Biographical Encyclopedia of Astronomers

Banachiewicz, Thaddeus Julian

Born Warsaw, Poland, 13 February 1882

Died Cracow, Poland, 17 November 1954

Thaddeus Banachiewicz combined unusual talents as a theoretician and an astronomical observer to make substantial contributions in celestial mechanics, mathematics, and geophysics. He was the

Youngest of the three children of Artur Banachiewicz, a landowner at Cychry (a village near Warsaw), and Zofia (née Rzeszotarski).

Banachiewicz studied astronomy at Warsaw University; he received a bachelor's degree in physical and mathematical sciences in 1904. His dissertation on the reduction constants of the Repsold heliometer earned a Gold Medal from the university senate. Banachiewicz continued his studies in Göttingen, Germany (1906–1907) under Karl Schwarzschild and later in Pulkovo, Russia (1908) under Jöns Oskar Backlund. On his return to Warsaw, Banachiewicz was appointed junior assistant at the University Observatory In January 1910, following further studies in Warsaw and Moscow, Banachiewicz was engaged as an assistant at the Engelhardt Observatory near Kazan, Russia, where he stayed until 1915. Banachiewicz then moved to Dorpat (now Tartu, Estonia) in 1915 as an assistant, but in September 1917 - when he obtained the degree of Magister Astronomiae - he was appointed assistant professor, and later promoted to associate professor and director of the University Observatory.

In 1918, Banachiewicz returned to Poland as a lecturer in geodesy at the Warsaw Polytechnic School, but was soon appointed full professor, chairman of the astronomy department, and director of the observatory at the Jagiellonian University in Cracow. Banachiewicz held these positions until his death in 1954, excluding an interruption of over five years during the German occupation of Poland, when Nazi forces removed the university faculty, including Banachiewicz, to the Gestapo concentration camp at Sachsenhausen near Berlin. After three months at Sachsenhausen, Banachiewicz was allowed to return to the observatory, renamed "Die Krakauer Sternwarte" by the Germans, where he was permitted to resume his astronomical work

After World War II, in addition to his duties at the Jagiellonian University, Banachiewicz also accepted the duties of professor of higher geodesy and astronomy at the Cracow University of Mining and Metallurgy for six years (1945–1951).

Banachiewicz's scientific interests were wide, encompassing astronomy, geodesy, geophysics, mathematics, and mechanics. His principal scientific achievements were generated through the use of the Cracovian calculus, a method he invented

As Witkowski and Mietelski have noted, before 1927 there was only one way of solving spherical polygons by resolution into triangles. By using the Cracovian calculus, in 1927 Banachiewicz obtained the general relations of spherical polygonometry in two forms: one which presents the generalized formulae of Gauss-Cagnoli previously known in spherical trigonometry, while the other yields the generalized formulae of Jean Delambre. In 1942, Banachiewicz developed a practical but elegant Cracovian algorithm for the least-squares method. Other achievements include Banachiewicz methods of solving the systems of linear

equations (both symmetrical and unsymmetrical), and rapid computation of determinants of any degree

Another astronomical area in which Banachiewicz's theoretical contributions were important is in the determination of a parabolic orbit. He demonstrated that the various approaches of the classical authorities (Carl Charlier, Adrien Legendre, Armin Leuschner, S. D. Tscherny, and Hermann Vogel) could, at times, give three different solutions. Banachiewicz showed that the equation of Johann Lambert could not be used in these singular Under these circumstances, he adapted Heinrich Olbers' method to arithmetic calculations using vectorial elements and eliminating some auxiliary angles. Textbooks today identify this thoroughly modified way of determining parabolic orbits as the Banachiewicz (Olbers) method. Banachiewicz also simplified existing procedures for determining elliptical orbits by introducing the chord-joining positions of the body instead of their heliocentric angles; some years earlier he had published several papers on Gauss's equation and provided useful tables for solving it. The practical value of Banachiewicz's orbital calculation methods may be illustrated by the fact that in 1930 an early orbit of Pluto was determined by Banachiewicz and Charles Smiley of Brown University, who was, at that time, studying in Cracow.

As an observational astronomer in Kazan, Banachiewicz carried out a 5-year series of heliometer observations of the Moon. Reductions of these observations by J. Mietelski (1968) by applying the Cracovian method yielded values of the principal physical libration parameters very close to modern values derived from lunar laser ranging techniques and from perturbations of lunar orbiters.

As a student, Banachiewicz began to observe occultations of stars by the Moon in 1901 and to calculate their ephemerides (and also those of occultations by planets and their satellites). He viewed these as important phenomena for the study of the Moon's motion. In this respect, Banachiewicz anticipated, by two decades, the work of Ernest Brown. In a similar way, Banachiewicz anticipated the work of Bertil Lindblad and others using solar eclipse phenomena for geodesy Banachiewicz organized geodetic surveys in Poland and conducted several Polish solar eclipse expeditions. Using the Baily's bead phenomenon, Banachiewicz's chrono-cinematographic method established the difference (moon-sun) in right ascension with a standard error of only ±0.04 arcseconds during the Lapland eclipse on June 12, 1927. As a result, at the 1928 meeting of the Baltic Geodetic Commission in Berlin, Banachiewicz proposed using total eclipses to connect distant points on the Earth's surface; in this way, a "lunar triangulation" could facilitate geodetic bridging of the oceans. Banachiewicz's ideas and techniques were applied to great advantage in the 1940s and 1950s on eclipse expeditions sponsored by the National Geographic Society and various US defense agencies.

Banachiewicz founded the Polish journal *Acta Astronomica* in 1925 and many publications of the Cracow Observatory. He was the first in Poland to recognize the importance of the emerging field of radio astronomy and inaugurated the first Polish radio telescope near Cracow in 1954.

Banachiewicz was a member of the Warsaw Scientific Society, the Poznań Society of Friends of Science, the Polish Academy of Arts and Sciences, and the Padua Academy. He was a foreign associate of the Royal Astronomical Society. He was also a founder of the Polish Astronomical Society in 1923 and served for 10 years as its president. In 1952, Banachiewicz was a titular member of the Polish Academy of Sciences

From 1924 to 1926, Banachiewicz served as vice president of the Baltic Geodetic Commission. He was also vice president and a member of the Executive Committee of the International Astronomical Union (IAU) from 1932 to 1938, and president of IAU Commission 17 (Movements and Figure of the Moon) from 1938 until 1952. Three universities conferred

honorary doctorates upon Banachiewicz: Warsaw (1928), Poznań (1938), and Sofia (1950). The minor planet (1286) was named Banachiewicz, as was a 70-km crater on the far side of the Moon.

In 1931, Banachiewicz married Laura (or Larysa) Solohub-Dykyj, a Ukrainian poetess. There were no children from this marriage

The personal data of Banachiewicz and documents concerning his Cracow collaborators and the Cracow University Observatory under his direction are held in the Archives of the Jagiellonian University, Cracow, Poland. The "Notaty codzienne" (a daily diary kept by Banachiewicz during the years 1932–1954, five volumes) is held privately by Jerzy Kordylewski in Cracow and may be accessed through the Jagiellonian University Observatory.

Jan Mietelski

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