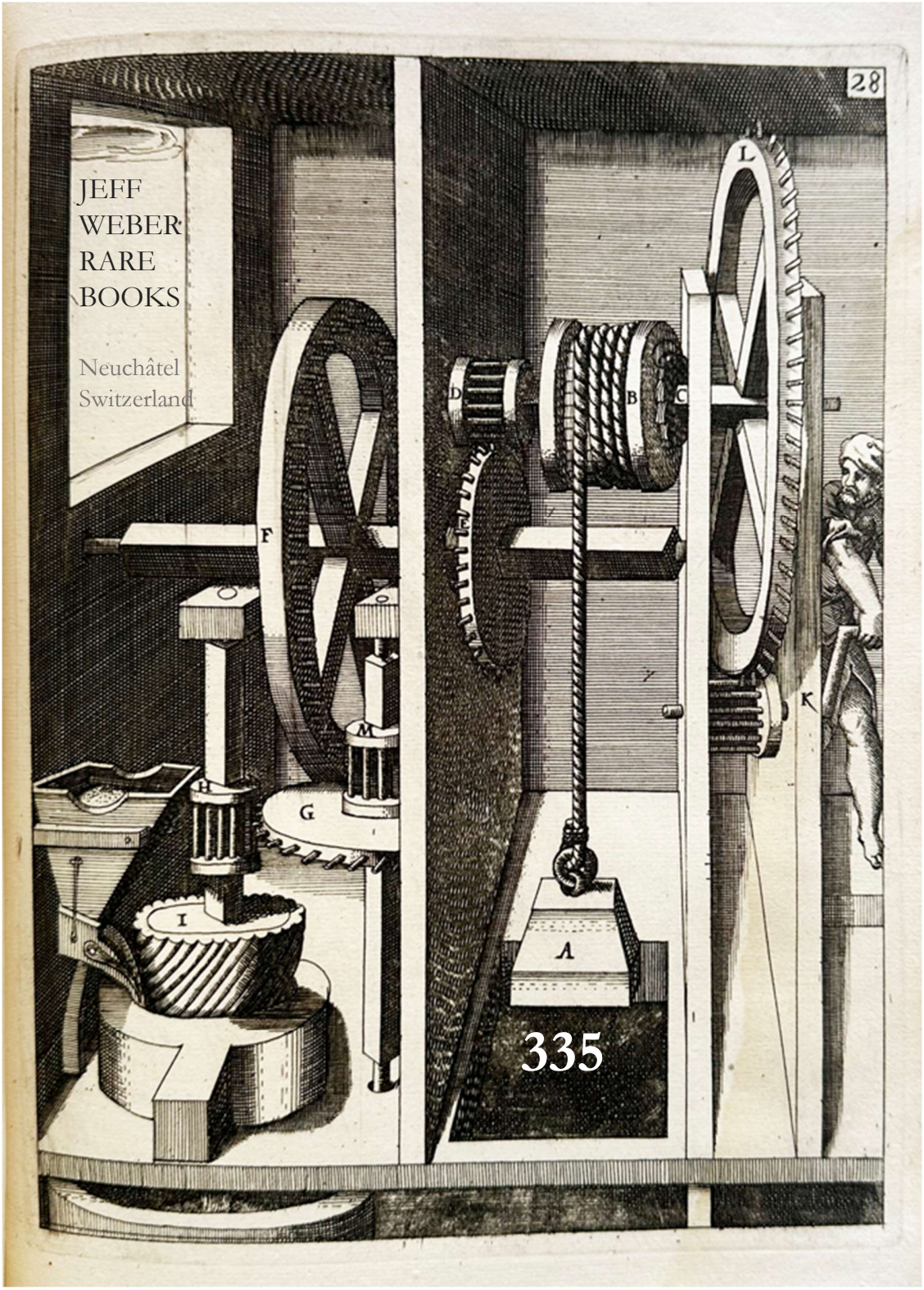


CATALOGUE 335

SCIENCE

In 3 parts:

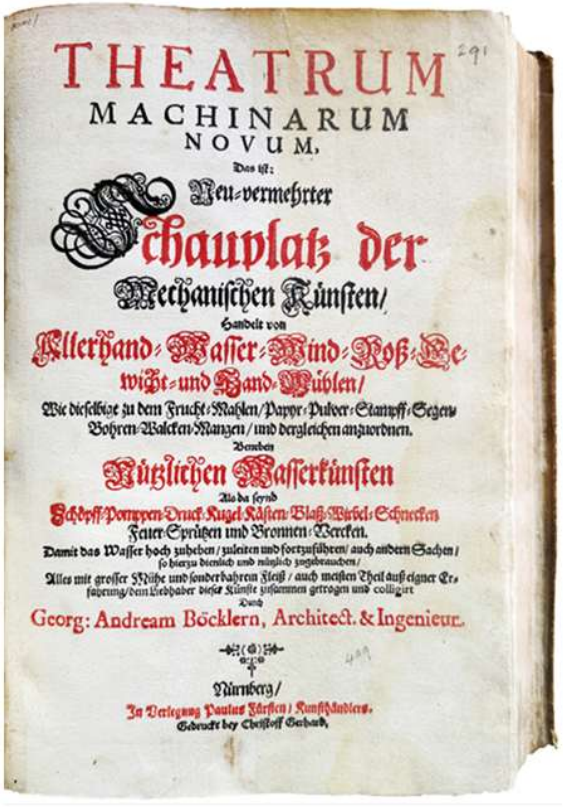
5 Great Science Books

34 papers written by Einstein

"P" Science, being mostly
Biochemistry, Genetics, Mathematics, Physics, Statistics

JEFF WEBER RARE BOOKS
Neuchâtel, Switzerland

PART I: 5 GREAT BOOKS


THEATRUM
MACHINARUM
NOVUM,
Das ist:
Neu-vermehrter
Schauplatz der
Mechanischen Künsten/
Handelt von
Allerhand-Wasser-Wind-Roß-Gewicht-und Hand-Mühlen/
Wie dieselbige zu dem Frucht-Mahlen/Papyr-Pulver-Stampff-Segen-Bohren-Walcken-Mangen/und dergleichen anzuordnen.
Beneben
Nützlichen Wasserkünsten
Als da seynd
Schöpff-Pomppen-Druck-Kugel-Kästen-Blaß-Wirbel-Schnecken
Feuer-Sprützen und Bronnen-Wercken.
Damit das Wasser hoch zuheben/zuleiten und fortzuführen/auch andern Sachen/so hierzu dienlich und nützlich zugebrauchen/
Alles mit grosser Mühe und sonderbahrem Fleiß/auch meisten Theil auß eigner Erfahrung/dem Liebhaber dieser Künste zusammen getragen und colligirt
Durch
Georg: Andream Böcklern, Architect. & Ingenieur.
Nürnberg/
In Verlegung Paulus Fürsten/Kunsthändlers.
Gedruckt bey Christoff Gerhard.

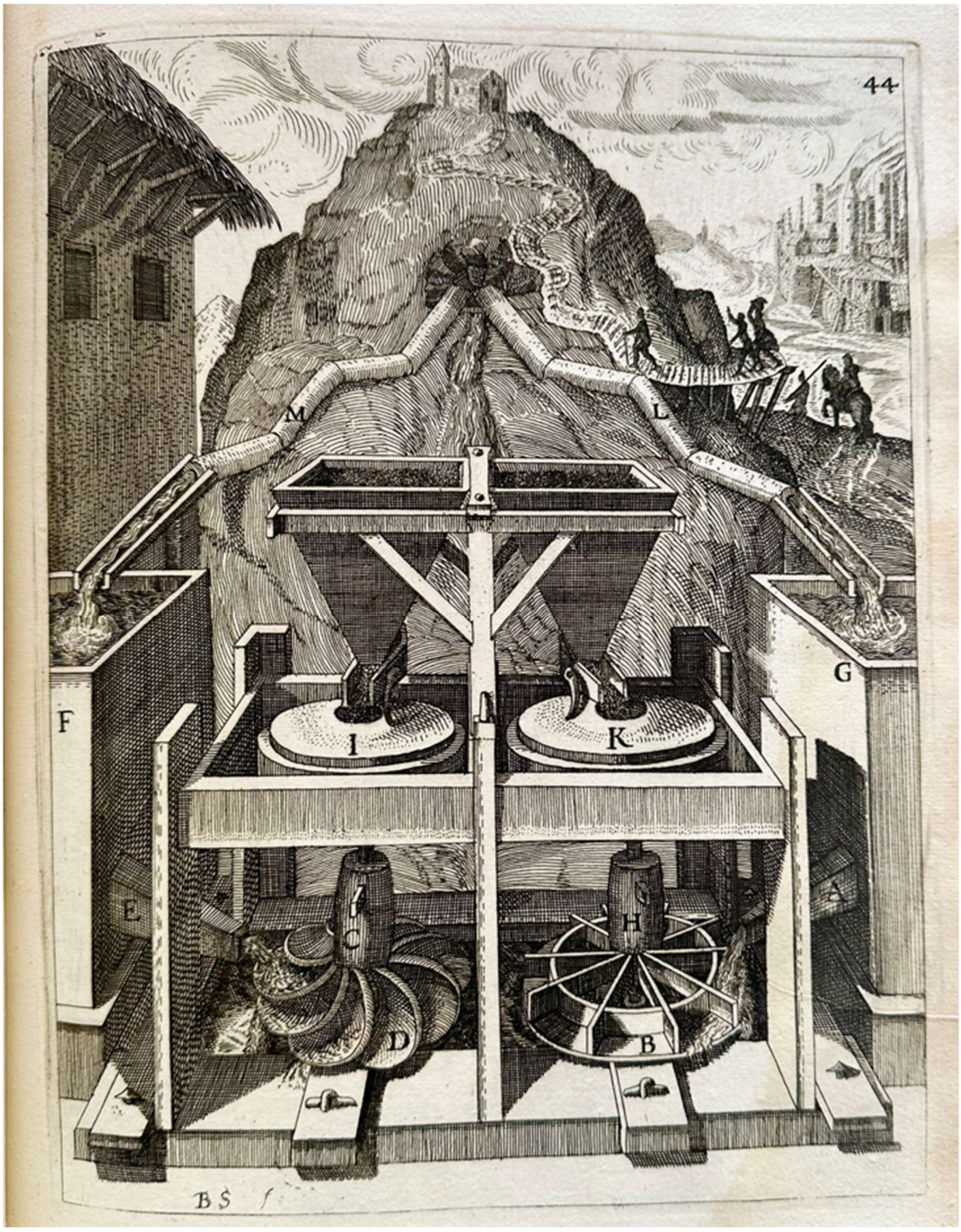
A. **BOECKLER, Georg Andreas [Böckler]** (c.1617-1687). *Theatrum machinarum novum das ist: Neu-vermehrter Schauplatz der mechanischen Künsten, Handelt von Allerhand- Wasser- Wind- Roß- Gewicht- und Hand-Mühlen Wie dieselbige zu dem Frucht-Mahlen/ Papyr- Pulver- Stampff- Segen- Bohren- Walcken- Mangen und dergleichen anzuordnen. Beneben Nützlichen Wasserkünsten Als da seynd Schöpff- Pomppen- Druck- Kugel- Kästen- Blaß- Wirbel- Schnecken Feuer-Sprützen und Bronnen-Wercken. Damit das Wasser hoch zuheben/ zuleiten und fortzuführen auch andern Sachen/ so hierzu dienlich und nützlich zugebrauchen.* Nürnberg: In Verlegung Paulus Fursten, Kunsthändlers, Gedruckt bey Christoff Gerhard, [1661]. ¶ Tall 4to. [6] ff., 68 pp. Elaborate half-title, title-page printed in red & black, 154 numbered plates; pl. 84 torn at margin, other lesser short tears or wear, pl. 100 repaired and still with a newer short tear, pl.111 with hole (that small piece from the hole is transferred by glue to the recto of pl. 112, final plate with backing.

Heavily repaired copy, the frontispiece gutter with loss at the gutter, the title and following leaf reinforced with semi-transparent fibrus tissue, waterstaining throughout, some leaves with older reinforcement. Original full vellum, yapped; rebacked with new vellum. Good. TK0110

$ 2,250

First edition (known in two different issues), of the author's review of windmills, pumps and other hydraulic machines. The machines depicted include machines for processing grain, powder, paper production, drilling, oil, hammer and sawmills, as well as water-lifting stations, pumps.

Machine to pump water and put out fires

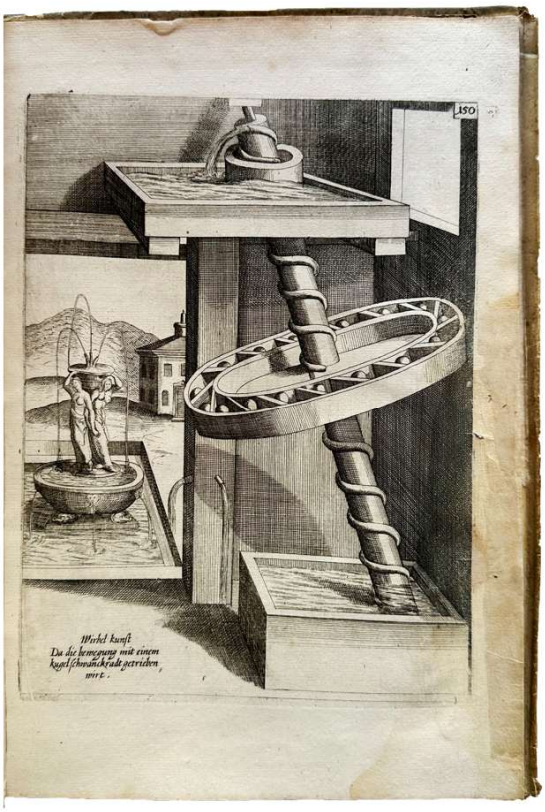


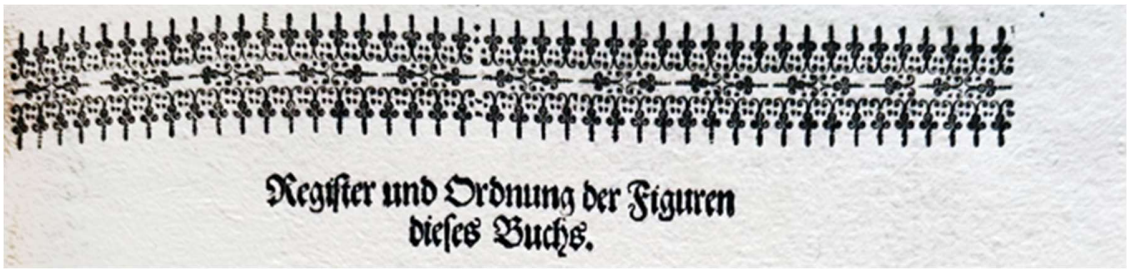
"Here is another of the great 'machine' books with many beautiful engravings of gunpowder mills, saw mills, water raising devices, fire engines, roasting spits and so on. Böckler was a German architect and engineer interested in masses

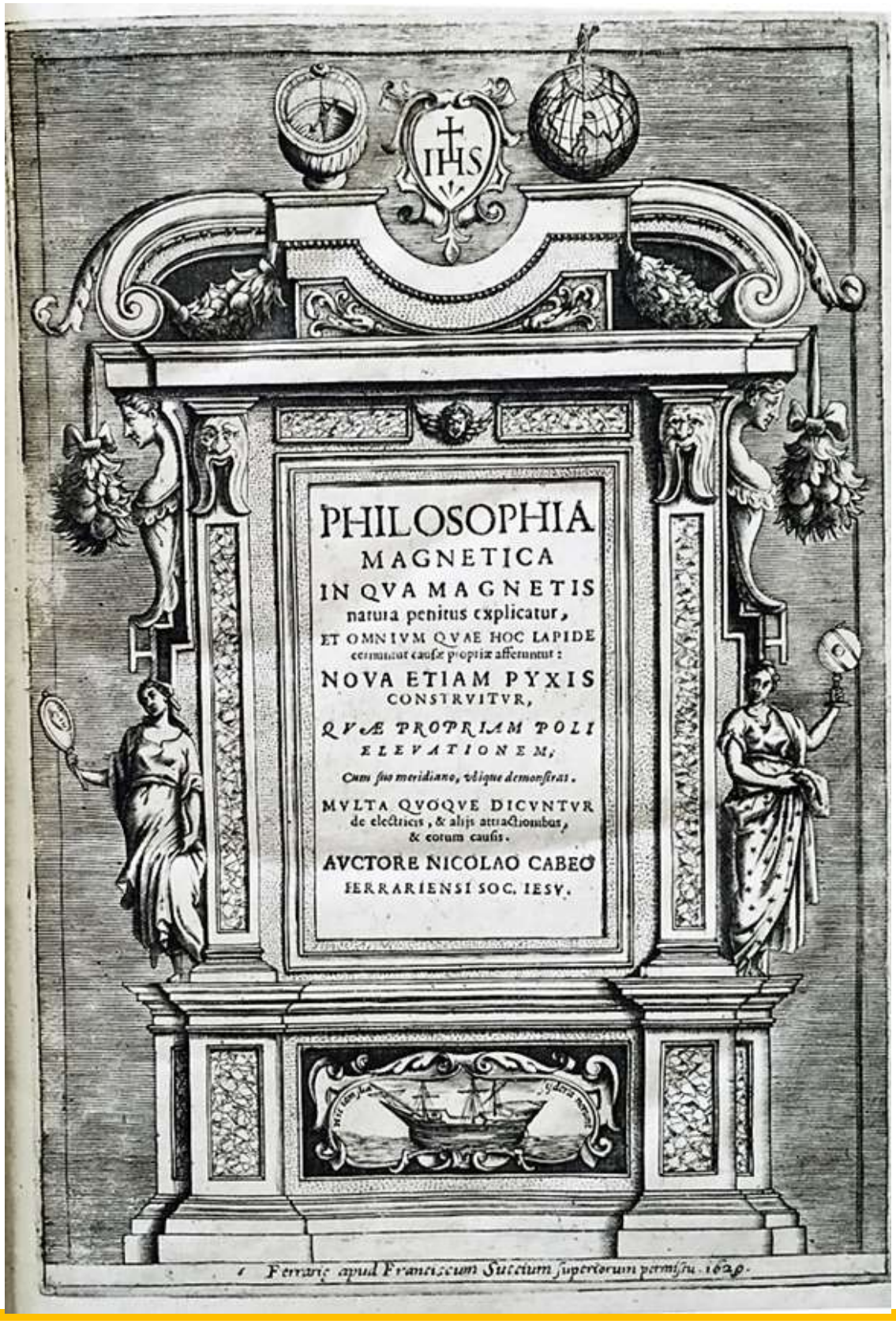
of gearing, complex workings, and devices that even by modern standards invite awe and admiration". – Hoover.

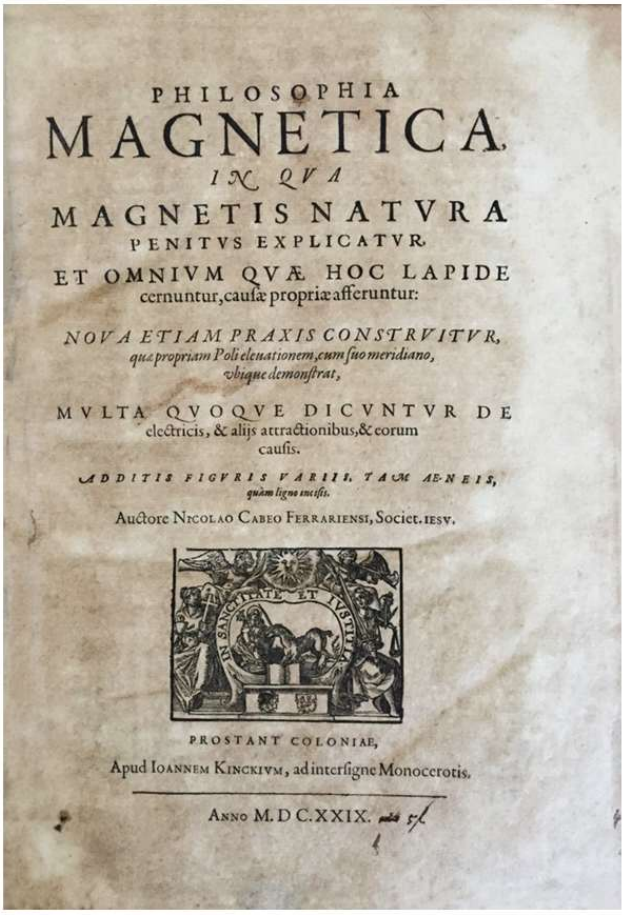
The book includes a famous plate of a fire engine water pump made by the inventor Hans Hautsch of Nuremberg, 1658.

§. Graesse I, 459; Hilz, *Theatrum machinarum*, (2008), p. 102; Honeyman-Sotheby 359; Sotheran I, 6284; Thorndike VII, 617; Zachert & Zeidler I, 220.




Register und Ordnung der Figuren dieses Buchs.


IHS
PHILOSOPHIA
MAGNETICA
IN QVA MAGNETIS
natura penitus explicatur,
ET OMNIVM QVAE HOC LAPIDE
cernuntur causæ propriæ afferuntur:
NOVA ETIAM PYXIS
CONSTRVITVR,
QVÆ PROPRIAM POLI
ELEVATIONEM,
Cum suo meridiano, vbique demonstrat.
MVLTA QVOQVE DICVNTVR
de electricis, & alijs attractionibus,
& eorum causis.
AVCTORE NICOLAO CABEO
FERRARIENSI SOC. IESV.
Ferrariæ apud Franciscum Suttium superiorum permissu. 1629.


PHILOSOPHIA
MAGNETICA
IN QVA
MAGNETIS NATVRA
PENITVS EXPLICATVR
ET OMNIVM QVÆ HOC LAPIDE
cernuntur, causæ propriæ afferuntur:
NOVA ETIAM PRAXIS CONSTRVITVR,
quæ propriam Poli elevationem, cum suo meridiano,
vbique demonstrat,
MVLTA QVOQVE DICVNTVR DE
electricis, & alijs attractionibus, & eorum
causis.
ADDITIS FIGVRIS VARIIS, TAM AENEIS,
quàm ligno incisis.
Auctore NICOLAO CABEO FERRARIENSI, Societ. IESV.
PROSTANT COLONIAE,
Apud IOANNEM KINCKIVM, ad interſigne Monocerotis.
ANNO M. D C. XXIX.

B. **CABEO, Niccolo [Cabaeus]**. *Philosophia Magnetica, In Qua Magnetis Natura Penitus Explicatur. Et Omnium Quae Hoc Lapide cernuntur, causae propriae afferuntur: Nova Etiam Praxis Construitur. quae propriam Poli elevationem, cum meridiano, ubique demonstrat*. Cologne and Ferrara: Johann Kinckius, Francesco Succi, 1629. ¶ Folio. [20], 412, [12] pp. Printer's mark of first title with the added fine engraved architectural title-page with scientific apparatus, 149 wood-engravings including world map (p. 93); first title and dedication pages browned as usual. Added t.p. engraved has "praxis" changed to "pyxis" and imprint reads: Ferrarie apud Franciscum Succium. Contemporary full vellum, gilt spine title, edges colored. The first [typographic] title and dedication pages were added to this Cologne edition (see below). Aside from the two German leaves, the rest of the text is clean, crisp and very fine. [S13076]

$ 7,500

FIRST EDITION, COLOGNE ISSUE, OF THE FIRST WORK TO DISCUSS ELECTRICAL REPULSION, "PERHAPS THE MOST SIGNIFICANT DISCOVERY OF THE CENTURY FOLLOWING GILBERT." – WOLF. THE FIRST WORK TO DISCUSS ELECTRICAL REPULSION.

"On p. 194 of this famous work of the great Italian Jesuit will be found the first recognition of electrical repulsion. Gilbert's discoveries and theories are freely discussed, the latter often adversely. Sympathetic telegraphy disproved (page 301); magnetic field mapped out by iron filings; also diagrams of the magnetic (lover's) telegraph. Cabeo opposed the views of Copernicus on astronomy, as well as those of Gilbert on terrestrial magnetism. Copies of this first edition are much sought after." – Wheeler Gift.

"An important work on the loadstone. . . A curious chapter. . .institutes a comparison between electrical and magnetical attraction. . .The *PHILOSOPHIA MAGNETICA* is the second Latin book published on electricity." – Mottelay.

The Cologne issue adds a new typographic title-page and resets the dedication leaf (conjugate leaf) beginning "Ludovico XIII" [see Wellcome description]. The Papal arms which were at the top of the engraved title-page are replaced with the Jesuit emblem and the last line of the title beginning with "multa quoque dicuntur." has been added. It seems fairly obvious that Succi printed two variants of the book, one intended for the German trade; the paper of the book is distinctly a superior Italian printing on fine paper except for the added leaves which are on the typically browned paper of seventeenth century German books. Probably Kinkius printed these two leaves and sent them to Italy to be added to his issue of the book. This copy is in a typical Italian binding of the time which implies, in this cataloger's mind, that Succi supplied the books with the changes in a finished form to his German counterpart.

aliquis ex ſcholarum rigore forteſſe deſideraret, quomodo ſcilicet Terrarum tractus illi hoc efficiant, vt diuertere faciant ad ſe verſorium. patet alibi expoſitum in noſtra iſta philoſophia. Interim certo conſtat hanc eſſe cauſam, ſicuti certo conſtat diſtantiam, verbi gratia, eſſe cauſam, cur res minor videatur, & in maiori diſtantia cur adhuc minor appareat, etiã ſi non clarè ſentias, qua ratione hoc diſtantia poſſit efficere: nec vllus negabit iure, te cauſam attuliſſe, cur nunc minor res videatur, dum diſtantiam profers, etiamſi nihil aliud addas. Explicata igitur, vt dixi, deuiationis magneticorum cauſa; loquor enim in vniuerſum de directione magneticorũ: nec enim puto ſolum verſorium, aut pyxidem declinare, ſed puto declinare etiam magnetem ipſum: Iam aliæ duæ propoſitiones explicatæ patebunt, & cauſæ in aperto erunt, quarum altera hæc ſit.

Propoſita ſit telluris mappa A. B. in hac ſumatur aliquis meridianus

circulus: dico in quolibet puncto illius meridiani, & in qualibet diſtantia à polis A. & B. non ſemper æqualiter magneticum diſcedere à vero meridiano. Probatur hoc primo experientia: nam in meridiano Conſtantinopolitano diſcedit, qua parte Septentrionem ſpectat, ad Orientem per aliquot gradus; at vero in eodem meridiano vltra æquatorem prope caput Bonæ ſpei

ſpei prorſus mãgnes congruit cum vero meridiano: eſt enim ibi ferè promontotium, quod propterea appellatur ab Hiſpanis *delas Agullias*. Hoc idem poſſet inductione oſtendi in alijs multis meridianis, & in illo ipſo *delos azores*, nam in illo toto, & in quolibet eius puncto circa terram non ſemper congruit pyxis cum vero meridiano, ſed vltra æquatorem ab illo diſcedit. Verum hoc paſſim obuium erit, ſi terram quis percurrere velit in mappa, & ex nautarum obſeruationibus magneticas deuiationes computare: nihil enim magis obuium erit, quam non vbique in eodem meridiano, æqualiter declinare pyxidem.

Huius ratio illa eſt, quam ſupra expoſui; quia tunc magneticum congruit, cum vero meridiano, quando ex vtraque parte illius meridiani continentium ſpatia ſunt ferè æqualia: tunc declinat ad vnam partem, quando ex illa parte longè maior Terrarum tractus iacet, quam ex alia; ſed poteſt contingere, & de facto accidit, vt in aliquo meridiano res ita ſe habeat, vt in vna eius latitudine Terrarum, ſpacia vtrinque ſint æqualia, in alia latitudine ſint longè inæqualia, vel in vtraque quidem inæqualia, ſed cum magna diuerſitate in iſta ipſa inæqualitate; quia vel longè maior ſit vna inæqualitas in vno paralielo, quam alia in alio, vel hic inæqualitas ſit ad Orientem, alibi ad Occidentem. ergo in illo caſu non erunt vtrobique eædem varietates, & declinationes magneticorum à vero meridiano. Illud igitur pro ratione adduco, cur non in qualibet latitudine eiuſdem meridiani exempli gratia, Conſtantinopolitani, æqualiter declinent magnetica; quia non vbique æqualia ſunt terrarum ſpacia hinc inde poſita ad latera illius meridiani: ad Conſtantinopolim enim maior terræ regio eſt ex parte Orientali tota nimirum vaſtiſſima Aſia; ideo declinat ibi pars Septentrionalis ad Orientem non nihil. At vero ad Caput Bonæ ſpei vtrinque ſunt ferè æquales Oceani vaſtitates, & ad frontem habet ferè mediam totam Africam, ideo ibi congruit cum vero meridiano.

Longitudo Terreſtris inueniri non poteſt per magneticam directionem ad polos.

Caput XII.

NVnc ex ſupra dictis errorem nonnullorum iam confutaui: ex eo enim quod magnetica deuiarent à vero meridiano, & in diuerſis locis nunc magis, nunc minus, in eam deuenere ſpem, vt putarent ſe poſſe per magneticam directionem expedire ab implicatiſſimo illo problemate Geographico, quo quæritur, quæ ſit longitudo

86 Magnet. Philos.

pto magnitudine verſorij inclinationis, quod habes: ita vt verſorium ſuo centro poſſit ſupra centrum huius circuli intra eius peripheriam præcisè conuertere expedite. Sume puncta A. B. in iſto circulo pro punctis horizontalibus, & diuide circulum incipiendo ab A. vel B. de more in gradus 360. vel, ſi malis, vnicum quadrátem in 90. partes oculte diſtribue. tum ex tabel-

la vide ad quem gradum deſcendat verſorium in latitudine graduū quinq; & ibi in circulo punctum nota, & adſcribe. 5. vide ad quem gradum deſcendat in latitudine graduum 10. ibi nota punctum, incipiendo ſemper ab A. vel B. & adſcribe decem, & ſic de ſingulis, quæ puncta poteris notare tam ex parte A. quam ex parte B. & tam ex parte inferiori, quam ex ſuperiori: &, ne confundantur puncta melius erit gradus non ſignaſſe in iſto circulo niſi leuiſſime, & obſcurè. Hæc puncta, ſi transferas in inſtrumentum inclinationis, & notes inferiora in circulo aliquo notato in ſcutella, per quæ puncta ex imo centro ducas circulos veluti almicantaracticos, infernos, ſuperiora autem puncta notes in circulo æneo, habebis completum inſtrumentum inclinatoris: ſtatim enim verſorium ſua inclinatione, & directione oſtendet, quæ ſit loci latitudo, deſignando aliquem ex notatis punctis, ex cuius numero habebis altitudinem poli.

Qua

Lib. I. Cap. XXII. 87

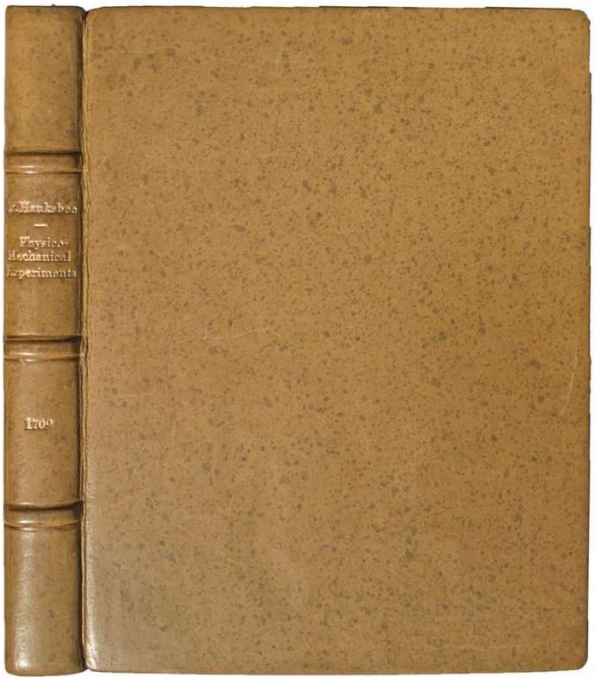
Qua ratione corrigenda videatur iſta regula directionum magneticarum ex aliquo phyſico experimento. Caput XXII.

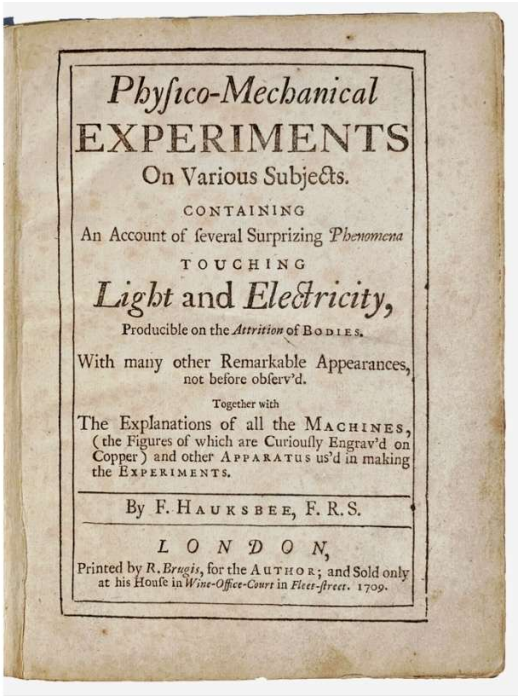
Via igitur modus iſte Gilberti, licet fortaſſe proximè accedat, tamen præciſus non eſt, & omnino exquiſitus: quod poteris etiam cognoſcere, ſi notes puncta in circulo ſupra poſito ex eius tabella: videbis enim interualla illa non ordinate decreſcere ſemper, vt ratio videtur poſtulare, aliam ego adhibebo ſtatim rationem phyſicam, qua inueniatur huiuſmodi inclinatio, & nouæ conſtituatur tabella, vel præcedens corrigatur; quæ ratio, ſi non erit exactiſſima, erit ſaltem magis phyſica, & ad magneticas rationes accommodata: præſertim poſitis his, quæ ſupra diximus, de virtute magnetica, quam terra valuiſſe poſſidet, propter quam terræ virtutem, vt magis etiam conſtabit ex alibi dicendis, magnetica ferramenta in æquilibrio poſita deſcendunt infra horizontem.

Sumę igitur globum magneticum conuenientis magnitudinis: immo

H2 qui

§ Bakken 7; Bibl. Dt. Mus. Libri rari 060; Ferguson I, p. 136; Neville I, p. 232; Riccardi I, 205; Ronalds 92; Sotheran, 659; Wheeler Gift 97; De Backer-Sommervogel II, 483, 1; Thorndike VII, 267ff.; Wellcome I, 1171a.



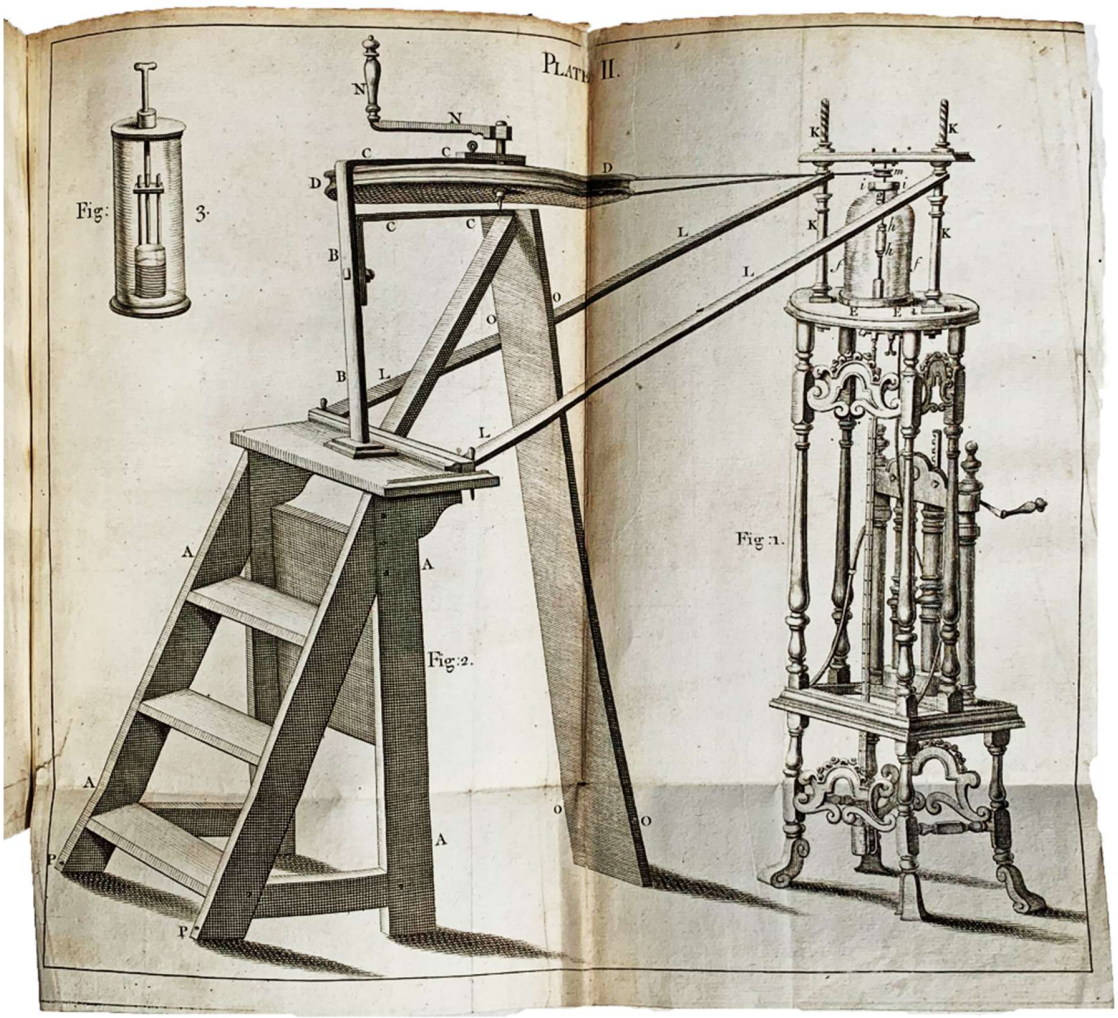


Physico-Mechanical
EXPERIMENTS
On Various Subjects.
CONTAINING
An Account of several Surprizing *Phenomena*
TOUCHING
Light and *Electricity*,
Producible on the *Attrition* of BODIES.
With many other Remarkable Appearances, not before observ'd.
Together with
The Explanations of all the MACHINES, (the Figures of which are Curiously Engrav'd on Copper) and other APPARATUS us'd in making the EXPERIMENTS.
By F. HAUKSBEE, F. R. S.
LONDON,
Printed by *R. Brugis*, for the AUTHOR; and Sold only at his House in *Wine-Office-Court* in *Fleet-street*. 1709.

C. **HAUKSBEE, Francis** (1666-1713). *Physico-Mechanical Experiments On Various Subjects. Containing An Account of several Surprizing Phenomena touching Light and Electricity, Producible on the Attrition of Bodies. With many other Remarkable Appearances, not before observ'd. Together with the Explanations of all the Machines, (the Figures of which are Curiously Engrav'd on Copper) and other Apparatus us'd in making the Experiments*. London: R. Brugis, 1709. ¶ Small 4to. (201 x 160 mm) [14], 194 pp. 8 plates (7 folding); foxing to some sections, plates 3 and 4 bound in reverse order, 1 plate facing p. 160, margins of two plates reinforced. Full modern speckled olive calf, raised bands, gilt-stamped spine title, by Johanna Rojgard [Sweden]. Bookplate of Andras Gedeon, ink ownership marks of James William Heath (1869), another (unreadable) 1854. Very good. SS9409

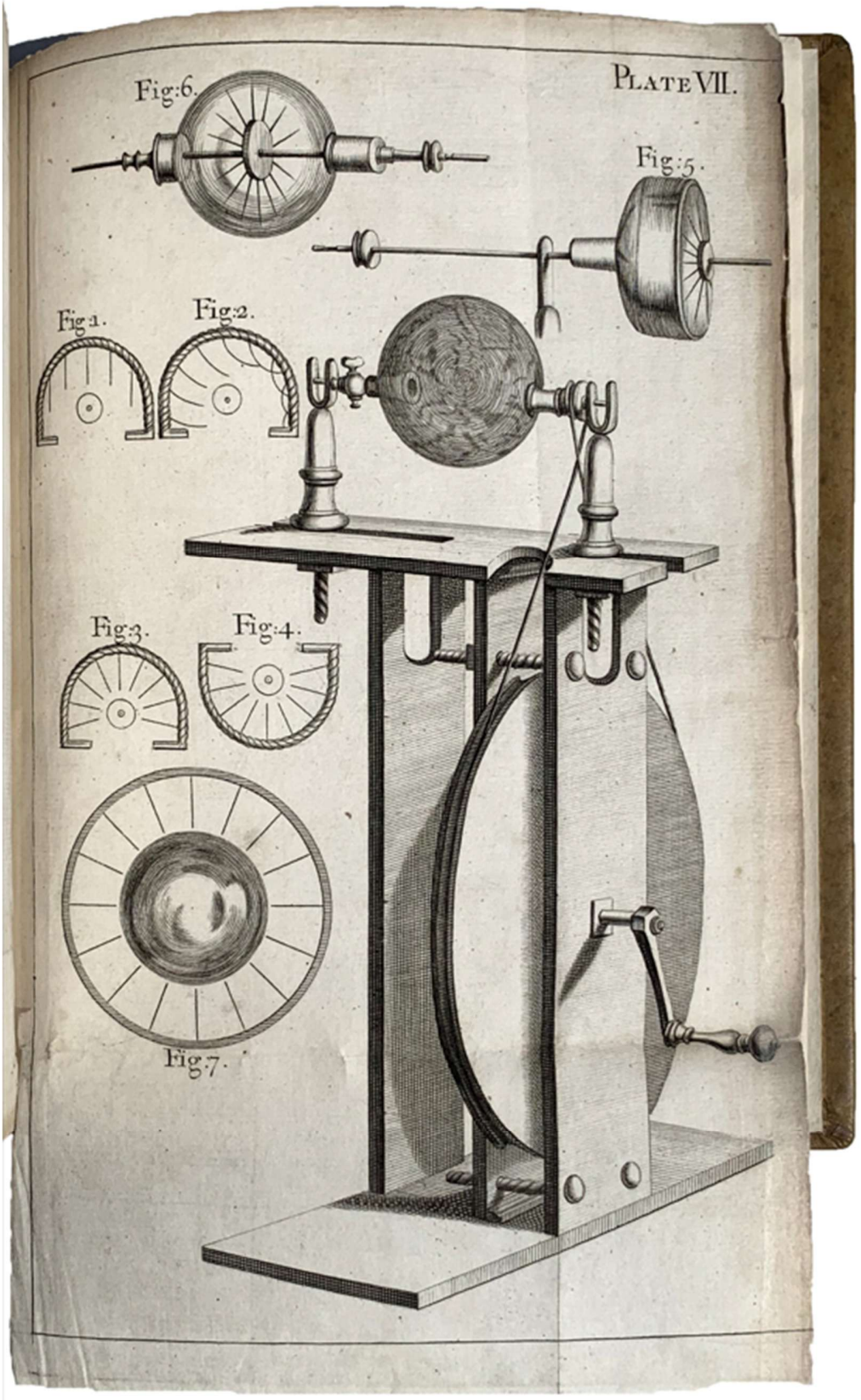
$ 4,500

FIRST EDITION. THE DISCOVERY OF NEON LIGHTING. By 1705, Hauksbee had discovered that if he placed a small amount of mercury in the glass of his modified version of Otto von Guericke's generator and evacuated the air from it, and then he caused a charge to be built up on the ball, a glow was visible if he placed his hand on the outside of the ball. This glow was bright enough to read by. This effect later became the basis of Neon lighting and mercury vapor lights.



"Hauksbee's important experiments on electroluminescence, static electricity, and capillarity, described in the present work, mark the beginning of sustained experimentation in the field of electricity. He was the first to demonstrate the optical effects produced by the passage of electricity through rarified air. His demonstration of the efficacy of glass in producing frictional electricity opened the way from the work of Gray, Dufay and Franklin, and his discoveries in capillarity (he was the first adequately to explore the subject) influenced Laplace nearly one hundred years later. Hauksbee performed many of his experiments at the suggestion of Isaac Newton, from whom Hauksbee learned the theoretical import of some of his discoveries; in turn, Hauksbee's results influenced Newton's revisions and additions in the new editions of his Principia and Optiks." [Norman].

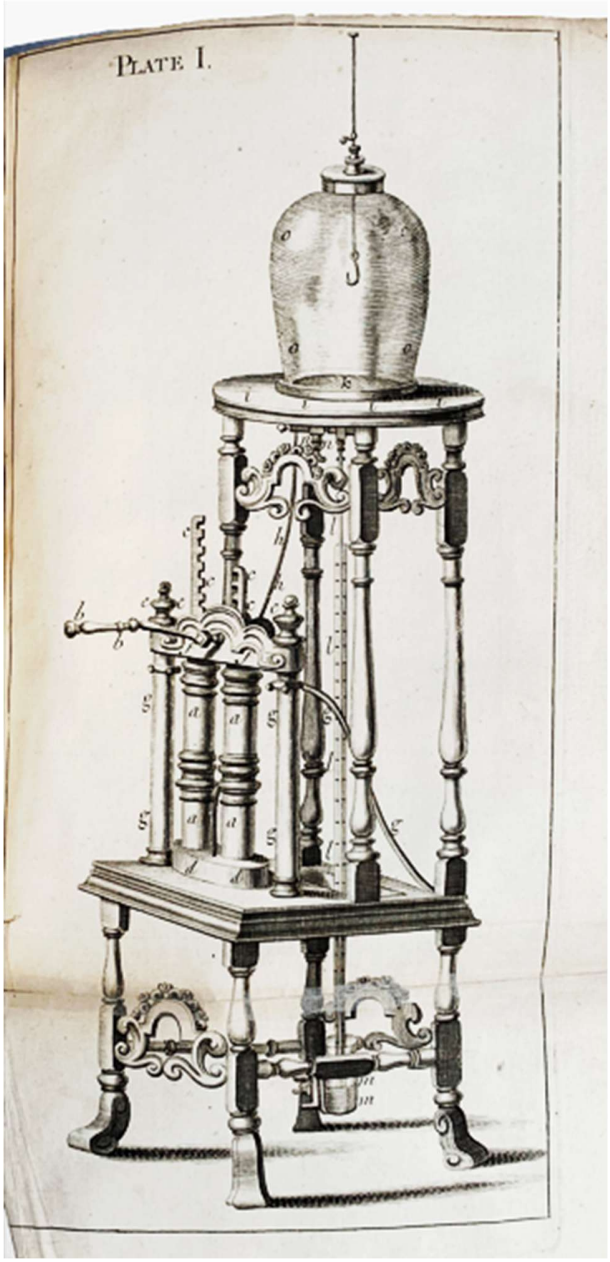
PLATE VII.

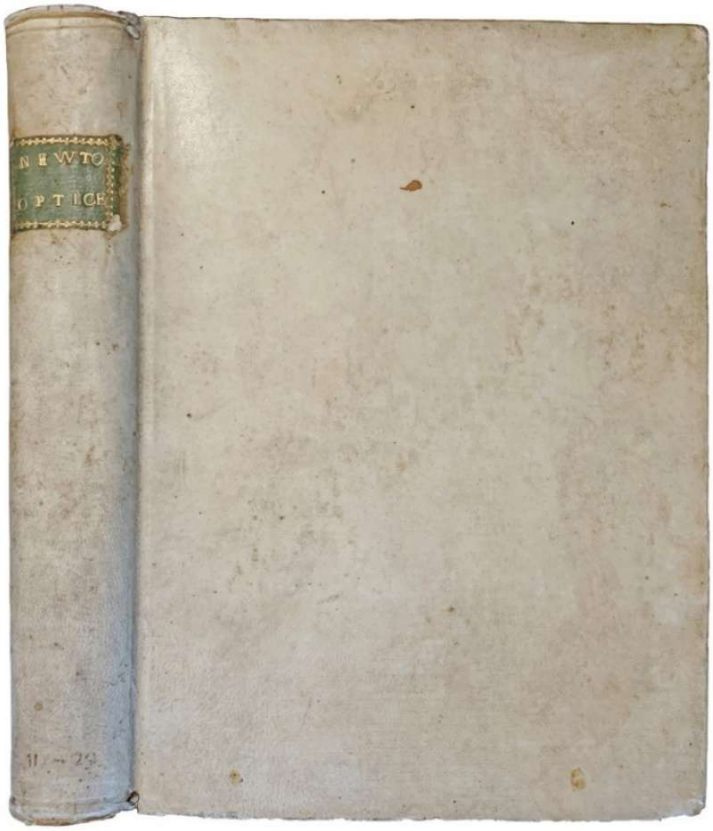


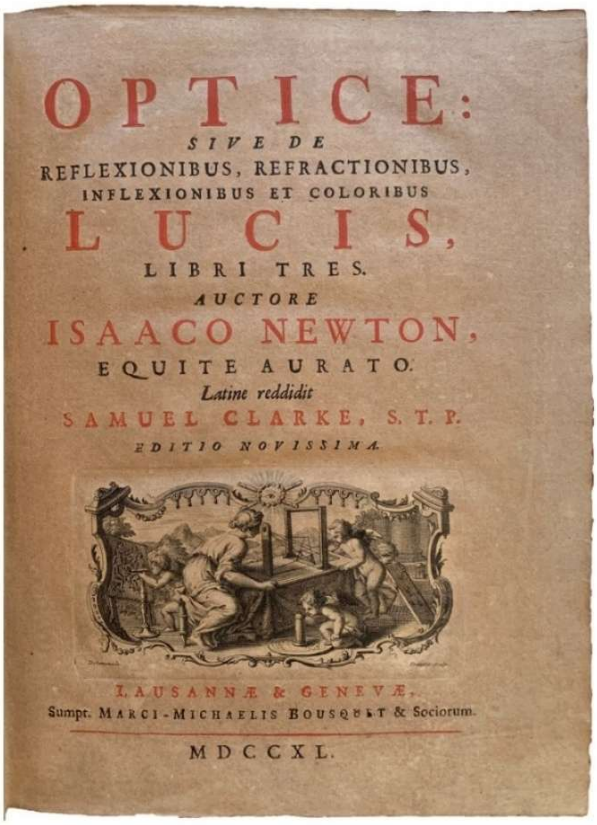
PROVENANCE: [Undetermined owner, 1854] –James William Heath (1869)

Dr. Andras Gedeon [Sweden] [c.2008].

§ *DSB* Vol. VI, pp. 169-175; Duveen, p. 282; ESTC T60574; Gedeon pp. 92-93 [this copy]; Norman 1020; Wheeler Gift 232.





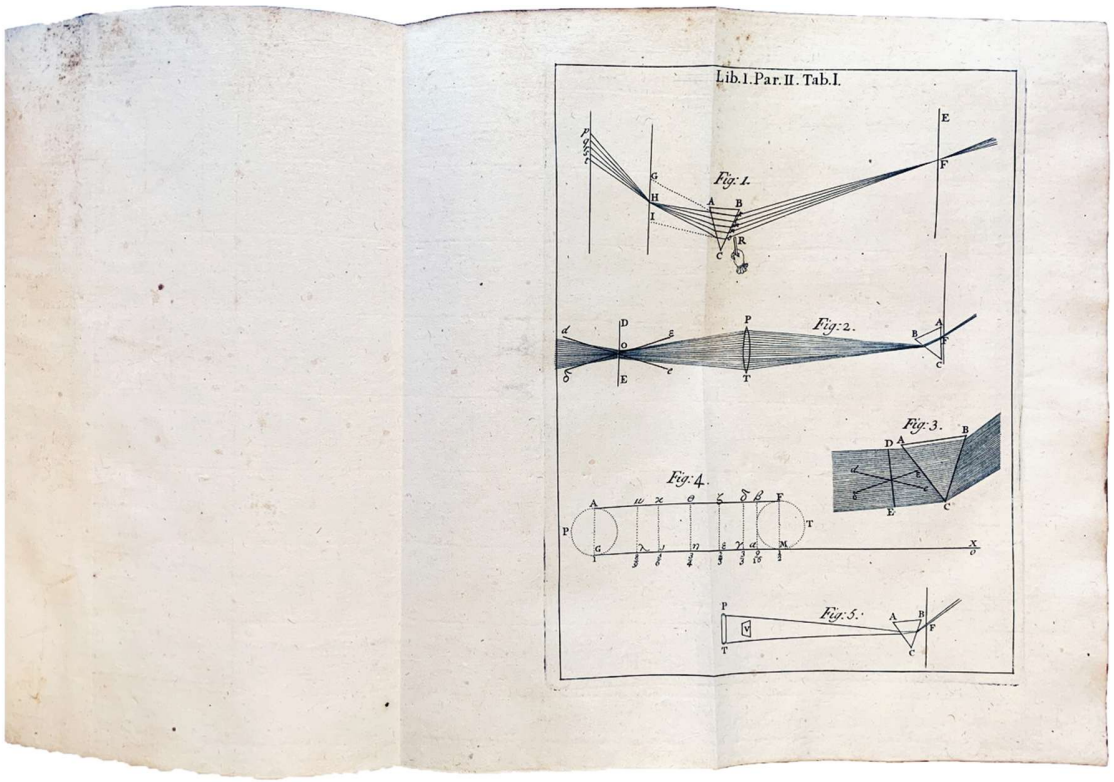


D. **NEWTON, Isaac** (1643-1727). *Optice: sive de Reflexionibus, Refractionibus, Inflexionibus et Coloribus Lucis, libri tres. Latine reddidit Samuel Clarke . . . Editio novissima.* Lausannae & Geneva, Marci-Michaelis Bousquet & Sociorum, 1740. ¶ 4to. [iv], xxxii, 363, [1] pp. Half-title, engraved frontispiece portrait of Newton (engr. Jean-Louis Daudet after Vanderbank), title printed in red & black, 12 engraved folding plates, title vignette of 4 cherubs and a female figure, each using an optical instrument, representing learning optics/perspective (drawn by Delamoncein and engraved by Daudet), head & tail pieces and woodcut initial letters drawn by Papillon, index; first 11 leaves browned. Contemporary full vellum, green leather gilt-stamped spine label, edges with decorative red freckling as designed by the binder; foot of spine with faint ink marking "11-[??]". Paper unevenly browned. Verso of title with small ink annotation "=1135="; rear pastedown with another notation "á 20.Luglio 1801." Very good. [S13116]

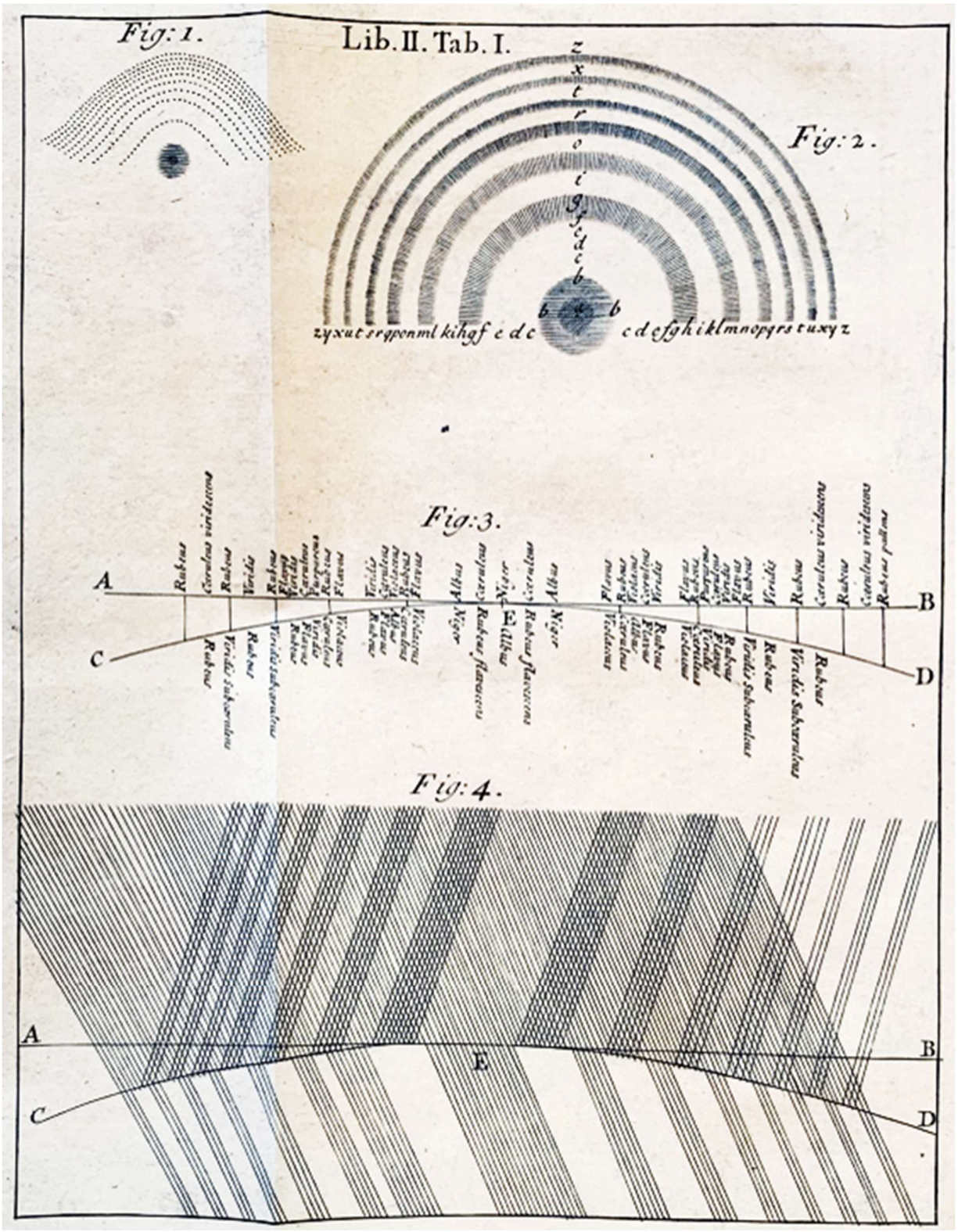
$ 2,750

Third Latin edition, edited by Bousquet, with a dedication to Joannes Bernoulli. This edition contains the full array of 31 querries.*

"Newton's contributions to the science of optics – his discovery of the unequal refractions of rays of different color, his theory of color, and his investigations of 'Newton's rings,' to mention only a few of the most noteworthy – place him among the premier contributors to that science. . . . Today we recognize that his work on optics offers unique rewards in its exciting, innovative conjunction of physical theory, experimental investigation, and mathematics, and in the revealing glimpse that it provides of a crucial period in the evolution of experimental science." – Alan E. Shapiro, *The Optical Papers of Isaac Newton:* Volume 1, (1984), p. xi.



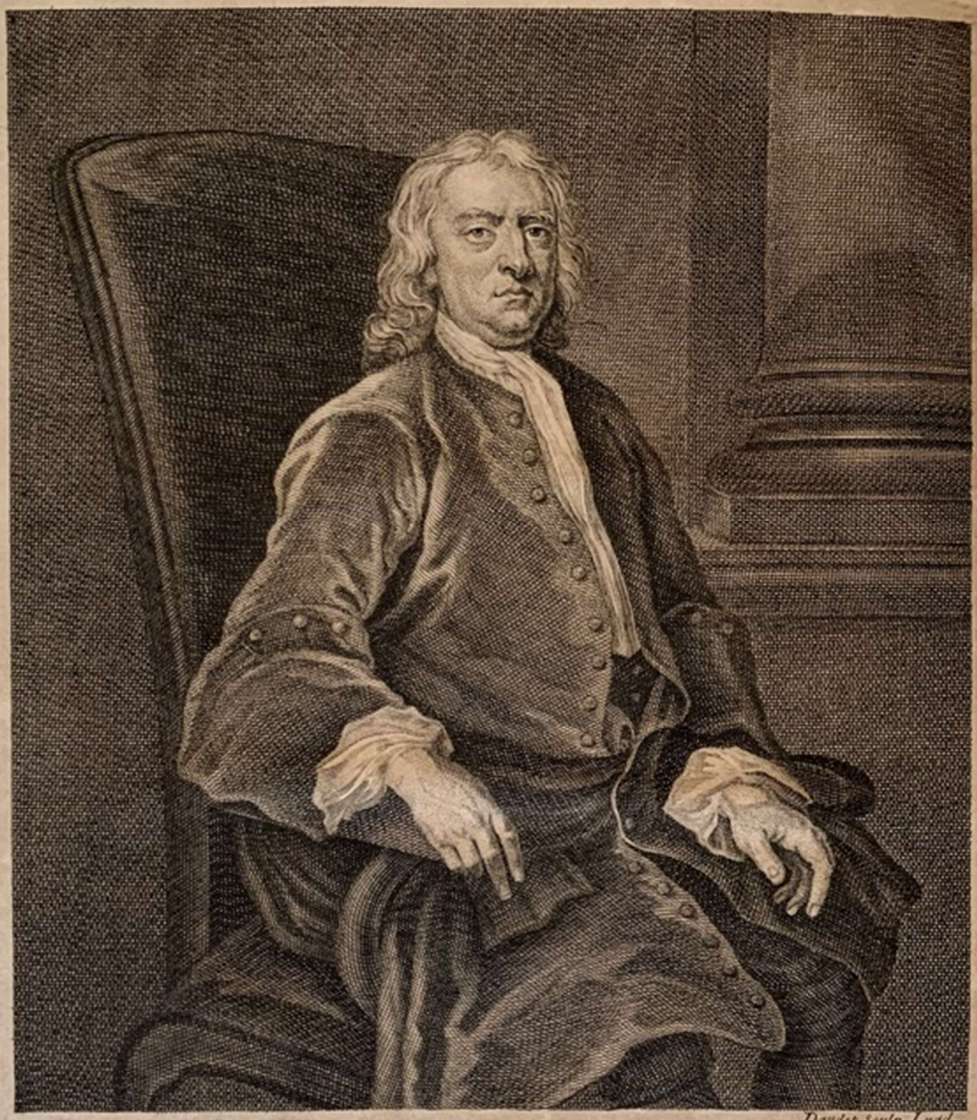
Jean-Louis Daudet (1695-1756), who made the frontispiece and title vignette, was an engraver and print publisher active in Lyon, inherited his business from his father Etienne Joseph Daudet. He flourished from 1722 till his death in 1756. Thereafter the business continued by his widow in association with his son-in-law Louis Martin Roch Joubert until 1773.



Newton

"Newton famously declared that it is not the business of science to make hypotheses. However, it's well to remember that this position was formulated in the midst of a bitter dispute with Robert Hooke, who had criticized Newton's writings on optics when they were first communicated to the Royal Society in the early 1670's. The essence of Newton's thesis was that white light is composed of a mixture of light of different elementary colors, ranging across the visible spectrum, which he had demonstrated by decomposing white light into its separate colors and then reassembling those components to produce white light again. However, in his description of the phenomena of color Newton originally included some remarks about his corpuscular conception of light (perhaps akin to the cogs and flywheels in terms of which James Maxwell was later to conceive of the phenomena of electromagnetism). Hooke interpreted the whole of Newton's optical work as an attempt to legitimize this corpuscular hypothesis, and countered with various objections."

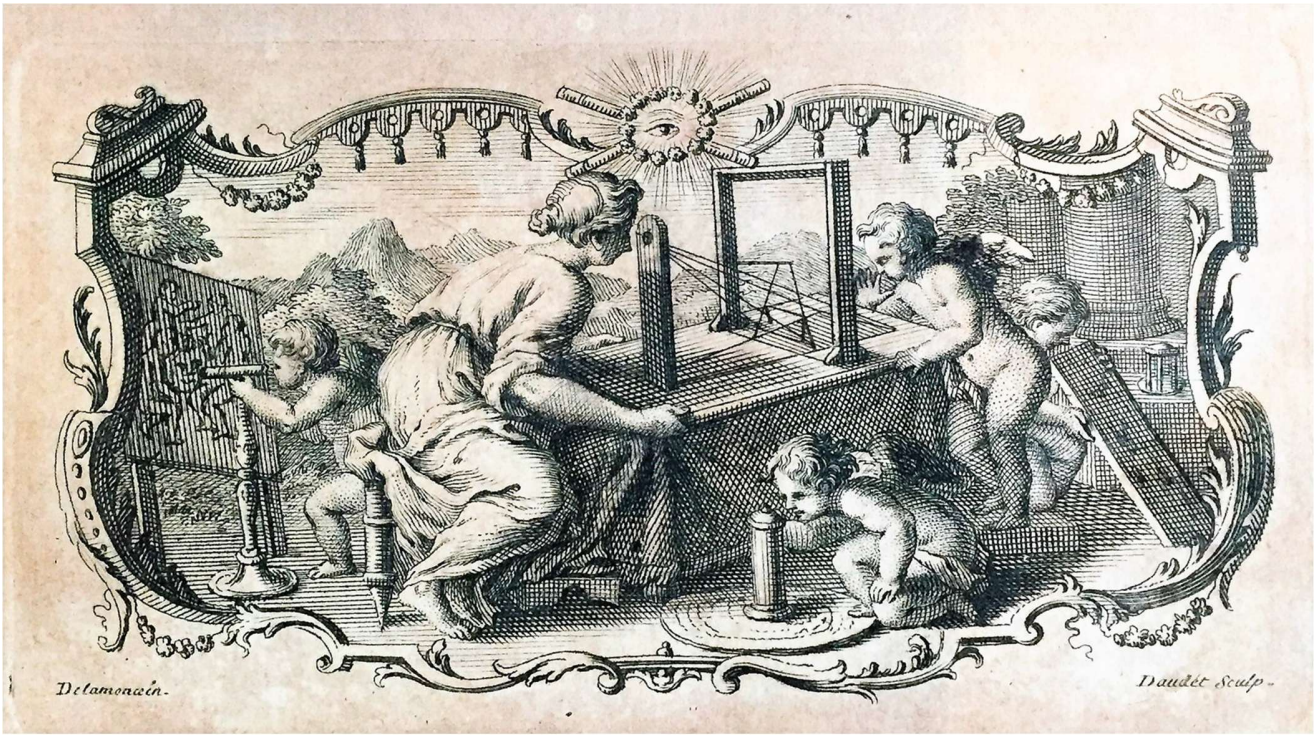
"Newton quickly realized his mistake in attaching his theory of colors to any particular hypothesis on the fundamental nature of light, and immediately back-tracked, arguing that his intent had been only to describe the observable phenomena, without regard to any hypotheses as to the cause of the phenomena. Hooke (and others) continued to criticize Newton's theory of colors by arguing against the corpuscular hypothesis, causing Newton to respond more and more angrily that he was making no hypothesis, he was describing the way things are, and not claiming to explain why they are. This was a bitter lesson for Newton and, in addition to initiating a life-long feud with Hooke, went a long way toward shaping Newton's rhetoric about what science should be. . .."



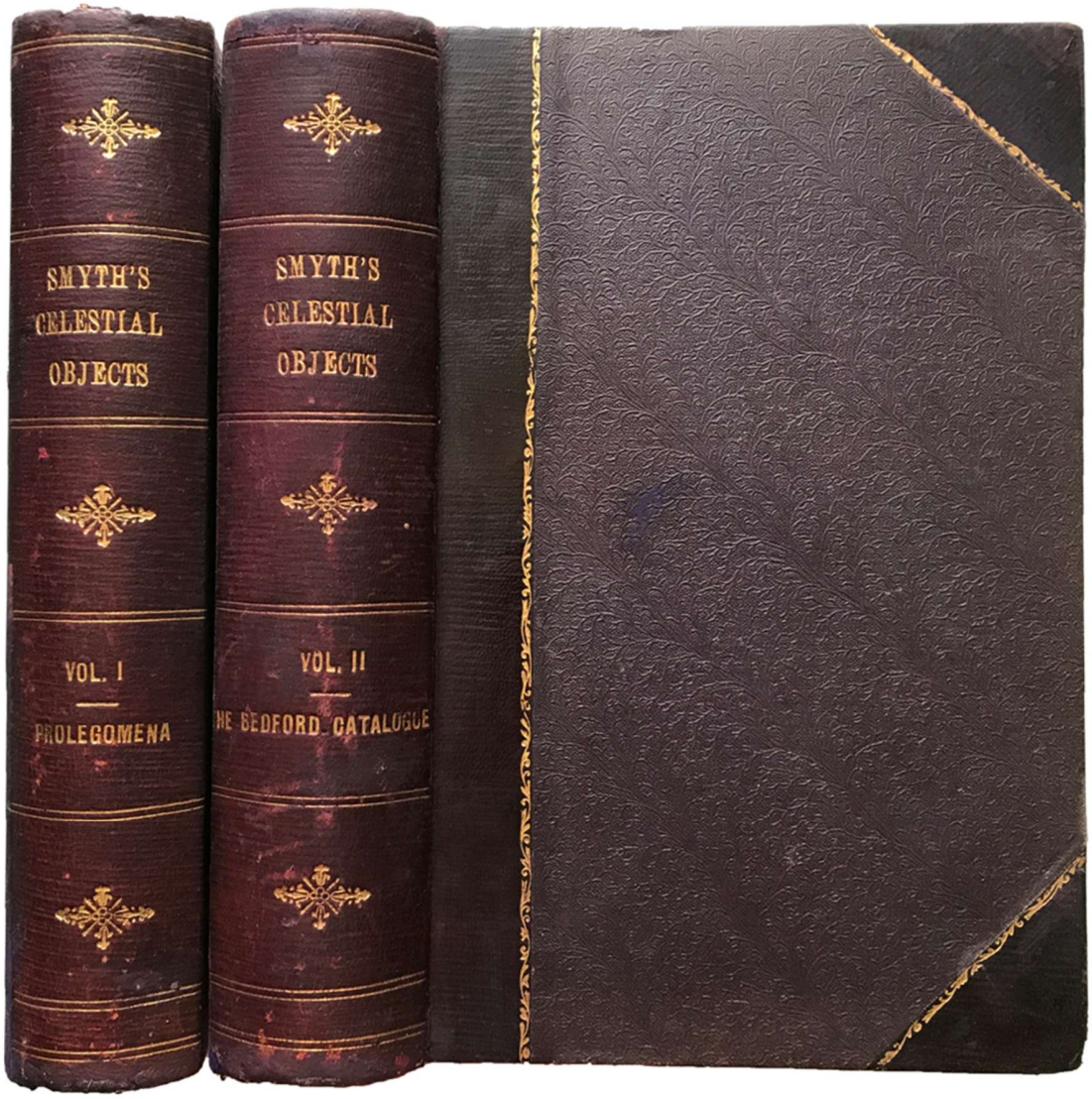
Daudet sculp. Lugd.

ISAACUS NEVVTON
EQUES Anno. Ætat. 84. An. Chr. 1726.
APUD
MARCUM-MICHAELEM BOUSQUET
Et Socios MDCCXL.

"The first edition of The *Opticks* (1704) contained only 16 queries, but when the Latin edition was published in 1706 Newton was emboldened to add seven more, which ultimately became Queries 25 through 31 when, in the second English edition, he added Queries 17 through 24. Of all these, one of the most intriguing is Query 28, which begins with the rhetorical question "Are not all Hypotheses erroneous in which Light is supposed to consist of Pression or Motion propagated through a fluid medium?" In this query Newton rejects the Cartesian idea of a material substance filling in and comprising the space between particles. Newton preferred an atomistic view, believing that all substances were comprised of hard impenetrable particles moving and interacting via innate forces in an empty space (as described further in Query 31)." – Newton's Cosmological Queries – MathPages.



§ Grace K. Babson, *Sir Isaac Newton*, (1950), 141; George J. Gray, *A Bibliography of the Works of Sir Isaac Newton*, 182; Wallis 182. See: *Printing and the Mind of Man*, 172.



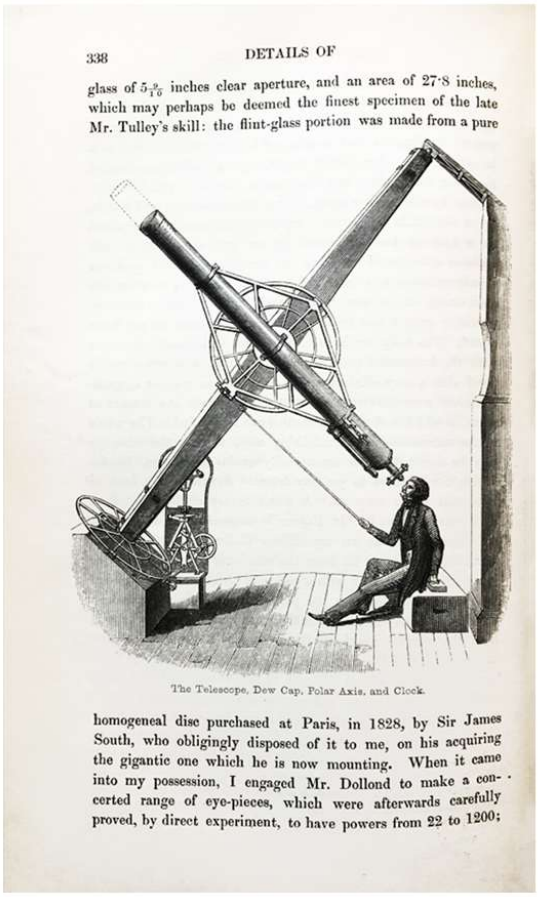
E. **SMYTH, Captain William Henry** (1788-1865). *A Cycle of Celestial Objects for the Use of Naval, Military, and Private Astronomers. Volume 1: Prolegomena; Volume II: The Bedford Catalogue*. London: John W. Parker, 1844. ¶ 2 volumes. 8vo. viii, [4], 516; xx, 560 pp. Original half purple calf, gilt-stamped spines, decorative publisher's cloth sides, green floral pattern endleaves; rubbed. Ownership signatures of H.J. Lewis [or T.H. Lewes?] and Rev. J.B. Allison (of Chesterfield, a star-gazer in 1883). Very good. WITH AN AUTOGRAPH LETTER SIGNED BY THE AUTHOR. Very Scarce. [S13118]

$ 1,750

The true first edition of William Henry Smyth's classic handbook intended for amateur astronomers. George Lovi calls it "THE FIRST TRUE CELESTIAL BAEDEKER and not just another 'cold' catalogue of mere numbers and data."

AN AUTOGRAPH LETTER SIGNED BY THE AUTHOR [to an unknown astronomer]: On his personal stationary "St. John's Lodge, near Aplesbury, [U.K.]. dated 11-10-'58 [October 11, 1858]. "My dear colleague, When I sent you a copy of my lugubrious "Farewell" to e Virginis, I think I omitted to enclose a set of the measures upon which her present epoch is based, - so here it is.

I propose to be at Almack's next Thursday (D.V.) – at 6 P.M. – in the hope of meeting you there, & meantime am, as always, Yours most truly, W.H. Smyth."

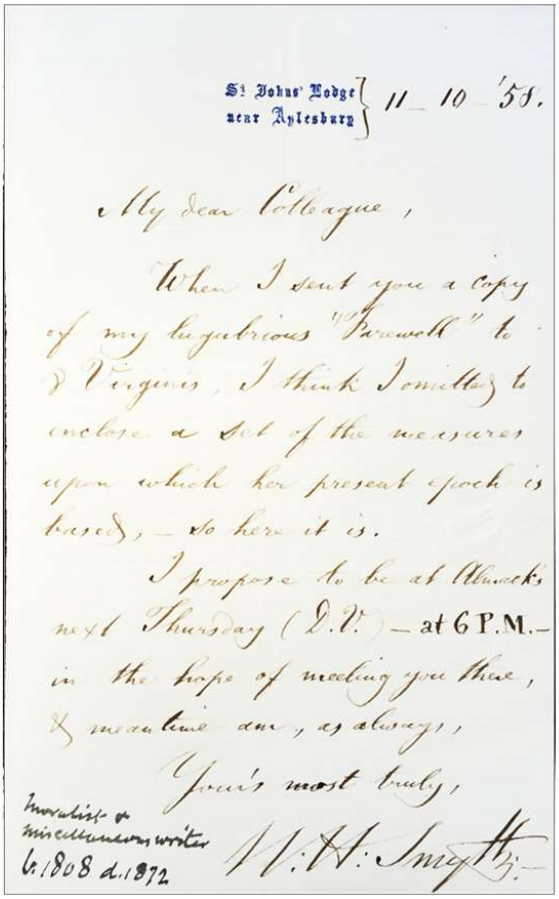


338 DETAILS OF

glass of $5\frac{3}{16}$ inches clear aperture, and an area of 27·8 inches, which may perhaps be deemed the finest specimen of the late Mr. Tulley's skill: the flint-glass portion was made from a pure

The Telescope, Dew Cap, Polar Axis, and Clock.

homogeneal disc purchased at Paris, in 1828, by Sir James South, who obligingly disposed of it to me, on his acquiring the gigantic one which he is now mounting. When it came into my possession, I engaged Mr. Dollond to make a concerted range of eye-pieces, which were afterwards carefully proved, by direct experiment, to have powers from 22 to 1200;



St. Johns' Lodge near Aplesbury 11 10 '58.

My dear Colleague,

When I sent you a Copy of my lugubrious "Farewell" to e Virginis, I think I omitted to enclose a Set of the measures upon which her present epoch is based, — so here it is.

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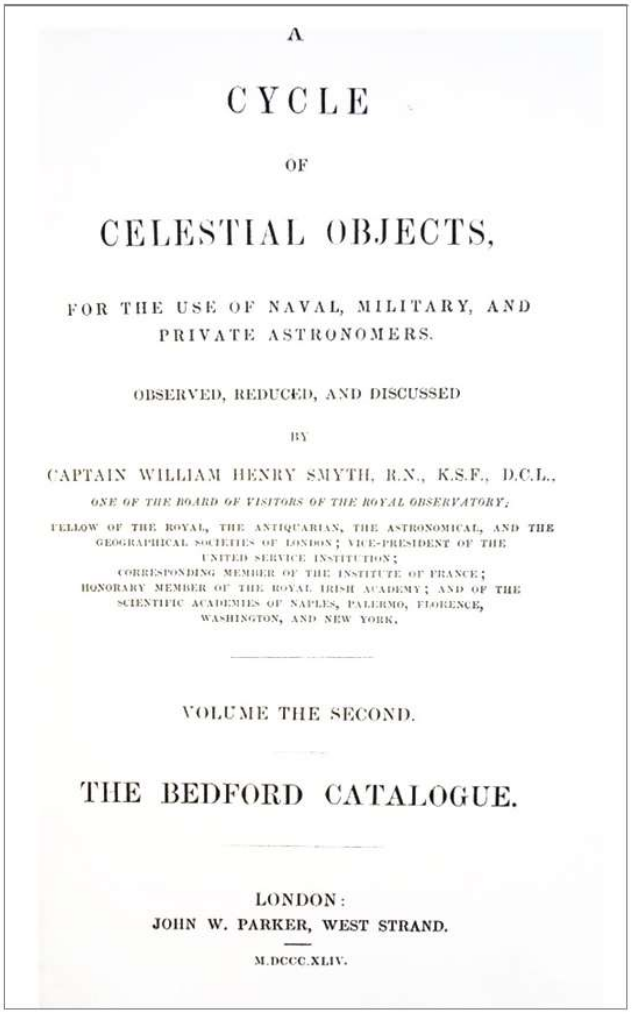
Yours most truly,

W.H. Smyth

Hydrographer & miscellaneous writer b.1808 d.1872

St. John's Lodge [Cardiff] was the author's home as well as the place where he made many of his astronomical observations and calculations.

"In 1825 Smyth established a private observatory in Bedford, England, equipped with a 5.9-inch refractor telescope. He used this instrument to observe a variety of deep sky objects over the course of the 1830s, including double stars, star clusters and nebulae. He published his observations in 1844 in the *Cycle of Celestial Objects*, which earned him the Gold Medal of the Royal Astronomical Society in 1845 and also the presidency of the society. The first volume of this work was on general astronomy, but the second volume became known as the Bedford Catalogue and contained Smyth's observations of 1,604 double stars and nebulae. It served as a standard reference work for many years afterward; no astronomer had previously made as extensive a catalogue of dim objects such as this. It was reprinted in 1986, and in the Foreword to that edition George Lovi . . . writes, 'What makes it so special is that it is the first true celestial Baedeker and not just another 'cold' catalogue of mere numbers and data. Like the original Baedeker travel guidebooks of the last century, this work is full of colorful commentary on the highlights of the heavenly scene and heavily influenced several subsequent works of its type, even to the present day. . . . It is in the descriptive material that Smyth is a delight. He not only describes what the user of a small telescope will see, but also includes much fascinating astronomical, mythological, and historical lore. Many of these descriptions are especially valuable for the novice and user of small telescopes of a size similar to Smyth's.'"



A

CYCLE

OF

CELESTIAL OBJECTS,

FOR THE USE OF NAVAL, MILITARY, AND PRIVATE ASTRONOMERS.

OBSERVED, REDUCED, AND DISCUSSED

BY

CAPTAIN WILLIAM HENRY SMYTH, R.N., K.S.F., D.C.L.,

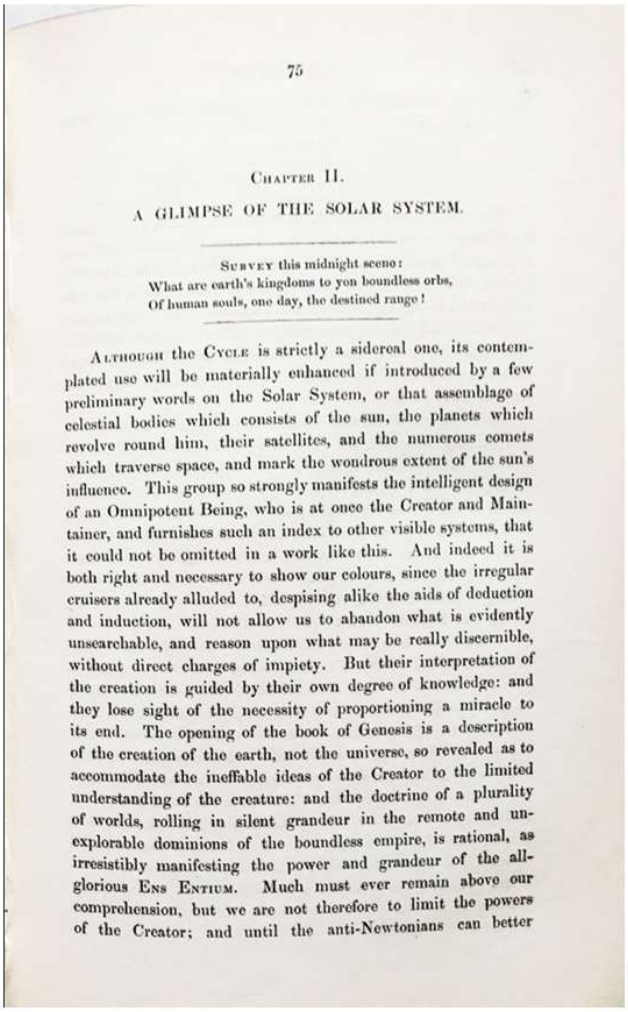
ONE OF THE BOARD OF VISITORS OF THE ROYAL OBSERVATORY;

FELLOW OF THE ROYAL, THE ANTIQUARIAN, THE ASTRONOMICAL, AND THE GEOGRAPHICAL SOCIETIES OF LONDON; VICE-PRESIDENT OF THE UNITED SERVICE INSTITUTION;
CORRESPONDING MEMBER OF THE INSTITUTE OF FRANCE;
HONORARY MEMBER OF THE ROYAL IRISH ACADEMY; AND OF THE SCIENTIFIC ACADEMIES OF NAPLES, PALERMO, FLORENCE, WASHINGTON, AND NEW YORK.

VOLUME THE SECOND.

THE BEDFORD CATALOGUE.

LONDON:
JOHN W. PARKER, WEST STRAND.
M.DCCC.XLIV.



75

CHAPTER II.

A GLIMPSE OF THE SOLAR SYSTEM.

SURVEY this midnight scene:
What are earth's kingdoms to yon boundless orbs,
Of human souls, one day, the destined range!

ALTHOUGH the CYCLE is strictly a sidereal one, its contemplated use will be materially enhanced if introduced by a few preliminary words on the Solar System, or that assemblage of celestial bodies which consists of the sun, the planets which revolve round him, their satellites, and the numerous comets which traverse space, and mark the wondrous extent of the sun's influence. This group so strongly manifests the intelligent design of an Omnipotent Being, who is at once the Creator and Maintainer, and furnishes such an index to other visible systems, that it could not be omitted in a work like this. And indeed it is both right and necessary to show our colours, since the irregular cruisers already alluded to, despising alike the aids of deduction and induction, will not allow us to abandon what is evidently unsearchable, and reason upon what may be really discernible, without direct charges of impiety. But their interpretation of the creation is guided by their own degree of knowledge: and they lose sight of the necessity of proportioning a miracle to its end. The opening of the book of Genesis is a description of the creation of the earth, not the universe, so revealed as to accommodate the ineffable ideas of the Creator to the limited understanding of the creature: and the doctrine of a plurality of worlds, rolling in silent grandeur in the remote and unexplorable dominions of the boundless empire, is rational, as irresistibly manifesting the power and grandeur of the all-glorious ENS ENTIUM. Much must ever remain above our comprehension, but we are not therefore to limit the powers of the Creator; and until the anti-Newtonians can better

See: (2008). William H. Smyth, "The Bedford Catalog from Cycle of Celestial Objects; foreword by George Lovi, 1986."

Admiral William Henry Smyth KFM DCL FRS FRAS FRGS FSA (1788-1865), born in Westminster, England, was an English naval officer, hydrographer, astronomer and numismatist. He is noted for his involvement in the early history of a number of learned societies, for his hydrographic charts, astronomical work, and a wide range of publications and translations. He died at his home in St. John's Lodge, Cardiff, and buried in the little churchyard at Stone near Aylesbury.

ILLUSTRATIONS AND DIAGRAMS.

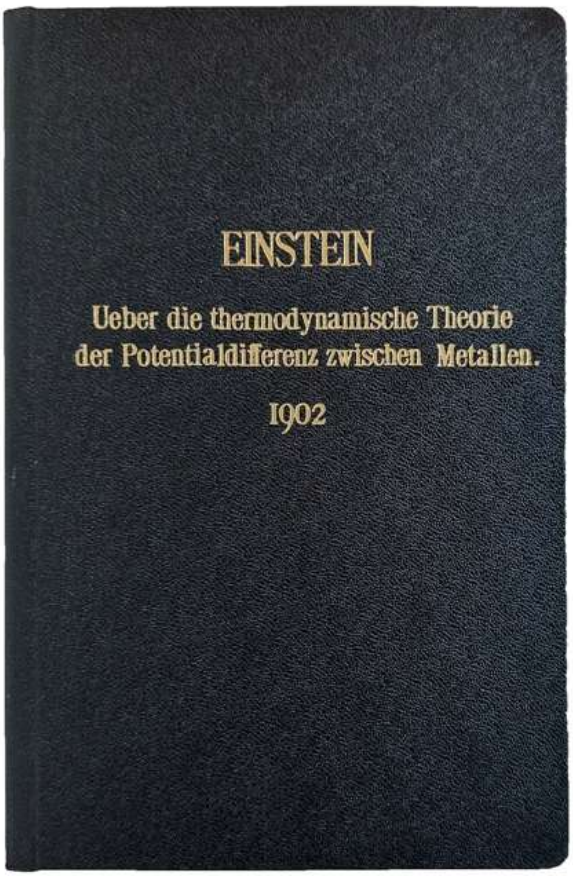
VOLUME II.

PROVENANCE: possibly owned by Thomas Lewis (1856-1927), who, for virtually the whole of his time at the Royal Observatory, Greenwich, was in charge of the Time Department, having taken on this role following a rearrangement of responsibilities following Christie's appointment as Astronomer Royal.

ALBERT EINSTEIN

PART II: 34 physics papers by Albert Einstein
(arranged by date)

NOTE: Each of these papers are newly bound as single papers by Einstein. They are all from the library of Dr Paul Nordmeyer, a physicist who was active during this same period. Some of the papers have his ownership signature. Nordmeyer wrote his dissertation, at University of Bonn, Physics Institute [physikalischen Institut der Universität, Bonn], under Professor Dr. Johannes Heinrich Gustav Kayser (1853-1940), and Dr. Bucherer. Nordmeyer publishd a paper in the *Annalen der Physik*, *Über den Einfluß der Erdbewegung auf die Verteilung der Intensität der Licht- und Wärestrahlung*. 1903.




798

5. *Ueber die thermodynamische Theorie der Potentialdifferenz zwischen Metallen und vollständig dissociirten Lösungen ihrer Salze und über eine elektrische Methode zur Erforschung der Molecularkräfte; von A. Einstein.*

§ 1. Eine hypothetische Erweiterung des zweiten Hauptsatzes der mechanischen Wärmetheorie.

Der zweite Hauptsatz der mechanischen Wärmetheorie kann auf solche physikalische Systeme Anwendung finden, die im stande sind, mit beliebiger Annäherung umkehrbare Kreisprocesse zu durchlaufen. Gemäss der Herleitung dieses Satzes aus der Unmöglichkeit der Verwandlung latenter Wärme in mechanische Energie, ist hierbei notwendige Voraussetzung, dass jene Processe realisirbar seien. Bei einer wichtigen Anwendung der mechanischen Wärmetheorie ist es aber zweifelhaft, ob dieses Postulat erfüllt ist, nämlich bei der Vermischung zweier oder mehrerer Gase mit Hülfe von semipermeabeln Wänden. Auf der Voraussetzung der Realisirbarkeit dieses Vorganges basir: die thermodynamische Theorie der Dissociation der Gase und die Theorie der verdünnten Lösungen.

Die einzuführende Voraussetzung ist bekanntlich folgende: Zu je zwei Gasen A und B sind zwei Scheidewände herstellbar, sodass die eine durchlässig für A, nicht aber für B, die andere durchlässig für B, nicht aber für A ist. Besteht die Mischung aus mehreren Componenten, so gestaltet sich diese Voraussetzung noch complicirter und unwahrscheinlicher. Da nun die Erfahrung die Resultate der Theorie vollständig bestätigt hat, trotzdem wir mit Processen operirt haben, deren Realisirbarkeit wohl bezweifelt werden kann, so erhebt sich die Frage, ob nicht vielleicht der zweite Hauptsatz auf ideale Processe gewisser Art angewendet werden kann, ohne dass man mit der Erfahrung in Widerspruch gerät.

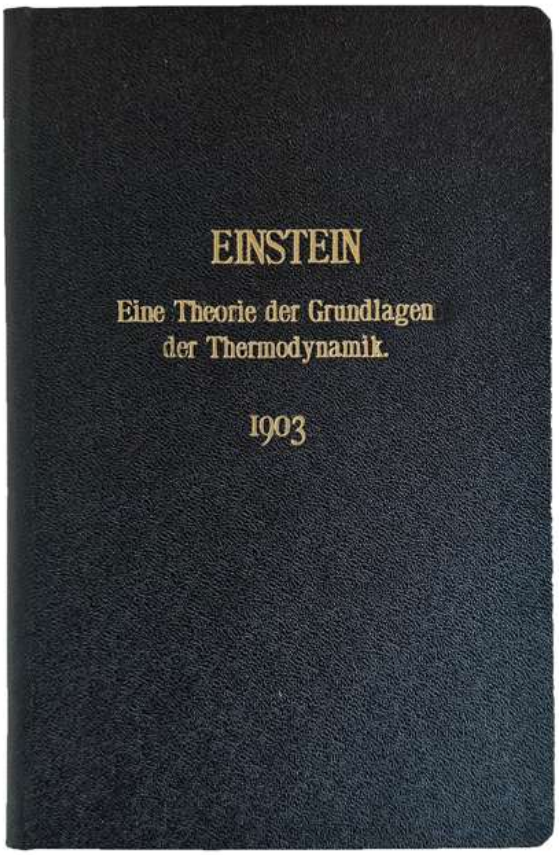
In diesem Sinne können wir auf Grund der gewonnenen Erfahrung jedenfalls den Satz aussprechen: Man bleibt in Einklang mit der Erfahrung, wenn man den zweiten Haupt-

1 **EINSTEIN, Albert** (1879-1955). *Ueber die thermodynamische Theorie der Potentialdifferenz zwischen Metallen und vollständig dissociirten Lösungen ihrer Salze und über eine elektrische Methode zur Erforschung der Molecularkräfte*. Leipzig: Johann Ambrosius Barth, 1902. ¶ In: *Annalen der Physik*. Vierte Folge. Band 8. 20x13.5cm. Small 8vo. pp. viii, 798-814. Modern black cloth, with cover title gilt-stamped. Fine.

$ 125

On the thermodynamic theory of the potential difference between metals and completely dissociated solutions of their salts and on an electrical method for investigating molecular forces. Einstein's second published scientific paper.

§ Alicke, Walter. *Albert Einstein* – Interlibrum, Catalogue 278, 3; Boni, Nell; Monique Russ; Dan H. Laurence, *A Bibliographical Checklist and Index to the Published Writings of Albert Einstein,* (1960), 2; Fölsing, *Einstein*, 1902a; Schilpp-Shields 2; Weil 2.




170

9. *Eine Theorie der Grundlagen der Thermodynamik; von A. Einstein.*

In einer neulich erschienenen Arbeit habe ich gezeigt, daß die Sätze vom Temperaturgleichgewicht und der Entropiebegriff mit Hülfe der kinetischen Theorie der Wärme hergeleitet werden können. Es drängt sich nun naturgemäß die Frage auf, ob die kinetische Theorie auch wirklich notwendig ist, um jene Fundamente der Wärmetheorie herleiten zu können, oder ob vielleicht bereits Voraussetzungen allgemeinerer Art dazu genügen können. Daß dieses letztere der Fall ist, und durch welche Art von Überlegungen man zum Ziele gelangen kann, soll in dieser Abhandlung gezeigt werden.

§ 1. **Über eine allgemeine mathematische Darstellung der Vorgänge in isolierten physikalischen Systemen.**

Der Zustand irgend eines von uns betrachteten physikalischen Systems sei eindeutig bestimmt durch sehr viele (*n*) skalare Größen $p_1, p_2 \ldots p_n$, welche wir Zustandsvariabeln nennen. Die Änderung des Systems in einem Zeitelement dt ist dann durch die Änderungen $dp_1, dp_2 \ldots dp_n$ bestimmt, welche die Zustandsvariabeln in jenem Zeitelement erleiden.

Das System sei isoliert, d. h. das betrachtete System stehe mit anderen Systemen nicht in Wechselwirkung. Es ist dann klar, daß der Zustand des Systems in einem bestimmten Zeitmoment in eindeutiger Weise die Veränderung des Systems im nächsten Zeitelement dt, d. h. die Größen $dp_1, dp_2 \ldots dp_n$ bestimmt. Diese Aussage ist gleichbedeutend mit einem System von Gleichungen von der Form:

$$(1) \qquad \frac{dp_i}{dt} = \varphi_i(p_1 \ldots p_n) \quad (i = 1 \ldots i = n),$$

wobei die φ eindeutige Funktionen ihrer Argumente sind.

Für ein solches System von linearen Differentialgleichungen existiert im allgemeinen keine Integralgleichung von der Form

$$\psi(p_1 \ldots p_n) = \text{konst.},$$

2 **EINSTEIN, Albert** (1879-1955). *Eine Theorie der Grundlagen der Thermodynamik.* Leipzig: Johann Ambrosius Barth, 1903. ¶ 20x13.5cm. Band 11. Small 8vo. pp. viii, 170-187. Modern black cloth, with cover title gilt-stamped. Fine.

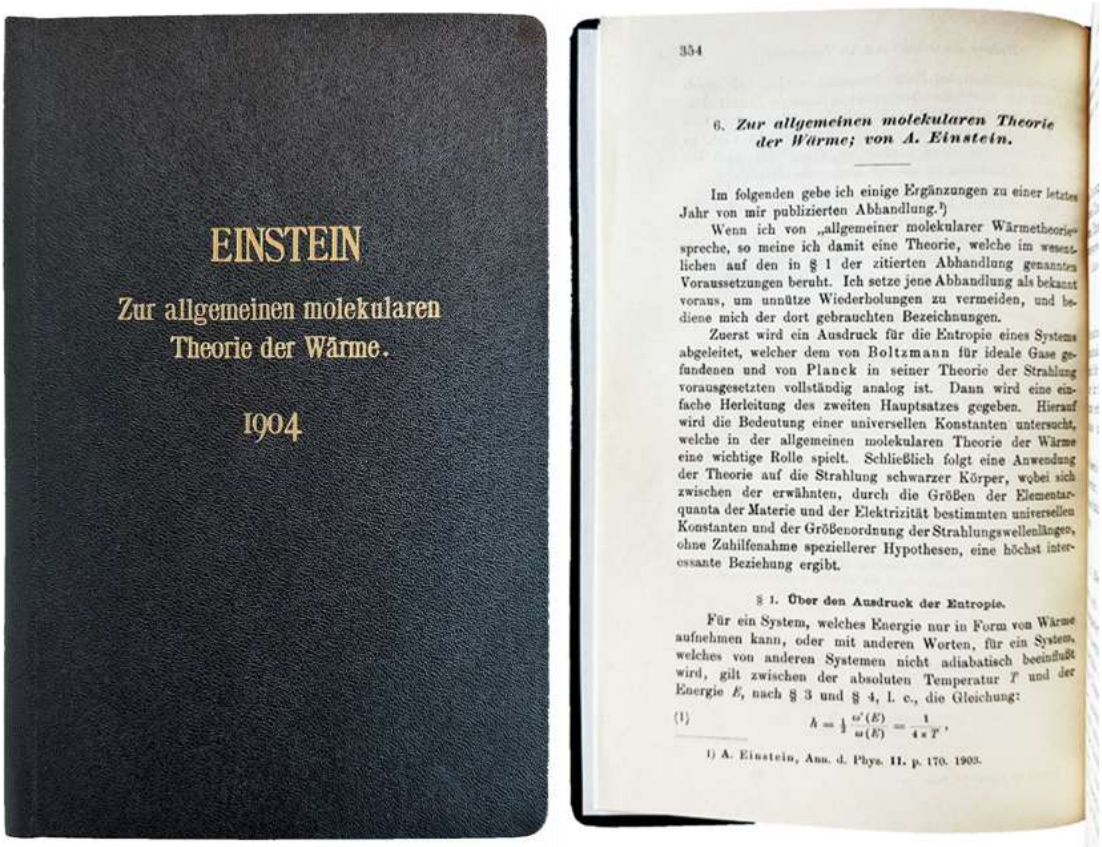
$ 175

A theory of the foundations of thermodynamics.

". . . to derive the law again in a more general and powerful way that would apply to mechanical systems, not just gases. Then, after one of his patent office colleagues pointed out a flaw in his reasoning, he produced yet another [Weil, Ernst, *Albert Einstein, a bibliography of his scientific papers*, 5], even more general, paper that extended his statistical legerdemain even to electromagnetic fields It took Albert two years to finish these three papers and publish them in the

Annalen der Physik, where the last one appeared in the Spring of 1904, but they did not set the world of physics on fire. As it happened, an American physicist, Willard Gibbs, had already done the same work, laying what is generally considered the foundation of moder statistical mechanics and thermodynamics. Albert was unaware of Gibbs - those were the wages of working in isolation. But even if they did not shake up science, the papers had a lasting influence on Albert's style as a scientist. The notion that one could start with a simple fact or supposition, such as the existence of atoms, and construct, on the basis of pure logic, a grand sweeping principle such as the second law of thermodynamics would remain with him for the rest of his life as the very model of what a physical theory should be". – Dennis Overbye, pp. 96-97.

§ Alicke, Walter. *Albert Einstein* – Interlibrum, Catalogue 278, 8; Boni, Nell; Monique Russ; Dan H. Laurence, *A Bibliographical Checklist and Index to the Published Writings of Albert Einstein,* (1960), 4; Fölsing, *Einstein*, 1903; Schilpp-Shield 4; Weil 4.

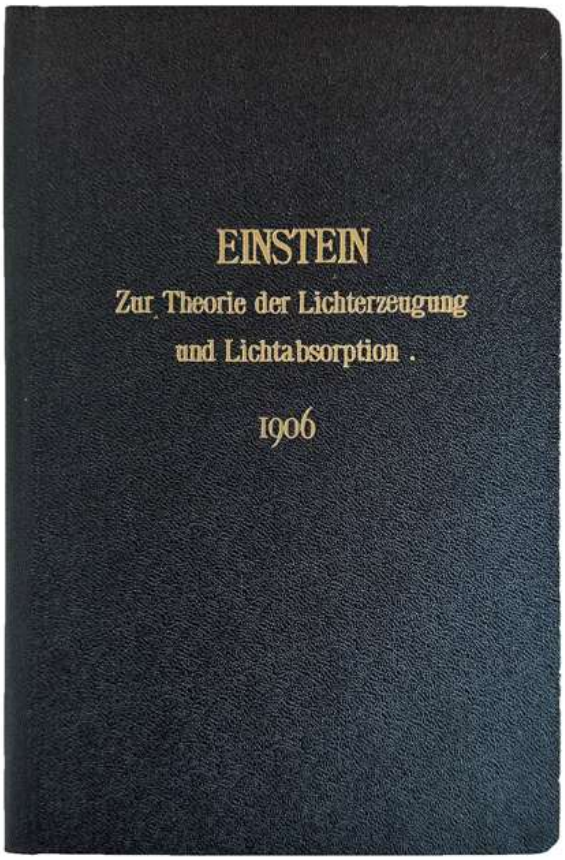


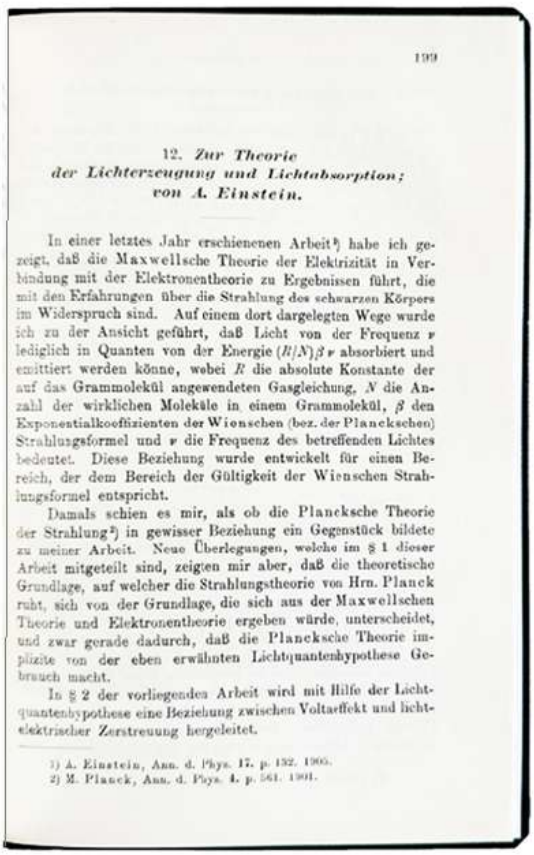
3 **EINSTEIN, Albert** (1879-1955). *Zur allgemeinen molekularen Theorie der Wärme*. Leipzig: Johann Ambrosius Barth, 1904. ¶ 20x13.5cm. Band 14. Small 8vo. pp. viii, 354-362. Modern black cloth, with cover title gilt-stamped. Fine.

$ 100

On the general molecular theory of heat.

§ Alicke, Walter. *Albert Einstein* – Interlibrum, Catalogue 278, 9; Boni, Nell; Monique Russ; Dan H. Laurence, *A Bibliographical Checklist and Index to the Published Writings of Albert Einstein,* (1960), 5; Fölsing, *Einstein*, 1904; Schilpp-Shields 5; Weil, Ernst, *Albert Einstein, a bibliography of his scientific papers*, 5.





199

12. *Zur Theorie der Lichterzeugung und Lichtabsorption;* von *A. Einstein.*

In einer letztes Jahr erschienenen Arbeit[1]) habe ich gezeigt, daß die Maxwellsche Theorie der Elektrizität in Verbindung mit der Elektronentheorie zu Ergebnissen führt, die mit den Erfahrungen über die Strahlung des schwarzen Körpers im Widerspruch sind. Auf einem dort dargelegten Wege wurde ich zu der Ansicht geführt, daß Licht von der Frequenz ν lediglich in Quanten von der Energie $(R/N)\beta\nu$ absorbiert und emittiert werden könne, wobei R die absolute Konstante der auf das Grammolekül angewendeten Gasgleichung, N die Anzahl der wirklichen Moleküle in einem Grammolekül, β den Exponentialkoeffizienten der Wienschen (bez. der Planckschen) Strahlungsformel und ν die Frequenz des betreffenden Lichtes bedeutet. Diese Beziehung wurde entwickelt für einen Bereich, der dem Bereich der Gültigkeit der Wienschen Strahlungsformel entspricht.

Damals schien es mir, als ob die Plancksche Theorie der Strahlung[2]) in gewisser Beziehung ein Gegenstück bildete zu meiner Arbeit. Neue Überlegungen, welche im § 1 dieser Arbeit mitgeteilt sind, zeigten mir aber, daß die theoretische Grundlage, auf welcher die Strahlungstheorie von Hrn. Planck ruht, sich von der Grundlage, die sich aus der Maxwellschen Theorie und Elektronentheorie ergeben würde, unterscheidet, und zwar gerade dadurch, daß die Plancksche Theorie implizite von der eben erwähnten Lichtquantenhypothese Gebrauch macht.

In § 2 der vorliegenden Arbeit wird mit Hilfe der Lichtquantenhypothese eine Beziehung zwischen Voltaeffekt und lichtelektrischer Zerstreuung hergeleitet.

1) A. Einstein, Ann. d. Phys. 17. p. 132. 1905.
2) M. Planck, Ann. d. Phys. 4. p. 561. 1901.

4 **EINSTEIN, Albert** (1879-1955). *Zur Theorie der Lichterzeugung und Lichtabsorption.* Leipzig: Johann Ambrosius Barth, 1906. ¶ 20x13.5cm. Small 8vo. pp. viii, 199-206. Modern black cloth, with cover title gilt-stamped. Signed by former owner Paul Nordmeyer (trimmed). Fine.

$ 200

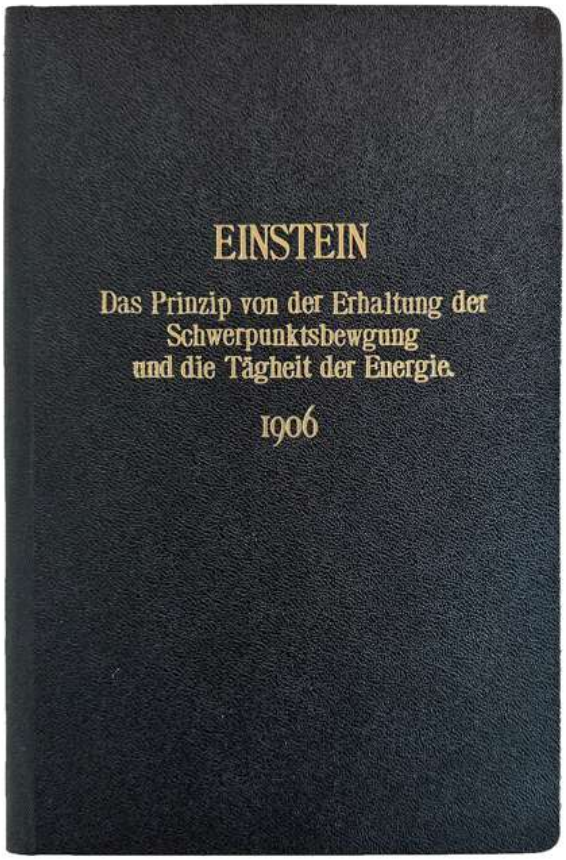
On the theory of light generation and light absorption.

Alicke: ". . . one of the major papers by Einstein, marked by Weil with an asterisk."

Einstein won the Nobel Prize for physics, 1921, which recognized this paper and his "*Ueber einen die Erzeugung und Verwandlung des Lichtes betreffenden heuristischen Gesichtspunkt*", 1905, "for his services to theoretical physics, and especially for his discovery of the law of the photoelectric effect".

§ Alicke, Walter. *Albert Einstein* – Interlibrum, Catalogue 278, 17; Boni, Nell; Monique Russ; Dan H. Laurence, *A Bibliographical Checklist and Index to the*

Published Writings of Albert Einstein, (1960), 12; Fölsing, *Einstein*, 1906c; Schilpp-Shields 13; Weil 12*.




627

13. *Das Prinzip von der Erhaltung der Schwerpunktsbewegung und die Trägheit der Energie; von A. Einstein.*

In einer voriges Jahr publizierten Arbeit[1]) habe ich gezeigt, daß die Maxwellschen elektromagnetischen Gleichungen in Verbindung mit dem Relativitätsprinzip und Energieprinzip zu der Folgerung führen, daß die Masse eines Körpers bei Änderung von dessen Energieinhalt sich ändere, welcher Art auch jene Energieänderung sein möge. Es zeigte sich, daß einer Energieänderung von der Größe ΔE eine gleichsinnige Änderung der Masse von der Größe $\Delta E/V^2$ entsprechen müsse, wobei V die Lichtgeschwindigkeit bedeutet.

In dieser Arbeit will ich nun zeigen, daß jener Satz die notwendige und hinreichende Bedingung dafür ist, daß das Gesetz von der Erhaltung der Bewegung des Schwerpunktes (wenigstens in erster Annäherung) auch für Systeme gelte, in welchen außer mechanische auch elektromagnetische Prozesse vorkommen. Trotzdem die einfachen formalen Betrachtungen, die zum Nachweis dieser Behauptung durchgeführt werden müssen, in der Hauptsache bereits in einer Arbeit von H. Poincaré enthalten sind[2]), werde ich mich doch der Übersichtlichkeit halber nicht auf jene Arbeit stützen.

§ 1. Ein Spezialfall.

K sei ein im Raume frei schwebender, ruhender starrer Hohlzylinder. In A sei eine Einrichtung, um eine bestimmte Menge S strahlender Energie durch den Hohlraum nach B zu senden. Während der Aussendung jener Strahlungsmenge wirkt ein Strahlungsdruck auf die linke Innenwand des Hohlzylinders K, der letzterem eine gewisse nach links gerichtete Geschwindigkeit verleiht. Besitzt der Hohlzylinder die Masse M,

1) A. Einstein, Ann. d. Phys. **18**. p. 639. 1905.
2) H. Poincaré, Lorentz-Festschrift p. 252. 1900.
40*

5 **EINSTEIN, Albert** (1879-1955). *Das Prinzip von der Erhaltung der Schwerpunktsbewgung und die Tägheit der Energie*. Leipzig: Johann Ambrosius Barth, 1906. ¶ 20x13.5cm. Band 20. Small 8vo. pp. 627-633. Modern black cloth, with cover title gilt-stamped. Fine.

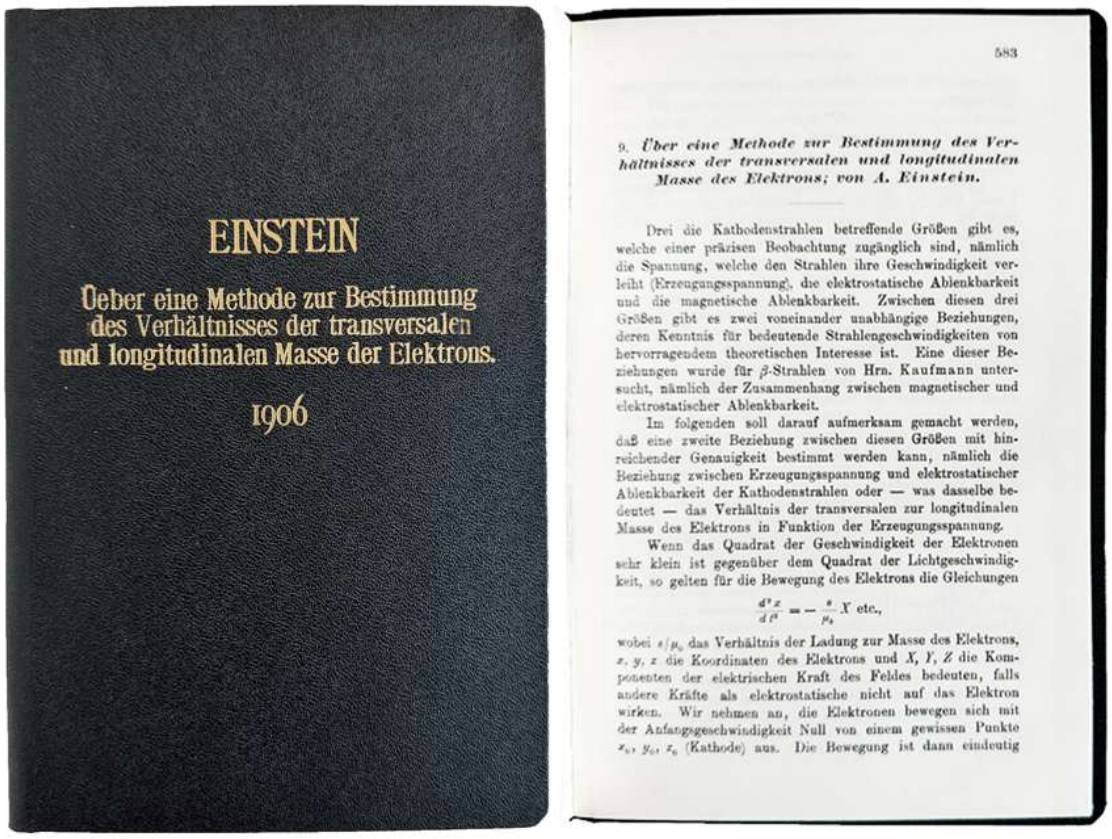
$ 200

The principle of conservation of center of gravity motion and the inertia of energy.

"The view of Einstein, that energy like matter possesses inertia [led] to novel conclusions. This theory plays a leading part in cosmological speculation. By the transformation of mass into energy, says J.H. Jeans, "the long-standing puzzle of the source of the sun's radiation appears at last to have been solved .

. . The source of the sun's radiation is the sun's mass; the sun keeps its radiation by transforming its mass into energy . . ." – Alicke.

§ Alicke, Walter. *Albert Einstein* – Interlibrum, Catalogue 278, 19; Boni, Nell; Monique Russ; Dan H. Laurence, *A Bibliographical Checklist and Index to the Published Writings of Albert Einstein,* (1960), 13; Cajori, *History of Physics*, p. 350; Fölsing, *Einstein*, 1906d; Schilpp-Shields14; Weil 13.

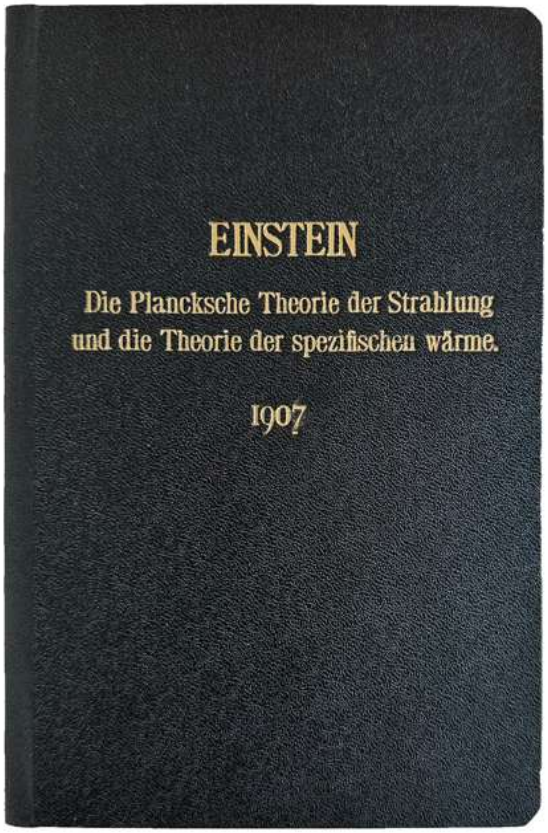


6 **EINSTEIN, Albert** (1879-1955). *Über eine Methode zur Bestimmung des Verhältnisses der transversalen und longitudinalen Masse des Elektrons*. Leipzig: Johann Ambrosius Barth, 1906. ¶ "Annalen der Physik. Vierte Folge. Band 21. 20x13.5cm. Small 8vo. pp. 583-586. Modern black cloth, with cover title gilt-stamped. Fine.

$ 100

On a method for determining the ratio of the transverse and longitudinal mass of the electron.

§ Alicke, Walter. *Albert Einstein* – Interlibrum, Catalogue 278, 20; Boni, Nell; Monique Russ; Dan H. Laurence, *A Bibliographical Checklist and Index to the Published Writings of Albert Einstein,* (1960), 14; Fölsing, *Einstein*, 1906f; Schilpp-Shields 15; Weil 14.




180

9. *Die Plancksche Theorie der Strahlung und die Theorie der spezifischen Wärme; von A. Einstein.*

In zwei früheren Arbeiten[1]) habe ich gezeigt, daß die Interpretation des Energieverteilungsgesetzes der schwarzen Strahlung im Sinne der Boltzmannschen Theorie des zweiten Hauptsatzes uns zu einer neuen Auffassung der Phänomene der Lichtemission und Lichtabsorption führt, die zwar noch keineswegs den Charakter einer vollständigen Theorie besitzt, die aber insofern bemerkenswert ist, als sie das Verständnis einer Reihe von Gesetzmäßigkeiten erleichtert. In der vorliegenden Arbeit soll nur dargetan werden, daß die Theorie der Strahlung — und zwar speziell die Plancksche Theorie — zu einer Modifikation der molekular-kinetischen Theorie der Wärme führt, durch welche einige Schwierigkeiten beseitigt werden, die bisher der Durchführung jener Theorie im Wege standen. Auch wird sich ein gewisser Zusammenhang zwischen dem thermischen und optischen Verhalten fester Körper ergeben.

Wir wollen zuerst eine Herleitung der mittleren Energie des Planckschen Resonators geben, die dessen Beziehung zur Molekularmechanik klar erkennen läßt.

Wir benutzen hierzu einige Resultate der allgemeinen molekularen Theorie der Wärme.[1]) Es sei der Zustand eines Systems im Sinne der molekularen Theorie vollkommen bestimmt durch die (sehr vielen) Variabeln $P_1, P_2 \ldots P_n$. Der Verlauf der molekularen Prozesse geschehe nach den Gleichungen

$$\frac{dP_\nu}{dt} = \Phi_\nu(P_1, P_2 \ldots P_n), \quad (\nu = 1, 2 \ldots n)$$

und es gelte für alle Werte der P_ν die Beziehung

$$\sum \frac{\partial \Phi_\nu}{\partial P_\nu} = 0. \tag{1}$$

1) A. Einstein, Ann. d. Phys. 17, p. 132, 1905 u. 20, p. 199, 1906.

7 **EINSTEIN, Albert** (1879-1955). *Die Plancksche Theorie der Strahlung und die Theorie der spezifischen Wärme.* Leipzig: Johann Ambrosius Barth, 1907. ¶ 20x13.5cm. Band 22. Small 8vo. pp. viii, 180-190. Frontispiece of Pierre Curie; waterstained. Modern black cloth, with cover title gilt-stamped. Former ownership signature of Paul Nordmeyer. Fine.

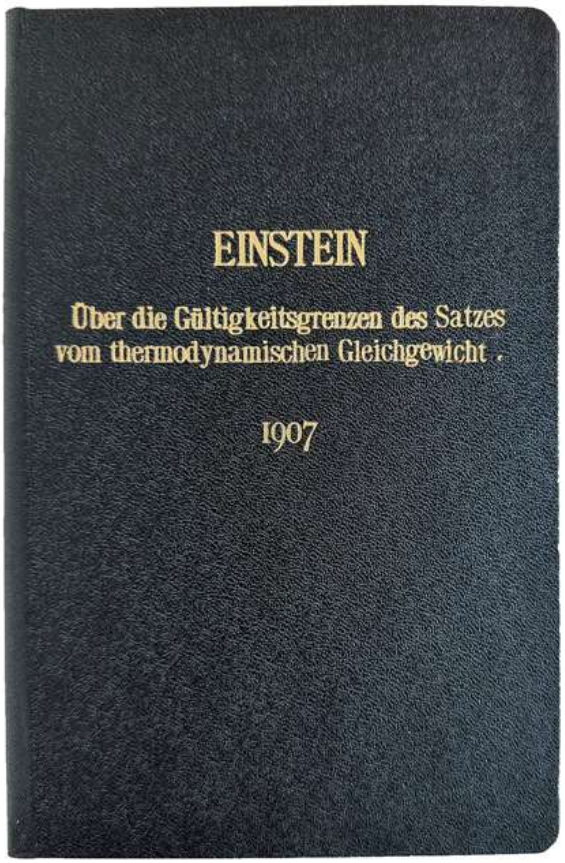
$ 150

Planck's theory of radiation and the theory of specific heat.

Alicke: ". . . one of the major papers by Einstein, marked by Weil with an asterisk."

"November. [Einstein] completes a paper on the specific heat of solids, the first paper ever written on the quantum theory of the solid state." – Pais, *Subtle is the Lord*, p. 522.

§ Alicke, Walter. *Albert Einstein* – Interlibrum, Catalogue 278, 22; Boni, Nell; Monique Russ; Dan H. Laurence, *A Bibliographical Checklist and Index to the Published Writings of Albert Einstein,* (1960), 15; d'Abro, *Rise of Modern Physics,* II, pp. 317 ff.; Fölsing, *Einstein*, 1907a; Schilpp-Shields 16; Weil 15*.




569

10. *Über die Gültigkeitsgrenze des Satzes vom thermodynamischen Gleichgewicht und über die Möglichkeit einer neuen Bestimmung der Elementarquanta; von A. Einstein.*

Der Zustand eines physikalischen Systems sei im Sinne der Thermodynamik bestimmt durch die Parameter λ, μ etc. (z. B. Anzeige eines Thermometers, Länge oder Volumen eines Körpers, Substanzmenge einer gewissen Art in einer Phase). Ist das System mit anderen Systemen nicht in Wechselwirkung, was wir annehmen, so wird nach der Thermodynamik Gleichgewicht bei bestimmten Werten λ_0, μ_0 etc. der Parameter stattfinden, für welche Werte die Entropie S des Systems ein Maximum ist. Nach der molekularen Theorie der Wärme jedoch ist dies nicht genau, sondern nur angenähert richtig; nach dieser Theorie besitzt der Parameter λ auch bei Temperaturgleichgewicht keinen konstanten Wert, sondern einen unregelmäßig schwankenden, der sich von λ_0 allerdings nur äußerst selten beträchtlich entfernt.

Die theoretische Untersuchung des statistischen Gesetzes, welchem diese Schwankungen unterworfen sind, scheint auf den ersten Blick bestimmte Festsetzungen in betreff des anzuwendenden molekularen Bildes zu erfordern. Dies ist jedoch nicht der Fall. Es genügt vielmehr im wesentlichen, die bekannte Boltzmannsche Beziehung anzuwenden, welche die Entropie S mit der statistischen Wahrscheinlichkeit eines Zustandes verbindet. Diese Beziehung lautet bekanntlich

$$S = \frac{R}{N} \lg W,$$

wobei R die Konstante der Gasgleichung und N die Anzahl der Moleküle in einem Grammäquivalent bedeutet.

Wir fassen einen Zustand des Systems ins Auge, in welchem der Parameter λ den von λ_0 sehr wenig abweichenden Wert $\lambda_0 + \varepsilon$ besitzt. Um den Parameter λ auf umkehrbarem Wege vom Werte λ_0 zum Werte λ bei konstanter Energie E

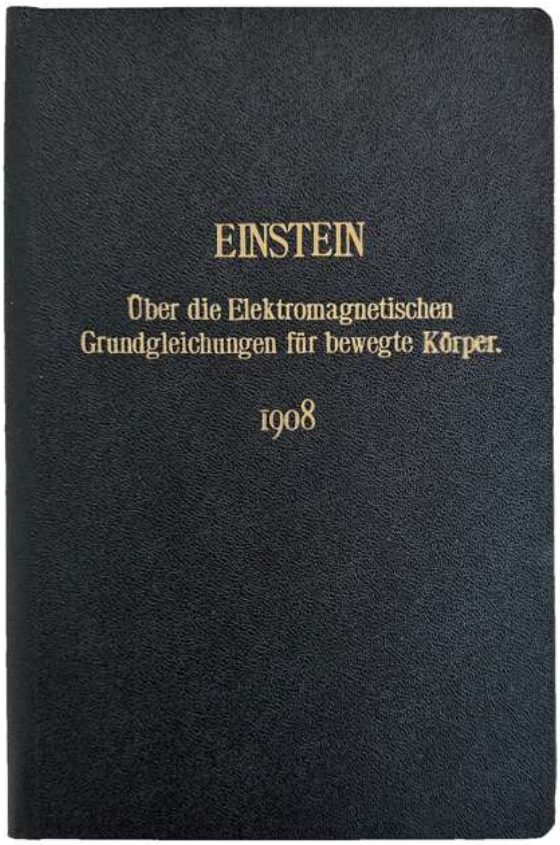
8 **EINSTEIN, Albert** (1879-1955). [2 papers included] [1] *Über die Gültigkeitsgrenzen des Satzes vom thermodynamischen Gleichgewicht und über die Möglichkeit einer neuen Bestimmung der Elementarquanta*. Leipzig: Johann Ambrosius Barth, 1907. ¶ 20x13.5cm. Band 22. Small 8vo. pp. 569-572; 800. Modern black cloth, with cover title gilt-stamped. Fine.

$ 125

With: [2] *Berichtigung zu meiner Arbeit: „Die Plancksche Theorie der Strahlung etc."*

On the limits of validity of the theorem of thermodynamic equilibrium and on the possibility of a new determination of elementary quanta.

§ Alicke, Walter. *Albert Einstein* – Interlibrum, Catalogue 278, 24; Boni, Nell; Monique Russ; Dan H. Laurence, *A Bibliographical Checklist and Index to the Published Writings of Albert Einstein,* (1960), 16; Fölsing, *Einstein*, 1907b; Schilpp-Shields 17; Weil 16.




532

5. *Über die elektromagnetischen Grundgleichungen für bewegte Körper; von A. Einstein und J. Laub.*

In einer kürzlich veröffentlichten Abhandlung[1]) hat Hr. Minkowski die Grundgleichungen für die elektromagnetischen Vorgänge in bewegten Körpern angegeben. In Anbetracht des Umstandes, daß diese Arbeit in mathematischer Beziehung an den Leser ziemlich große Anforderungen stellt, halten wir es nicht für überflüssig, jene wichtigen Gleichungen im folgenden auf elementarem Wege, der übrigens mit dem Minkowskischen im wesentlichen übereinstimmt, abzuleiten.

§ 1. Ableitung der Grundgleichungen für bewegte Körper.

Der einzuschlagende Weg ist folgender: Wir führen zwei Koordinatensysteme K und K' ein, welche beide beschleunigungsfrei, jedoch relativ zueinander bewegt sind. Ist im Raume Materie vorhanden, die relativ zu K' ruht, gelten in bezug auf K' die Gesetze der Elektrodynamik ruhender Körper, welche durch die Maxwell-Hertzschen Gleichungen dargestellt sind. Transformieren wir diese Gleichungen auf das System K, so erhalten wir unmittelbar die elektrodynamischen Gleichungen bewegter Körper für den Fall, daß die Geschwindigkeit der Materie räumlich und zeitlich konstant ist. Die so erhaltenen Gleichungen gelten offenbar mindestens in erster Annäherung auch dann, wenn die Geschwindigkeitsverteilung der Materie eine beliebige ist. Diese Annahme rechtfertigt sich zum Teil auch dadurch, daß das auf diese Weise erhaltene Resultat streng gilt in dem Falle, daß eine Anzahl von mit verschiedenen Geschwindigkeiten gleichförmig bewegten Körpern vorhanden ist, welche voneinander durch Vakuumzwischenräume getrennt sind.

1) H. Minkowski, Göttinger Nachr. 1908.

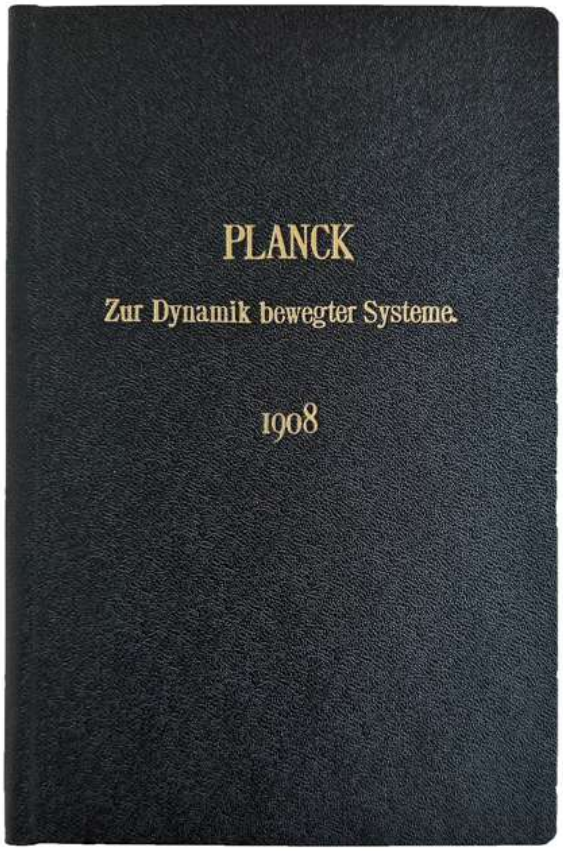
9 **EINSTEIN, Albert** (1879-1955); **Jakob LAUB** (1884-1962). *"Über die elektromagnetischen Grundgleichungen für bewegte Körper".* Leipzig: Johann Ambrosius Barth, 1908. ¶ In: *Annalen Der Physik*, Vierte Folge, Band 27. 20x13.5cm. Small 8vo. pp. 532-540. Modern black cloth, with cover title gilt-stamped. Former ownership signature of Paul Nordmeyer. Fine.

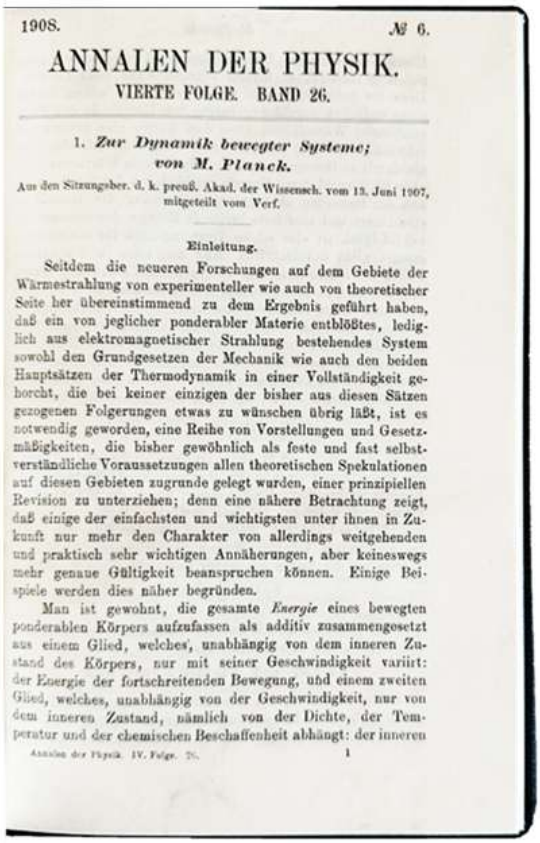
$ 165

Correction to the treatise: "On the Fundamental Electromagnetic Equations for Moving Bodies." which introduced the Einstein-Laub formulation for calculating electromagnetic forces in material media. This formulation is a classical alternative to the Lorentz force law, which requires hidden quantities to conserve momentum when applied to magnetic materials. The Einstein-Laub approach is more consistent with special relativity's conservation laws and offers a better theoretical framework for understanding electromagnetism in matter.

"In 1908 [Laub] wrote several works together with Einstein on the basic electromagnetic equations, which was aimed to replace the four-dimensional formulation of the electrodynamics by Minkowski by a simpler, classical formulation. Both Laub and Einstein discounted the spacetime formalism as too complicated. However, it turned out that Minkowski's spacetime formalism was fundamental for the further development of special relativity". – Wikip.

§ Alicke, Walter. *Albert Einstein* – Interlibrum, Catalogue 278, 28; Boni, Nell; Monique Russ; Dan H. Laurence, *A Bibliographical Checklist and Index to the Published Writings of Albert Einstein,* (1960)*,* 22; Fölsing, *Einstein*, 1908c; Weil, Ernst, *Albert Einstein, a bibliography of his scientific papers*, nos. 22, 23. See: Pais, Abraham, *Subtle is the Lord*, pp. 151, 154, 160.




1908. № 6.

ANNALEN DER PHYSIK.

VIERTE FOLGE. BAND 26.

1. *Zur Dynamik bewegter Systeme;*
von M. Planck.

Aus den Sitzungsber. d. k. preuß. Akad. der Wissensch. vom 13. Juni 1907, mitgeteilt vom Verf.

Einleitung.

Seitdem die neueren Forschungen auf dem Gebiete der Wärmestrahlung von experimenteller wie auch von theoretischer Seite her übereinstimmend zu dem Ergebnis geführt haben, daß ein von jeglicher ponderabler Materie entblößtes, lediglich aus elektromagnetischer Strahlung bestehendes System sowohl den Grundgesetzen der Mechanik wie auch den beiden Hauptsätzen der Thermodynamik in einer Vollständigkeit gehorcht, die bei keiner einzigen der bisher aus diesen Sätzen gezogenen Folgerungen etwas zu wünschen übrig läßt, ist es notwendig geworden, eine Reihe von Vorstellungen und Gesetzmäßigkeiten, die bisher gewöhnlich als feste und fast selbstverständliche Voraussetzungen allen theoretischen Spekulationen auf diesen Gebieten zugrunde gelegt wurden, einer prinzipiellen Revision zu unterziehen; denn eine nähere Betrachtung zeigt, daß einige der einfachsten und wichtigsten unter ihnen in Zukunft nur mehr den Charakter von allerdings weitgehenden und praktisch sehr wichtigen Annäherungen, aber keineswegs mehr genaue Gültigkeit beanspruchen können. Einige Beispiele werden dies näher begründen.

Man ist gewohnt, die gesamte *Energie* eines bewegten ponderablen Körpers aufzufassen als additiv zusammengesetzt aus einem Glied, welches, unabhängig von dem inneren Zustand des Körpers, nur mit seiner Geschwindigkeit variirt: der Energie der fortschreitenden Bewegung, und einem zweiten Glied, welches, unabhängig von der Geschwindigkeit, nur von dem inneren Zustand, nämlich von der Dichte, der Temperatur und der chemischen Beschaffenheit abhängt: der inneren

Annalen der Physik. IV. Folge. 26. 1

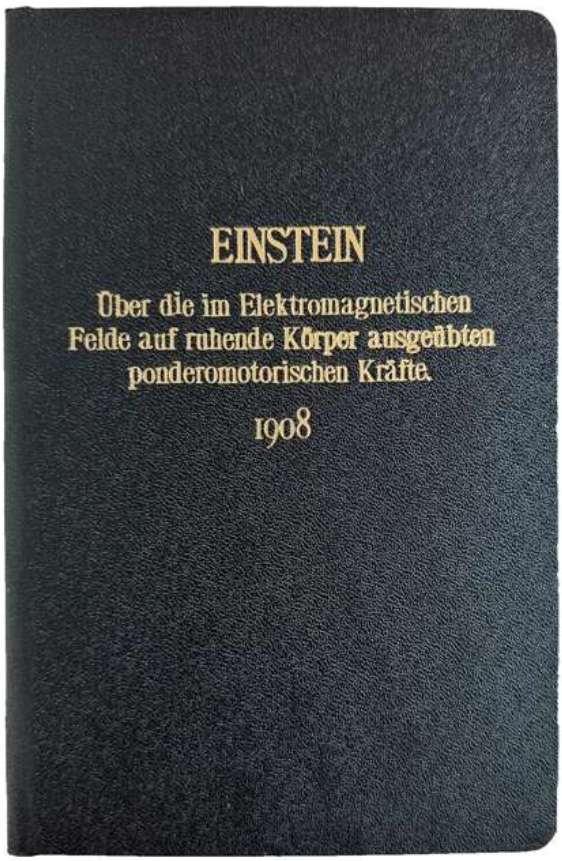
10 **PLANCK, Max** (1858-1947). *Zur Dynamik bewegter Systeme*. Leipzig: Johann Ambrosius Barth, 1909. ¶ 20x13.5cm. Band 28. Small 8vo. 34 pp. Modern black cloth, with cover title gilt-stamped. Fine.

$ 200

On the dynamics of moving systems.

Based on Mosengeil's work, Planck (1907/09) was also able to derive the mass-energy equivalence from the cavity radiation approach, and in addition, he also took into account the binding forces in matter. He acknowledged the priority of Einstein's 1905 work on equivalence, but Planck considered his own derivation to be more generally valid. – Miller, Arthur I. *Albert Einstein's special theory of relativity. Emergence (1905) and early interpretation (1905–1911)*. Addison-Wesley, Reading 1981. pp. 359–367.

§ Alicke, Walter. *Albert Einstein* – Interlibrum, Catalogue 278, 28 [Planck].



541

6. *Über die im elektromagnetischen Felde auf ruhende Körper ausgeübten ponderomotorischen Kräfte; von A. Einstein und J. Laub.*

In einer kürzlich erschienenen Abhandlung[1]) hat Hr. Minkowski einen Ausdruck für die auf beliebig bewegte Körper wirkenden ponderomotorischen Kräfte elektromagnetischen Ursprunges angegeben. Spezialisiert man die Minkowskischen Ausdrücke auf ruhende, isotrope und homogene Körper, so erhält man für die X-Komponente der auf die Volumeneinheit wirkenden Kraft:

$$(1) \qquad K_x = \varrho \mathfrak{E}_x + \mathfrak{s}_y \mathfrak{B}_z - \mathfrak{s}_z \mathfrak{B}_y,$$

wobei ϱ die elektrische Dichte, $\mathfrak{s}$ den elektrischen Leitungsstrom, $\mathfrak{E}$ die elektrische Feldstärke, $\mathfrak{B}$ die magnetische Induktion bedeuten. Dieser Ausdruck scheint uns aus folgenden Gründen mit dem elektronentheoretischen Bild nicht in Einklang zu stehen: Während nämlich ein von einem elektrischen Strom (Leitungsstrom) durchflossener Körper im Magnetfeld eine Kraft erleidet, wäre dies nach Gleichung (1) nicht der Fall, wenn der im Magnetfeld befindliche Körper statt von einem Leitungsstrom von einem Polarisationsstrom ($\partial \mathfrak{D}/\partial t$) durchsetzt wird. Nach Minkowski besteht also hier ein prinzipieller Unterschied zwischen einem Verschiebungsstrom und einem Leitungsstrom derart, daß ein Leiter nicht betrachtet werden kann als ein Dielektrikum von unendlich großer Dielektrizitätskonstante.

Angesichts dieser Sachlage schien es uns von Interesse zu sein, die ponderomotorischen Kräfte für beliebige magnetisierbare Körper auf elektronentheoretischem Wege abzuleiten. Wir geben im folgenden eine solche Ableitung, wobei wir uns aber auf ruhende Körper beschränken.

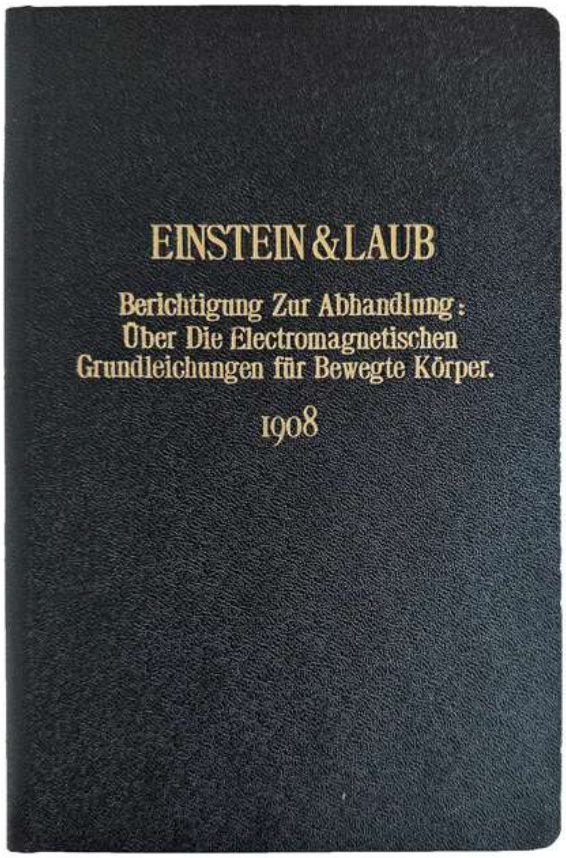
1) H. Minkowski, Gött. Nachr. 1908. p. 45.

12 **EINSTEIN, Albert** (1879-1955); **Jakob LAUB** (1884-1962). *Über die im elektromagnetischen Felde auf ruhende Körper ausgeübten ponderomotorischen Kräfte.* Leipzig: Johann Ambrosius Barth, 1908. ¶ 20x13.5cm. Band 26. Small 8vo. pp. 541-550. Closed tears pp. 547-550, minor loss. Modern black cloth, with cover title gilt-stamped. Interior: good +; binding: fine.

$ 125

On the ponderomotive forces exerted on bodies at rest in an electromagnetic field.

§ Alicke, Walter. *Albert Einstein* – Interlibrum, Catalogue 278, 28; Boni, Nell; Monique Russ; Dan H. Laurence, *A Bibliographical Checklist and Index to the Published Writings of Albert Einstein,* (1960), 23; Fölsing, *Einstein*, 1908d; Weil, Ernst, *Albert Einstein, a bibliography of his scientific papers*, nos. 22, 23.




232

14. *Berichtigung zur Abhandlung:*
„Über die elektromagnetischen Grundgleichungen für bewegte Körper“;
von A. Einstein und J. Laub.

In der genannten Abhandlung dieser Zeitschrift 26. p. 532 1908 sind zwei Fehler unterlaufen:

p. 534 Formel (8) muß heißen:

$$\varrho = \beta\left(\varrho' + \frac{v}{c^2}\mathfrak{E}_x'\right)$$

statt:

$$\varrho = \beta\left(\varrho' + \frac{v}{c}\mathfrak{E}_x'\right).$$

ferner die erste der Formeln (9):

$$\mathfrak{E}_x = \beta\left(\mathfrak{E}_x' + v\varrho'\right)$$

statt:

$$\mathfrak{E}_x = \beta\left(\mathfrak{E}_x' + \frac{v}{c}\varrho'\right).$$

Die erste der Formeln (12a) sowie die dritte der Formeln (13) müssen ebenfalls heißen:

$$\beta\left(\mathfrak{E}_x - v\varrho\right) = \sigma\mathfrak{E}_x$$

und

$$\beta\left(\mathfrak{E}_y - \left[\mathfrak{v}\mathfrak{H}\right]_y\right) = \sigma\left(\mathfrak{E} + \frac{1}{c}\left[\mathfrak{v}\mathfrak{H}\right]\right)_y.$$

(Eingegangen 24. August 1908.)

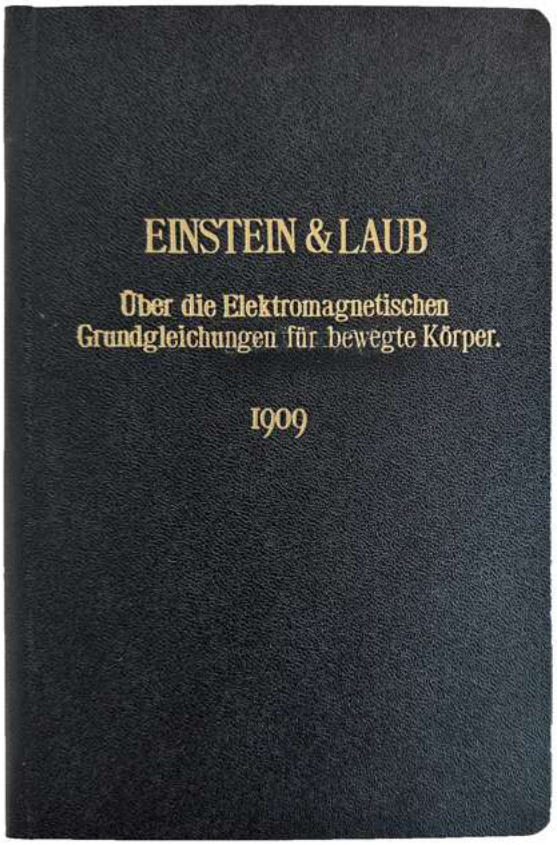
Druck von Metzger & Wittig in Leipzig

13 **EINSTEIN, Albert** (1879-1955); **Jakob LAUB** (1884-1962). *”Über die elektromagnetischen Grundgleichungen für bewegte Körper”.* Berlin: Johann Ambrosius Barth, 1909. ¶ 20x13.5cm. Small 8vo. p.232. Modern black cloth, with cover title gilt-stamped. Ownership signature of Paul Nordmeyer. Fine.

$ 60

Remarks: “Observations of our treatise ‘*On the fundamental electromagnetic equations for moving bodies.*’”

§ Alicke, Walter. *Albert Einstein* – Interlibrum, Catalogue 278, 32; Boni, Nell; Monique Russ; Dan H. Laurence, *A Bibliographical Checklist and Index to the Published Writings of Albert Einstein,* (1960), 36; Fölsing, *Einstein*, 1909a [his citation referring to a different pagination].

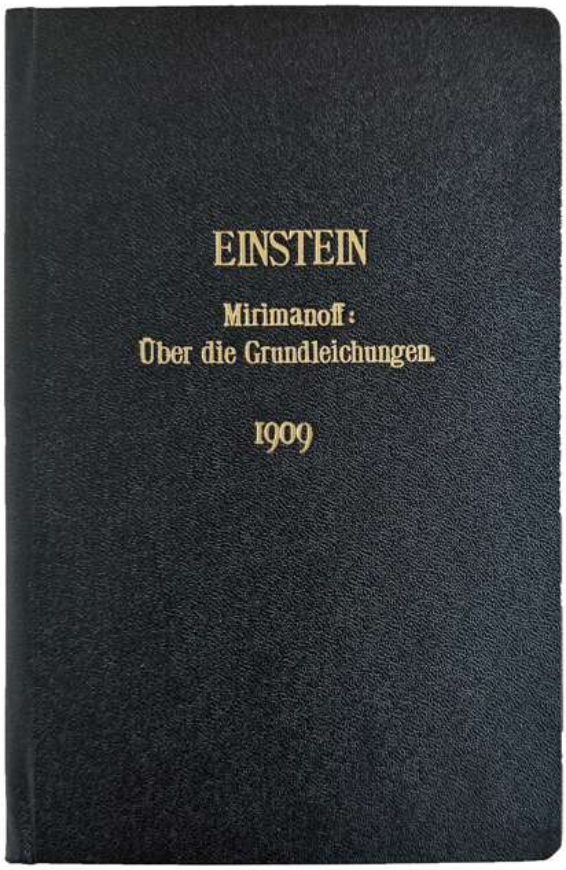


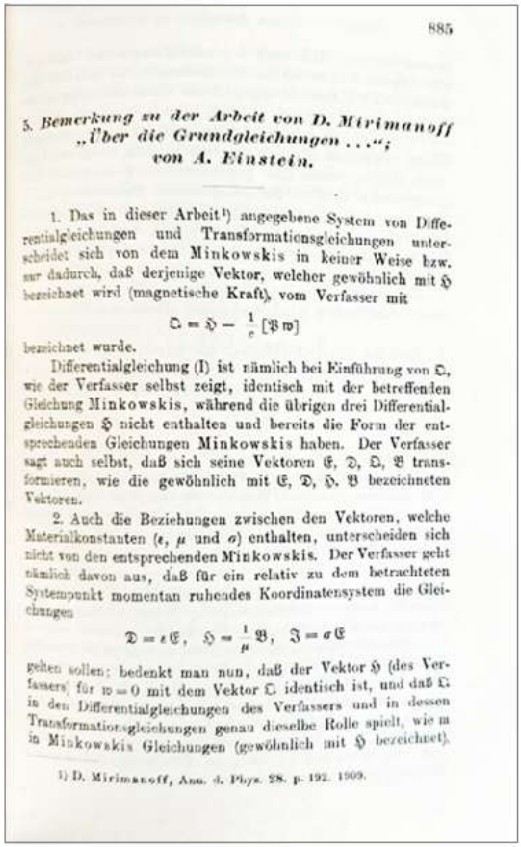
14 **EINSTEIN, Albert** (1879-1955). *Bemerkungen zu unserer Arbeit: Über die elektromagnetischen Grundgleichungen für bewegte Körper*. Berlin: Johann Ambrosius Barth, 1909. ¶ 20x13.5cm. Small 8vo. pp. 445-447. Modern black cloth, with cover title gilt-stamped. Fine.

$ 100

Remarks on our work: “On the fundamental electromagnetic equations for moving bodies”. A supplement to Weil nos. 22 & 23.

§ Alicke, Walter. *Albert Einstein* – Interlibrum, Catalogue 278, 32; Fölsing, *Einstein*, 1909a.





885

5. *Bemerkung zu der Arbeit von D. Mirimanoff „Über die Grundgleichungen . . .“; von A. Einstein.*

1. Das in dieser Arbeit[1]) angegebene System von Differentialgleichungen und Transformationsgleichungen unterscheidet sich von dem Minkowskis in keiner Weise bzw. nur dadurch, daß derjenige Vektor, welcher gewöhnlich mit $\mathfrak{H}$ bezeichnet wird (magnetische Kraft), vom Verfasser mit

$$\mathfrak{D} = \mathfrak{H} - \frac{1}{c}[\mathfrak{B}\mathfrak{w}]$$

bezeichnet wurde.

Differentialgleichung (I) ist nämlich bei Einführung von $\mathfrak{D}$, wie der Verfasser selbst zeigt, identisch mit der betreffenden Gleichung Minkowskis, während die übrigen drei Differentialgleichungen $\mathfrak{H}$ nicht enthalten und bereits die Form der entsprechenden Gleichungen Minkowskis haben. Der Verfasser sagt auch selbst, daß sich seine Vektoren $\mathfrak{E}$, $\mathfrak{D}$, $\mathfrak{H}$, $\mathfrak{B}$ transformieren, wie die gewöhnlich mit $\mathfrak{E}$, $\mathfrak{D}$, $\mathfrak{H}$, $\mathfrak{B}$ bezeichneten Vektoren.

2. Auch die Beziehungen zwischen den Vektoren, welche Materialkonstanten (ε, μ und σ) enthalten, unterscheiden sich nicht von den entsprechenden Minkowskis. Der Verfasser geht nämlich davon aus, daß für ein relativ zu dem betrachteten Systempunkt momentan ruhendes Koordinatensystem die Gleichungen

$$\mathfrak{D} = \varepsilon\mathfrak{E}, \quad \mathfrak{H} = \frac{1}{\mu}\mathfrak{B}, \quad \mathfrak{J} = \sigma\mathfrak{E}$$

gelten sollen; bedenkt man nun, daß der Vektor $\mathfrak{H}$ (des Verfassers) für $\mathfrak{w} = 0$ mit dem Vektor $\mathfrak{D}$ identisch ist, und daß $\mathfrak{D}$ in den Differentialgleichungen des Verfassers und in dessen Transformationsgleichungen genau dieselbe Rolle spielt, wie in Minkowskis Gleichungen (gewöhnlich mit $\mathfrak{H}$ bezeichnet),

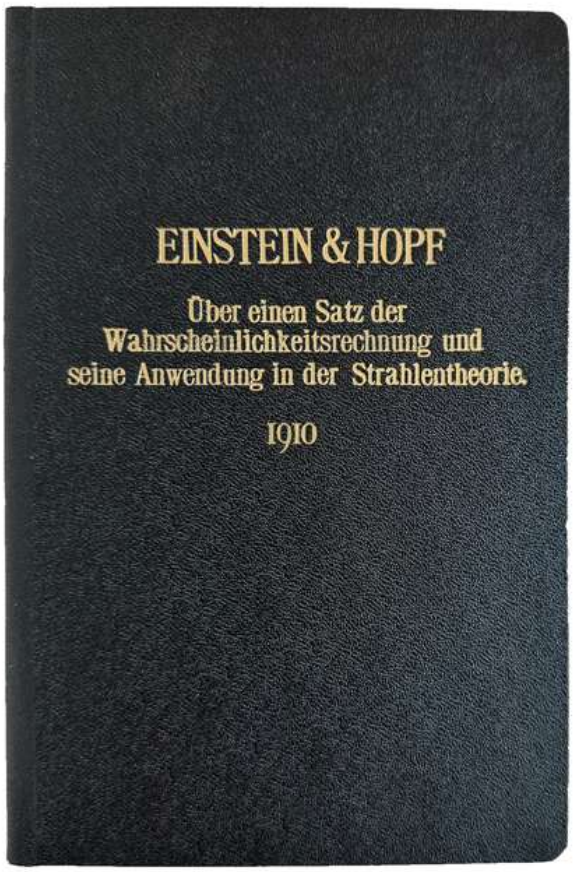
[1]) D. Mirimanoff, Ann. d. Phys. 28. p. 192. 1909.

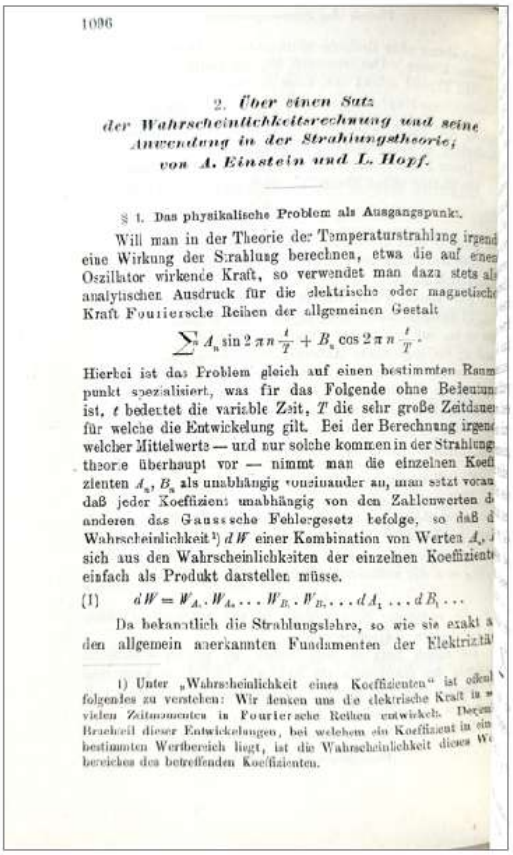
15 **EINSTEIN, Albert** (1879-1955). *Bemerkung zu der Arbeit von D. Mirimanoff: "Über die Grundgleichungen."* Leipzig: Johann Ambrosius Barth, 1909. ¶ In: *Annalen der Physik*. Folge 4. Band 28. 20x13.5cm. Small 8vo. pp. 885-888. Modern black cloth, with cover title gilt-stamped. Fine.

$ 75

Remark on the work of D. Mirimanoff: "On the fundamental equations."

§ Alicke, Walter. *Albert Einstein* – Interlibrum, Catalogue 278, 32; Boni, Nell; Monique Russ; Dan H. Laurence, *A Bibliographical Checklist and Index to the Published Writings of Albert Einstein,* (1960), 26; Fölsing, *Einstein*, 1909b; Schilpp-Shields 28; Weil 27.




1096

2. *Über einen Satz der Wahrscheinlichkeitsrechnung und seine Anwendung in der Strahlungstheorie;*
von A. Einstein und L. Hopf.

§ 1. Das physikalische Problem als Ausgangspunkt.

Will man in der Theorie der Temperaturstrahlung irgend eine Wirkung der Strahlung berechnen, etwa die auf einen Oszillator wirkende Kraft, so verwendet man dazu stets als analytischen Ausdruck für die elektrische oder magnetische Kraft Fouriersche Reihen der allgemeinen Gestalt

$$\sum_n A_n \sin 2\pi n \frac{t}{T} + B_n \cos 2\pi n \frac{t}{T}.$$

Hierbei ist das Problem gleich auf einen bestimmten Raumpunkt spezialisiert, was für das Folgende ohne Belang ist, t bedeutet die variable Zeit, T die sehr große Zeitdauer, für welche die Entwickelung gilt. Bei der Berechnung irgend welcher Mittelwerte — und nur solche kommen in der Strahlungstheorie überhaupt vor — nimmt man die einzelnen Koeffizienten A_n, B_n als unabhängig voneinander an, man setzt voraus, daß jeder Koeffizient unabhängig von den Zahlenwerten der anderen das Gausssche Fehlergesetz befolge, so daß die Wahrscheinlichkeit[1]) dW einer Kombination von Werten $A_1 \ldots$ sich aus den Wahrscheinlichkeiten der einzelnen Koeffizienten einfach als Produkt darstellen müsse.

$$(1) \qquad dW = W_{A_1} \cdot W_{A_2} \ldots W_{B_1} \cdot W_{B_2} \ldots dA_1 \ldots dB_1 \ldots$$

Da bekanntlich die Strahlungslehre, so wie sie exakt auf den allgemein anerkannten Fundamenten der Elektrizität

1) Unter „Wahrscheinlichkeit eines Koeffizienten" ist offenbar folgendes zu verstehen: Wir denken uns die elektrische Kraft in irgendeinen Zeitmomenten in Fouriersche Reihen entwickelt. Der Bruchteil dieser Entwickelungen, bei welchem ein Koeffizient in einen bestimmten Wertbereich liegt, ist die Wahrscheinlichkeit dieses Wertbereiches des betreffenden Koeffizienten.

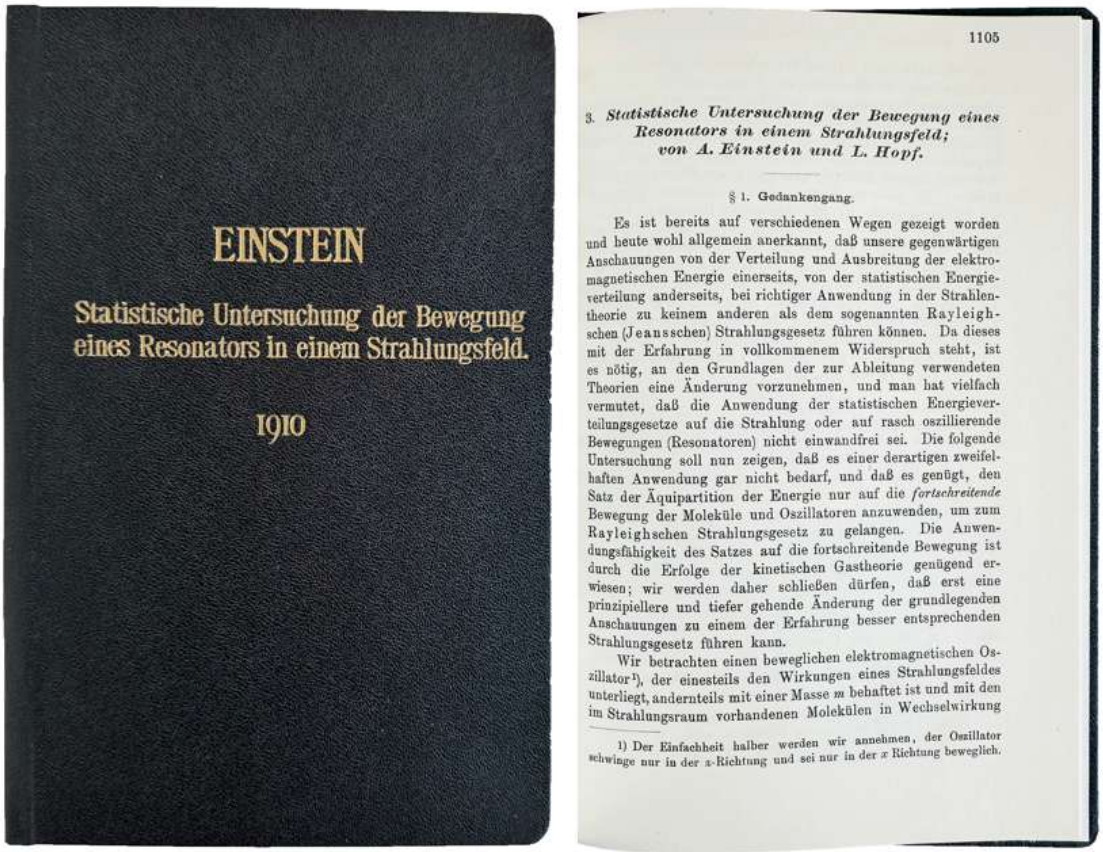
16 **EINSTEIN, Albert** (1879-1955)**; Ludwig HOPF** (1884-1939). *Über einen Satz der Wahrscheinlichkeitsrechnung und seine Anwendung in der Strahlentheorie*. Leipzig: Johann Ambrosius Barth, 1910. ¶ Extracted from: *Annalen der Physik* IV, Band 33. 20x13.5cm. Small 8vo. pp. viii, 1096-1104. Modern black cloth, with cover title gilt-stamped. Fine.

$ 95

On a theorem of probability theory and its application in ray theory. Ludwig Hopf was an assistant to Einstein at the University of Zurich.

See: O. A. Senatchin, *The Einstein-Hopf model within the realm of stochastic electrodynamics*, June 2001.

§ Alicke, Walter. *Albert Einstein* – Interlibrum, Catalogue 278, 35a; Boni, Nell; Monique Russ; Dan H. Laurence, *A Bibliographical Checklist and Index to the Published Writings of Albert Einstein,* (1960), 29; Fölsing, *Einstein*, 1910a.



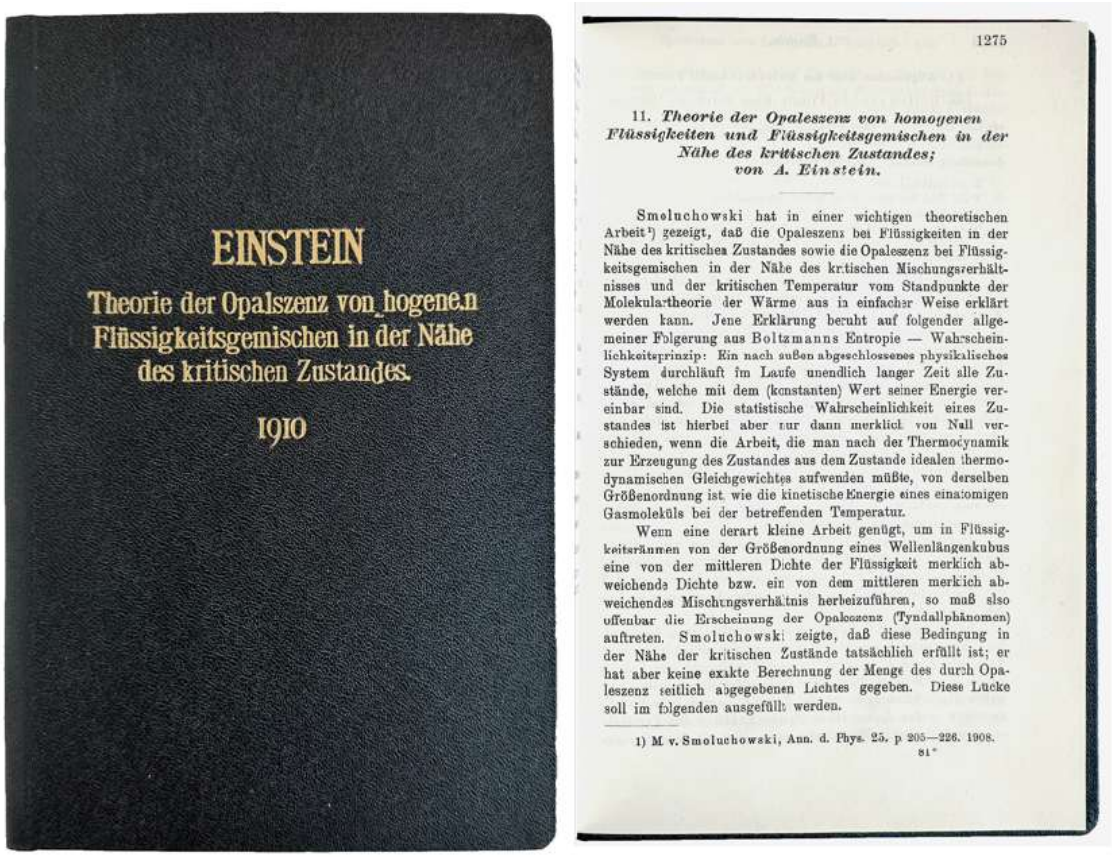
17 **EINSTEIN, Albert** (1879-1955)**; Ludwig HOPF** (1884-1939). *Statistische Untersuchung der Bewegung eines Resonators in einem Strahlungsfeld*. Leipzig: Johann Ambrosius Barth, 1910. ¶ Extracted from: *Annalen der Physik* IV, Band 33. 20x13.5cm. Small 8vo. pp. 1105-1115. Modern black cloth, with cover title gilt-stamped. Fine.

$ 95

Statistical investigation of the motion of a resonator in a radiation field.

See: O. A. Senatchin, *The Einstein-Hopf model within the realm of stochastic electrodynamics*, June 2001.

§ Alicke, Walter. *Albert Einstein* – Interlibrum, Catalogue 278, 36; Boni, Nell; Monique Russ; Dan H. Laurence, *A Bibliographical Checklist and Index to the Published Writings of Albert Einstein,* (1960), 30; Fölsing, *Einstein*, 1909b.



18 **EINSTEIN, Albert** (1879-1955). *Theorie der Opaleszenz von homogenen Flüssigkeiten und Flüsisgkeitsgemischen in der Nähe des kritischen Zustandes*. Leipzig: Johann Ambrosius Barth, 1910. ¶ Extracted from *Annalen der Physik* IV, Band 33. 20x13.5cm. Small 8vo. pp.1275-1298. Modern black cloth, with cover title gilt-stamped. Fine.

$ 75

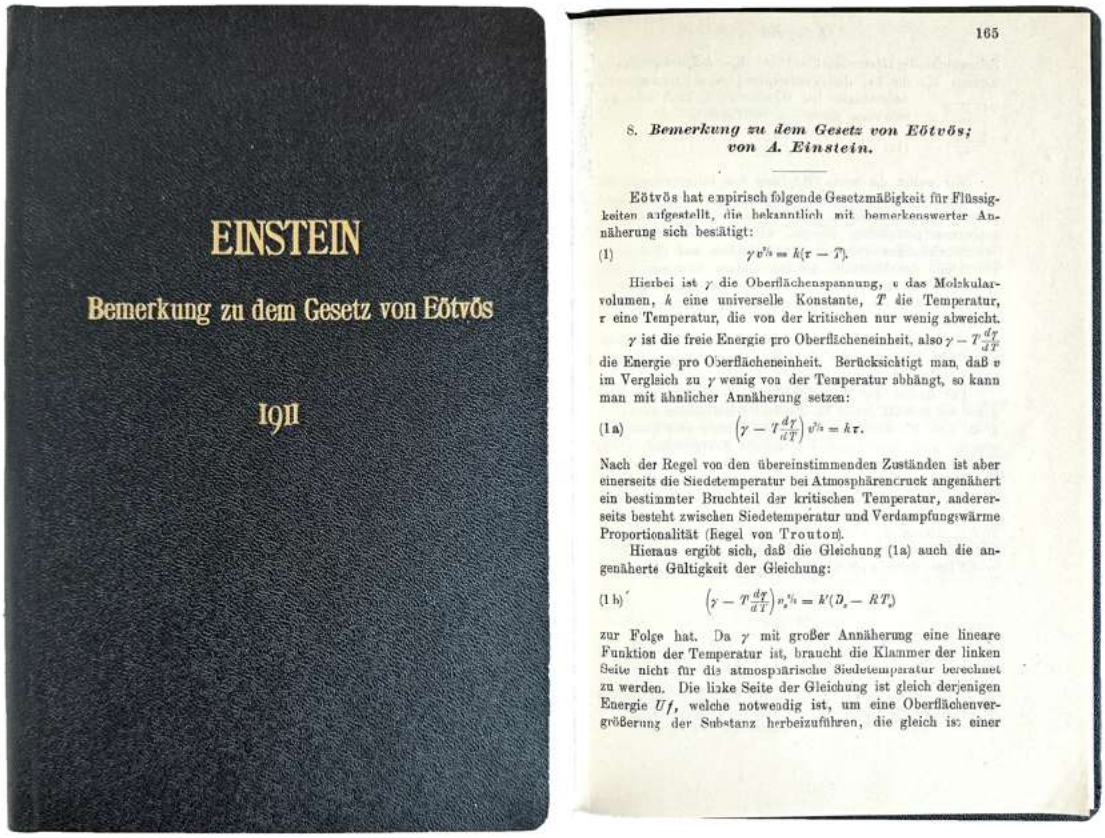
Theory of opalescence of homogeneous liquid mixtures near the critical state.

". . . one of the major papers by Einstein, marked by Weil with an asterisk."

"Einstein and Hopf wrote this paper to show that the failure of statistical mechanics vis-a-vis the radiation law cannot be ameliorated by proposing that individual statistical events in the emission of light from different points on the surface of a luminous body are not actually independent but instead are interdependent with each other. Even if one assumes a failure to be statistically independent, one derives the same usual form of the radiation law as Fourier

sum." – Calaprice, Alice; Kennefick, Daniel; Shulmann, Robert. *An Einstein Encyclopedia*. Princeton, 2015, p. 290.

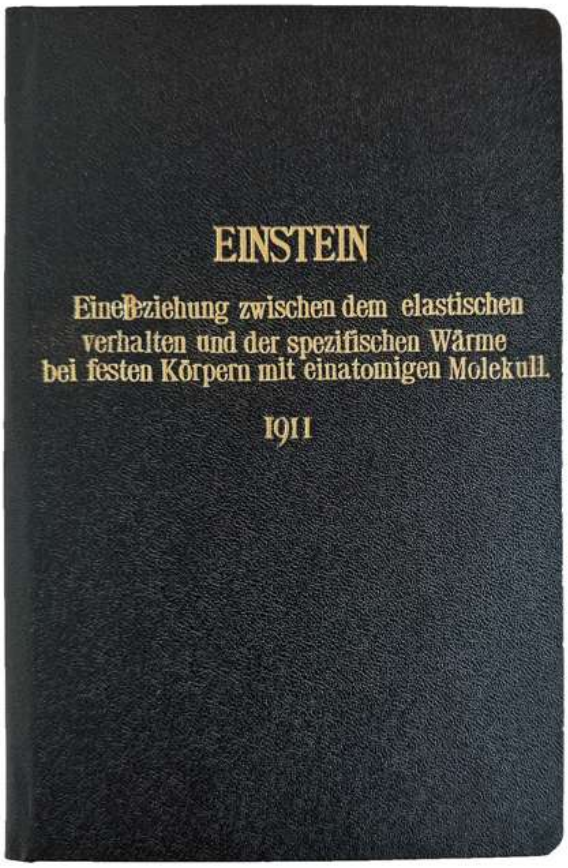
§ Alicke, Walter. *Albert Einstein* – Interlibrum, Catalogue 278, 37; Boni, Nell; Monique Russ; Dan H. Laurence, *A Bibliographical Checklist and Index to the Published Writings of Albert Einstein,* (1960), 31; Fölsing, *Einstein*, 1910c; Schilpp-Shields, 33; Weil 36*.



19 **EINSTEIN, Albert** (1879-1955). *Bemerkung zu dem Gesetz von Eötvös*. Leipzig: Johann Ambrosius Barth, 1911. ¶ 20x13.5cm. Small 8vo. pp. 165-169. Page 169 is in facsimile. Modern black cloth, with cover title gilt-stamped. Fine.
$ 55

Remark on Eötvös's law.

§ Alicke, Walter. *Albert Einstein* – Interlibrum, Catalogue 278, 35b; Boni, Nell; Monique Russ; Dan H. Laurence, *A Bibliographical Checklist and Index to the Published Writings of Albert Einstein,* (1960), 35; Fölsing, *Einstein*, 1911a.




170

9. *Eine Beziehung zwischen dem elastischen Verhalten und der spezifischen Wärme bei festen Körpern mit einatomigem Molekül;*
von A. Einstein.

Mein Kollege, Hr. Prof. Zangger, machte mich auf eine wichtige Bemerkung aufmerksam, die Sutherland[1]) neulich publizierte. Dieser stellte sich die Frage, ob die elastischen Kräfte fester Körper Kräfte derselben Art seien wie diejenigen Kräfte, welche die Träger der ultraroten Eigenschwingungen in ihre Ruhelage zurücktreiben, also deren Eigenfrequenzen bedingen. Er fand, daß diese Frage mit großer Wahrscheinlichkeit zu bejahen sei auf Grund folgender Tatsache: die ultraroten Eigenfrequenzen sind von derselben Größenordnung wie diejenigen Frequenzen, welche man anwenden müßte, um elastische Transversalschwingungen durch den Körper zu senden, deren halbe Wellenlänge gleich ist dem Abstand benachbarter Moleküle des Körpers.

Bei aller Wichtigkeit der Sutherlandschen Betrachtung ist es aber klar, daß man auf diesem Wege nicht mehr erlangen kann als eine rohe Größenordnungsbeziehung, und zwar insbesondere aus dem Grunde, weil anzunehmen ist, daß die bekannten ultraroten Eigenschwingungen in der Hauptsache als Schwingungen der verschieden geladenen Ionen eines Moleküls gegeneinander, die elastischen Schwingungen aber als Schwingungen der ganzen Moleküle gegeneinander aufzufassen sind. Es scheint mir deshalb, daß eine genauere Prüfung der Sutherlandschen Idee nur bei Stoffen mit einatomigem Molekül möglich sei, denen nach der Erfahrung und nach dem theoretischen Bilde optisch nachweisbare Eigenschwingungen von der bekannten Art nicht zukommen. Nach der von mir auf die

1) W. Sutherland, Phil. Mag. (6) 20. p. 657. 1910.

20 **EINSTEIN, Albert** (1879-1955). *Eine Beziehung zwischen dem elastischen verhalten und der spezifischen Wärme bei festen Körpern mit einatomigen Molekül.*

Leipzig: Johann Ambrosius Barth, 1911. ¶ 20x13.5cm. Small 8vo. pp. 170-174.

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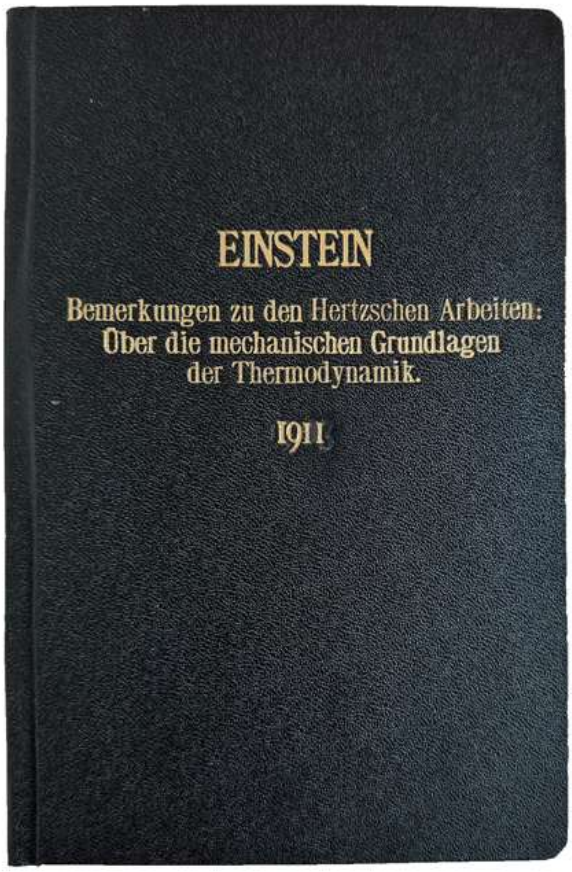
$ 100

A relationship between the elastic conduct (action/behavior) and the specific heat of solids with monatomic molecules.

". . . one of the major papers by Einstein, marked by Weil with an asterisk."

§ Alicke, Walter. *Albert Einstein* – Interlibrum, Catalogue 278, 35c; Boni, Nell; Monique Russ; Dan H. Laurence, *A Bibliographical Checklist and Index to the Published Writings of Albert Einstein,* (1960), 36; Fölsing, *Einstein*, 1911b; Weil, Ernst, *Albert Einstein, a bibliography of his scientific papers*, *39.




175

10. *Bemerkungen zu den P. Hertzschen Arbeiten: „Über die mechanischen Grundlagen der Thermodynamik“* [1]: *von A. Einstein.*

Hr. P. Hertz hat in seinen soeben genannten vortrefflichen Arbeiten zwei Stellen, die sich in Arbeiten von mir über den gleichen Gegenstand vorfinden, angegriffen. Zu diesen Angriffen will ich im folgenden kurz Stellung nehmen, wobei ich bemerke, daß das hier Gesagte das Resultat einer mündlichen Besprechung mit Hrn. Hertz ist, in welcher wir uns über die beiden in Betracht kommenden Punkte vollkommen geeinigt haben.

1. Im vorletzten Absatz des § 13 seiner zweiten Arbeit kritisiert Hertz eine von mir gegebene Ableitung des Entropiesatzes für nicht umkehrbare Vorgänge. Ich halte diese Kritik für vollkommen zutreffend. Meine Ableitung hatte mich schon damals nicht befriedigt, weshalb ich kurz darauf eine zweite Ableitung gab, die auch von Hrn. Hertz zitiert ist.

2. Die in § 4 seiner ersten Abhandlung enthaltenen Bemerkungen gegen eine in meiner ersten einschlägigen Abhandlung enthaltene Betrachtung [2] über das Temperaturgleichgewicht beruht auf einem Mißverständnis, das durch eine allzu knappe und nicht genügend sorgfältige Formulierung jener Betrachtung hervorgerufen wurde.

Da jedoch der Gegenstand durch die Arbeiten anderer Autoren genügend klar gelegt worden ist, und zudem ein Eingehen auf diesen speziellen Punkt wenig Interesse be-

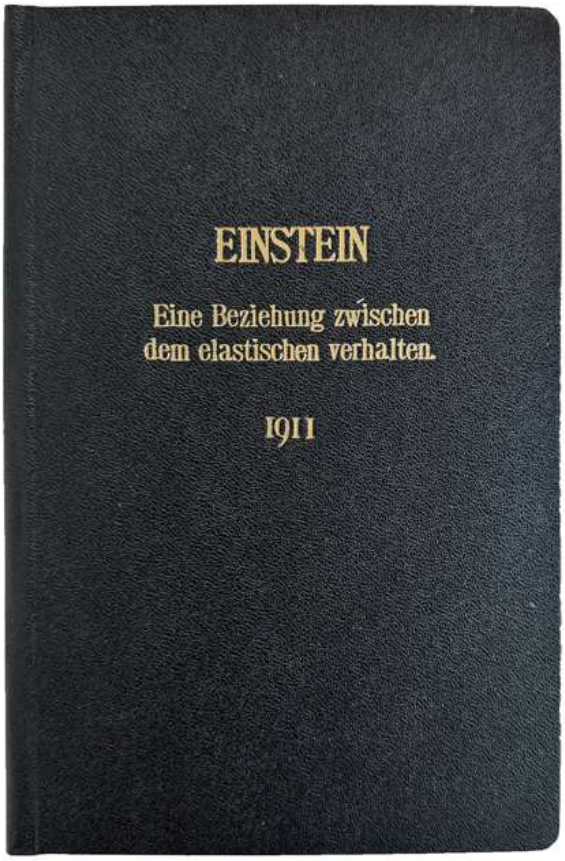
1) A. Einstein, Ann. d. Phys. 9. p. 425. 1902 und 11. p. 170. 1903.
2) P. Hertz, Ann. d. Phys. 33. p. 225 u. 537. 1910.

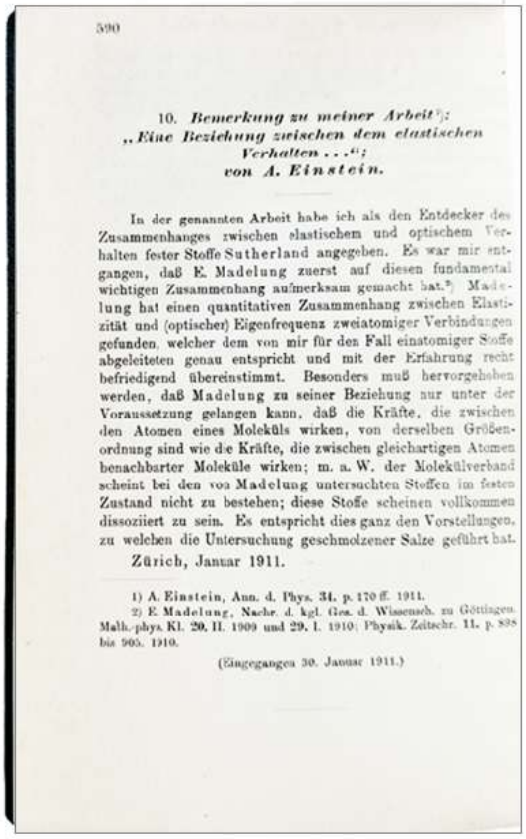
21 **EINSTEIN, Albert** (1879-1955). *Bemerkungen zu den P. Hertzschen Arbeiten: “Über die mechanischen Grundlagen der Thermodynamik”.* Leipzig: Johann Ambrosius Barth, 1911. ¶ 20x13.5cm. Band 34. Small 8vo. pp. 175-176. Modern black cloth, with cover title gilt-stamped. Fine.

$ 100

Remarks on P. Hertz’s works: “On the mechanical foundations of thermodynamics.”

§ Alicke, Walter. *Albert Einstein* – Interlibrum, Catalogue 278, 35d; Weil, Ernst, *Albert Einstein, a bibliography of his scientific papers*, 40; Boni, Nell; Monique Russ; Dan H. Laurence, *A Bibliographical Checklist and Index to the Published Writings of Albert Einstein,* (1960), 37; Fölsing, *Einstein*, 1911c.





590

10. *Bemerkung zu meiner Arbeit*[1]: *„Eine Beziehung zwischen dem elastischen Verhalten . . .“*; *von A. Einstein.*

In der genannten Arbeit habe ich als den Entdecker des Zusammenhanges zwischen elastischem und optischem Verhalten fester Stoffe Sutherland angegeben. Es war mir entgangen, daß E. Madelung zuerst auf diesen fundamental wichtigen Zusammenhang aufmerksam gemacht hat.[2] Madelung hat einen quantitativen Zusammenhang zwischen Elastizität und (optischer) Eigenfrequenz zweiatomiger Verbindungen gefunden, welcher dem von mir für den Fall einatomiger Stoffe abgeleiteten genau entspricht und mit der Erfahrung recht befriedigend übereinstimmt. Besonders muß hervorgehoben werden, daß Madelung zu seiner Beziehung nur unter der Voraussetzung gelangen kann, daß die Kräfte, die zwischen den Atomen eines Moleküls wirken, von derselben Größenordnung sind wie die Kräfte, die zwischen gleichartigen Atomen benachbarter Moleküle wirken; m. a. W. der Molekülverband scheint bei den von Madelung untersuchten Stoffen im festen Zustand nicht zu bestehen; diese Stoffe scheinen vollkommen dissoziiert zu sein. Es entspricht dies ganz den Vorstellungen, zu welchen die Untersuchung geschmolzener Salze geführt hat.

Zürich, Januar 1911.

1) A. Einstein, Ann. d. Phys. **34**. p. 170 ff. 1911.
2) E. Madelung, Nachr. d. kgl. Ges. d. Wissensch. zu Göttingen. Math.-phys. Kl. **20**. II. 1909 und **29**. I. 1910; Physik. Zeitschr. **11**. p. 898 bis 905. 1910.

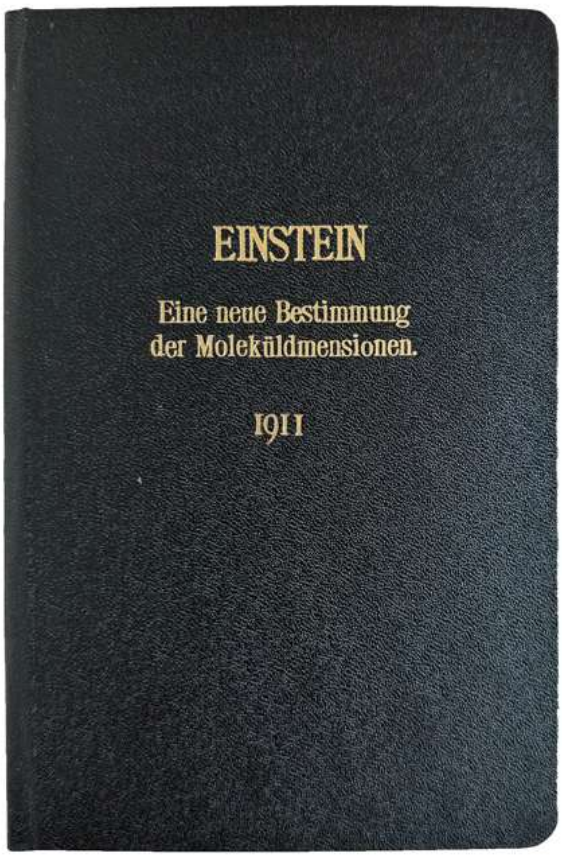
(Eingegangen 30. Januar 1911.)

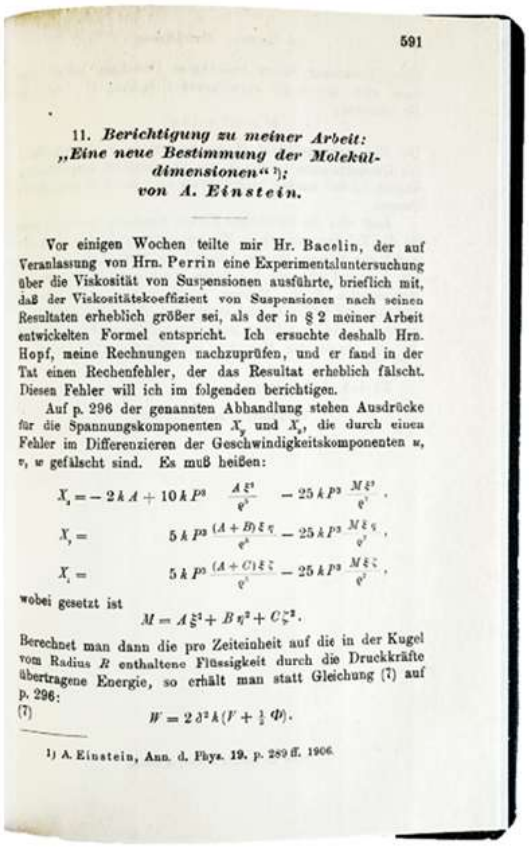
22 **EINSTEIN, Albert** (1879-1955). *Bermerkungen zu meiner Arbeit : “Eine Beziehung zwischen dem elastischen verhalten.”* Leipzig: Johann Ambrosius Barth, 1911. ¶ 20x13.5cm. Band 34. Small 8vo. p. 590. Modern black cloth, with cover title gilt-stamped. Fine.

$ 75

Remarks on my work: “A relationship between elastic behavior.”

§ Alicke, Walter. *Albert Einstein* – Interlibrum, Catalogue 278, 35c; Boni, Nell; Monique Russ; Dan H. Laurence, *A Bibliographical Checklist and Index to the Published Writings of Albert Einstein,* (1960), 36 (second part). Not in Fölsing, *Einstein.*





591

11. *Berichtigung zu meiner Arbeit: „Eine neue Bestimmung der Molekül-dimensionen“* [1]; *von A. Einstein.*

Vor einigen Wochen teilte mir Hr. Bacelin, der auf Veranlassung von Hrn. Perrin eine Experimentaluntersuchung über die Viskosität von Suspensionen ausführte, brieflich mit, daß der Viskositätskoeffizient von Suspensionen nach seinen Resultaten erheblich größer sei, als der in § 2 meiner Arbeit entwickelten Formel entspricht. Ich ersuchte deshalb Hrn. Hopf, meine Rechnungen nachzuprüfen, und er fand in der Tat einen Rechenfehler, der das Resultat erheblich fälscht. Diesen Fehler will ich im folgenden berichtigen.

Auf p. 296 der genannten Abhandlung stehen Ausdrücke für die Spannungskomponenten X_x und X_y, die durch einen Fehler im Differenzieren der Geschwindigkeitskomponenten u, v, w gefälscht sind. Es muß heißen:

$$X_x = -2kA + 10kP^3\frac{A\xi^3}{\varrho^3} - 25kP^3\frac{M\xi^3}{\varrho^3},$$

$$Y_x = 5kP^3\frac{(A+B)\xi\eta^2}{\varrho^3} - 25kP^3\frac{M\xi\eta^2}{\varrho^3},$$

$$Z_x = 5kP^3\frac{(A+C)\xi\zeta^2}{\varrho^3} - 25kP^3\frac{M\xi\zeta^2}{\varrho^3},$$

wobei gesetzt ist

$$M = A\xi^2 + B\eta^2 + C\zeta^2.$$

Berechnet man dann die pro Zeiteinheit auf die in der Kugel vom Radius R enthaltene Flüssigkeit durch die Druckkräfte übertragene Energie, so erhält man statt Gleichung (7) auf p. 296:

(7) $$W = 2\vartheta^2 k(V + \tfrac{1}{2}\Phi).$$

1) A. Einstein, Ann. d. Phys. 19. p. 289 ff. 1906.

23 **EINSTEIN, Albert** (1879-1955). *Berichtigung zu meiner Arbeit : “Eine neue Bestimmung der Moleküldimensionen.”* Leipzig: Johann Ambrosius Barth, 1911. ¶ [Bound extract]. Band 34. 20x13.5cm. Small 8vo. pp. 591-592. Modern black cloth, with cover title gilt-stamped. Fine.

$ 200

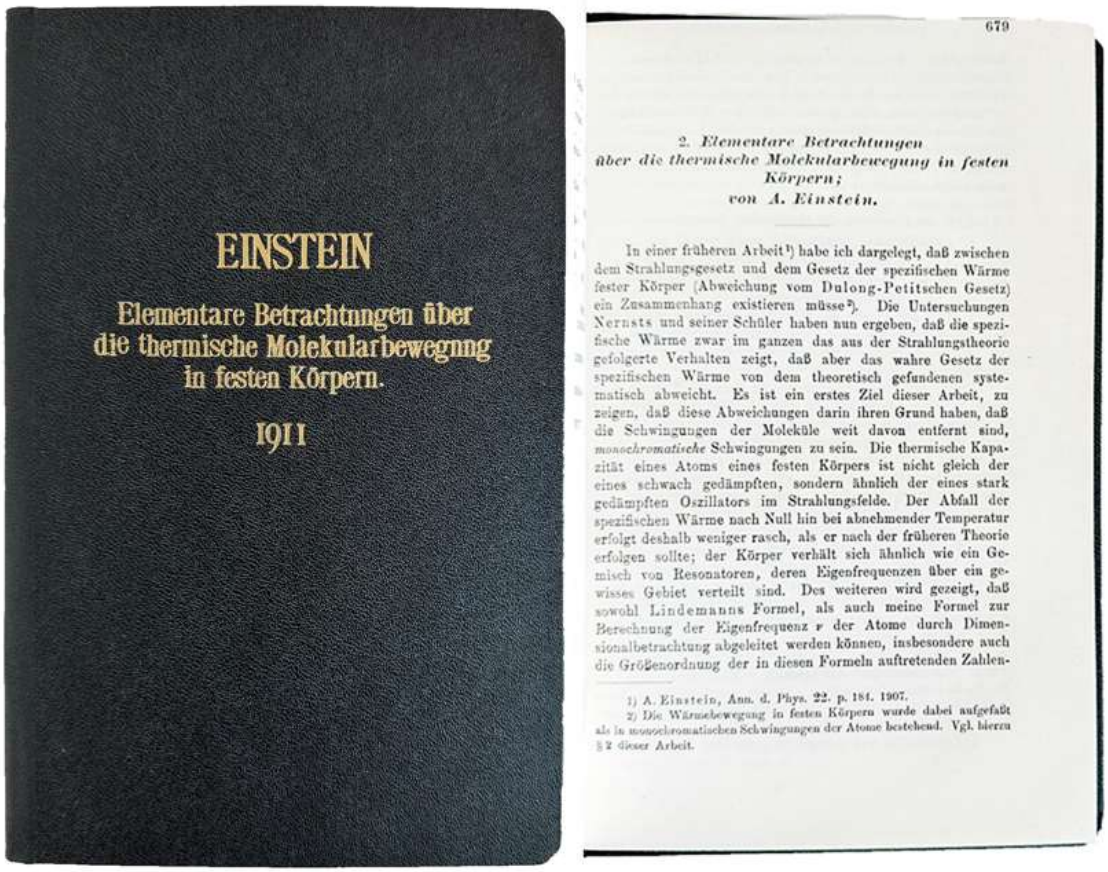
“A new determination of molecular dimensions”.

Einstein’s correction to his formula for the viscosity coefficient * = (1 +), a key equation in his 1905 doctoral thesis, in which he had presented a new theoretical method for determining molecular radii and Avogadro’s number. In 1910 Jacques Bacelin, a pupil of French physicist Jean-Baptiste Perrin, obtained experimental results indicating a possible error in Einstein’s formula.

“That prompted Einstein, after an unsuccessful attempt to find an error, to ask . . . Ludwig Hopf [who worked with Max Born] to check his calculations and arguments . . . Hopf did find an error in the dissertation, namely in the

derivatives of some velocity components, and obtained for a corrected coefficient 2.5 . . .In early 1911 Einstein submitted his correction for publication, and recalculated Avogadro's number. He obtained a value of 6.56 x 1023 per mole, a value that is close to those derived from kinetic theory and Planck's black-body radiation theory". – Duplantier (pp. 216-217).

§ Alicke, Walter. *Albert Einstein* – Interlibrum, Catalogue 278, 35; Duplantier, Bertrand, "Brownian motion, 'diverse and undulating,'" In: *Einstein, 1905-2005: Poincaré Seminar 2005* (pp. 201-293); Fölsing, *Einstein*, 1911d; Pais, Abraham, *Subtle is the Lord*, p. 92; Weil, Ernst, *Albert Einstein, a bibliography of his scientific papers*, 41. Not in Boni, Russ & Laurence.



24 **EINSTEIN, Albert** (1879-1955). *Elementare Betrachtungen über die thermische Molekularbewegung in festen Körpern*. Leipzig: Johann Ambrosius Barth, 1911. ¶ Band 35. 20x13.5cm. Small 8vo. pp. 679-694. Modern black cloth, with cover title gilt-stamped. Fine.

$ 100

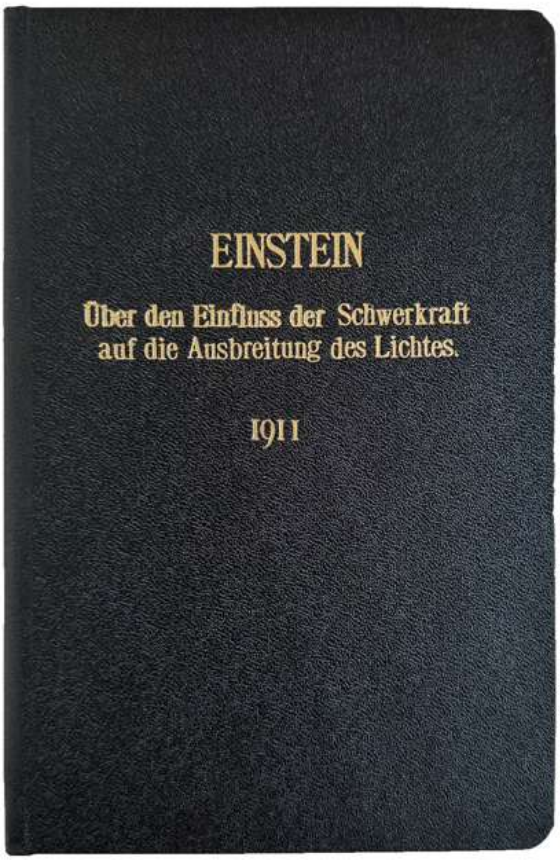
Elementary considerations of thermal molecular motion in solids.

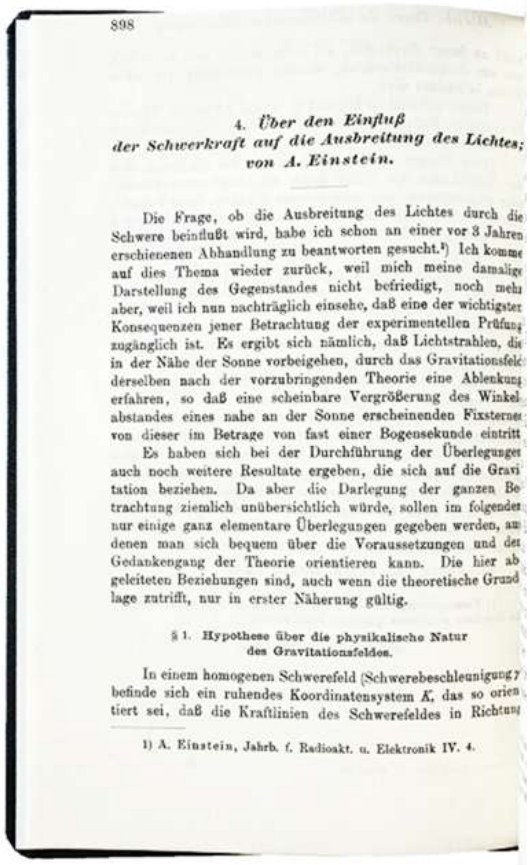
". . . one of the major papers by Einstein, marked by Weil with an asterisk."

Einstein's sequel and complement to his 1907 paper on Planck's theory of radiation and heat, translated as Elementary Observations on Thermal Molecular Motion in Solids. Einstein tries to improve upon his model of specific heats after realizing the model was incorrect at very low temperatures. The correct answer would come a year later with the Debye model.

"Elementary observations on thermal molecular motion in solids. . . Here Einstein continues the work he had begun in 1907 on the specific heat of solids, where the heat agitation of solids was reduced to a monochromatic oscillation of the atom, and the specific heat was determined based on the quantum treatment of an oscillator in a radiation field. He explains the discrepancies between his formula and the measurements at low temperatures." – Calaprice, Alice; Kennefick, Daniel; Shulmann, Robert. *An Einstein Encyclopedia*. Princeton, 2015, p. 291.

§ Alicke, Walter. *Albert Einstein* – Interlibrum, Catalogue 278, 40; Boni, Nell; Monique Russ; Dan H. Laurence, *A Bibliographical Checklist and Index to the Published Writings of Albert Einstein,* (1960), 38; Fölsing, *Einstein*, 1911f; Schilpp-Shields 41; Weil, Ernst, *Albert Einstein, a bibliography of his scientific papers*, *42.




898

4. *Über den Einfluß der Schwerkraft auf die Ausbreitung des Lichtes;* von *A. Einstein.*

Die Frage, ob die Ausbreitung des Lichtes durch die Schwere beeinflußt wird, habe ich schon an einer vor 3 Jahren erschienenen Abhandlung zu beantworten gesucht.[1] Ich komme auf dies Thema wieder zurück, weil mich meine damalige Darstellung des Gegenstandes nicht befriedigt, noch mehr aber, weil ich nun nachträglich einsehe, daß eine der wichtigsten Konsequenzen jener Betrachtung der experimentellen Prüfung zugänglich ist. Es ergibt sich nämlich, daß Lichtstrahlen, die in der Nähe der Sonne vorbeigehen, durch das Gravitationsfeld derselben nach der vorzubringenden Theorie eine Ablenkung erfahren, so daß eine scheinbare Vergrößerung des Winkelabstandes eines nahe an der Sonne erscheinenden Fixsternes von dieser im Betrage von fast einer Bogensekunde eintritt.

Es haben sich bei der Durchführung der Überlegungen auch noch weitere Resultate ergeben, die sich auf die Gravitation beziehen. Da aber die Darlegung der ganzen Betrachtung ziemlich unübersichtlich würde, sollen im folgenden nur einige ganz elementare Überlegungen gegeben werden, an denen man sich bequem über die Voraussetzungen und den Gedankengang der Theorie orientieren kann. Die hier abgeleiteten Beziehungen sind, auch wenn die theoretische Grundlage zutrifft, nur in erster Näherung gültig.

§ 1. Hypothese über die physikalische Natur des Gravitationsfeldes.

In einem homogenen Schwerefeld (Schwerebeschleunigung γ) befinde sich ein ruhendes Koordinatensystem K, das so orientiert sei, daß die Kraftlinien des Schwerefeldes in Richtung

1) A. Einstein, Jahrb. f. Radioakt. u. Elektronik IV. 4.

25 **EINSTEIN, Albert** (1879-1955). *Über den Einfluss der Schwerkraft auf die Ausbreitung des Lichtes.* Leipzig: Johann Ambrosius Barth, 1911. ¶ Band 35. 20x13.5cm. Small 8vo. pp. viii, 898-908. Modern black cloth, with cover title gilt-stamped. Fine.

$ 200

On the influence of gravity on the propagation of light. This is the epochal paper on gravitational red-shift and the bending of light.

". . . one of the major papers by Einstein, marked by Weil with an asterisk."

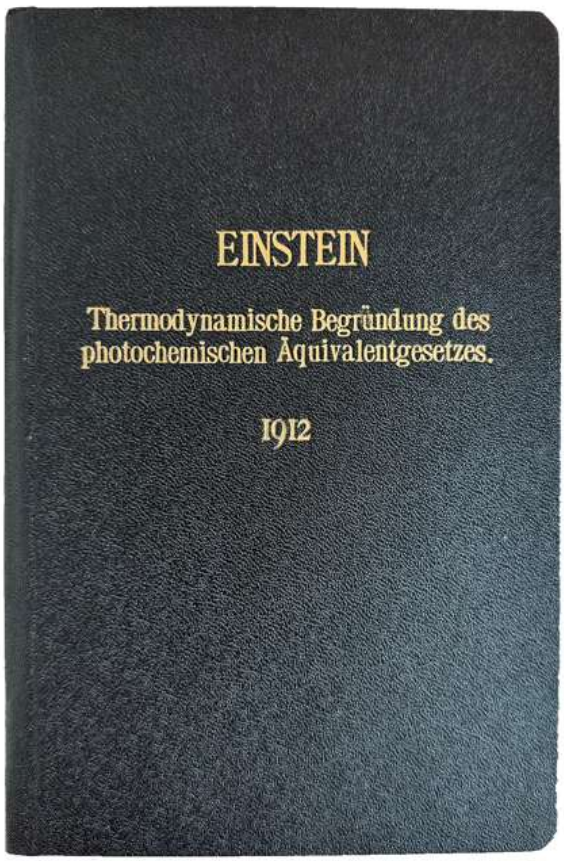
"Here Einstein continues the work he had begun in 1907 on the specific heat of solids, where the heat agitation of solids was reduced to a monochromatic

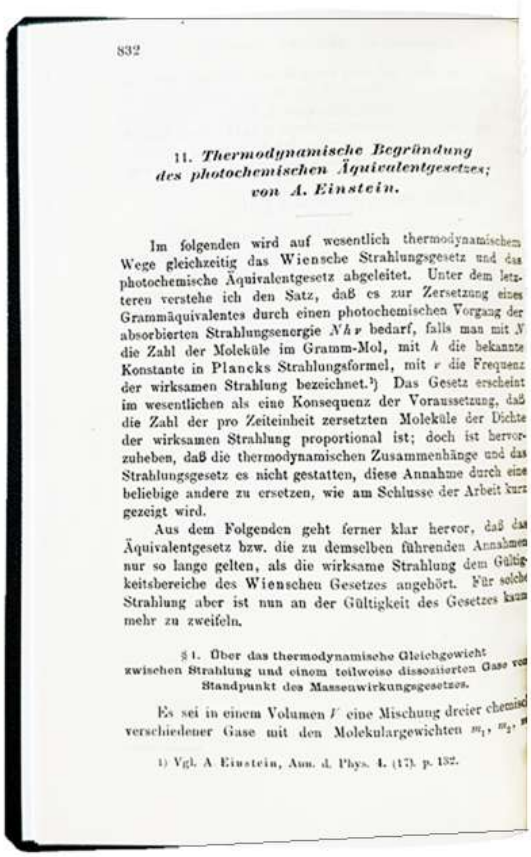
oscillation of the atom, and the specific heat was determined based on the quantum treatment of an oscillator in a radiation field. He explains the discrepencies between his formula and the measurements at low temperatures"– Calaprice, Alice; Kennefick, Daniel; Shulmann, Robert. *An Einstein Encyclopedia*. Princeton, 2015, p. 291.

"Thus in 1911 we discern the first glimpses of the new Einstein program: to derive the equivalence principle from a new theory of gravitation. This cannot be achieved within the framework of what he called the ordinary relativity theory, the special theory. Therefore one must look for a new theory not only of gravitation but also of relativity. Another point made in this paper likewise bears on that new program. 'Of course, one cannot replace an *arbitrary* gravitational field by a state of motion without gravitational field, as little as one can transform to rest by means of a relativity transformation all points of an arbitrarily moving medium.' This statement would continue to be true in the ultimate general theory of relativity". – Pais, *Subtle is the Lord*, pp. 195-196.

"The paper ends with a plea to the astronomers: 'It is urgently desirable that astronomers concern themselves with the question brought up here, even if the foregoing considerations might seem insufficiently founded, or even adventurous'". – Pais, p. 200.

§ Alicke, Walter. *Albert Einstein* – Interlibrum, Catalogue 278, 41; Boni, Nell; Monique Russ; Dan H. Laurence, *A Bibliographical Checklist and Index to the Published Writings of Albert Einstein,* (1960)*,* 39; Fölsing, *Einstein*, 1911g; Schilpp-Shields, 42; Weil 43*.




832

11. *Thermodynamische Begründung des photochemischen Äquivalentgesetzes; von A. Einstein.*

Im folgenden wird auf wesentlich thermodynamischem Wege gleichzeitig das Wiensche Strahlungsgesetz und das photochemische Äquivalentgesetz abgeleitet. Unter dem letzteren verstehe ich den Satz, daß es zur Zersetzung eines Grammäquivalentes durch einen photochemischen Vorgang der absorbierten Strahlungsenergie $N h\nu$ bedarf, falls man mit N die Zahl der Moleküle im Gramm-Mol, mit h die bekannte Konstante in Plancks Strahlungsformel, mit ν die Frequenz der wirksamen Strahlung bezeichnet.[1]) Das Gesetz erscheint im wesentlichen als eine Konsequenz der Voraussetzung, daß die Zahl der pro Zeiteinheit zersetzten Moleküle der Dichte der wirksamen Strahlung proportional ist; doch ist hervorzuheben, daß die thermodynamischen Zusammenhänge und das Strahlungsgesetz es nicht gestatten, diese Annahme durch eine beliebige andere zu ersetzen, wie am Schlusse der Arbeit kurz gezeigt wird.

Aus dem Folgenden geht ferner klar hervor, daß das Äquivalentgesetz bzw. die zu demselben führenden Annahmen nur so lange gelten, als die wirksame Strahlung dem Gültigkeitsbereiche des Wienschen Gesetzes angehört. Für solche Strahlung aber ist nun an der Gültigkeit des Gesetzes kaum mehr zu zweifeln.

§ 1. Über das thermodynamische Gleichgewicht zwischen Strahlung und einem teilweise dissoziierten Gase vom Standpunkt des Massenwirkungsgesetzes.

Es sei in einem Volumen V eine Mischung dreier chemisch verschiedener Gase mit den Molekulargewichten m_1, m_2, m

1) Vgl. A. Einstein, Ann. d. Phys. 4. (17). p. 132.

26 **EINSTEIN, Albert** (1879-1955). *Thermodynamische Begründung des photochemischen Äquivalentgesetzes*. Leipzig: Johann Ambrosius Barth, 1912. ¶ In *Annalen der Ph*ysik, Band 37. 20x13.5cm. Small 8vo. pp. 832-838. Modern black cloth, with cover title gilt-stamped. Fine.

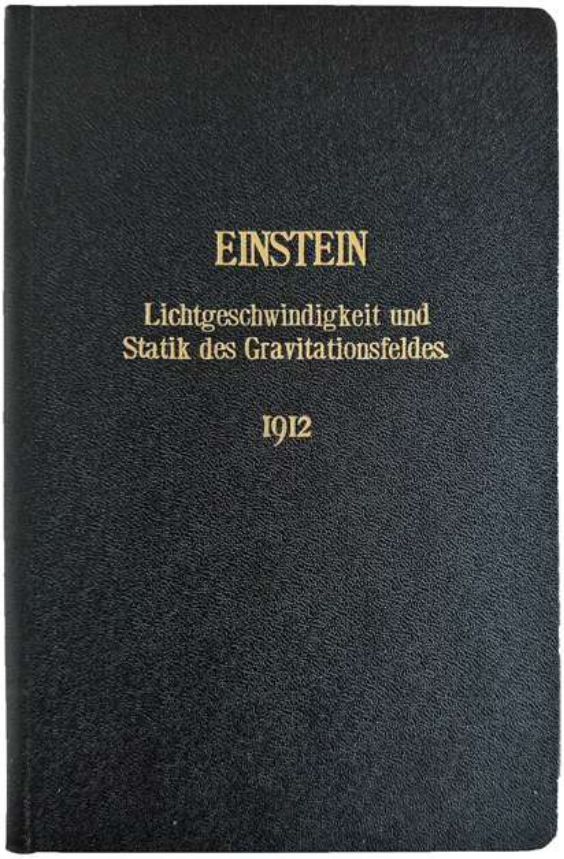
$ 125

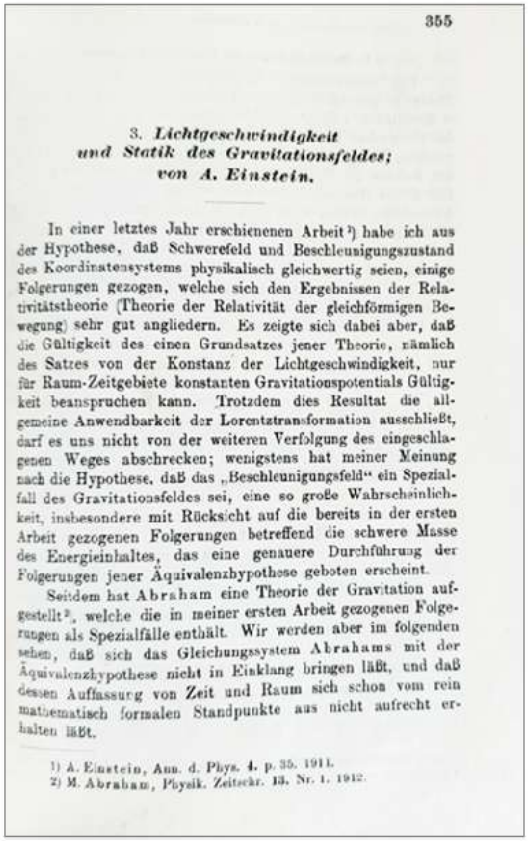
Thermodynamic justification of the photochemical equivalent law.

"Einstein presents a continuation of his earlier work on the interaction between light matter and on photochemical processes. It contrasts with earlier work in that it makes no use of the quantum hypothesis. He demonstrates how what he calls 'the law of photochemical equivalence' is deducible by purely thermodynamical arguments if one makes certain plausible assumptions. He wrote a supplement to the paper in five months later in the same journal." – Calaprice, Alice; Kennefick, Daniel; Shulmann, Robert. *An Einstein Encyclopedia*. Princeton, 2015, pp. 291-2.

§ Alicke, Walter. *Albert Einstein* – Interlibrum, Catalogue 278, 44; Findlay, *100 Years of Chemistry*, p. 252; Boni, Nell; Monique Russ; Dan H. Laurence, *A Bibliographical Checklist and Index to the Published Writings of Albert Einstein,* (1960), 42 [1st part]; Fölsing, *Einstein*, 1912a; Schilpp-Shield, 45; Weil, Ernst, *Albert Einstein, a bibliography of his scientific papers*, 46.

See: Partington, *History of Chemistry*, IV, p. 726 ff.




355

3. *Lichtgeschwindigkeit und Statik des Gravitationsfeldes;* von *A. Einstein.*

In einer letztes Jahr erschienenen Arbeit[1]) habe ich aus der Hypothese, daß Schwerefeld und Beschleunigungszustand des Koordinatensystems physikalisch gleichwertig seien, einige Folgerungen gezogen, welche sich den Ergebnissen der Relativitätstheorie (Theorie der Relativität der gleichförmigen Bewegung) sehr gut angliedern. Es zeigte sich dabei aber, daß die Gültigkeit des einen Grundsatzes jener Theorie, nämlich des Satzes von der Konstanz der Lichtgeschwindigkeit, nur für Raum-Zeitgebiete konstanten Gravitationspotentials Gültigkeit beanspruchen kann. Trotzdem dies Resultat die allgemeine Anwendbarkeit der Lorentztransformation ausschließt, darf es uns nicht von der weiteren Verfolgung des eingeschlagenen Weges abschrecken; wenigstens hat meiner Meinung nach die Hypothese, daß das „Beschleunigungsfeld" ein Spezialfall des Gravitationsfeldes sei, eine so große Wahrscheinlichkeit, insbesondere mit Rücksicht auf die bereits in der ersten Arbeit gezogenen Folgerungen betreffend die schwere Masse des Energieinhaltes, das eine genauere Durchführung der Folgerungen jener Äquivalenzhypothese geboten erscheint.

Seitdem hat Abraham eine Theorie der Gravitation aufgestellt[2]), welche die in meiner ersten Arbeit gezogenen Folgerungen als Spezialfälle enthält. Wir werden aber im folgenden sehen, daß sich das Gleichungssystem Abrahams mit der Äquivalenzhypothese nicht in Einklang bringen läßt, und daß dessen Auffassung von Zeit und Raum sich schon vom rein mathematisch formalen Standpunkte aus nicht aufrecht erhalten läßt.

1) A. Einstein, Ann. d. Phys. 4. p. 35. 1911.
2) M. Abraham, Physik. Zeitschr. 13. Nr. 1. 1912.

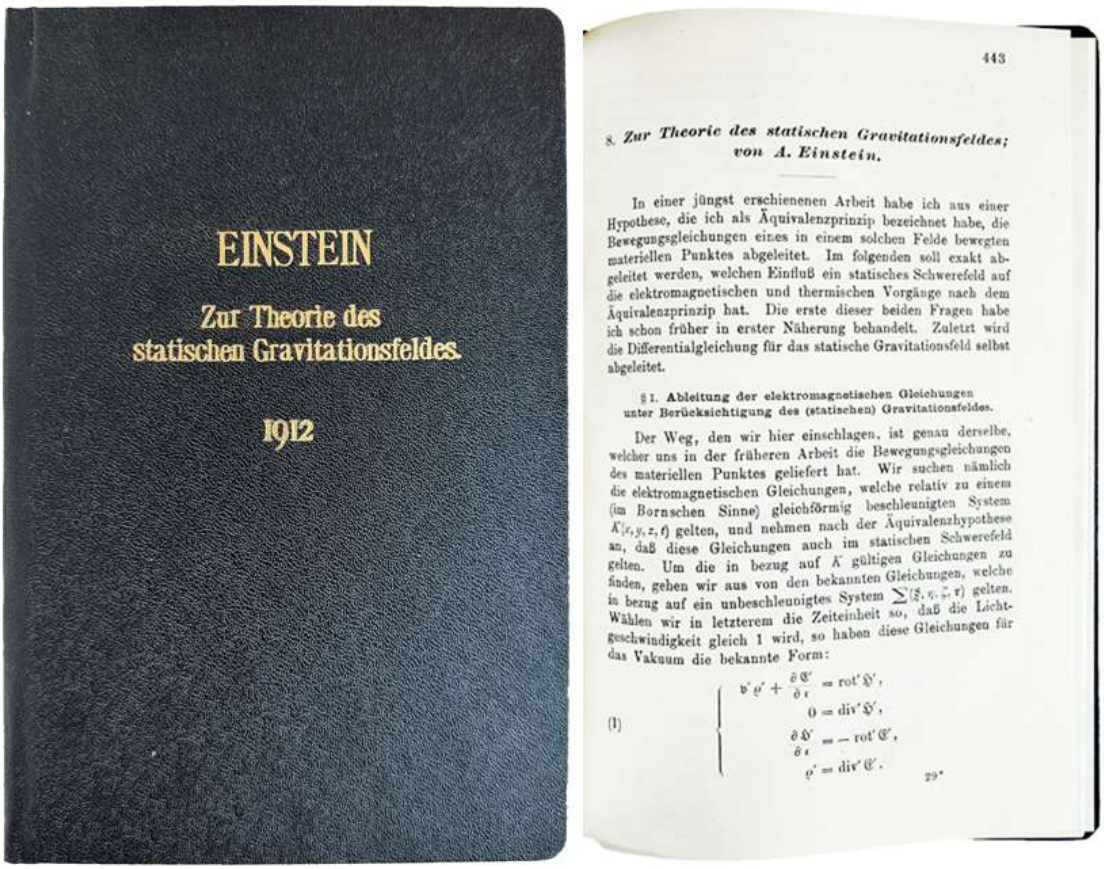
27 **EINSTEIN, Albert** (1879-1955). *Lichtgeschwindigkeit und Statik des Gravitationsfeldes*. Leipzig: Johann Ambrosius Barth, 1912. ¶ 20x13.5cm. Band 38, Small 8vo. pp. 355-369. Modern black cloth, with cover title gilt-stamped. Fine.

$ 125

Speed of light and statics of the gravitational field.

"Further exploring his studies of gravitation, based on the equivalence principle, Einstein sees with growing clarity that gravitation is intimately linked with the problem of the measurement of space and time". – Calaprice, Alice; Kennefick, Daniel; Shulmann, Robert. *An Einstein Encyclopedia*. Princeton, 2015, p. 292.

§ Alicke, Walter. *Albert Einstein* – Interlibrum, Catalogue 278, 46; Boni, Nell; Monique Russ; Dan H. Laurence, *A Bibliographical Checklist and Index to the Published Writings of Albert Einstein,* (1960)*,* 43; Fölsing, *Einstein*, 1912b [Note: Fölsing shows a different pagination for the same paper – my copy differs from what he recorded, i.e. his is in error (Fölsing shows the same pagination for 1912c, thus the error]; Schilpp-Shields, 46; Weil, Ernst, *Albert Einstein, a bibliography of his scientific papers*, 47.



28 **EINSTEIN, Albert** (1879-1955). *Zur Theorie des statischen Gravitationsfeldes*. Leipzig: Johann Ambrosius Barth, 1912. ¶ 20x13.5cm. Band 38. Small 8vo. pp. 443-458. Modern black cloth, with cover title gilt-stamped. Fine.

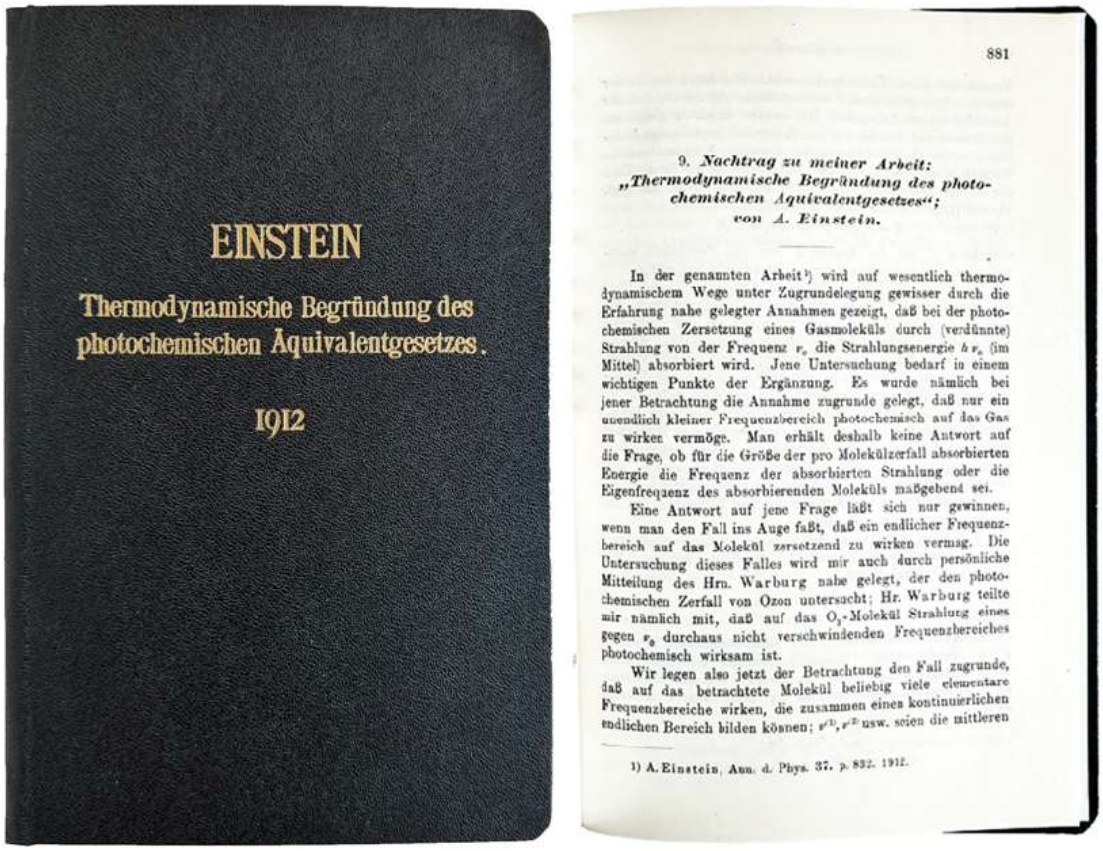
$ 125

On the theory of the static gravitational field.

"Einstein more closely analyzes the equations of motion stated in , *Lichtgeschwindigkeit und Statik des Gravitationsfeldes*, concluding that those equations cannot be reconciled with the given field equations for c [. . .] because the principle of "action equals reaction" is violated. – Calaprice, Alice; Kennefick, Daniel; Shulmann, Robert. *An Einstein Encyclopedia*. Princeton, 2015, p. 290.

§ Alicke, Walter. *Albert Einstein* – Interlibrum, Catalogue 278, 46; Boni, Nell; Monique Russ; Dan H. Laurence, *A Bibliographical Checklist and Index to the*

Published Writings of Albert Einstein, (1960), 44; Fölsing, *Einstein*, 1912c; Schilpp-Shields, 47; Weil, Ernst, *Albert Einstein, a bibliography of his scientific papers*, 48.

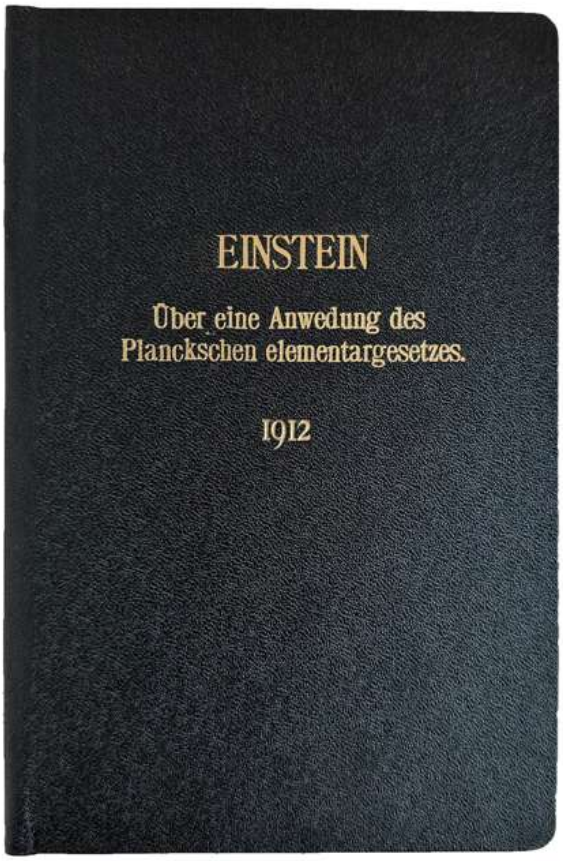


29 **EINSTEIN, Albert** (1879-1955). *"Thermodynamische Begründung des photochemischen Äquivalentgesetzes."* Leipzig: Johann Ambrosius Barth, 1912. ¶ 20x13.5cm. Band 38. Small 8vo. pp. 881-884. Modern black cloth, with cover title gilt-stamped. Fine.

$ 125

Addendum to Einstein's work: "Thermodynamic justification of the photochemical equivalent law."

§ Alicke, Walter. *Albert Einstein* – Interlibrum, Catalogue 278, 45; Boni, Nell; Monique Russ; Dan H. Laurence, *A Bibliographical Checklist and Index to the Published Writings of Albert Einstein,* (1960), 42 [2nd part]; Fölsing, *Einstein*, 1912a; Weil, Ernst, *Albert Einstein, a bibliography of his scientific papers*, 46.




888

11. *Antwort auf eine Bemerkung von J. Stark: „Über eine Anwendung des Planckschen Elementargesetzes . . .“; von A. Einstein.*

J. Stark hat zu einer kürzlich von mir publizierten Arbeit[1]) eine Bemerkung verfaßt zum Zwecke der Verteidigung seines geistigen Eigentums.[2]) Auf die aufgeworfene Frage der Priorität gehe ich nicht ein, weil sie kaum jemanden interessieren dürfte, zumal es sich bei dem photochemischen Äquivalentgesetz um eine ganz selbstverständliche Folgerung der Quantenhypothese handelt.[3]) Ich sehe aber aus Starks Bemerkung, daß ich das Ziel meiner Arbeit nicht genügend klar hervorgehoben habe. Es sollte gezeigt werden, daß man zur Ableitung jenes Äquivalentgesetzes nicht der Quantenhypothese bedarf, sondern daß dasselbe aus gewissen einfachen Annahmen über den photochemischen Prozeß auf *thermodynamischem* Wege gefolgert werden kann.

Prag, 30. Mai 1912.

1) A. Einstein, Ann. d. Phys. **37**. p. 832. 1912.
2) J. Stark, Ann. d. Phys. **38**. p. 467. 1912.
3) Für den Fall, daß das photochemisch empfindliche Molekül in Ionen gespalten wird, habe ich übrigens das Gesetz bereits in meiner ersten Arbeit über die Quantenhypothese (Ann. d. Phys. **17**. p. 148. 1905) besonders ausgesprochen.

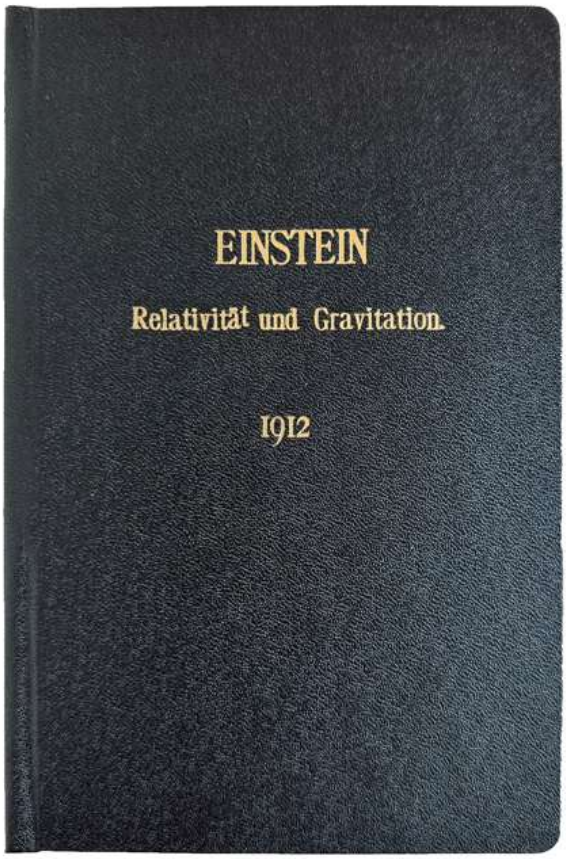
(Eingegangen 30. Mai 1912.)

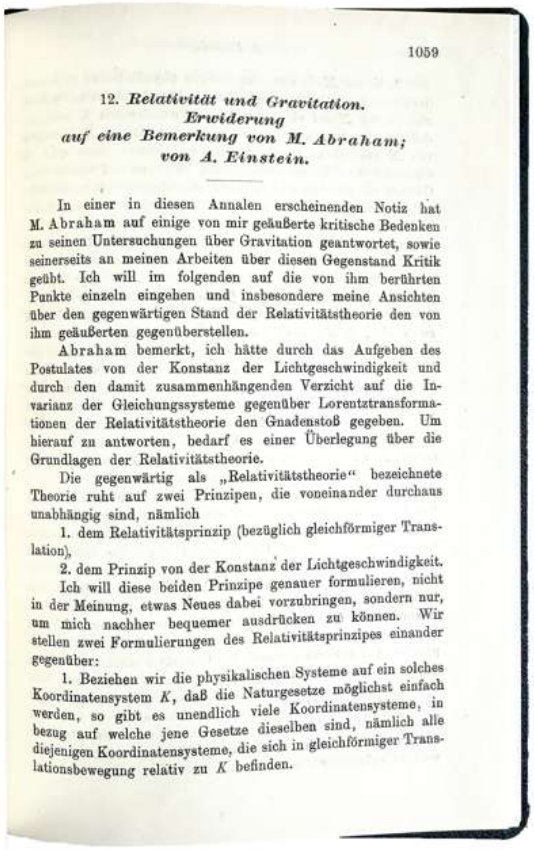
30 **EINSTEIN, Albert** (1879-1955). *Antwort auf eine Bemerkung von J. Stark: “Über eine Anwedung des Planckschen Elementargesetzes . . .”* Leipzig: Johann Ambrosius Barth, 1912. ¶ 20x13.5cm. Band 38. Small 8vo. p. 888. Modern black cloth, with cover title gilt-stamped. Fine.

$ 75

Reply to a remark by J. Stark: “On an application of Planck’s elementary law.”

§ Alicke, Walter. *Albert Einstein* – Interlibrum, Catalogue 278, 45; Boni, Nell; Monique Russ; Dan H. Laurence, *A Bibliographical Checklist and Index to the Published Writings of Albert Einstein,* (1960), 45; Fölsing, *Einstein*, 1912d.





1059

12. *Relativität und Gravitation. Erwiderung auf eine Bemerkung von M. Abraham; von A. Einstein.*

In einer in diesen Annalen erscheinenden Notiz hat M. Abraham auf einige von mir geäußerte kritische Bedenken zu seinen Untersuchungen über Gravitation geantwortet, sowie seinerseits an meinen Arbeiten über diesen Gegenstand Kritik geübt. Ich will im folgenden auf die von ihm berührten Punkte einzeln eingehen und insbesondere meine Ansichten über den gegenwärtigen Stand der Relativitätstheorie den von ihm geäußerten gegenüberstellen.

Abraham bemerkt, ich hätte durch das Aufgeben des Postulates von der Konstanz der Lichtgeschwindigkeit und durch den damit zusammenhängenden Verzicht auf die Invarianz der Gleichungssysteme gegenüber Lorentztransformationen der Relativitätstheorie den Gnadenstoß gegeben. Um hierauf zu antworten, bedarf es einer Überlegung über die Grundlagen der Relativitätstheorie.

Die gegenwärtig als „Relativitätstheorie" bezeichnete Theorie ruht auf zwei Prinzipen, die voneinander durchaus unabhängig sind, nämlich

1. dem Relativitätsprinzip (bezüglich gleichförmiger Translation),

2. dem Prinzip von der Konstanz der Lichtgeschwindigkeit.

Ich will diese beiden Prinzipe genauer formulieren, nicht in der Meinung, etwas Neues dabei vorzubringen, sondern nur, um mich nachher bequemer ausdrücken zu können. Wir stellen zwei Formulierungen des Relativitätsprinzipes einander gegenüber:

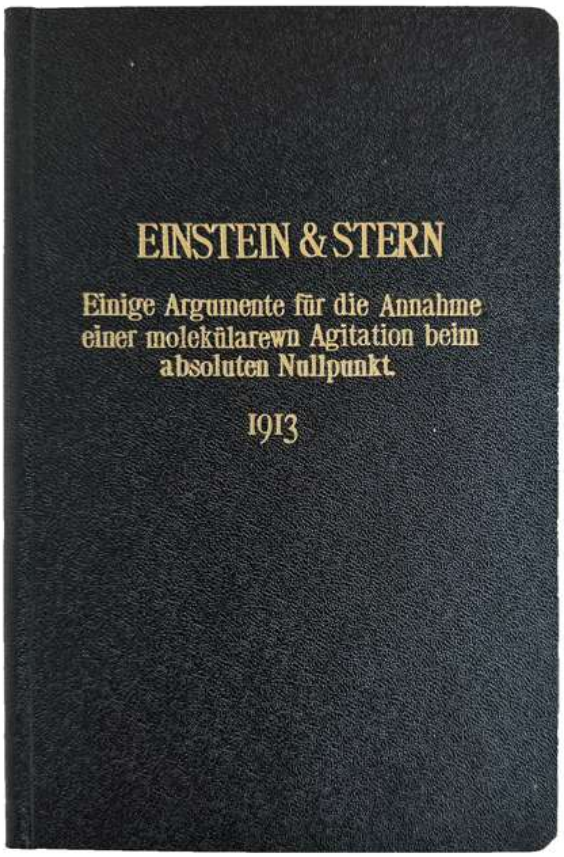
1. Beziehen wir die physikalischen Systeme auf ein solches Koordinatensystem K, daß die Naturgesetze möglichst einfach werden, so gibt es unendlich viele Koordinatensysteme, in bezug auf welche jene Gesetze dieselben sind, nämlich alle diejenigen Koordinatensysteme, die sich in gleichförmiger Translationsbewegung relativ zu K befinden.

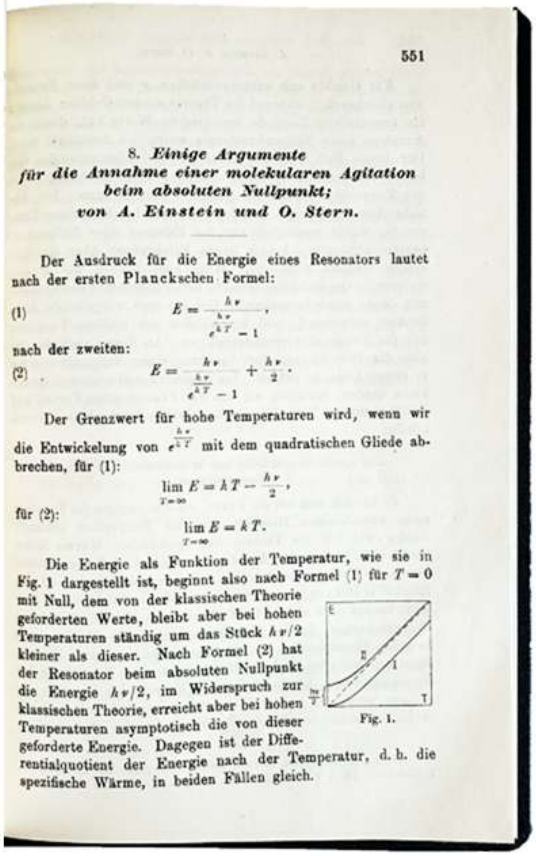
31 **EINSTEIN, Albert** (1879-1955). *Relativität und Gravitation. Erwiderung auf eine Bemerkung des Hrn. A. Einstein*. Leipzig: Johann Ambrosius Barth, 1912. ¶ 20x13.5cm. Band 38. Small 8vo. pp. 1059-1064. Modern black cloth, with cover title gilt-stamped. Fine.

$ 125

Relativity and Gravitation. Reply to a Remark by Mr. A. Einstein.

§ Alicke, Walter. *Albert Einstein* – Interlibrum, Catalogue 278, 45; Boni, Nell; Monique Russ; Dan H. Laurence, *A Bibliographical Checklist and Index to the Published Writings of Albert Einstein,* (1960), 46; Fölsing, *Einstein*, 1912f.




551

8. *Einige Argumente für die Annahme einer molekularen Agitation beim absoluten Nullpunkt; von A. Einstein und O. Stern.*

Der Ausdruck für die Energie eines Resonators lautet nach der ersten Planckschen Formel:

(1) $$E = \frac{h\nu}{e^{\frac{h\nu}{kT}} - 1},$$

nach der zweiten:

(2) $$E = \frac{h\nu}{e^{\frac{h\nu}{kT}} - 1} + \frac{h\nu}{2}.$$

Der Grenzwert für hohe Temperaturen wird, wenn wir die Entwickelung von $e^{\frac{h\nu}{kT}}$ mit dem quadratischen Gliede abbrechen, für (1):

$$\lim_{T=\infty} E = kT - \frac{h\nu}{2},$$

für (2):

$$\lim_{T=\infty} E = kT.$$

Die Energie als Funktion der Temperatur, wie sie in Fig. 1 dargestellt ist, beginnt also nach Formel (1) für $T = 0$ mit Null, dem von der klassischen Theorie geforderten Werte, bleibt aber bei hohen Temperaturen ständig um das Stück $h\nu/2$ kleiner als dieser. Nach Formel (2) hat der Resonator beim absoluten Nullpunkt die Energie $h\nu/2$, im Widerspruch zur klassischen Theorie, erreicht aber bei hohen Temperaturen asymptotisch die von dieser geforderte Energie. Dagegen ist der Differentialquotient der Energie nach der Temperatur, d. h. die spezifische Wärme, in beiden Fällen gleich.

Fig. 1.

32 **EINSTEIN, Albert** (1879-1955); **Otto STERN** (1888-1969). *Einige Argumente für die Annahme einer molekülarewn Agitation beim absoluten Nullpunkt.* Leipzig: Johann Ambrosius Barth, 1913. ¶ In: *Annalen der Physik,* (4) Band 40. 20x13.5cm. Small 8vo. pp. 551-560. Modern black cloth, with cover title gilt-stamped. Fine.

$ 75

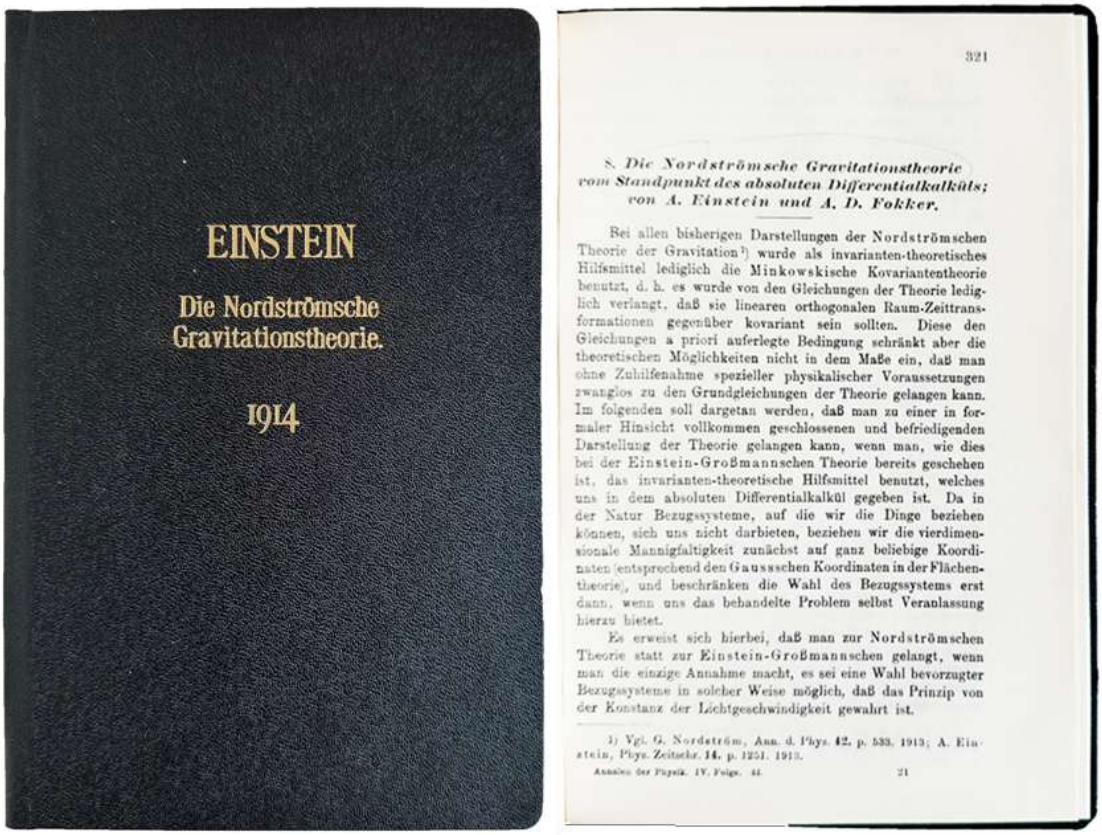
Some arguments for the assumption of molecular agitation at absolute zero.

Einstein received the Nobel Prize in Physics, 1921, for "his services to theoretical physics, and especially for his discovery of the law of the photoelectric effect".

Otto Stern received the Nobel Prize in Physics, 1943, "for his contribution to the development of the molecular ray method and his discovery of the magnetic moment of the proton". Stern completed his studies at the University of Breslau in 1912 with a doctoral dissertation in physical chemistry under

supervision of Otto Sackur on the kinetic theory of osmotic pressure in concentrated solutions. He then followed Albert Einstein to Charles University in Prague and in 1913 to ETH Zurich.

§ Alicke, Walter. *Albert Einstein* – Interlibrum, Catalogue 278, 50; Boni, Nell; Monique Russ; Dan H. Laurence, *A Bibliographical Checklist and Index to the Published Writings of Albert Einstein,* (1960), 51; Fölsing, *Einstein*, 1913a; Schilpp-Shields 54; [Stern] Charles W. Carey Jr., *American National Biography*. 1999; Weil, Ernst, *Albert Einstein, a bibliography of his scientific papers*, no. 53.



33 **EINSTEIN, Albert** (1879-1955); **FOKKER, Adriaan** (1887-1972). *Die Nordströmsche Gravitationstheorie vom Standpunkt des absoluten Differentialkalküls.* Leipzig: Johann Ambrosius Barth, 1914. ¶ In: *Annalen der Physik*, 4. Folge, Band 44, Heft 2. 20x13.5cm. Small 8vo. pp. viii, 321-328. Modern black cloth, with cover title gilt-stamped. Fine.

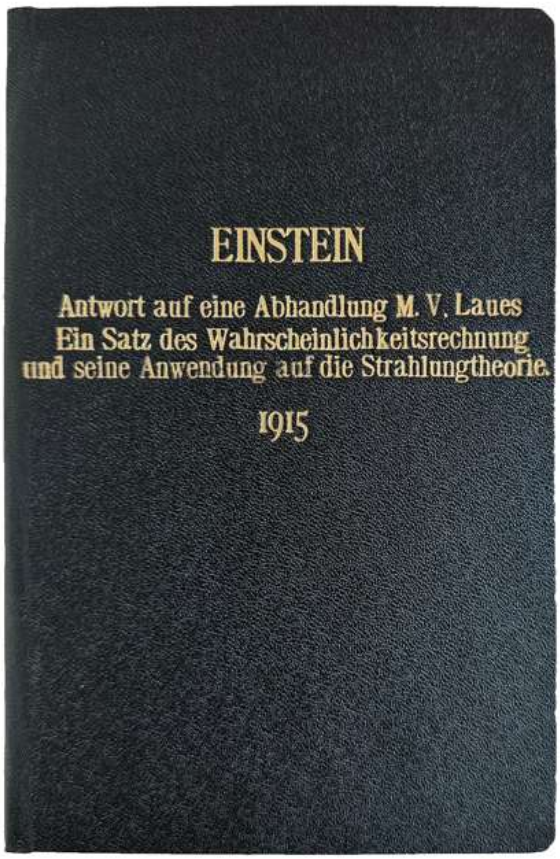
$ 150

Gunnar Nordström's theory of gravitation from the standpoint of general differential calculus.

"The theory for which Nordström was arguably most famous in his own lifetime, his theory of gravitation, was for a long time considered as a competitor to Einstein's theory of general relativity, which was published in 1915, after Nordström's theory. In 1914 Nordström introduced an additional space dimension to his theory, which provided coupling to electromagnetism. This was the first of the extra dimensional theories, which later came to be known as Kaluza–Klein theory. Kaluza and Klein, whose names are commonly used today for the theory, did not publish their work until the 1920s. Some speculations as to why Nordström's contribution fell into obscurity are that his theory was partly published in Swedish and that Einstein in a later publication referenced to Kaluza alone. Today extra dimensions and theories thereof are widely researched, debated and even looked for experimentally.

Nordström's theory of gravitation was subsequently experimentally found to be inferior to Einstein's, as it did not predict the bending of light which was observed during the solar eclipse in 1919." – Wikip.

§ Alicke, Walter. *Albert Einstein* – Interlibrum, Catalogue 278, 58; Boni, Nell; Monique Russ; Dan H. Laurence, *A Bibliographical Checklist and Index to the Published Writings of Albert Einstein,* (1960)*,* 56; Fölsing, *Einstein*, 1914a; Schilpp-Shields, 59; Weil 65.




879

2. *Antwort auf eine Abhandlung M. v. Laues „Ein Satz der Wahrscheinlichkeitsrechnung und seine Anwendung auf die Strahlungstheorie"; von A. Einstein.*

In der zitierten Arbeit bringt Laue die mathematische Grundlage der Statistik der Strahlung in eine Form, die an Prägnanz und Schönheit nichts zu wünschen übrigläßt. Was aber die Anwendung jener Grundlage auf die Strahlungstheorie anbelangt, so scheint er mir einem bedenklichen Irrtume zum Opfer gefallen zu sein, der dringend Berichtigung fordert. Wenn Laues Behauptung, daß die Koeffizienten der Fourierentwicklung der bei natürlicher Strahlung auftretenden örtlichen Schwingung nicht voneinander statistisch unabhängig zu sein brauchten, berechtigt wäre, böte sich wirklich ein höchst aussichtsreicher Weg zur Überwindung der Schwierigkeiten dar, welche in der theoretischen Unverdaulichkeit aller Gesetze besteht, in denen das Planck-sche „h" eine Rolle spielt. Dies war eben der Grund, der mich vor fünf Jahren veranlaßte, in einer mit L. Hopf zusammen publizierten Arbeit diese Frage näher zu prüfen.

Das Resultat jener in ihrer Durchführung nicht ganz einwandfreien Arbeit, wird von Laue als richtige Konsequenz der zugrunde gelegten Voraussetzungen anerkannt. Aber Laue bestreitet die Zulässigkeit der Grundvoraussetzung, die sich so formulieren läßt:

Wenn ich dadurch eine vollkommen ungeordnete Strahlung (statistisch unabhängige Fourierkoeffizienten) erhalte daß ich unendlich viele vollkommen gegebene, ganz miteinander übereinstimmende Strahlungen derart superponiere, daß bei dieser Superposition die Gesamtphasen dieser superponierten Strahlungen zufällig gewählt werden, so muß die natürliche Strahlung erst recht statistisch ungeordnet sein.

Diese Grundvoraussetzung schien mir damals evident. Der Umstand aber, daß sie von einem so erfahrenen Fachmann,

34 **EINSTEIN, Albert** (1879-1955). *Antwort auf eine Abhandlung M. V. Laues „Ein Satz der Wahrscheinlichkeitsrechnung und seine Anwendung auf die Strahlungstheorie".* Leipzig: Johann Ambrosius Barth, 1915. ¶ 20x13.5cm. Band 47. Small 8vo. pp. viii, 879-885. Modern black cloth, with cover title gilt-stamped. Fine.

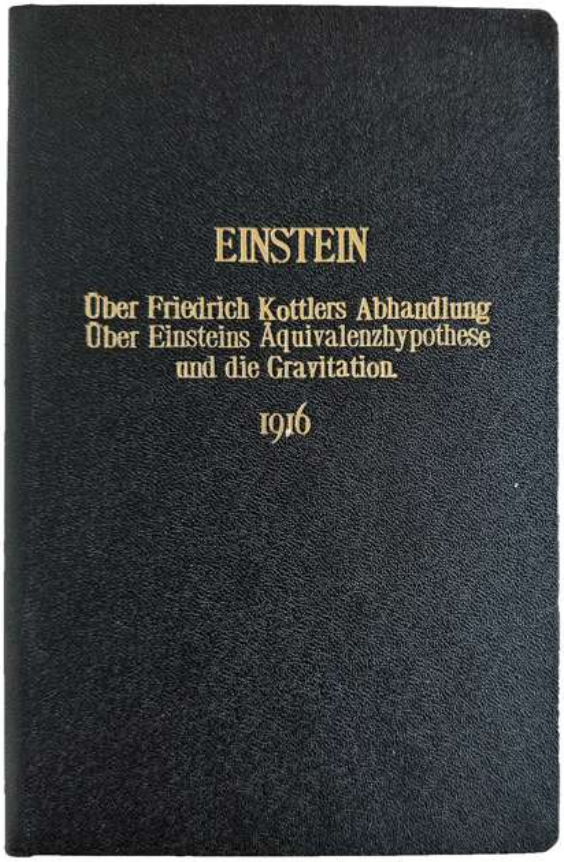
$ 95

Einstein's reply to a paper by Max Theodor Felix von Laue (1879-1960) "A theorem of probability theory and its application to radiation theory".

"Einstein and Hopf wrote this paper to show that the failure of statistical mechanics vis-a-vis the radiation law cannot be ameliorated by proposing that individual statistical events in the emission of light from different points on the surface of a luminous body are not actually independent but instead are

interdependent with each other. Even if one assumes a failure to be statistically independent, one derives the same usual form of the radiation law as Fourier sum." – Calaprice, Alice; Kennefick, Daniel; Shulmann, Robert. *An Einstein Encyclopedia*. Princeton, 2015, p. 290.

§ Alicke, Walter. *Albert Einstein* – Interlibrum, Catalogue 278, 64; Boni, Nell; Monique Russ; Dan H. Laurence, *A Bibliographical Checklist and Index to the Published Writings of Albert Einstein,* (1960), 71; Fölsing, *Einstein*, 1915c.




639

5. *Über Friedrich Kottlers Abhandlung „Über Einsteins Äquivalenzhypothese und die Gravitation"[1]; von A. Einstein.*

Unter den Arbeiten, welche sich kritisch mit der allgemeinen Relativitätstheorie beschäftigen, sind besonders diejenigen Kottlers bemerkenswert, denn dieser Fachgenosse ist wirklich in den Geist der Theorie eingedrungen. Mit der letzten dieser Arbeiten will ich mich hier auseinandersetzen.

Kottler behauptet, ich hätte das von mir aufgestellte „Äquivalenzprinzip", durch welches ich die Begriffe der „trägen Masse" und der „schweren Masse" zu einem einheitlichen Begriffe zu vereinigen strebte, in meinen späteren Arbeiten wieder aufgegeben. Diese Meinung muß darauf beruhen, daß wir beide nicht dasselbe als „Äquivalenzprinzip" bezeichnen; denn nach meiner Auffassung ruht meine Theorie ausschließlich auf diesem Prinzip. Deshalb sei folgendes wiederholt:

1. *Der Grenzfall der speziellen Relativitätstheorie.* Ein raumzeitlich endliches Gebiet sei frei von einem Gravitationsfelde, d. h. es sei möglich, ein Bezugssystem K („Galileisches System") aufzustellen, relativ zu welchem für das genannte Gebiet folgendes gilt. Koordinaten seien in bekannter Weise mit dem Einheitsmaßstab, Zeiten mit der Einheitsuhr unmittelbar meßbar, wie dies in der speziellen Relativitätstheorie vorausgesetzt zu werden pflegt. In bezug auf dieses System bewege sich ein isolierter materieller Punkt geradlinig und gleichförmig, wie es von Galilei vorausgesetzt wurde.

2. *Äquivalenzprinzip.* Ausgehend von diesem Grenzfall der speziellen Relativitätstheorie kann man sich fragen, ob

1) Ann. d. Phys. **50**. p. 955. 1916.

35 **EINSTEIN, Albert** (1879-1955). *Über Friedrich Kottlers Abhandlung „Über Einsteins Äquivalenzhypothese und die Gravitation."* Leipzig: Johann Ambrosius Barth, 1916. ¶ In: *Annalen der Physik*. Folge 4. Band 51. 20x13.5cm. Small 8vo. pp. 639-642. Modern black cloth, with cover title gilt-stamped. Fine.

$ 75

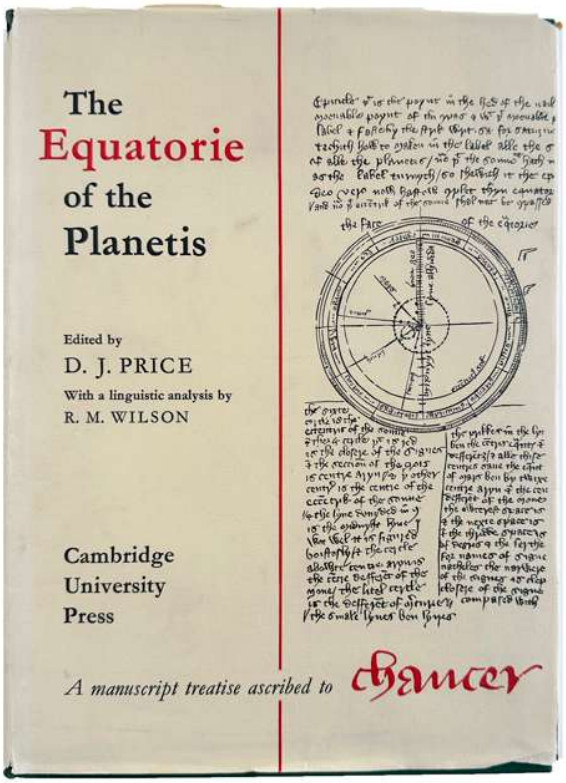
First edition. Einstein's response to Austrian theoretical physicist Friedrich Kottler's (1886-1965) paper "On Einstein's Equivalence Hypothesis and Gravitation."

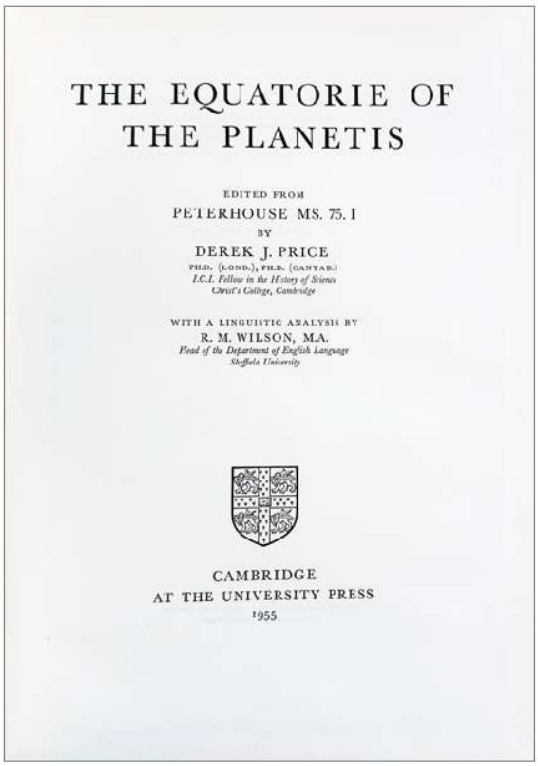
"In 1916 Kottler criticized the role of the equivalence principle in general relativity, which prompted a reply by Einstein in the same year [this paper]". (Wikip.).

§ Alicke, Walter. *Albert Einstein* – Interlibrum, Catalogue 278, 75; Boni, Nell; Monique Russ; Dan H. Laurence, *A Bibliographical Checklist and Index to the Published Writings of Albert Einstein,* (1960)*,* 79; Fölsing, *Einstein*, 1916i; Schilpp-Shields, Einstein, 90; Weil, Ernst, *Albert Einstein, a bibliography of his scientific papers*, 81.

P

PART III: GENERAL SCIENCE
with emphasis on biochemistry, genetics, microbiology, physics





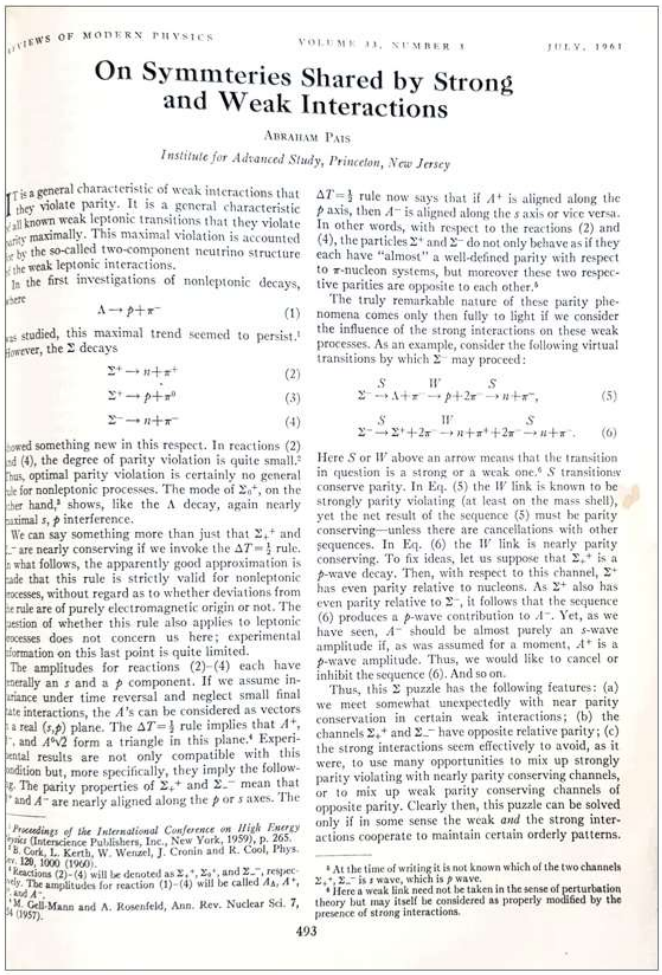
361. **CHAUCER, Geoffrey** (former attribution); **PRICE, Derek John de Solla** (1922-1983). *The Equatorie of the Planetis. Edited from Peterhouse MS. 75. I. By Derek J. Price, with a linguistic analysis by R.M. Wilson.* Cambridge: University Press, 1955. ¶ Large 8vo. xvi, 214 pp. Frontispiece, illus., index. Cloth, dust-jacket; jacket torn, some wear. Very good. S14344

$ 25

The *Equatorie* is a 14th century manuscript in the Library of Peterhouse Cambridge. The text describes the construction and working of a large device for calculating planetary positions.

Changing his life studies (ca.1950), "Price decided to make a career in the history of science, and enrolled for a second Ph.D. at the University of Cambridge, supported by an ICI fellowship. He had initially intended to work on a survey of scientific instruments, but during his studies he discovered *The Equatorie of the Planetis*, a Peterhouse manuscript in Cambridge University Library. The manuscript, written in Middle English, describes an Equatorium, an astronomical calculating instrument, and became the basis of the thesis for his PhD, which he obtained in 1954, and also for a book, published the following year. He believed the work to be by Geoffrey Chaucer, who had written *A Treatise on the Astrolabe*, but it is now attributed to a St Albans monk called John Westwyk."

362. **PAIS, Abraham** (1918-2000). *Dr. Pais presents SU(6) theory*. In: The Rockefeller Institute Review, Vol. 3, No. 1, January - February 1965. ¶ 281 x 214 mm. 4to. Page 16. [Entire issue: 18 pp.] 1 fig. Pictorial wrappers. Fine. S5593 $ 7



REVIEWS OF MODERN PHYSICS VOLUME 33, NUMBER 3 JULY, 1961

On Symmteries Shared by Strong and Weak Interactions

ABRAHAM PAIS

Institute for Advanced Study, Princeton, New Jersey

IT is a general characteristic of weak interactions that they violate parity. It is a general characteristic of all known weak leptonic transitions that they violate parity maximally. This maximal violation is accounted for by the so-called two-component neutrino structure of the weak leptonic interactions.

In the first investigations of nonleptonic decays, where

$$\Lambda \to p + \pi^- \quad (1)$$

was studied, this maximal trend seemed to persist.[1] However, the Σ decays

$$\Sigma^+ \to n + \pi^+ \quad (2)$$

$$\Sigma^+ \to p + \pi^0 \quad (3)$$

$$\Sigma^- \to n + \pi^- \quad (4)$$

showed something new in this respect. In reactions (2) and (4), the degree of parity violation is quite small.[2] Thus, optimal parity violation is certainly no general rule for nonleptonic processes. The mode of Σ_0^+, on the other hand,[3] shows, like the Λ decay, again nearly maximal s, p interference.

We can say something more than just that Σ_+^+ and Σ_-^- are nearly conserving if we invoke the $\Delta T = \frac{1}{2}$ rule. In what follows, the apparently good approximation is made that this rule is strictly valid for nonleptonic processes, without regard as to whether deviations from the rule are of purely electromagnetic origin or not. The question of whether this rule also applies to leptonic processes does not concern us here; experimental information on this last point is quite limited.

The amplitudes for reactions (2)–(4) each have generally an s and a p component. If we assume invariance under time reversal and neglect small final state interactions, the A's can be considered as vectors in a real (s,p) plane. The $\Delta T = \frac{1}{2}$ rule implies that A^+, A^-, and $A^0\sqrt{2}$ form a triangle in this plane.[4] Experimental results are not only compatible with this condition but, more specifically, they imply the following. The parity properties of Σ_+^+ and Σ_-^- mean that A^+ and A^- are nearly aligned along the p or s axes. The $\Delta T = \frac{1}{2}$ rule now says that if A^+ is aligned along the p axis, then A^- is aligned along the s axis or vice versa. In other words, with respect to the reactions (2) and (4), the particles Σ^+ and Σ^- do not only behave as if they each have "almost" a well-defined parity with respect to π-nucleon systems, but moreover these two respective parities are opposite to each other.[5]

The truly remarkable nature of these parity phenomena comes only then fully to light if we consider the influence of the strong interactions on these weak processes. As an example, consider the following virtual transitions by which Σ^- may proceed:

$$\Sigma^- \xrightarrow{S} \Lambda + \pi^- \xrightarrow{W} p + 2\pi^- \xrightarrow{S} n + \pi^-, \quad (5)$$

$$\Sigma^- \xrightarrow{S} \Sigma^+ + 2\pi^- \xrightarrow{W} n + \pi^+ + 2\pi^- \xrightarrow{S} n + \pi^-. \quad (6)$$

Here S or W above an arrow means that the transition in question is for a strong or a weak one.[6] S transitions conserve parity. In Eq. (5) the W link is known to be strongly parity violating (at least on the mass shell), yet the net result of the sequence (5) must be parity conserving—unless there are cancellations with other sequences. In Eq. (6) the W link is nearly parity conserving. To fix ideas, let us suppose that Σ_+^+ is a p-wave decay. Then, with respect to this channel, Σ^+ has even parity relative to nucleons. As Σ^+ also has even parity relative to Σ^-, it follows that the sequence (6) produces a p-wave contribution to A^-. Yet, as we have seen, A^- should be almost purely an s-wave amplitude if, as was assumed for a moment, A^+ is a p-wave amplitude. Thus, we would like to cancel or inhibit the sequence (6). And so on.

Thus, this Σ puzzle has the following features: (a) we meet somewhat unexpectedly with near parity conservation in certain weak interactions; (b) the channels Σ_+^+ and Σ_-^- have opposite relative parity; (c) the strong interactions seem effectively to avoid, as it were, to use many opportunities to mix up strongly parity violating with nearly parity conserving channels, or to mix up weak parity conserving channels of opposite parity. Clearly then, this puzzle can be solved only if in some sense the weak *and* the strong interactions cooperate to maintain certain orderly patterns.

[1] *Proceedings of the International Conference on High Energy Physics* (Interscience Publishers, Inc., New York, 1959), p. 265. B. Cork, L. Kerth, W. Wenzel, J. Cronin and R. Cool, Phys. Rev. 120, 1000 (1960).

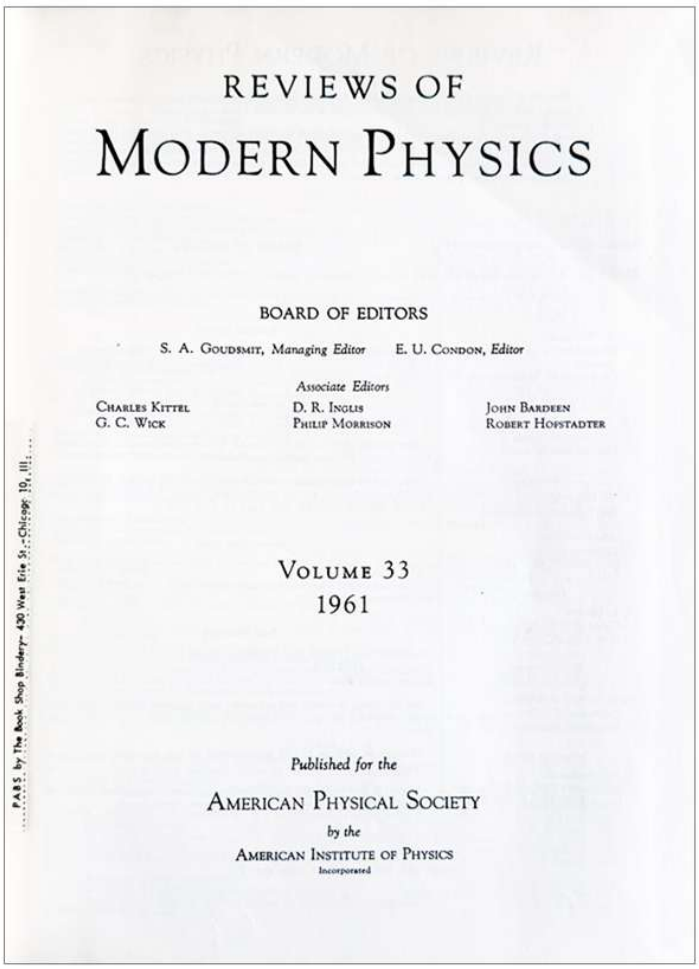
[2] Reactions (2)–(4) will be denoted as Σ_+^+, Σ_0^+, and Σ_-^-, respectively. The amplitudes for reaction (1)–(4) will be called A_Λ, A^+, A^0, and A^-.

[3] M. Gell-Mann and A. Rosenfeld, Ann. Rev. Nuclear Sci. 7, 34 (1957).

[4] At the time of writing it is not known which of the two channels Σ_+^+, Σ_-^- is s wave, which is p wave.

[5] Here a weak link need not be taken in the sense of perturbation theory but may itself be considered as properly modified by the presence of strong interactions.

493



REVIEWS OF MODERN PHYSICS

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1961

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363. **PAIS, Abraham** (1918-2000). *On symmetries shared by strong and weak interactions.* In: *Reviews of Modern Physics*, Vol. 33, No. 3, July, 1961. ¶ 272 x 202 mm. 4to. Pages 493-497. [Entire volume: [iv], 625 pp.] Full orange buckram, gilt spine. Ex library rubber stamps (those on edges obscured), spine label partially removed. Ownership name in gilt on cover of John R. Reynolds. Very good. S4267

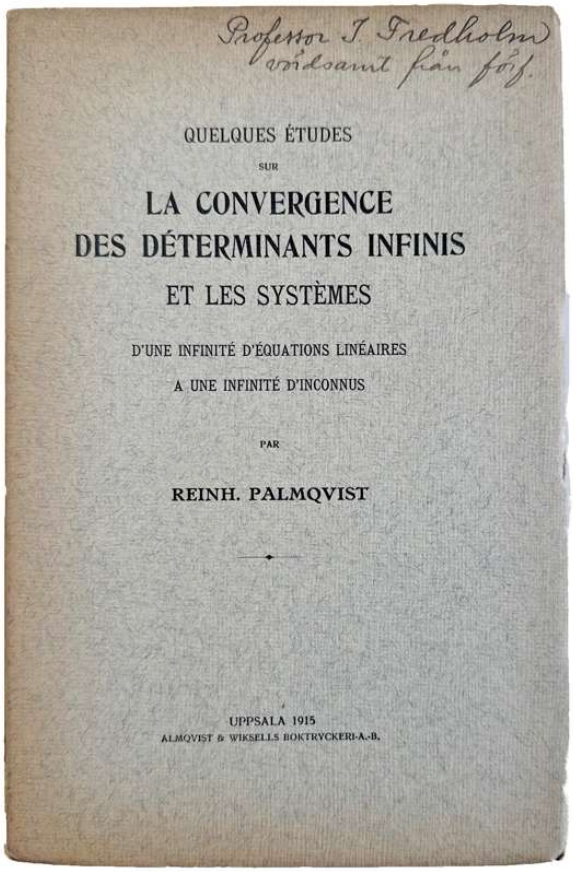
$ 45

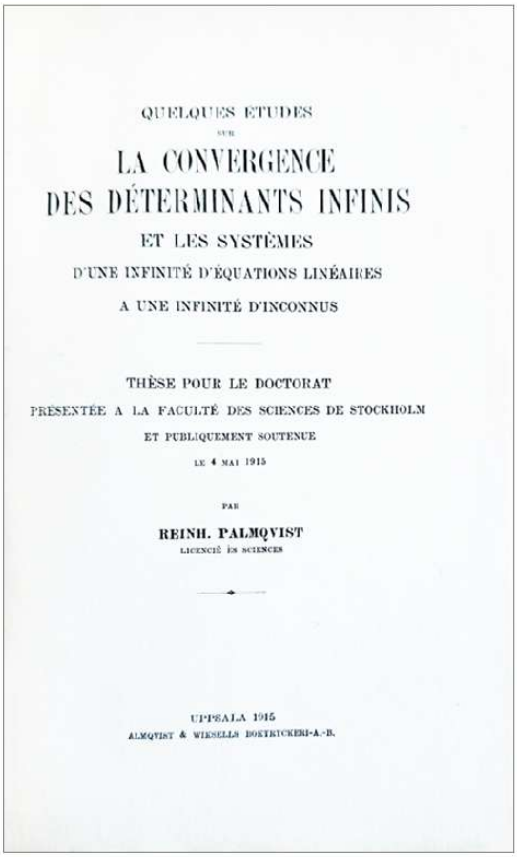
Abraham Pais and Murray Gell-Mann teamed together to work on the problem of strong and weak interactions.

Other contributions in this volume include: **K.P. Chopra**, Interactions of Rapidly Moving Bodies in Terrestrial Atmosphere. – **Peter Carruthers**, Theory of Thermal Conductivity of Solids at Low Temperatures. – **John A. Wheeler**,

Geometrodynamics and the Problem of Motion. – **William H. McMaster**, Matrix Representation of Polarization.

Abraham Pais received the Ph.D. from the University of Utrecht in 1941 and was professor of physics at the Institute for Advanced Study in Princeton, New Jersey from 1950-1963. Pais' research and publications were on the physics of fundamental particles, high energy physics, and field theory. See: Pais, *Inward bound*, p. 520.



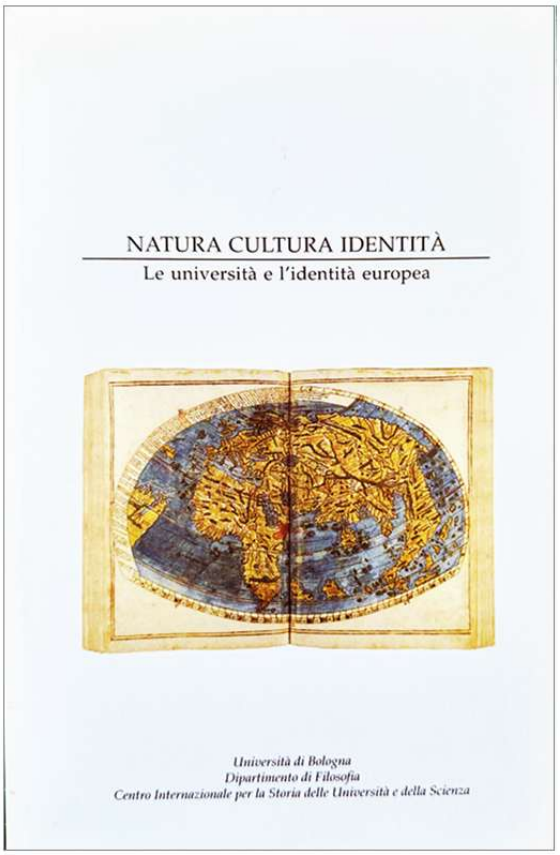


364. **PALMQVIST, Reinhold** (1885-1940). *Quelques Études sur la Convergence des Déterminants Infinis et les Systèmes d'Une Infinité d'Équations Linéaires a Une Infinité d'Inconnus.* Uppsala: Almqvist & Wiksells, 1915. ¶ First edition. 8vo. 52 pp. Pages uncut. Original printed wrappers; spine ends slightly rubbed, else fine. Early ownership inscription on front cover, "Professor I. Fredholm . . ." S7089

$ 20

[Some Studies on the Convergence of Infinite Determinants and Systems of an Infinity of Linear Equations with an Infinity of Unknowns]. Palmqvist was a noted Swedish actuary, who wrote several mathematical papers; this was his PhD thesis.

PROVENANCE: Probably owned by Erik Ivar Fredholm (1866–1927), who was a Swedish mathematician whose work on integral equations and operator theory foreshadowed the theory of Hilbert spaces.

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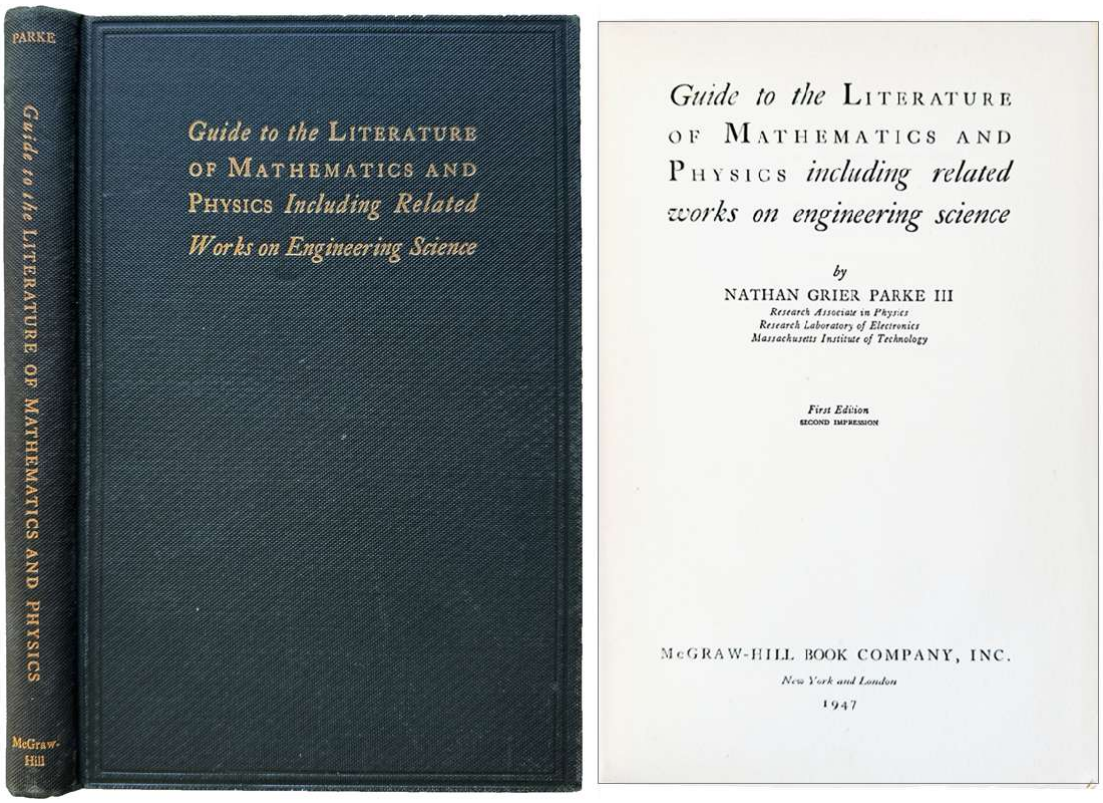
365. **PANCALDI, Giuliano** (1946-). *Natura, Cultura, Identita; Le Universita e L'identita Europea*. Bologna: Universita di Bologna, Dipartimento di Filosofia, 2004. ¶ Series: Bologna Studies in the History of Science, 10. 8vo. 213 pp. Index; dog ear p. 130. Printed wrappers. Very good. Rare. RH1180

$ 20

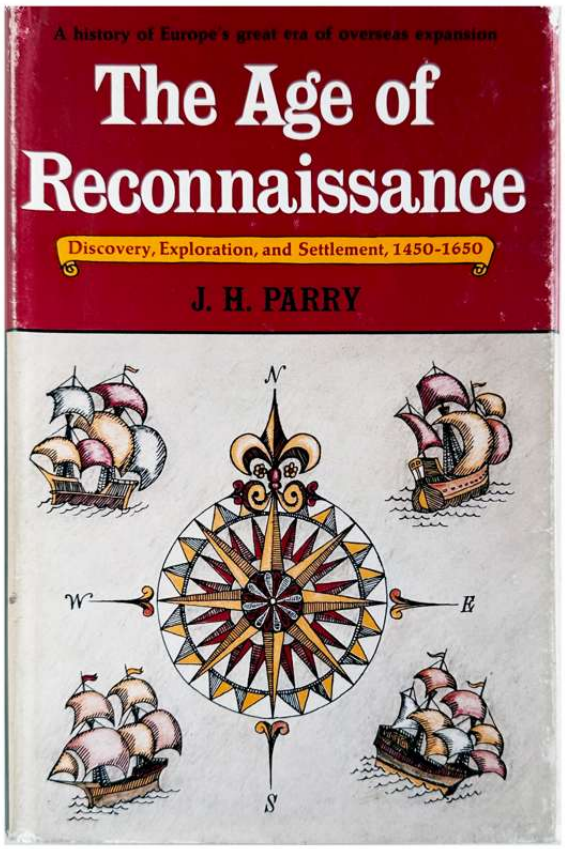
Includes papers by population geneticist Francesco Cavalli-Sforza (1950-), architectural historian Cesare de Seta (1941-), professor of the history of

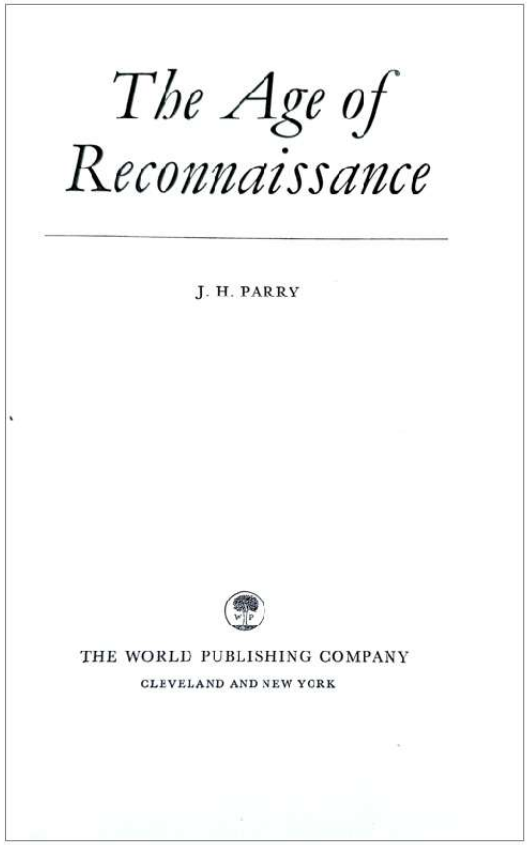
science Robert Marc Friedman (1949-), Carla Giovannini, and economist Andrea Segrè (1961-).

Giuliano Pancaldi is an Italian historian of science. Pancaldi is Professor of the History of Science, retired, at the University of Bologna. His books include: *Darwin in Italy: Science across Cultural Frontiers. Volta: Science and Culture in the Age of Enlightenment.*



366. **PARKE, Nathan Grier**, III. *Guide to the Literature of Mathematics and Physics Including Related Works on Engineering Science*. New York: McGraw-Hill, 1947. ¶ FIRST EDITION, second impression. 8vo. xv, [1], 205 pp. Indices. Gilt-stamped double-ruled navy cloth. Ownership signature (R. Priest). Near Fine. S11213 $ 15

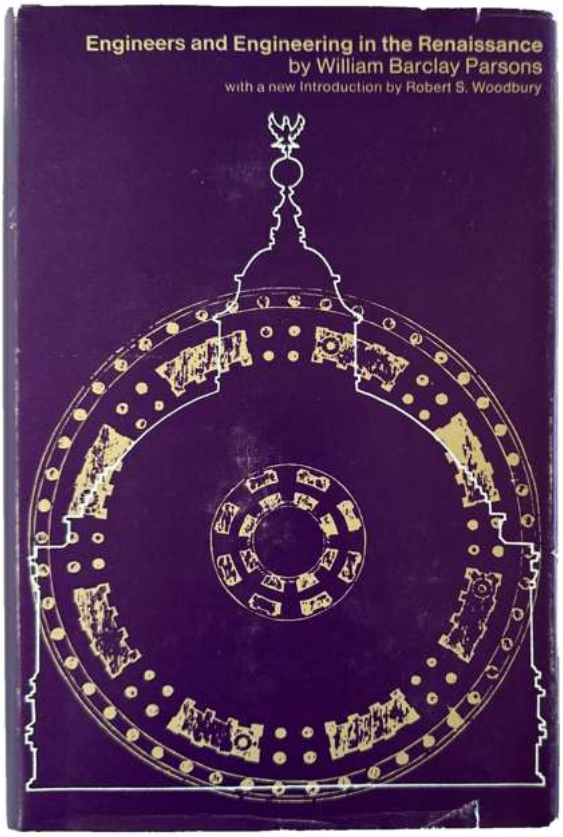


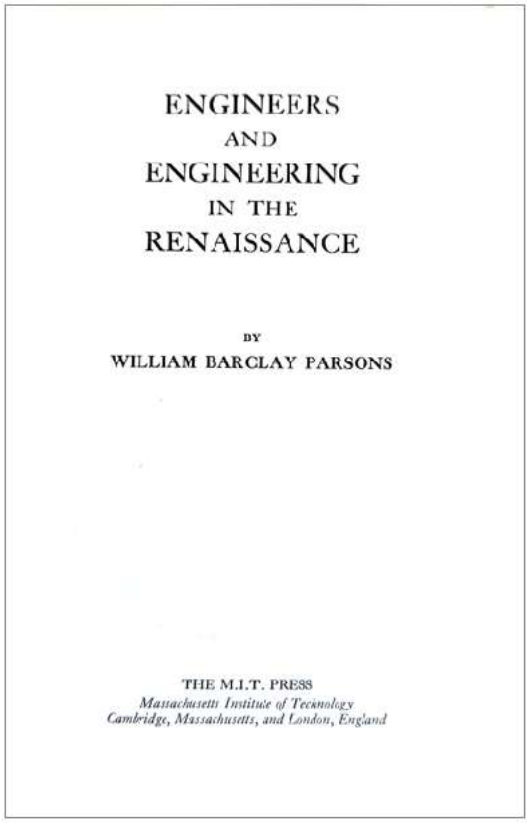


367. **PARRY, J. H**. (**John Horace**). *The age of reconnaissance*. Cleveland & New York: World Publishing, (1963). ¶ Series: *The World Histories of Civilization*. 248 x 162 mm. 8vo. xv, 364 pp. 80 illus. on plates, 5 maps, index. White cloth, dust-jacket; inner hinge cracked, jacket rubbed. Ownership signatures on front free end-paper and on page xv. Very good. S2260

$ 15

This work outlines the story of European geographical exploration, trade and settlement outside Europe in the fifteenth, sixteenth and seventeenth centuries; defines the factors which stimulated expansion and made it possible; and briefly describes the consequences which followed.

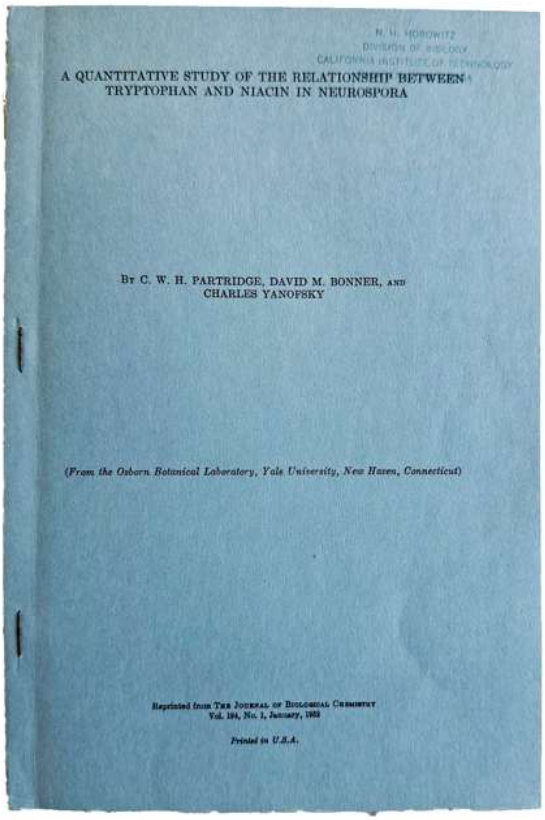


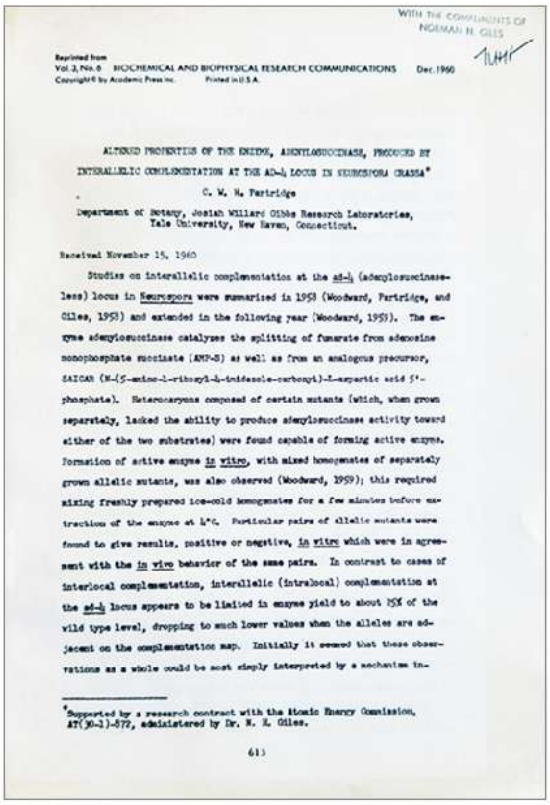


368. **PARSONS, William Barclay** (1859-1932). *Engineers and Engineering in the Renaissance*. Cambridge: MIT Press, 1967. ¶ 240 x 157 mm. 8vo. xx, 661 pp. 211 figs., tables, index. Orange cloth, purple & black dust jacket; jacket worn, top edge stained. Very good. S6540

$ 20

Reprinted from the 1939 edition. Parsons passed away in 1932 and the book was actually first printed in 1939, 7 years after his death. It is said it was published in a small edition. This was the only history of Engineering until the more comprehensive Charles Singer, *History of technology*, (5 vols.), 1954-58. The reviewer found the book biased, still it must have some interest as it is: a first printed history of this area. The reviewer also points out that the MIT editors made "significant deletions" from the original text to avoid some errors, including the first two chapters. He also concludes with saying the book has merit, noting it is an unfinished work, notable for its illustrations, long quotes in English from primary sources, 'an engineer's appreciation and analysis of Leonardo da Vinci, canal construction, certain bridges, two domes, etc.





369. **PARTRIDGE, C. W. H**. [Group of 5 offprints]. Includes: **PARTRIDGE**, **David M. BONNER** (1916-1964), & **Charles YANOFSKY** (1925-2018). "*A Quantitative Study of the Relationship Between Tryptophan and Niacin in Neurospora*." Offprint from: Journal of Biological Chemistry, vol. 194, no. 1, 1952. ¶ 8vo. 269-278 pp. Printed wrappers. Ownership rubber stamp of Norman Horowitz. FINE. S8375

$ 100

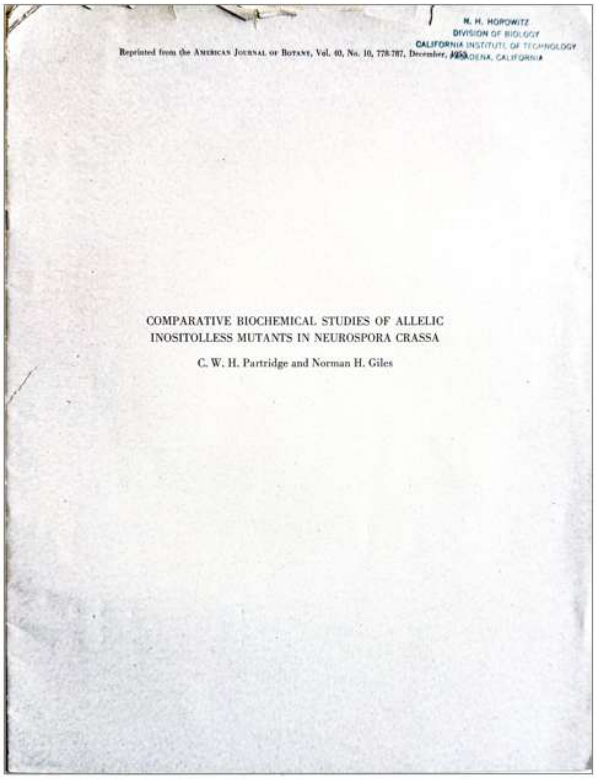
C. W. H. [Chester] Partridge was a researcher from Yale University, contributing to research in Neurospora and its genetics, particularly the relationship between tryptophan and niacin. He published on adenylosuccinase enzyme properties and made contributions to the understanding of the biochemical pathways in the fungus Neurospora crassa.

Charles Yanofsky, Stanford University, was a pioneer geneticist who "showed that suppressor mutations result in the reappearance of an enzyme that has been missing from a mutant organism." McGraw-Hill, *Modern Men of Science*, p.

621. He carried out numerous studies of tryptophan and Neurospora crassa, and made significant contributions to the science of genetics.

David Mahlon Bonner, Yanofsky's teacher, was also an accomplished geneticist who worked extensively on the subject at Yale.

PROVENANCE: Norman Horowitz was a pioneer Caltech geneticist.

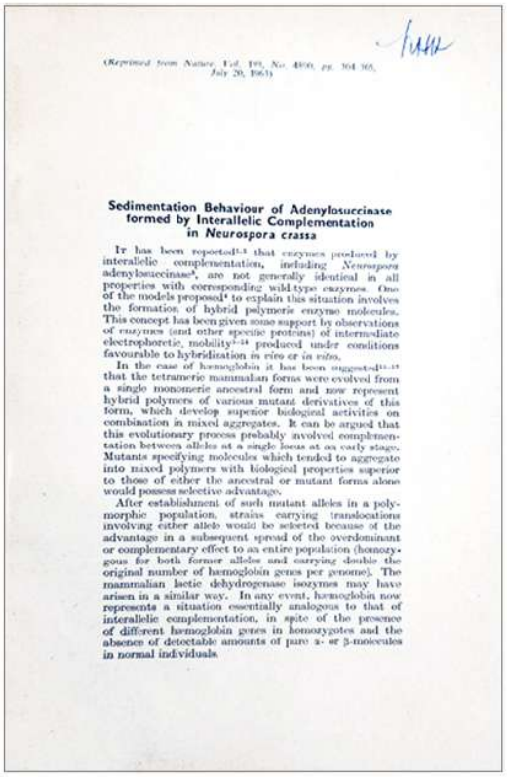


N. H. HOROWITZ
DIVISION OF BIOLOGY
CALIFORNIA INSTITUTE OF TECHNOLOGY
PASADENA, CALIFORNIA

Reprinted from the AMERICAN JOURNAL OF BOTANY, Vol. 40, No. 10, 778-787, December, 1953

COMPARATIVE BIOCHEMICAL STUDIES OF ALLELIC INOSITOLLESS MUTANTS IN NEUROSPORA CRASSA

C. W. H. Partridge and Norman H. Giles



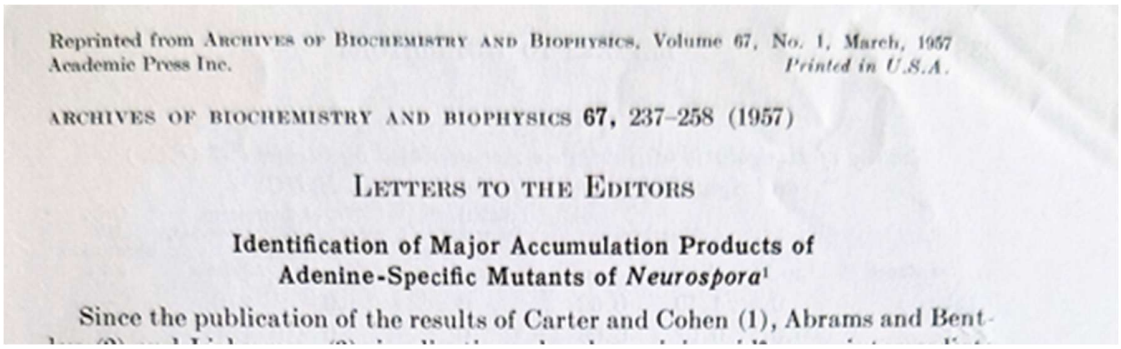
(Reprinted from Nature, Vol. 199, No. 4890, pp. 304-305, July 20, 1963)

Sedimentation Behaviour of Adenylosuccinase formed by Interallelic Complementation in *Neurospora crassa*

It has been reported[1-3] that enzymes produced by interallelic complementation, including *Neurospora* adenylosuccinase[4], are not generally identical in all properties with corresponding wild-type enzymes. One of the models proposed[4] to explain this situation involves the formation of hybrid polymeric enzyme molecules. This concept has been given some support by observations of enzymes (and other specific proteins) of intermediate electrophoretic mobility[5-14] produced under conditions favourable to hybridization *in vivo* or *in vitro*.

In the case of haemoglobin it has been suggested[15-17] that the tetrameric mammalian forms were evolved from a single monomeric ancestral form and now represent hybrid polymers of various mutant derivatives of this form, which develop superior biological activities on combination in mixed aggregates. It can be argued that this evolutionary process probably involved complementation between alleles at a single locus at an early stage. Mutants specifying molecules which tended to aggregate into mixed polymers with biological properties superior to those of either the ancestral or mutant forms alone would possess selective advantage.

After establishment of such mutant alleles in a polymorphic population, strains carrying translocations involving either allele would be selected because of the advantage in a subsequent spread of the overdominant or complementary effect to an entire population (homozygous for both former alleles and carrying double the original number of haemoglobin genes per genome). The mammalian lactic dehydrogenase isozymes may have arisen in a similar way. In any event, haemoglobin now represents a situation essentially analogous to that of interallelic complementation, in spite of the presence of different haemoglobin genes in homozygotes and the absence of detectable amounts of pure α- or β-molecules in normal individuals.



Reprinted from ARCHIVES OF BIOCHEMISTRY AND BIOPHYSICS, Volume 67, No. 1, March, 1957
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ARCHIVES OF BIOCHEMISTRY AND BIOPHYSICS **67**, 237–258 (1957)

LETTERS TO THE EDITORS

Identification of Major Accumulation Products of Adenine-Specific Mutants of *Neurospora*[1]

Since the publication of the results of Carter and Cohen (1), Abrams and Bent-

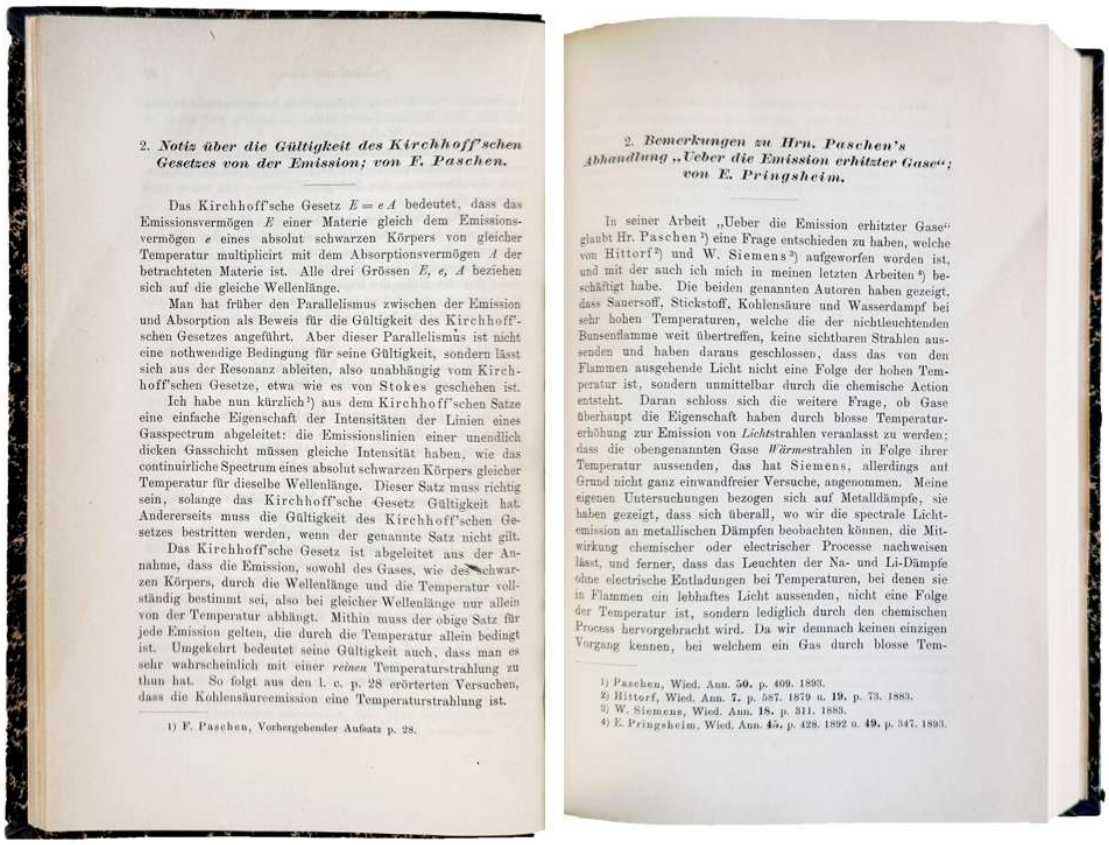
WITH: **PARTRIDGE**, & **Norman Henry GILES** (1915-2006). "*Identification of Major Accumulation Products of Adenine-Specific Mutants of Neurospora*." Offprint from: Archives of Biochemistry and Biophysics, vol. 67, no. 1, 1957. 8vo. 237-238 pp. Single leaf.

Norman H. Giles "was a pioneer in the fields of radiation cytology and fungal genetics. His early studies were on microsporogenesis and chromosome aberrations in *Tradescantia*. His first use of Neurospora crassa as an experimental organism was in reversion analyses of inositol mutants. This followed the work of Beadle and Tatum, who dealt with reversion of nutritional mutants. Subsequently, a number of important papers by Giles followed, including contributions on intragenic complementation, gene conversion, and analysis of gene clusters. He made particularly significant contributions to our molecular understanding of regulation of the genes of biochemical pathways in microorganisms, especially Neurospora crassa." – Mary E. Case & Frederick J. De Serres, *Biographical Memoirs*: Volume 91 (2009) Chapter: NORMAN HENRY GILES. National Academies of Sciences, Engineering, and Medicine. 2009. Biographical Memoirs: Volume 91.

WITH: **PARTRIDGE**. "*Altered Properties of the Enzyme, Adenylosuccinase, Produced by Interallelic Complementation at the AD-4 Locus in Neurospora Crassa.*" Offprint from: Biochemical and Biophysical Research Communications, vol. 3, no. 6, 1960. 8vo. 613-619 pp. Figs. Self-wraps. Signature of Horowitz, rubber stamp of Norman H. Giles.

WITH: **PARTRIDGE** & **GILES**. "*Sedimentation Behaviour of Adenylosuccinase Formed by Interallelic Complementation in Neurospora Crassa*." Offprint from: Nature, vol. 199, no. 4890, 1963. 8vo. 304-305 pp. Self-wraps. Initials of Horowitz.

WITH: **PARTRIDGE** & **GILES**. "*Comparative Biochemical Studies of Allelic Inositolless Mutants in Neurospora Crassa*." Offprint from: American Journal of Botany, vol. 40, no. 10, 1953. 8vo. 778-787 pp. Figs. Printed wrappers; extremities chipped.



2. *Notiz über die Gültigkeit des Kirchhoff'schen Gesetzes von der Emission; von F. Paschen.*

Das Kirchhoff'sche Gesetz $E = eA$ bedeutet, dass das Emissionsvermögen E einer Materie gleich dem Emissionsvermögen e eines absolut schwarzen Körpers von gleicher Temperatur multiplicirt mit dem Absorptionsvermögen A der betrachteten Materie ist. Alle drei Grössen E, e, A beziehen sich auf die gleiche Wellenlänge.

Man hat früher den Parallelismus zwischen der Emission und Absorption als Beweis für die Gültigkeit des Kirchhoff'schen Gesetzes angeführt. Aber dieser Parallelismus ist nicht eine nothwendige Bedingung für seine Gültigkeit, sondern lässt sich aus der Resonanz ableiten, also unabhängig vom Kirchhoff'schen Gesetze, etwa wie es von Stokes geschehen ist.

Ich habe nun kürzlich[1]) aus dem Kirchhoff'schen Satze eine einfache Eigenschaft der Intensitäten der Linien eines Gasspectrum abgeleitet: die Emissionslinien einer unendlich dicken Gasschicht müssen gleiche Intensität haben, wie das continuirliche Spectrum eines absolut schwarzen Körpers gleicher Temperatur für dieselbe Wellenlänge. Dieser Satz muss richtig sein, solange das Kirchhoff'sche Gesetz Gültigkeit hat. Andererseits muss die Gültigkeit des Kirchhoff'schen Gesetzes bestritten werden, wenn der genannte Satz nicht gilt.

Das Kirchhoff'sche Gesetz ist abgeleitet aus der Annahme, dass die Emission, sowohl des Gases, wie des schwarzen Körpers, durch die Wellenlänge und die Temperatur vollständig bestimmt sei, also bei gleicher Wellenlänge nur allein von der Temperatur abhängt. Mithin muss der obige Satz für jede Emission gelten, die durch die Temperatur allein bedingt ist. Umgekehrt bedeutet seine Gültigkeit auch, dass man es sehr wahrscheinlich mit einer *reinen* Temperaturstrahlung zu thun hat. So folgt aus den l. c. p. 28 erörterten Versuchen, dass die Kohlensäureemission eine Temperaturstrahlung ist.

1) F. Paschen, Vorhergehender Aufsatz p. 28.

2. *Bemerkungen zu Hrn. Paschen's Abhandlung „Ueber die Emission erhitzter Gase"; von E. Pringsheim.*

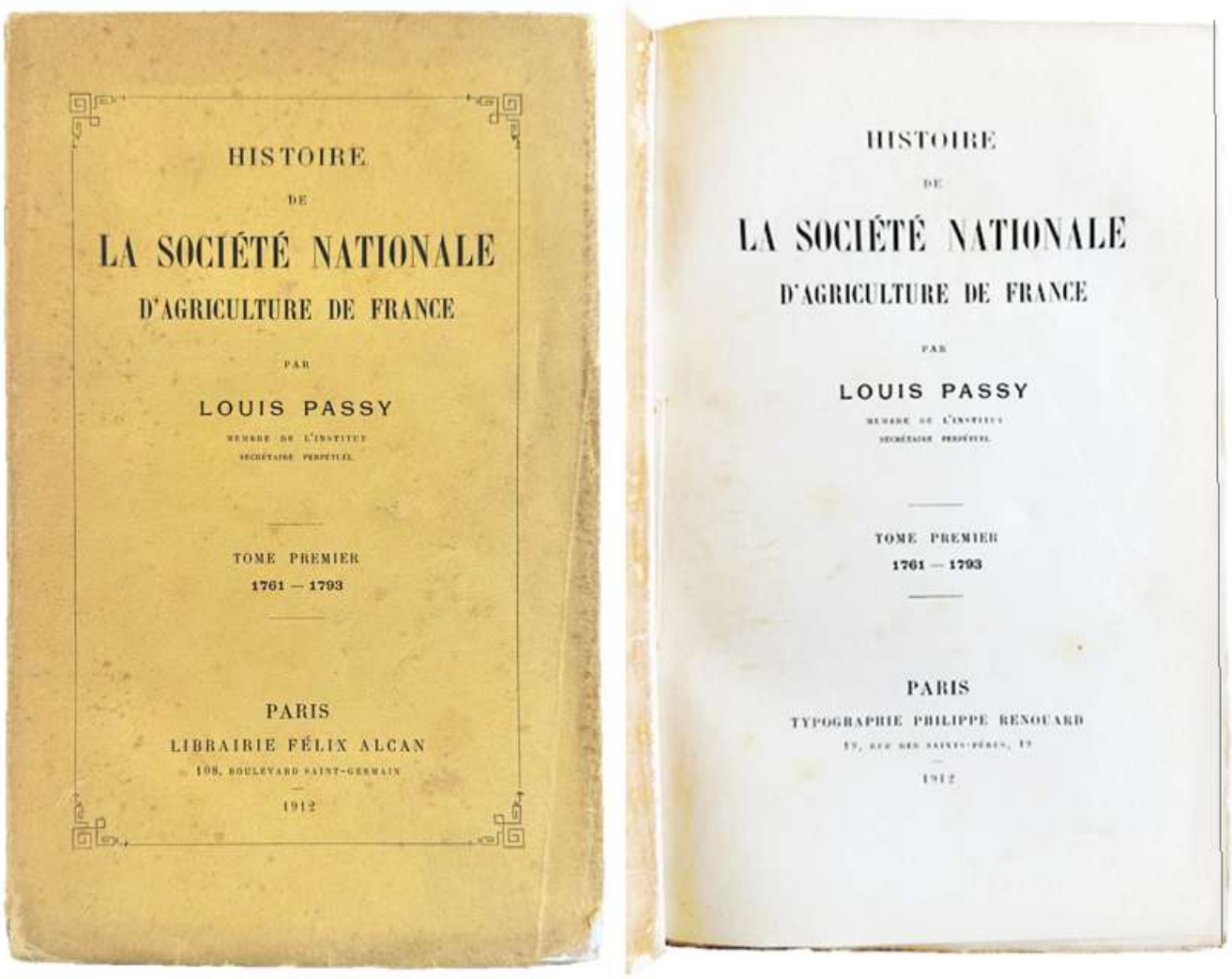
In seiner Arbeit „Ueber die Emission erhitzter Gase" glaubt Hr. Paschen[1]) eine Frage entschieden zu haben, welche von Hittorf[2]) und W. Siemens[3]) aufgeworfen worden ist, und mit der auch ich mich in meinen letzten Arbeiten[4]) beschäftigt habe. Die beiden genannten Autoren haben gezeigt, dass Sauerstoff, Stickstoff, Kohlensäure und Wasserdampf bei sehr hohen Temperaturen, welche die der nichtleuchtenden Bunsenflamme weit übertreffen, keine sichtbaren Strahlen aussenden und haben daraus geschlossen, dass das von den Flammen ausgehende Licht nicht eine Folge der hohen Temperatur ist, sondern unmittelbar durch die chemische Action entsteht. Daran schloss sich die weitere Frage, ob Gase überhaupt die Eigenschaft haben durch blosse Temperaturerhöhung zur Emission von *Licht*strahlen veranlasst zu werden; dass die obengenannten Gase *Wärme*strahlen in Folge ihrer Temperatur aussenden, das hat Siemens, allerdings auf Grund nicht ganz einwandfreier Versuche, angenommen. Meine eigenen Untersuchungen bezogen sich auf Metalldämpfe, sie haben gezeigt, dass sich überall, wo wir die spectrale Lichtemission an metallischen Dämpfen beobachten können, die Mitwirkung chemischer oder electrischer Processe nachweisen lässt, und ferner, dass das Leuchten der Na- und Li-Dämpfe ohne electrische Entladungen bei Temperaturen, bei denen sie in Flammen ein lebhaftes Licht aussenden, nicht eine Folge der Temperatur ist, sondern lediglich durch den chemischen Process hervorgebracht wird. Da wir demnach keinen einzigen Vorgang kennen, bei welchem ein Gas durch blosse Tem-

1) Paschen, Wied. Ann. **50.** p. 409. 1893.
2) Hittorf, Wied. Ann. **7.** p. 587. 1879 u. **19.** p. 73. 1883.
3) W. Siemens, Wied. Ann. **18.** p. 311. 1883.
4) E. Pringsheim, Wied. Ann. **45.** p. 428. 1892 u. **49.** p. 347. 1893.

370. **PASCHEN, Louis Carl Heinrich Friedrich** (1865-1947). "*Ueber die Emission der Gase.*" with: "*Notiz uber die Gultigkeit des Kirchhoff'schen Gesetzes von der Emission.*" with: **PRINGSHEIM, Ernst** (1850-1941). "*Bemerkungen zu Hrn. Paschen's Abhandlung 'Ueber die Emission erhitzter Gase.'*" In: *Annalen der Physik und Chemie*, Neue Folge, Vol. 51, 1894. Leipzig: Johann Ambrosius Barth (Arthur Meiner), 1894. ¶ 8vo. Pages (1)-39; (40)-46; (441)-447. [Entire volume: viii, 760 pp.] 1 fig., 3 tables, 1 fig. on plate I. Quarter cloth, cloth tips, paste-paper over boards, gilt spine. Blind-stamp of the Carnegie Institution of Washington, Solar Observatory. Fine. S6375

$ 100

FIRST EDITION. "Friedrich Paschen, 'probably the greatest experimental spectroscopist of his time,' . . . investigated the much mooted question of whether heat alone could bring gases to radiate, demonstrating - in contrast with the results of Ernst Pringsheim - the existence of infrared spectral lines produced by merely heating the gas." DSB, X. DSB, X, pp. 345-346; DSB, XI, pp. 148-151.



371. **PASSY, Louis** (1830-1913). *Histoire de la Société Nationale d'Agriculture de France. Tome premier 1761-1793*. Paris : Felix Alcan, 1912. ¶ Small 8vo. 475 pp. Plates. Original yellow printed wrappers. Good. [S14345] $ 25


DEUXIÈME ANNÉE. — N° 12. UN NUMÉRO : 30 CENTIMES. 18 FÉVRIER 1865.

REVUE DES
COURS SCIENTIFIQUES
DE LA FRANCE ET DE L'ÉTRANGER
PHYSIQUE — CHIMIE — ZOOLOGIE — BOTANIQUE — ANATOMIE — PHYSIOLOGIE
GÉOLOGIE — PALÉONTOLOGIE — MÉDECINE

Paraît tous les Samedis.

M. EUG. YUNG
DIRECTEUR

M. ÉMILE ALGLAVE

On s'abonne
A LA LIBRAIRIE GERMER BAILLIÈRE

SOMMAIRE.

Mort de M. Gratiolet. — Académie des sciences.

SOIRÉES SCIENTIFIQUES DE LA SORBONNE. — Histoire de la science.

SOIRÉES SCIENTIFIQUES DE LA SORBONNE. — Chimie.

ÉCOLE DE PHARMACIE. — Botanique.

Paris, 17 février 1865.

Mort de M. Pierre Gratiolet.

C'est avec une profonde douleur que nous annonçons à nos lecteurs la mort presque subite de l'homme de bien, du savant éminent, de l'éloquent professeur qui tenait encore, il y a quelques jours, sous le charme de sa puissante parole, le nombreux et sympathique auditoire de la Sorbonne. M. Gratiolet a succombé hier matin, après quelques heures de souffrance, aux suites d'une attaque d'apoplexie.

La nouvelle de cette perte cruelle a plongé dans la consternation les nombreux amis de cet homme éminent dont la vie si courte, hélas ! a été consacrée tout entière au culte de la famille, de l'amitié et de la science. Nature ardente et enthousiaste, âme généreuse et tendre, intelligence supérieure, admirablement servie par la parole et par la plume, M. Gratiolet laissera d'universels regrets. Puissent ces regrets adoucir quelque peu la cruelle épreuve que traversent en ce jour madame Gratiolet et ses enfants !

Tout entier à la douleur que nous cause cette fin pré-

maturée, nous ne nous sentons pas la force de retracer devant cette tombe qui n'est point encore fermée les titres scientifiques de celui dont nous avons eu le bonheur d'être l'ami. Tout au plus nous sera-t-il possible de rappeler aujourd'hui les grandes étapes de cette vie si noblement remplie et si brusquement éteinte.

Pierre Gratiolet est né à Sainte-Foy (Gironde), le 6 juillet 1815. Son père, médecin distingué, le dirigea vers la carrière qu'il avait lui-même honorablement parcourue. Reçu docteur en 1845, P. Gratiolet, qu'une vocation bien marquée entraînait vers les hautes études d'anatomie comparée, entra comme préparateur au Muséum d'histoire naturelle, L'élève et l'ami de M. de Blainville, il fut chargé pendant les six dernières années de la vie de cet illustre naturaliste de remplacer son maître dans la chaire qu'il occupait au Muséum. Cette suppléance lui donna l'occasion de déployer les brillantes facultés que chacun admirait naguère encore dans cette soirée de la Sorbonne où il devait pour la dernière fois faire entendre les mâles accents de sa voix éloquente. En 1852, M. Gratiolet suppléa Duvernoy au Collége de France. Nommé en 1855 aide-naturaliste au Muséum, il dut attendre jusqu'à ces dernières années la chaire de la Sorbonne, qu'il occupait avec tant d'éclat. La mort l'a frappé au moment où il allait recueillir le prix de ses labeurs : Ainsé de tous ceux qui l'approchèrent, connu des savants du monde entier par ses admirables travaux sur le système nerveux (1) ; libre enfin, grâce à sa position officielle, des préoccupations matérielles qui ne

(1) Voici les titres des principaux travaux de M. Gratiolet :


1865. REVUE DES COURS SCIENTIFIQUES. 199

SOIRÉES SCIENTIFIQUES DE LA SORBONNE.

CONFÉRENCE DE M. PASTEUR

Des fermentations ou du rôle de quelques êtres microscopiques dans la nature.

Nos lecteurs n'ont certainement pas oublié cette belle leçon consacrée l'an dernier, par M. Pasteur, à l'étude des générations dites spontanées, qui a eu un si grand retentissement et a soulevé dans le monde scientifique une polémique si vive (1).

M. Pasteur est mieux qu'un chimiste de profession, c'est un savant passionné pour la science. Sa parole un peu âpre à ses entournures accusées, l'allure décidée et nette qu'affecte le langage des hommes qui se croient en possession de la vérité. On sent, en l'écoutant, qu'il a une foi très-vive dans les idées dont il se constitue le défenseur, et que la lutte ne lui déplaît pas.

Et comme il possède un rare talent d'exposition, qu'il joint à ce mérite si précieux de savoir être clair sur forme vraiment élevée et littéraire, il ne faut pas s'étonner que l'annonce d'une leçon professée par lui attire à la Sorbonne beaucoup plus de monde que le grand amphithéâtre n'en peut contenir.

Ces jours-là, les adversaires de la doctrine des générations spontanées, qui sont évidemment en majorité dans l'assemblée, ne sont jamais bien sûrs de n'avoir pas été placés par une malice du hasard auprès d'un partisan fervent de cette même doctrine.

C'est un attrait plus vif que celui d'une simple curiosité scientifique, qui rend si attentifs tous les membres de cet auditoire d'élite. On sait qu'ils se croisent à la veille d'une de ces batailles courtoises, d'où la science, quel que soit le tainqueur ou le vaincu, sort toujours victorieuse.

L'éminent professeur avait, ce soir-là, choisi pour thème de son enseignement la question des fermentations.

« Tout ce qui vit doit mourir, dit en commençant M. Pasteur, et après la mort, tout se détruit, on meurt, tout se transforme. La vie et la mort sont choses corré-

(1) Voy. le n° 11 de l'année dernière.

latives. Il faut qu'après la mort toutes les matières » constituantes de l'être vivant fassent retour au sol et à » l'air atmosphérique.

« Mais comment ces principes des êtres vivants font-» ils retour au règne minéral ; en d'autres termes, en » quoi consiste ce que, dans le langage ordinaire de la » science, on appelle des noms de fermentation et de » putréfaction ? »

Voilà le problème à résoudre.

Sur le bureau, devant le professeur, au milieu de cet attirail de vases aux formes savamment bizarres qui sont l'accompagnement obligé de toute démonstration chimique, il y a un pot de fleur. Une petite plante parfaitement bien portante et couverte d'une verdure tendre s'y prélasse. Pourquoi est-elle là au milieu de ces ballons de verre et de ces éprouvettes. Qu'a-t-elle donc de particulier ? Presque rien ! Le vase dans lequel elle est placée a été rempli de sable rendu stérile par la calcination. On a déposé dans ce sable une graine. Cette graine, on l'a arrosée avec de l'eau distillée, c'est-à-dire ne contenant, non plus que le sable, un atome de matière organique. Et la graine est devenue la jolie plante que tous voyez, et cette plante a grandi, elle a suivi toutes les phases d'un développement régulier. Elle arrivera à produire des graines fécondes. De quoi vit-elle donc ? Eh bien ! elle vit, comme en dit, de l'air du temps. Et maintenant, que prouve ce singulier phénomène ? C'est que le grand réservoir où la vie des végétaux s'alimente, c'est l'atmosphère. C'est que toutes les matières organiques qui entrent dans la composition des végétaux ne sont que des combinaisons des principes élémentaires de l'air atmosphérique, et que, sauf la partie minérale, qui, après la mort retourne au sol, les tissus des plantes ne contiennent que de l'hydrogène, de l'oxygène, de l'azote et du charbon. Puis, comme les animaux, qu'ils vivent de plantes ou soient carnivores, ne se nourrissent en définitive que de produits du règne végétal, il en résulte qu'il en est de même des solides et des liquides dont leur corps est formé. « Donc, conclut le professeur, la vie est » la mise en œuvre des gaz de l'atmosphère, et consiste » dans le passage de ces gaz à l'état solide et à l'état li-» quide.

« Vivre, c'est en quelque sorte soustraire des gaz à » l'atmosphère, et les organiser en substances solides et » liquides. »

Mais s'il en est ainsi, s'il est vrai que l'atmosphère soit la source commune où tous les êtres organisés puisent la vie, comment se fait-il que depuis ces époques si lointaines où la terre était habitée par des tacrs d'animaux et de végétaux gigantesques, jusqu'à l'homme présent, cette source ne soit pas encore tarie, qu'elle ne semble pas près de se tarir encore ? C'est qu'elle trouve dans la mort, et dans la dissolution qui l'accompagne et qui la suit, un moyen de réparer ses pertes, c'est que tout ce qui a vécu retourne à l'atmosphère !

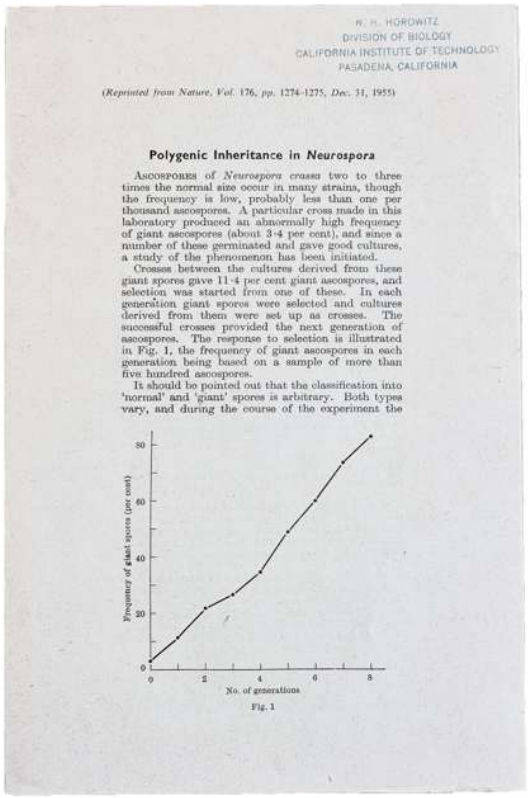
Comment la nature s'y prend-elle, après avoir trans-

372. **PASTEUR, Louis** (1822-1895). "*Des Fermentations, ou du rôle de quelques êtres microscopiques dans la nature.*" [Paris]: Revue des Cours Scientifiques de la France . . ., 1865. ¶ Series: Revue des Cours Scientifiques de la France et de L'Etranger, Deuxième Année, no. 12, 1865. 4to. 275 x 202 mm. pp. 199-202. [Entire issue: (189)-204 pp.] Self-wraps. Fine. S6144

$ 90

This article is a brief notice of a public discussion at an evening meeting of the Sorbonne conducted by Pasteur on the subject of spontaneous generation. It is reported by Monsieur Danicourt. It was not until thirty years after the researches of Charles Cagniard de la Tour (1777-1859), Theodor Schwann (1810-1882), and Friedrich Kutzing (1807-1893), that Louis Pasteur finally provided experimental proof for the actions of yeast in the fermentation process and finally laid to rest the theory of spontaneous generation.

Additionally there is a lengthy paper on **Sir Isaac Newton**, contributed at the Conference of M. Bertrand, "*Newton, sa vie et ses travaux.*" (pp. 190+).



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(Reprinted from Nature, Vol. 176, pp. 1274–1275, Dec. 31, 1955)

Polygenic Inheritance in *Neurospora*

Ascospores of *Neurospora crassa* two to three times the normal size occur in many strains, though the frequency is low, probably less than one per thousand ascospores. A particular cross made in this laboratory produced an abnormally high frequency of giant ascospores (about 3·4 per cent), and since a number of these germinated and gave good cultures, a study of the phenomenon has been initiated.

Crosses between the cultures derived from these giant spores gave 11·4 per cent giant ascospores, and selection was started from one of these. In each generation giant spores were selected and cultures derived from them were set up as crosses. The successful crosses provided the next generation of ascospores. The response to selection is illustrated in Fig. 1, the frequency of giant ascospores in each generation being based on a sample of more than five hundred ascospores.

It should be pointed out that the classification into 'normal' and 'giant' spores is arbitrary. Both types vary, and during the course of the experiment the

Fig. 1

BACK-MUTATION STUDIES AT THE *AM* LOCUS IN *NEUROSPORA CRASSA**

By J. A. PATEMAN

Department of Genetics, University of Sheffield

(*Received* 2 *October* 1956)

Introduction

A number of independently induced ammonium-deficient, mutant strains of *Neurospora crassa* are known which require a source nitrogen for normal growth. These strains are due to mutation at a single gene locus designated *am*, and lack detectable glutamic dehydrogenase activity (Fincham, 1950, 1951, 1954). Back-mutant wild-types were obtained from these *am* strains after irradiation by ultra-violet light. The irradiation experiments and the genetical and biochemical investigation of these induced wild-types are described in this paper.

Materials and methods

Derivation of experimental strains

The *am* and wild-type strains used have complicated pedigrees, but all with the possible exception of the St Lawrence wild-type were derived originally from the Abbot and/or the Lindegren wild-types. The wild-type St Lawrence *A* (St.L. *A*) which was obtained from Dr D. Newmeyer is probably also derived to a large extent from the Abbot and Lindegren wild-types. The *am* strains 32213 and 47305 were induced by Beadle & Tatum (1945) using ultra-violet light as the mutagenic agent. The *am* strain 8 2929 was induced by Barrett at Stanford, using 20-methyl-cholanthrene as the mutagen. For the sake of brevity the following notation will be used for *am* strains. If a strain carries an *am* allele derived from 32213 the strain number will be followed by the symbol am^{32}, e.g. F.1111-78-am^{32} and similarly for 47305 and 8 2929. Some of the strains used also carried one of the mutations albino, *al*, or aurescent, *au*, which result in effectively non-pigmented conidia. The following is the relevant detailed pedigree of the *am* strains used in the irradiation experiments.

(1) 817-am^{32} *al* was obtained after F.1111-78-am^{32} *al* had been backcrossed for three generations to the stock wild-type 487 *al a*.

(2) 934-am^{32} and 944-am^{32}. Both of these strains were obtained after backcrossing a strain derived from 32213 to the stock wild-type St.L. *A* for three generations.

(3) 826-am^{47} *al* was obtained as the result of backcrossing 481-am^{47} a strain derived from 47305 to the stock wild-type 487 *al a* for three generations.

(4) 933-am^{47} was obtained after backcrossing a strain derived from 47305 to the stock wild-type St.L. *A* for four generations.

* This work formed part of the requirements for the degree of Ph.D. in the University of London and was largely carried out during the tenure of a maintenance allowance from the Department of Scientific and Industrial Research.

373. **PATEMAN, J. A.** [**John Arthur**] (1926-2011). Group of 10 offprints. Includes: **PATEMAN**. "*Polygenic Inheritance in Neurospora*." Offprint from: *Nature*, vol. 176. [London]: Nature, 1955. 8vo. 1274-1275 pp. Fig. Self-wraps. Ownership rubber stamp of Norman Horowitz. FINE. S8698

$ 150

Professor John Arthur Pateman FRS, was a researcher in genetics, contributing to studies on Aspergillus nidulans and Neurospora crassa. He was associated with the Dept. of Genetics, University of Cambridge, the University of Melbourne, and later the University of Sheffield. Pateman published research on the genetic regulation of nitrate reduction in Aspergillus nidulans and the linkage of polygenes in Neurospora crassa. "His earliest contribution to genetics was the discovery (together with John Fincham) of intracistronic complementation, an important phenomenon to understand the relationship of genetic information and protein structure; this at a time when the actual coding relationships of DNA and proteins were not yet worked out. Later on, he and his students made a fundamental contribution to the understanding of control of gene expression in eukaryotic microorganisms, providing some of the

earliest examples of positive control. This work also led to the discovery of a new enzyme cofactor, the only one discovered through purely genetic evidence. He worked at various universities in Britain and Australia and trained a number of students who further developed the subject." [Royal Society]. All of the papers bear the rubber stamp of pioneer Caltech geneticist Norman Horowitz.

PATEMAN. "*Polygenic Inheritance in Neurospora*." Offprint from: *Nature*, vol. 176. 1955. 8vo. 1274-1275 pp. Fig. Self-wraps. Ownership rubber stamp of Norman Horowitz. FINE.

WITH: PATEMAN. "*Back-Mutation Studies at the AM Locus in Neurospora Crassa*." Offprint from: *Journal of Genetics*, vol. 55, no. 3, 1957. 8vo. 444-455 pp. Self-wraps.

WITH: PATEMAN. "*Back-Mutation Studies at the AM Locus in Neurospora Crassa*." Offprint from: *Journal of Genetics*, vol. 55, no. 3, 1957. 8vo. 444-455 pp. Self wraps.

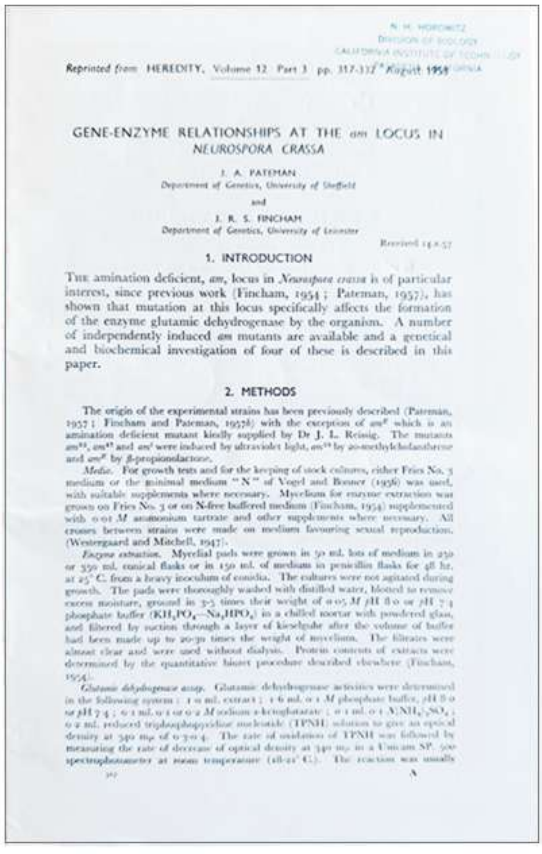
Aberrant Recombination at the *am* Locus in *Neurospora crassa*

A NUMBER of independently induced mutant alleles are known at the 'amination-deficient' locus in *N. crassa*. Previous work with four different *am* mutants, designated am^{39}, am^{53}, am^{47} and am^{6} has shown that certain combinations of these *am* alleles in pairs in heterocaryons were complementary[1,2]. In addition, apparently true wild-type ascospores were found in low frequency in the progeny of most crosses between strains which carried non-complementary *am* alleles.

The frequencies of wild-type production by various crosses between non-complementary *am* alleles were not easily explained in terms of recombination due to crossing-over of the classical type. Consequently, it was decided to repeat the cross between the pair of *am* alleles which gave the highest frequency of wild-types ($am^{39} \times am^{47}$), with marker genes on each side of the *am* locus. The markers used were the inositol-less strain 37401, and a morphological mutant known as 'spray'. The mutant spray was kindly supplied by Dr. R. W. Barrett (Dartmouth College, United States), who also located the *am* locus in chromosome V. The inositol locus is about 2-3 cM. distal to *am*, while spray is about 5-8 cM. distant from *am* proximal to the centromere. Two types of cross were set up, *sp* $am^{47} \times am^{39}$ *inos* and *sp* $am^{39} \times am^{47}$ *inos*, and the ascospores plated on a selective medium. Any wild-type colonies which appeared were transferred and classified for the markers *sp* and *inos*. The results are given in Table 1, the first three lines of

Table 1. WILD-TYPE 'RECOMBINANTS' FROM *am* × *am* CROSSES

Cross	Genotypes				No. of wild-types	No. of live ascospores in thousands
	sp + +	+ + +	*sp* + *inos*	+ + *inos*		
$am^{39} \times am^{47}$	—	—	—	—	0	585
$am^{47} \times am^{47}$	—	—	—	—	0	465
$am^{39} \times am^{53}$	—	—	—	—	14	861
sp am^{47} +	—	—	—	—	0	209
am^{47} *inos*						
sp am^{39} +	9	0	8	7	24	1,314
am^{47} *inos*						
sp am^{47} +	17	0	6	0	23	1,549
am^{39} *inos*						



Reprinted from HEREDITY, Volume 12 Part 3 pp. 317-337 August 1958

GENE-ENZYME RELATIONSHIPS AT THE *am* LOCUS IN *NEUROSPORA CRASSA*

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and
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Department of Genetics, University of Leicester

Received 14.x.57

1. INTRODUCTION

THE amination deficient, *am*, locus in *Neurospora crassa* is of particular interest, since previous work (Fincham, 1954; Pateman, 1957), has shown that mutation at this locus specifically affects the formation of the enzyme glutamic dehydrogenase by the organism. A number of independently induced *am* mutants are available and a genetical and biochemical investigation of four of these is described in this paper.

2. METHODS

The origin of the experimental strains has been previously described (Pateman, 1957; Fincham and Pateman, 1957*b*) with the exception of am^{6} which is an amination deficient mutant kindly supplied by Dr J. L. Reissig. The mutants am^{53}, am^{47} and am^{2} were induced by ultraviolet light, am^{39} by 10-methylchloranthrene and am^{6} by β-propiolactone.

Media. For growth tests and for the keeping of stock cultures, either Fries No. 3 medium or the minimal medium "N" of Vogel and Bonner (1956) was used, with suitable supplements where necessary. Mycelium for enzyme extraction was grown on Fries No. 3 or on N-free buffered medium (Fincham, 1954) supplemented with 0·01 *M* ammonium tartrate and other supplements where necessary. All crosses between strains were made on medium favouring sexual reproduction, (Westergaard and Mitchell, 1947).

Enzyme extraction. Mycelial pads were grown in 50 ml. lots of medium in 250 or 550 ml. conical flasks or in 150 ml. of medium in penicillin flasks for 48 hr. at 25° C. from a heavy inoculum of conidia. The cultures were not agitated during growth. The pads were thoroughly washed with distilled water, blotted to remove excess moisture, ground in 3·5 times their weight of 0·05 *M* pH 8·0 or pH 7·4 phosphate buffer (KH_2PO_4—Na_2HPO_4) in a chilled mortar with powdered glass, and filtered by suction through a layer of kieselguhr after the volume of buffer had been made up to 20-30 times the weight of mycelium. The filtrates were almost clear and were used without dialysis. Protein contents of extracts were determined by the quantitative biuret procedure described elsewhere (Fincham, 1954).

Glutamic dehydrogenase assay. Glutamic dehydrogenase activities were determined in the following system: 1·0 ml. extract; 1·6 ml. 0·1 *M* phosphate buffer, pH 8·0 or pH 7·4; 0·1 ml. 0·1 or 0·2 *M* sodium α-ketoglutarate; 0·1 ml. 0·1 *N* NH_4Cl; 0·2 ml. reduced triphosphopyridine nucleotide (TPNH) solution to give an optical density at 340 mμ of 0·30-0·4. The rate of oxidation of TPNH was followed by measuring the rate of decrease of optical density at 340 mμ in a Unicam SP. 500 spectrophotometer at room temperature (18-21° C.). The reaction was usually

WITH: PATEMAN. "*Aberrant Recombination at the am Locus in Neurospora Crassa*." Offprint from: *Nature*, vol. 181, 1958. 8vo. 1605-1606 pp. Self wraps.

WITH: PATEMAN, & J. R. S. FINCHAM. "*Gene-Enzyme Relationships at the AM Locus in Neurospora Crassa*." Offprint from: *Heredity*, vol. 12, part 3, 1958. 8vo. 317-332 pp. Self wraps. [John Robert Stanley Fincham FRS FRSE (1926-2005) was a noted British geneticist who made important contributions to biochemical genetics and microbial genetics.]

WITH: PATEMAN. "*The Effect of Selection on Ascospore Size in Neurospora Crassa*." Offprint from: *Heredity*, vol. 13, part 1, 1959. 8vo. 1-12 pp. Self wraps.

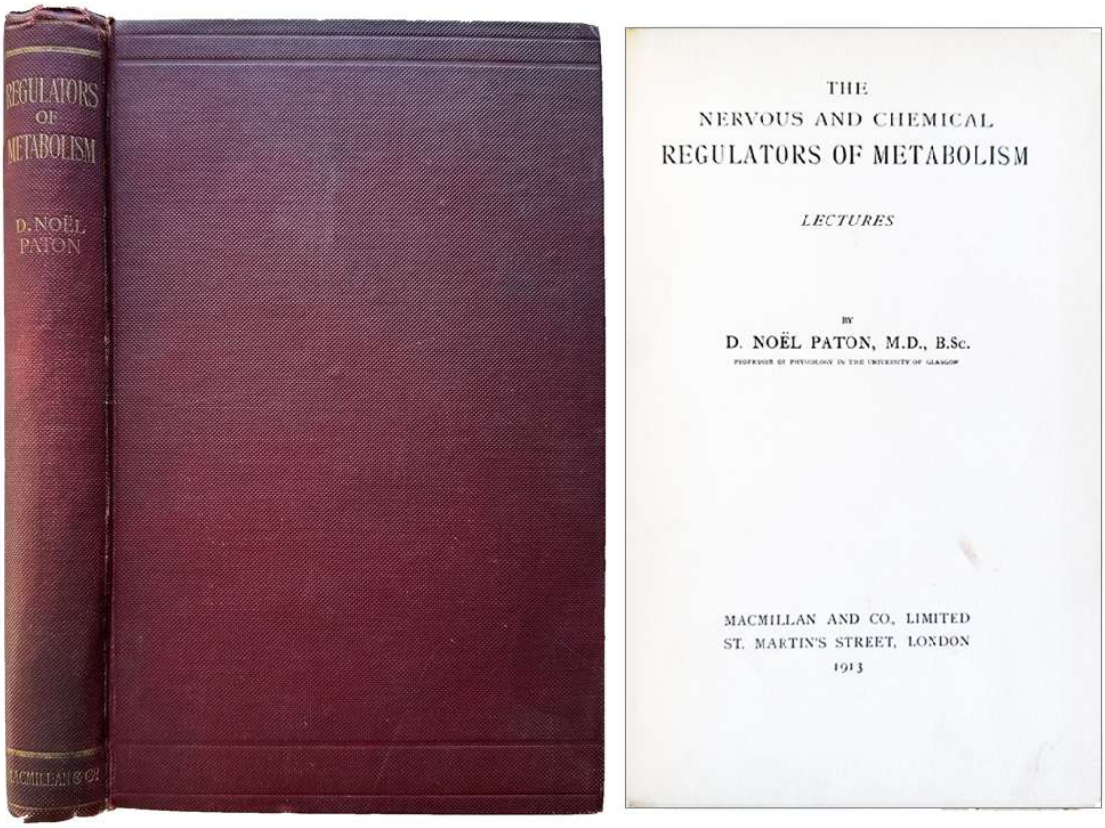
WITH: PATEMAN, & B. T. O. LEE. "*Linkage of Polygenes Controlling Size of Ascospore in Neurospora Crassa*." Offprint from: *Nature*, vol. 183, 1959. 8vo. 698-699 pp. Single leaf.

WITH: PATEMAN. "*High negative Interference at the AM Locus in Neurospora Crassa*." Offprint from: *Journal of Genetics*, vol. 45, no. 7, 1960. 8vo. 839-846 pp. Self wraps.

WITH: PATEMAN. "*Inter-Relationships of Alleles at the AM Locus in Neurospora Crassa*." Offprint from: *J. Gen Microbiol.*, vol. 23, 1960. 8vo. 393-399 pp. Self wraps.

WITH: PATEMAN, & R. R. BURK. "*Glutamic and Alanine Dehydrogenase Determined by One Gene in Neurospora Crassa*." Offprint from: *Nature*, vol. 196, 1962. 8vo. 450-457 pp. Self wraps.

WITH: PATEMAN, & D. J. COVE. "*Independently Segregating Genetic Loci Concerned with Nitrate Reductase Activity in Aspergillus Nidulans*." Offprint from: *Nature*, vol. 198, 1963. 8vo. 262-263 pp. Self wraps.



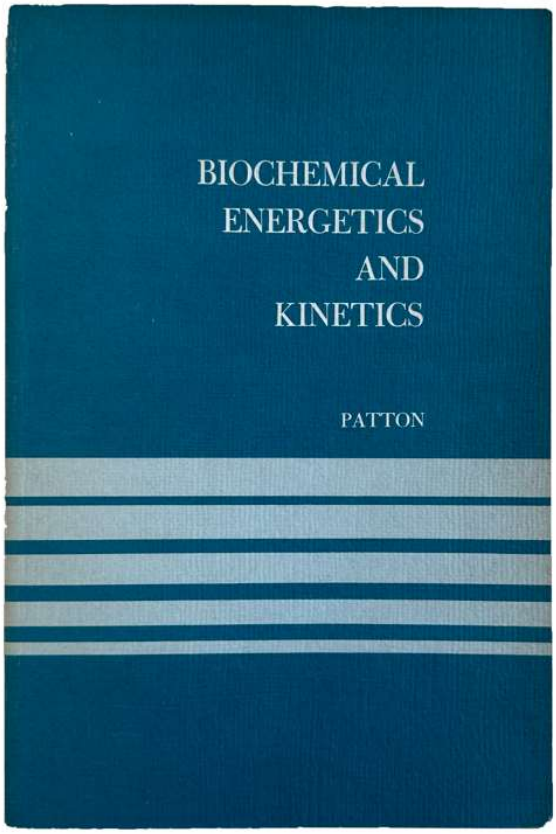
Futcher's copy

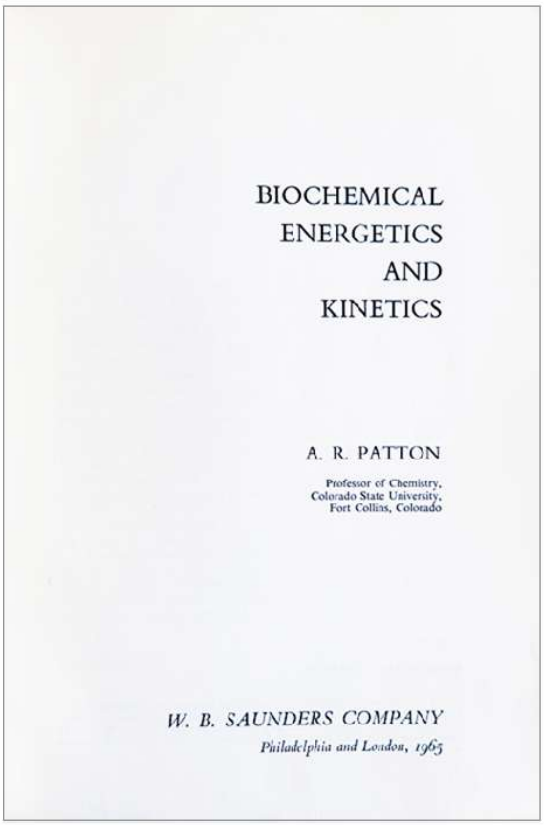
374. **PATON, D. Noël** (1859-1928). *The Nervous and Chemical Regulators of Metabolism*. London: Macmillan, 1913. ¶ FIRST EDITION. 8vo. x, 217 pp. Maroon cloth, gilt-stamped spine title; extremities lightly rubbed. Ownership signature of Thomas B. Futcher, MD (1871-1938). Very good. S10062

$ 25

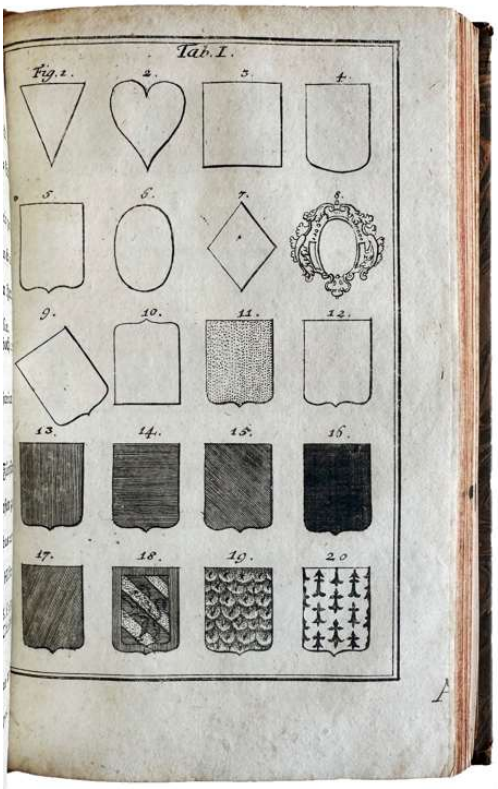
Diarmid Noël Paton, known as Noël Paton, was a Scottish physician and academic. From 1906 to 1928, he was the Regius Professor of Physiology at the University of Glasgow.

PROVENANCE NOTE: Thomas B. Futcher, MD was Sir William Osler's assistant resident physician in medicine at Johns Hopkins Hospital.





375. **PATTON, A. R**. *Biochemical Energetics and Kinetics*. Philadelphia: W. B. Saunders, 1965. ¶ FIRST EDITION. 8vo. vi, 116 pp. Figs., index. Printed wrappers; spine ends slightly rubbed, else fine. Ink ownership signature of Norman Horowitz. Fine. S7791 $ 6


Tab. I.
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Tab. XX.
Gräfft. Podevillsche
Wappen

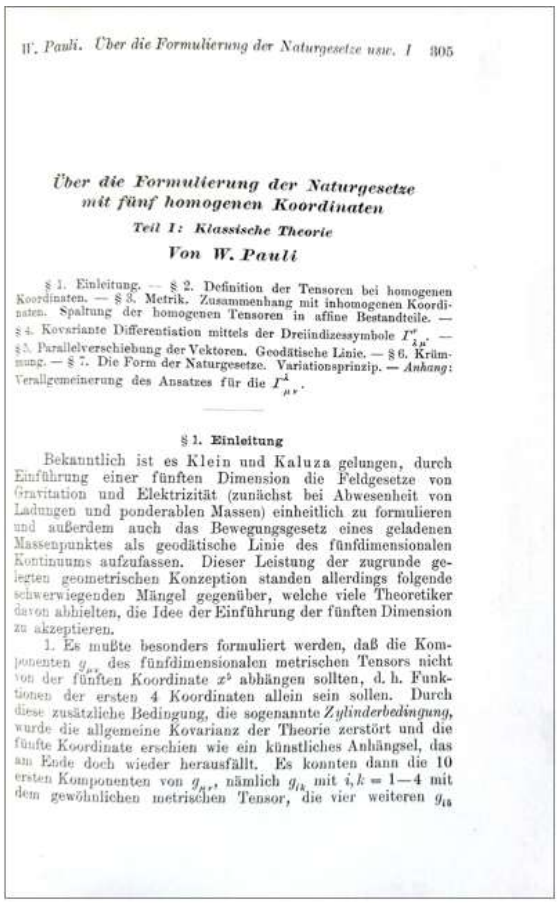
Prussian Heraldry

376. **PAULI, Karl Friedrich**. *Einleitung in die Kenntniss des Deutschen Hohen und Niedern Adels*; [with]: *Erweis und Rechtfertigung einiger Satze seiner Einleitung in die Kenntniss des deutschen hohen und niedern Adels, welche in dem 107 Stuck der Gottingischen Anzeigen von gelehrten Sachen dieses Jahres in Zweifel gezogen und verfalscht worden*; [with]: *Abgenothigte Beantwortung des 151sten Stucks der gottingschen Anzeigen von gelehrten Sachen 1753 und des 94 und 95sten Stucks der hannoverschen gelehrten Anzeigen vom Jahr 1753*. Halle: Johann Justinus Gebauern, 1753-4. 3 WORKS IN 1. 8vo. Collation:)(8, A-L; A-C8; A8, B4. Pagination: [16], 176; 48; 23, [1] pp. 20 plates of heraldic arms; light foxing. 20th century sheep-backed marbled boards, marbled endpapers, edges pale red; joints cracked and worn. Good. S13803

$ 175

First Editions of these three works dealing with heraldry and the lives of the nobility. Pauli (1723-1778), born in Prussia and studied law at Konigsburg, was

Professor of philosophy and history at the University of Halle. He wrote several works on Prussian history.



W. Pauli. Über die Formulierung der Naturgesetze usw. I 305

Über die Formulierung der Naturgesetze mit fünf homogenen Koordinaten

Teil I: Klassische Theorie

Von W. Pauli

§ 1. Einleitung. — § 2. Definition der Tensoren bei homogenen Koordinaten. — § 3. Metrik. Zusammenhang mit inhomogenen Koordinaten. Spaltung der homogenen Tensoren in affine Bestandteile. — § 4. Kovariante Differentiation mittels der Dreiindizessymbole $\Gamma^{\sigma}_{\lambda\mu}$. — § 5. Parallelverschiebung der Vektoren. Geodätische Linie. — § 6. Krümmung. — § 7. Die Form der Naturgesetze. Variationsprinzip. — *Anhang*: Verallgemeinerung des Ansatzes für die $\Gamma^{\lambda}_{\mu\nu}$.

§ 1. Einleitung

Bekanntlich ist es Klein und Kaluza gelungen, durch Einführung einer fünften Dimension die Feldgesetze von Gravitation und Elektrizität (zunächst bei Abwesenheit von Ladungen und ponderablen Massen) einheitlich zu formulieren und außerdem auch das Bewegungsgesetz eines geladenen Massenpunktes als geodätische Linie des fünfdimensionalen Kontinuums aufzufassen. Dieser Leistung der zugrunde gelegten geometrischen Konzeption standen allerdings folgende schwerwiegenden Mängel gegenüber, welche viele Theoretiker davon abhielten, die Idee der Einführung der fünften Dimension zu akzeptieren.

1. Es mußte besonders formuliert werden, daß die Komponenten $g_{\rho\sigma}$ des fünfdimensionalen metrischen Tensors nicht von der fünften Koordinate x^5 abhängen sollten, d. h. Funktionen der ersten 4 Koordinaten allein sein sollen. Durch diese zusätzliche Bedingung, die sogenannte *Zylinderbedingung*, wurde die allgemeine Kovarianz der Theorie zerstört und die fünfte Koordinate erschien wie ein künstliches Anhängsel, das am Ende doch wieder herausfällt. Es konnten dann die 10 ersten Komponenten von $g_{\rho\sigma}$, nämlich g_{ik} mit $i,k = 1-4$ mit dem gewöhnlichen metrischen Tensor, die vier weiteren g_{i5}

ANNALEN DER PHYSIK

5. FOLGE. BAND 18. HEFT 4. OKTOBER 1933

Über die Formulierung der Naturgesetze mit fünf homogenen Koordinaten

Teil II: Die Diracschen Gleichungen für die Materiewellen

Von W. Pauli

§ 1. Einleitung. — § 2. Aufbau des metrischen Tensors $g_{\mu\nu}$ aus [illegible] — § 3. Koordinaten- und S-Transformationen. — § 4. Kovariante Differentiation der Spinoren. — § 5. Zusammenhang der projektiven mit den affinen Spinoren. Aufstellung der Wellengleichung. — § 6. Variationsprinzip und Feldgleichungen.

§ 1. Einleitung

Der Versuch, die Diracschen Wellengleichungen des Elektrons umzugießen in eine Form, bei der die Wellenfunktionen von fünf homogenen Koordinaten abhängen, scheint in noch viel höherem Maße kritischen Bedenken ausgesetzt, als der entsprechende Versuch bei den klassischen Gleichungen des Gravitations- und elektromagnetischen Feldes. Selbst wenn wir davon absehen, daß solche Methoden ganz allgemein als „formal" verschrieen sind — ohne die Frage, ob dieses Urteil berechtigt ist, definitiv entscheiden zu können, können wir hiervon absehen im Hinblick darauf, daß die Methode eine logische *Vereinheitlichung* der Grundlagen der Naturgesetze bringt — muß vom physikalischen Standpunkt aus betont werden, daß die physikalischen Grundlagen der Diracschen Theorie überaus fragwürdig sind. Führt sie doch zu den der Erfahrung widersprechenden Zuständen negativer Energie der materiellen Teilchen! Die folgenden Ausführungen sollen also nicht den Zweck erfüllen, neue Stützen für die Diracschen Wellengleichungen beizubringen, sondern vielmehr zu zeigen, daß die einheitliche Zusammenfassung des Gravitations- und des elektromagnetischen Feldes durch die projektive Differentialgeometrie mittels fünf homogener Koordinaten eine allgemeine Methode ist, deren Tragweite über die klassische Feldphysik hinaus- und in die Quantentheorie hineinreicht. Vielleicht ist es nicht unberechtigt, zu hoffen, daß die

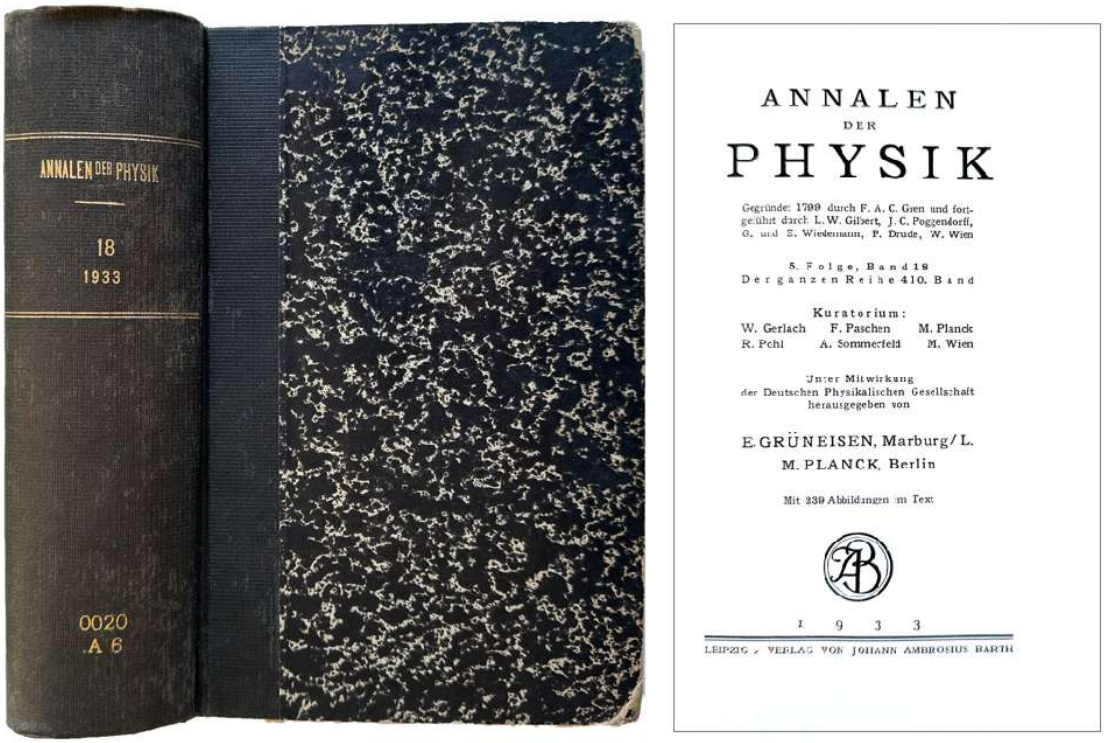
Annalen der Physik. 5. Folge. 18. 23

377. **PAULI, Wolfgang** (1900-1958). "*Uber die Formulierung der Naturgesetze mit fünf homogenen Koordinaten. Teil I: Klassische Theorie.*" with: *"Uber die Formulierung der Naturgesetze mit fünf homogenen Koordinaten. Teil II: Die Diracschen Gleichungen für die Materiewellen*." In: *Annalen der Physik*, 5th Series, Vol. 18, 1933. Leipzig: Johann Ambrosius Barth, 1933. ¶ 8vo. 305-336; (337)-372 pp. Minor ink scribbling in margin at page 335. Quarter black cloth, paste-paper over boards, gilt spine. Blind-stamp of the Carnegie Institution of Washington, Mount Wilson Observatory. Fine. S6819

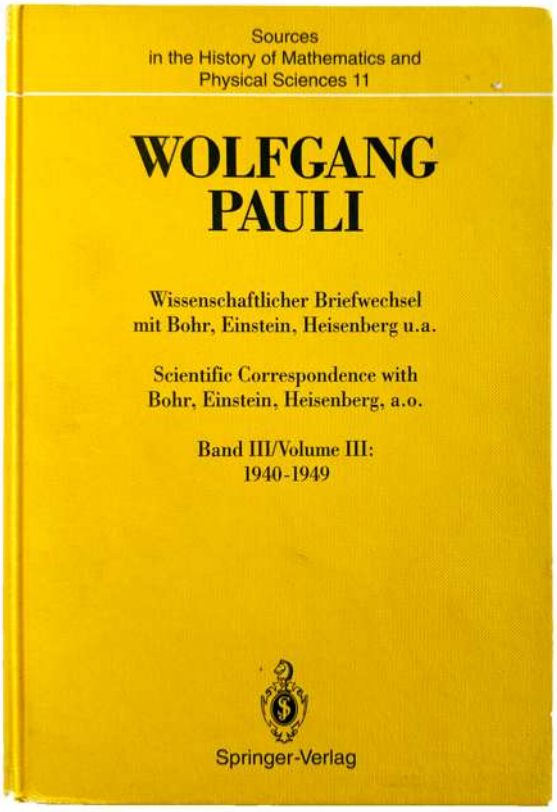
$ 100

"In the first part of his paper Pauli gave a beautiful account of this projective geometry and its tensor analysis, which were developed from first principles, and he formulated the Einstein-Maxwell equations in projective coordinates.

The second part dealt with the incorporation of spinors and of Dirac's equation into this geometrical structure. In my opinion, this is by far the most satisfactory exposition of spinors in general relativity – quite independent of the problems of a unified field theory." Bargmann. Wolfgang Pauli's work on relativity, which began with his article on the theory of relativity for the *Encyklopadie der mathematischen Wissenschaften* in 1921 (ed. Felix Klein) when Pauli was twenty years old, established Pauli as a scientist of rare depth, and of an unsurpassed power of both synthesis and critical analysis.



§ Bargmann, "*Relativity*," in Fierz & Weisskopf, eds., *Theoretical physics in the twentieth century*, pp. 196-197; *DSB*, X, pp. 422-425; Enz*, No time to be brief*, pp. 263-270; Pais, *The genius of science*, pp. 141-142.



378. **PAULI, Wolfgang** (1900-1958). *Scientific Correspondence with Bohr, Einstein, Heisenberg a.o. Volume III: 1940-1949*. Berlin: Springer-Verlag, (1993). ¶ Series: *Sources in the History of Mathematics and Physical Sciences*, 11. 8vo. lxiv, 1070 pp. Illus., including frontis., index. Yellow black-stamped cloth; bit rubbed else fine. SS12734

$ 95

A remarkable resource for the original letters exchanged between Wolfgang Pauli and his colleagues, including especially Bohr, Einstein and Heisenberg. Starting with Vol. I: 1919-1929. Volume IV has been issued in 4 parts, including 1950-1952 and 1957-1958. (7 volumes thus far).

Offered here, also called, *Wissenschaftlicher Briefwechsel mit Bohr, Einstein, Heisenberg u.a. / Scientific Correspondence with Bohr, Einstein, Heisenberg, a.o.*, is the third installment including the crucial war years, 1940-1949. Issued in softcover or hardcover, this is the preferred hardcover version.

[379] Pauli 1927

Über Gasentartung und Paramagnetismus.

Von **W. Pauli jr.** in Hamburg.

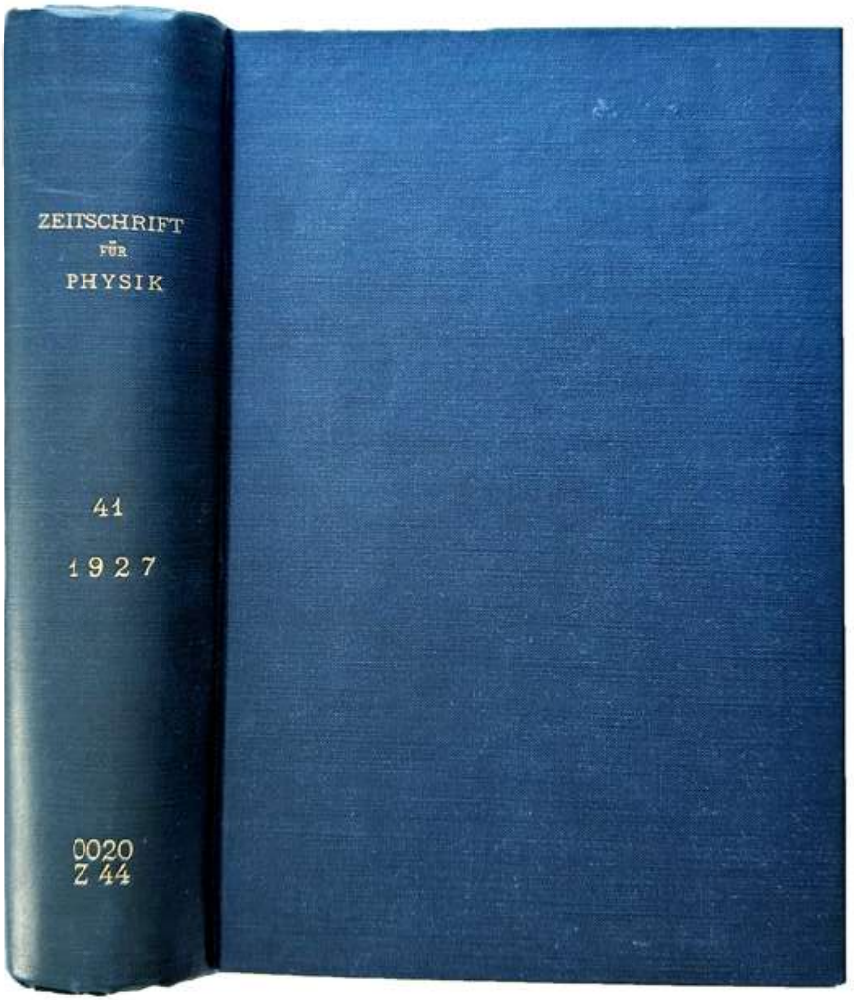
(Eingegangen am 16. Dezember 1926.)

Die auf einer Verallgemeinerung der „Äquivalenzregel“ des Atombaues beruhende, von Fermi herrührende Quantenstatistik des einatomigen idealen Gases wird auf den Fall von Gasatomen mit Drehimpuls erweitert und auf die Magnetisierung solcher Gase angewendet. Betrachtet man die Leitungselektronen im Metall als entartetes ideales Gas — was gewiß nur als ganz provisorisch anzusehen ist, für den vorliegenden speziellen Zweck aber erlaubt sein mag —, so gelangt man auf Grund der entwickelten Statistik zu einem wenigstens qualitativen theoretischen Verständnis der Tatsache, daß trotz des Vorhandenseins des Eigenmomentes des Elektrons viele Metalle (insbesondere die Alkalimetalle) in ihrem festen Zustand keinen oder nur einen sehr schwachen und annähernd temperaturunabhängigen Paramagnetismus zeigen.

§ 1. Übersicht über den gegenwärtigen Stand der Gasentartungsfrage. Von den Theorien der Gasentartung ist in letzter Zeit besonders die Einsteinsche Theorie [1]) viel diskutiert worden, die auf der Annahme einer weitgehenden Analogie von Molekülgas und schwarzer Strahlung (Lichtquantengas) beruht. Um diese Analogie durchzuführen, überträgt Einstein eine zuerst von Bose [2]) für das Verhalten der Lichtquanten vorgeschlagene statistische Annahme auf das materielle Gas. (Hier und im folgenden wird es sich stets um einatomige Gase handeln, bei denen von den mechanischen Wechselwirkungskräften zwischen den Atomen herrührende und von der freien Weglänge abhängige Effekte vernachlässigt werden.) Diese Annahme involviert eine statistische Abhängigkeit der Gasatome voneinander und läßt sich folgendermaßen formulieren: Man teile den Phasenraum eines Gasatoms in Zellen von der Größe h^3, und zwar so, daß diese Zellen in bezug auf die Lagenkoordinaten der Partikel das ganze Volumen V des Gases umfassen, also der Raum der Impulskoordinaten des Gasatoms in Zellen vom Volumen h^3/V geteilt wird. Dann soll ein mikroskopischer Zustand des Gases durch die Angabe definiert sein, wie viele Atome sich in jeder Zelle befinden, gleichgültig, welche individuellen Atome dabei im Spiele sind, und alle so definierten mikroskopischen Zustände sollen gleich wahrscheinlich sein.

Schrödinger [3]) hat sodann gezeigt, daß diese Statistik des idealen Gases auch in einer anderen Weise dargestellt werden kann, bei der, statt

[1]) A. Einstein, Berl. Ber. 1924, S. 261; 1925, S. 3.
[2]) S. N. Bose, ZS. f. Phys. **26**, 178, 1924.
[3]) E. Schrödinger, Phys. ZS. **27**, 95, 1926.



379. **PAULI, Wolfgang** (1900-1958). "*Uber gasentartung und paramagnetismus*." In: *Zeitschrift fur physik*, 41, (1927). ¶ pp. 81-103. 8vo. Navy cloth, gilt stamped spine. Ex library Carnegie Institution of Washington Mount Wilson Observatory with call number gilt stamped on spine and library blind-stamp on front free end paper. Clean copy, handsomely bound; covers lightly freckled, else fine. RARE. S0464

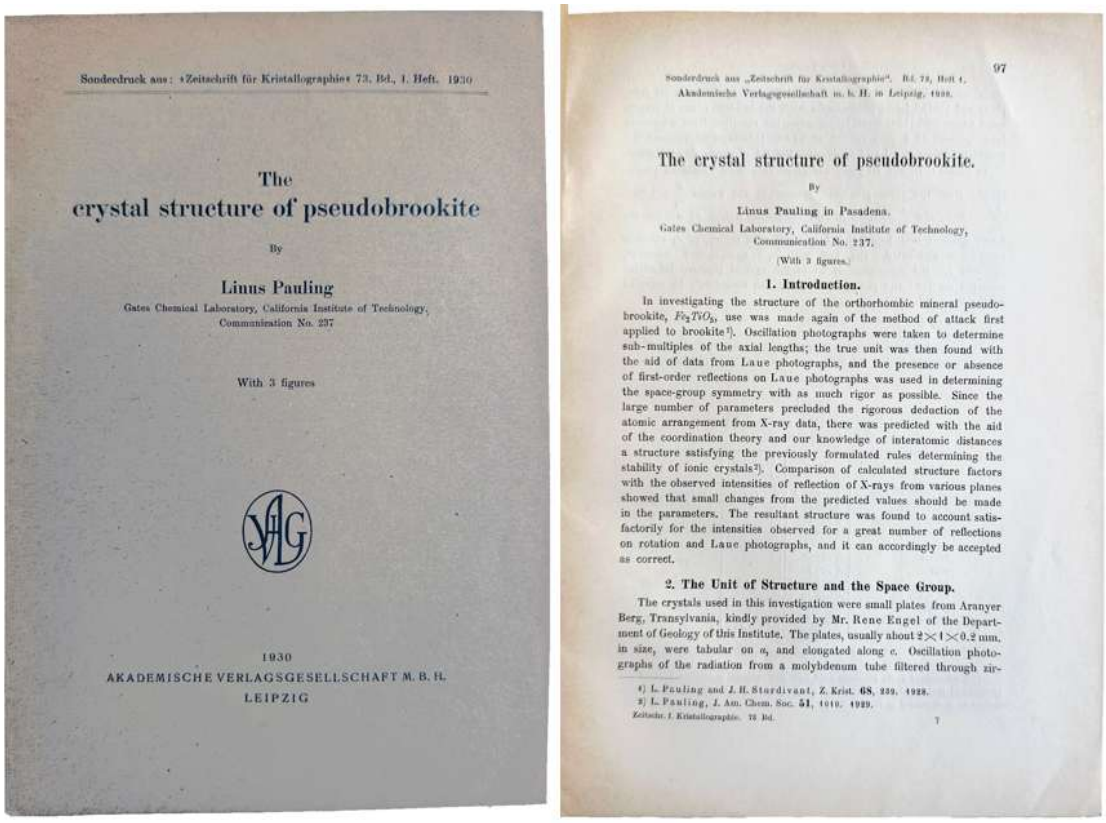
$ 150

PROBABILITY OF A MANY-PARTICLE SYSTEM INTRODUCED. This paper deals with gas degeneracy and paramagnetism. In a footnote (note 1, p. 83), Pauli introduced for the first time the probability for a many-particle system with coordinates q1. . .,qf: "|((q1. . .,qf |.dq1. . .,dqf is the probability that, in the relevant quantum state of the system, the coordinates simultaneously lie in the relevant volume element of configuration space." Thus Pauli's paper is a contribution to the ongoing problem of the appropriate application of Bose-Einstein statistics or Fermi-Dirac statistics. In this paper Pauli wrote, "We shall take the point of view also advocated by Dirac, that the Fermi, and not the Einstein-Bose, statistics applies to the material gas," thus clearing up the matter. See Pais, Inward bound, p. 258; Pais, Subtle is the Lord, p. 432 and 285.

The following article is included in volume 41:

LAUE, Max von, (1879-1960) & **Lise MEITNER**, (1878-1968). "*Die berechnung der reichweitestreuung aus Wilson-Aufnahmen*." In: *Zeitschrift fur physik*, 41 (1927), pp. 397-406. In this paper Meitner and von Laue report their inconclusive efforts to test a theoretical formula of Bohr's that related statistical variations in range to the mechanism by which alpha particles lost energy to the atoms they encountered.

§ Sime, *Meitner*, p. 113-114.


Sonderdruck aus: »Zeitschrift für Kristallographie« 73. Bd., 1. Heft. 1930

The
crystal structure of pseudobrookite

By

Linus Pauling

Gates Chemical Laboratory, California Institute of Technology,
Communication No. 237

With 3 figures

1930
AKADEMISCHE VERLAGSGESELLSCHAFT M. B. H.
LEIPZIG

Sonderdruck aus „Zeitschrift für Kristallographie". Bd. 73, Heft 1.
Akademische Verlagsgesellschaft m. b. H. in Leipzig. 1930.

97

The crystal structure of pseudobrookite.

By

Linus Pauling in Pasadena.

Gates Chemical Laboratory, California Institute of Technology,
Communication No. 237.

(With 3 figures.)

1. Introduction.

In investigating the structure of the orthorhombic mineral pseudobrookite, Fe_2TiO_5, use was made again of the method of attack first applied to brookite[1]). Oscillation photographs were taken to determine sub-multiples of the axial lengths; the true unit was then found with the aid of data from Laue photographs, and the presence or absence of first-order reflections on Laue photographs was used in determining the space-group symmetry with as much rigor as possible. Since the large number of parameters precluded the rigorous deduction of the atomic arrangement from X-ray data, there was predicted with the aid of the coordination theory and our knowledge of interatomic distances a structure satisfying the previously formulated rules determining the stability of ionic crystals[2]). Comparison of calculated structure factors with the observed intensities of reflection of X-rays from various planes showed that small changes from the predicted values should be made in the parameters. The resultant structure was found to account satisfactorily for the intensities observed for a great number of reflections on rotation and Laue photographs, and it can accordingly be accepted as correct.

2. The Unit of Structure and the Space Group.

The crystals used in this investigation were small plates from Aranyer Berg, Transylvania, kindly provided by Mr. Rene Engel of the Department of Geology of this Institute. The plates, usually about $2 \times 1 \times 0.2$ mm. in size, were tabular on a, and elongated along c. Oscillation photographs of the radiation from a molybdenum tube filtered through zir-

[1]) L. Pauling and J. H. Stardivant, Z. Krist. **68**, 239. 1928.
[2]) L. Pauling, J. Am. Chem. Soc. **51**, 1010. 1929.

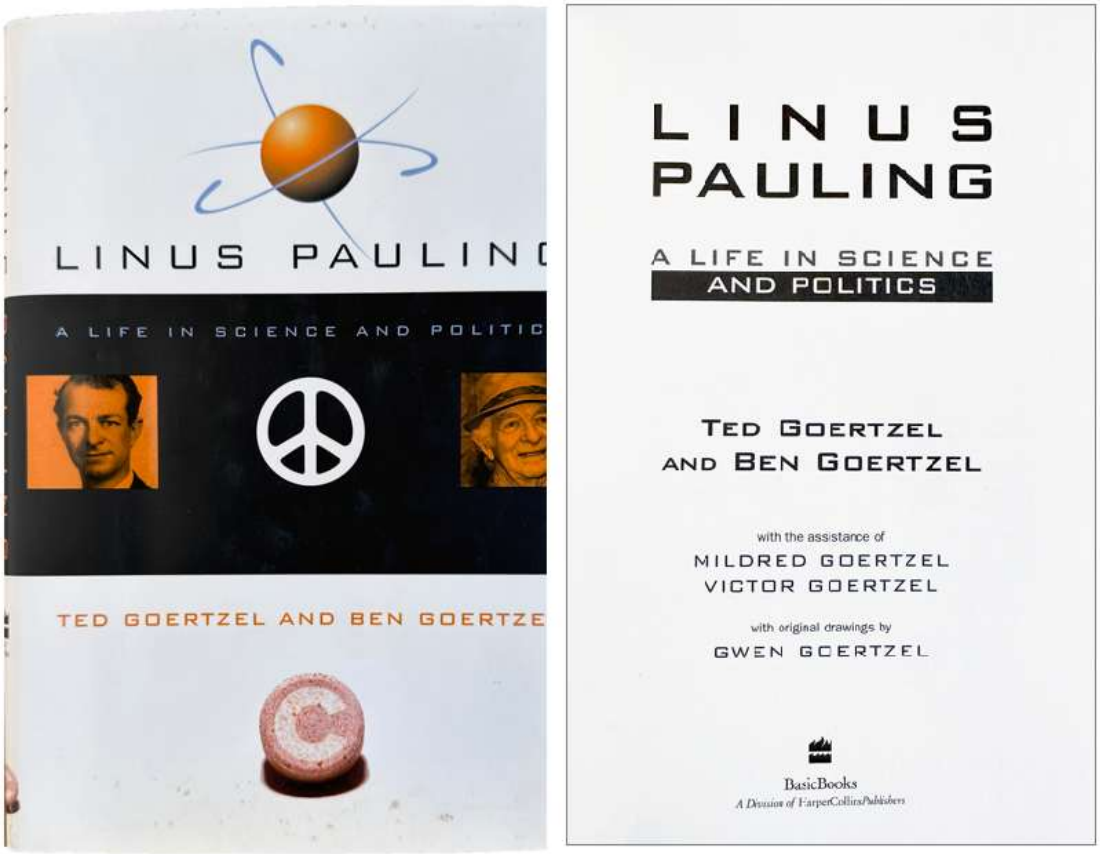
Zeitschr. f. Kristallographie. 73 Bd. 7

380. **PAULING, Linus** (1901-1994). "*The Crystal Structure of Pseudobrookite*." Offprint from :*Zeitschrift für Kristallographie*, vol. 73, no. 1, 1930. Leipzig: Akademische Verlagsgesellschaft M. B. H., 1930. ¶ Offprint. 8vo. pp. 97-112 3 figs., tables. Original printed wrappers. Fine. Very rare. S7077

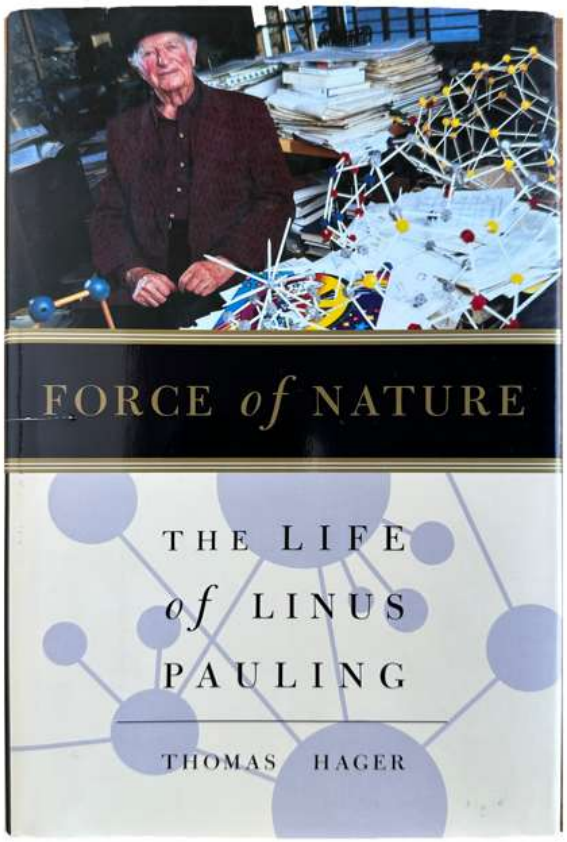
$ 175

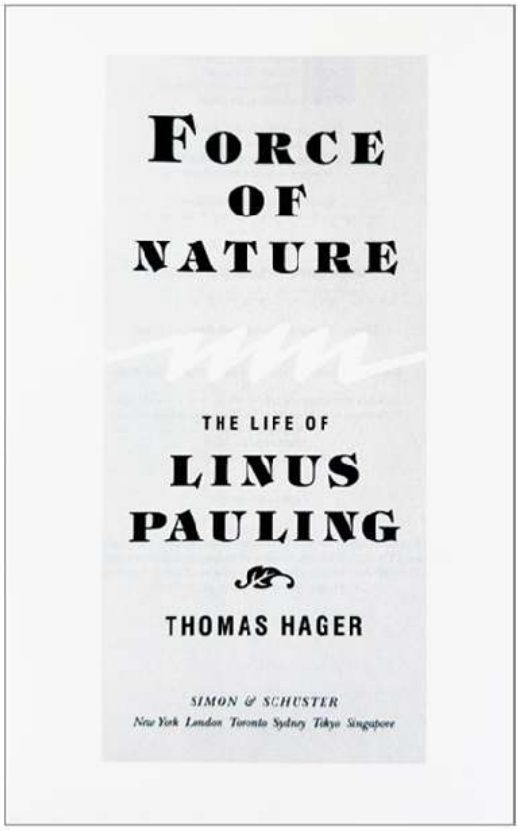
An important early work by the two-time Nobel prize winner. Linus Pauling was one of the twentieth century's greatest chemists, and his efforts culminated in the 1954 Nobel Prize for chemistry for his research on the nature of the chemical bond. His second Nobel Prize came in 1963 for his tireless efforts in the name of peace. "In investigating the structure of the orthorhombic mineral pseudo-brookite, Fe2TiO5 use was made again of the method of attack first applied to brookite). Oscillation photographs were taken to determine sub-multiples of the axial lengths; the true unit was then found with the aid of data from Laue photographs, and the presence or absence of first-order reflections on Laue photographs was used in determining the space-group symmetry with as much rigor as possible. Since the large number of parameters precluded the rigorous deduction of the atomic arrangement from X-ray data, there was

predicted with the aid of the coordination theory and our knowledge of interatomic distances a structure satisfying the previously formulated rules determining the stability of ionic crystals). Comparison of calculated structure factors with the observed intensities of reflection of X-rays from various planes showed that small changes from the predicted values should be made in the parameters. The resultant structure was found to account satisfactorily for the intensities observed for a great number of reflections on rotation and Laue photographs, and it can accordingly be accepted as correct." – Pauling.



381. [**PAULING, Linus** (1901-1994)] **GOERTZEL, Ted; Ben GOERTZEL**. *Linus Pauling; a life in science and politics. With the assistance of Mildred Goertzel, Victor Goertzel. With original drawings by Gwen Goertzel.* (New York): Basic Books, (1995). ¶ 240 x 151 mm. 8vo. xvii, 300 pp. 16 figs. on plates, bibliog., index. Quarter black cloth, dust-jacket. Fine.
S4735 $ 27.50

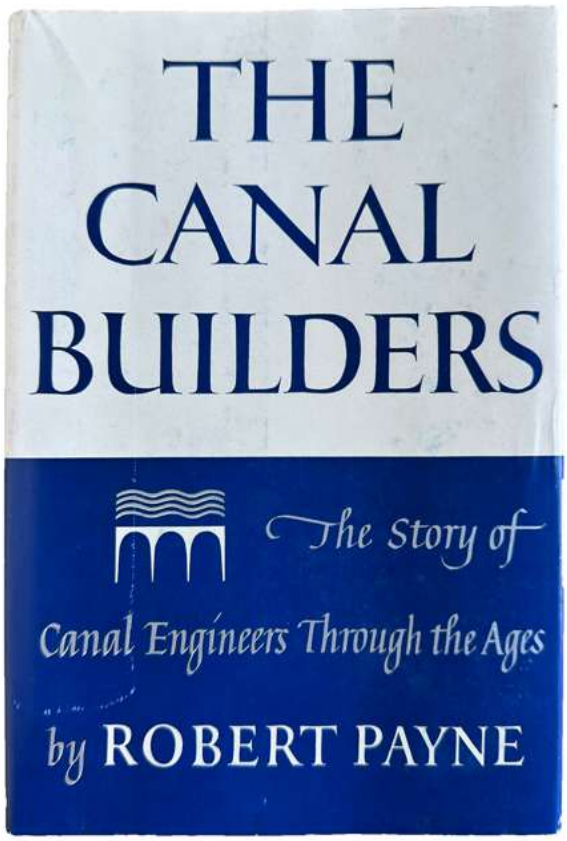


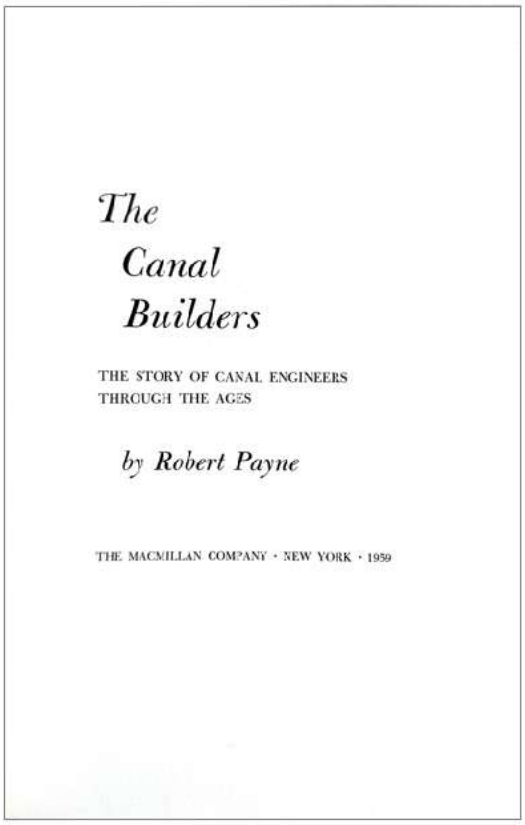


382. [**PAULING, Linus** (1901-1994)] **HAGER, Thomas** (1953-). *Force of Nature. The life of Linus Pauling*. New York et al.: Simon & Schuster, (1995). ¶ First edition. 8vo. 721 pp. Figs., bibliog., index. Quarter black cloth over grey boards, gilt-stamped spine title, dust jacket. NEW. S9196

$ 10

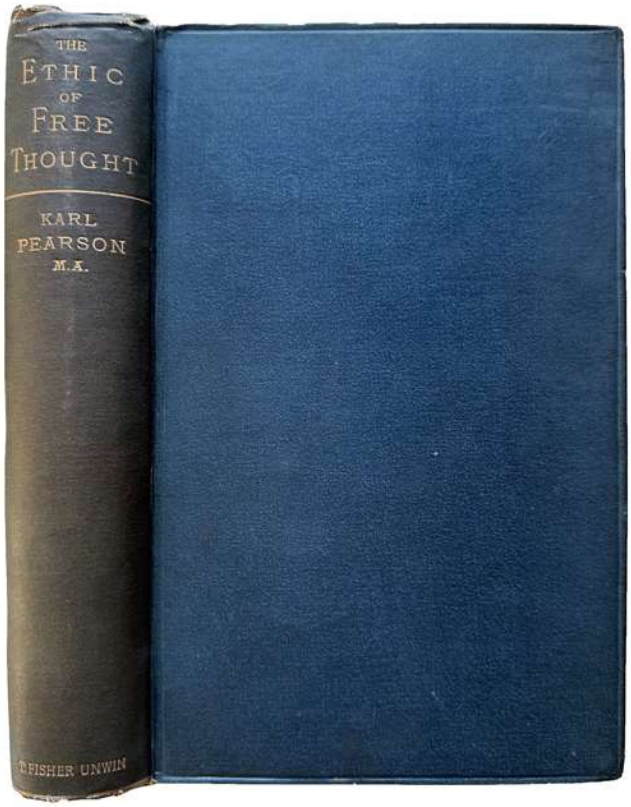
"*Force of Nature* is the first full-scale account of Pauling's remarkable life. It also tells the story of Pauling's wife of nearly sixty years, Ava Helen Miller, a woman as intelligent and as strong-willed as he, and an important influence on his politics. Pauling's story also included many luminaries from both science and politics, from G. N. Lewis and Erwin Schrodinger, to Albert Einstein and Albert Schweitzer, to J. Robert Oppenheimer, Edward Teller, and the Hollywood ten. Written with Pauling's cooperation - including hours of interviews and access that Pauling granted Thomas Hager to private papers, correspondence, and diaries - *Force of Nature* also draws on scores of other interviews and thousands of pages of previously unreleased FBI, Department of State, and other documents to tell the compelling story of one of the great and controversial minds of our time." – publisher.

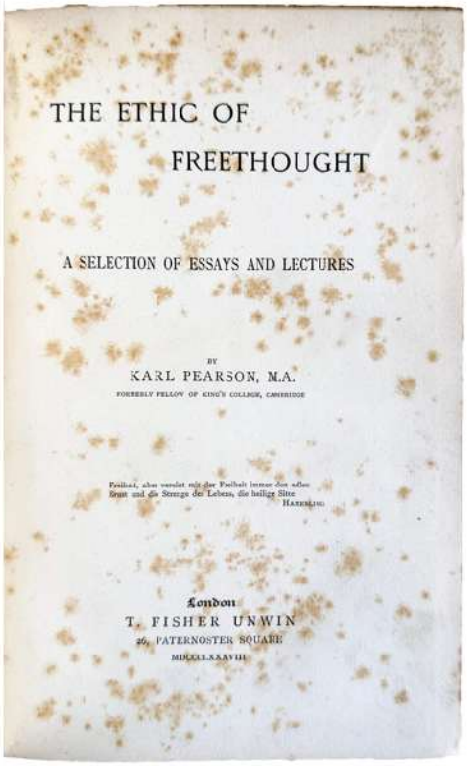




383. **PAYNE, Robert**. *The canal builders; the story of canal engineers through the ages*. New York: Macmillan, 1959. ¶ 8vo. ix, 278 pp. Figs., maps, bibliog., index. Quarter cloth, dust-jacket. Very good. S5502 $ 12

Contents

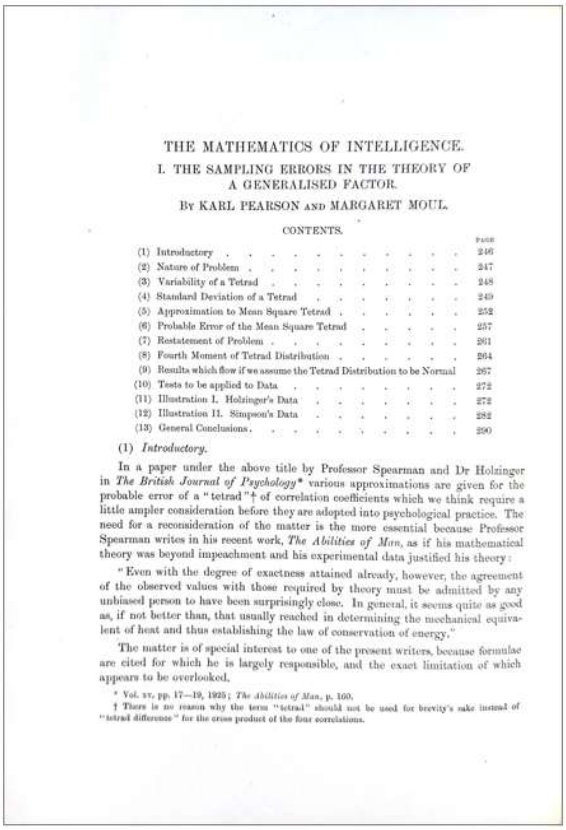




384. **PEARSON, Karl** (1857-1936). *The ethic of freethought; a selection of essays and lectures*. London: T. Fisher Unwin, 1888. ¶ 8vo. 446, [ads] 32 pp. Foxed. Blind-stamped blue cloth, gilt spine; rubbed. Very good. S13744

$ 50

FIRST EDITION. "During 1880-1881 Pearson found diversion from his legal studies in lecturing on Martin Luther at Hampstead, and on socialism, Marx, and Lassalle at workingmen's clubs in Soho. In 1882-1884 he gave a number of courses of lectures around London on German social life and thought from the earliest times up to the sixteenth century, and on Luther's influence on the material and intellectual welfare of Germany. In addition he published in the Academy, Athenaeum, and elsewhere a substantial number of letters, articles, and reviews relating to Luther. Many of these were later republished, together with other lectures delivered between 1885-1887, in his *The Ethic of Freethought* (1888)." *DSB*, X, pp. 447-473.



THE MATHEMATICS OF INTELLIGENCE.

I. THE SAMPLING ERRORS IN THE THEORY OF A GENERALISED FACTOR.

BY KARL PEARSON AND MARGARET MOUL.

CONTENTS.

(1) *Introductory.*

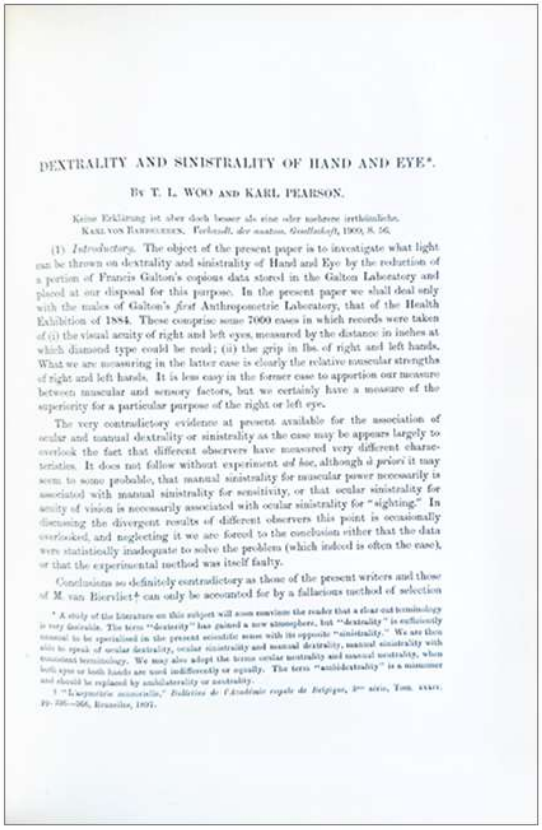
In a paper under the above title by Professor Spearman and Dr Holzinger in *The British Journal of Psychology** various approximations are given for the probable error of a "tetrad"† of correlation coefficients which we think require a little ampler consideration before they are adopted into psychological practice. The need for a reconsideration of the matter is the more essential because Professor Spearman writes in his recent work, *The Abilities of Man*, as if his mathematical theory was beyond impeachment and his experimental data justified his theory:

"Even with the degree of exactness attained already, however, the agreement of the observed values with those required by theory must be admitted by any unbiased person to have been surprisingly close. In general, it seems quite as good as, if not better than, that usually reached in determining the mechanical equivalent of heat and thus establishing the law of conservation of energy."

The matter is of special interest to one of the present writers, because formulae are cited for which he is largely responsible, and the exact limitation of which appears to be overlooked.

* Vol. xv, pp. 17—19, 1925; *The Abilities of Man*, p. 100.

† There is no reason why the term "tetrad" should not be used for brevity's sake instead of "tetrad difference" for the cross product of the four correlations.



DEXTRALITY AND SINISTRALITY OF HAND AND EYE*.

BY T. L. WOO AND KARL PEARSON.

Keine Erklärung ist aber doch besser als eine oder mehrere irrthümliche.
KARL VON RABDOHLDEN, *Verhandl. der anatom. Gesellschaft*, 1900, S. 56.

(1) *Introductory.* The object of the present paper is to investigate what light can be thrown on dextrality and sinistrality of Hand and Eye by the reduction of a portion of Francis Galton's copious data stored in the Galton Laboratory and placed at our disposal for this purpose. In the present paper we shall deal only with the males of Galton's *first* Anthropometric Laboratory, that of the Health Exhibition of 1884. These comprise some 7000 cases in which records were taken of (i) the visual acuity of right and left eyes, measured by the distance in inches at which diamond type could be read; (ii) the grip in lbs. of right and left hands. What we are measuring in the latter case is clearly the relative muscular strengths of right and left hands. It is less easy in the former case to apportion our measure between muscular and sensory factors, but we certainly have a measure of the superiority for a particular purpose of the right or left eye.

The very contradictory evidence at present available for the association of ocular and manual dextrality or sinistrality as the case may be appears largely to overlook the fact that different observers have measured very different characteristics. It does not follow without experiment *ad hoc*, although *à priori* it may seem to some probable, that manual sinistrality for muscular power necessarily is associated with manual sinistrality for sensitivity, or that ocular sinistrality for acuity of vision is necessarily associated with ocular sinistrality for "sighting." In discussing the divergent results of different observers this point is occasionally overlooked, and neglecting it we are forced to the conclusion either that the data were statistically inadequate to solve the problem (which indeed is often the case), or that the experimental method was itself faulty.

Conclusions so definitely contradictory as those of the present writers and those of M. van Biervliet† can only be accounted for by a fallacious method of selection

* A study of the literature on this subject will soon convince the reader that a clear-cut terminology is very desirable. The term "dexterity" has gained a new atmosphere, but "dextrality" is sufficiently unusual to be specialised in the present scientific sense with its opposite "sinistrality." We are then able to speak of ocular dextrality, ocular sinistrality and manual dextrality, manual sinistrality with consistent terminology. We may also adopt the terms ocular neutrality and manual neutrality, when both eyes or both hands are used indifferently or equally. The term "ambidextrality" is a misnomer and should be replaced by ambilaterality or neutrality.

† "L'asymétrie manuelle," *Bulletins de l'Académie royale de Belgique*, 3me série, Tom. xxxv, pp. 336—366, Bruxelles, 1898.

385. **PEARSON, Karl** (1857-1936); **Margaret MOUL**. "*The mathematics of intelligence. I. The sampling errors in the theory of a generalised factor*." In: *Biometrika*, Vol. XIX, Parts I and II, July, 1927. ¶ Large 8vo. Pages (246)-291. [Entire volume: v, 442 pp.] 2 diagrams, tables; a few pages (in contents pages) expertly repaired. Later black buckram, gilt spine. Ex library copy, paper spine label removed. Very good. SS6149

$ 125

This volume includes papers by Karl Pearson, most notably a piece on "The mathematics of intelligence," which is an attack on Charles Spearman.

Also included within this volume:

On the approximate quadrature of certain skew curves, with an account of the researches of Thomas Bayes, by **John Wishart**. [Thomas Bayes (1702-1761) was an English clergyman and mathematician famous for Bayes's Theorem, a foundational concept in probability theory.]

On partial multiple correlation coefficients in a universe of manifold characteristics, by **M. Tappan**.

NOTES ON CERTAIN EXPANSIONS IN ORTHOGONAL AND SEMI-ORTHOGONAL FUNCTIONS: I. Note on Chebysheff's Interpolation Formula, by **Leon Isserlis** (1881-1966). [Leon Isserlis (1881–1966) was a Russian-born British statistician known for his work on the exact distribution of sample moments, including Isserlis' theorem. He also brought to the attention of British statisticians the work of Russian mathematicians and statisticians, including Chebyshev and Chuprov].

NOTES ON CERTAIN EXPANSIONS IN ORTHOGONAL AND SEMI-ORTHOGONAL FUNCTIONS: II Note on Orthogonalising Series of Functions and Interpolation, by **Vsevolod Ivanovich Romanovsky** (1879-1954). [Romanovsky gained an international reputation for his work in mathematical statistics and probability theory.].

Determination of the cranial capacity of the negro from measurements on the skull or the living head, by **Miriam L. [Louise] Tildesley** (1883-1979). [Tildesley MBE was an English educator, anthropologist and museum curator. As an anthropologist, she specialised in human craniometry and osteology.].

On the frequency distribution of the means of samples from a population having any law of frequency with finite moments, with special reference to Pearson's type II, by **J. O. Irwin** (1898-1982). [Joseph Oscar Irwin was a British statistician who advanced the use of statistical methods in biological assay and other fields of laboratory medicine. Irwin's grasp of modern mathematical statistics distinguished him not only from older medical statisticians like Major Greenwood but contemporaries like Austin Bradford Hill.]

A Study of the Badarian Crania Recently Excavated by the British School of Archaeology in Egypt, by **Brenda N. [North] Stoessiger**, B.Sc..

§ See: *DSB*, X, pp. 447-473; Stigler, *The History of statistics*.

A STUDY OF THE BADARIAN CRANIA RECENTLY EXCAVATED BY THE BRITISH SCHOOL OF ARCHAEOLOGY IN EGYPT.

By BRENDA N. STOESSIGER, B.Sc., Cresdson Bennington Student in Craniometry.

CONTENTS.

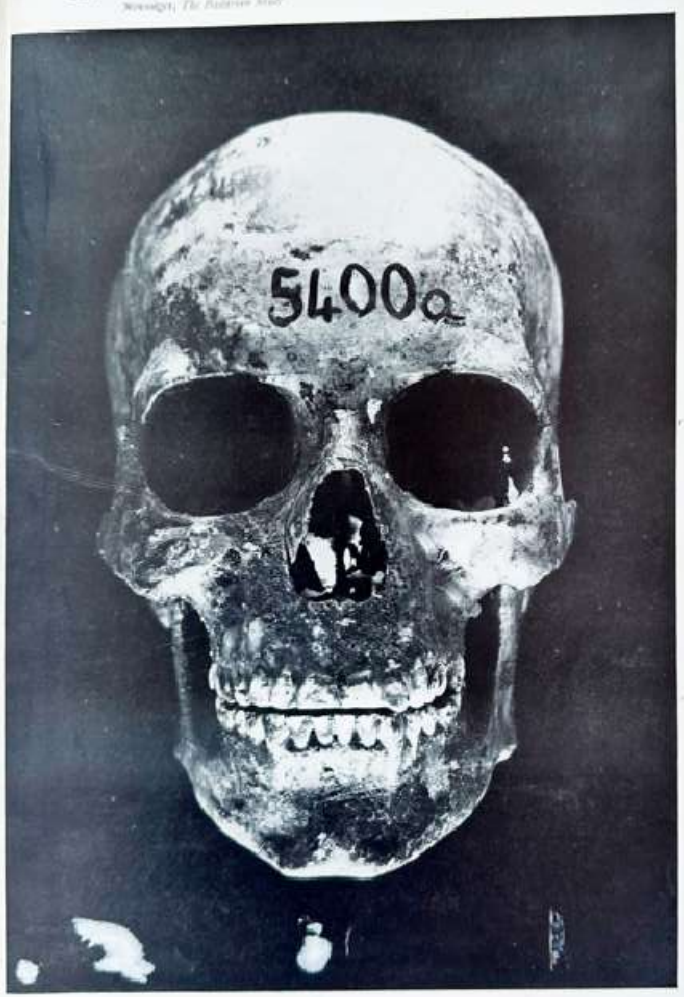
1. *Introductory.*

In 1924—25 excavations by the British School of Archaeology in Egypt were made in the district of Badari, 20 miles south of Asyut. A settlement actually in Badari was worked by Miss Caton-Thompson, and cemeteries, a few miles to the north, exhibiting the same culture and of the same period, were worked by Mr and Mrs G. Brunton. Some sixty crania brought home were most kindly placed at the disposal of the Biometric Laboratory by Sir W. M. Flinders Petrie.

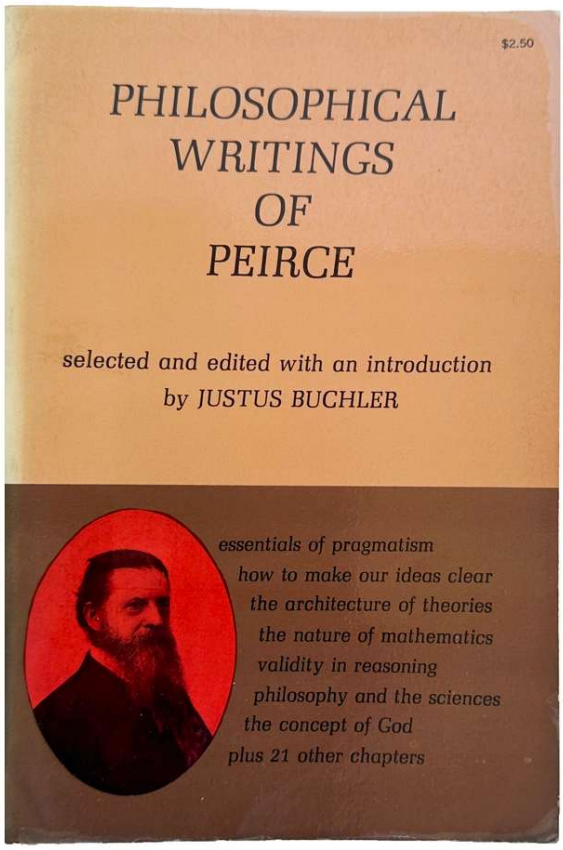
All authorities seem to agree that this Egyptian civilization is the most ancient yet discovered in Egypt, but further than this the actual dating has caused much controversy*. A detailed account of the excavations has not yet been published; some account was given in the *Proceedings of the British Association*, Sessions 1925 and 1926.

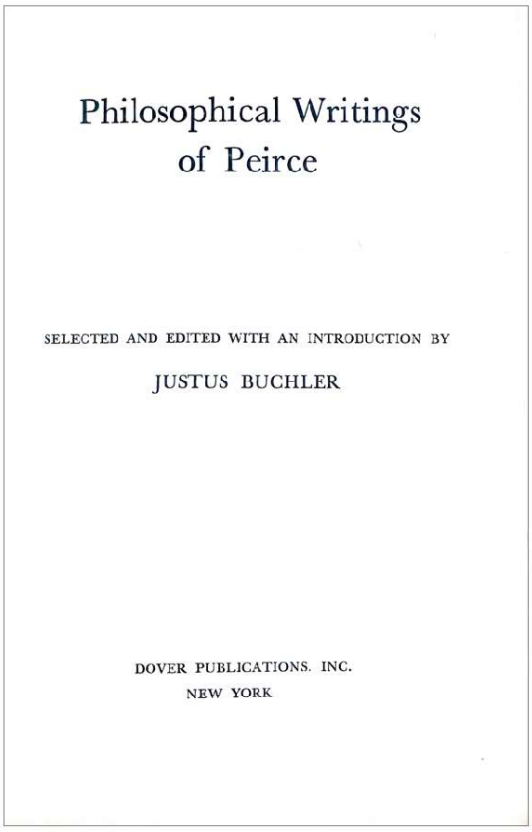
In general appearance, the skulls are very like the crania from Naqada; they are markedly dolichocephalic, smooth, fragile and very feminine in type. They are rather more prognathous than the Naqada skulls and the series may be slightly less homogeneous.

* See *Man*, Vol. xxv. No. 9, p. 129, *Nature*, Vol. cxvii. pp. 463 and 514.



Typical Badarian Male (5400 a). *Norma facialis* (circa natural size).



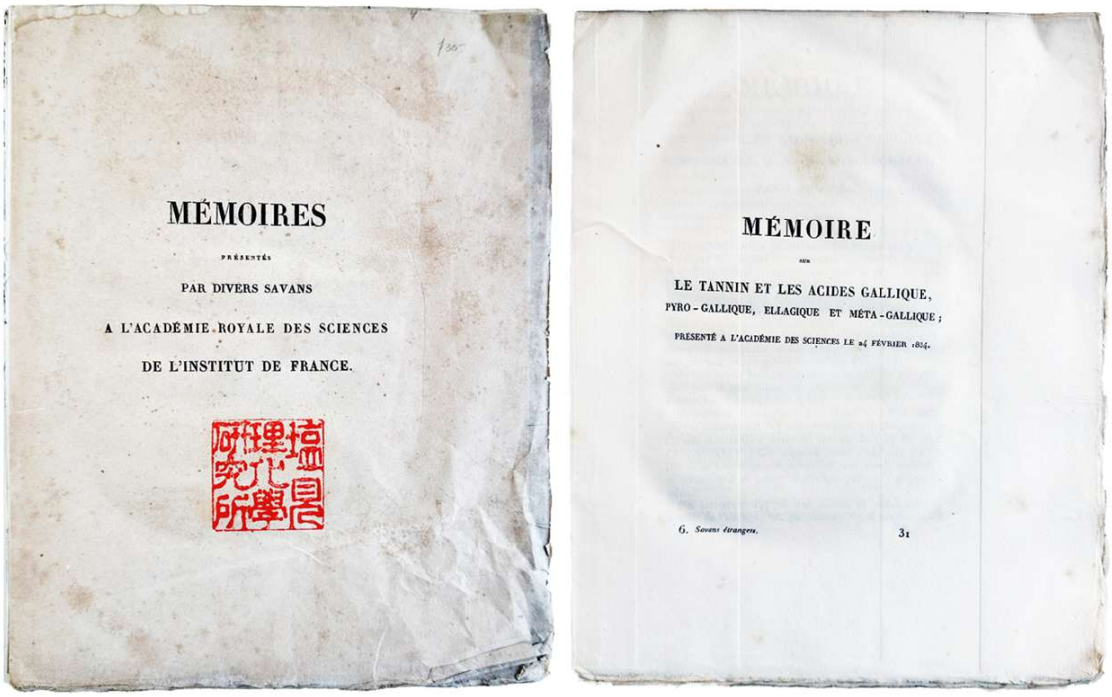


386. [**PEIRCE, Charles** (1839-1914)] **BUCHLER, Justus**, editor. *Philosophical writings of Peirce*. New York: Dover, (1955). ¶ 8vo. xvi, 386 pp. 5 figs., 2 tables, index. Printed wrappers; spine faded, else very good. S0471

$ 5

Charles Sanders Peirce was an American scientist, mathematician, logician, and philosopher who is sometimes known as "the father of pragmatism".

According to philosopher Paul Weiss, Peirce was "the most original and versatile of America's philosophers and America's greatest logician".



MÉMOIRES

PRÉSENTÉS

PAR DIVERS SAVANS

A L'ACADÉMIE ROYALE DES SCIENCES

DE L'INSTITUT DE FRANCE.

MÉMOIRE

SUR

LE TANNIN ET LES ACIDES GALLIQUE,
PYRO-GALLIQUE, ELLAGIQUE ET MÉTA-GALLIQUE;

PRÉSENTÉ A L'ACADÉMIE DES SCIENCES LE 24 FÉVRIER 1834.

6. Savans étrangers. 31

387. **PELOUZE, Theophile-Jules** (1807-1867). "*Mémoire sur le tannin et les acides gallique, pyro-gallique, ellagique et meta-gallique; présente a l'Académie des Sciences le 24 février 1834*." Offprint from: *Mémoires présentes par divers savans a l'Académie Royal des Sciences de l'Institut de France, et imprimes par son ordre, Sciences Mathématiques et Physiques*, Tome Sixième. Paris: Bachelier, 1835. ¶ 4to. [x], (243)-270 pp. Occasional marginal foxing. Dis-bound, unopened. With large red ex libris rubber stamp (Chinese-language) on half-title and another type, black-stamped, on the general title. AS IS. S6377

$ 30

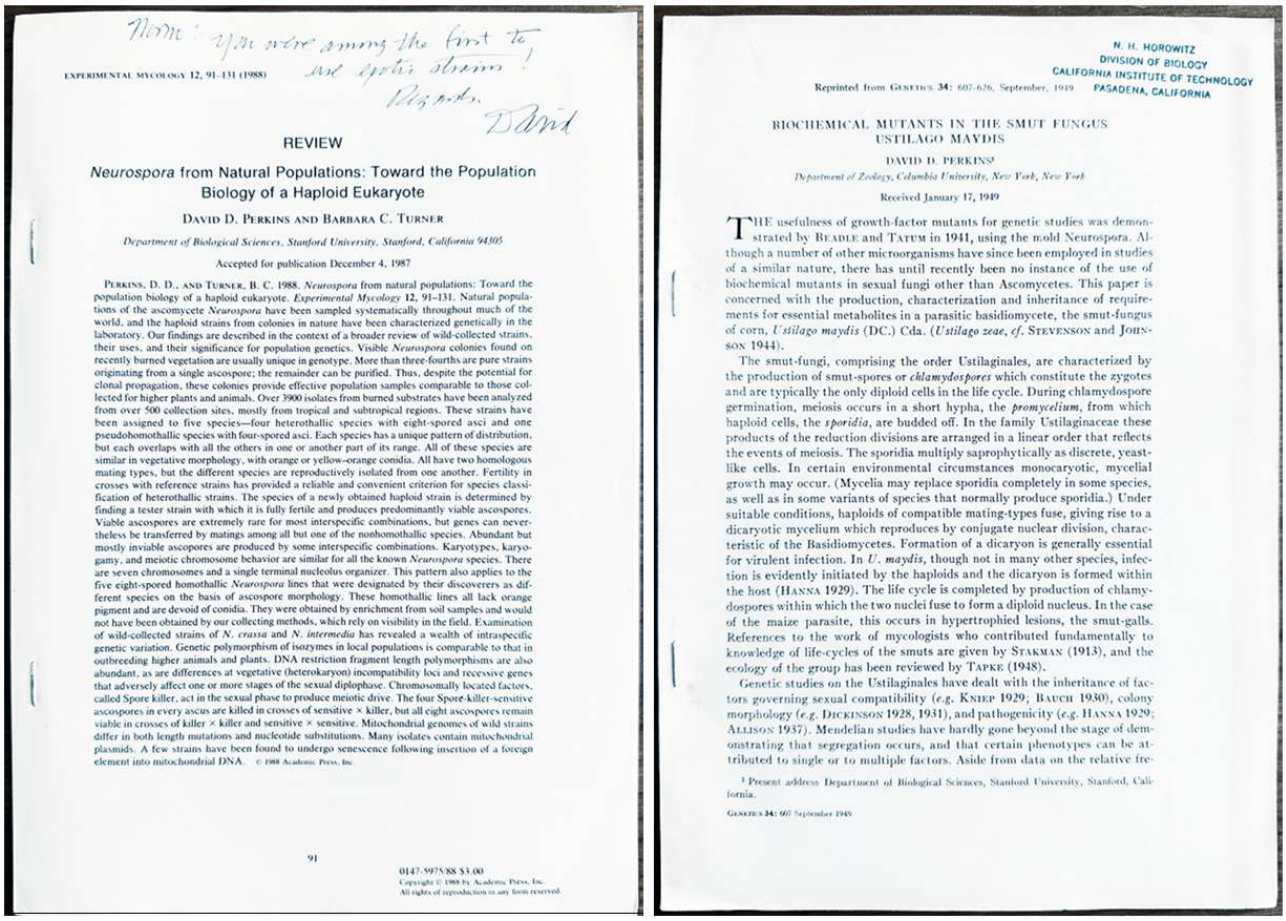
["Memoir on tannin and gallic, pyrogallic, ellagic and metagallic acids"].

During his career, Jules Pelouze held the position of assayer at the Paris mint, professor of chemistry at the Ecole Polytechnique, and at the College de France, and president of the Commission of the Mint. Beginning in 1830, Pelouze quickly established himself as an outstanding analytical and experimental chemist, including early investigations such as this on pyrogallic acid.

"One can find its uses [of pyrogallic acid] in hair dyeing, dyeing of suturing materials and for oxygen absorption in gas analysis. Pyrogallic Acid also has

antiseptic properties. Pyrogallic Acid was also used as a developing agent in black-and-white developers, but its use is largely historical except for special purpose applications."

§ *DSB*, X, p. 499; Partington, *A history of chemistry*, IV, p. 251, 395.



Norm: You were among the first to use exotic strains! Regards, David

EXPERIMENTAL MYCOLOGY 12, 91–131 (1988)

REVIEW

Neurospora from Natural Populations: Toward the Population Biology of a Haploid Eukaryote

DAVID D. PERKINS AND BARBARA C. TURNER

Department of Biological Sciences, Stanford University, Stanford, California 94305

Accepted for publication December 4, 1987

PERKINS, D. D., AND TURNER, B. C. 1988. *Neurospora* from natural populations: Toward the population biology of a haploid eukaryote. *Experimental Mycology* 12, 91–131. Natural populations of the ascomycete *Neurospora* have been sampled systematically throughout much of the world, and the haploid strains from colonies in nature have been characterized genetically in the laboratory. Our findings are described in the context of a broader review of wild-collected strains, their uses, and their significance for population genetics. Visible *Neurospora* colonies found on recently burned vegetation are usually unique in genotype. More than three-fourths are pure strains originating from a single ascospore; the remainder can be purified. Thus, despite the potential for clonal propagation, these colonies provide effective population samples comparable to those collected for higher plants and animals. Over 3900 isolates from burned substrates have been analyzed from over 500 collection sites, mostly from tropical and subtropical regions. These strains have been assigned to five species—four heterothallic species with eight-spored asci and one pseudohomothallic species with four-spored asci. Each species has a unique pattern of distribution, but each overlaps with all the others in one or another part of its range. All of these species are similar in vegetative morphology, with orange or yellow-orange conidia. All have two homologous mating types, but the different species are reproductively isolated from one another. Fertility in crosses with reference strains has provided a reliable and convenient criterion for species classification of heterothallic strains. The species of a newly obtained haploid strain is determined by finding a tester strain with which it is fully fertile and produces predominantly viable ascospores. Viable ascospores are extremely rare for most interspecific combinations, but genes can nevertheless be transferred by matings among all but one of the nonhomothallic species. Abundant but mostly inviable ascospores are produced by some interspecific combinations. Karyotypes, karyogamy, and meiotic chromosome behavior are similar for all the known *Neurospora* species. There are seven chromosomes and a single terminal nucleolus organizer. This pattern also applies to the five eight-spored homothallic *Neurospora* lines that were designated by their discoverers as different species on the basis of ascospore morphology. These homothallic lines all lack orange pigment and are devoid of conidia. They were obtained by enrichment from soil samples and would not have been obtained by our collecting methods, which rely on visibility in the field. Examination of wild-collected strains of *N. crassa* and *N. intermedia* has revealed a wealth of intraspecific genetic variation. Genetic polymorphism of isozymes in local populations is comparable to that in outbreeding higher animals and plants. DNA restriction fragment length polymorphisms are also abundant, as are differences at vegetative (heterokaryon) incompatibility loci and recessive genes that adversely affect one or more stages of the sexual diplophase. Chromosomally located factors, called Spore killer, act in the sexual phase to produce meiotic drive. The four Spore-killer-sensitive ascospores in every ascus are killed in crosses of sensitive × killer, but all eight ascospores remain viable in crosses of killer × killer and sensitive × sensitive. Mitochondrial genomes of wild strains differ in both length mutations and nucleotide substitutions. Many isolates contain mitochondrial plasmids. A few strains have been found to undergo senescence following insertion of a foreign element into mitochondrial DNA. © 1988 Academic Press, Inc.

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0147-5975/88 $3.00
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DIVISION OF BIOLOGY
CALIFORNIA INSTITUTE OF TECHNOLOGY
PASADENA, CALIFORNIA

Reprinted from GENETICS 34: 607-626, September, 1949

BIOCHEMICAL MUTANTS IN THE SMUT FUNGUS USTILAGO MAYDIS

DAVID D. PERKINS[1]

Department of Zoology, Columbia University, New York, New York

Received January 17, 1949

THE usefulness of growth-factor mutants for genetic studies was demonstrated by BEADLE and TATUM in 1941, using the mold Neurospora. Although a number of other microorganisms have since been employed in studies of a similar nature, there has until recently been no instance of the use of biochemical mutants in sexual fungi other than Ascomycetes. This paper is concerned with the production, characterization and inheritance of requirements for essential metabolites in a parasitic basidiomycete, the smut-fungus of corn, *Ustilago maydis* (DC.) Cda. (*Ustilago zeae*, *cf.* STEVENSON and JOHNSON 1944).

The smut-fungi, comprising the order Ustilaginales, are characterized by the production of smut-spores or *chlamydospores* which constitute the zygotes and are typically the only diploid cells in the life cycle. During chlamydospore germination, meiosis occurs in a short hypha, the *promycelium*, from which haploid cells, the *sporidia*, are budded off. In the family Ustilaginaceae these products of the reduction divisions are arranged in a linear order that reflects the events of meiosis. The sporidia multiply saprophytically as discrete, yeast-like cells. In certain environmental circumstances monocaryotic, mycelial growth may occur. (Mycelia may replace sporidia completely in some species, as well as in some variants of species that normally produce sporidia.) Under suitable conditions, haploids of compatible mating-types fuse, giving rise to a dicaryotic mycelium which reproduces by conjugate nuclear division, characteristic of the Basidiomycetes. Formation of a dicaryon is generally essential for virulent infection. In *U. maydis*, though not in many other species, infection is evidently initiated by the haploids and the dicaryon is formed within the host (HANNA 1929). The life cycle is completed by production of chlamydospores within which the two nuclei fuse to form a diploid nucleus. In the case of the maize parasite, this occurs in hypertrophied lesions, the smut-galls. References to the work of mycologists who contributed fundamentally to knowledge of life-cycles of the smuts are given by STAKMAN (1913), and the ecology of the group has been reviewed by TAPKE (1948).

Genetic studies on the Ustilaginales have dealt with the inheritance of factors governing sexual compatibility (*e.g.* KNIEP 1929; BAUCH 1930), colony morphology (*e.g.* DICKINSON 1928, 1931), and pathogenicity (*e.g.* HANNA 1929; ALLISON 1937). Mendelian studies have hardly gone beyond the stage of demonstrating that segregation occurs, and that certain phenotypes can be attributed to single or to multiple factors. Aside from data on the relative fre-

[1] Present address: Department of Biological Sciences, Stanford University, Stanford, California.

GENETICS 34: 607 September 1949

"Norm, you were among the first to use exotic strains! Regards, David"

388. **PERKINS, David D**. (1919-2007). Group of 40 papers. Includes: **PERKINS**, & **Barbara C. TURNER**. "*Neurospora from Natural Populations: Toward the Population Biology of a Haploid Eukaryote*." Offprint from: *Experimental Mycology*, 12. New York: Academic Press, 1988. ¶ 8vo. 91-131 pp. Self-wraps. INSCRIBED BY PERKINS to Norman Horowitz. FINE. S8697

$ 400

Perkins received his PhD in zoology from Columbia in 1949, and has been a faculty member at Stanford University since 1948, when he began a collaboration with geneticist Edward Tatum (1909-1975). Perkins is renowned for his decades-long work on the fungus Neurospora genetics. He became a member of the National Academy of sciences in 1981 and in 1994 was awarded the Genetics Society of America Morgan Medal. He has written extensively on genetics for over 60 years and remains a leading figure in American science today. Most of the papers bear the rubber stamp or signature of pioneer Caltech geneticist Norman Horowitz.

WITH: PERKINS. "*Biochemical Mutants in the Smut Fungus Ustilago Maydis.*" Offprint from: *Genetics*, vol. 34, 1949. 8vo. 607-626 pp. Photos. Self-wraps.

WITH: **PERKINS**. "The Detection of Linkage in tetrad Analysis." Offprint from: *Genetics*, vol. 38, no. 2, 1953. 8vo. 187-197 pp. Tables. Self wraps.

WITH: **PERKINS**. "Tetrads and Crossing Over." Offprint from: *Journal of Cellular and Comparative Physiology*, vol. 45, supp. 2, 1955. 8vo. 119-149 pp. Figs. Self wraps.

WITH: **PERKINS**, et al. "New markers and Multiple Point Linkage Data in Neurospora."

WITH: "Linkage Data for Group III Markers in Neurospora."

WITH: "Linkage Data for Group IV Markers in Neurospora."

WITH: "Linkage Data for Group V Markers in Neurospora." Offprint from: *Genetics*, vol. 44, no. 6, part 2, 1959. 8vo. 1185-1226 pp. Figs. Printed wrappers.

WITH: **PERKINS**, et al. "Crossing-Over and Interference in the Centromere Region of Linkage Group I of Neurospora." Offprint from: *Genetics*, vol. 47, no. 9, 1962. 8vo. 1243-1252 pp. Tables. Self wraps.

WITH: **PERKINS**. "Crossing-Over and Interference in a Multiply Marked Chromosome Arm of Neurosproa." Offprint from: *Genetics*, vol. 47, no. 9, 1962. 8vo. 1253-1274 pp. Tables. Self wraps.

WITH: **PERKINS**, et al. "New Data on Markers and Rearrangements in Neurospora." Offprint from: *Canadian journal of Genetics and Cytology*, vol. VI, no. 2, 1962. 8vo. 187-205 pp. Printed wrappers.

WITH: **PERKINS**. "The Frequency in Neurospora Tetrads of Multiple Exchanges Within Short Intervals." Offprint from: *Genet. Res. Camb.*, vol. 3, 1962. 8vo. 315-327 pp. Tables. Self wraps.

WITH: **PERKINS**. "Preservation of Neurospora Stock Cultures with Anhydrous Silica Gel." Offprint from: *Canadian Journal of Microbiology*, vol. 8, 1962. 8vo. 591-594 pp. Self wraps.

WITH: **PERKINS**, et al. "Crossing Over Frequency Following Inbreeding in Neurospora." Offprint from: *Genetica*, vol. 37, 1966. 8vo. 6 pp. Self wraps.

WITH: **PERKINS**, et al. "New Duplication-Generating Inversions in Neurospora." Offprint from: *Canadian Journal of Genetics and Cytology*, vol. XI, no. 3, 1969. 8vo. 622-638 pp. Tables. Printed wrappers.

WITH: **PERKINS**, et al. "New Markers and Map Sequences in Neurospora Crassa, with a Description of Mapping by Duplication Coverage, and of Multiple Translocation Stocks for Testing Linkage." Offprint from: *Genetica*, vol. 40, 1969. 8vo. 247-278 pp. Tables. Self wraps.

WITH: **PERKINS**. "Genetics of Neurospora Populations Collected from Nature." Offprint from: *Year Book of the American Philosophical Society*, 1970. 8vo. 333-334 pp. Single leaf.

WITH: **PERKINS**, et al. "An Insertional Translocation in Neurospora That Generates Duplications Heterozygous for Mating Type." Offprint from: *Genetics*, vol. 71, 1972. 8vo. 25-51 pp. Figs. Self wraps.

WITH: **PERKINS**. "The Manifestation of Chromosome Rearrangements in Unordered Asci of Neurospora." Offprint from: *Genetics*, vol. 77, 1974. 8vo. 459-489 pp. Figs. Self wraps.

WITH: **PERKINS**. "The Use of Duplication-Generating Rearrangements for Studying Heterokaryon Incompatibility Genes in Neurospora." Offprint from: *Genetics*, vol. 80, 1975. 8vo. 87-105 pp. Figs. Self wraps.

WITH: **PERKINS**, et al. "Strains of Neurospora Collected from Nature." Offprint from: *Evolution*, vol. 30, no. 2, 1976. 8vo. 281-313 pp. Photos. Printed wrappers.

WITH: **PERKINS**, & **Edward G. BARRY**. "The Cytogenetics of Neurospora." Offprint from: *Advances in Genetics*, (New York: Academic Press, 1977). 8vo. 133-285 pp. Figs. Printed wrappers.

WITH: **PERKINS**. "Behavior of Neurospora Sitophila Mating-Type Alleles in Heterozygous Duplications After Introgression into Neurospora Crassa." Offprint from: *Experimental Mycology*, vol. 1, 1977. 8vo. 166-172 pp. Self wraps.

WITH: **PERKINS**, et al. "Barren Perithecia in Neurospora Crassa." Offprint from: *Canadian Journal of Genetics and Cytology*, vol. 20, 1978. 8vo. 41-59 pp. Photos. Self wraps.

WITH: **PERKINS**. "Neurospora as an Object for Cytogenetic research." Offprint from: *Stadler Symp.*, vol. 11, 1979. 8vo. 145-164 pp. Figs. Self wraps.

WITH: **PERKINS**, & **Barbara TURNER**. "Spore Killer, A Chromosomal Factor in Neurospora that Kills Meiotic Products Not Containing it." Offprint from: *Genetics*, vol. 93, 1979. 8vo. 587-606 pp. Self wraps.

WITH: **PERKINS**, et al. "Neurospora Crassa Genetic Maps." Offprint from: *Genetic Maps*, vol. 1, 1980. 8vo. 160-165 pp. Self wraps.

WITH: **PERKINS**, et al. "A Chromosome Rearrangement in Neurospora that Produces Viable Progeny Containing Two Nucleolus Organizers." Offprint from: *Chromosoma*, vol. 76, 1980. 8vo. 255-275 pp. Photos. Self wraps.

WITH: **PERKINS**, et al. "Chromosomal Loci of Neurospora Crassa." Offprint from: *Microbiological Reviews*, vol. 46, no. 4, 1982. 8vo. 426-570 pp. Tables. Self wraps.

WITH: **PERKINS**, et al. "Conventional and Unconventional Analysis of an Inversion in Neurospora." Offprint from: *Genet. Res. Camb.*, vol. 40, 1982. 8vo. 175-190 pp. Figs. Self wraps.

WITH: **PERKINS**, et al. "Neurospora Crassa Genetic Maps." Offprint from: *Genetic Maps*, vol. 2, 1982. 8vo. 10 pp. Tables. Self wraps.

WITH: **PERKINS**. "Aspects of the Neurospora Genome." Offprint from: *Molecular genetics of Filamentous Fungi*, (Alan R. Liss, 1985). 8vo. 277-294 pp. Self wraps.

WITH: **PERKINS**. "Determining the Order of Genes, Centromeres, and Rearrangement Breakpoints in Neurospora by Tests of Duplication Coverage." Offprint from: *Journal of genetics*, vol. 65, no. 3, 1986. 8vo. 121-144 pp. Figs. Printed wrappers.

WITH: **PERKINS**, et al. "An Annotated Pedigree of Neurospora Crassa Laboratory Wild Types, Showing the Probable Origin of the Nucleolus Satellite and Showing that Certain Stocks are Not Authentic." Offprint from: *Fungal Genetics Newsletter*, vol. 34, 1987. 8vo. 46-51 pp. Table. Self wraps.

WITH: **PERKINS**, et al. "Meiotic Drive in Neurospora and Other Fungi." Offprint from: *The American Naturalist*, vol. 137, no. 3, 1991. 8vo. 416-429 pp. Photos. Self wraps.

WITH: **PERKINS**. "In Praise of Diversity." Offprint from: *More Gene Manipulations in Fungi*, (New York: Academic Press, 1991). 8vo. 3-26 pp. Figs. Self wraps.

WITH: **PERKINS**, et al. "Expression of Meiotic Drive Elements Spore Killer-2 and Spore Killer-3 in Asci of Neurospora Tetrasperma." Offprint from: *Genetics*, vol. 129, 1991. 4to. 25-37 pp. Photos. Self wraps.

WITH: **PERKINS**. "Neurospora: The Organism Behind the Molecular Revolution." Offprint from: *Genetics*, vol. 130, 1992. 4to. 687-701 pp. Photos. Self wraps.

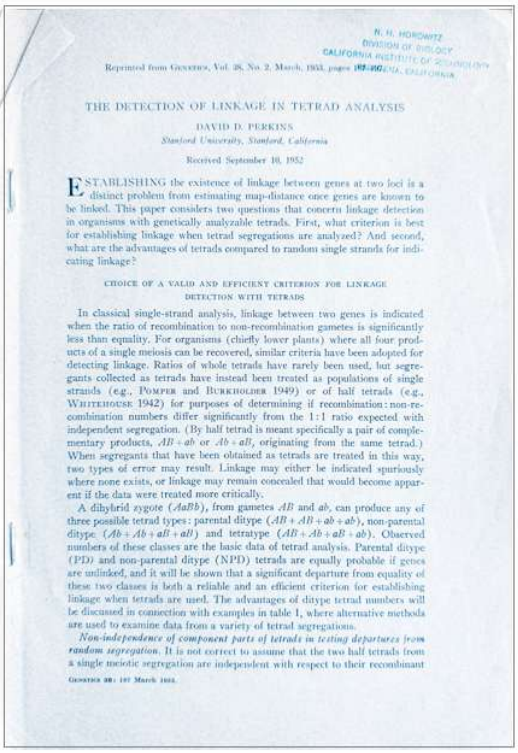
WITH: **PERKINS**. "Neurospora Crassa Genetic Maps." Offprint from: *Genetic Maps, Sixth edition*, (Cold Spring Harbor, 1992). 4to. 10 pp. Tables. Stapled sheets.

WITH: **PERKINS**. "Neurospora Chromosmes." Offprint from: *The Dynamic Genome: Barbara McClintock's Ideas in the Century of Genetics*, (Cold Spring Harbor, 1992). 8vo. 33-44 pp. Self wraps.

WITH: **PERKINS**, et al. "Diverse Programs of Ascus Development in Pseudohomothallic Species of Neurospora Gelasinospora, and Podospora." Offprint from: *Developmental Genetics*, vol. 15, 1994. 4to. 104-118 pp. Photos. Stapled sheets.

WITH: **PERKINS**, et al. "Fratricide, Incest, and Miscegenation in Neurospora." Offprint from: *Developmental Genetics*, vol. 15, 1994. 4to. 104-118 pp. Stapled sheets.

WITH: **PERKINS**, et al. "Crossing-Over in Linkage Group I of Neurospora." Offprint from: *X International Congress of Genetics*, Proceedings vol. II. 8vo. Single leaf.



N. H. HOROWITZ
DIVISION OF BIOLOGY
CALIFORNIA INSTITUTE OF TECHNOLOGY
PASADENA, CALIFORNIA

Reprinted from GENETICS, Vol. 38, No. 2, March, 1953, pages 163-171
PRINTED IN U. S. A.

THE DETECTION OF LINKAGE IN TETRAD ANALYSIS

DAVID D. PERKINS

Stanford University, Stanford, California

Received September 10, 1952

ESTABLISHING the existence of linkage between genes at two loci is a distinct problem from estimating map-distance once genes are known to be linked. This paper considers two questions that concern linkage detection in organisms with genetically analyzable tetrads. First, what criterion is best for establishing linkage when tetrad segregations are analyzed? And second, what are the advantages of tetrads compared to random single strands for indicating linkage?

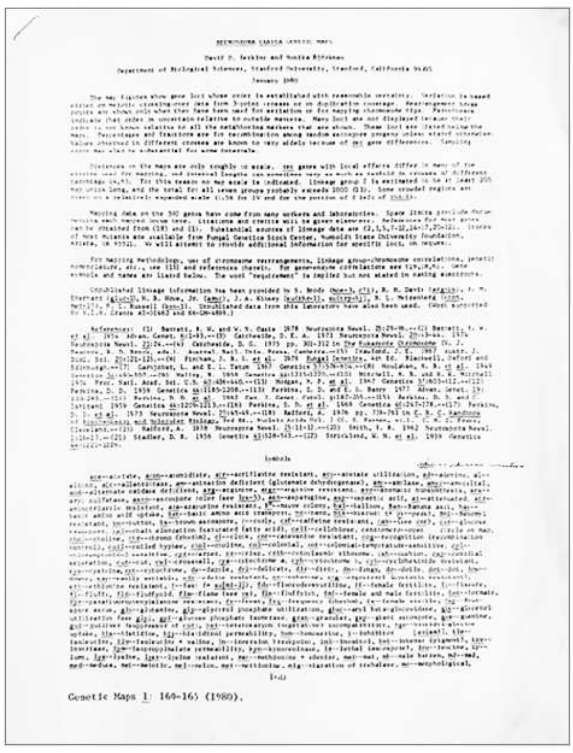
CHOICE OF A VALID AND EFFICIENT CRITERION FOR LINKAGE DETECTION WITH TETRADS

In classical single-strand analysis, linkage between two genes is indicated when the ratio of recombination to non-recombination gametes is significantly less than equality. For organisms (chiefly lower plants) where all four products of a single meiosis can be recovered, similar criteria have been adopted for detecting linkage. Ratios of whole tetrads have rarely been used, but segregants collected as tetrads have instead been treated as populations of single strands (e.g., POMPER and BURKHOLDER 1949) or of half tetrads (e.g., WHITEHOUSE 1942) for purposes of determining if recombination : non-recombination numbers differ significantly from the 1:1 ratio expected with independent segregation. (By half tetrad is meant specifically a pair of complementary products, $AB + ab$ or $Ab + aB$, originating from the same tetrad.) When segregants that have been obtained as tetrads are treated in this way, two types of error may result. Linkage may either be indicated spuriously where none exists, or linkage may remain concealed that would become apparent if the data were treated more critically.

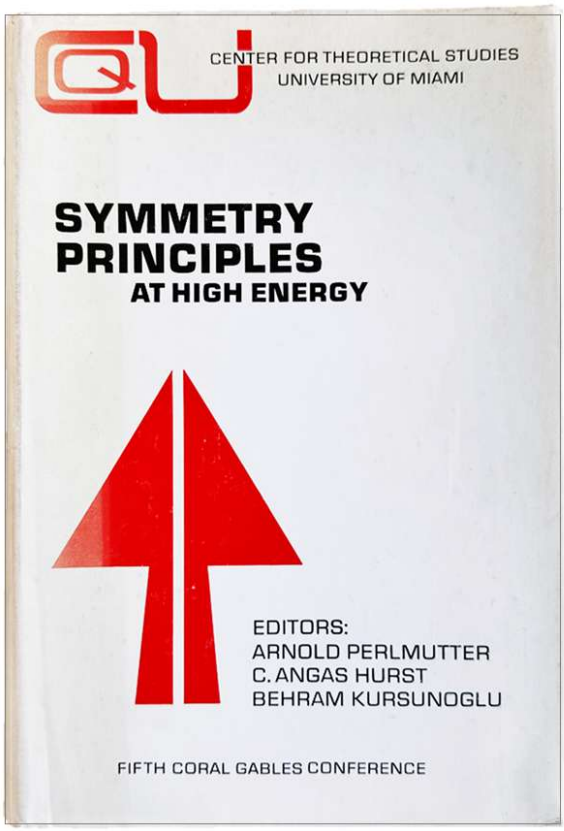
A dihybrid zygote ($AaBb$), from gametes AB and ab, can produce any of three possible tetrad types : parental ditype ($AB + AB + ab + ab$), non-parental ditype ($Ab + Ab + aB + aB$) and tetratype ($AB + Ab + aB + ab$). Observed numbers of these classes are the basic data of tetrad analysis. Parental ditype (PD) and non-parental ditype (NPD) tetrads are equally probable if genes are unlinked, and it will be shown that a significant departure from equality of these two classes is both a reliable and an efficient criterion for establishing linkage when tetrads are used. The advantages of ditype tetrad numbers will be discussed in connection with examples in table 1, where alternative methods are used to examine data from a variety of tetrad segregations.

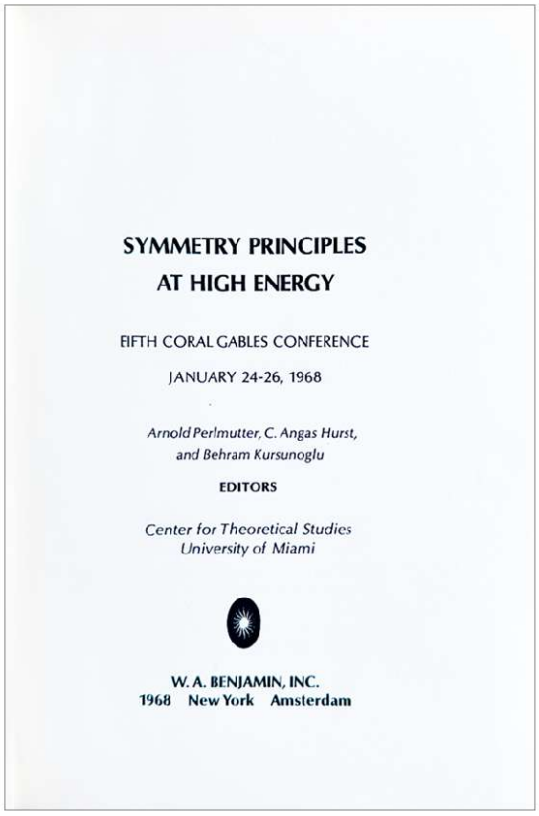
Non-independence of component parts of tetrads in testing departures from random segregation. It is not correct to assume that the two half tetrads from a single meiotic segregation are independent with respect to their recombinant

GENETICS 38: 187 March 1953.



Genetic Maps 1: 160-165 (1980).



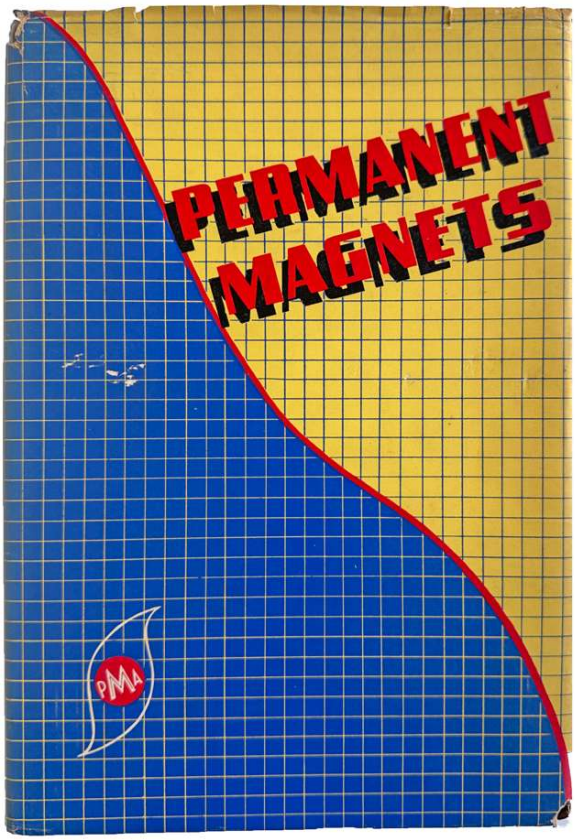


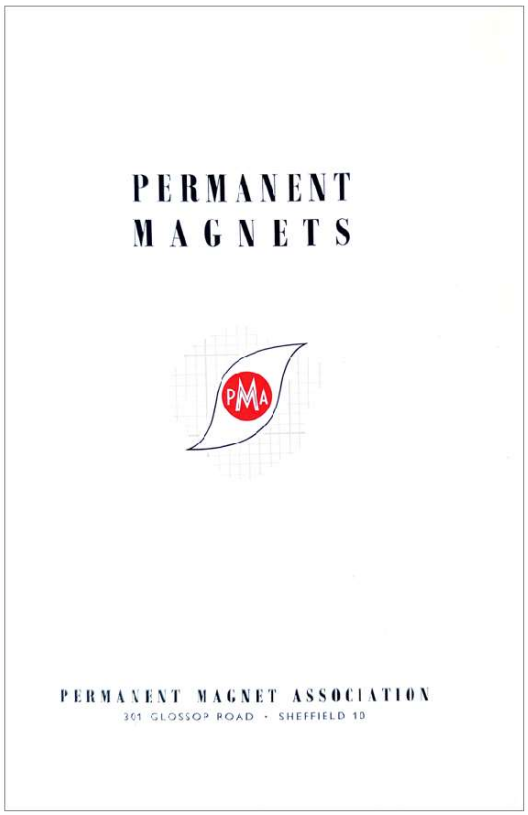
389. **Coral Gables Conference; PERLMUTTER, Arnold**, et al, editors. *Symmetry principles at high energy. Fifth Coral Gables Conference, January 24-26, 1968*. New York and Amsterdam, 1968. ¶ 234 x 159 mm. 8vo. ix, 383 pp. Figs., tables, list of participants. Orange cloth, gilt spine, dust-jacket; jacket rubbed. Abraham Pais ownership signature. Very good. S5344

$ 12

Edited by Arnold Perlmutter, C. Angas Hurts, and Behramn Kursunoglu (1922-2003).

Includes: Time Reversal, by Edward Teller (1908-2003). "π - π phase shift extraction from Ke4" by Abraham Pais. Other conference participants included: Behram Kurşunoğlu, and A. S. Wightman.

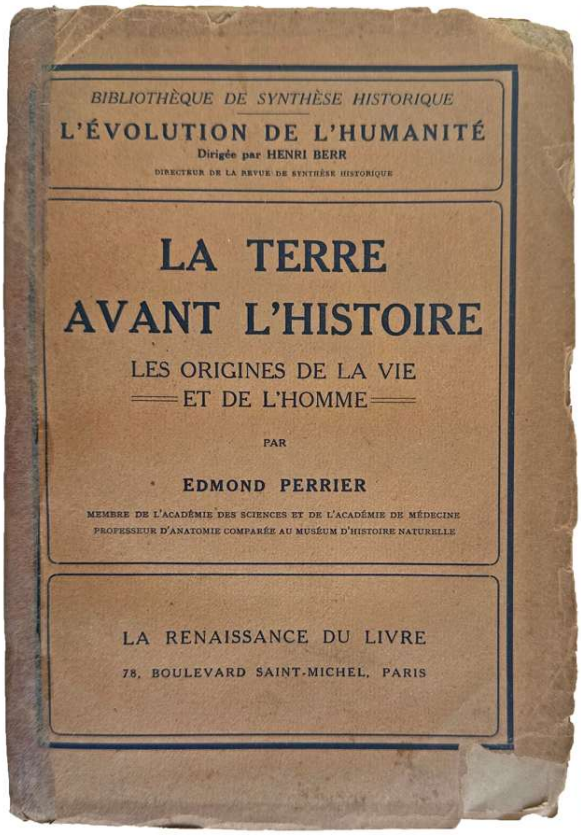


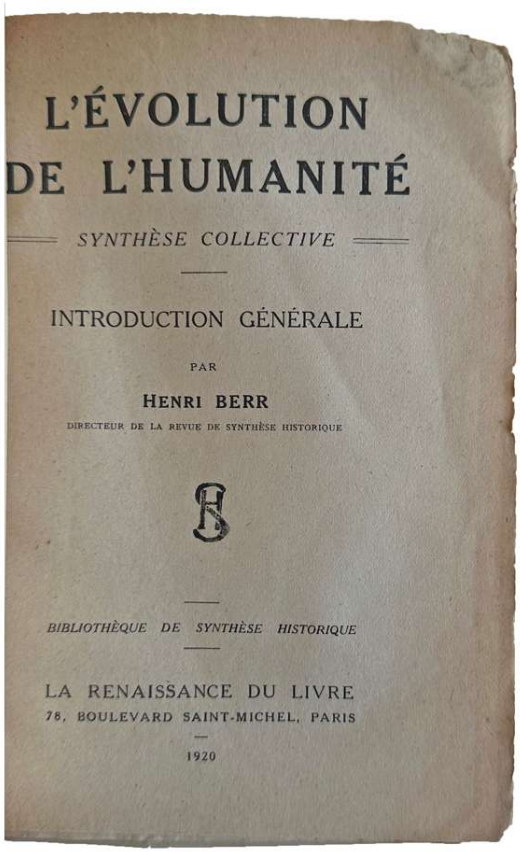


390. **Permanent Magnet Association**. *Permanent Magnets*. Sheffield, UK, PMA, [1955?]. ¶ 4to. 28 pp. Figs., glossary, 1 transparent sheet in pocket inside back cover. Quarter gray cloth, boards, dust-jacket; jacket worn at corners. Provenance: Fritz Strauss, engineer, Christie Electrical Corp., Los Angeles. S2262

$ 12.50

TLS from the Permanent Magnet Association addressed to Fritz Strauss.

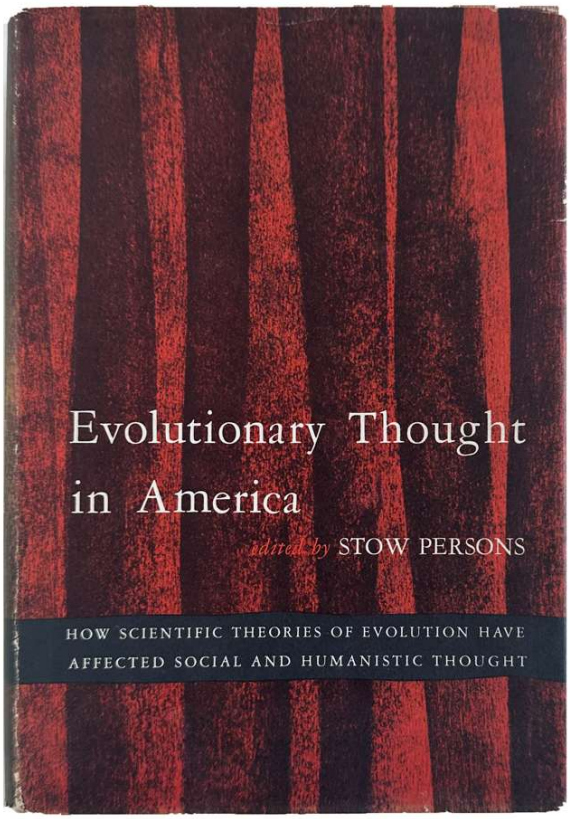


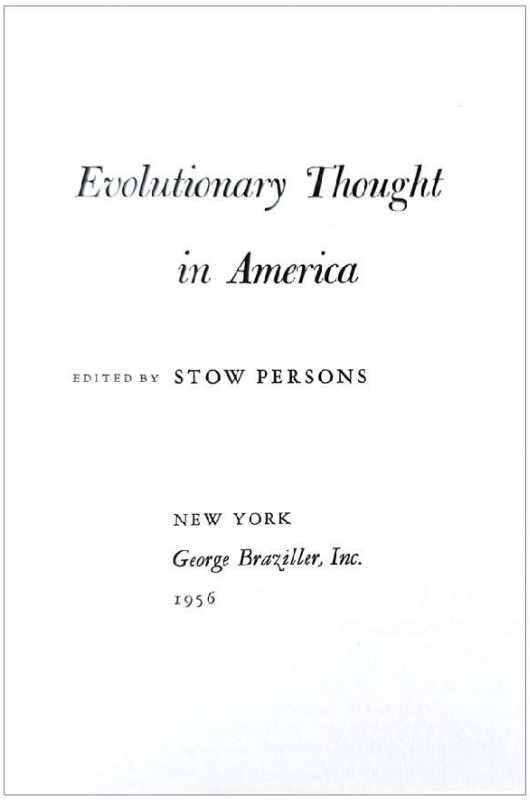


391. **PERRIER, Edmond** (1844-1921). *La terre avant l'histoire. Les origins de la vie et de l'homme*. Paris: La Renaissance du Livre, 1920. ¶ Series: *l'Evolution de l'Humanite. Synthese collective*. Introduction générale, par Henri Berr. Bibliotheque de Synthese Historique. 8vo. xxviii, 414 pp. Original printed wrappers; spine replaced with kozo. Good. S9768

$ 5

"Perrier, who declared his acceptance of the theory of evolution in 1879, was always particularly interested in the study of the oligochaetes and echinoderms, since these groups represented the two major types of animal organization. . . Perrier quickly became one of the principal defender in France of the theory of evolution; but he was never a Darwinian in the strict sense and was one of those mainly responsible for the revival of Lamarckism in France." [*DSB* Vol. X, pp. 522-23].



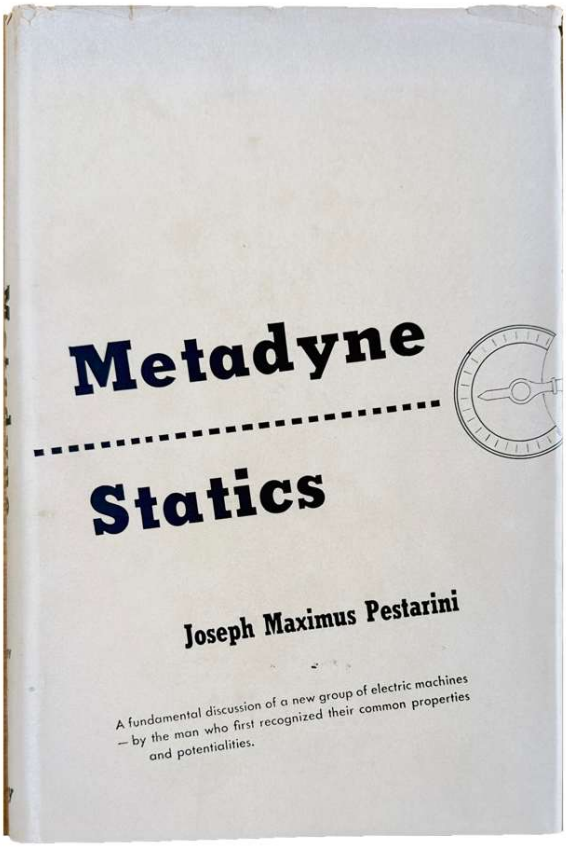


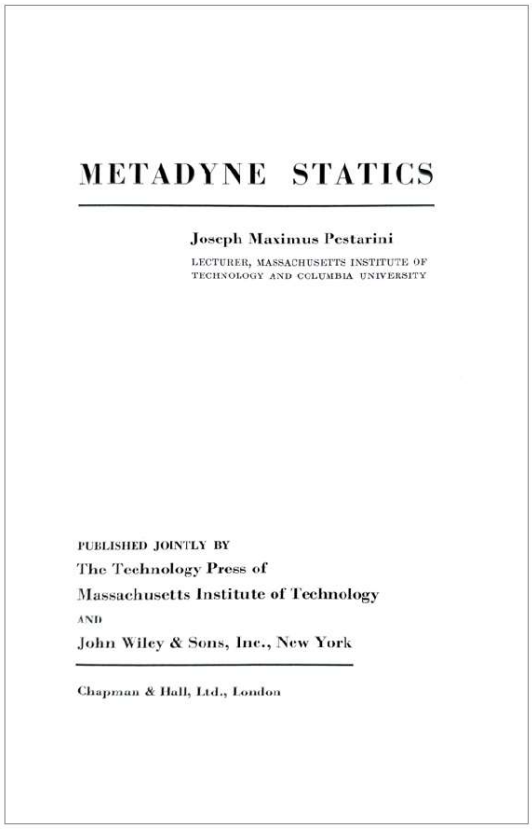
392. **PERSONS, Stow** (1913-2006), editor. *Evolutionary thought in America*. New York: George Braziller, 1956. ¶ 8vo. x, 462 pp. Illus., index. Cloth, dust-jacket. Very good. S3479

$ 15

Subtitle (cover): How scientific theories of evolution have affected social and humanistic thought.

Persons was a distinguished intellectual historian at the University of Iowa. "Next came two studies whose origins were in his teaching at Princeton in the Program on American Civilization. One was Evolutionary Thought in America (1950), which he edited, and along with notable scholars such as Edwin S. Corwin, Joseph J. Spengler, and Theodosius Dobzhansky, contributed an essay." – Hamilton Cravens, Iowa State University, AHA Perspectives on History, March 2007.




METADYNE STATICS

Joseph Maximus Pestarini

LECTURER, MASSACHUSETTS INSTITUTE OF TECHNOLOGY AND COLUMBIA UNIVERSITY

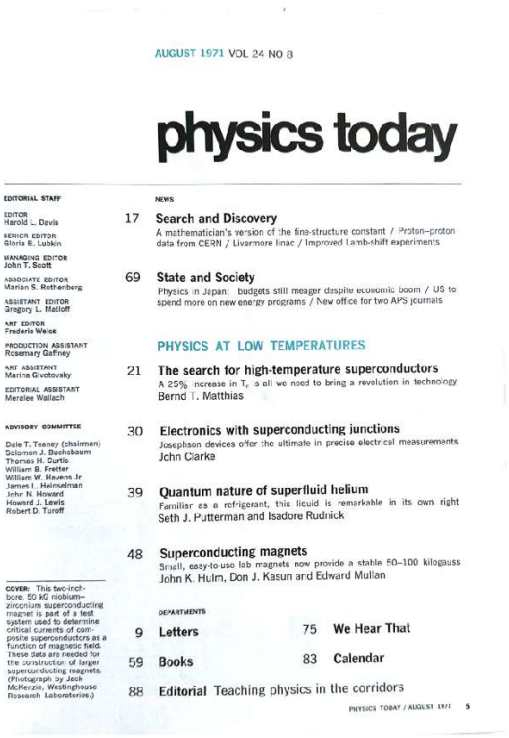
PUBLISHED JOINTLY BY
The Technology Press of
Massachusetts Institute of Technology
AND
John Wiley & Sons, Inc., New York

Chapman & Hall, Ltd., London

393. **PESTARINI, Joseph Maximus**. *Metadyne statics*. New York: Published jointly by the Technology Press of Massachusetts Institute of Technology and John Wiley & Sons; London: Chapman & Hall, (1952). ¶ Series: *Technology Press Books*. 235 x 157 mm. 8vo. xvi, 415 pp. 318 figs., glossary., index. Blue cloth, dust-jacket; jacket lightly worn, else fine. S2264

$ 18

Joseph Maximus Pestarini was a Lecturer at MIT and Columbia University.



394. **Physics Today**. Special issue: *Physics at Low Temperatures*. [College Park, Maryland]: American Institute of Physics, 1971. ¶ Series: *Physics Today*, Vol. 24, No. 8, August 1971. 285 x 212 mm. 4to. Pages 23-57. [Entire issue: 88 pp.] Numerous figs., tables. Pictorial wrappers. Good. S5346

$ 6.95

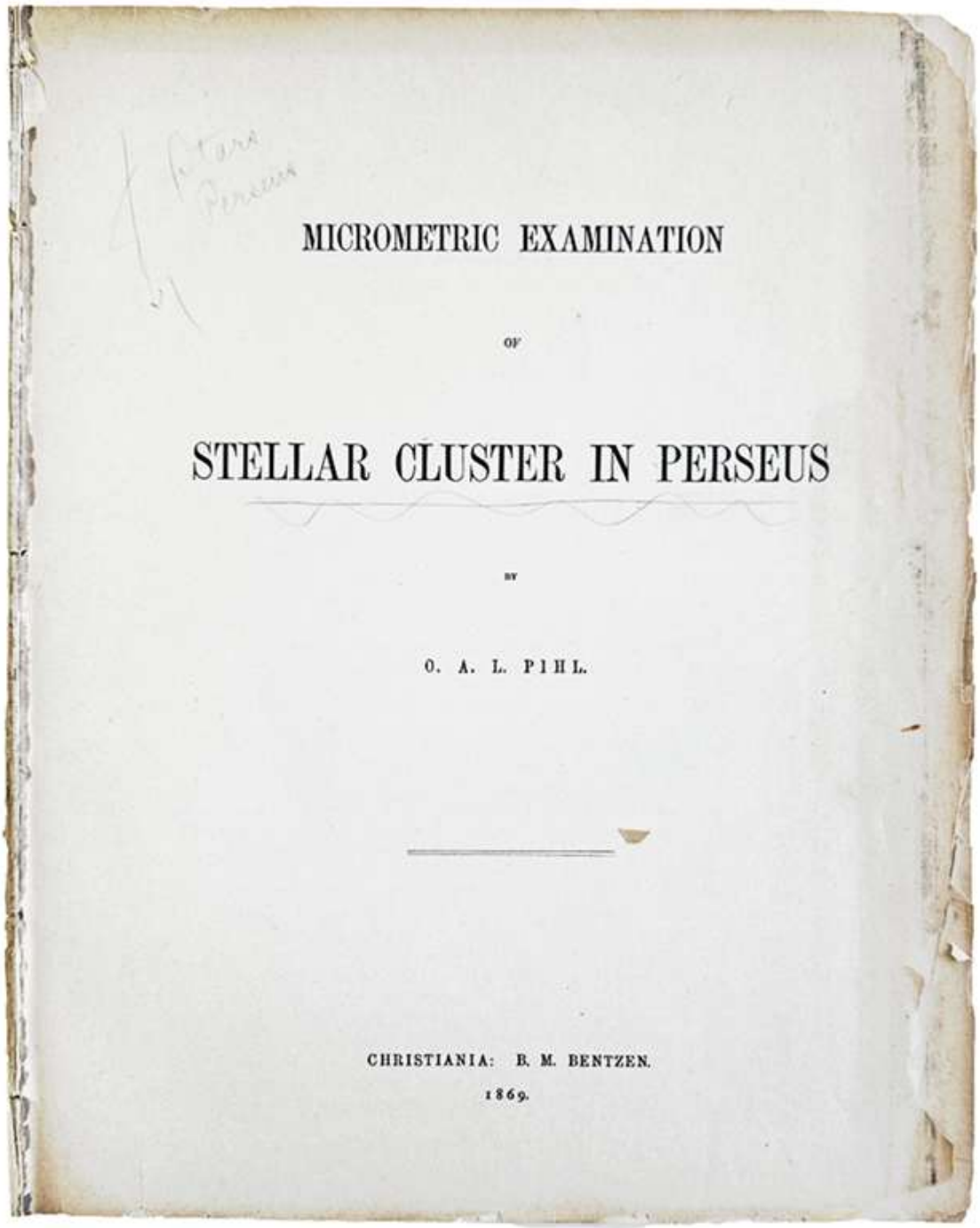
This special issue dedicated to low temperature physics includes four papers:

Bernd T. Matthias (1918-1980), "The search for high-temperature superconductors,"

John Clarke, "Electronics in superconducting junctions,"

Seth J. Putterman (1945-) and **Isadore Rudnick** (1917-1997), "Quantum nature of superfluid helium,"

John K. Hulm (1923-2004), et al, "Superconducting magnets."



MICROMETRIC EXAMINATION

OF

STELLAR CLUSTER IN PERSEUS

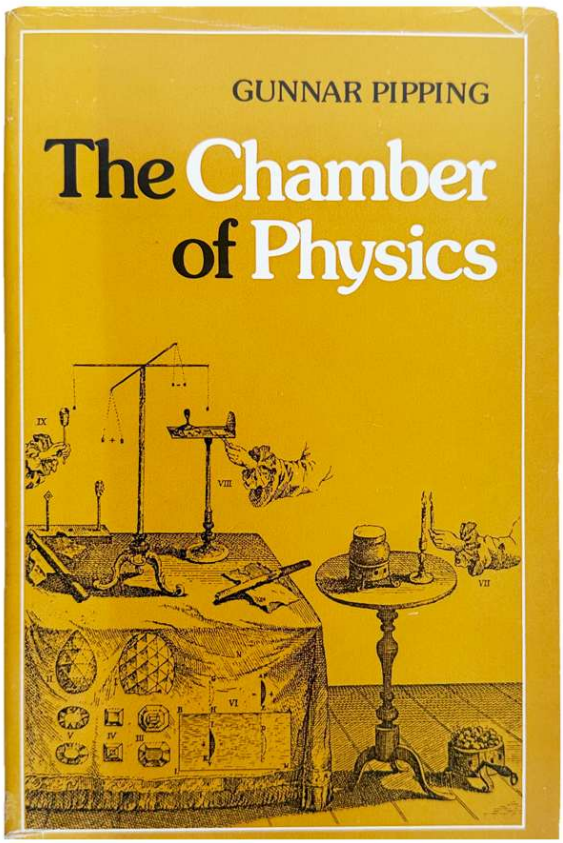
BY

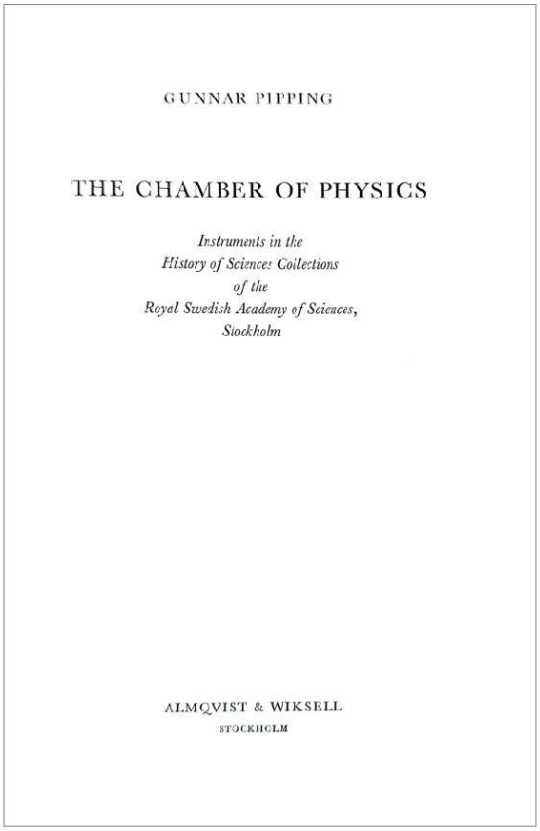
O. A. L. PIHL.

CHRISTIANIA: B. M. BENTZEN.

1869.

395. **PIHL, Olaf Andreas Lowald** (1822-1895). *Micrometric examination of stellar cluster in Perseus*. Christiania: B. M. Bentzen, 1869. ¶ 4to. 42 pp. Tables, 2 folding plates. Dis-bound; edges brittle and chipped. Ms. notation on top cover. AS IS. S6378 $ 12




GUNNAR PIPPING

THE CHAMBER OF PHYSICS

Instruments in the History of Sciences Collections of the Royal Swedish Academy of Sciences, Stockholm

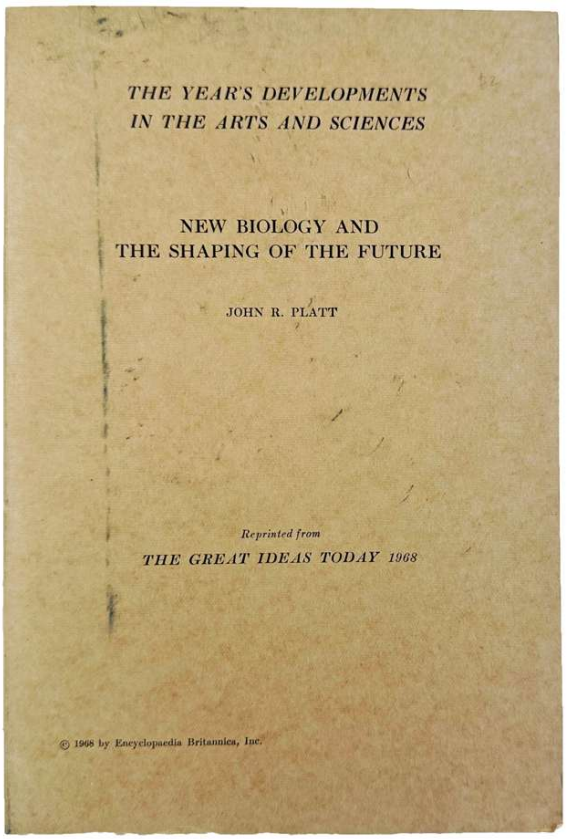
ALMQVIST & WIKSELL
STOCKHOLM

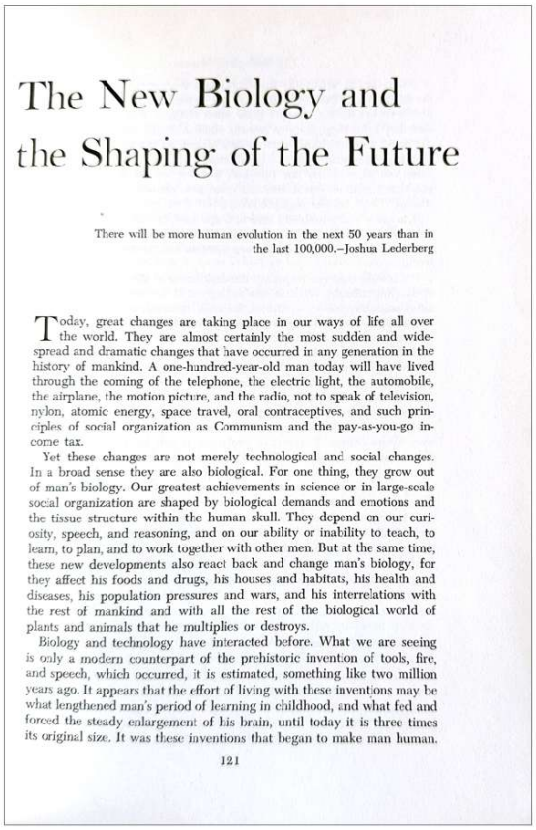
Scientific Instruments in the History of Sciences Collections of the Royal Swedish Academy of Sciences

396. **PIPPING, Gunnar** (1927-2015). *The Chamber of Physics: Instruments in the History of Sciences Collections of the Royal Swedish Academy of Sciences, Stockholm*. Stockholm: Almquist & Wiskell, (1977). ¶ Series: *Bidrag Till Kungl. Svenska Vetenskaps-Akademiens Historia,* XII. 8vo. 250 pp. 42 plates, pages mostly uncut. Printed wrappers, dust-jacket; jacket extremities lightly rubbed, foot a bit torn. Very good. S11215

$ 40

On the mathematical, philosophical, and optical instruments at the Royal Swedish Academy of Sciences, Stockholm.



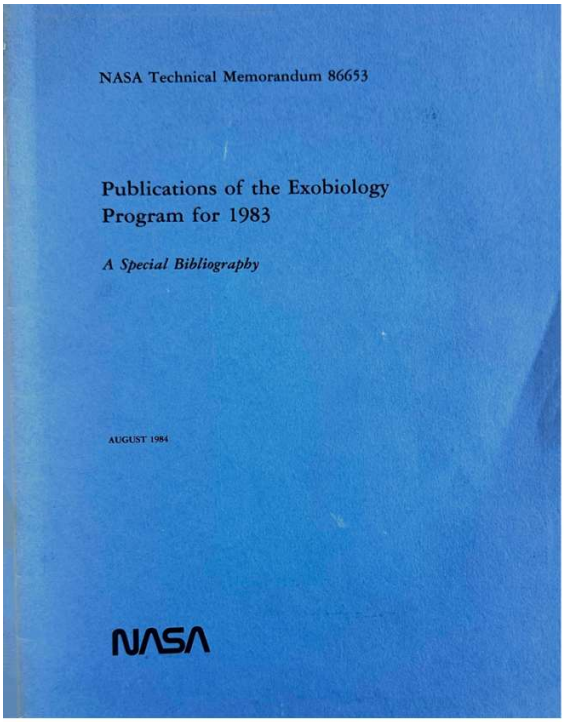


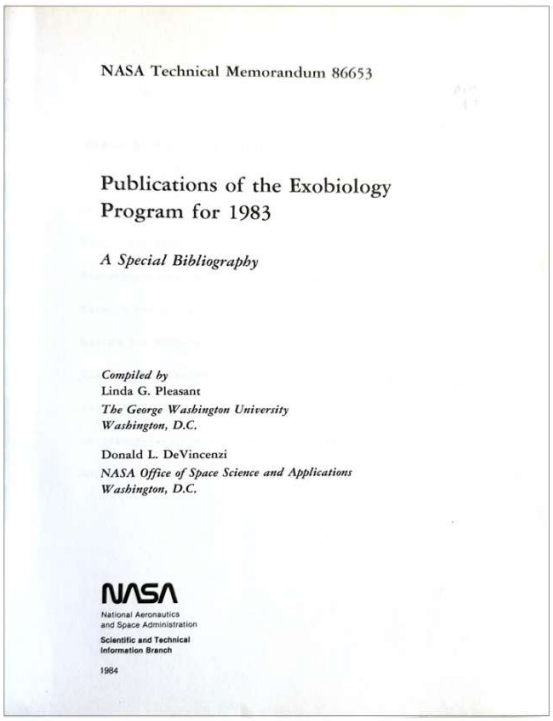
The Great Ideas Today series

395. **PLATT, John R**. (1918-1922). "*The Year's Developments in the Arts and Sciences. New Biology and the Shaping of the Future.*" Offprint from: *The Great Ideas Today*. No place: *Encyclopedia Britannica*, 1968. ¶ 8vo. 120-169 pp. Printed wrappers. FINE. S8700

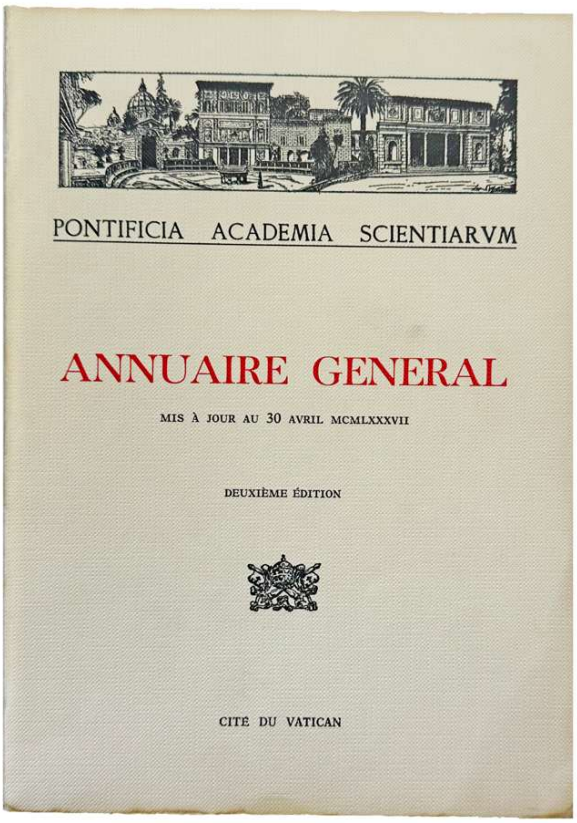
$ 4.95

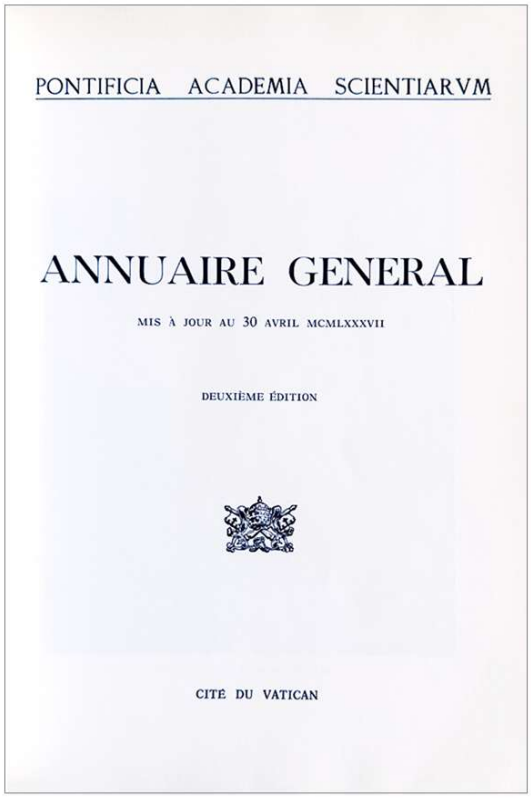
John Rader Platt was an American physicist and biophysicist, professor at the University of Chicago, noted for his pioneering work on strong inference in the 1960s and his analysis of social science in the 1970s.





396. **[Exobiology] PLEASANT, Linda G. & Donald L. DEVINCENZI** [compilers]. *Publications of the Exobiology Program for 1983: A Special Bibliography.* [Washington, DC]: NASA Scientific and Technical Information Branch, 1984. ¶ Series: NASA Technical Memorandum, 86653. Large 8vo. 35 pp. Original blue printed wrappers. RARE. Near fine. S11370 $ 10

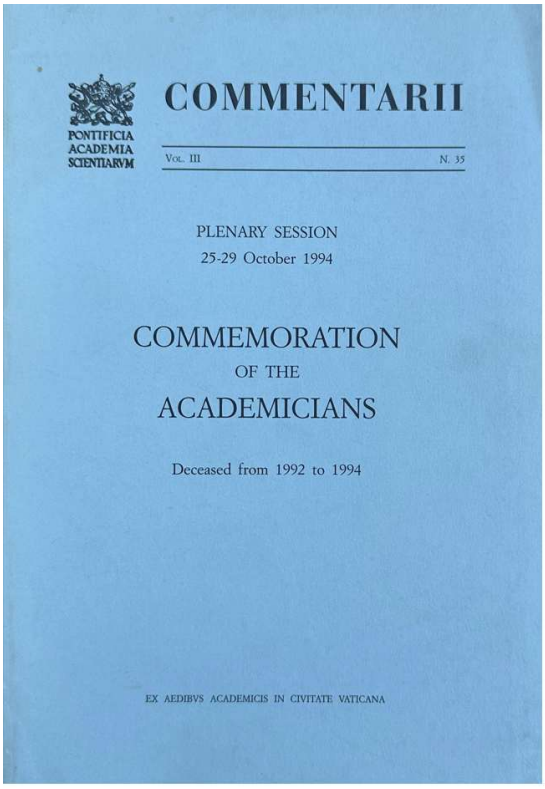


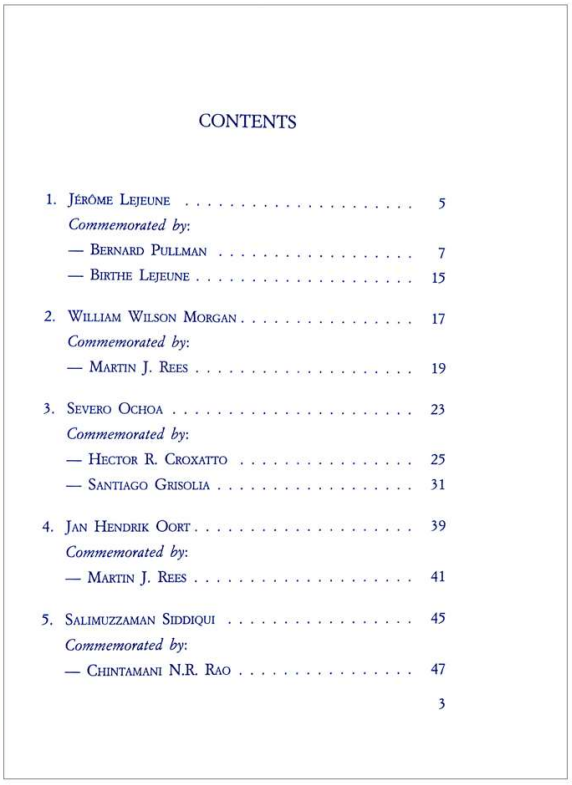


397. **Pontificia Academia Scientiarum**. *Annuaire General mis a Jour au 30 Avril MCMLXXXVII.* Vatican City: Pontificia Academia Scientiarum, 1987. ¶ 8vo. xxv, 375 pp. Photographs, index. Black-and-red-stamped soft-cover cream cloth; spine creased, extremities lightly rubbed. Introduction in French, text in English. Very good. S11519

$ 22

Contains photographs and biographies of all of the members of the Pontifical Academy of Sciences, including but not limited to Stephen Hawking, Werner Carl Heisenberg, Walter Rudolf Hess, Kenichi Fukui, Percy Cyril Claude Garnham, Paul Germain, Gerhard Herzberg, Alan Lloyd Hodgkin, Sven Horstadius, Har Gobind Khorana, Niels Bohr, Aage Niels Bohr, and Jean Lecomte, etc.





CONTENTS

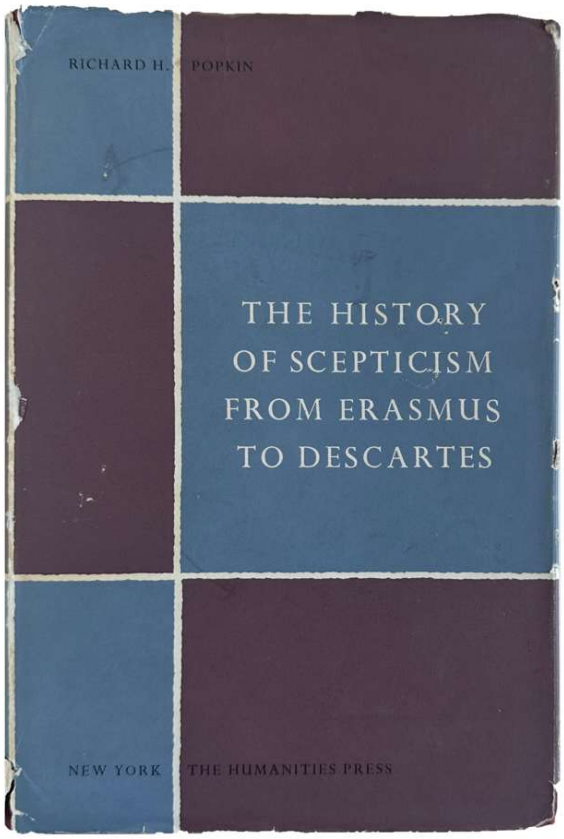
3

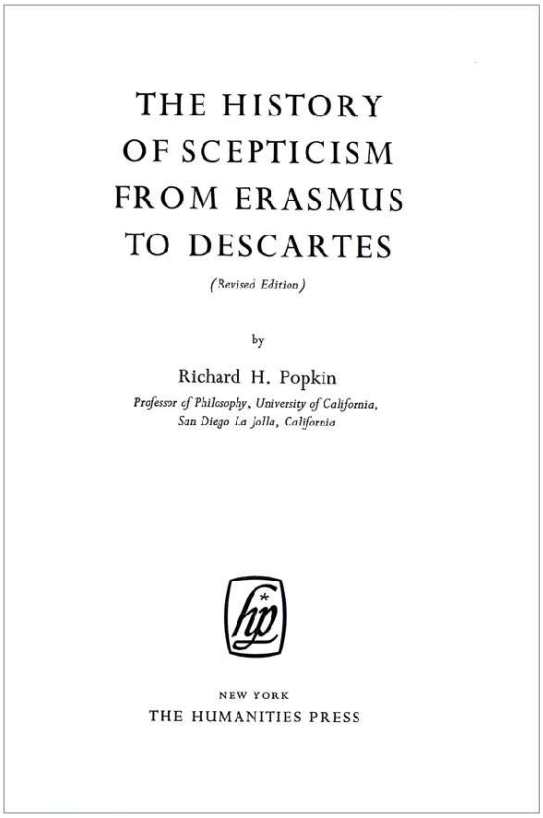
398. **Pontificia Academia Scientiarum**. *Commemoration of the Academicians Deceased from 1992 to 1994*. Vatican City: Ex AEdibus Academicis, 1994. ¶ Series: Commentarii, Vol. III, No. 35, Plenary Session, October 25-29, 1994. 8vo. 64 pp. Original blue printed wrappers. Copy of TLS from Renato Dardozzi (1 p., 4/24/96) to "Excellency" offering him the book laid-in. Very good. S11520

$ 12

This work contains commemorations for Jerome Lejeune (1926-1994), William Wilson Morgan (1906-1994), Severo Ochoa (1905-1993), Jan Hendrik Oort (1900-1992), Salimuzzaman Siddiqui (1897-1994), and Janos Szentagothai (1912-1994). Note: Renato Dardozzi (1922-2003) was an Italian electronic engineer who worked the state telecommunications company of Vatican State. At the age of 52, he became ordained as a priest, and soon became chancellor of the Pontifical Academy of Sciences. For twenty years, he was one of the very few directors of the Secretary of State of the Holy See, the oldest and

most important department of the Roman Curia, first with the Cardinal Secretary of State Agostino Casaroli then with his successor Angelo Sodano. Dardozzi is perhaps most famous for being a whistleblower on unscrupulous financial activities of the Church, smuggling over 4,000 internal documents of the Vatican's central bank, Institute for the Works of Religion to the press. "It is interesting to note that Dardozzi's motive for turning whistleblower was not unalloyed disapproval of the IOR's unethical conduct. His decision to smuggle his secret archive out of the Vatican was motivated, at least in part, by anger at the institute's refusal to pay him a commission on the sale of a valuable real estate property near Florence. The unusual monsignor wanted to leave the money to his adoptive daughter, whose health condition required expensive hospital treatment. Whatever the reason, Dardozzi's archive offers an unprecedented glimpse of the inner workings of one of the world's most secretive and unaccountable financial institutions" (Willan). "Excellency" is the formal way to address a bishop of the Catholic Church. Willan, Philip, "[Review of:] How the Vatican Sold Its Soul," *The Guardian*, 6/3/2009, available on-line.



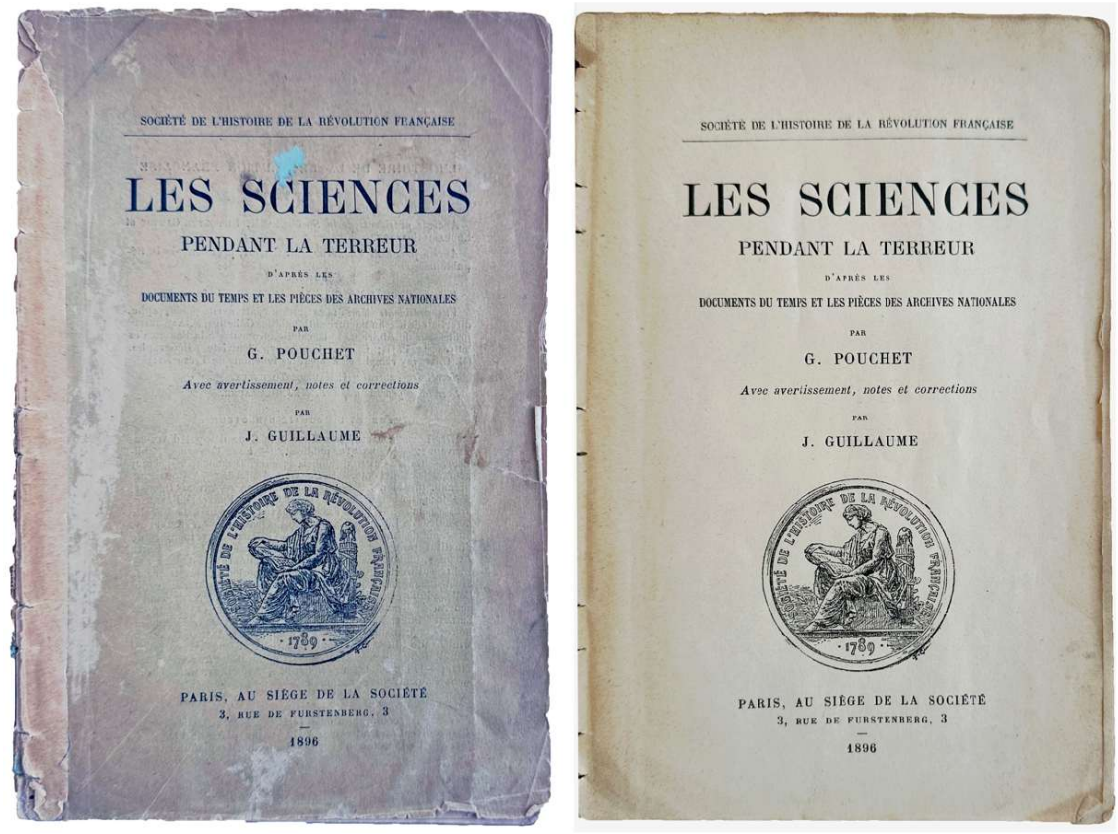


David C. Lindberg's copy with his extensive notes

399. **POPKIN, Richard H.** (1923-2005). *The History of Scepticism from Erasmus to Descartes*. New York: Humanities Press, (1964). ¶ Revised edition. 8vo. xvii, 240 pp. Bibliography, index; ink underlining and marginalia throughout. Gilt-stamped red cloth, dust-jacket; jacket heavily rubbed, corners and spine ends missing pieces. Ownership signature of Professor David C. Lindberg (1935-2015), with his extensive ink markings. As is. S10201

$ 10

Richard Henry Popkin was an American academic philosopher who specialized in the history of enlightenment philosophy and early modern anti-dogmatism. Popkin "was a prolific scholar who published widely on a variety of subjects, most notably the history of skepticism (or, as he always insisted on spelling it, "scepticism"), Jewish-Christian intellectual relations in the early modern period, millenarian thought, and many other topics. He also published one of the first books challenging the Warren Commission report about the assassination of John F. Kennedy." – Jeremy D. Popkin, University of Kentucky [R.H.P.'s son].



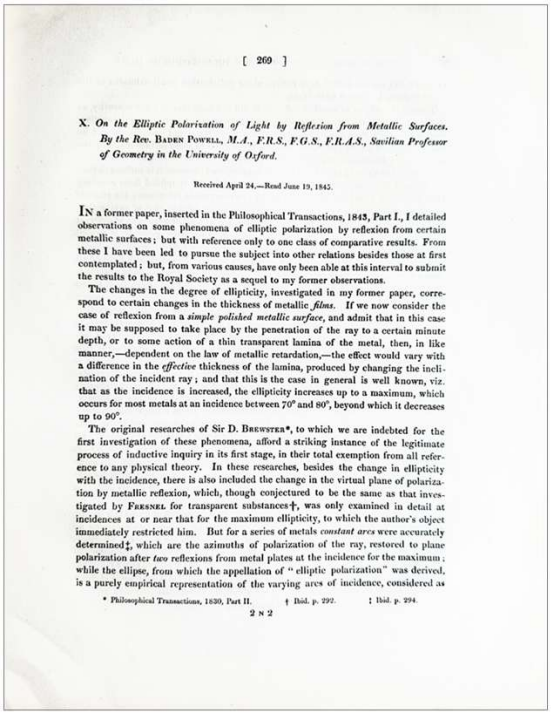
Science During the Reign of Terror

400. **POUCHET, Georges** (1833-1894). *Les Sciences Pendant la Terreur d'après les documents du temps et les pièces des archives nationales*. Paris: Au siège de la Société, 1896. ¶ Series: *Société de l'histoire de la révolution française*. 8vo. 60 pp. Original pale green printed wrappers; first signature and cover off. Good. Charles Henri Georges Pouchet (1833–1894) was a French naturalist and anatomist chief of anatomical works at the Museum national d'histoire naturelle in Paris. Scarce. As is. RH1586

$ 8.95

[Science During the Reign of Terror, based on contemporary documents and items from the national archives].

From the collection of Roger Hahn (1932-2011). "Roger Hahn was a distinguished member of the first cohort of historians of science trained in the programs established in the United States after World War II. As an undergraduate in physics and history at Harvard (AB, 1953), he had an opportunity of hearing T.S. Kuhn and I.B. Cohen. After obtaining a master's degree in teaching at Harvard (1954), he went to Paris on a Fulbright to prepare himself more pertinently in the seminars of Alexandre Koyre and Rene Taton. From Koyre he took an interest in philosophical questions; from Taton, an interest in the dissemination of science." "Roger died on May 30, 2011, en route to Paris, where he was to hold an early celebration of his 80th birthday. During a stopover in New York, he contracted a respiratory disease that overwhelmed an immune system weakened by years of battling cancer. In his baggage was a large manuscript, finished apart from a few minor details, containing Laplace's known correspondence and the significant records about him that Roger had uncovered during almost fifty years of resourceful searching." [University of California, Berkeley]. See: *ISIS*, vol. 24, no. 2, February 1936. My added note: I bought Roger's office library circa May 1, 2011. Since then, I have slowly brought his books to the market.



[269]

X. *On the Elliptic Polarization of Light by Reflexion from Metallic Surfaces.* *By the Rev.* Baden Powell, *M.A., F.R.S., F.G.S., F.R.A.S., Savilian Professor of Geometry in the University of Oxford.*

Received April 24,—Read June 19, 1845.

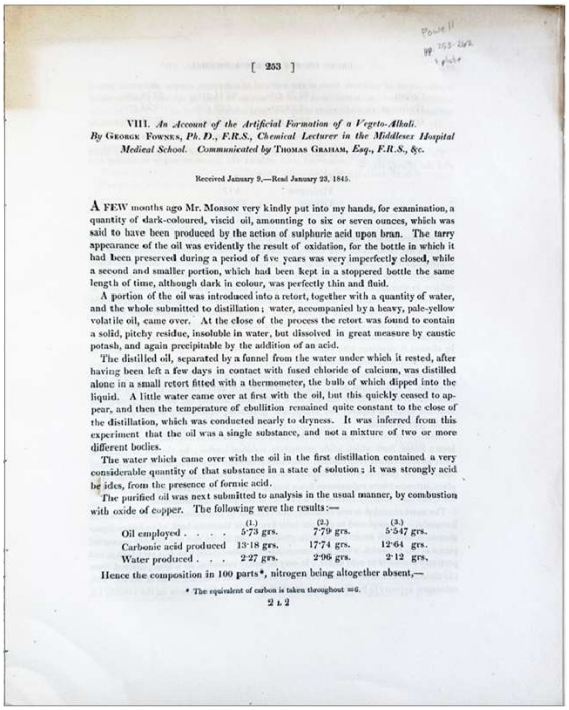
In a former paper, inserted in the Philosophical Transactions, 1843, Part I., I detailed observations on some phenomena of elliptic polarization by reflexion from certain metallic surfaces; but with reference only to one class of comparative results. From these I have been led to pursue the subject into other relations besides those at first contemplated; but, from various causes, have only been able at this interval to submit the results to the Royal Society as a sequel to my former observations.

The changes in the degree of ellipticity, investigated in my former paper, correspond to certain changes in the thickness of metallic *films*. If we now consider the case of reflexion from a *simple polished metallic surface*, and admit that in this case it may be supposed to take place by the penetration of the ray to a certain minute depth, or to some action of a thin transparent lamina of the metal, then, in like manner,—dependent on the law of metallic retardation,—the effect would vary with a difference in the *effective* thickness of the lamina, produced by changing the inclination of the incident ray; and that this is the case in general is well known, viz. that as the incidence is increased, the ellipticity increases up to a maximum, which occurs for most metals at an incidence between 70° and 80°, beyond which it decreases up to 90°.

The original researches of Sir D. Brewster*, to which we are indebted for the first investigation of these phenomena, afford a striking instance of the legitimate process of inductive inquiry in its first stage, in their total exemption from all reference to any physical theory. In these researches, besides the change in ellipticity with the incidence, there is also included the change in the virtual plane of polarization by metallic reflexion, which, though conjectured to be the same as that investigated by Fresnel for transparent substances†, was only examined in detail at incidences at or near that for the maximum ellipticity, to which the author's object immediately restricted him. But for a series of metals *constant arcs* were accurately determined‡, which are the azimuths of polarization of the ray, restored to plane polarization after *two* reflexions from metal plates at the incidence for the maximum; while the ellipse, from which the appellation of "elliptic polarization" was derived, is a purely empirical representation of the varying arcs of incidence, considered as

* Philosophical Transactions, 1830, Part II. † Ibid. p. 292. ‡ Ibid. p. 294.

2 N 2



[253]

VIII. *An Account of the Artificial Formation of a Vegeto-Alkali.* *By* George Fownes, *Ph. D., F.R.S., Chemical Lecturer in the Middlesex Hospital Medical School. Communicated by* Thomas Graham, *Esq., F.R.S., &c.*

Received January 9,—Read January 23, 1845.

A few months ago Mr. Monson very kindly put into my hands, for examination, a quantity of dark-coloured, viscid oil, amounting to six or seven ounces, which was said to have been produced by the action of sulphuric acid upon bran. The tarry appearance of the oil was evidently the result of oxidation, for the bottle in which it had been preserved during a period of five years was very imperfectly closed, while a second and smaller portion, which had been kept in a stoppered bottle the same length of time, although dark in colour, was perfectly thin and fluid.

A portion of the oil was introduced into a retort, together with a quantity of water, and the whole submitted to distillation; water, accompanied by a heavy, pale-yellow volatile oil, came over. At the close of the process the retort was found to contain a solid, pitchy residue, insoluble in water, but dissolved in great measure by caustic potash, and again precipitable by the addition of an acid.

The distilled oil, separated by a funnel from the water under which it rested, after having been left a few days in contact with fused chloride of calcium, was distilled alone in a small retort fitted with a thermometer, the bulb of which dipped into the liquid. A little water came over at first with the oil, but this quickly ceased to appear, and then the temperature of ebullition remained quite constant to the close of the distillation, which was conducted nearly to dryness. It was inferred from this experiment that the oil was a single substance, and not a mixture of two or more different bodies.

The water which came over with the oil in the first distillation contained a very considerable quantity of that substance in a state of solution; it was strongly acid besides, from the presence of formic acid.

The purified oil was next submitted to analysis in the usual manner, by combustion with oxide of copper. The following were the results:—

	(1.)	(2.)	(3.)
Oil employed	5·73 grs.	7·79 grs.	5·547 grs.
Carbonic acid produced	13·18 grs.	17·74 grs.	12·64 grs.
Water produced . . .	2·27 grs.	2·96 grs.	2·12 grs.

Hence the composition in 100 parts*, nitrogen being altogether absent,—

* The equivalent of carbon is taken throughout 6.

2 L 2

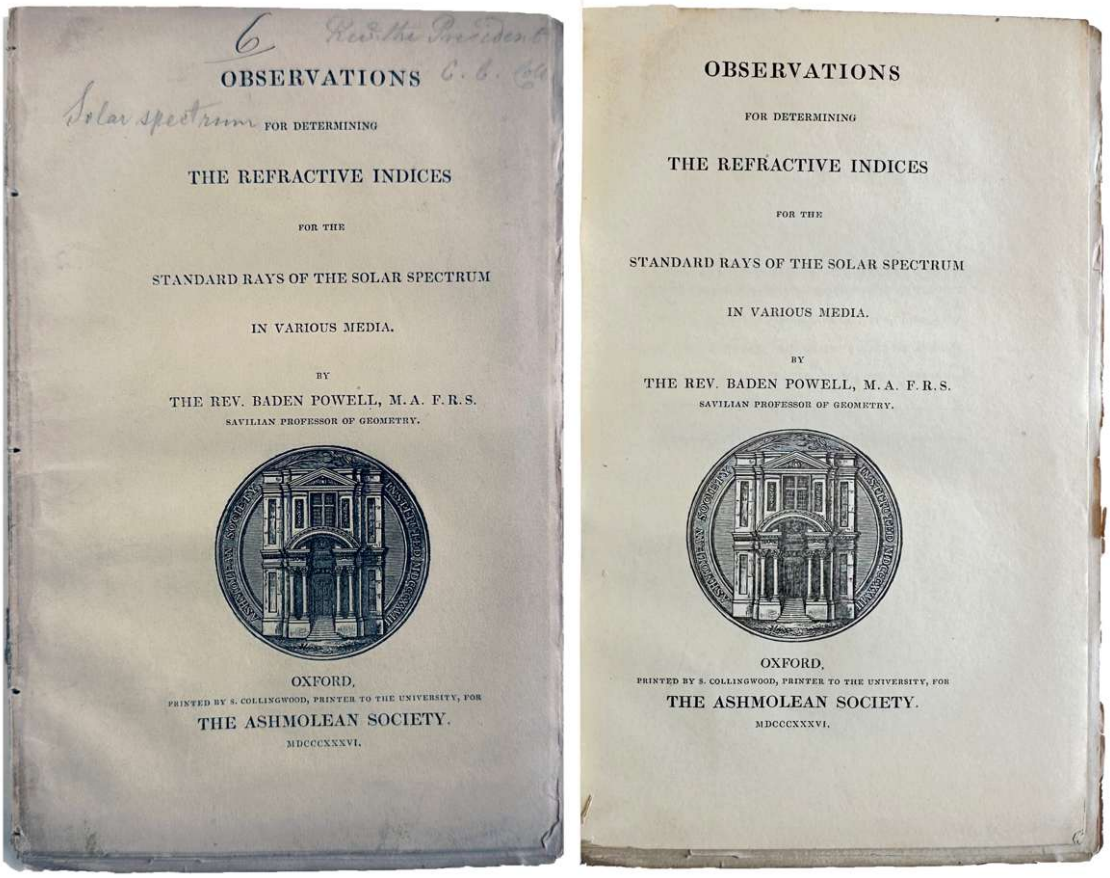
401. **POWELL, Baden** (1796-1860). *On the elliptic polarization of light by reflexion from metallic surfaces.* with: **FOWNES, George** (1815-1849). *An account of the artificial formation of a vegeto-alkali.* with: **FOWNES**. *On benzoline, a new organic salt-base from bitter almond oil.* Extract from: *Philosophical Transactions of the Royal Society of London*, Volume 135, Part II. London: Richard and John E. Taylor, 1845. ¶ 300 x 234 mm. 4to. Pages 253-262; 263-267; 269-282. 4 tables, 1 lithographic plate; numerous tables. Dis-bound. S4275

$ 20

The most notable [of Powell's experimental work] was the investigation of the dispersion of light (described in the *Philosophical Transactions of the Royal Society* between 1835 and 1838), which he used to support the wave theory as treated by Cauchy." *DSB*, XI, pp. 115-116.

See: *DNB*, XVI, p. 239. George Fownes's "most notable achievement" was the isolation of two new organic bases. In 1845 . . . he isolated benzoline (hydrobenzamide) from the oil of bitter almonds." – *DSB*.

Fownes received the Ph.D. in 1839 from the University of Giessen under Liebig. He died in 1849 of tuberculosis. – *DSB*, V, pp. 103-104.



OBSERVATIONS

FOR DETERMINING

THE REFRACTIVE INDICES

FOR THE

STANDARD RAYS OF THE SOLAR SPECTRUM

IN VARIOUS MEDIA.

BY

THE REV. BADEN POWELL, M.A. F.R.S.

SAVILIAN PROFESSOR OF GEOMETRY.

OXFORD,

PRINTED BY S. COLLINGWOOD, PRINTER TO THE UNIVERSITY, FOR

THE ASHMOLEAN SOCIETY.

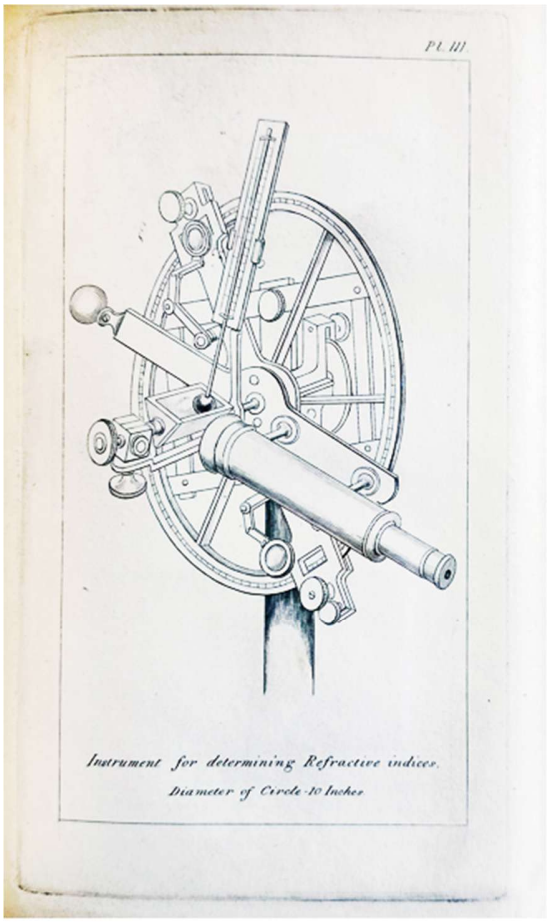
MDCCCXXXVI.

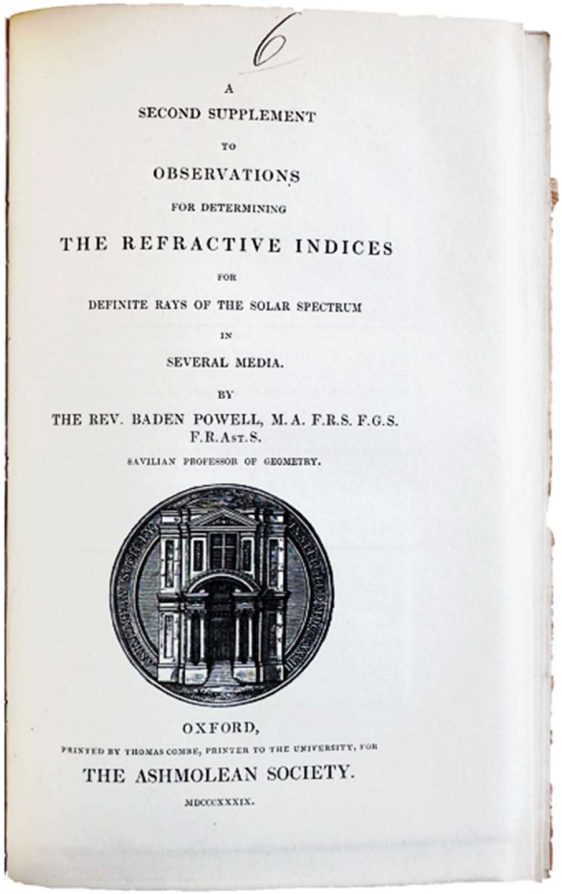
402. **POWELL, Baden** (1796-1860). *Observations for determining the refractive indices for the standard rays of the solar spectrum in various media. with: Additional observations for determining the refractive indices for definite rays of the solar spectrum in several media. with: A second supplement to observations for determining the refractive indices for definite rays of the solar spectrum in several media.* Oxford: Ashmolean Society, 1836, 1838, 1839. ¶ Three parts. 227 x 147 mm. Small 4to. [iv], [24]; 18, 2; [ii], 8 pp. Title-page vignettes, 38 tables, 3 engraved plates. Printed wrappers (top cover of first item only); dis-bound, but glued at spine end. Ink and pencil notations on top cover and last two title pages. Very good. RARE. S3601

$ 200

FIRST EDITION. These researches on the refractive powers of various media upon the solar spectrum date from the period of Baden Powell's best-known scientific research. He is best-known for experiments on the heating effect produced beyond the red end of the solar spectrum reported in the *Philosophical*

Transactions of the Royal Society in 1825 and 1826. He also investigated the dispersion of light which he used to support the wave theory as treated by Cauchy. Baden Powell was Savilian professor of geometry at Oxford beginning in 1827 until his death. In 1835-7 he prepared a series of four papers on dispersion of light for the *Philosophical Transactions*. Powell was a frequent contributor to scientific periodicals, chiefly on optical questions, but also on questions connected with the general history and study of science. See: *DNB*, XVI, p. 239; *DSB*, XI, pp. 115-116.

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A
SECOND SUPPLEMENT
TO
OBSERVATIONS
FOR DETERMINING
THE REFRACTIVE INDICES
FOR
DEFINITE RAYS OF THE SOLAR SPECTRUM
IN
SEVERAL MEDIA.
BY
THE REV. BADEN POWELL, M.A. F.R.S. F.G.S.
F.R.Ast.S.
SAVILIAN PROFESSOR OF GEOMETRY.

OXFORD,
PRINTED BY THOMAS COMBE, PRINTER TO THE UNIVERSITY, FOR
THE ASHMOLEAN SOCIETY.
MDCCCXXXIX.

17 Hertford Street,
Mayfair. W

Oct 27/73

Dear Sir

You are quite welcome to make use of my name, if it will be of the least use to King's College Hospital — Believe me

Yours very truly

Wm Priestley

[4]3 PRIESTLEY

403. **PRIESTLEY, William Overend** (1829-1900). Autograph letter signed to unknown recipient. London, October 27, 1873. ¶ 1 page. Folded. Fine. S14346

$ 35

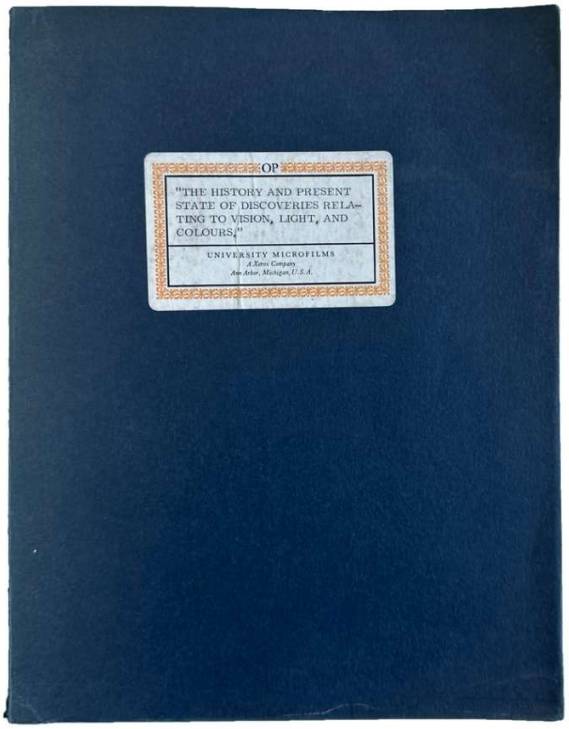
"Dear Sir,/ You quite welcome/ to make use of my home,/ if it will be of the best [?]/ all [?] to Kings College Hos-/ pital—Behind me./ Yours very truly/ Wm. O. Priestley."

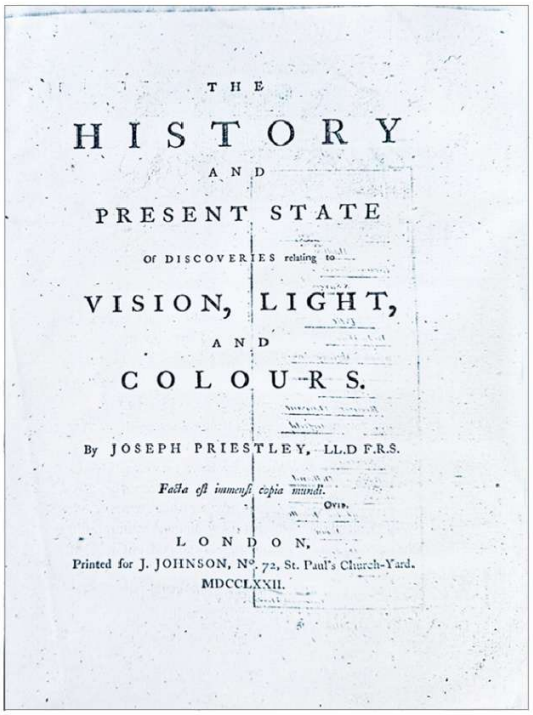
The letter is written on Priestley's letterhead bearing his address of 17 Hertford St., Mayfair [London].

Sir William Overend Priestley was a British physician and great nephew of Joseph Priestley. He was educated at King's College and Edinburgh University, becoming a Senate Gold Medalist upon his graduation from Edinburgh. He was a professor of obstetrics at King's College in London, working at King's College Hospital, a position he held from 1862 to 1872. In 1865, Priestley "was appointed Physician-Accoucheur to the Princess of Hesse, and to the members of the Orleans family resident in England" (Smith, p. 121). Priestley was knighted in 1893 and became a conservative Member of Parliament for the universities of Edinburgh and St. Andrews in 1896 – See: "David Murray Marshall Hall…"). He was a member of the Royal College of Surgeons of England (Medical Directory for 1872, p. 198). Priestley is the author of "numerous papers on natural history and medicine" (Smith, p. 121).

The case notes (1870-74) of Priestley and Dr. William Smoult Playfair are held in the King's College Hospital and "describe medical disorders and procedures such as renal disease, pneumonia, rickets, bronchitis, croup, cyanosis, convulsions, diarrhoea, chorea, febricula (fever), essential paralysis, pleurisy, typhoid fever, and congenital heart defect. Case notes give patient name, address, admission date, and ward." (KH/CN3/3 1870, Jun-1874, Jul.).

☼ "David Murray Marshall Hall's Ancestors and Their Descendants" [available on-line]; Kings College Hospital Archives. KH/CN3/3 June 1870 – July 1874; The Medical Directory for 1872 and the General Medical Register. London: J. and A. Churchill, 1872; Smith, William. The History and Antiquities of Morley. London: Longmans, Green, 1876.




THE
HISTORY
AND
PRESENT STATE
Of DISCOVERIES relating to
VISION, LIGHT,
AND
COLOURS.
By JOSEPH PRIESTLEY, LL.D F.R.S.
Facta est immensi copia mundi.
OVID.
LONDON,
Printed for J. JOHNSON, N° 72, St. Paul's Church-Yard.
MDCCLXXII.

404. **PRIESTLY, Joseph** (1733-1804). *The History and Present State of Discoveries Relating to Vision, Light, and Colours.* Ann Arbor, MI: University Microfilms, [n.d.]. ¶ Microfilm facsimile. Large 8vo. v, 812 pp. Fold-out frontispiece, plates, index. Blue wrappers, title labels tipped-in to spine and front cover; spine creased, edges rubbed. Very good. S10586

$ 35

Microfilm facsimile of an original copy (London: J. Johnson, 1772) at the University of Michigan.

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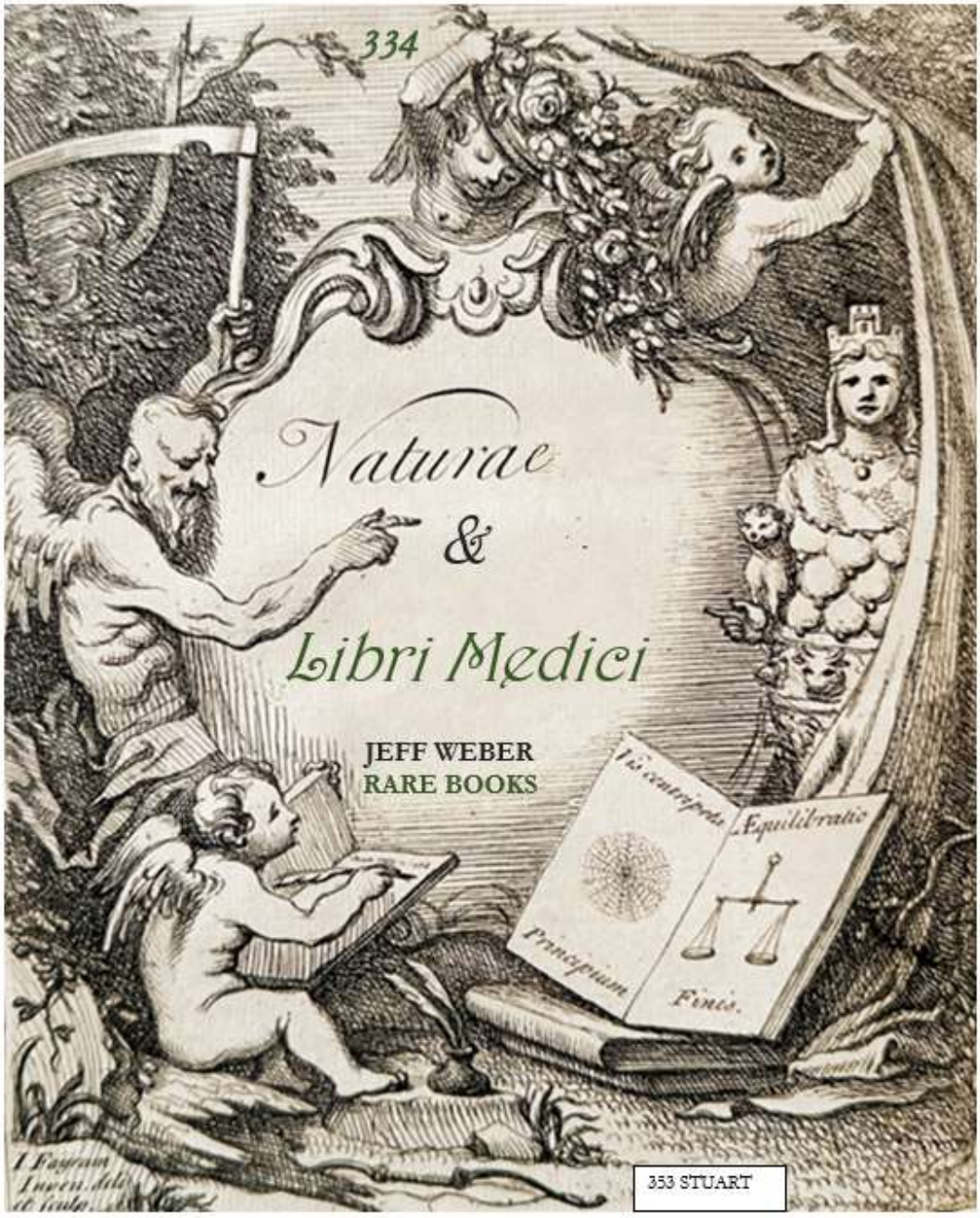

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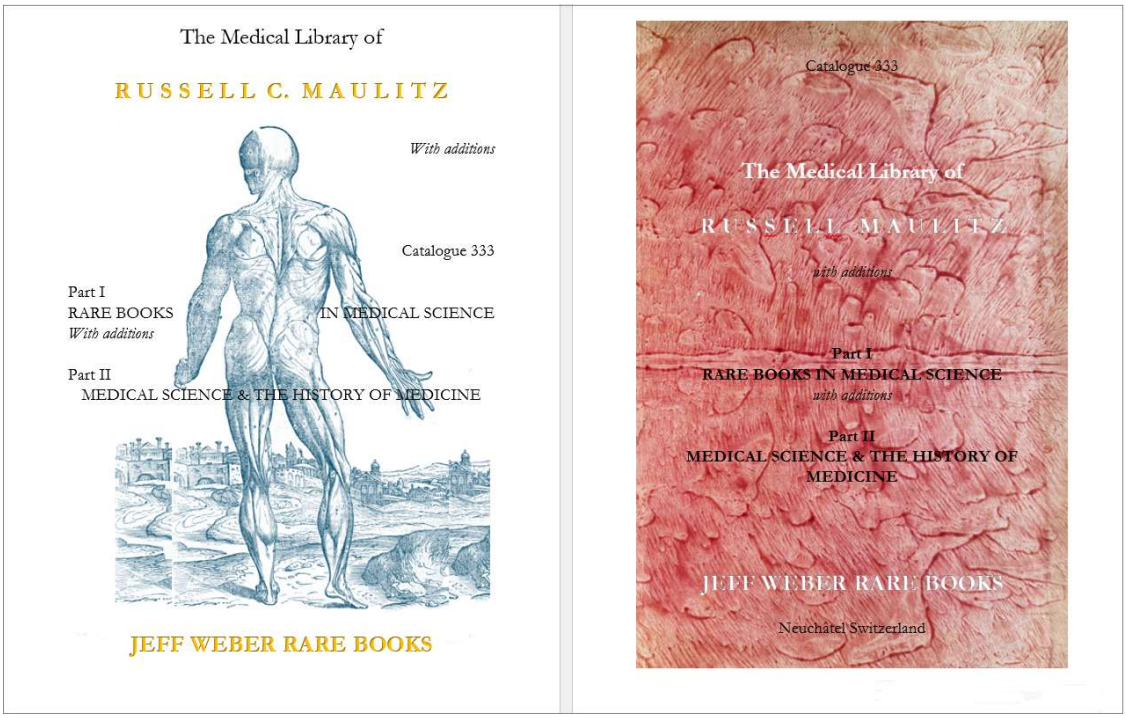
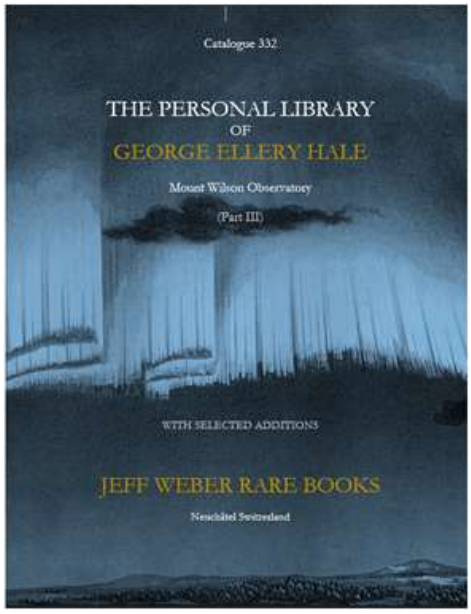
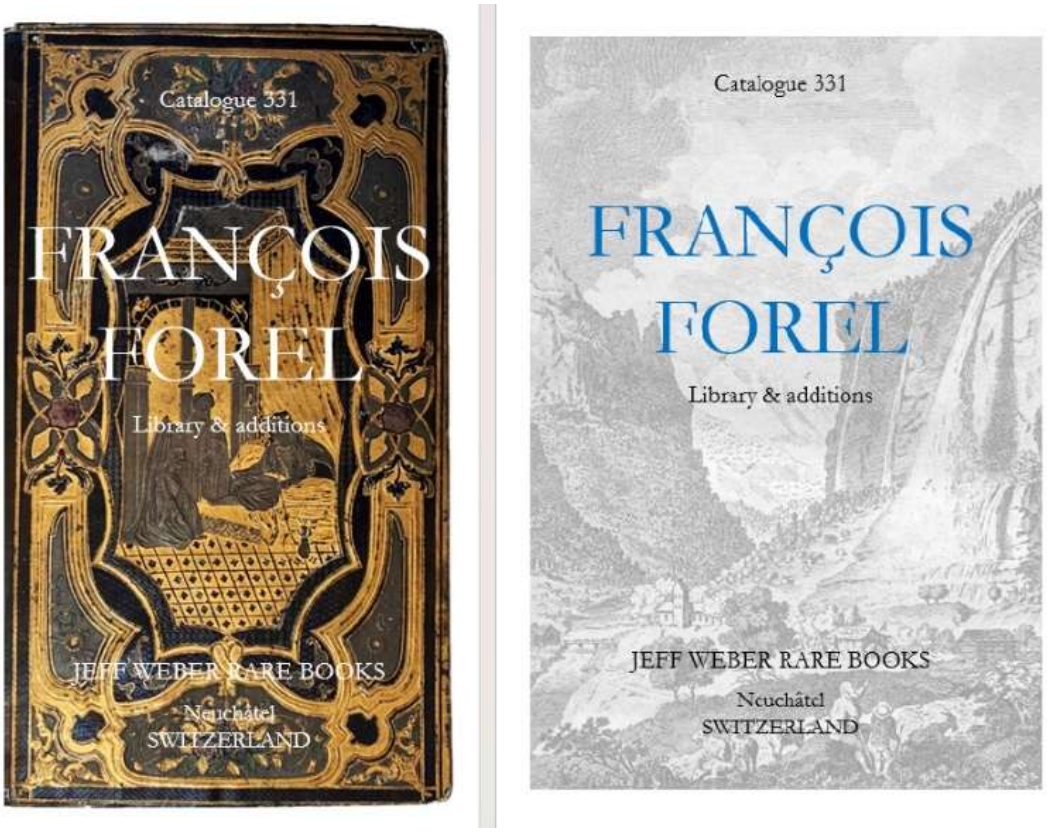


Catalogue 333: The Medical Library of Russell C. Maulitz, with additions.



Catalogue 332: My third installment of books from the Mount Wilson Observatory, including a considerable number signed by George Ellery Hale, the great solar astronomer of Pasadena, California.



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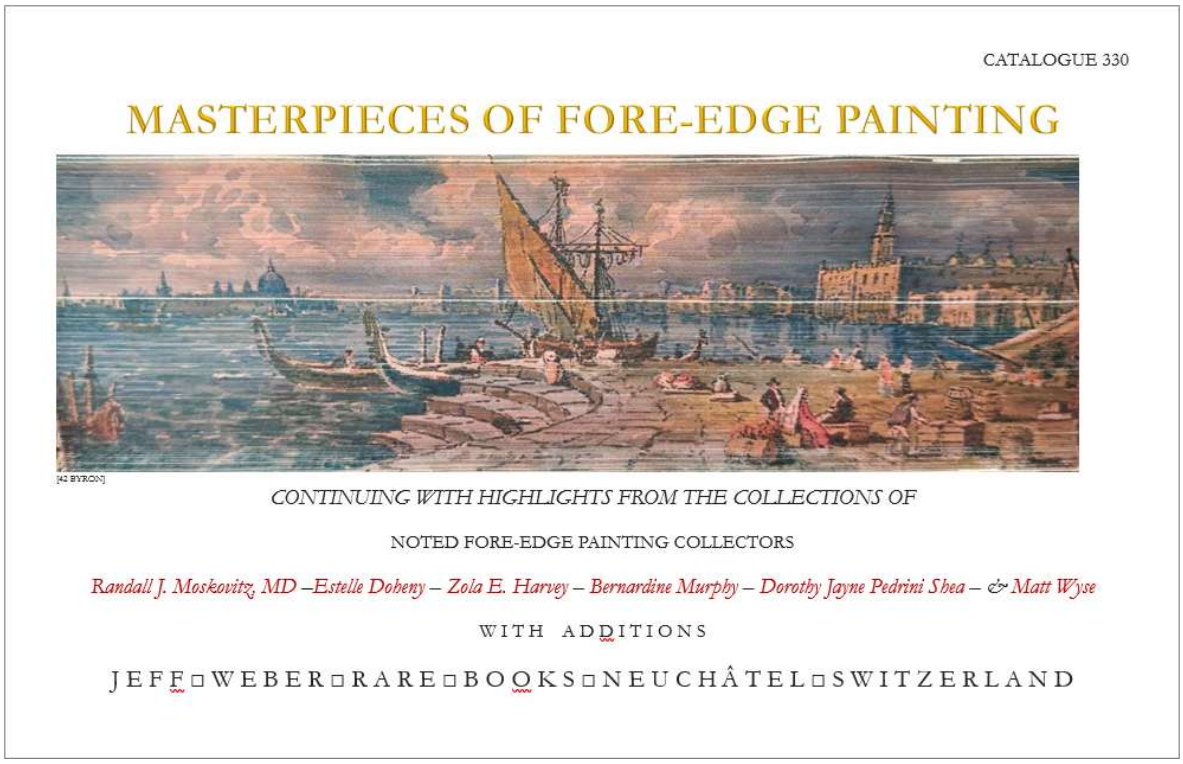

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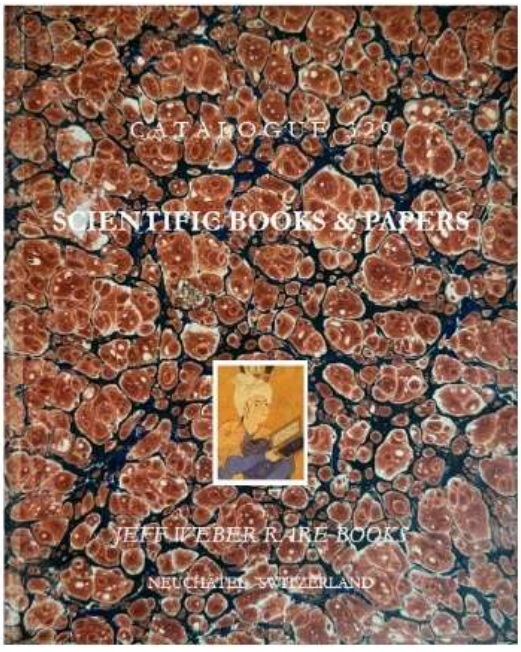

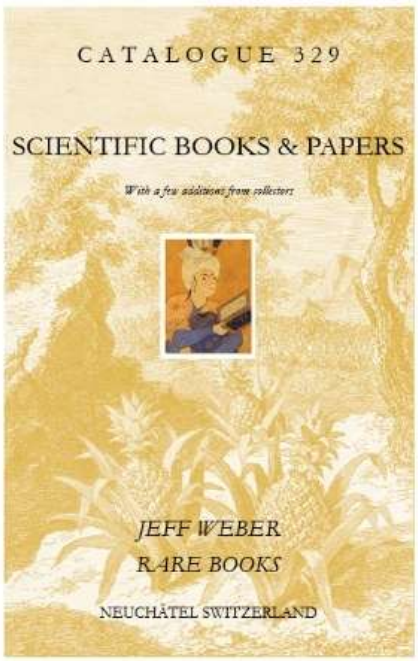

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