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# The 1769 Transit of Venus as a Springboard for Jesuit Ministries among the Learned

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**Abstract**

This article examines how two Jesuit astronomers made use of a rare celestial phenomenon in attempts at winning the favor of intellectual and ruling élites outside of Catholic regions. The Heidelberg professor Christian Mayer (1719–83) went to Saint Petersburg, where he observed the transit of Venus in 1769 from the observatory of the prestigious Imperial Academy of Sciences. The imperial and royal astronomer of Vienna, Maximilian Hell (1720–92) went to Vardø in northeastern Norway, where he built a small observatory and successfully observed the same transit. The scientific works they published under the auspices of the leading scientific academies in Orthodox Russia and Lutheran Denmark–Norway are analyzed as examples of missionary texts, in an enlarged sense of the word.

**Keywords**

Jesuit science – transits of Venus – eighteenth century – Russia – Denmark – Norway – Christian Mayer (1719–83) – Maximilian Hell (1720–92) – history of astronomy – book history – neo-Latin literature

## Two Jesuits, Two Transits

By the middle of the eighteenth century, the Society of Jesuit stood on the brink of losing its foothold among Catholic nations, a process beginning with the expulsion from Portugal and all its colonies in 1759 and culminating with the universal suppression of the Society issued by Pope Clement XIV (r.1769–74) in 1773. In the same period, a rare celestial phenomenon attracted massive

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interest throughout the world of learning—the passages (or transits) of Venus in front of the Sun that were predicted to take place on June 6, 1761 and June 3, 1769. By means of an unprecedented observation scheme that involved astronomers scattered across the face of the Earth, precious datasets were to be assembled to facilitate calculation of the exact distance between the Earth and the Sun, and indeed the scale of the entire solar system.[1] Jesuit astronomers were part and parcel of this global enterprise.

The importance of science for the missionary efforts of the early modern Society of Jesus is well known. Throughout Europe and beyond, Jesuits established institutions for teaching alongside facilities for experimental and empirical research. The classic top-down strategy of the Society of Jesus has been coined "ministries among the learned."[2] The exact sciences were particularly powerful tools in this respect. By proving their worth as eminent professionals, Jesuits often managed to gain the patronage of majesties and state officials. Members of the Society were not only the confessors of royal families and teachers of their children but also figured as official court astronomers and mathematicians. The idea was that from the very top of society, pro-Catholic sentiment would trickle downwards and ultimately inspire conversions. One further observation, taken from the field of book history, is that "no other order has attributed such a prominent status to the printed word as have the Jesuits."[3] The Jesuits encountered in this article had the privilege of using the printing presses of royal academies of science in an Orthodox and a Lutheran country, respectively.

Over the course of the eighteenth century, astronomy as a scientific discipline had become increasingly institutionalized, with new observatories mushrooming across Europe. As directors of observatories and authors of

1 The classic study is Harry Woolf, *The Transits of Venus: A Study in Eighteenth-Century Science* (Princeton: Princeton University Press, 1959). See also Don W. Kurtz, ed., "Transits of Venus; New Views on the Solar System and Galaxy," *Proceedings of the International Astronomical Union Colloquium*, No. 196, 2004 (Cambridge: Cambridge University Press, 2005); Andrea Wulf, *Chasing Venus: The Race to Measure the Heavens* (New York: Knopf, 2012); Christiaan Sterken and Per Pippin Aspaas, eds., "Meeting Venus: A Collection of Papers Presented at the Venus Transit Conference in Tromsø 2012," *The Journal of Astronomical Data* 19, no. 1 (2013), available also in Open Access at https://hdl.handle.net/10037/5195 (accessed October 22, 2022).

2 Steven J. Harris, "Confession-Building, Long-Distance Networks, and the Organization of Jesuit Science," *Early Science and Medicine* 1, no. 3 (1996): 287–318, here 289.

3 Reinhard Wittmann, "Frühes Druck- und Verlagswesen der Jesuiten: Ein Desiderat der Forschung," *Mitteilungen der Gesellschaft für Buchforschung in Österreich* [2], no. 2 (2000): 1–11, here 3: "Kein anderer Orden hat dem gedruckten Wort einen so herausragenden Stellenwert beigemessen wie die Jesuiten." (All translations in this article are by the author.)

well-reputed ephemerides and other works of astronomy, Jesuits sought to carve out a position for themselves as proponents of an ideologically palatable and "pure" science, ostensibly with no confessional or theological strings attached. If we turn to the transits of Venus, the reputational standing of Jesuit astronomy is visible on a quantitative as well as a qualitative level. Globally, at least twenty-four of 130 successful observations of the transit of Venus in 1761 were made by Jesuits. (The term "successful observation" here means that an observer had the luck of clear skies—not clouds blocking the view during the crucial moments of the transit—and that the dataset was published in keeping with quality standards recognized at the time.) Eight years later in 1769, the number of successful observations worldwide rose to 154. However, the number of observations made by Jesuits decreased to less than a dozen.[4] One important reason for this decrease was that the suppression of the Society of Jesus had by then begun in earnest. Another, equally important factor was that for most observatories in heartland Europe the 1769 transit was invisible because it took place during the night, when the sun was below the horizon. Nevertheless, publications by Jesuit authors were among the most cherished—and debated—items in the scientific periodicals of Enlightenment Europe after the transit had taken place.

This article is a case study of two Jesuit astronomers who were commissioned with the task of observing the transit of 1769 from non-Catholic soil. Christian Mayer (1719–83), court astronomer of the elector of the Palatinate (a part of Baden-Württemberg in modern Germany), first observed the 1761 transit from the palace at Schwetzingen before traveling to Saint Petersburg, capital of Orthodox Russia, in 1769. Maximilian Hell (1720–92), court astronomer of Maria Theresa (r.1740–80) in Vienna, organized observations in and around Vienna in 1761 and then went to Vardø in the far north of the Lutheran Kingdom of Denmark and Norway for the transit of 1769. The expeditions, and indeed the entire careers of the two Jesuits, have been scrutinized before.[5] The purpose of the present contribution is to shed light on some hitherto neglected

4 Figures taken from Woolf, *The Transits of Venus*, supplemented by Per Pippin Aspaas, "Maximilianus Hell (1720–1792) and the Eighteenth-Century Transits of Venus: A Study of Jesuit Science in Nordic and Central European Contexts" (PhD diss., University of Tromsø, 2012), 213–18 and 269–77, in Open Access at https://hdl.handle.net/10037/4178 (accessed October 18, 2022).

5 On Mayer, see especially Alexander Moutchnik, *Forschung und Lehre in der zweiten Hälfte des 18. Jahrhunderts: Der Naturwissenschaftler und Universitätsprofessor Christian Mayer SJ (1719–1783)* (Augsburg: Erwin Rauner, 2006). On Hell, see Per Pippin Aspaas and László Kontler, *Maximilian Hell (1720–92) and the Ends of Jesuit Science in Enlightenment Europe* (Leiden: Brill, 2020), available also in Open Access at doi:10.1163/9789004416833 (accessed October 18, 2022).

aspects of the scientific texts that Mayer and Hell wrote about their observations in Russia and Scandinavia. The question is not so much whether they succeeded in recruiting proselytes in Orthodox Russia or Lutheran Scandinavia. The question is how they tried, by means of classical rhetoric, to portray themselves as eminent and well-connected scholars, capable of enhancing the reputation of the royal courts that sponsored their work.

Christian Mayer produced a 355-page monograph on the scientific, cultural, and historical significance of the 1769 transit of Venus dedicated to Catherine II (later nicknamed the Great), the empress of Russia (r.1762–96). While in Russia, he also published two shorter works on astronomical observations and geodesy.[6] Maximilian Hell published a large-format, eighty-two-page report on his Venus transit observation in remote Vardø, dedicated to Christian VII, the young monarch of Denmark and Norway (r.1766–1808). Furthermore, he announced plans for a richly illustrated, three-volume expedition report encompassing numerous branches of science, only parts of which ever materialized.[7]

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6 Christian Mayer, *Ad Augustissimam Russiarum omnium Imperatricem CATHARINAM II. ALEXIEWNAM Expositio de transitu Veneris ante discum Solis d. 23 Maii, 1769, iussu illustrissimi et excellentissimi Domini D. Comitis WOLODIMERI AB ORLOW, illustr. Academiae Scientiarum Directoris suscepta, vbi agitur de fine huius obseruationis, 1) cognoscendi veram parallaxin horizontalem solis, 2) determinandi veram distantiam solis a tellure, 3) ceterorumque planetarum et cometarum ordinem et distantiam, 4) deque commodis inde natis pro Geographia, Re nautica, Physica, etc., adductis vbique obseruationibus, earumque calculis ac methodis, ipsaque parallaxi hinc deducta* (St. Petersburg: Typis Academiae Scientiarum, 1769). See also his short report *Expositio vtriusque et obseruationis Veneris et eclipsis Solaris factae Petropoli in specula astronomica die 23. Maii 1769. Illustrissimo ac Excellentissimo Domino Comiti de Orlow, Caesareae Scientiarum Academiae Directori, totique Illustrissimae Academiae demisse oblata* (St. Petersburg: Typis Academiae Scientiarum, 1769); reprinted in *Novi Commentarii Academiae Scientiarum Imperialis Petropolitanae*, 13 pro Anno 1768 (St. Petersburg: Typis Academiae Scientiarum, 1769), 541–60 and in *Collectio omnium observationum quae occasione transitus Veneris per Solem a. MDCCLXIX. iussu Augustae per Imperium Russicum institutae fuerunt una cum theoria indeque deductis conclusionibus* (St. Petersburg: Typis Academiae Scientiarum, 1770), [3]–22 and the booklet *Nouvelle méthode pour lever en peu de tems et à peu de frais une carte générale exacte de toute la Russie* (St. Petersburg: Imprimerie de l'Académie Impériale des Sciences, 1770); reprinted with the title *Nouvelle méthode pour lever en peu de tems et à peu de frais une carte générale exacte de toute la Russie, et autres pays* (Copenhagen: Cl. Philibert, 1770). The first-mentioned monograph was also issued in Russian translation, see Moutchnik, *Forschung und Lehre*, 221–22.

7 Maximilian Hell, *Observatio Transitus Veneris ante discum Solis die 3 Junii Anno 1769. Wardoëhusii, auspiciis potentissimi ac clementissimi Regis Daniæ et Norvegiæ, CHRISTIANI VII. facta, et Societati Regiæ Scientiarum Hafniensi prælecta* (Copenhagen: Gerhard Giese Salicath, 1770); reprinted in *Ephemerides Astronomicæ ad meridianum Vindobonensem* Anni 1771 (Vienna: Trattner, 1770), Appendix, 1–96 and *Nova Acta Eruditorum* Anno 1770

Both Mayer and Hell were firmly established as respected professionals of astronomy by the time the transits of the 1760s took place. Professor at Heidelberg since 1751, Mayer was officially nominated court astronomer of the enlightened Prince Elector Charles Theodore (r.1742–99) in 1763. His papers on astronomy and allied sciences were published in the *Philosophical Transactions of the Royal Society of London* amongst other reputable outlets.[8] Besides his professorship, Mayer was the director of the physics laboratory at Heidelberg and a founding father of sumptuous observatories in both Schwetzingen and Mannheim. His contemporary, Maximilian Hell was appointed imperial and royal astronomer in 1755, with the responsibility of directing an observatory at the top of the Viennese University's new assembly hall. He was also commissioned with the task of producing an official almanac, the *Ephemerides* (*Astronomicae*) *ad meridianum Vindobonensem*, to which he appended reports of observations as well as theoretical works of astronomy and allied sciences, making it a scientific journal in its own right. Like Mayer, Hell was active in other branches of science as well, including meteorology, magnetism, and history.[9]

Since early in their careers, Mayer and Hell had developed personal networks involving both Jesuit and non-Jesuit "citizens" of the contemporary Republic of Letters. Hell became a corresponding member of the French Académie des Sciences in 1758 without ever visiting Paris; Mayer, who did visit Paris twice (in 1757 and 1762) and established life-long correspondence with several leading members of the Académie, did not receive this honor. He was, however, nominated fellow of the Royal Society of London in 1765, having applied for this *in absentia*. The 1769 expeditions further corroborated the international fame of Mayer and Hell, although the latter engaged in several hefty debates that alienated himself—at least temporarily—from colleagues in various quarters. Those controversies lie outside the scope of this article, however.[10]

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(Leipzig: Io. Bapt. Gleditschii et Lanckisii heredes, 1770), 1–102. Also, in Danish translation in *Skrifter, som udi det Kiøbenhavnske Selskab af Lærdoms og Videnskabers Elskere ere fremlagte og oplæste*, 10, i Aarene 1765. 1766. 1767. 1768. og 1769 (Copenhagen: Gerhard Giese Salicath, 1770), 537–618. As for Hell's plans for a three-volume expedition report, see his call for subscriptions, edited with an English translation in Aspaas, "Maximilianus Hell," 361–81.

8 For a complete list of Mayer's printed works, see Moutchnik, *Forschung und Lehre*, 464–75.

9 For a comprehensive list of his printed works, see Carlos Sommervogel, "Hell, Maximilien," in *Bibliothèque de la Compagnie de Jésus* [...] *Bibliographie*, 11 vols. (Brussels: Oscar Schepens/Paris: Alphonse Picard, 1890–1932), 4:238–58.

10 See instead Per Pippin Aspaas, "Le Père Jésuite Maximilien Hell et ses relations avec Lalande," in *Jérôme Lalande (1732–1807): Une trajectoire scientifique*, ed. Guy Boistel, Jérôme Lamy, and Colette Le Lay (Rennes: Presses universitaires de Rennes, 2010), 129–48,

## Northernmost Europe in a Global Observation Scheme

Each of the two eighteenth-century transits of Venus lasted for about six hours. Whereas the 1761 transit was an early morning event, the 1769 transit took place during the middle of the night at Central European longitudes. The great powers of European astronomy, France and Britain could only witness the phenomenon in part, or not at all; prospects were even bleaker for the southern German- and Italian-speaking regions. For the delicate process of calculating the size of the solar system, it was necessary to catch the entire duration of the transit in optimal atmospheric conditions. The northern and eastern fringes of Europe emerged as ideal places for observations, thanks to the midnight sun (farthest north) or early sunrise (in the east).

The northern powers did attempt to observe the 1761 transit but with only varying success. The Imperial Academy of Sciences in Saint Petersburg dispatched a couple of expeditions to eastern parts of the realm, only one of whose observations were actually published. Observations were also made at the official observatory of the academy in Saint Petersburg, though international attention was scarce. At the same time, Russia received a visitor, Jean Baptiste Chappe d'Auteroche (1722–69), a young astronomer from Paris. After some diplomatic problems, he obtained permission to go to the Siberian town of Tobolsk, where he successfully observed the transit. The bare observations of Chappe were printed immediately upon his return from Siberia, but several years later (in 1768) he published a lengthy account of his journey in which Russia was brandished as a backward and un-enlightened country. This prompted a vehement response by an anonymous author, the so-called *Antidote* (1770). The author of the antidote was probably someone close to the Empress Catherine II, who had by then seized power—some historians have even argued that the author may have been the empress herself.[11] The honor of Russia was at stake.

On a global scale, results of the 1761 observations were unsatisfactory. Despite the wide distribution of observers, attempts to calculate the Earth–Sun distance based on the entire corpus of datasets varied between a solar

available also in Open Access at doi:10.4000/books.pur.108608 (accessed October 18, 2022). In the late 1770s, Hell and Mayer even had a scientific controversy of their own, over the so-called Fixsterntrabanten, or double stars. See Moutchnik, *Forschung und Lehre*, 279–98.

11 The standard edition is Chappe d'Auteroche, *Voyage en Sibérie fait par ordre du Roi*, ed. Michel Mervaud, Studies on Voltaire and the Eighteenth Century, 2 vols. (Oxford: Voltaire Foundation, 2004). On the Antidote in particular, see Mervaud's "Introduction: Jean Chappe d'Auteroche, savant et voyageur au siècle des Lumières," 1:1–122, here 86–95.

parallax of 8.28 and 10.24 arc seconds.[12] It was universally acknowledged that for the next—and last—opportunity of the eighteenth century, it would be necessary to spread observers even farther apart.

Like Russia, the kingdom of Denmark and Norway failed in 1761. There was little activity and even less success in terms of international impact. In the capital of Copenhagen, the astronomer royal Christian Horrebow (1718–76) admitted that he had made a grave mistake in the time keeping. In Norwegian Trondheim, observers were only able to observe the phenomenon in part. A ship had been sent towards the trading colony of Trankebar but had not made it any further than to the Mediterranean when the transit took place.[13]

Sweden had for its part mustered two successful observations in the northernmost parts of its kingdom in 1761. This came in addition to numerous observation sites in southern parts of the country. Publication of the observations was swift and efficient. As the 1769 transit of Venus approached, strategists in Stockholm were aiming even higher than previously, with three observations commissioned in the far north. Two of the observers revisited areas that had quite literally been put on the map of learning in the wake of the Tornedalen Valley expedition of the 1730s by "the man who flattened the earth," Pierre Louis Moreau de Maupertuis (1698–1759).[14] Sweden stationing its own astronomers in this region can be seen as part of a science policy aimed at strengthening the country's reputation abroad. The French had once initiated and financed its own expedition to far-northern Sweden in order to examine the true shape of the Earth. Now the Swedes took full responsibility by equipping local experts with the means to examine the distances of the solar system. Copenhagen and Saint Petersburg were, for their part, preparing to leapfrog their neighbors by executing an even more impressive program of observations. In contrast to the scientific strategists of Sweden, Denmark–Norway and Russia not only

12 Per Pippin Aspaas, "Maximilianus Hell," 200–1. The term solar parallax is a universally accepted, condensed measure of the Earth–Sun distance. It is today fixed at 8.794148 arc seconds, meaning that the Earth, in its mean distance from the Sun, is "a couple of meters shy of 149,597,870,700 m[eters]" away: E. Myles Standish, "The Astronomical Unit Now," in *Proceedings of the International*, ed. Don W. Kurtz, 163–79, here 174.

13 Per Pippin Aspaas, "Denmark–Norway, 1761–1769: Two Missed Opportunities?," in "Meeting Venus," 39–48.

14 The literature on the geodetic expedition of Maupertuis is vast. In English, the standard monograph is Mary Terrall, *The Man who Flattened the Earth: Maupertuis and the Sciences in the Enlightenment* (Chicago: University of Chicago, 2002). An overview of Swedish strategies in relation to the Venus transits of the 1760s is given in Sven Widmalm, "Science in Transit: Enlightenment Research Policy and Astronomy in Sweden," in "Meeting Venus," 21–32.

mustered their own citizens, but combined engagement of national experts with recruitment of astronomers from abroad.

With Empress Catherine II, Russia's Academy of Sciences became more westerly oriented than it had ever been since its inception in 1724.[15] Leonhard Euler (1707–83), the great mathematician, was recruited back to Saint Petersburg with his entire family shortly after she had taken over the throne in 1762. Professor Euler's oldest son, Johann Albrecht (Jean Albert, 1734–1800) was appointed secretary of the academy and became its driving force. With the help of the nobleman Vladimir Orlov (1743–1831), director of the Imperial Academy, J. A. Euler in early 1767 presented the empress with a plan implying four expeditions to be dispatched across the vast Russian empire. The answer was astonishing. The empress doubled the number of astronomical expeditions to eight, promising to place the necessary funds at the academy's disposal. Alongside the Venus transit expeditions, several simultaneous expeditions were to be charged with research programs encompassing natural history, ethnology, and linguistics.[16] In this massive project, a number of experts were recruited from abroad, among them Mayer, who was to conduct observations from the academic observatory in the capital while the institution's own astronomers were away on expeditions.

The recruitment of Mayer took place more or less by hazard. Initially, Mayer had planned to accompany his confrère Roger Joseph (Ruđer Josip) Boscovich (1711–87) on an expedition to Baja California. These plans were stalled, however, at least in part because of anti-Jesuit sentiment among the Spanish rulers. (In the end, Chappe d'Auteroche in the company of two Spanish astronomers went to Baja California, where they did succeed to observe the transit, only to perish soon after from a local plague.) As of January 1769, Mayer had no prospects of traveling anywhere to observe the transit. At the same time, his correspondent Jérôme Lalande (1732–1807), a leading French astronomer and an important networker in each of the Venus transit projects of the 1760s, had a similar problem. Not because he had plans to travel anywhere himself, but because he had promised his colleagues in Russia to send one of his assistants to Saint Petersburg to act as a makeshift astronomer of the Imperial

15 See for example Georges Dulac, "La vie académique à Saint-Pétersbourg vers 1770, d'après la correspondance entre J. A. Euler et Formey," in *Académies et sociétés savantes en Europe (1650–1800)*, ed. Daniel-Odon Hurel and Gérard Laudin (Paris: Honoré Champion/Genève: Slatkine, 2000), 221–63.

16 It is illustrative that the official proceedings of the Imperial Academy had to be split into two halves in order to give comprehensive coverage of the activities of the various expeditions: *Novi Commentarii Academiae Scientiarum Imperialis Petropolitanae*, 14:1–2 pro Anno 1769 (St. Petersburg: Typis Academiae Scientiarum, 1770).

Observatory. One after the other, his assistants refused. When Lalande learnt of Mayer's situation, he took a quick decision, without even consulting his colleagues at the Russian academy. In place of an assistant from Paris, he gave the task to the Jesuit Mayer, who gladly accepted.[17]

Denmark–Norway made similar attempts at boosting its reputation as a nation of science around the time of the transits of Venus. Although it had a strong history in promoting astronomy, having hosted immortal names such as Tycho Brahe (1546–1601) and Ole Rømer (1644–1710) in previous centuries, by the middle of the eighteenth century the reputation of Danish astronomy was at a low point. The recruitment of one of Europe's leading professionals, the Viennese astronomer Hell, was their principal asset as far as the Venus transit of 1769 was concerned. The Vardø island, famous for its Vardøhus Fortress at the extreme northeastern corner of the kingdom, was to be his observation site. Hell's status as a Jesuit was evidently no serious concern, despite the letter of the law that forbade the presence of "monks, Jesuits, and papistic ecclesiastics of that sort" on Danish–Norwegian soil.[18] In fact, Denmark was not only targeting Hell. Mayer writes that he had received a generous offer from the foreign minister of Denmark to observe the transit from wherever he wanted in Norway "in case it should turn out to be impossible to reach Saint Petersburg due to lack of time or adverse winds."[19]

While Hell and Mayer both had the luck of clear skies during the crucial moments of the transit, other observers in the far north experienced overcast weather. In the end, there were altogether ten attempts in far-northern Scandinavia and Russia, only three of which succeeded in observing the beginning and the end of the phenomenon.[20] In northwestern Russia, there were three expeditions on the Kola Peninsula in addition to Mayer's site of observation in the capital. One team, in the town of Kola, did observe the transit, but the observation was considered doubtful due to clouds. A Swedish observer

17 Moutchnik, *Forschung und Lehre*, 177–201.

18 In *Kong Christian den Femtes Danske Lov*, in effect since the 1680s, one reads under the heading 6. Bog, Cap. 1,3 (Copenhagen: I. F. Schultz, 1797), 858: "Munke, Jesuiter, og deslige papistiske geistlige Personer, maae under deres Livs Fortabelse ikke her i Kongens Riger og Lande lade sig finde, eller opholde."

19 Mayer, *Ad Augustissimam*, 317: "si per temporis angustias ventosque contrarios *Petropolim* adire non licuisset."

20 See Christiaan Sterken and Per Pippin Aspaas, "A Synoptic Overview of Selected Key People and Key Places Involved in Historical Transits of Venus," in "Meeting Venus," 3–18. Also, Truls Lynne Hansen and Per Pippin Aspaas, *Maximilian Hell's geomagnetic observations in Norway 1769*, Tromsø Geophysical Observatory Reports, 2 (Tromsø: University of Tromsø, 2005), esp. the map on p. 5. Available also in Open Access, at https://hdl.handle.net/10037/2392 (accessed October 18, 2022).

in Cajaneborg (Kajaani in present-day Finland) also saw substantial parts of the transit but not under ideal conditions. Pure luck, or—as Hell would later explain—Divine Providence played a great part in the outcome of the project.

## The Minerva of Russia

Archival sources show that news of Mayer's assignment was received with some grudging comments in Saint Petersburg, where he showed up in May 1769. He certainly enjoyed the warmest of recommendations from the authority Lalande, but even so, his Jesuit allegiance was an unexpected and delicate issue. However, whatever protests were voiced were soon scuffed underneath the carpet and Mayer was—quite literally—handed the keys to the prestigious observatory of the Imperial Academy of Russia.[21]

In the company of the secretary Johann Albrecht Euler, the mathematician Anders Johan Lexell (1740–84), and his own travel companion the gymnasium teacher Gottfried Stahl (d.1783) of the Society of Jesus, Mayer succeeded in observing the transit of Venus from the academy building. In the immediate aftermath, he wrote a succinct, twenty-page account explaining the details of his observation, prefaced by a dedication to Orlov, director of the Imperial Academy.[22] It was promptly printed and distributed abroad, as part of the standard procedure of exchange of periodicals and other printed works between early modern academies. His written testimony might have ended here, with the raw data and their dry description in printed form. However, the Jesuit visitor had another proposal to make. He asked the director of the Imperial Academy for a stipend to write a much larger report dedicated to the empress, explaining the phenomenon to a wider audience of non-experts. The result was published in Latin just before Christmas 1769, with an unabridged Russian translation appearing soon after (see fig. 1). The print-run was three hundred copies for the Latin edition and the same amount for the Russian translation.[23] The monograph is our main source to Mayer's activity in Russia as a "missionary among the learned."

In an eight-page dedicatory preface, Mayer emphasizes the personal involvement of the empress, who actively supported the Academy in its efforts to measure the scale of our solar system. This she did by donating money,

21 Moutchnik, *Forschung und Lehre*, 192, 198–99.

22 Mayer, *Expositio vtriusque*. Note that the reprints in *Novi Commentarii* and *Collectio omnium* are without dedication and without preface.

23 Moutchnik, *Forschung und Lehre*, 221–22.

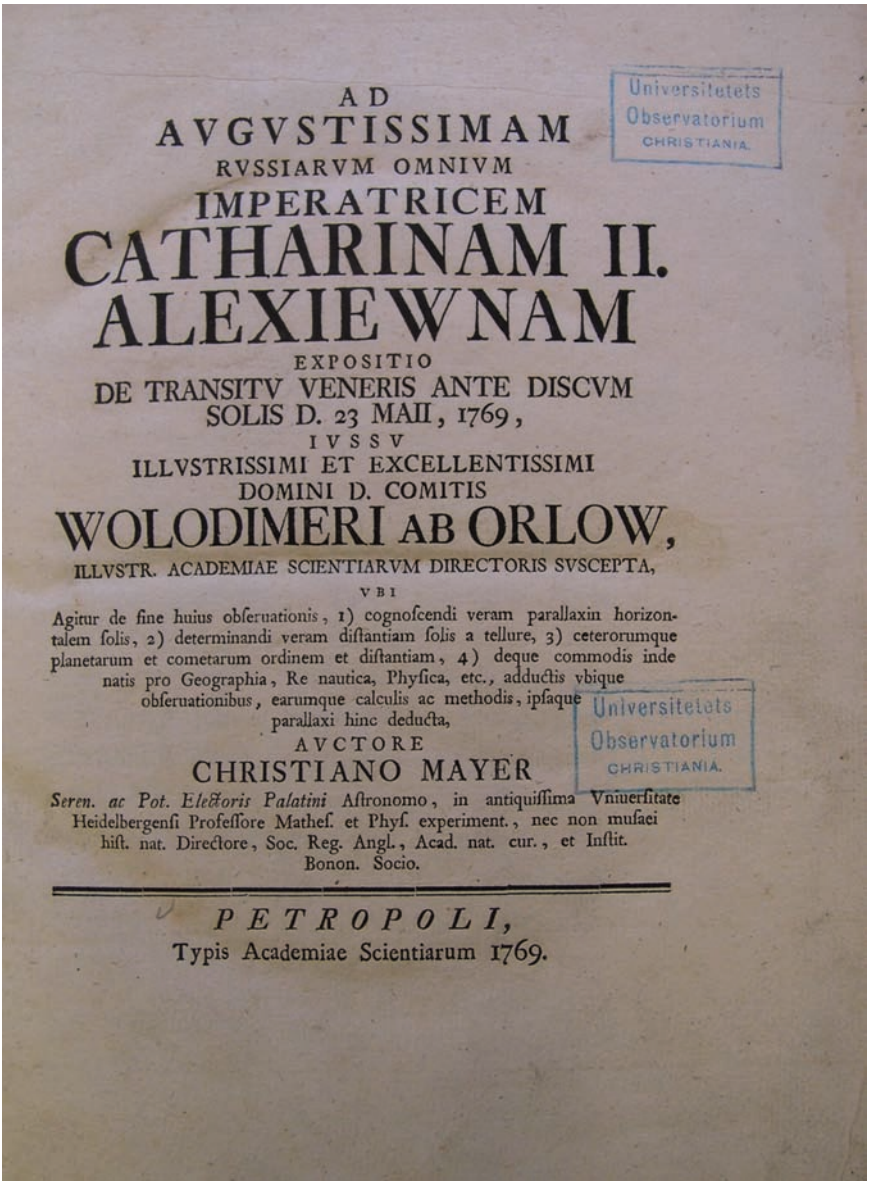


FIGURE 1 Front page of Christian Mayer's 1769 monograph dedicated to Catherine the Great. The name of the empress dominates the lay-out, with the academy director, nobleman Orlov the second most highlighted piece of information. Mayer's Jesuit identity is not revealed.

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ordering instruments from England and France, and equipping the expeditions in the best possible manner. Mayer suggests that Minerva (Athena), the Greco-Roman goddess of bravery and wisdom, should be Catherine's symbol: in war, she subjugates her enemies, whereas in peaceful times, she cultivates the sciences. Furthermore, Mayer points to the fact that the Russian Empire encompassed about a quarter of the territories of the earth. Her Majesty was relentless in her efforts at modernizing this vast realm, with colleges, military academies, orphanages, hospitals, etc. being founded alongside aqueducts, bridges, castles, and so on. There was even a new constitution in the making. Last, but not least, Mayer emphasizes that Catherine II observed the transit of Venus with her very own eyes, a true example for her people.

The text proceeds with a cogent introduction to the general history of astronomy, from Moses and Pythagoras to modern household names like Nicolaus Copernicus (1473–1543) and Isaac Newton (1642/43–1727). Having spent ten percent of the monograph on this introduction, Mayer finally introduces the main scope of his work, namely, that of explaining how it is possible to use a transit of Venus to measure the distance between the Sun and Earth. Mayer remarks that this explanation was requested by Catherine herself.[24] As mentioned above, a key element in the astronomical calculation in question is *parallax*: a small object (Venus) is seen to shift its position when viewed against a larger background (the Sun) from different angles (various positions on the Earth). With the creativity of a pedagogue, Mayer explains the concept of parallax by analogy with an experiment "that each and every person can try out in whatever chamber in his own home."[25] A small ball hanging by a thread from the ceiling in front of a portrait of the empress will seem to shift position when viewed from various positions. An accompanying illustration (fig. 2) leaves little room for doubt that the example, a portrait of the empress, is by no means picked at random. The Russian empress is depicted with Minerva's helmet. As the Minerva of Russia, she symbolically oversees amateur experiments in private homes, just as she in real life keeps a close eye on the professional efforts of her Academy, a true "Sun Queen" bringing Enlightenment to her people.

The significance of Mayer's contribution to the Venus transit project soon takes on global dimensions. In a set of principles (*principia*) on how the

24 Mayer, *Ad Augustissimam*, 36: "Operae igitur pretium erit, vt satisfaciam AVGVSTISSIMAE HVIVS MONARCHAE voluntati, modum explanare, qui fieri possit, vt ex hac obseruatione veram parallaxin solis, et ex cognita parallaxi solis veram eiusdem a tellure distantiam eruamus."

25 Mayer, *Ad Augustissimam*, 37: "visum est, *parallaxin* obuio aliquo experimento ante oculos ponere, quod quiuis domi suae quolibet in conclaui tentare potest."

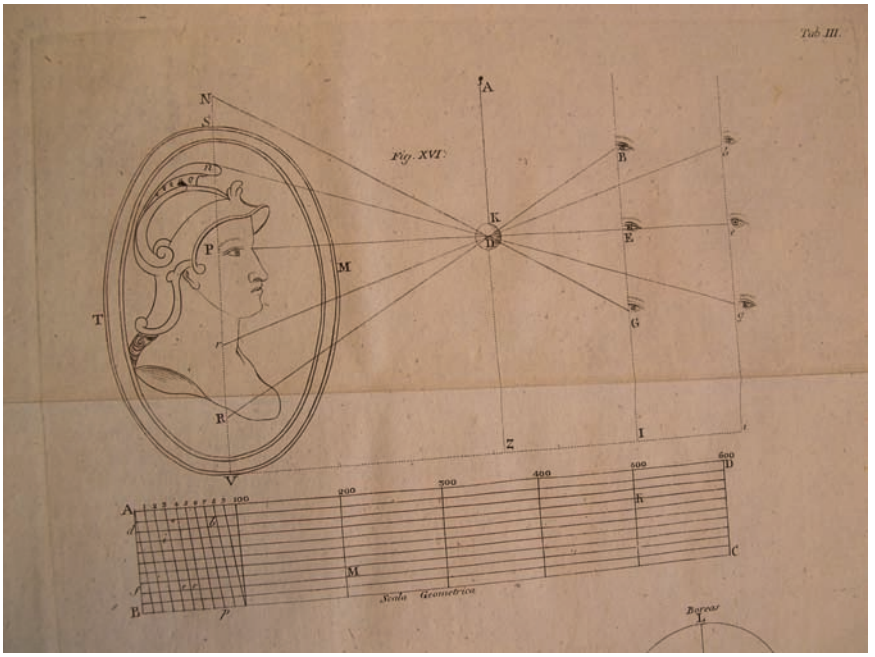


FIGURE 2 Illustration explaining the phenomenon of parallax. One notices the helmet of Minerva (Athena) on the portrait of the empress. Taken from Christian Mayer's monograph *Ad Augustissimam* … (1769).
COPY AT THE UNIVERSITY LIBRARY OF OSLO, DIGITIZED BY PER PIPPIN ASPAAS. LICENSE: PUBLIC DOMAIN.

observation of the transit can be used to measure the Earth–Sun distance, Saint Petersburg becomes the pivot around which the rest of the world turns. The prime meridian is not Greenwich but the observatory of the Russian capital. "Antipodes vrbis Petropolitanae" are listed in several tables,[26] before Mayer positions himself, quite literally, in the very epicenter of the project:[27]

> Whoever carefully considers the position of the city of Saint Petersburg, capital of this immense empire, and the advantages that it possesses for

26 Mayer, *Ad Augustissimam*, 68–76, see also 107–17.

27 Mayer, *Ad Augustissimam*, 84–85: "Quicunque enim paulo attentius *situm* vrbis *Petropolitanae*, Imperii amplissimi sedis, secum perpenderit, eiusque commoda, quae afferre potest determinandae *parallaxi* solari, facile videbit, istam stationem non modo vtilem, sed omnino necessariam fuisse, quam impensis quibusque Astronomorum aliquis occuparet. Liquet inde ILLVSTRISSIMAE ACADEMIAE sapientia singularis, quae nihil hoc in negotio omittendum putauit, quod quacunque ratione fini proposito idoneum videretur."

> the determination of the solar parallax, will easily realize that it was not only useful, but plainly necessary, that one astronomer or other, at whatever cost, stationed himself there. This proves the illustrious Academy's unique wisdom, since it considered that nothing was to be omitted in this project, as long as it seemed to be useful in any way for the attainment of its goal.

Curiously, Mayer argues that although the Sun was extremely close to the horizon in Saint Petersburg when the transit took place, atmospheric disturbances were more likely to render observations from Siberia or the far-northern Lapland inaccurate.[28] Mayer's observation, however, was not his, but should be attributed to Her Highness the Empress, who "dispatched the most skillful of experts to all parts of the Russian Empire, equipped with instruments so costly that it surpassed all hopes."[29] The real leader was none other than the empress herself, who "begged to loan some instruments from the observatory of the academy, on condition that no instrument necessary for the observation in Saint Petersburg was taken away" to her site of observation, somewhere on the banks of the Neva River.[30] There, she "observed Venus on the sun, both during sunset and from the very first light of day the next morning." She even made sure to observe a partial solar eclipse that took place around noon, a few hours after Venus had left the disc of the Sun—Mayer incidentally mentions that it was he who had given her highness instructions as to how the observations were to be made. Catherine thus deigned to participate personally in the endeavor as a *Dux expeditionum omnium*, or leader of all the expeditions in Russia, "a memorable example to posterity, that nowhere have the sciences and the arts flourished more than where monarchs engage in philosophy."[31]

Nowhere in Mayer's monograph is the scandalous *Voyage en Sibérie* by Chappe d'Auteroche mentioned. His condescending remarks on a backward

28 Mayer, *Ad Augustissimam*, 89.

29 Mayer, *Ad Augustissimam*, 90: "Quanquam obseruatio haec non nostra, sed tota, quanta est, AVGVSTISSIMAE IMPERATRICIS dici potest. Eius GLORIOSISSIMIS AVSPICIIS immensae pecuniarum summae in id opus profusae, expediti in omne, qua late patet, *Russorum* imperium Viri maxime idonei, tanto pretiosissimorum instrumentorum apparatu, vt fidem omnen superet."

30 Mayer, *Ad Augustissimam*, 91: "Quantae non fuit modestiae, *Russorum* IMPERATRICEM instrumenta aliqua speculae Academicae postulasse? ea tamen lege, ne quid ad obseruationem *Petropoli* faciendam necessarium deesset."

31 Mayer, *Ad Augustissimam*, 91–92: "vesperi occasum solis, et postridie a primo solis ortu Venerem in sole, totamque sequentem eclipsin telluris ab initio ad finem vsque spectauit, memorando posteris exemplo, scientias et artes nuspiam melius efflorescere, quam vbi Monarchae philosopharentur."

and anti-enlightened Russia are however implicitly refuted, when Mayer proceeds to describe how amateurs of science made their own observations both in and around the capital. Indeed, interest was so great that the academy director Orlov had to set out armed guards at the gates of the academy building to prevent curious Petersburg citizens from entering the building and disturb the observations.[32]

While acknowledging the importance of transnational collaboration and the merits of spreading observers as far apart as possible, Mayer is pointing to Russia as a possible source to the solution of the entire solar parallax question. There were expeditions in remote America and the Pacific, whose fate no one in Europe still knew.

> However, in case only the sole observation in Iakutsk has the luck of a successful outcome, astronomy will have a substitute to make a possible lack of American observations more manageable. The world of learning will in any case have observations from Kola, Ponoi, Orsk, Gur'ev, Orenburg, and Saint Petersburg, which will make it feel eternally grateful to Her Highness the Empress as well as to this illustrious Academy,

Mayer predicts.[33] He then proceeds to explain in detail the laws of planetary motion developed by Johannes Kepler (1571–1630), before sliding into another theme: that of the orbits of comets. In the summer of 1769, a new comet was observed all over Europe, including Saint Petersburg. The Jesuit in the service of Catherine II does not shy away from connecting this event quite closely to the on-going efforts at calculating the size of the solar system. The great mathematician Euler and his assistant Lexell are already engaged in the calculation of its orbit. Posterity will surely admire Catherine II for the fact that a new comet was studied in her metropolis.[34] Moreover, even the distances to the various fix stars can be more accurately measured as soon as the solar parallax question has been solved once and for all, Mayer claims. Saint Petersburg is thus not only portrayed as a center on the earth, but a center of the universe.[35]

The rest of Mayer's account deals with geodesy and geography, how to measure longitude and latitude as well as the height above the sea level. What is

32 Mayer, *Ad Augustissimam*, 92–94.

33 Mayer, *Ad Augustissimam*, 113: "veruntamen si vel vna obseruatio *Iakuzkoi* effectum felicem sortiatur, habebit Astronomia, vnde defectum *Americae* tolerabilius ferre possit, habebit orbis literatus obseruationes *Kolae*, *Ponoi*, *Orskae*, *Gurief*, *Orenburgi*, *Petropolis*, vnde AVGVSTISSIMAE IMPERATRICI, atque huic Illustrissimae Academiae grates immortales referat."

34 Mayer, *Ad Augustissimam*, 155–216, here 211.

35 Mayer, *Ad Augustissimam*, 215–34.

exposed in this exposé is a scholar keen to inform about his personal networks. He mentions freshly received letters from Lalande and numerous other scholars, he demonstrates that he has read and grasped the implications of the latest treatises in physics, meteorology, geodesy, etc.—in short, he is well informed about current developments in all branches of applied mathematics. One such current development was Harrison's chronometer, a tool to measure longitude at sea that had just been invented. Mayer, however, argues that the laborious task of measuring the vast Russian empire could benefit immensely from the use of such chronometers. This idea, originally summarized in a footnote to Mayer's monograph,[36] later became the straws he clutched at in order for him to subsist another few months in Saint Petersburg.

Archival sources show that during the autumn and winter months of 1769/70, other astronomers that had returned from expeditions soon demanded to be handed the keys to the imperial observatory. Mayer, although being a protégé of the secretary of the academy, came under attack from these colleagues, notably the Russian astronomer Stepan Rumovskii (1734–1812). Since the Jesuit visitor had now fulfilled his task, was it not time to get him off the academy's payroll? Mayer, for his part, argued that he could not possibly travel back to Schwetzingen in the winter, when the ice prevented ships from operating the ports of Saint Petersburg. The solution became yet another assignment, this time on a novel method of cartography.

In April 1770, Mayer presented the manuscript of a French booklet on geodesy to the Imperial Academy in Saint Petersburg. Its title can be translated as "A New Method to Produce in Short Time and with Little Cost an Exact Map of Entire Russia." According to Mayer, the academy acknowledged it as a "very useful and successful invention." As far as the imperial court was concerned, Mayer added that[37]

> my satisfaction will be complete, if this method catches the attention of Her Imperial Majesty, this elevated sovereign who loves, cultivates, and protects the sciences and the arts throughout her territories, and whose well-known eminent qualities, enlightenment, and learning are the object of admiration in entire Europe.

36 Mayer, *Ad Augustissimam*, footnote on pp. 300–1.

37 Mayer, *Nouvelle Méthode*, St. Petersburg ed., 3–4: "La lecture en a été faite le 16 d'Avril 1770 dans une assemblée de l'Académie, qui l'a généralement approuvée comme une invention très utile & une heureuse découverte. […] Ma satisfaction sera entière, si elle excite l'attention de SA MAJESTÉ IMPERIALE, cette Auguste Souveraine qui aime, cultive & protêge dans ses états les arts & les sciences, & dont les éminentes qualités, les lumières & les connoissances sont connuës, & font l'objet de l'admiration de toute l'Europe."

Apart from the courtly flattery, Mayer's eagerness to portray himself as a well-connected savant is evident in this text as well. There is mention of previous experience with geodesy in the company of Cassini de Thury (1714–84), the astronomer of the king of France, who measured the entire stretch of land between Paris and Vienna, as well as Mayer's own measurements between Mannheim and Basel, conducted in 1763.[38] Mayer further mentions that he has presented the rudiments of his *Nouvelle Méthode* to Britain's ambassador to Russia, who strongly encouraged him to write a treatise on the topic.[39] The personal connection between Mayer and the imperial court may well have been weak but it is hardly portrayed as such.

One conspicuous feature in Mayer's texts is that none of them mentions his allegiance to the Society of Jesus. This was, however, no secret to the circles of learning that he frequented. Letters exchanged between fellows of the academy of Saint Petersburg and their peers at foreign academies bear witness to this fact.[40] When Mayer finally left the Russian capital, thirteen months after his arrival, he did not take a direct route back to Schwetzingen, but visited Åbo (Turku), Stockholm, and Copenhagen. In Stockholm, he was received by the secretary of the Academy of Sciences and appears to have received an audience with the queen.[41] Later in the summer of 1770, he arrived in Copenhagen,

38 Mayer, *Nouvelle Méthode*, St. Petersburg ed., 23.

39 Mayer, *Nouvelle Méthode*, St. Petersburg ed., 24.

40 To cite but one example: Royal Academy of Sciences in Stockholm, Wargentins brevvexling: Anders Johan Lexell, letter to Pehr Wilhelm Wargentin in Stockholm, dated Saint Petersburg, June 10/11, 1770: "Prof: Mayer reser i dag här ifrån landwägen genom Swerige, och profiterar jag af det tillfället at med honom skrifva. Han lär redan förut sielf genom bref berättat Herr Secreteraren det. Emedan det i Swerige lär wara förbudit, för Jesuiter, at komma in i landet, lär wara nödigt, at hålla den omständigheten hemlig. Jag är öfvertygad at Herr Secreteraren af wanligt ädelmod lemnar honom alt möjeligt biträde, samt skaffar honom tilfälle at se, hwad i Stockholm kan wara märkvärdigt; eljest skulle jag taga mig friheten, at å egna wägner där om ödmiukast anhålla. Han har under sitt wistande här wisat mig mycken wänskap" (Professor Mayer leaves this place today to travel overland through Sweden, which gives me occasion to write this letter with him [i.e., so that he can bring it with him to Stockholm]. He has probably informed the secretary [of the Royal Academy of Stockholm, i.e. Wargentin] about this already. Since I have the impression that it is illegal for Jesuits to enter the country, I guess this circumstance should be kept secret. I am convinced that the secretary in his noble spirit will offer him all possible support, including the opportunity to see whatever may be worth seeing in Stockholm; in any case, I would humbly beg him do so on my behalf. Mayer has during his stay here shown me great friendship).

41 Royal Academy of Sciences in Stockholm, Wargentins brevvexling: Christian Mayer, letter to Pehr Wilhelm Wargentin, dated Heidelberg November 17, 1771: "ut meo quoque nomine augustissimæ Reginæ Sueciæ nunc viduæ longe demississima mea obsequii

where his *Nouvelle Méthode* was reissued, with the following remark by the printer:[42]

> The author of this work, Professor Mayer *of the Society of Jesus* [my emphasis] has assured me that only fifty copies were printed in Saint Petersburg financed by the Imperial Academy. I have therefore decided to reprint it, with his permission, so that it can be of use in all countries just as much as in Russia.

One notices that in Denmark, where the existence of Jesuits was strictly prohibited under penalty of death, is Mayer's Jesuit identity publicly announced. In Russia it is not. While his allegiance to "His August Sovereign the Elector Palatine," the University of Heidelberg, the Royal Society of London, the (Jesuit-run) Institute of Bologna, and the Academia Leopoldina are advertised on the various Latin and French title pages, his status as a Jesuit is officially concealed.

The Jesuit Mayer was not a unique case in the lands of Catherine II. Especially in regions south of the capital there were several Jesuit colleges, whose activities were regulated by a special state decree on Catholicism from the year 1769. After the 1773 papal bull *Dominus ac redemptor noster*, which effectively ruled out the existence of the Jesuit order in the world, Russian authorities allowed the Society of Jesus to continue to operate schools and organize its missionary activities unabated. Apart from a political statement of Russia's independence vis-à-vis the Western powers, the protection of the Jesuits can also be seen as a purely utilitarian and pragmatic measure: Catherine II needed Jesuit schools to take care of the education of her subjects.[43] Whether the "learned missionary" Mayer had any influence at all on such decisions is however dubious. After his productive thirteen-month period in Saint Petersburg, Mayer never set foot on Russian soil again.

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et venerationis obsequia deferres pro eximiis ejusdem et plane regiis præstitis mihi favoribus" (Please extend to Her Highness the Queen of Sweden, who has now become a widow, my most humble gratitude in humility and veneration for the amazing and truly royal favors that she showed to me).

42 "L'Auteur de cet Ouvrage, Monsieur le Professeur MAYER, S.J. m'ayant assuré qu'on n'en a imprimé à St. Petersbourg que 50 ex. aux dépens de l'Académie Impériale, je me suis déterminé à le réimprimer, avec son approbation, puisqu'il pourra être utile en tous pays aussi bien qu'en Russie." Mayer, *Nouvelle Méthode*, Copenhagen ed., [2].

43 To what degree Jesuit scholars' participation in scientific activities (beyond teaching) in eighteenth-century Russia actually influenced sentiments towards Catholicism appears not to have been placed under scrutiny, at least not in Western scholarship. See for

## The Splendor of Denmark

In September 1767, Hell was invited to the residence of the Danish ambassador in Vienna, who presented him with the idea of an expedition to Vardø on the extreme northeastern periphery of Norway, fully financed by King Christian VII. The invitation, which took Hell by surprise, was accepted there and then. Hell appears to have been the Danish authorities' first choice; the high ministers of the realm saw in him the potential for a wholescale reform of Danish astronomy that was to restore its reputation to its former days of glory. As for the observation site, this was ideally suited for purely scientific as well as geopolitical reasons. Vardø had a fortress signaling the presence of the Danish flag in the border regions with Russia and Sweden. Hell explains that he had already received—but declined—two similar offers by the time the Danes contacted him. This claim is hard to corroborate, however.[44]

Visiting the farthest north of Europe was no trivial task and Hell had to rely on help from both state officials and local scientific experts. In contrast to Mayer, who took the Imperial Academy by surprise, the announcement of Hell appears to have been welcomed unanimously by the two leading scientific bodies in the realm, the Royal Society of Sciences in Copenhagen (founded 1742) and its younger counterpart, the Royal Society of Trondheim (founded 1760). Hell and his assistant, the Hungarian-speaking Jesuit Joannes (János) Sajnovics (1733–85), left Vienna in April 1768 and reached Vardø in October of the same year. Whereas the organizers had envisioned a short stay in Vardø during the spring and early summer of 1769, Hell insisted on spending the entire winter in Vardø. Here, he had the opportunity to engage in a wide range of scientific activities besides his main task, that of observing the transit on June 3, 1769. He returned several months later to Copenhagen, where he spent the winter and following spring in the academic milieu of the Society of Sciences and its president, Count Otto Thott (1703–85). Not until September 1770, he was back at his workplace in Vienna.

In Vardø, Hell and his assistant Sajnovics made meteorological observations, examined marine life, studied the aurora borealis, drew up a map of Vardø Island, and compared the language of the indigenous Sámi (Lapponian)

example Daniel Beauvois, "Les jésuites dans l'Empire Russe: 1772–1820," *Dix-huitième siècle* 8 (1976): 257–72; Georg Schuppener, "Die Jesuiten im Bildungswesen Russlands vom 17. bis zum 19. Jahrhundert," *Schweizerische Zeitschrift für Religions- und Kulturgeschichte* 106 (2012): 585–609; Robert A. Maryks and Jonathan Wright, eds., *Jesuit Survival and Restoration: A Global History, 1773–1900*, Studies in the History of Christian Traditions, 178 (Leiden: Brill, 2015).

44 Aspaas and Kontler, *Maximilian Hell*, 189–94.

population with Hungarian. According to Hell's ambitious expedition program, also the figure of the Earth was to be measured more accurately than ever and theories of a thicker atmosphere in the far north were to be verified. The first priority, however, was the observation of the transit, which turned out miraculously well: clouds blocked the view for most of the night between June 3 and 4, only to drift away and leave a free sight to the midnight sun during the crucial moments of beginning and end of the transit. The precious data was secured. Hell immediately wrote an enthusiastic letter to Orlov's counterpart in Copenhagen, Count Thott. In the letter, he only revealed that the observations had been successful.[45] As we shall see below, the various observers of Russia sent their datasets by express mail to Saint Petersburg so that these could be printed and shared immediately with the international community of astronomers. Hell's behavior was different.

In September 1769, Hell was back in Copenhagen with his massive collections of instruments, notes, and samples from his fieldwork. During sessions of the Royal Society in November and December, he presented a comprehensive account of his Venus transit observation. Not until February 1770 was the report printed (fig. 3). The print-run of the first edition was eight hundred copies, five hundred of which were reserved for distribution abroad.[46] Later in the same year, the report was printed in Latin in both Leipzig and Vienna; it was also translated and published in a Danish edition.[47] In terms of length, it was more than four times as long as the average Venus transit report from 1769. After Hell's report, Sajnovics presented to Copenhagen's royal society a sensational "Demonstration That the Language of the Hungarians and the Lapponians Is the Same"[48] and Hell presented a "New Theory of the Aurora Borealis."[49] Finally, a couple of days before they left the country for good in May 1770, Hell handed over to the Danish royal society a paper on "The Latitudes of Several Places" measured on his journey between Vardø and Copenhagen.[50]

45 Aspaas, "Maximilianus Hell," 305–6.

46 Danish National Archives, Copenhagen: Missionskollegiet og Direktionen for Vajsenhuset: Vajsenhusets direktions protokol 1735–1776, F323–1, p. 497.

47 In Latin in *Nova Acta Eruditorum* and in *Ephemerides Astronomicæ*; in Danish in *Skrifter*.

48 Joannes Sajnovics, *Demonstratio: Idioma Ungarorum et Lapponum idem esse; Regiae Scientiarum Societati Danicae praelecta Hafniae mense Januario Anno* MDCCLXX (Copenhagen: Gerhard Giese Salicath, [1770]).

49 A series of lectures held before the Royal Society in March 1770, later published as "Aurorae Borealis Theoria Nova," *Ephemerides Astronomicæ ad Meridianum Vindobonsem*, Anni 1777 (Vienna: Trattner, 1776), Appendix, 1–119.

50 Published in Danish translation: Maximilian Hell, "Nogle Steders Geographiske Breder i Finmarken, Nordlandene, Norge og Sverrige bestemmede ved astronomiske Observationer," *Skrifter*, 619–52.

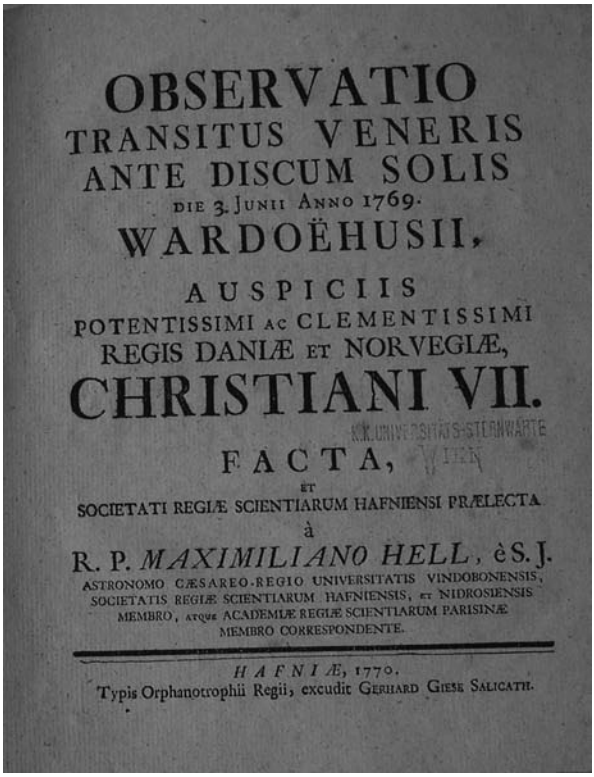
OBSERVATIO
TRANSITUS VENERIS
ANTE DISCUM SOLIS
DIE 3. JUNII ANNO 1769.
WARDOËHUSII,
AUSPICIIS
POTENTISSIMI AC CLEMENTISSIMI
REGIS DANIÆ ET NORVEGIÆ,
CHRISTIANI VII.
FACTA,
ET
SOCIETATI REGIÆ SCIENTIARUM HAFNIENSI PRÆLECTA
À
R. P. MAXIMILIANO HELL, è S. J.
ASTRONOMO CÆSAREO-REGIO UNIVERSITATIS VINDOBONENSIS,
SOCIETATIS REGIÆ SCIENTIARUM HAFNIENSIS, ET NIDROSIENSIS
MEMBRO, ATQUE ACADEMIÆ REGIÆ SCIENTIARUM PARISINÆ
MEMBRO CORRESPONDENTE.
HAFNIÆ, 1770.
Typis Orphanotrophii Regii, excudit GERHARD GIESE SALICATH.

FIGURE 3 Title page of Hell's report on his transit of Venus observation in Vardø (1770). The name of his sponsor is the most conspicuous piece of information. Hell is however singled out as a Jesuit.
HELL'S OWN COPY, KEPT AT THE LIBRARY OF THE INSTITUT FÜR ASTROPHYSIK DER UNIVERSITÄT WIEN IN VIENNA, AUSTRIA. PHOTOGRAPH BY PER PIPPIN ASPAAS. LICENSE: PUBLIC DOMAIN.

The principal printed outcome of Hell's Venus transit expedition was the report on his observation. The most conspicuous name on the title page is that of Christian VII. There then follows a five-page preface to "His Highness Christian the Seventh, King of Denmark and Norway, Mightiest and Mildest."[51] With considerable pathos, Hell characterizes the observation as the work of the king. To Him alone, among all that attempted to observe the transit of Venus in the far north, Divine Providence has secured a successful outcome. This

51 Hell, *Observatio Transitus*, no page: "Augustissimo CHRISTIANO SEPTIMO, Daniæ et Norvegiæ REGI potentissimo, clementissimo."

feat is historic, but does fit into a long tradition of Danish-sponsored scientific activity: "Astronomy, mother of all natural sciences, was neglected and almost buried for many centuries, until it was restored to its former splendor by Tycho [Brahe]" thanks to the patronage of "FREDERICK II, the best of princes of Your elevated house, the greatest supporter of the sciences in Denmark at that time, to whom the world of learning owes its gratitude." The gratitude of the learned world will now be even greater, Hell argues, for "thanks to Your gift, the true and accurate scale of the entire planetary system, unknown up to this day ever since the creation of the world, will finally reach its long-desired solution!"[52] Furthermore, Hell thanks for the honorific task of observing the transit on His Majesty's behalf, and hopes his observation—that he has undertaken "with all the capability that God has given me"—shall meet His expectations.[53]

Another introduction, this time directed *Ad Astronomos*, brings the details of Hell's invitation, the construction of his observatory in the inclement climate of Vardø, as well as a summary of his plans for a more comprehensive expedition report, titled *Expeditio litteraria*. Next, there are detailed descriptions of the instruments that he brought with him. Here, a more finely granulated expression of gratitude is brought to the awareness of the reader: in addition to King Christian, there are an ambassador, a minister, a professor of astronomy, an instrument maker, and an amateur of science that in various ways have lent support to Hell on his scientific mission.[54] Following a careful examination of the instruments and discussion of the methods used, Hell devotes several pages of his report on the exact latitude and longitude of Vardø. On June 4, the day after the transit, a partial solar eclipse took place. In contrast to most other Venus transit observers, who simply printed the raw data, leaving the exact calculation of the longitude for later, Hell had the benefit of time: since his report was not written until more than six months after the observation, he had already received corresponding observations of the solar eclipse from his pen-friends in Greenwich (the astronomer royal, Nevil

52 Hell, *Observatio Transitus*, no page: "Astronomiam, Scientiarum naturalium Matrem, multis retro Seculis neglectam ac veluti sepultam, splendori suo a Tychone restitutam iterum, FRIDERICO II. Augustissimæ TUÆ Domus Principi optimo, Scientiarum id temporis in Dania PATRI maximo orbis debet litteratus: Quantum debebit TIBI, REX Augustissime! qui TUO munere Systematis universi Planetarii veram, exactamque Magnitudinem, ab orbe condito huc usque ignoratam, desideratamque, definitam tandem habebit!"

53 Hell, *Observatio Transitus*, no page: "Felicem me! Si labores hi fini evocationis a Regia TUA Majestate mihi clementissime proposito, si votis Augustissimæ meæ Imperatricis, ac Imperatoris Regio TUO desiderio complacendi causa susceptis, pro viribus mihi a DEO datis, omni ex parte respondeant."

54 Hell, *Observatio Transitus*, 1–7.

Maskelyne [1732–1811]), Paris (Charles Messier [1730–1817], astronomer of the marine), Copenhagen (the astronomer royal, Horrebow), Stockholm (two observers, including Pehr Wargentin [1717–83], secretary of the Royal Academy of Sciences), Saint Petersburg (Mayer), Vienna (two observers, including the Jesuit Anton Pilgram [1730–93]), and Ingolstadt (the Jesuit Caesarius Aman [1727–92]).[55] After a long list of calculations and explanations thereof, Hell discusses the method of observation and the time-keeping of his clocks in some detail. Finally, on page 69, all is set for the chapter on the "Observation of the Transit of Venus in front of the disc of the Sun on June 3."[56]

In the description of the actual observation of the transit, Hell's report contrasts with that of Mayer in Saint Petersburg. Whereas the director of the Saint Petersburg Academy had made sure to set armed guards at the gate of the observatory building, Hell invited the local population of Vardø into his observatory, so that they could witness Venus in front of the Sun. These are the commander of the local fortress, whose help had been invaluable in order to get the small observatory constructed, as well as a lower military officer, the vicar of Vardø, a caretaker, a merchant, and a surgeon from the fortress. In addition, the senior district stipendiary of Finnmark was expected, but failed to make it to Vardø in time because of adverse winds.[57] In the company of these witnesses, and with the aid of their "tour guide" Jens Finne Borchgrevink (1736–1819) from Trondheim, Hell and Sajnovics observed the beginning and end stages of the phenomenon in perfect conditions, thanks to "God's special dispositions."[58] The final page of Hell's report returns to the immortal gratitude that the learned world will feel towards Christian VII for facilitating the Vardø expedition.[59]

The late arrival of Hell's report, combined with the news that nearly all other observers in the far north had experienced bad weather, made some colleagues suspicious. The worst claims, which reached Hell by way of rumors, was that the Jesuit in the Arctic probably had seen little or nothing of the transit but instead of admitting the fact, had taken his time to cook up a dataset that was entirely fictive. To these allegations Hell answered that he had been forced to put the distribution of his dataset on hold until his report had been delivered, in printed form, to his sponsor King Christian VII. The ensuing turbulence could not take anything away from the fact that Hell's observation was

55 Hell, *Observatio Transitus*, 33.
56 Hell, *Observatio Transitus*, 69: "Observatio Transitus Veneris ante discum Solis die 3 Junii."
57 Hell, *Observatio Transitus*, 69, footnote.
58 Hell, *Observatio Transitus*, 75: "spe sola in speciali DEI dispositione collocata."
59 Hell, *Observatio Transitus*, 82.

distributed far and wide, with a number of favorable reviews in leading periodicals and altogether four editions—one Danish and three Latin editions—issued in the same year.[60]

### Anything Particularly "Jesuit"?

Both Mayer and Hell succeeded at observing the transit of Venus. They could have submitted a brief report and then immediately left the country, as did most other astronomers engaged on Venus transit expeditions. Instead, the two Jesuits expanded their assignments far beyond the task of merely observing and reporting on the transit. Mayer spent an entire year on Russian soil, Hell more than two years in the kingdom of Denmark and Norway. Evidently, the rare opportunity of interacting with non-Catholic scholars and using the printing presses of leading scientific bodies was to be exploited in the best manner possible.

Praise of monarchs may not have been unique to the Jesuits of Old-Regime Europe. But it certainly was taken to great lengths by Mayer and Hell. In July 1772, having returned to Vienna, Hell published a treatise on the solar parallax. There, he characterizes his own observation from Vardø, combined with corresponding observations made by Captain James Cook (1728–79) and his team in Tahiti, as something very special indeed:[61]

> Tahiti and Vardø will be the two columns upon which the true Solar parallax of 8.70 arc seconds will rest firmly and be preserved—like upon pillars of bronze—to the eternal memory of Posterity, a memory that a distant past will decorate again and again with its palms of victory.

In the draft introduction to his unfinished expedition report, the *Expeditio litteraria ad Polum Arcticum*, Hell summarizes all the observation efforts in Scandinavia and Russia in 1769 with the quite striking remark that all efforts would have been in vain, had it not been for the expedition of Hell, commissioned by King Christian VII of Denmark.[62]

60 Aspaas, "Maximilianus Hell," 265, 310–17.

61 Hell, "De parallaxi Solis ex observationibus Transitus Venus Anni 1769," in *Ephemerides Astronomicæ ad Meridianum Vindobonensem* Anni 1773 (Vienna: Trattner, 1772), Appendix, 1–116, here 109: "*Taiti* & *Wardhus* binæ erunt columnæ, quibus veluti fulcris æneis innixa vera Solis Parallaxis 8″,70 ad æternam Posterorum memoriam inconcussa servabitur, quamque sera Posterorum ætas suis identidem decoratura est Palmis."

62 See the critical edition in Aspaas, "Maximilianus Hell," 383–417, here 402–3.

The sense of being part of a decisive moment in history surfaces repeatedly in Mayer's monograph from December 1769 as well, again with the majestic sponsor looming large in the account:[63]

> How wonderfully lucky have we not been, considering that this second transit of Venus was bestowed upon us by divine grace, for the sake of removing this ignorance from us mortals! This in fact will be Astronomy's true year of birth, constituting a new epoch [...]. Those that come after us will begin their calendars with the year in which the question of the true distance between the Sun and the Earth, and indeed the entire celestial machinery, got settled correctly and definitely. How glorious will it not be when following generations feel gratitude to the special part played by Catherine II, Monarch of all Russians, in the attainment of this goal! Given the enormous benefits that this knowledge brings for Astronomy, Geography, Seamanship, and Statesmanship, I do not think there can exist any person in this world who refuses to feel joy over the total amount of expenditure that has been devoted on the observation of this transit.

Other astronomers involved in Russia in 1769 employed royal praise to a far lesser extent. Two Swiss astronomers that went to the Kola Peninsula, Jacques-André Mallet (1740–90) and Jean-Louis Pictet (1739–81), only published brief accounts of their observations, Mallet's report prefaced by a letter to the members of the Imperial Academy, Pictet's by a very brief dedication to its director Orlov, none of them mentioning Catherine II.[64] Wolfgang Ludwig Krafft (1743–1814) and Christoph Euler (1743–1808; a younger brother of Johann Albrecht), having traveled to Orenburg and Orsk respectively, got their reports published without any accompanying dedication, except an introductory letter to the

63 Mayer, *Ad Augustissimam*, 126–27: "Quam igitur bene, beateque actum est de nobis, cum, ad tollendam hanc mortalibus ignorantiam, hunc iterum transitum Veneris nobis diuinitus datum, concessumque esse, intuemur! Erit sane hic annus verae Astronomiae natalis, qui nouam *epocham* constituet [...]: erunt posteri nostri, qui suos fastos a determinatione verae distantiae solis a terra, totiusque caelestis machinae rite cognita constitutione ordiantur. Quam ergo gloriosum erit et illustre, venturis temporibus huius constitutionis, rectaeque ordinationis partem praecipuam CATHARINAE II. *Russorum* omnium MONARCHAE ferre in acceptis! Quodsi praeterea ea cognitio ingentes Astronomiae, Geographiae, reique nauticae et politicae fructus afferat, iam, qui de immensis, ad obseruationem hanc collatis sumptibus gaudere nolit, deinceps puto fore neminem."

64 Mallet, *Observation du passage de Vénus devant le disque du Soleil faite à Ponoi en Lapponie* (St. Petersburg: De l'Imprimérie de l'Academie des Sciences, 1769); Pictet, *Extrait du journal d'observations faites à l'occasion du passage de Vénus devant le disque du Soleil à Oumba en Laponie* (St. Petersburg: De l'Imprimérie de l'Academie des Sciences, 1769).

Imperial Academy.[65] Equally, reports from Georg Moritz Lowitz (1722–74; observations in Gur'ev) and Ivan Islen'ev (1738–84; Iakutsk), came from the press with brief editorial remarks, free from any royal praise or dedication.[66]

There were, however, two official accounts that did mention the empress: one being the preface to the exceptionally bulky issue of the official proceedings of the Imperial Academy of Saint Petersburg assembling reports from the various observers. This brief, Latin text—in all probability written by Johann Albrecht Euler—summarizes the history of the Venus transit expeditions across Russia in 1769 and emphasizes Catherine II's involvement not only on a financial level but also in the professional part of the project.[67] The other text is by Stepan Rumovskii, the astronomer and regular observer at the Imperial Observatory, who had traveled to the town of Kola (close to present-day Murmansk) in 1769. In a 165-page Russian monograph (published 1771), he praises Empress Catherine II, to whom the book is dedicated, but in a slightly different manner than Mayer. Like in Euler's official preface to the academy's periodical, there is no mention of amateurs of astronomy. In this respect, both Euler and Rumovskii differ from Mayer. Rumovskii glorifies the empress for her learning and involvement in scientific activities but his focus is not on the Enlightenment of the population. In contrast to Mayer's account of amateurs being inspired by the Empress to conduct various kinds of scientific activities, Rumovskii presents a chance meeting with two elderly representatives of the common people that he encountered *en route* between Kola and Saint Petersburg. Many decades ago, the two men had seen Emperor Peter the Great (r.1682–1721) with their own eyes. When they heard Rumovskii mention the name of the ruler, their eyes lit up and they were overwhelmed with joy. Rumovskii concludes that they would have been at least as happy if they had had the opportunity to see Empress Catherine II, this wonderful

65 Krafft, *Auszug aus den Beobachtungen welche zu Orenburg bey Gelegenheit des Durchgangs der Venus vorbey der Sonnenscheibe angestellt worden sind* (St. Petersburg: Kayserl. Academie der Wissenschaften, 1769); Christoph Euler, *Auszug aus den Beobachtungen welche zu Orsk bey Gelegenheit des Durchgangs der Venus vorbey der Sonnenscheibe angestellt worden sind* (St. Petersburg: Kayserl. Academie der Wissenschaften, 1769).

66 Georg Moritz Lowitz, *Auszug aus den Beobachtungen welche zu Gurjef bey Gelegenheit des Durchgangs der Venus vorbey der Sonnenscheibe angestellt worden sind* (St. Petersburg: Kayserl. Academie der Wissenschaften, 1770); Islenief, *Extrait du journal d'observations faites à l'occasion du passage de Vénus devant le disque du Soleil à Yakoutsk* (St. Petersburg: De l'Imprimerie de l'Academie des Sciences, [1770]).

67 [J. A. Euler,] "Praefatio," *Novi Commentarii Academiae Scientiarum Imperialis Petropolitanae*, 14:1 pro Anno 1769 (1770).

monarch and patron of the sciences.[68] The loyal subject in the countryside venerating the majesty may not contradict the urban enlightened dilettante depicted by Mayer, but the emphasis is definitely different. Unsurprisingly, Mayer's contribution to the project is not given any particular significance by Rumovskii, nor is his monograph even mentioned despite its overlapping content.[69] Rumovskii's monograph was printed in 1,200 copies, far more than Mayer's corresponding work.[70]

As for Denmark–Norway, we do not have comparable published reports from 1769, since bad weather spoiled the other attempts at observing Venus in front of the Sun, making Hell's report the sole example. It is striking, however, that Hell is Mayer's equal when it comes to combining enlightenment ideals with royal praise. Thanks to the visit of the Jesuit, cutting-edge astronomical research was brought to the awareness of the populace in the remotest corner of the Danish ruler's realm, we are told. Hell continued to promote his sponsor by publishing fragments from his unfinished *Expeditio litteraria* for the rest of his life. He was certainly a loyal visitor who never defected from his double task—that of observing the transit on his majesty's behalf and at the same time defend the splendor of Denmark as a nation of science.

The contributions by Mayer and Hell were noticed in their immediate academic milieux as well as in the wider Republic of Letters, not least thanks to their impressive pieces of Latin rhetoric. This immediate impact did not last for long, however. Just as the close alignment of science and monarchy would become questionable with the advent of republicanism, radical secularism cut short the possibilities for Jesuit rhetoric to find fertile soil among future generations of learned Scandinavians and Russians. Neither the Latinity of the

68 Stepan Rumovskii, *Nabliudeniia iavleniia venery v solntse v rossiiskoi imperii v 1769 godu uchinennyia s istoricheskim preduvedomleniem* (St. Petersburg: Imperatorskaia akademiia nauk, 1771), 15–16. I am indebted to Professor Yngvar Steinholt for summarizing the contents of this text.

69 Rumovskii, *Nabliudeniia iavleniia venery*, 1–39 (on Mayer, p. 34). Initially, a short report with the dataset from Kola was printed in Russian and Latin, accompanied by an introductory letter to director Orlov, in which Rumovskii expresses hopes that the other observers have had more success than him: "Propter commodum publicum, honorem Academiae tuamque Illustriss. Comes gloriam de toto corde opto voueoque, vt reliqui obseruatores ad illustriss. Academiam gratiores nuntios ablegare queant" (For the sake of the common good, for the honor of the Academy and for Your glory, Illustrious Count, I hope and pray with all my heart that the other observers will be able to deliver more welcome reports to the illustrious Academy). The Empress is not mentioned in this short report. Stephanus Rumovsky, *Observationes spectantes Transitum Veneris per discum Solis et eclipsin Solarem die 27. Maii/3. Junii 1769. Kolae in Lapponia institutae* (St. Petersburg: Typis Academiae Scientiarum, 1769), no page.

70 Moutchnik, *Forschung und Lehre*, 221–22.

supranational Society of Jesus nor the cosmopolitan ideals of the Republic of Letters fared well in the face of nationalistic historiography. Hell's expedition has hardly been inscribed in the Dano-Norwegian canon, whereas Mayer is all but forgotten in Russian historiography of science.

## Conclusion

In the end, the transit of Venus project of 1769 yielded less diverging results than the datasets from 1761: after all observations from the remotest parts of the earth had been published, calculations differed between 8.40 and 8.80 arc seconds, whereas earlier results had ranged from 8.28 to 10.24.[71] At the center of this massive project—albeit briefly—were two Jesuit astronomers from German-speaking parts of Europe. Already before the transit of 1769, the two were prominent in their local settings, in the Palatinate and Austria respectively, where they directed recently constructed observatories and successfully observed the transit of 1761.

The transit of 1769 propelled Mayer and Hell to the pinnacles of their careers. The publications they produced while on foreign soil enjoyed the imperial and royal stamps of Russia and Denmark–Norway, respectively. From their emerging status as "fix stars" running permanent observatories of a high standard in Schwetzingen and Vienna in 1761, they hoped to explode upon the firmament as "supernovas" of the Republic of Letters in 1769.

Although the contributions of the two Jesuits to the general history of astronomy in the period have received some attention in recent historiography, their roles as "missionaries" in a wider sense of the word have hardly been studied comprehensively, at least not in comparison. Through close reading of the official reports from their expeditions, a peculiar kind of rhetorical narrative comes to the fore, one aimed at galvanizing the status of Jesuit scholars as loyal and useful promoters of enlightened monarchs and the "nations of science" over which they ruled.

While traditional textual hermeneutics and book history cannot be used to assess the degree of success of Jesuit "ministries among the learned," such methodology is certainly needed in order to recognize the rhetorical strategies of Jesuit professionals such as Mayer and Hell, who operated with their backs against the wall, towards the very end of the era of the Old Society of

71 Aspaas, "Maximilianus Hell," 200–1; 324–26.

Jesus. To them, the 1769 transit of Venus served as a springboard for promoting Jesuit science in non-Catholic regions. Although they did make the most of the opportunity, their strenuous efforts could not secure lasting fame either to themselves or to the order they represented, at least not in the historiography of science in Russia and Scandinavia.