

Biographical Encyclopedia of Astronomers

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Wolf, Johann Rudolf

Born Fällanden, (Zurich), Switzerland, 7 July 1816

Died Zurich, Switzerland, 6 December 1893

Johann Wolf is best known for his observations of sunspots and, in particular, his development of a formula for describing the number of observed sunspots. Wolf was born to Johannes Wolf (1768-1827), the fourth generation of Evangelical pastors in his family, and to Regula Gossweiler (1780-1867), a daughter of a Protestant minister. Wolf claimed to owe his scientific career in large part to his older brother, Johannes, who first announced his intention to carry on the family's religious tradition

Wolf began his education at the Technological Institute in Zurich, but soon transferred to the newly founded Zurich University in 1833, where he studied until 1836, though he left without receiving a degree. He spent the following two years traveling to various universities and observatories across Europe. His most important steps on this journey were:

- (1) an extended 18-month stay in Vienna, where he attended physics and astronomy lectures at the university and worked with Johann von Littrow;
- (2) a four-month stay in Berlin, where he rubbed shoulders with a number of established physicists and astronomers at the Berlin Observatory and the Academy of Sciences;
- (3) a short but influential stay at the Göttingen Observatory, where he was introduced by Karl Gauss to contemporary geomagnetic theories and measurements; and,
- (4) his visit to Gotha, where he became acquainted with the library collection and historical research of János von Zach

Wolf returned to Zurich at the end of 1838, and the following year began teaching mathematics, physics, and astronomy in Bern, where he became director of the local observatory in 1847. In 1855, he moved back to Zurich with a triple appointment as lecturer in mathematics at the Hochschule, extraordinary professor at the university, and professor of astronomy at what is now the Eidgenössische Technische Hochschule [ETH]. Wolf subsequently became the first director of the Federal Observatory inaugurated at the ETH in 1864, a position he held until his death. He was a member of the Swiss Natural History Society already in his student days, and over the years presided over its Bern and Zurich chapters. Wolf was also for a time director of the Swiss Meteorological Headquarters,

and president of the Commission on Meteorology and Geodesy. He was elected a foreign member or associate of the Astronomische Gesellschaft Leipzig (Germany, 1850), the Società degli Spettroscopisti (Italy, 1859), the Royal Astronomical Society (England, 1864), and the Académie des sciences (Paris, 1885). He was granted an honorary doctorate by Bern University

in 1852. Wolf never married, and after enjoying good health throughout his life, died after a short illness

Wolf's astronomical interests ranged from comets to nebulae, but by far his most important contribution to astronomy was his historical reconstruction of solar activity based on sunspot numbers. His interest in such matters was sparked by the observation of a particularly large and long-lived sunspot group in December 1847. Already aware of Heinrich Schwabe's 1843 announcement of the sunspot cycle, Wolf embarked on his own sunspot-observing program. Using observatory records from across Europe, he began a program of historical research aimed at extending sunspot cycle data prior to Schwabe's observations. In 1850, he introduced his relative sunspot number (R_2), defined as

$$R_2 = k (10g+f),$$

where g is the number of sunspot groups observed on a given day, f the number of individual sunspots, and k a numerical scaling coefficient. Setting $k = 1$ for his own observations, Wolf assigned distinct k values to different observers, so that their numerical values for g and f would yield the same R_2 on common observing days. This simple rescaling procedure thus allowed him to put on the same numerical scale sunspot observations carried out by observers of widely varying ability and diligence, and using equally widely varying instruments and techniques

By 1852, Wolf had revised Schwabe's 10-year cycle duration to an average value of 11.11 years and offered evidence for significant variations in the cycle's duration, an anticorrelation between cycle amplitude and duration, and longer, secondary periodicities superimposed on the primary cycle. By 1868, he had extended his sunspot number reconstruction back to 1700. Wolf continued to revise his time series of sunspot numbers throughout his life, as more and more data became available to him. His successors in Zurich continued his work for nearly a century, with the Brussels Observatory carrying on the tradition since 1981. The Wolf sunspot number, as it is now called, remains to this day the classical (and most intensively studied) measure of solar activity

In July 1852, Wolf was one of four researchers (along with Edward Sabine in England, Johann von Lamont in Germany, and Jean Gautier in Switzerland) to demonstrate independently and more or less simultaneously that a marked 11-year periodicity also appears in geomagnetic measurements. Wolf went on to discover the correlation between sunspot numbers and auroral records, also independently noted by American scientist Elias Loomis. Wolf continued to seek sunspot-related periodicities in various meteorological phenomena, but with inconclusive results.

Throughout his life, Wolf was very active in the Bern and Zurich chapters of the Swiss Natural History Society and contributed numerous papers to the society's *Vierteljahrsschrift* (Quarterly Journal), for which he also acted as editor for many years. Already in 1855, Wolf's Wide-ranging interests and scholarship led to his appointment as the first ETH librarian, and it was largely through his initiative that the library's remarkable historical collections were assembled. Other technical interests of his included geodesy, surveying, number theory, and the empirical study of probability.

Wolf was an indefatigable worker and a prolific writer by any standards. In the course of his career, he authored some 258 articles or books in the fields of astronomy, meteorology, mathematics, surveying, and the history of science, culture, and religion. He also regularly penned articles and delivered lectures aimed at the general public. In 1856, Wolf inaugurated his solo astronomical journal, *Astronomische Mittheilungen*, adding up to 13 volumes by the year of his death, and in which he published results of his astronomical and historical researches.

Paul Charbonneau

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