SELF-STYLED CURMUDGEON, W. J. LUYTEN, 1899–1994

Dorrit Hoffleit
Department of Astronomy
Yale University
New Haven, CT 06520-8101

Received: December 31, 1995

Abstract

Willem J. Luyten (1899–1994), Ejnar Hertzsprung's first graduate student at Leiden, overcame many obstacles to achieve outstanding success in his search for white dwarf stars. When he was first employed at Harvard Observatory in 1923, only three white dwarfs had been recognized. Among the over half-million high proper motion stars he discovered, he found about 7000 white dwarfs. From age 15, his earliest observations were of variable stars, in which he maintained a lively interest all his life.

1. Introduction

Although the designation was appropriate, a man who would call himself a "curmudgeon" must have had a redeeming sense of humor. What made Willem J. Luyten the way he was? He will long be remembered for his extensive catalogues of high proper motion stars (98,218 southern stars obtained from measurements of Harvard 24-inch Bruce plates, and 300,000 from Palomar 48-inch Schmidt plates—approximately 20 times as many as were determined by others within the same 72-year span). This colossal amount of work was carried out as a means of discovering white dwarfs, only three of which had been accidentally discovered when he undertook his systematic survey. Now over 7000 are known, the vast majority discovered by Luyten himself.

His early work with the Harvard plates was carried out with an old-fashioned blink microscope, hand operated with manually recorded measurements of rectangular coordinates on the plates. For the far greater task of measuring the Palomar plates, some containing upwards of half a million star images, he felt the need of an automatic measuring engine. He solicited the help of Control Data Corporation, where engineers Robert L. Lillestrand and A. E. LaBonte designed and built an automatic blink machine capable of measuring the coordinates and diameters of 50 images per second to an accuracy of one micron. The accompanying computer then printed out the equatorial coordinates, red magnitudes (usually between magnitudes 11 and 19) based on the diameters, and the annual proper motions that exceeded 0".08, as ascertained from the differences between pairs of plates separated by about 9 to 20 years.

Besides his numerous catalogues, Luyten published many articles based on these data, luminosity functions for nearby stars (relative numbers of stars for successive absolute magnitude intervals), double stars with high proper motion, variable stars found during blinking of the Harvard plates, and miscellaneous other publications. In all, including some 200 articles for *The New York Times*, Luyten published nearly 800 articles (ten or more after the publication of his autobiography in 1987).

2. Honors and errors

Late in life numerous honors were conferred upon Dr. Luyten: the Watson Medal of the National Academy of Sciences (1964); the Bruce Medal of the Astronomical Society of the Pacific (1968); membership in the National Academy of Sciences (1970);

D.Sc. from St. Andrews University in Scotland (1970); and asteroid No. 1964 was named for him. With so many achievements, why should he be remembered as a curmudgeon? This seems like a case of "whip a docile dog too often and he becomes aggressive."

Luyten encountered numerous events of discrimination, starting in his student years. Once, when we were discussing Cecilia Payne Gaposchkin's autobiography, I remarked to him that so much was being written about discrimination against women, I felt it time we heard about discrimination against men, and suggested he write his autobiography. He promptly replied he had already done so and that it was being edited. He sent me a preview copy of *My First 70 Years of Astronomical Research: Reminiscences of an Astronomical Curmudgeon, Revealing the Presence of Human Nature in Science* (Luyten 1987a). It was privately published with a few additions two years later. Luyten had a knack for finding fault with the researches of others, particularly when they rediscovered some of his high proper motion stars without according him due credit. In general he was correct in his criticisms, but almost invariably lacking in tact: it seemed as though he correlated diplomacy with hypocrisy, which he could not tolerate. I sometimes jested that you could not be a good astronomer unless you were on Luyten's black list, so many of the most respected astronomers of the time came under his criticism; some he even described in print as liars.

3. Early life with ups and downs

Willem Luyten was born of Dutch parents in Java in 1899. It was Halley's comet in 1910 that inspired him to study astronomy. In 1912, the family returned to Holland, where young Willem began observing variable stars, at first with binoculars, then with small portable telescopes. He joined the AAVSO (founded at Harvard in 1911) as its youngest charter member. In 1916, he entered the University of Amsterdam. Because of the black-outs of World War I, young Luyten took advantage of the dark skies to continue his variable-star observing with a portable telescope. This almost got him into trouble with the police, who assumed the equipment he was carrying home was stolen. Fortunately he had documents from Harvard with him to prove his work was legitimate.

Twice while at the University he learned of a prize essay to be written on a specific topic for which data had been secured by older astronomers. Both times when he asked for the application forms, he was told that the necessary data or preliminary computations had already been given other students, which would have made it almost futile for him to carry out the necessary analyses on time. In one of these instances, it was the son of the astronomer who had made the observations to be analyzed who was awarded the prize. The inequality of opportunities indeed irked Luyten. But these were only the first of the apparent injustices he was to experience.

When he had completed the preliminary requirements for his doctorate at Leiden, but before he had chosen a thesis, he was offered a job at Lick Observatory. Concerned that he might have to learn a great deal all over again if he were away from the University for several years, he sought the advice of his teacher, Ejnar Hertzsprung. A great lover of variable stars, Hertzsprung recommended that Luyten (his first pupil at Leiden) write a thesis based on the variable star observations he had made as a high school student. This Luyten accomplished in the six weeks before he was to leave for America. Years later when he revisited Holland, one mathematics professor remarked that he had seen just one thesis poorer than Luyten's!

4. Initiation of the Bruce Proper Motion Survey

After spending 1921–23 at Lick, Luyten was employed at Harvard College Observatory. At that time, the companion to Sirius, the companion of o^2 Eridani, and van Maanen's star (Wolf 28) were the only known white dwarfs. Luyten conceived the idea of searching for more by looking for white stars with high proper motions. He was to use an old blink microscope to scan plates taken with Harvard's ten-inch Metcalf telescope; but neither the blink nor the plates proved suitable. However, the plates taken with the 24-inch Bruce telescope did seem suitable, although only early epoch plates were available. He proposed going to South Africa to take second epoch plates (average time interval about 20 years), for which he was granted a Guggenheim Fellowship. This was the time when the Harvard southern station had been transferred from Arequipa, Peru, to Bloemfontein, South Africa. Only after Luyten arrived in Bloemfontein did he learn that the Bruce telescope had not yet been mounted and he necessarily lost a lot of time. By February 1930 he finished taking the first 300 plates to pair with those taken earlier. Regular assistants at the Southern Station later took some 1000 more.

5. Fired from Harvard. Why?

Just before Luyten returned to Harvard he was surprised to be informed that his appointment would end as of September 1930. No reason seems to have been given, but it is surmised that hard feelings between Luyten and the "Dean of Astronomers," Henry Norris Russell, may have played a role. (Russell had been mentor to his graduate student Harlow Shapley at Princeton, and Shapley still heeded Russell's opinions.) While still at Lick, Luyten had written a paper in which he compared early Mount Wilson spectroscopic absolute magnitudes with those computed from Allegheny trigonometric parallaxes. He concluded that if all the M-type giant stars were assigned the same absolute magnitude, the dispersion of the differences from the magnitudes based on the trigonometric parallaxes would be significantly reduced. Director Campbell approved the paper, but when Russell visited Lick, Luyten quotes Russell as having said, "Even if this were true, I could say it; you can't," to which young Luyten responded, "I thought that in science the only thing that mattered was WHAT was said, not WHO said it." Luyten in his autobiography implies that this response, as well as a few subsequent encounters after he came to Harvard, made Russell his enemy for life.

Russell, as a visitor at Harvard, had given a colloquium on the mass-luminosity relation of binary stars. Shortly thereafter Shapley showed Russell the manuscript of Luyten's paper on the nearby stars (Luyten 1923) in which Luyten had independently derived a mass-luminosity relation (log mass = a + bM, where M is the absolute magnitude). Russell immediately, but mistakenly, accused Luyten of having plagiarized the formula from his, Russell's, colloquium. Luyten responded immediately that Hertzsprung (1919) some four years previously had derived a closely similar equation. In conciliation, Luyten revised his paper to read, "An exhaustive treatment of the subject has been given by Professor H. N. Russell," citing two references (Russell 1923 and Russell *et al.* 1923), and relegated Hertzsprung's formulae to a footnote. Neither of the two references to Russell actually gives any formula; nor in Russell's extensive bibliography (Shapley 1957) do I find any other reference where Russell did publish his formula. Luyten himself derived the relation that would best fit the masses Russell had derived. The following formulae occur (mainly in a footnote on page 88) in Luyten's extensive paper, to which I have added the formula Russell used in his later valuable catalogue of dynamical parallaxes (Russell and Moore 1940, p.112):

Log Mass =	-0.06 (M - 5)	Hertzsprung 1919
	-0.084 (M - 5)	Hertzsprung 1923
	-0.065 (M - 4.8)	Luyten from Russell data 1923
	-0.09 (M - 4.8)	Luyten 1923
	-0.105 (M - 5.23)	Russell and Moore 1940

In view of the paucity of data available at the earlier times, the accordance of these various determinations should have been greeted with satisfaction, not as a contest for priority of discovery. Russell, moreover, was irritated that Luyten, a disciple of Hertzsprung, always referred to what we now call the *HR diagram* as the *Hertzsprung diagram*, whereas all Americans referred to it as the *Russell diagram*. Unhappily, not only did Luyten meet with opposition to some of his scholastic work at Harvard, he suffered a handicap that might have deterred another astronomer from further observational work. In 1925, while playing tennis with the grandson of the poet Henry W. Longfellow, he lost one eye when the ball struck him.

6. *New York Times*: Transition to Minnesota

Upon his return to America in 1930, Luyten had difficulty finding a job in an observatory. He had frequently written outstanding astronomical articles for *The New York Times*, notably when he wrote up his observations of the eclipse of 1925 as viewed from an airplane, and again when *The New York Times* commissioned him to survey the Grootfontein meteorite in South Africa (Luyten 1929). Hence, at his time of need he was given a job at *The New York Times*.

One day, while he was not at home, Cecilia Payne (who at Russell's behest had previously toned down her own important Ph.D. thesis-conclusion about the stellar abundance of hydrogen) came to visit the Luytens. He told me many years later that Cecilia had gotten on her knees to beg his wife to make sure that Willem did not give up astronomy. The editors of *The New York Times* thought so highly of Luyten that he inferred it was they who helped get him his job at the University of Minnesota, where he spent the remainder of his long and fruitful life. He was permitted to borrow the Bruce plates from Harvard to continue with the project he had initiated. He also took from Harvard the manual blink measuring machine that Yale's Professor Frank Schlesinger (1926) had built for him when the older Harvard equipment proved unsuitable. He completed the measurements of the Bruce plates in 1937, their reductions for publication by 1964.

7. Penalized for pointing out errors

Meanwhile, Luyten wrote numerous papers, many pointing out errors in other people's work. While at Harvard he had examined Bruce plates on the cluster M3, where he found a high proper motion star adjacent to a stationary bright star—a typical optical double. He did not specifically call attention to this, but when fair-haired young Kopal at Harvard in 1939 made the same discovery on the same plates and published a paper in which he described the pair as either an optical or binary system but clearly favored the binary with an orbital period of about 700 years, Luyten was upset. The bright star was a typical yellow star at probably a distance of some hundreds of parsecs so that the apparent "orbital motion" would imply an exorbitant mass some 60,000 times the mass of the sun. He sent this conclusion to Shapley, who promptly replied that if Luyten were to publish this conclusion, he would get no further support from Harvard for his proper motion project (i.e., he could no longer borrow the plates he had gone to such trouble to obtain). Needless to say, this gem was not published until his autobiography. Couteau (1956) ultimately proved that the double is indeed optical.

8. The fastest fully automatic blink machine

Having completed the Bruce Proper Motion Survey, which covered primarily the southern hemisphere, Luyten realized that the Palomar Sky Survey Plates taken with the 48-inch Schmidt type telescope would be very satisfactory for surveying the northern hemisphere, and also to much fainter magnitudes than were available with the Bruce. On the basis of a few sample regions, he realized that with the old fashioned equipment he had previously used it would take so much time to scan the plates that at best he could only carry out a small sample. He therefore conceived of building the automatic blinking and measuring machine which should accomplish the entire task in a reasonable number of years—a machine that exceeded everyone's greatest expectations.

When he had completed his intended project and would have liked to have the machine transferred to Mount Wilson, where further work on the Palomar plates could be carried out, he met with opposition, fully described with considerable bitterness in one of his latest publications (Luyten 1987b). The machine remained at Minnesota, but no longer under his jurisdiction.

9. Dr. Jekyll and Mr. Hyde

Having encountered several unfortunate obstacles throughout his busy and productive career, it is small wonder this gifted researcher became and remained a curmudgeon. The fact that Shapley "fired" him, as he describes it in his autobiography, was perhaps his greatest setback. Nevertheless, he could say, "Yet in many ways Shapley was a good administrator. There were many plus points, and he certainly brought and kept the Harvard Observatory in the forefront of American astronomy." For me it has been painful learning of the apparent injustices perpetrated on Luyten, as well as his often exaggerated reactions to the unfavorable acts of astronomers whom I have otherwise greatly admired and respected. Like Luyten in his final evaluation of Shapley, most of us learn that there is a Dr. Jekyll and Mr. Hyde in everyone.

One instance of Luyten's sense of humor is noted by his gleeful quotation from the Surgeon General of the United States. Luyten had applied for a National Science Foundation grant for meeting the expenses of his attending a 1970 conference at St. Andrews University in Scotland on White Dwarfs. This inspired the Surgeon General to demand a yes or no answer to two questions:

> 1. Are human subjects going to be used for experimentation in your conference on White Dwarfs?
>
> 2. You realize that Federal funds may not be used for segregated conferences.

Luyten's response to the second was that, should the conference prove a success, the organizers would plan another on Yellow Degenerates. This, he noted later, was before the thaw with China!

10. Variable stars

Luyten is less likely to be remembered for his work on variable stars than for his work on proper motions, luminosity function, and especially white dwarfs. Yet it is in the field of variable stars that he encountered the fewest obstacles and greatest friendships. The AAVSO certainly remembers him in his most charming light, from his once having been its youngest member to finally its oldest. Among his hundreds of publications there are about sixty dealing with variable stars. A few examples are cited here.

Between 1915 and 1919, he observed 214 variables, totalling 13,500 magnitude estimates. For the long period variables, he computed O-C values based on earlier period determinations and then derived new periods, paying special attention to possibly varying periods. He extensively amplified and modified the material in his thesis (Luyten 1921) in a later publication (Luyten 1922). His continuing interest in changing

Illustration 1. Willem J. Luyten operating the manual blink machine in his laboratory at the University of Minnesota. Photo by Leon Bonrud (1986); reproduced courtesy of Willemina Miedema (Mrs. Willem J.) Luyten.

periods was exemplified later by his thorough investigation of SX Her (1923), with periods changing around 100 days, and RZ Cep (Leavitt 1925).

Henrietta Leavitt had discovered the RR Lyrae type star RZ Cep in 1907. This star proved to be an exceptionally interesting star when it was discovered to have a changing period and a high space velocity. In 1921, Miss Leavitt had almost finished an analysis of all the available data when she died. Luyten completed the analysis and wrote the paper (Leavitt 1925). Two abrupt changes in period seemed to represent the light variations best. The current *General Catalogue of Variable Stars* (Kholopov *et al.* 1982) lists seven successive periods oscillating between 0.308697 and 0.3086203 day, and indicates variations in amplitude and shape of light curve varying in a period of about 29 days.

In 1918, Luyten discovered Nova Aql No. 3, on June 8, as did numerous others in Europe the same day; but Noel Bower of Madras, India, was evidently the earliest (Prager 1934). However, Luyten (1927) was the first to find a nova in the large Magellanic Cloud, RY Dor, magnitude 12.4 on September 8, 1926, but fainter than 16 at minimum on the Harvard plates.

In the course of his searches for high proper motion stars, Luyten (1927) published proper motions for eleven known RR Lyrae stars.

While examining the Harvard Bruce plates, Luyten (1938) discovered 2350 new variable stars. At the time of their discovery they could not be examined on a sufficient number of plates to ascertain types or periods. Many still need to be verified. Luyten (1949) also has the distinction of having been the first to identify UV Ceti as the prototype flare star. This was the third flare star to have been discovered; the first two were discovered by van Maanen, WX UMa in 1940 and YZ CMi in 1943. Now about 750 are known.

The most impressive conclusion reached from a survey of the life of Willem J. Luyten is that obstacles can incite a greater determination to succeed. We trust that this loyal friend of the AAVSO will long be remembered for his monumental contributions to astronomy.

References

Abt, H. A. 1968, *Publ. Astron. Soc. Pacific*, **80**, 247.
Couteau, P. 1956, *Journ. des Obs.*, **39**, 143.
Hertzsprung, E. 1919, *Astron. Nach.*, **208**, 89.
Hertzsprung, E. 1923, *Bull. Astron. Inst. Netherlands*, **2**, 18.
Hoffleit, D. 1969–1970, 1984–1987, private communications.
Kholopov, P. N. *et al.* 1982, *General Catalogue of Variable Stars*, 4th ed., Moscow.
Kopal, Z. 1939, *Bull. Harvard Coll. Obs.* No. 911, 33.
Leavitt, H. A. 1925, *Cir. Harvard Coll. Obs.*, No. 261. (Miss Leavitt did much of the research, but W. J. Luyten wrote the final analysis after her death.)
Luyten, W. J. 1921, *Observations of Variable Stars*, dissertation, Leiden University.
Luyten, W. J. 1922, *Ann. Leiden Obs.*, **13**, Pt. 2.
Luyten, W. J. 1923, *Ann. Harvard Coll. Obs.*, **85**, Pt. 5.
Luyten, W. J. 1927, *Bull. Harvard Coll. Obs.*, No. 847, 8.
Luyten, W. J. 1929, *South African J. Sci.*, **26**, 19.
Luyten, W. J. 1938, *Publ. Minnesota Obs.*, **2**, No. 6.
Luyten, W. J. 1981, *Proper Motion Survey with the 48-inch Schmidt Telescope*, No. 58, 9.
Luyten, W. J. 1987, *My First 70 Years of Astronomical Research: Reminiscences of an Astronomical Curmudgeon, Revealing the Presence of Human Nature in Science*, privately published.
Luyten, W. J. (undated; 1987 or later), *Proper Motion Survey with Schmidt Telescopes*, No. 73.
Prager, R. 1934, *Geschichte und Literatur des Lichtwechsels*, Berlin, **1**, 81.
Russell, H. N. 1923, *Pop. Astron.*, **31**, 250.
Russell, H. N., Adams, W.S., and Joy, A.H. 1923, *Publ. Astron. Soc. Pacific*, **35**, 189.
Russell, H. N., and Moore, C. E. 1940, *The Masses of the Stars*, Univ. Chicago Press, 326.
Schlesinger, F. 1926, *Astron. J.*, **37**, 45.
Shapley, H. 1957, *Biog. Mem. Nat. Acad. Sci.*, **32**, 354.