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# ROMANIAN ASTRONOMY AND THE 1874 TRANSIT OF VENUS

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**Abstract:** The 1874 transit was an event that attracted world-wide attention, and many nations arranged observing stations within their own territories or organized international expeditions in order to try and contribute to one of the most challenging problems in astronomy at the time: the value of the solar parallax (and hence the 'astronomical unit'). Romania was also involved in these exploits when two Austrian astronomers, Edmund Weiss and Theodor von Oppolzer, came to Jassy to observe the transit, with assistance from two Romanian astronomers, Stefan Micle and Neculai Culianu. In this paper I describe the state of Romanian astronomy at this time before providing an account of the transit observations.

**Keywords:** 1874 transit of Venus, Romania, Neculai Culianu, Stefan Micle, Theodor von Oppolzer, Edmund Weiss

## 1 INTRODUCTION

On 5/6 June 2012 a celestial event will take place which none of our contemporaries will ever have the chance to see again: there will be a transit of Venus. This is an opportunity to recall those famous observations that aimed to measure the distance between the Earth and the Sun, namely the astronomical unit.

Impressed by the large number of observations registered around the world during the eighteenth and nineteenth century transits (see Sheehan and Westfall, 2004; Woolf, 1959), I naturally wondered what impact these events had on Romanian astronomy. There are occasional records that seem to refer to phenomena of this kind, but the first truly professional observations were made during the 1874 transit in Jassy, an important university center in the north-east of present day Romania, by a team including the Austrians, Theodor von Oppolzer and Edmund Weiss, and two Romanian astronomers, Stefan Micle and Neculai Culianu. This transit was a challenge for Romanian scientific astronomy, which was still in its formative stage (see Botez, 2008; Stavinschi, 2010; Stavinschi and Mioc, 2008).

The 1874 transit took place at a time when important technical innovations had occurred in astronomy, especially in the field of astronomical photography, which was to play a key role in many transit expeditions (Lankford, 1987). This transit was visible from China, Japan and elsewhere in Asia, through to Australia, New Zealand and Oceania (Orchiston 2004; Orchiston and Buchanan, 1993; Orchiston et al., 2000). The Astronomer Royal, Sir George Airy (1881), co-ordinated eight British expeditions (see Ratcliff, 2008), including one to Hawai'i (Chauvin, 2004) and another to New Zealand (Orchiston, 2004). In Russia the event was observed from twenty-four stations, spread out from the Sea of Japan in the east to the Black Sea in the west (Werrett, 2006). The French organized three expeditions (Dumont, 2004; Lauga, 2004), to China, Japan (Débarbat and Launay, 2006) and Indochina, under the leadership of G.-E. Fleuriais, J. Janssen, F. Tisserand and A. Heraud, and three others to the southern hemisphere, under the leadership of A. Bouquet de La Grye, E. Mouchez and C. André . On that occasion, Jules Janssen invented a type of 'photographic revolver' that allowed him to take 48 successive images of the transit (Launay and Hingley, 2005).

The number of expeditions organized for the 1882 transit was even higher (Sheehan and Westfall, 2004): we mention here only those to North and South America, Haiti, Mexico, Martinique, Florida, Patagonia, Chile and South Africa (Duerbeck, 2004a; 2004b; Koorts, 2003; 2004; Sterken and Duerbeck, 2004).

On the basis of the observations made during these two transits and the two eighteenth century ones, Newcomb (1895) calculated a value for the solar parallax of $8.794 \pm 0.018''$,[1] that compares very favourably with the currently-accepted value of $8.794148 \pm 0.000007''$ which is based on radar measurements and was adopted by the IAU in 1976 (see Dick et al., 1998: Table 1, page 223).

## 2 ROMANIAN ASTRONOMY DURING THE NINETEENTH CENTURY

On 24 January 1859 the Principalities of Moldavia and Wallachia merged together as 'the United Principalities' under the leadership of Alexandru Ioan Cuza, but it was only in 1866 that the Romanian state was proclaimed and the name 'Romania' was formally adopted.

One of the first measures Cuza took for the prosperity of the new state was to set up universities in the two former capitals: the University of Jassy in 1860 and the University of Bucharest in 1864. They represented a modernization of the traditional education system, which was still far from the typical Western one due to the very complicated political situation in this part of Europe.

Astronomy was among the first scientific disciplines offered at the new University of Jassy, and from the start it was taught by Neculai Culianu (1832–1915), a member of a famous Culianu – Nanu – Zarifopol family of Romanian intellectuals and renowned aristocrats.[2]

Prior to joining the University Culianu was a mathematician at the Mihailean Academy, and since astronomy was primarily celestial mechanics at this time, it was taught mostly by mathematicians. Following his appointment, Culianu occupied all the positions in the Jassy University hierarchy, ending as Rector between 1880 and 1898; he also remained the Dean of the Sciences Faculty until 1906, the year of his retirement.

Culianu was the author of the first textbook on mathematical analysis published in Romanian, the English translation of its title being *Lectures on Differential and*

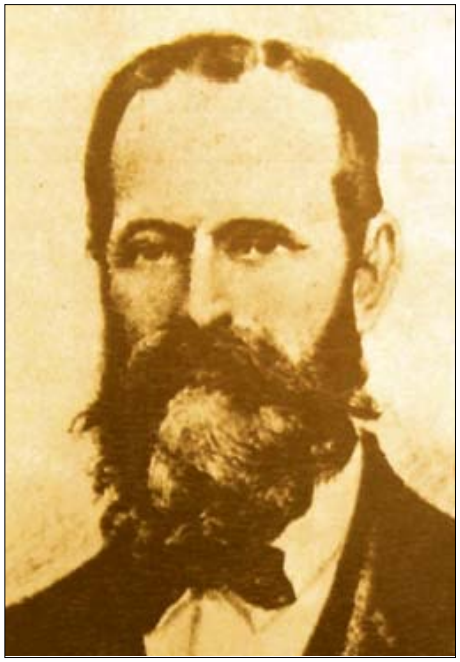

Figure 1: Stefan Micle (courtesy: www. vesperala. com/uploads/1242654943/gallery_1_81_24429. jpg).

*Integral Calculus* (1870); he also wrote a book, in Romanian, titled *Course in Cosmography* (1873; my English translation). He was a founding member of the journal *Scientific Recreations*; a member of Junimea (an influential literary society); the President of the Jassy Section of the Cultural League; and a member of the Romanian Academy (which was set up in April 1866). He was also the President of the Senate between 1892 and 1896.

Another staff member who taught astronomy at Jassy University was Professor Stefan Micle (1820?–1879), who was one of a series of Romanian professors who came from Transylvania, a province which only joined Romania in 1918. Together with other colleagues from over the Carpathians, Micle (Figure 1) contributed in his own way to the renewal of the traditional links between members of the Romanian academic community.

Figure 2: Theodor Ritter von Oppolzer (courtesy: www.univie.ac.at/EPH/Sofi/ sf1999/englhs.html).

Apparently, these two remarkable astronomy professors from Jassy University were little known in their own country for their scientific contributions, but they were well respected abroad, and this explains their collaboration with the Austrian astronomers Theodor von Oppolzer and Edmund Weiss during the 1874 transit of Venus.

## 3 THE AUSTRIAN COLLABORATORS

### 3.1 Theodor Ritter von Oppolzer

Von Oppolzer (Figure 2) was born in Prague on 26 October 1841 and died in Vienna on 26 December 1886 (Obituary …, 1887). From an early age he was interested in astronomy, and had his own private observatory. However, he followed in his famous father's footsteps and studied medicine at the University of Vienna, but by the time he graduated with a doctoral degree of medicine in 1865 he had already published a number of papers in astronomy. In 1866 he was appointed a Lecturer in Astronomy at the University, and in 1871 he also accepted the Directorship of the Austrian Geodetic Survey. In 1875 he was promoted to Professor of Celestial Mechanics and Geodesy at the University of Vienna. He was elected a member of the Imperial Academy of Sciences of Vienna in 1882 and of the American National Academy of Sciences in 1883, and in 1886 he became the President of the International Geodetic Association (E.W., 1887).

Von Oppolzer was a remarkably productive nineteenth century astronomer, one of his biographers commenting that "We may well be astonished at the vast amount of work which he accomplished in his short life." (Obituary …, 1887: 309). For instance, he wrote more than 300 research papers, most of which related to the orbits of comets and asteroids.

In 1868 von Oppolzer took part in a solar eclipse expedition, after which he decided to calculate the parameters of as many solar and lunar eclipses as possible. The result of this industrious endeavour was his famous *Catalogue of Eclipses* (*Canon der Finsternisse*) of 1887, in which he brought together information on about 8,000 solar eclipses and 5,200 lunar eclipses that had taken place or would take place between 1207 BC and AD 2161 (solar eclipses) and 1206 BC and AD 2163 (lunar eclipses). At the time, this was "… one of the greatest works of calculation which has ever been accomplished by man." (Obituary …, 1887: 310), and it has remained a standard reference work through to the present day.

Von Oppolzer's premature death at the age of 45 did not allow him to finish his other major project, a detailed investigation of the motion of the Moon (E.W., 1887), but his work was continued by his son, Egon Ritter von Oppolzer.

### 3.2 Edmund Weiss

Another remarkable Austrian astronomer was Edmund Weiss, who was born on 26 August 1837 in Fryvaldov, which was then in Austrian Silesia but is now in the Czech Republic. His father, Josef Weiss, was a surgeon who worked in hydrotherapy, and in 1842 he took the family to England. There Edmund attended primary school, only returning to Austria in 1847 after his father's death. He then attended secondary school in Troppau. He was mostly interested in the natural

sciences, in mathematics, physics and astronomy. In 1855 he graduated from high school with 'excellent' grades and began his studies in the Faculty of Philosophy at Vienna University (Crommelin, 1918).

In 1858 upon completing his degree Weiss was offered the position of Assistant at the Imperial Astronomical Observatory, and in 1860 he completed his studies with a doctorate in philosophy. In 1862 he was promoted to Associate Astronomer at the Observatory, and in 1879 he succeeded Karl von Littrow as Director. He retained this post until his retirement in 1910 (ibid.). Arguably, Weiss' greatest achievement as Director was the acquisition of the celebrated 27-in Grubb refractor, which for a short time was the largest refracting telescope in the world.

Weiss was appointed a Lecturer in Mathematics at Vienna University in 1861, the year after he completed his doctorate, and by 1869 he was an Associate Professor. He was promoted to full Professor in 1875 (ibid.). Among his students was Tomas Masaryk, who would become the first President of the Czech Republic.

As a researcher, Weiss is known mainly for his studies of comets, meteors and minor planets. He

> … perfected new methods for finding the improved orbits of these bodies. Weiss investigated the orbits of meteors and demonstrated an association between the Lyrids and comet C/1861 G1 (Thatcher) and between the Andromedids and comet 3D/Biela. From these associations, he developed the accepted view that meteors are the disintegration products of comets. (Schnell, 2007: 1202).

This work won Weiss international acclaim, and among those who showed their appreciation was Alexander Herschel (the grandson of the famous discoverer of Uranus), who was himself an authority on meteors (Millman, 1980).

Apart from taking part in the 1874 transit of Venus expedition to Jassy, Weiss organized or participated in solar eclipse expeditions in 1861 (Greece), 1867 (Dalmatia), 1868 (Aden) and 1870 (Tunis). This led to a growing interest in solar physics, and he became an active member of the International Union for Solar Research (Crommelin, 1918). He was an honorary member of the Royal Society of London, was awarded an honorary doctorate by Dublin University and received a knighthood (being a counselor at the Emperor's court). Edmund Weiss died in Vienna on 21 June 1917 after a long and productive life (ibid.).

## 4 ROMANIAN OBSERVATIONS OF THE 1874 TRANSIT OF VENUS

Von Oppolzer and Weiss came to Jassy to observe the 8 December 1874 transit of Venus and to determine the latitude and longitude of the observation site, and their results were recorded in *Astronomische Nachrichten* (see Oppolzer, 1875a).

The choice of an observing site was difficult to make, because the town has hills and valleys, and the Sun would be rather low that winter day. Thus, several days of field observations were necessary, when von Oppolzer and Weiss received help from the Austrian Consul, Professors Culianu and Micle, and from the Romanian authorities. Finally they decided to set up their instruments in the garden on the southern side of the prefect's office, one of the few sites in Jassy where the surrounding hills only masked the horizon by 1-2°. Furthermore, the telegraph had recently been linked to the prefect's office, which was a great help when it came to determining the longitude of the observing site. Weiss mounted a transit instrument of 8 inches aperture on a corner of an interior garden wall, and the distance to the middle of the southern middle pavilion in the prefect's office was found to be 36 meters and its azimuth 156.4°. The prefect's office was already connected by telegraph to St. Haralambie Church, whose geographical co-ordinates had previously been determined by Otto Struve using the telegraphic connections between the Church, Cernauti and Krakow. Meanwhile, they derived the following co-ordinates for the Jassy transit station (Oppolzer, 1875a):

Longitude $01^h\ 41^m\ 00.41^s$ E of Paris
$00^h\ 44^m\ 49.70^s$ E of Vienna
Latitude 47° 09′ 25.2″ ± 0.2″ N.

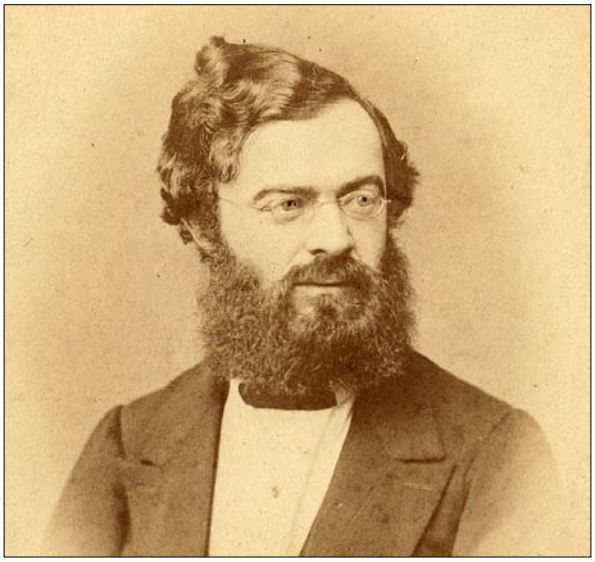

Figure 3: Edmund Weiss (courtesy: en.wikipedia.org/wiki/Edmund_Weiss.jpg).

Several details relating to the observation of the transit by von Oppolzer and Weiss are worth mentioning. In Jassy, on the early morning on 8 December the sky was clear and images of the stars were steady near the horizon. Shortly before sunrise a thick fog rose from the river valley and rapidly covered the entire city. However, as soon as the Sun rose the fog began dissipating, but unfortunately not quickly enough to permit observation of the first contact during the transit. Using a 4-inch Schaffler refractor with a Steinheil objective and a magnification of 60×, Venus could then be seen passing across the solar disk. As the ingress phase approached, the fog dissipated even more, and when the third and fourth contacts occurred it was only a very thin veil; but the solar images continued to be unstable.

In spite of the atmospheric turbulence, the second contact was timed at 13h 36m 50s (local time) using a Molineux chronometer. Knowing the longitude, the correction of the chronometer was calculated, and the moment of the fourth contact was timed at 20h 25m 56.7s. Because of the unsteady seeing, the precise time of the contact was estimated to be several seconds earlier.

## 5 CONCLUDING REMARKS

Further details of the observations of the 1874 transit of Venus made from Jassy are included in the papers published by von Oppolzer (1875b) and Weiss (1875) in *Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften in Wien*. From a national perspective, however, these scientific observations marked an important—albeit little-known—page in the annals of Romanian astronomy.

## 6 NOTES

1. Note that the quoted error is a 'probable error', which is 74% of the 'mean error' or 'standard error' that we use today.
2. One of the best-known members of this family is Ioan Petru Culianu (1950–1991), who is the author of more than fifteen books on science and literature and is a unique figure in the history of religion field.

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