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SETH BARNES NICHOLSON

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A Biographical Memoir by
PAUL HERGET

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Seth B. Nicholson

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SETH BARNES NICHOLSON was most distinctly recognized in astronomical circles for his discovery of four satellites of Jupiter, a feat equaled only by Galileo when he directed his first telescope toward the planet. Nicholson was wont to quip that all that was needed to discover a new satellite was the largest telescope in the world. These discoveries were surrounded by interesting sidelights, and they formed part of a significant series of events having important bearing on theories of the origin of the solar system.

Using the 36-inch Crossley reflector of the Lick Observatory, C. D. Perrine discovered, in December 1904, a faint satellite of Jupiter, moving in an orbit 7.5 million miles from the planet, in a period of 260 days. In 1905 he discovered another satellite, and for the first time in the history of astronomy the orbits of two satellites were found to be at the same distance from their primary. Yet these orbits were interlocked and linked in such a way that the two objects could not collide under present circumstances. At the Greenwich Observatory in 1908, Melotte discovered another outer satellite, twice as distant from Jupiter, and having a period slightly over two years. This, for the first time, revealed a satellite of Jupiter revolving in the opposite direction from all the other satellites, and from the rotation of the primary.

Nicholson entered this scene in 1914, when there was an eclipse of the Sun visible in Russia. The senior astronomers of the Lick Observatory went to observe the eclipse, and the director left orders behind that this faint, new, retrograde satellite was to be observed whenever telescope time was available. The assignment fell to Nicholson; as an astute young graduate student, he took an extra long exposure in order to be on the safe side. The result was that he discovered yet another satellite in the vicinity, and it proved to be a "twin" of Jup. VIII, also having retrograde motion, the same period and distance, and again being interlocked in such a way as to preclude collisions. This was no mean feat of observing, since the object was barely on the limit of detectability of the 36-inch telescope and the photographic plates then in existence. The whole experience presaged not only Nicholson's ability as a keen and ardent observer but also his ability to handle the theoretical side of the astronomical problems he encountered. The discovery provided the material for his Ph.D thesis. His computation of the orbital elements and ephemerides typified the first-rate treatment he brought to bear on all his work.

For over two decades he was the target of occasional jibes from his Mt. Wilson colleagues to the effect that, since he was the only one who had ever observed this satellite, it could very well be a hoax which he had perpetrated. Then in 1938 the International Astronomical Union meeting in Stockholm attracted many of the Mt. Wilson astronomers so that enough observing time on the 100-inch telescope became available to Nicholson to enable him to conduct a search over some 6° $\times$ 2°.5 of the sky for more satellites in the vicinity of Jupiter. This led to the discovery of more than forty faint, moving objects, each of which must patiently be observed and followed until it could definitely be established as a foreground object moving in an orbit about the Sun. The result led him not only to the independent rediscovery of each of the known satel-

lites but also to the discovery of two more. Each one matched one of the known pairs, so that now each became a set of "triplets," a circumstance which has no known counterpart anywhere in the solar system. The following year I saw Nicholson's observation book with notations indicating Jup. XII and Jup. XIII. But these only proved to be the most recalcitrant cases, which eventually joined all the others which had to be rejected. When asked if he got a thrill out of his satellite discoveries he indicated that he did not, because the "discoveries" are so slow in coming and because it takes so long before one can be certain about them. In 1951, while intending to observe Jup. X, he discovered Jup. XII. It also has a retrograde orbit, but it does not fit quite so closely the elements of Jup. VIII, Jup. IX, and Jup. XI. Nicholson was finally of the opinion that there are still fainter satellites of Jupiter to be discovered. I often wondered why he never made a similar survey around Saturn, but I never had the chance to ask him.

Seth Nicholson's forebears can be traced back through several lines of Scottish and English ancestry. Martha Ames, his mother, was of the eighth generation from William Ames, who emigrated from England in 1635. All these Ameses lived in the vicinity of Boston, until her father moved to Iowa. Another maternal line can be traced to John Cary, who joined the Plymouth Colony at about the same time as William Ames's arrival. His name appears in the land deed granted by Massasoit "to Miles Standish . . . in behalf of William Bradford, John Cary, . . ."(and 52 others who are named). Seth's great-grandmother was descended from Rev. James Keith who came to Boston from Aberdeen, Scotland, in 1662. An uncle and his maternal grandfather were both ministers of the Disciples of Christ church. In 1885 the grandfather, Rev. Lucius Bowles Ames, moved from Toulon, Illinois, to Des Moines, Iowa, so that his children might attend Drake University.

Seth's paternal grandfather was a pioneer farmer who emi-

grated from Scotland to Illinois. William F. Nicholson, Seth's father, graduated from Knox College in Galesburg, Illinois, and then earned a master's degree in geology at Cornell University. He became an elementary-school teacher and principal at Springfield, Illinois. He married Martha Ames on August 21, 1888. Seth Barnes was born November 12, 1891. An older sister, Neva, devoted her active life as a missionary in India. Two younger sisters, Carrie and Helen, served as schoolteachers in Pasadena and Los Angeles. In 1898 William Nicholson moved his family to a farm near Toulon, Illinois, for reasons of his health. After six years he returned to teaching, and became the principal of the Toulon Academy (a high school). Thus it happened that Seth spent his first grade and all of his high school years in schools where his father was the principal. He attended a country school for the remainder of his elementary school years.

In this rural environment, his youth included all the experiences of a farm hand, and the summers of his high school years were spent in such employment. But the intellectural atmosphere of his home was not lost upon him, and even as a boy he owned a small telescope and watched the stars. He once wrote to an inquiring young correspondent: "When I was a boy our family lived on a farm in northern Illinois. My father had been a geologist and a schoolteacher before we moved to the farm because of his health. He was interested in science of all kinds and from him I learned the names of the stars, flowers, birds and rocks. I was then just as interested in geology and botany as in astronomy. Electricity was my favorite hobby and my father showed me how to make toy motors, telegraph instruments, and induction coils.

"I remember watching an eclipse of the sun when I was a boy, but I was not especially interested in astronomy before going to college at Drake University."

Nicholson enrolled at Drake in 1908, and the turn which

his career took was shaped by Dr. D. W. Morehouse, the Professor of Astronomy. Morehouse had just discovered a comet which reached a splendid naked-eye visibility, and two years later Halley's Comet appeared. Some of the classic photographs of Halley's Comet were taken by Nicholson with the 8-inch telescope at Drake, even though he was still an under graduate. We have no sure way to assess, we can only surmise from the external evidence, the influence of one of his classmates, Miss Alma Stotts. They worked together to compute the orbit of a minor planet which had been discovered by Metcalf in the winter of 1909, and then prevailed upon Metcalf to name it Ekard, or Drake spelled backwards, in honor of their school. After graduation from Drake in 1912, they both enrolled in the graduate department of astronomy at the University of California at Berkeley. Their names appear as co-workers in the computation of several comet orbits. They were married on May 29, 1913. Their home was blessed with three children, Margaret (1915), Donald (1918), and Jean (1921).

A perusal of Nicholson's bibliography of 267 entries reveals at the beginning his interest in the small bodies of the solar system: minor planets, comets, and satellites. This interest never waned. In 1936 he extended the observed arc of Adonis by a whole month; and after his retirement he discovered another Trojan minor planet. In 1930 when Pluto was discovered, Nicholson was the forerunner in the competition to derive a reliable solution for its orbit. He found the four observations on Mt. Wilson plates which had been taken in 1919. His experience and judgment enabled him to ferret out an erroneous prediscovery observation, and he was the first to demonstrate that the determination of the mass of Pluto depended almost entirely upon the less precise 1795 observation of Neptune.

Nonetheless, after receiving his doctorate at Berkeley he was appointed to the staff at Mt. Wilson, which was then primarily a solar observatory, and so most of his career was spent

in observational work on the Sun. Beginning in 1920 he issued annual reports on sunspot activity and additionally since 1940 there were reports on solar and magnetic data. The continuous solar history over several sunspot cycles, as recorded by the tower telescopes at Mt. Wilson, is in the largest part Nicholson's work during those years.

In the early 1920s he collaborated with Dr. C. E. St. John to establish an independent value of the solar parallax from extensive spectroscopic observations of Venus. A significant series of scientific contributions came from his collaboration with Edison Pettit in making vacuum thermocouple measurements of the radiation and temperatures of the planets and the Moon. Thus, for the first time, conjecture was replaced by evidence. The rapid fall and rise of the lunar temperature during an eclipse from 350°K to 150°K and back was observed. Likewise the 600°K temperature of Mercury, the relatively lower temperature of sunspots, and the low density of the atmosphere of Mars were all established. The delicacy of these observations in those early years is hard to realize. The sensitivity required with the equipment used has been compared to detecting a candle light 100 miles away.

Nicholson was an observer with solar eclipse expeditions in 1923, 1925, 1930, and 1932. During World War I he taught navigation, and during World War II he was engaged in several classified projects which included investigations of aerial cameras, as well as work at Los Alamos. From 1946 to 1961 he collaborated with O. R. Wulf in detailed studies of the relationship of geomagnetic and solar activity.

Another facet of Nicholson's career was his hearty participation in the astronomical community of the West Coast. He served the Astronomical Society of the Pacific as president in 1935 and 1960, and as editor of its *Publications* from 1940 to 1955. On numerous occasions, as Morrison Lecturer or as a visiting lecturer of the Society, he addressed local sections or

school groups. He had a tremendously appealing platform personality when lecturing, and he was equally at ease whether with astronomers or with students. After retirement, he was coordinator of the western region for the visiting professors program of the American Astronomical Society and the National Science Foundation and presented 45 lectures himself in visits to the central and western states during 1957-1962. This quotation from a local newspaper (1930) illustrates the reception of his lectures.

"Dr. Seth B. Nicholson lectured before a capacity audience at Cal. Tech. in one of a series of talks conducted by the Astronomical Society of the Pacific and the local observatory.

"The audience agreed the lecture was one of the best ever heard during the history of the astronomical series; that Dr. Nicholson possesses the unusual ability to transmit to the layman the results of his profound studies."

Excerpts from a letter written by one of Nicholson's sisters illustrate his experiences. "In 1962 he was asked to give a series of talks at the California Christian Home for Senior Citizens. He gave three talks which thrilled the people there. He spoke of the good questions that some of them asked at the close of the lecture. . . . A 97-year old lady in the Scripps Home asked him to come there to lecture as the main feature of her birthday party. He delighted in every indication that people should continue to learn as long as they lived."

Seth was fond of recreation. He enjoyed a vigorous game of tennis, and often omitted lunch in order to play ping-pong with members of the Observatory staff. With scouts or his family, he was an inveterate hiker on the mountain trails above Altadena.

Nicholson served in numerous civic and community enterprises, and was an especially beloved scoutmaster from 1923 to 1938. Afterward he was troop committeeman and later commissioner. He received the Silver Beaver Award as a tribute to

his outstanding scouting service. From 1950 to 1962 he served on the Altadena Library Board successively as trustee, secretary, and president.

It was a delight to know Nicholson and to be his friend. He was helpful to everyone, but always in a sensible way. As R. S. Richardson relates, Seth provided some technical information to a movie studio, but in return he insisted on six free passes to visit the movie set during filming—not to be used for himself, but for some likely visitor. When my wife and I visited Pasadena the first time, we had barely introduced ourselves before he had arranged for our visit to the Huntington Memorial Library. He was like that. The answering of written inquiries to the Observatory just naturally seemed to gravitate to him. One graduate student who was working on a doctoral research project wrote, in part, "If you are willing, please briefly comment on your interpretation of the scientific method or scientific methods." Nicholson replied:

"During my career as an astronomer I have given very little thought to the 'scientific method.' Curiosity about the unknown kept me going. That and the fun I've had finding out about things and telling others about them, especially young people.

"I have been primarily interested in observing. It has never seemed necessary to have a theory to be proved or disproved by my observations. The temperatures of the moon, planets, sun, and stars were measured to find out what they were, not to prove some theory about life on the planets or about stellar evolution. The calculation of a comet's orbit satisfied my curiosity and I enjoyed filling pages with figures to learn about the orbit, not to test a theory about the origin of comets.

"It has seemed to me that good observations were the basis of science. Scientific observations must be checked and controlled in systematic ways. My 'scientific method' has been 'check and double check.' I know that observations alone do not tell the whole story, but I have been content to let others

make up theories to fit the observations and was glad when they did. The new and most interesting observations are seldom directed by theoretical predictions.

"Several articles about the 'scientific method' have appeared in the *American Scientist*. I like 'To Tell or Hear Some New Thing,' by Joel H. Hildebrand in the March 1963 number. If you have read it, I do not need to say more. If you have not, you should."

A few of the many tributes sent to Mrs. Nicholson by younger astronomers are revealing.

"I give credit to Seth for getting me started in the right way on my professional career. It was he who told me of an opening for a computer at Mt. Wilson. That opportunity opened a new world to me, for which I have Seth to thank. Also while in Pasadena those two years I had the privilege of working with Seth on the orbit of Pluto. That experience is unforgettable: under his guidance and stimulation, I learned thoroughness, accuracy, and imaginative approach to orbit work. It was apparent to me then, and was in subsequent years re-enforced, that Seth was one of the best, most broadminded, and expertly informed astronomers on the Mt. Wilson staff. In addition to his professional competence, Seth was outstanding for his handling of young people with great good humor and sound counsel. I was indeed fortunate to have been associated with him so early in my career in astronomy."

"It is difficult to write what you already know—that Dr. Nicholson was effectively a father to the entire astronomical community, and that we all share your missing him. For the last 10 to 12 years, I am sure I have asked him for advice about twice a year—and I owe a lot to the fact that I followed it. I realize now that I probably never specifically told him how much this meant to me, and even when I did *not* rely on him, it was nice to know that he was 'available.' The home you have with him must be wonderful."

Nicholson held memberships in the American Astronom-

ical Society, Astronomical Society of the Pacific, American Association for the Advancement of Science (Chairman of Section D, Astronomy, 1944), International Astronomical Union, the National Academy of Sciences (1937), Phi Beta Kappa, and Sigma Xi. He received an honorary LL.D. degree from Drake University in 1949. Undoubtedly the honor that he treasured most highly was the Catherine Bruce Gold Medal, awarded by the Astronomical Society of the Pacific on June 13, 1963. Tragically, he had to hear the presentation ceremonies over a telephone hook-up from the San Diego meeting to his hospital bed in Los Angeles. He died shortly afterward on July 2.

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KEY TO ABBREVIATIONS

Astron. J. = Astronomical Journal
Astron. Soc. Pac. Leaflet = Astronomical Society of the Pacific Leaflet
Astrophys. J. = Astrophysical Journal
Carnegie Inst. Wash. Publ. = Carnegie Institution of Washington Publication
Griffith Obsr. = Griffith Observer
J. Geophys. Res. = Journal of Geophysical Research
J. Opt. Soc. Am. = Journal of the Optical Society of America
Lick Obs. Bull. = Lick Observatory Bulletins
Mt. Wilson Commun. = Mount Wilson Communications
Mt. Wilson Contrib. = Mount Wilson Contributions
Mt. Wilson Palomar Obs. Reprint = Mount Wilson and Palomar Observatory Reprint
Phys. Rev. = Physical Review
Pop. Astron. = Popular Astronomy
Proc. Nat. Acad. Sci. = Proceedings of the National Academy of Sciences
Publ. Am. Astron. Soc. = Publications of the American Astronomical Society
Publ. Astron. Soc. Pac. = Publications of the Astronomical Society of the Pacific
Terr. Mag. = Journal of Terrestrial Magnetism and Atmospheric Electricity
Trans. Am. Geophys. Union = Transactions of the American Geophysical Union
Trans. Internat. Astron. Union = Transactions of the International Astronomical Union

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