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Euler and Venus' Suspicious Moon

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Abstract

This is a brief note on Leonhard Euler's published German translation from the French of two memoirs read by Armand Henri Baudouin de Guémadeuc to the Paris Academy of Sciences in 1761 and published the same year. The memoirs report on observations made of the planet Venus, performed in Limoges, France by Jacques Montaigne, where he claimed to have detected a moon orbiting the Morning and Evening Star.

1 Introduction

In a letter dated July 31/August 11, 1761 to Gerhard Friedrich Müller, then permanent secretary of the Russian Imperial Academy of Sciences, Leonhard Euler, in his rundown of recent events and happenings related to himself and the Berlin Academy, included the following morsel:

The Paris Academy twice sent me a printed report of the discovery made in Limoges of a moon of Venus, which the Imperial Academy has undoubtedly received, but this important discovery still strikes me as somewhat suspicious [6, p. 177].¹

Euler's suspicion of such a claim is not surprising. Of course nowadays, we know that Venus has no moon. But as a diligent and thorough scholar and scientist, Euler would have naturally wanted to scrutinize the presented evidence and also seek corroborating observations. At this time, even though there had been reported sightings of an alleged moon of Venus by European astronomers for over a century, it was not widely accepted that Venus had a moon.² But interest in the planet was robust as even certain facts such as its actual size were not known. In the spring of 1761 astronomers in Europe were especially excited to observe Venus with an opportunity to witness its transit across the sun on June 6.

Around the same time Euler was living through and experiencing the effects of the Seven Years' (1756-1763) War both professionally and personally. His Charlottenburg estate had been pillaged by Russian soldiers the year before despite prior assurance by a Russian general that the estate would be spared [4, p. 44]. Publication of the *Mémoires* of the Berlin Academy had been halted.

¹The letter was written in German. All translations made of passages from the source texts either from the German or the French are the author's own.

²The earliest reports were made by Francesco Fontana (1645, 1646) and Jean-Dominique Cassini (1672, 1686), and more recently in the early part of the 18th century by James Short (1640). For a thorough chronicle of alleged observations of Venus' moon by European astronomers, see the book [9] and article [11] by Helge Kragh and Kurt Møller Pedersen.

His correspondence with the Russian Imperial Academy and particularly with Müller was initially put in a standstill early in the war but has recovered by this time [5, p. 421]. Nevertheless, Euler found time to attend familial, personal, and collegial obligations, having taken his son Karl to the University of Halle and visiting friends and colleagues thereafter in May, 1761 [5, p. 428].

2 Baudouin de Guémadeuc's Memoirs on the Moon of Venus

On the 21st and 27th of May, 1761 Armand Henri Baudouin de Guémadeuc read two reports to the Paris Academy of Sciences of observations of Venus' moon. The observations were not made by Baudouin himself, but rather by Jacques Montaigne who observed Venus four times and *detected* its satellite in the early part of the month in Limoges, France. The reports were then shortly published into two memoirs titled respectively "Mémoire sur la découverte du satellite de Vénus, & sur les nouvelles observations qui viennent d'être faites à ce sujet" [1] and "Remarques sur une quatrième observation du satellite de Vénus" [2].³ Two copper plate images depicting positions of the concerned celestial bodies as seen during the observations accompanied the memoirs.

In the first memoir, Baudouin recounted the observations performed by Montaigne on May 3rd, 4th, and 7th. From the observed positions of the moon those different evenings, Baudouin set out to establish some of the characteristics of the moon's orbit around Venus and calculate the satellite's distance to its parent or primary planet. Before doing so he disclosed the limitations of the telescope used, having neither reticle nor micrometer, so that, as Baudouin wrote, "M. Montaigne's observations are merely based on an estimate aided by the knowledge that he had of the telescope's field of view." He warned his reader not to expect extreme accuracy of results. Nevertheless, he determined that the orbit was very slightly elliptical and estimated its eccentricity to be about $\frac{3}{20}$. However, to simplify the remainder of his calculations, he assumed the orbit to be circular. Baudouin summarized his findings about Venus' moon in the very last paragraph. He determined that the moon's orbit is perpendicular to the ecliptic and has a period of nine days and seven hours. Its (average) distance to its primary planet is the same as that between the Moon and Earth, that is to say 60 times the radial distance.

The second memoir reported on Montaigne's observation on May 11th, which was apparently a relatively favorable evening to observe the neighboring planet. Baudouin began by addressing the skepticism he must have encountered from his colleagues:

³The English translations of the titles are "Memoir on the discovery of Venus' moon and on the new observations recently made on this subject" and "Remarks on a fourth observation of Venus's moon," respectively. On the title pages of the two memoirs, Baudouin de Guémadeuc is designated as a council member of the *Grand Conseil* or Great Council a juridical institution during the *Ancien Régime*. The *Biographie Universelle Ancienne et Moderne* listed Baudouin as a *référéndraire* or a type of magistrate at the Great Council. He was also an amateur astronomer but was eventually most known for being a lampoonist in publishing anonymized anecdotes from his time working with the courts [10, p. 205–206].

I never believed that an observer could be mistaken three days in a row on the same phenomenon, seeing the satellite of Venus with a phase similar to that of this planet, of the same diameter as it was seen in the past. So many determining circumstances could not let me even suspect that M. Montaigne had taken a star for a satellite of Venus, and even less that he had been deceived by a false light formed on the glass of his telescope. But, despite my view, I respected, with too much reason, the doubts which the astronomers of this illustrious company seemed to raise on this subject, and all my ambition was limited to being able to remove them.

Baudouin took advantage of this new observation together with the three preceding ones to make further calculations. He reconfirmed the orbit of Venus' moon as perpendicular to the ecliptic but recalculates its period to twelve days rather than just over nine days. More ambitiously, he provided an estimate of Venus' mass which he determined to be almost the same as Earth's (more precisely 0.98 times),⁴ under the assumption that the ratio of diameters of the former to the latter is 1075 : 1558, which he obtained from Pierre Charles Le Monnier's *Institutions Astronomiques* [7].⁵

3 Euler's Translation of Baudouin's Memoirs

As referenced in the aforementioned letter to Müller, Euler received the reports and was either asked or took it upon himself to translate them into German. Indeed, on the second page right after the title page, Euler provided a short explanation for the existence of this translation and was signed *L. Euler* and dated June 22, 1761:

The following two documents have been especially printed by order of the Royal Academy of Sciences in Paris due to the importance of the discovery therein, and for the very same reason a German translation is hereby put into light.

Euler translation of Baudouin's memoirs appeared as a monograph and was published in Berlin also in 1761 [3]. The printing of the translation that year by the publication wing of the Buchladens der Realschule in Berlin stands in stark contrast to the dearth of printed publications by the Berlin Academy coming out of that period as affected by the Seven Years' War (1756-1763). Erik Tou in [12] stated that "Euler's publication record during the war was strong, if inconsistent," observing that Euler's output in *written* pages was at its lowest in 1760-1761. More remarkably, there was a noticeable halt in printing of the Berlin Academy's *Mémoires* in the first half of the 1760s. As Ronald Calinger wrote, many of the issues were prepared on time, but their printing was postponed so that the paper could be used for more pressing state business [5, p. 420]. Indeed as Tou reported, Volume 14, for the title year 1758 and would normally

⁴Venus' mass is about 0.82 times that of Earth's with a diameter about 0.95 times.

⁵A bit later in the report, Baudouin conceded that if he took Venus' diameter to be about equal that of Earth as astronomers such Giovanni Cassini or Christian Huygens have claimed, then Venus' mass should be about three times as large instead.

would have been printed two years later, did not see printing and publication until 1765 [12].

Euler introduced the translation via a *Vorbericht des Uebersetzers*, a *Preliminary Translator's Report*, serving as a foreword, where he asks the reader to take the observations and conclusions from the translation at face value, emphasizing that such observations might not be the most accurate due to the inadequacies of the instrument used. In the first part of his translator's report, Euler pointed out that the fact that no one had seen a moon during Venus's passage in front of the Sun a mere nine days after Baudouin's reading of the second memoir in front of the Paris Academy was not proof in itself that the moon did not exist. He intimated that the three initial observations (which is the topic of the first memoir) and the data derived therefrom, which Baudouin used to calculate the satellite's orbital period, seemed far from accurate. However, Euler declared that the fourth observation (chronicled in the second memoir) was more accurate and could account for the possibility that the moon's orbital position placed it *outside* the Sun during Venus' passage, thereby providing a reason why the moon would have not been observed during Venus' passage across the Sun. Euler wrote:

It will be demonstrable from this document itself to any attentive reader of it that on June 6th the moon was in such a position in its orbit, which then has an apparent diameter that is more than twice that of the Sun, that it was necessarily at such a great distance from it so as to pass under its southern edge. Consequently, It brings more credit than detriment to the French observations that the satellite was nowhere to be seen in (front of) the Sun at this time.

Euler continued by expressing his regret that Montaigne had not been provided with the best instruments to perform observations. Nevertheless, he remained hopeful that a more definitive discovery could be made and encouraged those with better instruments to make their own observations. Euler then called upon the great scholars to fulfill their due diligence of advancing science by writing:

The many useful truths which can be derived from a reliable theory of a satellite of that principal planet which is among the nearest, are well worth employing the ingenious investigations of the greatest scholars, no less than the idle astonishment of the ignorant. And the obligation to increase possible insights into the great works of God, who also wants to be known from his works and for this very reason has set up so many brilliant monuments of his wonderful qualities in them, justly obliges every reasonable inhabitant of the world to make such efforts that provide just as much pleasure as benefit.

Euler extended the wish that the provided translation, whose sole purpose was to make such a contribution, would not be deemed unsuitable for such efforts and offered his approach and operating principle in translating the original documents:

In the preparation of the translation every effort has been made to express clearly what was said in the French original without doing it word for word and without translating each and every coined word, which, in doing so, would render the document rather incomprehensible or at least strange, and moreover, would be just disadvantageous to the purity of our German language as to the French.

Euler contributed a total of 18 footnotes (11 for the first and 7 for the second) to accompany the translations of the two memoirs, saying (at the end of foreword) that “to those who do not need them and for whom they were not written, will nevertheless find them not entirely useless.” In the plurality of these notes Euler supplied further astronomical background information to support Baudouin’s assertions. In a few others he provided historical background and context, with one including a reference to a previous volume of the *Mémoires* of the Paris Academy of Sciences. In most of the rest, Euler primarily elaborated on and gave more precision on Baudouin’s calculated results and other claims. In the very last note, he used the more recent observation of Venus during its transit across the Sun on June 6 to say that the planet was probably smaller than commonly thought at the time, giving its angular diameter to be a few seconds of arc smaller than what Baudouin had used in his calculations.

4 Conclusion

This note was prepared with the modest objective of recounting and capturing an aspect of Euler’s professional life detached from the elevated image of an illustrious and prolific scholar. The larger intent is to learn more about the person.⁶ Euler’s translation of Baudouin’s treatises to a local vernacular and contribution of context, commentary, and scrutiny illustrate his willingness to fulfill his collegial obligations as a member of a larger scientific community and his commitment to disseminate scientific discovery to a wider audience. This is yet another example for us as 21st century scholars to follow.

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⁶Another recent *Euleriana* note that paints a picture of Euler’s day to day activities is Dominic Klyve’s analysis of Euler’s correspondence schedule [8].

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