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ELECTRICITY FROM BEIJING TO PETERSBURG

Abstract: We compiled a detailed study focused on the Beijing invention of early electrophorus in 1755: it was designed by Hallerstein's Beijing Jesuits and their collaborators. They sent their results to Petersburg as a part of their correspondence with the Russian academicians. This essay is an extension of our earlier work printed in Europe, in USA, in Japan, and in China.

Key words: electrophorus; Beijing Jesuits; Petersburg academicians; Aepinus; Hallerstein; Amiot; Gaubil; Richmann; Wilcke; Volta; History of electricity; 18th century; scientific correspondences; Russian-Chinese relations.

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ЭЛЕКТРИЧЕСТВО ИЗ ПЕКИНА В ПЕТЕРБУРГ

Аннотация: Мы составили подробное исследование, посвященное пекинскому изобретению раннего электрофора в 1755 году: оно было разработано пекинскими иезуитами Халлерстайна и их сотрудниками. Свои результаты они отправили в Петербург в рамках переписки с русскими академиками. Это эссе является продолжением нашей предыдущей работы, напечатанной в Европе, США, Японии и Китае.

Ключевые слова: электрофор; пекинские иезуиты; петербургские академики; Эпин; Галлерштейн; Амио; Габиль; Рихманн; Вильке; Вольта; история электричества; XVIII век; научная переписка; русско-китайские отношения.

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INTRODUCTION

The Beijing design of electrophorus (持续起电盘, [电] 起电盘, 电气盆) was a precursor of Voltaic pile: together with compasses it might have been one of the greatest Beijing contributions to modern electronics before CCP era, very important for today's competition between China and USA.

The Beijing electrophorus experiment had another handicap: Aepinus and all after him referred to Beijing success under corporate name "Beijing Jesuits". No personal names, no nationality: just geographical and religious determinations.

BEIJING ELECTROPHORUS

The experiments with electricity and magnetism were the Chinese domain for millennia. The alchemy related to early chemistry as well. The Beijing literati might not have officially mixed both those agendas into Galvanic and Voltaic conglomerates, but in 1755 the Chinese and their Jesuit visitors enabled Volta's discoveries anyway.

HALF OF A CENTURY FROM LEYDEN JAR THROUGH THE BEIJING ELECTROPHORUS INTO VOLTAIC PILE

Let us arrange some timetable as a reminder:

In 1745/46 the first European Leyden Jars were constructed in now northwest Polish Kamień Pomorski and Koszalin as well as in Leyden.

In March 1746 in his Portuguese missionary headquarters Hallerstein inherited Johann Schreck's legacy which advanced Hallerstein's close collaboration with Beijing Jesuits who worked under French flag: few months later, on 2 November 1746 his Beijing neighbor Pierre Noël Nicolas Le Chéron d'Incarville (*1706; †1757) reported to the Parisian Bernard Jussieu that Hallerstein lent him Johann Schreck's masterpiece *Plinius Indicus* full of plants, minerals and animals harvested in nature at a more liberal era when the Ming authorities allowed the missionaries' travels across China and neighbouring countries.

Just before he left Petersburg in 1748, in 1747 António-Nunes Ribeiro Sanches (*1699 Penamacor in east Portugal; †1783 Paris) instructed his Londoner friend the equally Marrano (crypto-Jew) physician Jacob de Castro Sarmento (Henriques, *1690 Bragança in northeast Portugal; †1762 London) to send to Hallerstein the electrical machine from Peter Collinson's collections together with John Bevis' instrument designed for the observation of eclipses [1].

On 12 November 1752 Gaubil reported to Mortimer that Hallerstein and Gogeisl got their Londoner passage instrument: on 7 November 1756 Hallerstein confirmed that receipt (Gaubil 1870, 703; Hallerstein 1764, 511). Therefore, it arrived in Beijing between 1748–1752, most probably in 1750. Their electrical machine might have been a Leyden Jar almost simultaneously sent to B. Franklin. Richmann obtained it in Petersburg much earlier: obliviously, Richmann was much closer to Leyden, Kamień Pomorski, and Koszalin which is just 1000 km southwest of Petersburg. The co-inventor of Leyden Jar Ewald Georg von Kleist's (Ewald Jürgen, * 1700 Wicewo; †1748 Koszalin) last residence in Koszalin is 692 km southwest from Richmann's native Pärnu. Subsequently, Richmann had much quicker access to the new electromagnetic devices than B. Franklin or A. Hallerstein.

On 12 April 1753 in Petersburg Kratzenstein and around the same time Richmann reported about their electrical studies to the Beijing Jesuits: they certainly included their recent publications. On 26 July 1753 Richmann died electrocuted: Kratzenstein left for Copenhagen few days later, on 13 August 1753.

In November 1753 the Petersburg academy of science and the empress announced a prize-winning question about the physical and chemical backgrounds of electrical phenomena: the last day for mailing the anonymous essayistic answers under the pseudonyms encrypted into anagrams was 1 June 1755. The deceased Richmann, Kratzenstein, Lomonosov, Wilcke, Aepinus, Beijing Jesuits and their collaborators probably did not compete for that prize or at last did not win one of the three awards: all the victors were foreigners because even the Petersburg born Johann Albrecht Euler worked in Berlin in those times.

On 27 July 1750 Jean-Joseph-Maria Amiot (Amyot, Qián Démíng, T'ien té-ming jo-ché, *1718 Toulon; †1793 Beijing) arrived in Macao: he reached Beijing together with Joseph D'Espinha (José, *1722 Portugal; †1788) and the surgeon Emmanuel de Mattos (*1725 Portugal; †1764) on 22 August 1751 [2, pp. 41, 66, 103]. Amiot and others used Hallerstein's electrical machine which was not necessarily needed for their electrophorus in 1752–1755: electrophorus was just an electrostatic generator producing charge by electrostatic induction. But in 1752 Richmann charged his device by Leyden Jar which means that the Beijing Jesuits probably did the same in their answer to Richmann's letter three years later, especially if they experimented after reading Richmann's messages. Gaubil died in 1759 but the future member of Petersburg academy Hallerstien and his collaborator Amiot certainly read Aepinus's Petersburg comments of their Beijing experiments, and maybe even Wilcke's Stockholm data: but those Beijing experts eventually did not issue any further research on those topics to Europeans, at least not in any published form.

On 26/27 November 1754 Jelačić arrived in Beijing through Siberia: three years earlier Amiot travelled from the opposite direction from Macao like Hallerstein who retuned from Macao to Beijing on 21 October 1753 after his farewell from the Portuguese diplomatic envoys who brought 28 items as their tribute goods including flintlock rifles and pistols, enamel knives, silver candleholders, pure gold stationery and snuff boxes, gold-threaded brocade, and gold-embroidered textiles [3, p. 165]. As he was only a messenger, Jelačić probably did not inform Gaubil about Richmann's and Kratzenstein's whereabouts on 12 January 1755. In April 1755 Gaubil passed to Jelačić a report about Amiot's successes while assuming that Richmann was still alive: in Beijing, Amiot must have experimented with electricity sometimes between September 1751 and March 1755. It is not very probably that he did that same research previously in Macao where the tools were scarce, but he might have gained some ideas from his Chinese hosts especially from the five Chinese catechists or missionaries included in then Beijing French Jesuit Mission. Those intellectual exchanges were frequent in China of those times: just like the Beijing bells casting combined Michel Benoist's (Benoît) westernized alloy with Tibetan formula later in 1771 [3, p. 181–182].

On 6 September 1755 the Russian Empress declared three winners of the prize competition: eventually, the Beijing Jesuits did not compete as they were informed too late, or their approach was not theoretical and philosophical enough.

On 10 March 1757 Aepinus read his paper about new electrical experiences concerning tourmaline in front of the Berliner academy: that crystal was rare in then Europe, mostly imported from Sri Lanka (Ceylon). It was praised by mediaeval Persians and not yet promoted by its greatest mines in Brazil and in the Equatorial Africa. The inducted difference of electrical charges on both sides of tourmaline so much resembled the Beijing electrophorus that Aepinus immediately connected both effects when the Russians gave him Beijing report of 1755 (Aepinus 1757).

In July 1756 Jelačić brought his newly acquired Beijing items to Petersburg. Gaubil's letter about Amiot's electrical experiments and probably also other letters about similar topics were not passed to Lomonosov but to Aepinus.

On 10 March 1757 in Berlin Aepinus reported about the new tourmaline-related electrical experiments. A year later in Petersburg he discussed the Beijing electrophorus on 9 March 1758 and on 17 November 1758 [4, pp. 10–11]. Therefore, at least during eight months officially nobody bothered about the Beijing electrophorus in the European Petersburg: the Jesuits certainly put forward some notes about the new electrophorus at the Chinese court of their employers. Aepinus used the misleading collective name "Beijing Jesuits" while omitting Amiot's or other names because of Seven Years War of Aepinus Prussia fighting against Amiot's native France, Hallerstein's native Habsburgian monarchy, and the Russians. Despite of war, the Euler's and Aepinus's communications worked well between Berlin and Petersburg.

Aepinus promptly informed his friend Wilcke in Stockholm. Few years later in 1762 Aepinus's student Wilcke designed his own electrophorus in Stockholm.

Joseph Louis Lagrange left Torino for Berliner academy in 1766. From Berlin Lagrange informed Gian Francesco Cigna in Torino about Aepinus' and Wilcke's comments on Beijing electrophorus for Cigna's own advanced electrophorus.

On 10 June 1775 from Como Volta asked Joseph Marie count Maistre's antagonist J. Priestley about Volta's newly named elettroforo perpetuo (electrophorus): in his reply letter Priestley mentioned at least Wilcke, but the well-read Priestley also knew all about Beijing, Aepinus, and Cigna. Anyway, the Beijing, Richmann's and Cigna's merits were gradually forgotten for the benefits of Wilcke's and Volta's electrophorus except for the Jesuit authors like the Viennese professor of experimental physics Joseph Herbert (1725–1794). The internationality of Beijing Jesuits dwarfed their deserved prestige [5, 26; pp. 122–123]: the people wanted names while Aepinus referred only to the Jesuitical Beijing collective.

No electrophorus necessary involved Hallerstein's Leyden Jar, or electrostatic generator, or sophisticated chemistry: mere triboelectrification by friction was sufficient for its electrostatic induction. But in 1752 Richmann used his charging with Leyden Jar which means that the Beijing Jesuits did the same in their answer to Richmann's letter three years later, especially if they experimented after Jelačić gave them Richmann's letter which included the preprint of his article that was published in Petersburg after his death, but widely circulated much earlier. The chemistry and zoology joined their game by Luigi Galvani's (1737–1798) and his wife's Bolognese frogs. Like Cigna and Lagrange before him, Galvani studied the ideas of Piarist Giovanni Battista Beccaria. Politically and therefore also scientifically Volta's Habsburgian Lombardy was at odds with Galvani's Bolognese Papal states as well as with Beccaria's-Cigna's royal Torino: just like Galileo's Florence of Medici competed with the Jesuitical Rome a century and half earlier.

HALLERSTEIN'S AND AMIOT'S CHINESE ELECTROPHORUS

Hallerstein was especially close to the French Jesuits Gaubil, d'Incarville and Amiot. If there has ever been a serious competition between the two groups, Hallerstein had put an end to it by the time when the sharing of scientific devices and the exchange of knowledge became increasingly necessary for those somewhat isolate' Beijing's Jesuits: while their core activity was inextricably shifting from religion to science in fatal decades before the ban of their Jesuit order. Hallerstein has repeatedly tried to convince his European correspondents about his insufficient supply of astronomical and physical tools. In his own right, that was primarily a smart policy for acquiring better equipment: with them a conscientious observer Hallerstein also earned his knowledges of natural phenomena. Hallerstein's European correspondents in London and elsewhere accepted his explanations and helped him: they sent new devices and books for astronomical and other observations in a kind of exchange for Hallerstein's Chinese measurements.

Before 1750, Hallerstein and his associates from the Portuguese college of St. Joseph in Beijing received an electric device, along with John Bevis' (1695–1771) tools to observe the eclipses. The Jewish doctor Antonio-Nunes Ribeyra Sanches (1699–1783) obtained both those instruments with the help of his friends in London and the Netherlands and sent them to Beijing in 1747. The newly appointed Bishop of Beijing Polycarpe de Souza (1697–1757) assisted at least the transport of passage instrument. Gaubil reported to Londoner secretary of RS Mortimer about that passage instrument. On 7 November 1756 Hallerstein confirmed Gaubil's narration: "The passage of the Sun and Mercury through the meridian, which they call the Culmination, was observed by an instrument of three feet. That (instrument) was brought to us few years ago as the gift of Antonio Ribeiro Sanches, and we put it carefully, accurately, firmly, successfully in the Meridian…" That passage instrument was the meridian transit instrument: a small telescope with extremely precisely graduated mount used for the accurate observation of star positions. It might have been otherwise termed Bevis' instrument designed for the observation of eclipses, which means that it arrived in Beijing together with electric device. After 1746 Bevis and William Watson corresponded extensively with Benjamin Franklin's Philadelphia group as they jointly refined the Leyden jar. Even before Sanches delighted Hallerstein with that electric device, the wealthy Quaker Peter Collinson (1694–1768) sent a Leyden jar from the London royal society to Benjamin Franklin across the Atlantic. In 1751, Collinson arranged for the publication of their correspondence, which largely defined modern thinking about electricity and lightning rods. Sanches also corresponded with Collinson; he sent him the seedlings of rhubarb, which he received from Hallerstein's Jesuits [6, vol. 2, pp. 701, 760; 7, pp. 37, 617, 703, 850; 8, pp. 510–511; 9, pp. 177, 179; 10, pp. 850, 851; 11, pp. 148, 224, 232, 234-235; 12, pp. 98, 101; 13; 14, p. 88; 15; 11, p. 563].

According to their report sent to Petersburg in 1755, the Beijing Jesuits fused a thin glass plate and placed it on a compass' glass cover so that the charging could be repeated several times. Each time the magnet needle rose again and returned to its original position in a few hours. When the Jesuits withdrew the previously charged glass panel, the compass's magnetic needle rose again and remained in contact with the glass cover. When they returned their glass plate to its previous place, the needle dropped again. Thus, the Pekingese Jesuits could repeat the experiment many times: that was certainly the influence of their Chinese hosts who loved the Confucian repeatable histories of their dynastic successes determined by the mandates of heaven. The Jesuits and their native Chinese collaborators were certainly not fully aware that for the first time in history at their controlled laboratory environment they observe a repeatable experiment with a permanent source of electricity, as we do with today's batteries or electrical outlets. But they were sufficiently self-conscious: they reported their success immediately to the Petersburg Academy. Seven years later in 1762 that Academy accepted Hallerstein as its correspondent (foreign) member, then only Catholic of Slavic origins besides Janez Žiga Valentin Popovič and Bošković who both became honorary members on 17 January 1760. On 17 February 1765, Hallerstein was elected honorary member of Petersburg academy.

In November 1753, the Petersburg academy of science published a prize-winning question about the real causes of electricity and its theory: the last day for mailing the answers was 1 June 1755. The Russians were interested in both physical and chemical backgrounds of electrical phenomena [16, p. 130; 17; 18, pp. 3–4, 8, 10].

We do not know whether the competing contribution of the Hallerstein's Chinese Jesuits arrived in timely manner to Petersburg before 1 June 1755: probably not if Jelačić was their postman. Despite of all the praise they received by Aepinus, those Beijing experts were not officially rewarded. According to the contributions of other competitors, it might be possible to say that the exploration of the Pekingese Jesuits was primarily a careful experimental observation, as were all other Hallerstein's works, while those eventual winners of that Russian competition mostly provided a more philosophical explanation of the background of electrical phenomena.

AEPINUS COMMENTS THE BEIJING ELECTROPHORUS

L. Euler's protegee Aepinus preferred Beijing electrophorus and tourmalines over the electrical fish which might be hard to obtain in Prussia or Russia which lacked equatorial colonies. Aepinus took over Beijing electrophorus data soon after he arrived in Petersburg. His messenger was Franz Luka Jelačić (Франц-Лука Елачич, 1720–1776) inside the expedition lead by Aleksei M. Vladykin, the son of boyar child Matvei Mikhailovich Vladykin (Матвей Михайлович Владыкин). On 12 May 1753 the former student of Beijing Mission appointed in 1732 Aleksei Vladykin (Алексей Матвеевич Владыкин, Alexey) now translator of Chinese and Manchurian works in Petersburg college for the foreign affairs headed the Siberian caravan which left Russia and arrived in Beijing in late 1754 [19, pp. 171–173, 176, 180–181, 188–189, 193]. The Petersburg Chinese collection of Яков Вилимович Брюс (1670–1735) was distinguished by its versatility: it included exotic items and artistic monuments and household items of the 17th — early 18th centuries. During a fire on 5 December 1747, those items were burnt down along with other items from the Chinese collection in Saint Petersburg Kunstkamera (Кунсткамера) facing the Winter Palace. In 1753, the doctor Jelačić accompanied Vladykin to Beijing to restore that lost collection: Jelačić was hired to replace the lost curiosities with the similar rarities. He was a granduncle of the Croatian ban Josip Jelačić (1801–1859). A Habsburgian native, Franjo Luka came to St. Petersburg in 1742. On 23 January 1748 he was hired by the Academy of Sciences as a doctor. He visited China on three occasions in 1747, 1754–1756, and 1757–1764. For his second time in 1753 he went to Beijing as part of a trade caravan with the assignment to "collect everything memorable in Siberia and China" to replenish the burnt Chinese and Siberian collections and books. To help him, they gave him an illustrated catalog of things lost in the 1747 fire. Returning to St. Petersburg in July 1756, Jelačić handed over to the Academy of Sciences all the items he had brought in China: he also carried Gaubil's and other letters with him. His "Register of Chinese and Manchurian Books and Things" compiled by him consisted of 274 numbers: 50 books and 224 other items. He acquired many additional valuables of his choice. Having accepted things and books according to the "Register", non-commissioned librarian of the Academy of Sciences Ivan Ivanovich Taubert (Иван Иванович Тауберт, 1717–1771) reported to the Academy Chancellery that they were better in value and quality and more numerous than those lost during the fire. They characterized the life, culture, and art of the Chinese. The artefacts brought by Jelačić from China in 1756, together with the private collection acquired in 1754 from Lorenz Lange (Лоренц Ланг, 1684–1752) who personally visited China several times, enabled the restoration of the ethnographic collection at the Petersburg Kunstkamera.

On 12 January 1755, Jelačić handed to Gaubil an undated letter from Georg Wilhelm Richmann (1711–1753) and a letter from Christian Gottlieb Kratzenstein (1723–1795) dated on 12 April 1753: both were corporately addressed to the Jesuits of Beijing. They certainly included their recent publications: Kratzenstein's electrotherapy resembling Mary Shelley's Frankenstein, as well as Richmann's inventions accomplished a year earlier in 1752 but published in Petersburg only after Richmann passed away. Richmann might have provided one of the first western descriptions of induction which he called "magnetic force without a magnet". Richmann copied John Michell's English sources and repeated Michell's experiments: "Having received from the most reverend Dumaresque (Dumaresq), a pastor of the Church of England, letters written to him by certain persons from England, in which they described a method of communicating magnetic power without a magnet by steel plates prepared for this purpose, to which, however, the magnetic power had not yet been communicated. I tried to imitate those experiments performed in England. And since all that was required for the proper organization of these experiments was not at my hand, the English author Michal Anglo [13] prescribed the method proposed less distinctly, I substituted the former by which I thought, that the same would be accomplished, and I changed his method by some part to obtain the same by taking over some risks." Michell's main references were the later British Museum principal librarian Dr. Gowen Knight's (1713 Corringham, Lincolnshire-1772 London) commercial magnets (1740), W. Gilbert, Servington Savery's compound magnets designed in Shilfton in 1735, Brook Taylor (1685–1731), and Musschenbroek. In those times Michell was still a Cambridge lecturer of Greek, Hebrew, arithmetic, and geometry. His illustrations inserted between pages 72/73 did not match Richmann's figures 6-7 at Richmann's table VI. Michell described his repetitive magnetizations which became the basis of repetitive electrifications of Richmann's and Beijing electrophorus: "…may now lay down the first half dozen, in a line as before, and retouch them after the same manner with the latter, which have just received their Magnetism from them: this done, lay those down also again, and retouch them with the others: Repeat this a few times, first touching one Set, and then the other, till they have acquired as much Magnetism, as they will retain; or till they will receive no additional force, by any further repetitions." Richmann commented that: "b) However, the power of the verticals is weakened by such a reason. Michell asserts the contrary in his great treatise: that by such an exchange of plates the power of the petiole is increased to a definite degree. So, either he did not observe the decrease in the power of the vertical plates, or I made a mistake in some circumstance while I imitated his experiment" [20, pp. 235, 239; 21, p. 31]. Richmann used Michell's original and not the French translation which was published during Richmann's own writing in that same year 1752. In his next article printed at the same volume of Peterburg acts, Richmann discussed heat and then designed the instrument to measure such small inductive electromagnetic forces noted by Michell. The friend Lomonosov helped Richmann: "confirmed by an excellent experiment, to which contributed the most honorable colleague the great Lomonosov with three portions of glass, ground into a powder of various subtleties…" Richmann used Franklin's method to charge his Leyden jar by atmospheric electricity: he discharged it through his own body. Richmann placed his charged Leyden jar on an insulating support: he connected its electrodes to linen wire electrometers which were his own invention known abroad under the name of electric gnomon. By touching the bars, he observed the deviation of the wires if the outer electrode consisted of a metal cylinder in which the jar was placed. Therefore, he highlighted the phenomena resembling those encountered when manipulating the later electrophorus. In both cases, the process can be repeated several times while the device has only been charged once. Richmann described his new tool: "if the mass KL immediately electrified by the electrifying glass is touched, its electricity is lost: the wire OP is attached to the rule, and for a moment also another wire ST is attached to its rule, but the electricity is soon restored in the mass MN, because of the repulsion of the wire. If this mass is now touched again, the indicator wire attaches itself to the ruler, and the mass, receives electricity from the other side of the flask, which shows the repulsion of the wire. This, without the motion of the engine, if the electricity is strong, it repeats alternately for ten times until the total extinction of electricity. Does this infinite body take away the motion of particles of glass, or particles of electric matter, particles of glass adhering to it impressed on one side of the surface of the bottle: and arrange it only on the other side of the surface? Or it really allows a certain passage of matter from an infinite body into a finite body?" That Richmann's alternation was probably the inspiration needed for the Beijing electrophorus, if Beijing experts worked during few weeks after Gaubil gave them the items received from Richmann.

Richmann added some vacuum experiments: "The empty space of the air can easily be filled in the dark with electric light, which can be observed with great efficiency. The Torricellian phosphorescent tube was attached to a wooden board which was suspended from a ferric cord, composed of electrified electricity, electrified with mercury mass through an iron wire: the line would be distant from the wooden board. During the electrification a continuous flash of lightning and a mute light arose in the darkness in the empty tube without any flickering of the mercury: the electrifying motion of the glass had several times provoked hither and thither the touch panel which released light to the touch. If, however, the table was not touched, occasional flashes of lightning would arise from the bridge for a hundred times in the void, the interval of time between the two flashes sometimes exceeding the minute or a second. When the composite mass is electrified, the light sometimes flickers in the vacuum tube, a sure indication that the electricity of the mass has not yet been completely extinguished, but that there is a residue, which is awakened by illuminating the Torricellian vacuum tube. Are lightnings equally produced in a vacuum by simple electricity? Spontaneously, however, they appear less frequently after the electrified movement of the glass. Could not even the vortexes arise in the rarer region of the air, and from there the weak electricity that follows the thunder? Are not the northern lights also similar?" Certainly, a Chinese kind of repeating, the aurora borealis which were not infrequent north of Petersburg, and finally a thunder fatal for Richmann: "at the approach of different clouds, unevenly electrified, a thunderbolt may arise, and thence lightning and thunder: the radius of the sphere of the activity of the cloud may be increased, as an iron rod is more rapidly immersed in the sphere and of the heat, and thus suddenly electricity may arise. Assuming that if the medium is a fixed and original source of electricity, which happens to electrify the chain, the electricity can persist for some time at the same intensity. If, however, the medium is moist, and so approaches the character of bodies which translate the electricity, the supports of the chain can easily be moistened, and thus the whole chain may be changed in a short time into a body infinitely translating electricity; whence it is not surprising if the electricity suddenly decreases" [22, pp, 277–278; 20, pp. 235–236, 316, 324–325, table VIII, figure 3, 329–330, 339; 21, pp. 8, 18–20, 22, 31].

Besides Richmann's letter, Jelačić also brought to Beijing the mail from Razumovski and Lomonosov's Moscow classmate Stepan Petrovich Krasheninnikov (Степан Петрович Крашенинников, 1711–1755), the Russian traveler and explorer of Kamchatka and member of the St. Petersburg Academy since 1750: following the poor Richmann, Krasheninnikov also died shortly after the Beijing Jesuits received his letter. A month after he delivered the Petersburg mail to Beijing Jesuits, on 11 February 1755 Jelačić additionally donated to the Beijing Jesuits the volumes 7–14 (1740–1747 for the years 1735–1742) of the acts of Petersburg Academy of Sciences and a tractate on the theory of the Moon.

On 30 April 1755 Gaubil replied to Razumovski and to both Petersburg academicians, Richmann and Kratzenstein: Gaubil mentioned and included Amiot's experiments "which Amiot sends." Gaubil might have supposed that the Chinese were not very interested in electrical experiments compared to the European and American euphoria of that time. That comment could be misleading: additionally, as the servants paid by the emperor the Beijing Jesuits were formally obliged to provide their data about new electrophorus to the Chinese court. Maybe even three months after Jelačić's departure in middle May 1755, Gaubil sent many parcels to the Russian Razumovski, among them two Amiot's packets around August 1755 [7, pp. 803, 810–811, 818; 23, p. 405; 24, p. 41; 25, p. 55; 14, p. 58; 26, p. 88].

Gaubil's or other Beijing mail sent to Petersburg in 1755 was classified under corporate "Beijing Jesuits" term while cited by Aepinus and all the others who followed Aepinus' research: no personal names were mentioned, nor the French or Portuguese group involved. In that same year 1755 Felix de Rocha joined the president of the Astronomical bureau Hallerstein and his deputy Gogeisl at the bureau. On 24 May 1755, the head of the Chinese mission and vice-provincial Felix de Rocha wrote to Razumovski that the Petersburg academy should donate books to the Beijing missionaries in return for four volumes of research work that the Chinese Jesuits had given them. Certainly, all Beijing Jesuits welcomed the opportunity to communicate with Europeans by Jelačić's caravan. On 30 September 1757, Rocha wrote again to the St. Petersburg Academy and described the scientific work he was doing together with Hallerstein and Bahr [7, pp. 803–804, 810–811, 818; 24, p. 41; 23, p. 405; 25, p. 55; 14, p. 58; 27, p. 51].

On 17 November 1754 Gaubil wrote to Delisle who received that letter a year later, on 16 November 1755. Gaubil noted that the Russian caravan which he mentioned previously on 3 November will arrive to Beijing in 9-10 days, but Gaubil did not know yet if they are bringing any items for his fellow Jesuits. In that letter Gaubil reported about the visit of the »Hungarian« Jelačić in Beijing: "The Russian caravan has been here this year… Some members of the Academy and Razumovski have written together to the Jesuits of Peking… A Hungarian surgeon ordered some purchases to be made here for the cabinet and the library of the (Petersburg) Academy…" [7, p. 793]. Gaubil received the books from the Mr. surgeon (alias Jelačić) on 11 February 1755 including the theory of Moon. As a fine official Gaubil replied to Razumovski in the name of his Jesuit superior [7, p. 804].

On November 21, 1749, Jean-Joseph-Maria Amiot's (1718–1793) sailed for China and landed in Macao next year. Two days before his departure he sent the letter to Delisle on 19 November 1749: Delisle moved from Petersburg to Paris in 1747. Amiot arrived in Beijing on 22 August 1751 while the French Mission had five Chinese catechists or missionaries: those might have influenced Amiot.

On 30 April 1755 unaware of Richmann' misfortune Gaubil sent Latin compliments to Richmann and Kratzenstein for their research and publications about the electricity. According to a French copy made by the Jesuit sinologist Louis Gaillard (1850 Paris — 1900 Beijing), Gaubil noted that: (…Josephus Amiot, a member of our French college, diligently carried out the experiments he had devised and was ingenious in the manner of making those examinations. He has already achieved something; he is sending everything to you, as he observed the length of the pendulum (probably electrified as in later Beccaria's experiments), examined the declination and inclination of the (magnetic) needle. That author (Amiot) is sending them to you as our teachers and masters in that matter. I highly recommend them and P. Benoit who work according to your method and your thoughts…"). In 1760 the Petersburg academy published those astronomical observations noted in Beijing on 6 May 1753 — February 1755 as the work of French college in Beijing together with later measurements accomplished in December 1755-November 1756. But those Amiot's investigations of electricity were never published in that manner under his name in Petersburg. Also, the Beijing electrophorus experiments of 1775 were published in Petersburg just with the comments of Aepinus.

A dozen days later, on 12 May 1755 Gaubil wrote to Michael Angelo Deshauterayes (1724–1795) that the Russian caravan will depart for Petersburg in few days. Therefore, Jelačić stayed in Beijing just a half of year from 26/27 November 1754 to middle May 1755. But the way back was nearly so long as the sailing to Portugal: he gave his Chinese items to Petersburg academy a year after he left Beijing, in July 1756 [7, pp. 473–476, 810–811; 2, p. 66; 28].

Gaubil did not publish experiments with electricity. His notes about Amiot's pendulum, declination, and inclination were not meant to be exact, but it is obvious that Gaubil did not include any kind of the Beijing electrophorus. Jelačić was their probable messenger, but Jelačić of somebody else certainly carried to Petersburg another almost simultaneous report about electrophorus: as Jelačić's caravan was there visiting them in Beijing, the Jesuits did not use the boats to deliver their letters, but besides Jelačić there were also other occasional Russian visitors. In 1752 Richmann charged his device by Leyden Jar which means that the Beijing Jesuits probably repeated that same design in their answer to Richmann's letter three years later filled with their description of electrophorus, especially if they experimented during short Jelačić's stay in Beijing after they read Richmann's letter. The Leyden Jar might not be the indispensable Beijing charger of electrophorus, but it was a convenient one.

Richmann and Kratzenstein published about electricity which stimulated their Beijing correspondents. Eventually, in 1755 Gaubil was not aware that Richmann died in 1753. Soon afterwards on August 13, 1753, Kratzenstein left the academy of Petersburg to become professor of medicine and experimental physics at the University of Copenhagen, just before the Petersburg academy announced its prize question about electricity [25, p. 80]. In 1756 Aepinus' new collaborator Johan Ernst Zeiher (1720–1784) replaced Kratzenstein and replied to Gaubil: he reported about Richmann's death [14, p. 58].

Richmann's substitute was Aepinus. In his native Rostock Aepinus completed his studies and taught. He collaborated with his Swedish student Johann Karl Wilcke (1732–1796) on the early type of Beijing condenser that Volta later developed into electrophorus at the Grammar School at Como in 1775. After working in Berlin for a short time, Aepinus was appointed member of the Petersburg academy instead of Richmann. On May 10, 1757 [4, p. 10], Aepinus arrived in Petersburg and remained professor of physics at the academy until 1798: he also tutored the prince and headed Russian secret cryptographic service from 1764 until 1797.

The data about Beijing experiments were passed to the new professor of physics Franz Maria Ulrich Theodosius Aepinus (1724–1802). Just months later he submitted the report on the Beijing experiments to the Petersburg academy [4, p. 11; 16, p. 492]: he read his paper about tourmaline in Berlin on 10 March

1757 and about the Beijing electrophorus in Petersburg a year later, on 9 March 1758. Aepinus explained the Beijing experiment by the small conductivity of glass with the induced charge on the glass coverage of the magnetic needle, slow movement of the charge into the attached needle during the experiment, and equally slow returning of the charge after the induced charge was removed. Aepinus successfully repeated Beijing experiment and added twelve similar designs of his own. He stated that Beijing experiment fully confirms Franklin's theory [18, pp. 23–24].

Aepinus' anonymous reviewer continued: "Now it happens that, by their new electrical experiment very singularly instituted, they have provided a loop to further illuminate the Theory of Electricity itself, and to throw out almost as much in a matter about which we have as many opinions as there are heads. Their electric glass plate is attached to a magnetic box covered with glass, and while this is being done, the magnetic needle, leaning on the glass with its cup, is quickly snatched up to the glass covering the box, and for two or three hours it adheres tightly, as if glued. After the procedure the needle suddenly falls and returns to its usual position. The plate is removed from the box: behold a paradox! With the said needle which they fastened again, adhering again to the glass cover of the cylindric, and at the space of two or three hours, as it had been before, sticking to the plate again, the needle falls off. By being uplifted it is again attracted. The Jesuit Fathers were able to repeat this a hundred times. And this is the essential of the Beijing experiment which everyone will wonder how (to explain). The electricity, which after the lapse of several hours seemed to be completely extinguished, could have been revived in a moment, as it were there before: without any new friction, or excitement, by the mere removal of the plate. Having come to the knowledge of the author of this dissertation soon decided that he should inquire into the cause of these so unusual phenomena and examine it from the principles of Franklin's electric theory, which, as is evident from Franklin's own book on the Theory of Electricity and Magnetism, have experienced a strange manner of congruence with nature that it can explain [18, pp. 23]. (Franklin's theory) provided a remarkable agreement. By the Beijing experiment, (Aepinus) drew various conclusions about the new phenomena: the new experiments suggested to him conclusions which he instituted with great diligence. We attribute to the usual dexterity of the Author, that he has taken great precautions in this matter. We know that he would have said goodbye to the principles of the Franklinian theory, if the experiments opposed what they were supposed to teach had ordered it. But the opposite happened; therefore, now he strengthened himself in every way in his (and Franklin's) opinion."

CONCLUSION: WHY THE MODERN EUROPEANS NEGLECTED THE BEIJING ELECTROPHORUS?

Certainly, there are always several possible levels defining the generally praised experiments (and publications) which determines the successful paradigm: one of them is hailed by the nationalistic imperialism. The other Needham's and M. Weber's question is why the Chinese failed to produce Volta, Faraday, Edison, or Tesla needed for electrodynamical moneymaking out of electromagnetism? Just like the Chinese steam engineers failed to produce James Watt. Or did they, according to the provocative turning of the puzzle upside down by Nathan Sivin (1931–2022).

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