Allgemeine Naturgeschichte

und

Theorie des Himmels,

oder

Versuch

von der Verfassung und dem mechanischen Ursprunge

des ganzen Weltgebäudes

nach

Newtonischen Grundsätzen

abgehandelt.

* * * * * * * * * * * * * * * *

Königsberg und Leipzig,

bey Johann Friederich Petersen, 1755.

Catalogue 63

Origin of the Solar System: Milestones of Cosmogony

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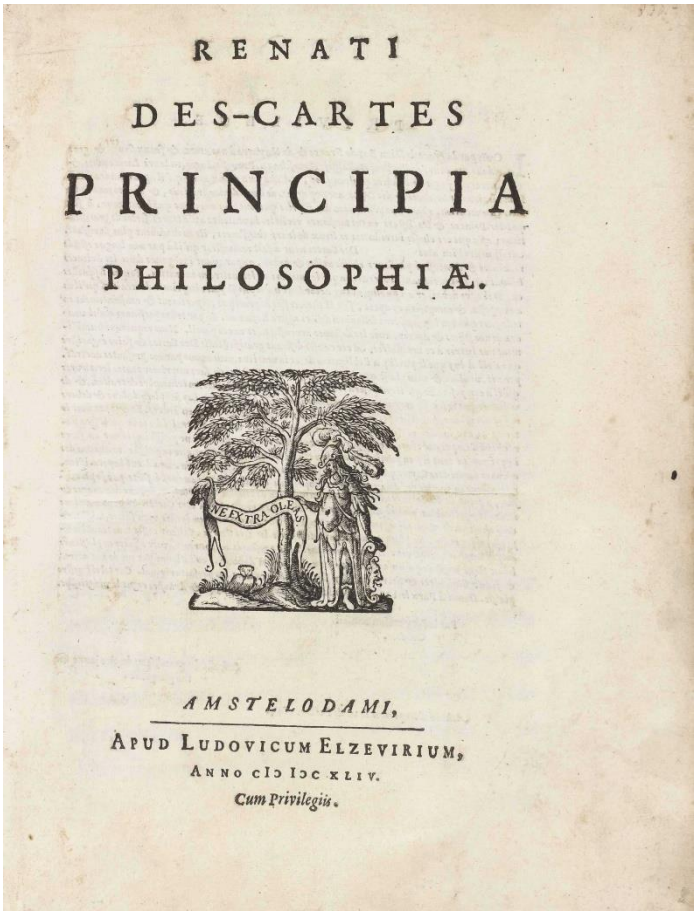
A look at the universe in a fundamentally new mechanistic way

1 **DESCARTES, René**. *Principia philosophiae*. Amsterdam, L. Elzevir, 1644. [22], 310 pp., printer's device on title, woodcut initials, several woodcut illustrations in text, some full page, bound without the blank leaves b4 and 2Q4. [Bound with:] *Specimina philosophiae: seu Dissertatio de methodo recte regendae rationis, & veritatis in scientiis investigandae: Dioptrice et Meteora. Ex Gallico translata, & ab auctore perlecta, variisque in locis emendata*. Amsterdam, L. Elzevier, 1644. [16], 331 [1] pp., printer's device on title, woodcut initials, several woodcut illustrations and diagrams in text, 10 full page. 2 works in 1 volume. 4to (200 x 155 mm). Contemporary full vellum with yapp edges, spine lettered in manuscript, marbled pastedown, flyleaves gone (some soiling and spotting of vellum). Text generally crisp and clean with only very minor occasional spotting, some light dampstaining in places, short clean tear in two leaves, first title slightly dust-soiled at outer margins. A very-good, well-margined copy in untouched binding of its time. (#003249) € 5800

I. FIRST EDITION OF DESCARTES' SYSTEM OF PHYSICS, in which he developed his theory of vortices. Based in part on his then unpublished work *Le monde*, which treated the creation and function of the universe in completely mechanistic terms, Descartes' *Principia* provides a systematic statement of his metaphysics and natural philosophy. The first part, *De principiis cognitionis humanae* (Of the Principles of Human Knowledge) deals with the nature of motion, rest, force, and action. He defines motion in Book II and distinguishes the difference between translation and 'the force that brings about this translation.' Descartes was careful in the *Principia* to qualify his mechanistic Copernican views with the idea that all motion is relative. "His vortical theory allowed him to argue that since the earth is at rest in its surrounding medium it remains unmoved, although it, together with its entire vortex, necessarily circles the sun" (Norman 622). Descartes' system represents a truly comprehensive look at the universe in a fundamentally new, mechanistic and non-teleological way. His vortex theory was the starting point for all serious work in physical theory in the mid-17th century, including Newton. The fourth and final part of the work contains the first scientific theory of magnetism.


RENATI
DES-CARTES
PRINCIPIA
PHILOSOPHIÆ.
NE EXTRA OLEAS
AMSTELODAMI,
APUD LUDOVICUM ELZEVIRIUM,
ANNO CIↃ IↃC XLIV.
Cum Privilegiis.

René Descartes made philosophy as a method of knowledge the basis of thought. Knowledge was to be gained exclusively through deduction. In doing so, he took the first step towards the development of a natural science based on subjective certainty by introducing rational methods of knowledge independently of and at a diplomatic distance from the idea of the divine. One of the first scientific cosmogonies is contained in his work *Principia philosophiae* (The Principles of Philosophy) from 1644. Descartes attempted to explain gravity using mechanistic models. The necessary turbulence of clouds of matter caused by centrifugal forces, whereby the particles trapped in them should only exchange their energy in direct contact, explained planetary movements and also the formation of the world system. In contrast to the Christian view, Descartes thus removed man from the center and at the same time declared the earth to be immovable by means of linguistic convolutions. A relationship with the church between consideration and rebellion was typical of the 17th century; the latter ended at the stake for Giordano Bruno, who, like Descartes, had professed the Copernican world view. As an explanation of the origin, Descartes has God create a dense pack of

matter vortices. The auxiliary construction of God as a primordial drive provided the kinetic energy that still exists today (see Mauthner).

References and Bibliography to I.: Norman 622; Guibert 118-119 nr. 1. STCN (5, i.a. BL London). BN Paris (2). Willems 1008. Guibert 104-105 nr. 1. STCN (3, i.a. BL London). BN Paris (5). Willems 1008. NLM/Krivatsy 3116; F. Mauthner, *Wörterbuch der Philosophie*, Leipzig 1923, pp. 288-295.

II. FIRST LATIN EDITION of the *Discours de la méthode*, which omits the treatise *Géometrie*. It includes the first appearance of the Cartesian sound-bite: *'cogito, ergo sum*'. Although separate works, these two Elzevir publications often appear together.

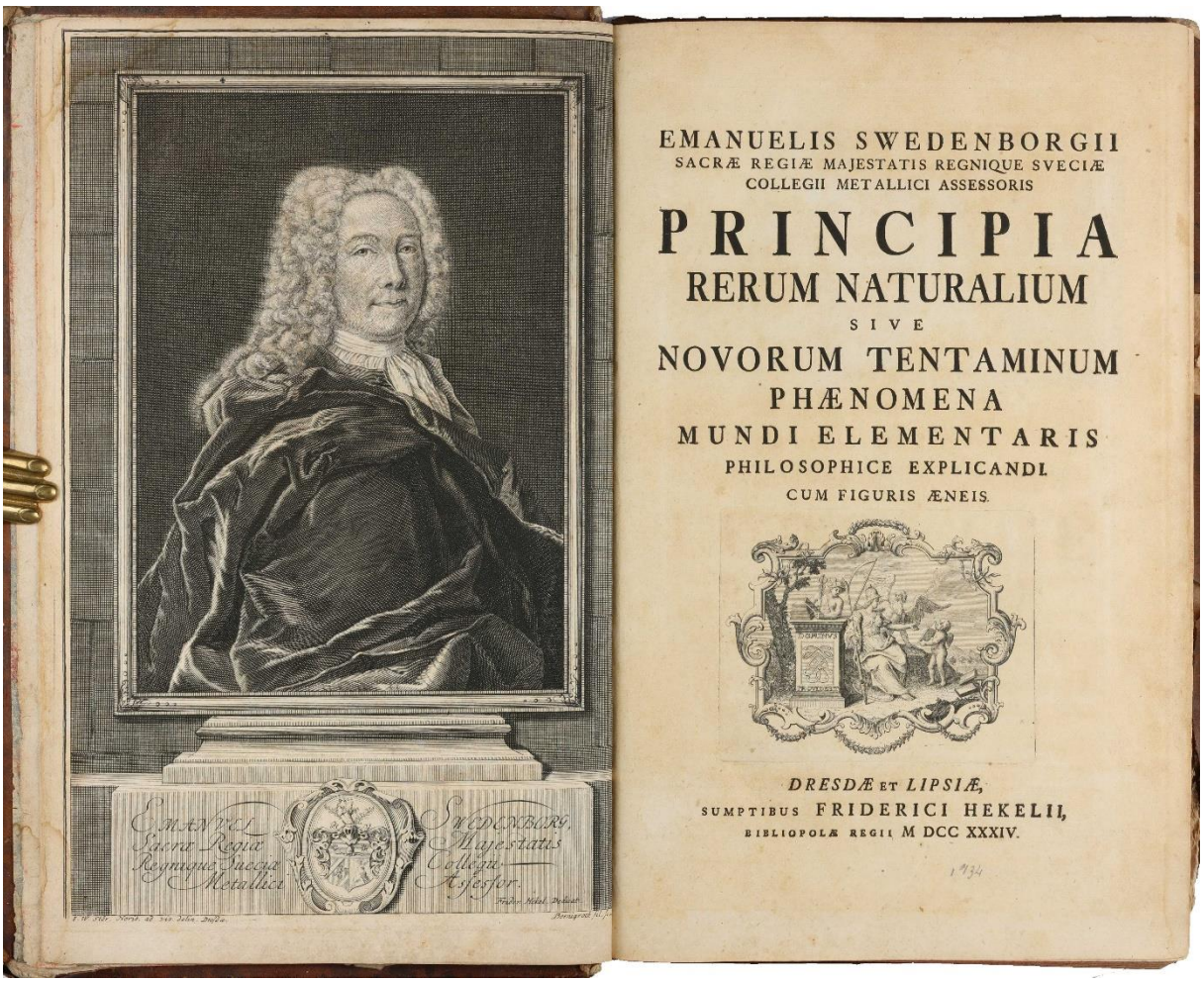
References and Bibliography to II.: Norman 623; Guibert, p. 104; NLM/Krivatsy 3116; Tchemerzine II, p. 777; Willems 1008.

The origin of the sun and the planets: a first nebular hypothesis

2 **SWEDENBORG, Emanuel**. *Opera philosophica et mineralia*. Volumes I-III (all published). Dresden & Leipzig: Friedrich Heckel, 1734. Folio (323 x 200 mm). [16], 1-452 (i.e. 448); [12], 1-164, [2], 165-386; [14], 1-534 pp., bound without the leaf "Dem Buchbinder" as usual. Engraved frontispiece portrait of the author by Bernigrot fil after I.W. Stör in vol. I, half-title in vol. I only as called for, engraved vignettes on title-pages and dedication leaves, engraved headpieces, woodcut initials and tailpieces, 2 large folding engraved maps and 123 engraved sheets of plates (25 folding). Uniform contemporary calf, spines with 6 raised bands richly gilt in compartments and with gilt-lettered labels, red-dyed edges, marbled endpapers (extremities worn, boards scratched and rubbed, corners scuffed and bumped, joints partly cracked but holding firm, chipping to spine heads and foots). Text little browned (a few gatherings stronger); occasional minor spotting; several plates heavily browned as usual due to paper used, large folding plate "Tab. II" in vol. III with long clearn tear (no loss). Provenance: C. Colombini (early ownership inscription to first flyleaves). A very good set in contemporary bindings. Collated and complete. (#003852) € 7500

FIRST COLLECTED EDITION, rarely found complete with the portrait as here. Edited by Fredrik Hekelius. The work, and specially vol. I "Principia rerum naturalium" maybe the most important Swedish work in natural philosophy. Swedenborg, best known for his contributions to natural philiosophy, religion and mysticism, was appointed assessor-extraordinary to the Swedish board of mines in 1716.

In the first volume enitlted *Principia Rerum Naturalium* Swedenborg presents a model of the origin and evolution of our solar system. He was thus the first to formulate a nebular hypothesis, even before Kant and Laplace.


EMANUELIS SWEDENBORGII
SACRÆ REGIÆ MAJESTATIS REGNIQUE SVECIÆ
COLLEGII METALLICI ASSESSORIS
PRINCIPIA
RERUM NATURALIUM
SIVE
NOVORUM TENTAMINUM
PHÆNOMENA
MUNDI ELEMENTARIS
PHILOSOPHICE EXPLICANDI
CUM FIGURIS ÆNEIS.
DRESDÆ ET LIPSIÆ,
SUMPTIBUS FRIDERICI HEKELII,
BIBLIOPOLÆ REGII M DCC XXXIV.

"In the chapter entitled 'Solar and Planetary Nebular Matter' Swedenborg describes a theory of the evolution of the solar system somewhat within the context of his scheme of elementary and finite particles. In characteristic fashion, he reasons that the planets must have their origin near the sun [. .

.] Swedenborg suggests his theory of planetary evolution as a general mechanism to explain the appearance of new stars. For as the planetary material leaves the solar vortex the star becomes visible to the observer. [...] Swedenborg's structure of elements does not fit, in any exact sense, the models of present-day elementary particle physics. Furthermore, his theory of planetary evolution, based on the elements seems vague and lacking in empirical support. However, Swedenborg's work should be viewed in the context of the contemporary natural philosophy, and most noteworthy in this regard is the essential agreement of Swedenborg's rational cosmology with the previously developed Cartesian world view. Both Descartes and Swedenborg proposed a filled universe or plenum of several elements. Both men described mechanisms for planetary evolution, with special emphasis on the vortex as a primary motion in nature. Yet Swedenborg's work did contain elements of originality. He worked hard to describe the 'first natural point' as the connection between the physical and nonphysical worlds. Swedenborg saw this starting point as logically important to a world system and representative of the absolutely deepest parts of nature. The Swedenborgian system of elements is more complex than the three-element system of Descartes. While further complexity does not necessarily imply progress, Swedenborg's scheme of elements with their inner and outer parts, and their construction through the intermediate steps of the finites, is an attempt at greater differentiation of levels and motion in nature. [...]

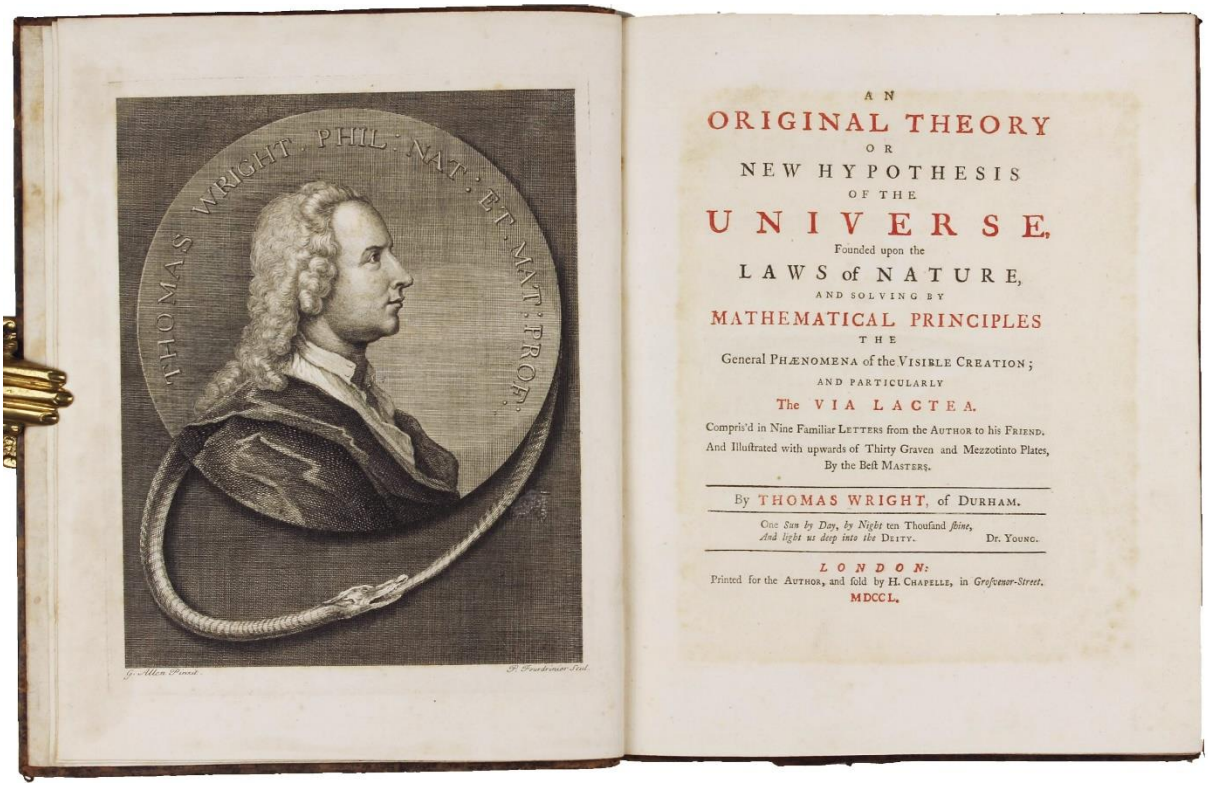
Perhaps most intriguing is Swedenborg's theory of planetary evolution. A prominent theory of planetary generation is the Kant-Laplace nebular hypothesis of the gradual evolution of planets from the sun. Both Swedenborg and Descartes proposed theories which resemble this hypothesis but whereas Descartes' planets developed from their own interior suns. Swedenborg's planets broke off from the belt of matter which spread from the sun. Therefore Swedenborg's theory is closer to the nebular hypothesis and was published some 20 years before Kant presented his thesis in 1754. The Swedish physical chemist Svante Arrhenius noted this priority in his work on the history of cosmology, but Swedenborg is not always mentioned in connection with the origins of the nebular hypothesis. There are limitations in Swedenborg's work on natural philosophy. His style of writing is often lacking in clarity, at least from the viewpoint of the modern reader. Perhaps more surprising is the fact that despite his admiration for Newton, Swedenborg does not incorporate Newton's methods or ideas into his work, and his attempts at mathematization of concepts are unproductive. Furthermore, the Cartesian influence is so clearly evident in the *Principia* that it is often difficult to delineate the extensions and modifications which are Swedenborg's own. Yet these shortcomings do not erase the value of the original contributions he did make" (Baker, pp. 444-46).

"History testifies that he anticipated many scientific developments far ahead of his time." (Hoover). Vol. II contains a detailed study on the metallurgy of copper and brass. According to Darmsädter, vol. III contains the first handbook of ferrous metallurgy (Darmstädter 177). The fine engraved plates in vols. II and III are arguably the best illustrations of mining technology since Agricola. Vol. II has no plate with number 27, which according to Hyde is correct. Swedenborg took a leave of absence from his position as assessor to the board of mines to oversee the printing of this work. Volume 3 deals with the metallurgy of copper, and is profusely illustrated with impressively drawn technical plates of mine operations, smelting equipment, mineral samples, etc.

Literature: G. L. Baker, Emanuel Swedenborg - An 18th century cosmologist. In: *The Physics Teacher* Oct. 1983); Hyde, *Bibliography of Swedenborg's works* p.228-30; Wheeler Gift I, 283; Ward & Carozzi 2140; Hoover 773-5; Waller 11018; DSB XIII, p.179; Stroh & Ekelöf, Kronologisk *förteckning öfver Emanuel Swedenborgs skrifter* 95; Parkinson, *Breakthroughs*, p. 151 (for the Principia volume).

3 **WRIGHT, Thomas**. *An original theory or new hypothesis of the universe, founded upon the laws of nature, and solving by mathematical principles the general phaenomena of the visible creation; and particularly the Via Lactea.* London: Printed for the Author, and sold by H. Chapelle, 1750. 4to (286 x 226 mm). viii, [4], 84 pp. Engraved portrait frontispiece* of the author by Fourdrinier after G. Allen, title printed in red and black, 32 engraved plates (2 folding, 8 in mezzotint), wood-engraved initials, head- and tailpieces, with the errata- and list of subscribers leaves, without the final blank. Contemporary mottled calf, spine with 5 raised bands richly gilt in compartments and with gilt-lettered morocco label in first compartment (boards and extremities rubbed, corners bumped and scuffed). Internally very little age-toned, minor spotting to a few leaves only, light offsetting from frontispiece on title-page, tiny hole in plate 28 from paper flaw not affecting image. Provenance: inscribed monogram L.C.B. to front pastedown. An outstanding, bright and crisp copy with very broad margins. (#002600) € 32,000

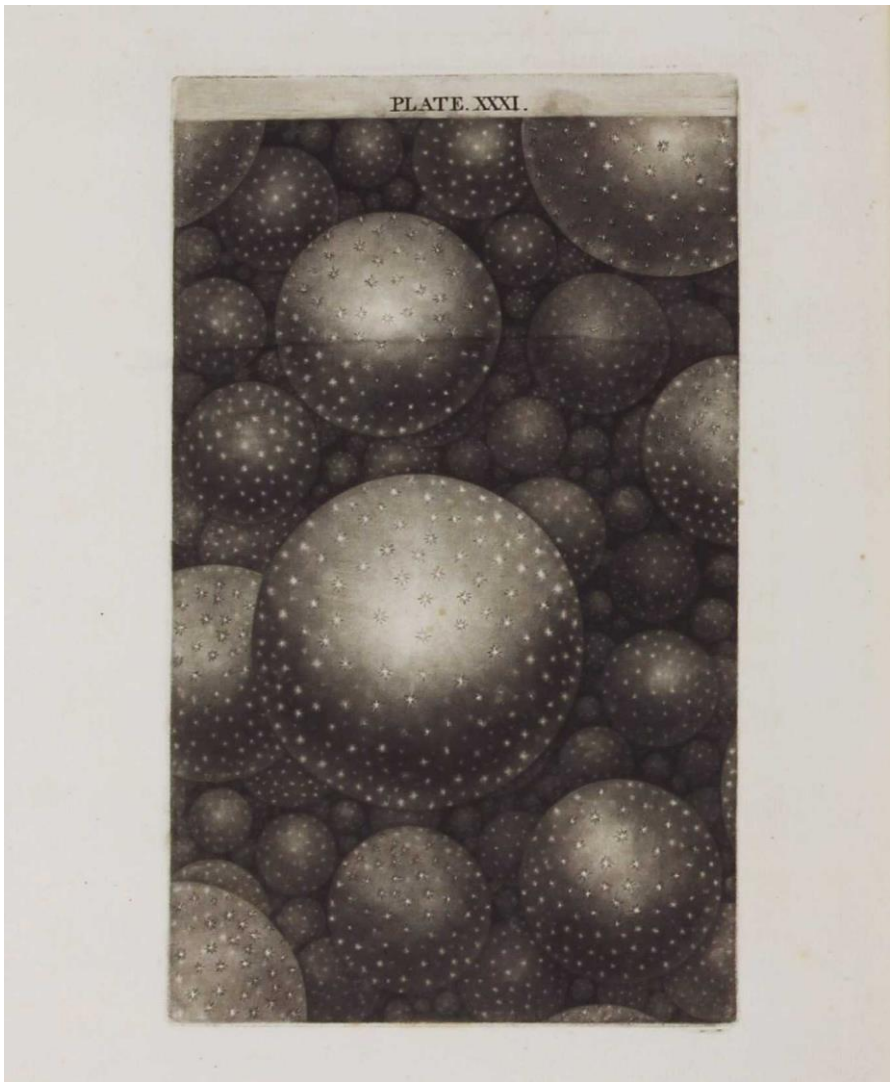
RARE FIRST EDITION of this attempt at reconciling religion and science and establishing an understanding of the Milky Way. A book of considerable importance in the history of science. Wright first explained the Milky Way and the nebulae as external galaxies and provided the basis for the theories on the universe by Kant, Herschel and Laplace (see Paneth for a detailed discussion of the connection between Wright and Kant).



Wright, a teacher of navigation and a land surveyor by profession, "hypothesized a 'divine center' of the universe, corresponding to a gravitational center around which the sun and other stars orbited. He also proposed, as a possible explanation for the visual phenomenon of the Milky Way, a model of the universe in which the orbiting stars formed a flattened ring, this hypothesis caused Immanuel Kant, who did not realize that Wright's 'center' was supernatural, to credit Wright with originating a disk-shaped model of the galaxy" (Norman).

"The title [of Wright's book] already indicates that here he is aiming much higher: an *original* theory or *new* hypothesis of the Universe, solving particularly the phenomenon of the Milky Way. Let us state at the outset that this claim is not at all exaggerated. For the first time in the history of astronomy the view is expressed here that the fixed stars are not distributed at random in space, but mainly concentrated in a flat disk; that the Sun with his planets is situated somewhere not too far from the disk's centre, and that, therefore, for us many more stars are visible in the direction of the disk's plane

than in any other. As they are too numerous to be seen separately they appear to the naked eye as a luminous circle on the sky - the Milky Way. The explanation given here by Wright of the galaxy as an optical phenomenon, following from, and thus revealing, a disk-like distribution of the visible stars, is contained in the seventh letter, and illustrated by a diagram. The wording of the crucial paragraph is rather clumsy and involved, and the author at once proceeds to much wilder speculations in which the Universe appears as a combination of concentric shells ; the Eye of Providence is seated in the Centre and becomes, therefore, clearly visible on the plate depicting the Universe in cross section. It was, perhaps, a blessing in disguise that the very careful abstractor who reviewed the book for a Hamburg periodical, the *Freys Urtheile und Nachrichten zum Aufnehmen der Wissenschaften und der Historie überhaupt* (Year 8, Part I, Jan. 1, 1751) was, to his regret, unable to include the copper plate prints and had consequently to omit these passages which could not be presented without reference to the diagrams. Wright's convincing explanation of the nature of the galaxy stands out all the clearer in the translator's account. It was this summary which Kant happened to read, and which became the starting point of his own cosmological speculations" (Paneth, pp. 74-75).



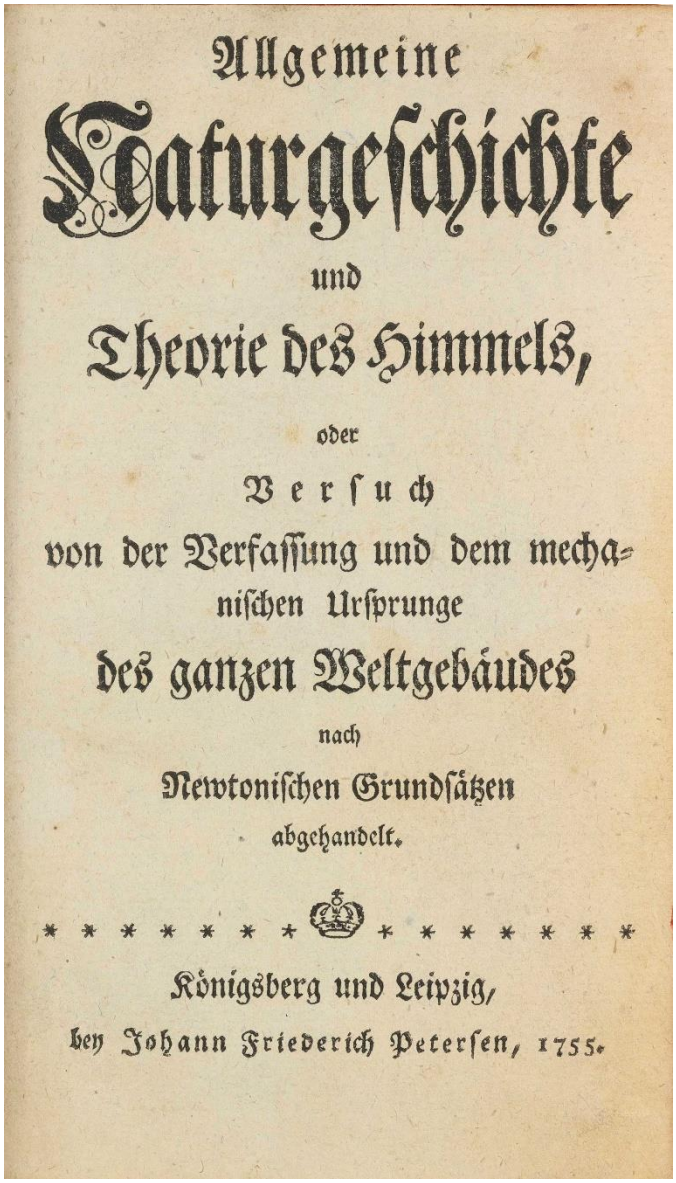
*The engraved portrait frontispiece is not called for in this work, but is part of Wright's earlier work *Clavis coelestis* (London, 1742).

References and Literature: Norman 2265; DSB XIV, p. 518-9; Honeyman 3143; Gingerich, *Rara Astronomica* 53; Hoskin, *J. for the History of Astronomy*, 1, pp. 44-52; F. A. Paneth, Thomas Wright of Durham and Immanuel Kant. In: *The Observatory*, Vol. 64, p. 71-82 (1941).

The exceptionally rare first edition of a milestone of cosmogony

4 **KANT, Immanuel**. *Allgemeine Naturgeschichte und Theorie des Himmels, oder Versuch von der Verfassung und dem mechanischen Ursprunge des ganzen Weltgebäudes nach Newtonischen Grundsätzen abgehandelt*. Königsberg and Leipzig: Johannn Friederich Petersen, 1755. Three parts in one volume. 8vo (172 x 104 mm). [56], vi, [2], 200 pp., including section title A4 to first part (misbound before the general title a1), woodcut initials, head- and tailpieces. Signatures: a-c^{8} d^{4}, A^{4} ^{2}A^{8} B-M^{8} N^{4}. Contemporary half-calf over sprinkled boards, spine with 5 raised bands, portion of hand-lettered paper label to spine, red-dyed edges, original endpapers (spine heavily worn with chipping and cracking of leather, joints split but cords holding, corners scuffed and bumped, rubbing to boards, paper over boards partly chipped at lower corner and edges). Text with minor even browning and spotting in places, ink marginal to p. 165. Provenance: Rössler (contemporary inscription to first flyleaf); Hartmut Patzke (bookplate to front pastedown dated in pencil 23.10.2012). A very good, untouched copy in original binding. (#003868) € 120,000

FIRST EDITION, AND OF UTMOST RARITY, of Immanuel Kant's *Universal Natural History and Theory of the Heavens*, his anonymously published first major work which he wrote while still a tutor on the von Hülsen estate in Gross-Arnsdorf near Königsberg and with which he unsuccessfully applied for a chair at the Albertina after his return to Königsberg in 1755 (Kant did not receive the long-awaited appointment to the chair of logic and metaphysics until 1770 at the 'advanced' age of 46). Kant's important cosmogonical work received little recognition and attention, which certainly had to do with the bankruptcy of his Königsberg publisher at the time of publication. Copies of this first edition are considered sought-after rarities and are almost impossible to find on the market. We have been unable to trace any other copy that has come to auction in the past 50+ years. Our copy is the variant with the correct pagination of the last page (200); the VD18 also knows copies with the incorrect pagination "100".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Königsberg und Leipzig,
bey Johann Friederich Peterſen, 1755.

Kant had read a 1751 review of Thomas Wright's *An original theory or new hypothesis of the Universe* (1750), and he credited this with inspiring him in writing the *Universal Natural History*. He answered to the call of the Berlin Academy Prize in 1754 with the argument that the Moon's gravity would eventually cause its tidal locking to coincide with the Earth's rotation. The next year, he expanded this reasoning to the formation and evolution of the Solar System in the *Universal Natural History*. Within the work Kant quotes Pierre Louis Maupertuis, who discusses six bright celestial objects listed by Edmond Halley, including Andromeda. Most of these are nebulae, but Maupertuis notes that about one-fourth of them are collections of stars - accompanied by white glows which they would be unable to cause on their own. Halley points to light created before the birth of the Sun, while William Derham 'compares them to openings through which shines another immeasurable region and perhaps the fire of heaven.' He also observed that the

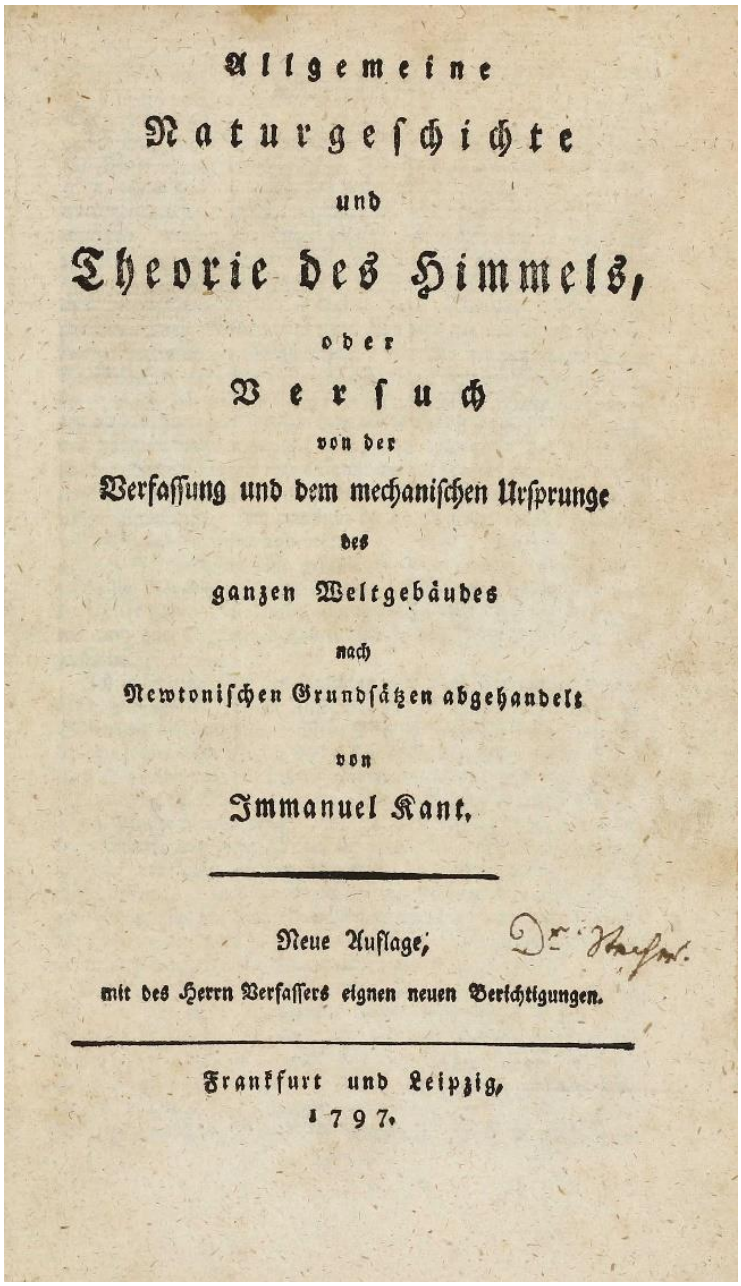
collections of stars were much more distant than stars observed around them. Johannes Hevelius noted that the bright spots were massive and were flattened by a rotating motion; they are in fact galaxies. Kant's assumption of a multitude of galaxies (which he calls "islands of worlds") formulated here could be proven in the 1920s by Edwin Hubble based on exact measurements.

In his nebular hypothesis, Kant proposes that solar systems are the result of nebulae (interstellar clouds of dust) coalescing into accretion disks and then forming suns and their planets from the forces of attraction and repulsion of matter as formulated by Isaac Newton in his *Principia* (1687). Kant is the first to put forward the theory that was confirmed not long afterwards, in 1761, by Johann Heinrich Lambert in his *Cosmological Letters*. Kant also discusses comets, and postulates that the Milky Way is only one of many galaxies. Kant's book ends with an almost mystical expression of appreciation for nature: "In the universal silence of nature and in the calm of the senses the immortal spirit's hidden faculty of knowledge speaks an ineffable language and gives [us] undeveloped concepts, which are indeed felt, but do not let themselves be described.

"When the *Universal Natural History and Theory of the Heavens* appeared in 1755, Kant, then in his thirty-first year, was on the threshold of a new career. After serving for a period of nine years as a family tutor, he was about to return to the University of Königsberg as a privatdocent. He probably hoped that his bold and ingenious theory about the origin and evolution of the universe would attract attention and smooth his path towards a professorship. Unfortunately, his publisher, Johann Friedrich Peterson, went bankrupt just at the time the book came off the press. The stock was impounded and hardly any copies of Kant's treatise reached the public. It only became widely known more than fifty-one years later when three separate editions appeared in 1797, 1798 and 1808. An interest in Kant's work may have been sparked by the publication of Laplace's *Exposition du système du monde* in 1796. There are significant differences between Laplace's theory and Kant's, but admirers of the German philosopher were quick to claim that Laplace had borrowed his ideas from Kant. [. . .] There are two English translations: Hastie (1900), omitting the third part of Kant's treatise which deals with the inhabitants of heavenly bodies; and Jaki (1981), which gives the full text and provides a scholarly introduction and lengthy notes. Hastie's translation is more literary; Jaki's more literal. Whereas Hastie praises Kant for 'appropriating all the mathematical and physical science of his age' (p. xvii), Jaki criticizes him for 'wilful and often confused speculation, not science' (p. 8)" (Shea, p.95). However, Stephen Palmquist argued that Jaki's criticisms are biased and "[a]ll he has shown [. . .] is that the *Allgemeine Naturgeschichte* does not meet the rigorous standards of the twentieth-century historian of science" (Palmquist). "Kant's treatise has tended to be celebrated for its anticipations of more recent developments or to be condemned for its lack of scientific rigour. Main discussions are: Ueberweg (1865); Hay (1866); Reuschle (1868); Eberhard (1893; the 34 quarto-pages work out many of the calculations relevant to Kant's hypothesis); Adickes (1924-1925; p. 207: in 1922 only six copies of fhe first edition were known to exist in Germany)" (Shea, p.95). Ultimately, Kant's cosmogony is closer to today's accepted ideas than that of some of his contemporary thinkers, such as Pierre-Simon Laplace. Moreover, Kant's thought in this volume is strongly influenced by the atomist theory, in addition to the ideas of Lucretius.

Literature & References: VD18 1388719X; Warda No. 4, (A. Warda, *Die Druckschriften Immanuel Kants (bis zum Jahre 1838)*, 1919, p.12); Gerd Irrlitz, *Kant-Handbuch*, 2015, pp. 79-82; Erich Adickes, *Kant als Naturforscher*, Vol. 2, 1924, pp. 206-315; William R. Shea, FILLED WITH WONDER: Kant's Cosmological Essay, the Universal Natural History and Theory of the Heavens. In: R. E. Butls (ed.), *Kant's Philosophy of Physical Science*, 1986, D. Reidel Publishing Co., pp. 95-124; F. Ueberweg, Ueber Kants 'Allgemeine Naturgeschichte und Theorie des Himmels'. In: *Altpreussiche Monatsschrift* 2, 1865, 339–353; K. G. Reuschle, Kant und die Naturwissenschaft, mit besonderer Rücksicht auf neuere Forschungen. In: *Deutsche Vierteljahrs-Schrift* (Stuttgart), 31/2, 1868, 50–102; G. Eberhard, *Die Cosmogonie von Kant*. Vienna, 1893; E. Hay, Ueber Kants Kosmogonie. In: *Altpreussiche Monatsschrift* 3, 1866, pp. 312–322; S. L. Jaki, *Planets and Planetarians*. New York: John Wiley & Sons, 1978; W. Hastie, *Kant's Cosmogony*. Glasgow: James Maclehose & Sons, 1900; S. Palmquist, Kant's Cosmogony Re-Evaluated, In: *Studies in History and Philosophy of Science* 18:3 (September 1987), pp. 255–269; F. A. Paneth, Thomas Wright of Durham and Immanuel Kant. In: *The Observatory*, Vol. 64, p. 71-82 (1941).

5 **KANT, Immanuel.** *Allgemeine Naturgeschichte und Theorie des Himmels, oder Versuch von der Verfassung und dem mechanischen Ursprunge des ganzen Weltgebäudes nach Newtonischen Grundsätzen abgehandelt*. Frankfurt, Leipzig: [publisher unknown], 1797. 8vo (200 x 120 mm). [20], 130 pp. Later cardboard (slightly stained towards lower spine, corners little bumped), red-dyed edges. Text little evenly browned, brown spot to upper blank margin of 3 leaves, otherwise pretty clean and virtually unfoxed. Provenance: Illegible ownership inscription on title, a few text annotations in pencil. Near fine copy. (#003177) € 3000



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von
Immanuel Kant.

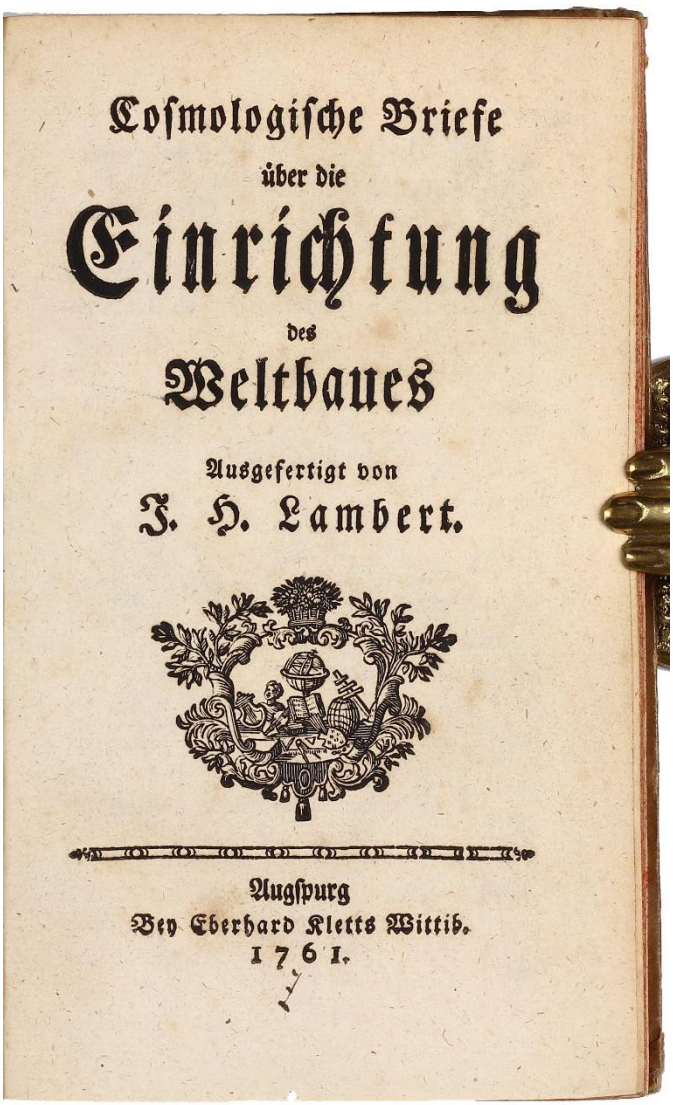
Neue Auflage,
mit des Herrn Verfaſſers eignen neuen Berichtigungen.

Frankfurt und Leipzig,
1797.

D.S.B VII, p.231; Warda 6. - Scarce second edition of Kant's third work, first printed in 1755. An "Auszug", i.e only part of the *Naturgeschichte*, was printed in 1791, but no other editions or part of the work appeared between 1755 and 1797, though a third and fourth edition appeared in 1798 and 1808.

6 **LAMBERT, Johann Heinrich.** *Cosmologische Briefe über die Einrichtung des Weltbaues.* Augsburg: Eberhard Kletts Wittiv, 1761. 8vo (194 x 120 mm). xxviii, 318 pp., woodcut printer's device to title and final page, woodcut initials, head- and tailpieces, folding letterpress table. Near contemporary German card board, spine with gilt lettered label and gilt ruling, red-sprinkled edges (spine rubbed, label with minor loss of gilt lettering, corners worn).Text with light even browning, occasional very minor spotting. Provenance: Johann Benedict Listing* (ownership entry on first free endpaper, "J. B. Listnig (sic!), Göttingen, June 1833"). A handsome copy in untouched original binding. (#001707) € 1400

The scarce first edition of Lambert's sensational *Cosmological Letters*, his most important astronomical work, in which he to a large extent fore-shadowed the documentation of the basic features of the universe that Herschel later carried out. The work became very popular and was translated into French, Russian, and English, and it was later re-written and published as "Systeme du Monde" in Berlin, 1770.


Cosmologiſche Briefe
über die
Einrichtung
des
Weltbaues
Ausgefertigt von
J. H. Lambert.
Augſpurg
Bey Eberhard Kletts Wittib.
1761.

"Of special interest among Lambert's astronomical writings - apart from applications of his physical doctrines - are his famous Cosmologische Briefe über die Einrichtung des Weltbaues" (Augsburg, 1761). Not familiar with the similar ideas of Thomas Wright (1750) and with Kant's "Allgemeine Naturgeschichte und Theorie des Himmels" (1755), Lambert had the idea that what appears as the Milky Way might be the visual effect of a lens-shaped universe. On this basis he elaborated a theory according to which the thousand of stars surrounding the sun constituted a system. Moreover he considered the Milky Way as a large number of such systems, that is, a system of higher order... Only when William Herschel systematically examined the heavens telescopically and discovered numerous nebulae and "telescopic milky-ways" did it become obvious that Lambert's description was not mere science fiction but to a large extent a bold vision of the basic features of the universe" (Scriba in D.S.B. VII:598). "His Cosmological letters [...] obtained some popularity but were apparently as unknown as Wright or Kant to W. Herschel when he began to investigate the distribution of the stars by a long series of carefully planned observations" (Paneth, p.79).

Kant's mentor (Martin Knutzen) died in 1755, three years before the pre-critical project unfolded. But Kant still had the chance of meeting kindred spirits. One of these was the great philosopher and mathematician Johann Heinrich Lambert, whom he admired a great deal. Finally he had encountered a thinker who appreciated both the scientific and metaphysical perspective, who worried about their tensions, and who was searching for a truce. In his "Cosmologische Briefe..." (Cosmological Letters on the establishment of the universe), Lambert worked on the same topic as Kant had worked on in his earlier Universal Natural History. The tasks and results of both works resemble each other, in so far as they were both proposals of integrating Newtonian physics into a larger framework, and they both contained a theory of the dynamic constitution of the universe. Furthermore, as Kant's scientific works should be viewed under the perspective of his general philosophical outlook, so must Lambert's work in physics and astronomy be seen in relation to his general philosophical outlook and his perpetual

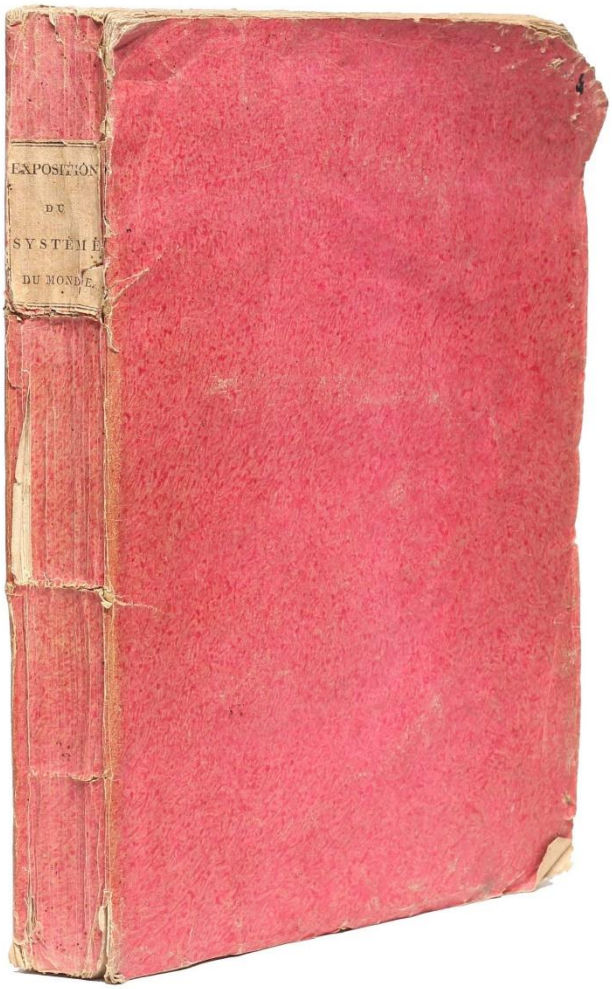
quest for introducing mathematical exactness into the sciences. "Lambert's efforts to improve communication and collaboration in astronomy were noteworthy. He promoted the publication of astronomical journals and founded "Berliner astronomisches Jahrbuch oder Ephemeriden". Many of the articles that he contributed to it were not published until after his death... He also favored the founding of the Berlin observatory. These suggestions, in line with Leibniz' far-reaching plans for international cooperation of scientific societies, inaugurated a new period of scientific teamwork." (D.S.B.).

*Johann Benedict Listing (1808-1882) was a German mathematician and physicist. He studied mathematics and architecture at the University of Göttingen. He received his doctorate there in 1834. Thereafter he made a three-year journey with Wolfgang Sartorius of Waltershausen to investigate the volcanic activity of Mount Etna in Sicily. In 1837 he became a teacher of mechanical drawing, machine science and applied mathematics at the Higher Industrial School in Hanover, and in 1839, associate professor of physics as successor to Wilhelm Eduard Weber and 1849 professor of mathematics in Göttingen. Through his mentor Carl Friedrich Gauss, Listing began to specialize in the topology, which at that time was still called analysis situs. He first introduced the term "topology", in a famous article published in 1847, although he had used it in correspondence some years earlier. He (independently) discovered the properties of the half-twisted strip at the same time (1858) as August Ferdinand Möbius, and went further in exploring the properties of strips with higher-order twists (paradromic rings). He discovered topological invariants which came to be called Listing numbers.

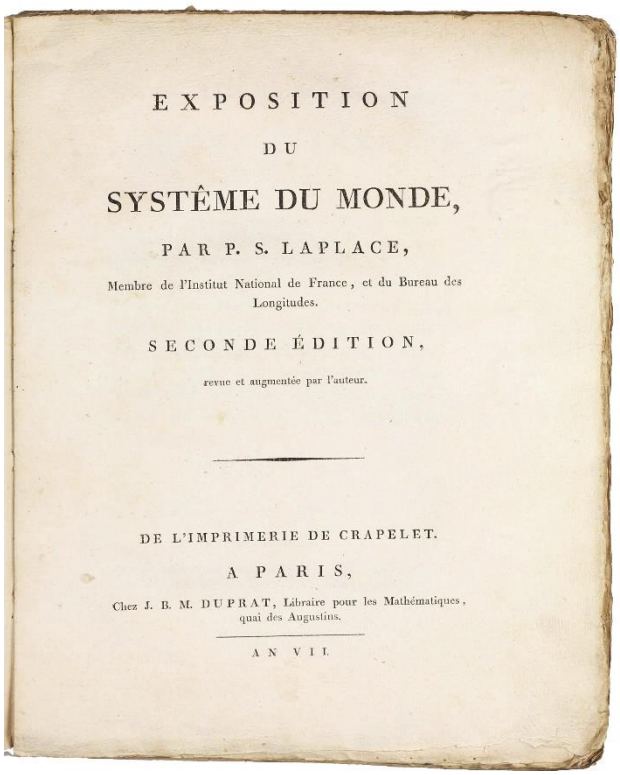
References & Bibliography: Houzeau-L. 8886; Poggendorff I, 1355 ; Goed. IV 1, 479, 1. Ziegenfuss II, 11; F. A. Paneth, Thomas Wright of Durham and Immanuel Kant. In: *The Observatory*, Vol. 64, p. 71-82 (1941); DSB VII, p.598.

In the original wrappers

7 **LAPLACE, Pierre Simon.** *Exposition du Systeme du Monde*. Paris: Imprimerie de Crapelet, An VII [1799]. 4to (270 x 215 mm). [i-vi] vii-viii, 351 [1] pp. including half title. Preserved in the original pink mottled wrappers with original printed spine label, all pages uncut (minor chipping and fraying of paper over spine. Text light even browning, a few small brown spots in places, but in all very crisp and clean. Provenance: from a French private collection. A fine, unsophisticated copy. (#003347) € 1200



SECOND EDITION, revised and enlarged by the author, of one of the most brilliant and successful popularizations of science ever composed. "In the sixth, and last, chapter of Book V, Laplace introduced a speculation on the origin of the solar system and another on the nature of the universe beyond its confines... The former speculation, which has quite generally come to be misnamed the nebulous hypothesis, was presented with the "misgivings" [défiance] that anything should arouse that is in no way the product of observation or calculation... If we were to find a phrase that would characterize what Laplace had in mind... it would not be 'nebular hypothesis'. It would be 'atmospheric hypothesis'. And if, further, we were to identify the context in which he raised the question at all, it would not be the evolution of history of nature. It would be the probability of cause" (DSB Suppl. I, 344). Laplace merits one of the longest articles in DSB and a 5-page section in it devoted to *The System of the World* was specially commissioned from Dr C.A. Whitney. Bibliography: Sparrow 123; Houzeau & Lancaster 8940.


EXPOSITION
DU
SYSTÊME DU MONDE,
PAR P. S. LAPLACE,
Membre de l'Institut National de France, et du Bureau des Longitudes.
SECONDE ÉDITION,
revue et augmentée par l'auteur.
DE L'IMPRIMERIE DE CRAPELET.
A PARIS,
Chez J. B. M. DUPRAT, Libraire pour les Mathématiques, quai des Augustins.
AN VII.

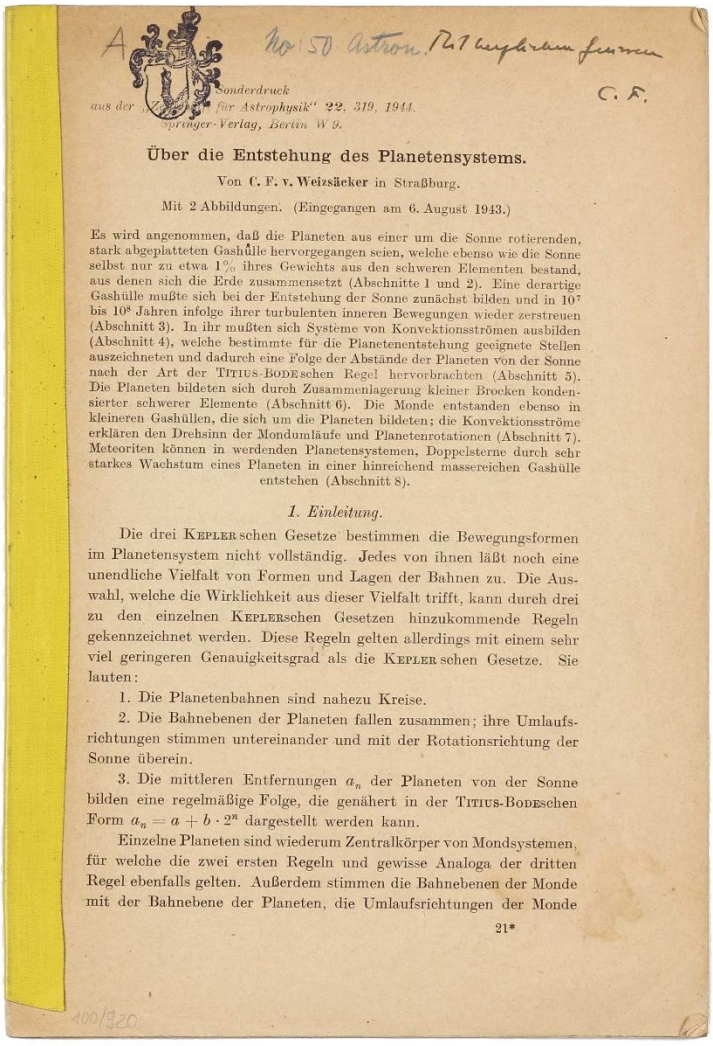
8 **HELMHOLTZ, Hermann von.** Über die Entstehung des Planetensystems - Vortrag gehalten in Heidelberg und Cöln am Rhein im Jahre 1871, pp. 101-139. In*: Populäre Wissenschaftliche Vorträge, drittes Heft*. Braunschweig: Friedrich Vieweg & Sohn, 1876. 8vo (213 x 136 mm), vii, [3], 139 [1]; [1], vi-xxv, [2], 582-598 pp. Simple card boards, cloth backed spine, hand-lettered paper label (spine worn, label chipped). Text somewhat browned and with occasional foxing (stronger to first pages including title). (#003883) € 150

The lecture was Hermann Helmholtz's farewell lecture in Heidelberg in 1871. He presented Immanuel Kant's and Pierre-Simon Laplace's independently developed hypothesis that the solar system was created through the attraction and repulsion of matter. As proof of the similarity of matter between the sun and the earth, he refers to the results of the spectral analysis developed by Robert W. Bunsen and Gustav R. Kirchhoff in Heidelberg in 1860.

Rare offprint, inscribed and monogramed by the author

9 **WEIZÄCKER, Carl Friedrich**. *Über die Entstehung des Planetensystems*. pp. 319-355. Offprint from: Zeitschrift für Astrophysik, vol. 22, 1944. Berlin: Julius Springer, 1944. 8vo (230 x 155 mm). Stapled as issued (spine enforced with yellow tape). Internally somewhat browned throughout. Provenance: small coat of arms stamp. Inscribed and monogrammed 'Mit freundlichen Grüssen C. F.' by the author in pencil to top margin of first page. (#002796) € 600

RARE FIRST EDITION. In this groundbreaking paper on the origin of the solar system and planet formation, Weizäcker introduced a new idea that within the protoplanetary disc a pattern of turbulence-induced eddies was set up. "A suitable combination of clockwise rotation of each vortex with anti-clockwise rotation of the whole system can lead to individual elements of the disc movin around the central mass in Keplerian orbits. Thus there would be very little dissipation of energy due to the overall motion of the system but material would be colliding at high relative velocity at the boundary between vortices, as shown at the point P. According to the von Weizsacker model, in such regions small roller-bearing eddies would form and in these regions, where matter was heavily interacting, material would coalesce to give condensations. The condensations would form in rings and once all condensations in a ring had come together there would be a family of planets. If there were five vortices to a ring then von Weizsacker showed that the orbital radii would give something similar to Bode's law. (Woolfson, M. M. *The Origin and Evolution of the Solar System*, CRC Press, 2000, pp. 136-7).



Sonderdruck
aus der „Zeitschrift für Astrophysik" 22, 319, 1944.
Springer-Verlag, Berlin W 9.

C. F.

Über die Entstehung des Planetensystems.

Von **C. F. v. Weizsäcker** in Straßburg.

Mit 2 Abbildungen. (Eingegangen am 6. August 1943.)

Es wird angenommen, daß die Planeten aus einer um die Sonne rotierenden, stark abgeplatteten Gashülle hervorgegangen seien, welche ebenso wie die Sonne selbst nur zu etwa 1% ihres Gewichts aus den schweren Elementen bestand, aus denen sich die Erde zusammensetzt (Abschnitte 1 und 2). Eine derartige Gashülle mußte sich bei der Entstehung der Sonne zunächst bilden und in 10^7 bis 10^8 Jahren infolge ihrer turbulenten inneren Bewegungen wieder zerstreuen (Abschnitt 3). In ihr mußten sich Systeme von Konvektionsströmen ausbilden (Abschnitt 4), welche bestimmte für die Planetenentstehung geeignete Stellen auszeichneten und dadurch eine Folge der Abstände der Planeten von der Sonne nach der Art der TITIUS-BODEschen Regel hervorbrachten (Abschnitt 5). Die Planeten bildeten sich durch Zusammenlagerung kleiner Brocken kondensierter schwerer Elemente (Abschnitt 6). Die Monde entstanden ebenso in kleineren Gashüllen, die sich um die Planeten bildeten; die Konvektionsströme erklären den Drehsinn der Mondumläufe und Planetenrotationen (Abschnitt 7). Meteoriten können in werdenden Planetensystemen, Doppelsterne durch sehr starkes Wachstum eines Planeten in einer hinreichend massereichen Gashülle entstehen (Abschnitt 8).

1. Einleitung.

Die drei KEPLERschen Gesetze bestimmen die Bewegungsformen im Planetensystem nicht vollständig. Jedes von ihnen läßt noch eine unendliche Vielfalt von Formen und Lagen der Bahnen zu. Die Auswahl, welche die Wirklichkeit aus dieser Vielfalt trifft, kann durch drei zu den einzelnen KEPLERschen Gesetzen hinzukommende Regeln gekennzeichnet werden. Diese Regeln gelten allerdings mit einem sehr viel geringeren Genauigkeitsgrad als die KEPLERschen Gesetze. Sie lauten:

1. Die Planetenbahnen sind nahezu Kreise.

2. Die Bahnebenen der Planeten fallen zusammen; ihre Umlaufsrichtungen stimmen untereinander und mit der Rotationsrichtung der Sonne überein.

3. Die mittleren Entfernungen a_n der Planeten von der Sonne bilden eine regelmäßige Folge, die genähert in der TITIUS-BODEschen Form $a_n = a + b \cdot 2^n$ dargestellt werden kann.

Einzelne Planeten sind wiederum Zentralkörper von Mondsystemen, für welche die zwei ersten Regeln und gewisse Analoga der dritten Regel ebenfalls gelten. Außerdem stimmen die Bahnebenen der Monde mit der Bahnebene der Planeten, die Umlaufsrichtungen der Monde

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