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(*b*. Warsaw, Poland, 13 February 1882; *d*. Krakow, Ploand. 17 November 1954)

Astronomy.

The younger son of Arthur Banachiewicz, a landowner in the Warsaw district, and Sophia Rzeszotarska, Banachiewicz received his bachelor's degree in astronomy in 1904 from Warsaw University, where one of his astronomical papers had earlier won a gold medal. He continued his studies in Gottingen under Schwarzchild and in Pulkovo. After his return to Warsaw he was junior assistant at the Warsaw Observatory in 1908-1909. In 1910 he received the master's degree in astronomy from Moscow University and soon afterward was appointed assistant at the Engelhardt Observatory, near Kazan, where he stayed until 1915. For the next three years he taught at Dorpat. He returned to Warsaw in 1918 and for a short time was Dozent of geodesy at the Warsaw Polytechnic High School. Toward the end of that year he accepted the professorship of astronomy at the University of Krakow and directorship of the Krakow Observatory. He spent the rest of his life in Krakow, the only interruption occurring in the winter of 1939/ 1940, when the Krakow faculty was taken to the Gestapo concentration camp at Sachsenhausen, near Berlin."

Banachiewicz's work concerned many important problems of astronomy, geodesy, geophysics, mathematics, mechanics, and numerical calculus. His principle of repeated verification made his 240 published papers safe from errors. His most important astrodomical and geodetical work was theoretical. As early as 1906 a paper of his that dealt with Lagrange's three-body problem was presented to the Paris Academy by Poincaré. The paper, "Über die Anwendbarkeit der Gyldén-Brendelschen Störungstheorie auf die Jupiternahen Planetoiden," gave a brilliant analysis of Gyldén-Brendel's theory, pointing out its illusiveness when applied to small planets in the vicinity of Jupiter.

He also published several papers on Gauss's equation and gave useful tables to facilitate its numerical solution. These tables have been reprinted in J. Bauschinger and G. Stracke's *Tafeln zur theoretischen Astronomie*.

Banachiewicz paid considerable attention to multiple solutions in the determination of parabolic orbits Legendre, Charlier, Vogel, and others claimed to have solved the question in the sense that the two equations obtained in the process of determining a parabolic orbit from three observations lead to a single solution. Banachiewicz showed that they were basing their reasoning on Lambert's equation, which fails in certain circumstances, In these exceptional cases three solutions are possible, as he demonstrated with a fictitious numerical example.

One of Banachiewicz's great achievements in theoretical astronomy was the simplification of Olbers' method of determining parabolic orbits. These new methods used a much improved technique of computing, for which Banachiewicz had invented the cracovian calculus. The cracovians are related to Cayley's matrices but differ in the definition of the product, the cracovians being multiplied column by column. This change in the product rule leads to considerable differences between the theories of Cayley and Banachiewicz and makes cracovians more suitable for machine computation. The invention of rotary cracovians enabled Banachiewicz to obtain the solution of the general problem of spherical polygonometry, which had been sought for over a century. Having these new formulas at his disposal, he simplified Bessel's classic method of reducing heliometric observations of the moon's libration. He successfully applied the cracovians to the correction of orbits and gave a simple, practical, and elegant solution of the problem. Convenient cracovian formulas were introduced by Banachiewicz for computing the precessional effect of star coordinates, and his orthogonal transformation formulas facilitated the reduction of the vectorial elements of planets and comets from one epoch to another.

Banachiewicz's investigations into the theory of linear equations produced interesting applications of the cracovian method to such problems as the reduction of astrographic plates, here cracovian formulas led to a general solution that comprised the formulas of Turner and those of the dependency method. He also simplified the classical method of least squares the cracovin method is well suited to numerical computation. Its importance lies in the fact that the unknowns and their weights are found simultaneously during the process of computation, which is not the case in Gauss's method.

Banchiewicz was not only a prominent theorist but also a gifted and assiduous observer. While a student he promoted observations of occultations of stars by the moon, insisting on their importance for the study of the moon's motion, and developed a purely mathematical method for predicting occultations of stars that had great advantages over the graphical methods. He was also interested in occultations of stars by planets. His ephemerides drew attention to the occultation of 6G Librae by Ganymede, Jupiter's III satellite, on 13 August 1911, which was unique in the history of astronomy because it was the only occultation of a bright star by a planet's satellite to be predicted and observed. From probability considerations one may conclude that an occultation of a star of magnitude ≤7 ″ by Ganymede occurs once in a thousand years. While in Kazan he carried out very precise observations of the moon's libration with a four-inch heliometer. Banachiewicz attached much importance to observations of eclipsing variables and introduced them into the working program of the Krakow Observatory. He considered eclipsing binaries the clue to many important questions of the sidereal universe and insisted on gathering observational material for "the future Kepler of eclipsing binaries,"04. Banachiewicz proposed to use total eclipses for "lunar triangulations" capable of connecting distant points of the earth's surface.

In astrophysics Banachiewicz was especially interested in photometric problems. Besides the photometry of variable stars he was interested in the illumination of planetary disks and of our sky. He was the first in Poland to appreciate the value of radio signals for the time service and of phototubes in photometry. At his urging the first Polish radio telescope was installed at Fort Skala, a branch station of the Krakow Observatory. Polish astronomy is also indebted to him for his organizational activity. Because of the poor observing conditions at the old Krakow Observatory, he set up a branch station on Mount Lubomir, about nineteen miles south of Krakow. Many observations of variable stars were made there, and several new comets were discovered The station was burned down by a Gestapo detechment in 1944, but shortly before his death Banachewicz began the building of a new branch station at Fort skala.

Banachiewicz was founder and editor of *Acta astronomica, Ephemerides of Eclipsing Binaries, and Circulaire de l'Observatoire de Cracovie.*

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II. Secondary Literature. Banachiewiez's tables are reprinted in Julius Bauschinger, *Tafeln zur theoretischen Astronomie*, 2nd ed. by G. Stracke)Leipize, 1934); table 22, "Auflösung der Gauss'schen Gleichung," pp. 126-130, is identical with Banchiewicz's. See also Stracke's *Bahnbestimmung der planeten und Kometen, ch.* 13, which concerns Banachiewicz's method of determining parabolic orbits; fourteen of Banchiewicz's papers are also cited.