

Biographical Encyclopedia of Astronomers

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Eckert, Wallace John

Born Pittsburgh, Pennsylvania, USA, June 19, 1902

Died Englewood, New Jersey, USA, August 24, 1971

American celestial mechanic Wallace Eckert pioneered the application of punch-card computing machines to problems of astronomical orbit determination. He was the son of farmers John and Anna (Née Heil) Eckert, and received degrees from Oberlin College (AB: 1925), Amherst College (AM: 1926), and Yale University (Ph.D. in astronomy: 1931, with a thesis on the orbit of Trojan-type minor planet (624) Hector, completed under Ernest Brown). From 1926 to 1940, Eckert served on the astronomy department faculty of Columbia University, rising to the level of professor of celestial mechanics. He spent his last two professional years, 1968–1969, at Yale University, and throughout his career was particularly generous in providing computational facilities for the astronomers at Yale University working on planetary, asteroid, and satellite orbits

In 1933, Eckert worked on developing a punch-card accounting machine for astronomical calculations at the automatic scientific computing laboratory at Columbia University. The laboratory became the Thomas J. Watson Astronomical Computing Bureau in 1937 as a joint project between the university and International Business Machine Corporation [IBM]. The Watson Laboratory led the way in developing large-scale computers for use in World War II.

In 1940, Eckert became the director of the Nautical Almanac Office of the United States Naval Observatory and served in that capacity until the end of World War II. He published his book *Punch Card Methods in Scientific Computation* in the same year. During the war, the Almanac Office used automatic calculation methods to develop celestial navigational charts and tables for use by the US Army and US Air Force. The first *Air Almanac* was published in 1940.

At the end of the war, Eckert left the Nautical Almanac Office to become the director of the Watson Scientific Computing Laboratory, a department of pure science at IBM. He held this position for 23 years. The laboratory served as a major computer research and training facility in all branches of science. Hundreds of scientists were trained in scientific computation there

In early January 1948, Eckert and a team from IBM finished the Selective Sequence Electronic Calculator [SSEC], which is considered the first true electronic computer. On January 27, 1948, the SSEC became the first electronic computer to accomplish the difficult task of calculating the Moon's position. This hybrid machine was made of several storage systems that included 12,500 vacuum tubes and 21,400 mechanical relays. Its memory section consisted of eight vacuum tubes, 150 words on a memory relay, and 66 loops of banded paper that could store 20,000 words of 20 digits each. This machine could read its instructions either from one of the paper loops or from memory

In 1954, Eckert and his team completed the Naval Ordnance Research Calculator [NORC]. At the time of its construction, NORC was the most powerful computer in the world. Eckert used SSEC and NORC to compute precise planetary positions and refine lunar theory. In 1951, he published his book *Coordinates of the Five Outer Planets*. This work consisted of precise orbital calculations for the planets Jupiter, Saturn, Uranus, Neptune, and Pluto.

In the late 1950s and early 1960s, Eckert worked on developing precise positions of the Moon based on the formulas developed by astronomer and mathematician Ernest Brown. Brown's formulas consisted of about 1,650 trigonometric terms, with many of them being variable coefficients. Eckert realized that using Brown's tables alone as a basis for improving the accuracy of knowing the Moon's position was no longer viable. He therefore developed a computer program to calculate the lunar position using Brown's formulas directly instead of relying on tables based on the formulas. In 1965, Eckert was able to determine that there must be a concentration of mass near the lunar surface that was causing slight variations in the Moon's orbital position. These mass concentrations (known as mascons) were later proven to exist when they caused fluctuations in the orbital elevation of a spacecraft in lunar orbit as the craft passed over the mascons. Eckert's lunar positions were accurate to within a few feet per century and included accounting for lunar oscillations as small as 1 inch.

In 1966, Eckert was awarded the James Craig Watson Medal of the National Academy of Sciences, and in 1968, he received an honorary doctorate of science from Oberlin College. Eckert retired from IBM in 1967 and from his professorship of celestial mechanics at Columbia in 1970

Without the pioneering computer work done by Eckert, his staff, and students in determining the exact position of the Moon at any given time, the manned landings on the Moon might not have been possible by the end of the 1960s. A nearside lunar crater at 17.3 N; 58.3 E was named in 1973 by the International Astronomical Union to honor Wallace John Eckert, and the minor planet (1750) Eckert was named for him.

Robert A. Garfinkle

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