greatest color excesses were found along the galactic equator and in the general direction of the center of the galaxy.

Further work on space reddening was aided by regular access to the 60-inch and 100-inch telescopes of the Mount Wilson Observatory. Stebbins became a Research Associate of the Carnegie Institution of Washington in 1931, and for the next fifteen years the observational program was increasingly centered around an annual visit to Pasadena; most often this came in the summer months.

Technological improvements augmented the gain that came from the great light-gathering power of the large telescopes. In 1932 vacuum-tube amplification of photocurrents displaced the electrometer and brought considerably fainter objects within reach. It was in connection with that development that the writer of this memoir came into association with Stebbins; many years of close collaboration followed. A second change was the introduction of the refrigerated cesium oxide cell for certain tasks in order to get a much wider spectral range than that to which the Kunz potassium hydride cell was sensitive. This followed the initial work of J. S. Hall at the Yale Observatory.

The second class of objects chosen by Stebbins as a test for space reddening was the system of globular clusters. Here again the photoelectric method of measuring colors proved to be ideally suited, and a striking effect that had escaped the photographic observers was apparent from the first season's reconnaissance at Mount Wilson. The reddening was closely correlated

with galactic latitude. Large corrections to the distances were inevitable; the feeble light of the clusters in the direction of the center of the galaxy was in part due to interstellar absorption and was not to be ascribed entirely to their great distance. The resulting contraction in the scale of the galaxy, a contraction from the first estimates based on the system of the globular clusters, reduced the embarrassing discrepancy between the size of the Milky Way and the then-accepted size of other galaxies.

Further measures of the colors of globular clusters at Mount Wilson and of B stars at Mount Wilson and Madison made it possible to map reddening effects with essentially all the known objects of these types accessible to Northern Hemisphere observers. In the end the colors of 1332 B stars were measured. The extreme patchiness of the absorbing dust clouds stood out. It became clear that the previously used mean coefficients of absorption were unreliable.

In order to evaluate the total absorption in visual light from these two-color measures, it was necessary to know the variation of absorption with wavelength—the so-called law of reddening. Calculations seeking to deduce the physical nature of the interstellar dust particles, their size, and their total mass also depended on this information. Stebbins and his collaborators attacked this problem in 1937 at Mount Wilson, using a wide-range cesium oxide cell at the exit aperture of a slitless spectrometer. The first results on a few highly reddened stars confirmed what others had found over a shorter range of wavelengths: to a first approximation the absorption varied inversely as the wavelength.

A more extended study involving many more stars used a set of six glass filters with band centers from 3500 angstroms in the ultraviolet to 10,300 angstroms in the infrared. From this larger body of data it was possible to conclude in 1943 that the law of reddening is the same in all directions in the galaxy, and the interstellar dust is therefore essentially uniform in quality wherever it is found. A previously suspected departure from strictly

linear variation with inverse wavelength in the sense of reduced absorption in the ultraviolet was confirmed; this property of the reddening law later became the basis of separating reddened stars from others when only the colors were known.

After 1943, Stebbins' interests turned to other subjects. Investigation of the properties of interstellar dust continued to be an active field of research among astronomers because of the role that dust plays in the formation of new young stars. Photoelectric evaluation of reddening by the method that Stebbins introduced eventually came to be a routine step in determining the distances of all types of objects other than the nearest stars.

Further recognition came to Stebbins during this period. He was elected president of the American Astronomical Society in 1940 for a three-year term. He was awarded the Bruce Medal of the Astronomical Society of the Pacific in 1941. He is remembered in the Astronomical Society as the chairman who introduced the ten-minute bell for contributed papers; a society that had started out as a small company of gentlemen had been reluctant to introduce so shrill a reminder.

During the first of his annual observing sessions at Mount Wilson, Stebbins began photoelectric measurements of the brightness and color of external galaxies. The linear response, the direct subtraction of sky background, and particularly the integration of all the light coming through the focal-plane aperture into a single photocurrent, gave the method a considerable advantage over the photographic plate in comparing the diffuse images of galaxies with stars. Under the urging of Edwin Hubble and Walter Baade, these measurements were continued and expanded and eventually became the third major interest in Stebbins' research career.

Observations of 165 galaxies reaching down to the fourteenth magnitude had accumulated by 1935. These provided standards and calibration points; they included members of the important Virgo and Coma clusters of galaxies. Measures of

galaxy magnitudes were resumed at Mount Wilson in 1947, when the multiplier phototube that became available after the war had replaced the Kunz potassium hydride cell. Considerably fainter galaxies now came within range; the observations included the eighteenth-magnitude object with the largest redshift then known. The sequence of progressively redder colors from open spirals to elliptical galaxies confirmed in general what was known about stellar content. In particular, the ellipticals showed a remarkably homogeneous color, a property that reassured those who were using them as standard candles in studies of the velocity-distance relation.

Two complementary investigations carried out by Stebbins and his collaborators involved the recalibration of the standard sequences of stellar magnitudes against which the galaxies had been measured. In order to remove all doubts about the strict linearity of the photoelectric apparatus over a range of a factor of 100,000, careful checks were instituted. At the fainter magnitudes, the new results diverged quite seriously from the older photographic determinations. In some instances stars at the nineteenth magnitude were scarcely more than half as bright as had been previously thought. This disturbing conclusion did much to accelerate the movement from photographic to photoelectric brightness measurements for all the faint objects used in setting up the extragalactic distance scale and particularly for the very distant galaxies that had the greatest weight in investigations of the cosmological problem.

The next step in the study of galaxies was the transition from a simple two-color index to the wide-range spectrophotometry of the six-color system. The results were published in 1948. Representative bright galaxies showed the type of energy curve to be expected from a mixture of stars of different temperatures. The strong radiation in the infrared indicated that cool red stars formed an important component. The effect of the redshift on the color of an elliptical galaxy could now be calculated from its

measured energy curve. But the observed color of a system with a redshift of 39,000 kilometers per second showed a much larger change in color than predicted. The discrepancy, which came to be known as the "Stebbins-Whitford effect," was tentatively ascribed to evolutionary changes in the intrinsic color during the light-travel time. The implausibly high evolution rate immediately raised doubts. The suggestion that an energy curve that depended on six broadband filters had involved far too much smoothing was later confirmed by Whitford when more detailed energy curves became available. The "effect" was laid to rest, but once again Stebbins' initiative in applying the photoelectric technique to this problem pointed the way to important work that followed.

When he reached the age of seventy in 1948, Stebbins retired as professor of astronomy and director of Washburn Observatory at the University of Wisconsin. His life as an astronomer did not stop, however. He returned to the scene of his graduate student days for another decade of productive work as a research associate at Lick Observatory. The family home was moved to Menlo Park, California, from which he commuted to the mountain each week by the Southern Pacific railroad and the Mount Hamilton stage. His collaborator at Lick was G. E. Kron, whom he had introduced to astronomy at Wisconsin.

The research undertaken on Mount Hamilton involved further applications of the six-color photometric system. The number of stars of various types observed on this system was increased to several hundred. The pulsating variables were singled out for detailed study. Light curves in six colors from observations at Mount Wilson and Lick were analyzed to separate the part of light variation due to the cyclic diameter changes from the part due to temperature changes. The resulting stellar diameters and temperature estimates strongly supported an upward revision of the intrinsic luminosity of classical cepheids by a factor of four relative to the luminosity of the RR Lyrae variables. The revision of the extragalactic distance scale advocated

by Walter Baade on other grounds thus found confirmation in a direct astrophysical study of the relevant stellar prototypes.

A second major project of this period was a redetermination of the stellar magnitude and color of the sun. By a series of carefully calibrated intermediate steps, Stebbins and Kron bridged the enormous brightness ratio between the sun and reference stars—amounting to nearly three trillion—with an accumulated probable error of no more than 3 percent. Their result became the definitive value for a fundamental astrophysical constant.

These years on Mount Hamilton were marked by additional honors. In 1950 Stebbins was awarded the Gold Medal of the Royal Astronomical Society and journeyed to London to deliver the George Darwin Lecture. Honorary degrees from the University of California in 1953 and the University of Chicago in 1954 were added to those from the University of Wisconsin in 1920 and the University of Nebraska in 1940. In 1958 he returned to Madison to deliver the dedicatory address at the opening of the Pine Bluff station of the Washburn Observatory.

Finally, at age eighty, Stebbins retired to his home in Menlo Park. He could look back on fifty years of photoelectric photometry. For nearly half of this period, his observatory had been the only one in the United States engaged in the practice of the photoelectric art. In 1928 he had written:

Perhaps a word of warning or of commiseration is due to those who may take up this kind of work. The photo-electric cell with its installation is a delicate piece of apparatus, and requires considerable patience to learn its idiosyncracies. Nowadays our photometer will work uniformly for months at a time, but occasionally some trouble arises, and perhaps once a year a new kind of "kick" will turn up which is a real puzzle. The ordinary troubles from moisture, defective battery, dirty or poor contacts, etc., can be recognized by simple tests, but it is difficult to put down in black and white just what to do when things go wrong. ["Photo-electric Photometry of Stars," *Publications of the Washburn Observatory*, 15(1928):16]

During the years 1932–1940, three or four other observatories entered the field. The movement toward adoption of photoelectric methods accelerated in the postwar years; the

advent of the multiplier phototube had made it much less of an art. By 1957, when Stebbins recalled the early days at Illinois at a meeting of the American Astronomical Society, routine use of the photoelectric technique as the standard method of astronomical photometry was becoming universal. The faintest stars seen on photographs taken with the 200-inch Palomar telescope were now measurable—a gain of twenty-five magnitudes (or a factor of ten billion) over the first objects attempted in Urbana.

Stebbins' last paper (with Kron) was completed in his Menlo Park study; it dealt with the standardization of the six-color system in terms of black-body temperatures, and appeared in 1964. The remarkable vigor that had made him seem much younger than he was during the very productive last two decades of his career finally began to fade. Failing eyesight made reading difficult, and the onset of leukemia sapped his strength. Joel Stebbins died on March 16, 1966, in a Palo Alto hospital, at the age of eighty-seven. He was survived by his wife, May; his son, Robert, an attorney in Green Bay, Wisconsin; and his daughter, Isabelle (Mrs. T. A. Dodge), of Tucson, Arizona. May Stebbins died in Tucson on October 10, 1970.

All who knew Joel Stebbins remember him for those unique personal traits that gave a characteristic flavor and style to whatever he said or did. He possessed a rare blend of wit and wisdom, which he shared with those around him with such geniality and urbanity that he lifted the spirits of any company of which he was a part.

There was both a serious and a lighter side to his nature. Those who worked in daily association with him saw his extraordinary dedication to his work. Astronomy came first—it was his calling and his hobby as well. He demanded a high standard of performance from his co-workers and from himself. Nevertheless, he thoroughly enjoyed being an observational astronomer. The steps along the way to the final result were not drudgery; he relished doing the computations himself. Most of all he enjoyed the night hours in the dome. He had a special

affection for the clicks and whirs and squeaks that went with the operation of a large telescope.

One of Stebbins' deepest aesthetic pleasures was the naked-eye view of the night sky from an especially fine site. In an address to a Phi Beta Kappa group in Madison, he recalled his impression of such a view from Palomar Mountain during the preconstruction days. Because of the meadows and cows, he called it "a bit of Wisconsin placed a mile above the sea." He went on:

I . . . have been on Palomar at night, alone except for some yelping coyotes, and there through the transparent air, far from the lights of cities, the whole sky takes on a different aspect. It is as though a veil had been removed from one's eyes, and Orion and the winter constellations have so many stars as to be almost unrecognizable. The summer Milky Way, with its two branches and the great enlargement about the center of the galaxy in Sagittarius, stands out with such prominence that one wonders why it took so long for us to decide that the sun is not at the center of things. ["The Constant Stars," *The American Scholar*, 12(1943):339-51]

A quality that stands out in the memory of those who knew Stebbins, even casually, was his unfailing ability to see the latent humor in many an everyday situation. If there was anomaly or irony or paradox, he was amused by it, and quoted a fitting epigram. Often this would remind him of a droll story. Any conversational group that included Stebbins was sure to be enlivened by his dry wit. He charmed his listeners with an inexhaustible fund of anecdotes, many of them recalling events of the early days on Mount Hamilton or the eccentricities of the astronomers he had known.

One of these stories involved a question put to him during his student days while he was "pulling dome" at the 36-inch refractor for an old-line visual observer: "Are you going to be a real astronomer or just one of these newfangled photographers?" As it turned out, Joel Stebbins bypassed photography almost completely and led the way in gauging the light of the stars by a method that surpassed those that depended on either the human eye or the photographic plate.

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KEY TO ABBREVIATIONS

Astrophys. J. = Astrophysical Journal

Lick Obs. Bull. = Lick Observatory Bulletin

Phys. Rev. = Physical Review

Pop. Astron. = Popular Astronomy

Proc. Natl. Acad. Sci. USA = Proceedings of the National Academy of Sciences of the United States of America

Publ. Astron. Soc. Pac. = Publications of the Astronomical Society of the Pacific

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