NATIONAL ACADEMY OF SCIENCES

ARMIN OTTO LEUSCHNER

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A Biographical Memoir by

PAUL HERGET

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A. O. Leuschner

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ARMIN OTTO LEUSCHNER was born on January 16, 1868, in Detroit, Michigan, and died in Berkeley, California, on April 22, 1953. His professional career, which was spent at the University of California, began in the early days of the University's Lick Observatory. In 1939, at a banquet of the American Astronomical Society, Leuschner delivered an after-dinner speech entitled, "The Three Times I Was Fired from the University of California." This was hyperbole, because he was never fired at all, but it is unfortunate that this speech is now lost to posterity.

Two of the occasions to which he referred concerned altercations with the autocratic first director of the Lick Observatory, E. S. Holden. Leuschner had just begun his graduate studies, and, according to his story, he put up some window curtains in the rather desolate shack assigned to him as his living quarters on Mt. Hamilton. Holden berated him for such frivolity and waste of effort, which he declared could be put to better use. Leuschner was not a meek soul, and, in the heated words that were exchanged, he was threatened with dismissal. But the matter was eventually smoothed over and lingered only as one of the many untoward incidents that occurred in the isolated and oft-strained atmosphere of the mountaintop.

The second occasion took place about ten years later. Leu-

schner took a group of his students from Berkeley up to Mt. Hamilton (not a simple excursion in those days) in order to see the telescopes and instrumental equipment. In his usual manner, Holden took exception to this arrangement (or perhaps the lack of it) and forbade the students to be shown around, whereupon the students gave a rousing good cheer for Leuschner, followed by the converse for Holden.This so infuriated Holden that he attempted to get Leuschner dismissed, but without success.

The third incident occurred early in World War I, when Leuschner came under the prejudices and accusations of the anti-German element in the community. He stood his ground and weathered the storm—thus gaining added respect for his character, as well as a title for an after-dinner speech.

Before Leuschner was a year old, his father, Richard Otto Leuschner, died, and his mother, Caroline (née Humburg), of German parentage, returned to Germany very shortly thereafter. Leuschner graduated from the Kgl. Wilhelms Gymnasium in Kassel in 1886 and throughout his adult life spoke English with a strong German accent. His speech was further affected by some difficulty in his nasal passages. The students at Berkeley adopted the British *ex, why,* and *zed* because *the, see, c,* and *z* were all rendered indistinguishable by Leuschner's *zee,* and thus they eliminated one ambiguity when discussing mathematical formulas. They were also amused at some of his habitual misconstructions, e.g., "leaves of absences," "chambers of commerces."

Leuschner attended the University of Michigan for two years and graduated with an A.B. in 1888. He was a graduate student at Lick Observatory from 1888 to 1890, an Instructor in Mathematics at Berkeley from 1890 to 1892, and Assistant Professor of Mathematics from 1892 to 1894. He was then appointed Assistant Professor of Astronomy and Geodesy. The years 1896–1897 were spent at the University of Berlin, where

he received a Ph.D. in 1897. His thesis earned him the highest accolade that Berlin had to offer, *testimonium acuminis insigne.*

Upon returning to Berkeley, he held the title Associate Professor of Astronomy and Geodesy and Director of the Students' Observatory from 1898 to 1907. From 1907 until his retirement in 1938 he held the title Professor of Astronomy and Director of the Students' Observatory. His story of the early years of his fledgling department is well told in *Publications of the Astronomical Society of the Pacific*, vol. 16, p. 68. He single-handedly founded the astronomy department at Berkeley, and his early association with the Lick Observatory did much to establish mutually cordial relations between the personnel of the two places. It was common practice for individuals to exchange places for a semester or a school year, thus bringing the students at Berkeley into direct contact with observational astronomers and also affording the teachers a period of uninterrupted research on Mt. Hamilton.

Leuschner held high ideals, and he accomplished many things besides building a strong department. He was Dean of the Graduate School from 1913 to 1923, except for a year and a half during World War I when he served as a major in the Chemical Warfare Service, U.S. Army. During those troubled times, he organized a training program in navigation, was a consultant to the U.S. Shipping Board, and served on the Occupational Selection Committee of the State Council of Defense. In 1919 he was both the Executive Secretary of the National Research Council and Chairman of its Division of Physical Sciences. In the midst of these activities, he accepted the editorship of the University of California Semi-Centennial Publications in 1918.

He was among the initiators of the Association of American Universities, served as its Secretary in 1900, and beginning in 1915 was for many years the Chairman of its Committee on Academic and Professional Higher Degrees. He was an early

and staunch supporter of the American Association of University Professors, and he served a term as national President from 1923 to 1925. From 1906 to 1910 he was Secretary of the California State Earthquake Commission.

Within the University of California, he exerted a strong influence on behalf of high standards of academic work as well as adequate support for research, not only from his positions as Dean and department head, but also as Chairman of the Board of Research from 1916 until 1935. It was his insight and perseverance, perhaps more so than any other individual, that raised the University of California to the level of a great university. For example, he early supported the work of E. O. Lawrence and provided a leading influence in obtaining the first cyclotron. Lawrence often expressed his deep gratitude for this help. When W. W. Campbell came down from Mt. Hamilton to assume the presidency of the university, Leuschner did much to ease his path and to offer helpful advice.

Within his department Leuschner was very generous with the time he devoted to his students, not only in discussing their studies or encouraging their ambitions, but also in seeing to their personal welfare if occasion required. His main astronomical interest was orbit determination, which began with his doctoral thesis and continued to the end of his career. "Leuschner's Method" was the Gospel, the Law and the Prophets in the Students' Observatory. Unfortunately it was not without its disadvantages, as came to light on several occasions. If one reads the obituary that R. G. Aitken wrote as his tribute to W. W. Campbell and if one knows what was going on behind the scenes, one can perceive that on occasion the Lick astronomers sat up all night in order to complete the computation of a comet orbit as soon as the necessary observations became available because they were apprehensive of the reliability of the predictions that came from Berkeley when Leuschner was first developing his new method. But over the years the Harvard

Announcement Cards bear testimony to the large amount of work done by Leuschner's students in computing the orbits of newly discovered comets.

It was standard operating procedure for the students to vie for the assignment if a new object was discovered. Everything possible was done in preparation (often including sandwiches and coffee), and after dark, as soon as the last observation could be completed at the Lick Observatory, it would be telephoned down to the waiting students. Then they feverishly tried to complete their task before anyone else could, especially their rivals at Harvard or in Europe. The next morning Leuschner was always eager to see their results before transmitting them and to discuss any peculiar situations that had been encountered.

In principle, Leuschner's Method is based upon a Taylor's series expansion of the apparent trajectory in terms of the position and velocity vectors at the time of the middle observation. This requires the solution for four unknowns. The error equation is solved by the Newton–Raphson approximation method. All this is relatively simple for the student in terms of its mathematical development. But the method must also be judged in terms of the computing technology available at the time. In the early days, this consisted of nothing but lead pencil and six-place logarithm tables. The alternative Gaussian method has only two unknowns, but it also has somewhat more complicated formulas to be evaluated. Thus the choice between the two becomes a question of the modifications that can be devised and one's personal preferences.

My own memorable experience came in March 1936, when the unusual minor planet, Adonis, was discovered. Three observations on three successive days had been received by telegraph in midafternoon. The students who received the assignment to compute the orbit asked me to work with them. We had desk calculators, and we began in earnest about 4:00 p.m. We dutifully followed one formula after another, but it became

apparent to me that we were getting into trouble. About 6:30 p.m. the students decided to take a break and buy some food before the stores closed. I ordered something for them to bring back for me and then quickly started to make the solution for the orbit by the Gaussian method. I was nearly finished when they returned, and they were aghast at this heresy. But I reassured them that I would take the blame.

The next morning the orbit class met at 9:00 a.m. I offered to show Leuschner my results when he entered, but he waved me aside. All he wanted were the three observations, in their original form. He wrote them on the blackboard and computed the divided differences. Then, without knowing anything about what had actually transpired, he began to explain what difficulties were to be expected in this unusual case. The Taylor's series that was actually used was truncated before the third-order term. What would the effect of this circumstance be? This new, fast-moving object was obviously very close to the earth. What would be the effect of neglecting the unknown parallax? What kind of errors would be propagated in the expansions by the first approximate solution? He concluded by estimating that the expected residuals would each be about ten minutes of arc—about 500 times as large as the accuracy one usually expected to attain. To me it was a masterful presentation, drawing upon his many experiences and reaching so deftly what I knew to be a correct conclusion. Computing a new orbit was a challenging game, to be played and won.

Leuschner was an inspiring teacher. He wanted his students to understand what they were doing, rather than just follow the formulas by rote. Only then, after his presentation, did he turn to me and ask me what value we got for Kappa. (This is the curvature of the apparent path, and if it is nearly zero, the situation is hopeless.) Fortunately the bell rang for the end of the class period and we had no personal encounter before the students. I spread my sheets on the front table. I showed him

what I had done and reminded him that he himself had already reached a dire conclusion. It just so happened that in this case his method was at a disadvantage. He never once interrupted my presentation (which, I was told afterward, was unusual), but he recognized the situation for what it was and accepted it gracefully. After some minor discussion, the information was dispatched in the name of the Students' Observatory in the usual way.

During the early years of his department, Leuschner taught a course in general astronomy, and alternated courses in practical astronomy, geodesy, orbit theory, celestial mechanics, and general perturbations. Some of this work was for the benefit of the students in civil engineering, and later some of these courses were taken over by other professors. But never the orbit course! It was reputed that only one student in the department had ever succeeded in graduating without having computed at least one orbit. That student was said to be Fredrick Leonard, and as a meteoriticist it would have stood him in good stead. It is difficult to identify the individuals who may be thought of as Leuschner's students, because the faculty included almost all of the staff of the Lick Observatory as well. Many prominent astronomers were trained in this department, and those who were most surely influenced by Leuschner would include Frank Ross, Russell T. Crawford, Seth B. Nicholson, Dinsmore Alter, Charles Smiley, Phyllis Hayford, Allan D. Maxwell, Fred L. Whipple, and Samuel Herrick.

In the area of research, Leuschner worked assiduously for many years with Dr. Sophia Levy and a few computing assistants to compute the general perturbations of the minor planets discovered by J. C. Watson, under the terms of a bequest that Watson had left to the National Academy of Sciences. Some of the more favorable cases were done by Hansen's method and the rest by the Bohlin–Von Zeipel method. This led to the construction of the Berkeley Tables. The results were reasonably satis-

factory for all except a few cases of extremely unusual orbits. The last of these, (132) Aethra, with an eccentricity of 0.38, had never been tackled. When I was ready to leave Berkeley in 1936, I promised Leuschner that I would undertake to do it. I shall never forget the smile this brought to his face: satisfaction that his Watson project would finally be completed, pleasure at seeing a young student willing to test his mettle against a formidable job, and confidence that his favorite type of astronomical work would be carried on in the future. He thanked me sincerely, and I never saw him again, except for a casual visit in 1939.

Leuschner was married at San Francisco, California, on May 20, 1896, to Ida Louise Denicke, daughter of Col. Ernst August Denicke and granddaughter of Friedrich Schuenemann-Pott. They had three children: Erida Louise, born on November 22, 1898; Richard Denicke, born on November 1, 1902; and Frederick Denicke, born on May 14, 1905. Leuschner was bereaved at the passing of his wife on November 15, 1941, and his youngest son on December 8, 1941.

Leuschner's memberships in various societies were so extensive that they are simply tabulated along with his bibliography. He received honorary doctorates from the University of Pittsburgh in 1900, the University of Michigan in 1913, and the University of California in 1938. His election to the National Academy of Sciences came in April 1913. In 1916 he received the James Craig Watson Gold Medal of the Academy, and in 1924 he was made a Knight of the Order of the North Star, Sweden. With the founding of the International Astronomical Union in 1919, he was elected President of Commission 20 on Minor Planets, Comets and Satellites—a position he held until 1938. In 1934 he was elected a foreign member of the Royal Physiographical Society at Lund. He received the Bruce Medal of the Astronomical Society of the Pacific in 1936 and the Rittenhouse Astronomical Society Medal in 1937. His crowning

joy was in being invited to deliver the Halley Lecture at Oxford University, England, in 1938. The title, "Minor Planets of the Hecuba Group," provided the subject for which he had full well "the cue for passion."

SOCIETY MEMBERSHIPS

Deutschen Astronomischen Gesellschaft
American Mathematical Society
American Astronomical Society, Vice-President, 1926–1928
Astronomical Society of the Pacific, President, 1907–1908, 1936–1937
Fellow, American Association for the Advancement of Science, Chairman Section A, 1915; President of the Pacific Division, 1931
National Academy of Sciences
Washington Academy of Sciences
California Academy of Sciences
Fellow, Royal Astronomical Society
Royal Physiographical Society, Sweden
Knight of the Order of the North Star, Sweden
International Astronomical Union, President of Commission 20 on Minor Planets, 1919–1938
International Geophysical Union
Rittenhouse Astronomical Society, Philadelphia
American Association of University Professors, President, 1923–1925
Association of American Universities, Chairman of the Committee on Academic and Professional Higher Degrees
American Philosophical Society
American Seismological Society
Geological Society of America
American–Scandanavian Foundation, Vice-President of the California chapter
Educational Foundation of Commission for Relief to the Belgians
Cosmos Club, Washington
University Club, San Francisco
Claremont Country Club, Oakland
Faculty Club, University of California
Authors' Club, London, England
Sigma Xi, Executive Committee 1932–1938
Delta Tau Delta, Distinguished Service Chapter, 1939

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KEY TO ABBREVIATIONS

Astron. J. = Astronomical Journal
Astron. Nachr. = Astronomische Nachrichten
Bull. Nat. Res. Counc. = Bulletin of the National Research Council
J. Proc. Addr. Assoc. Am. Univ. = Journal of Proceedings and Addresses of the Association of American Universities
Lick Obs. Bull. = Lick Observatory Bulletins
Proc. Nat. 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
Publ. Lick Obs. = Publications of the Lick Observatory
Sci. Mem. Nat. Acad. Sci. = Scientific Memoirs of the National Academy of Sciences
Univ. Calif., Univ. Chron. = University of California, University Chronicle

1889

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