

Trigonometry from Brahe's Library –

Extremely rare photographically illustrated work, one of only five copies produced

**[BRAHE, TYCHO.] [BÖHM, JOSEF GEORG.]** PHOTOGRAPHISCHE COPIE VON TYCHO BRAHE'S MANUSCRIPT: "Triangulorum planorum et sphaericorum Praxis Arithmetica etc." [K. k Hofbuchdruckerei v. Gottlib Haase Soehne in Prag. 1862.]

Large 4to, ff. [2] printed half-title and introductory leaf, 44 original albumen photographs, laid recto and verso on 22 card leaves, each retaining separating tissue guard; leaves all a little browned with some marginal soiling, some tissue guards a little foxed with a few small tears, but otherwise good; gutter cracked a little before half title and a little delicate, small residue of paper on final paste-down, possibly an old binders label; in contemporary full brown morocco, elaborately lettered and tooled in gilt, presumably for presentation, with gloss paper paste-downs and front free endpapers, inner hinge cracked but holding; a fine copy of a unique and remarkable production.

**\$24,000**

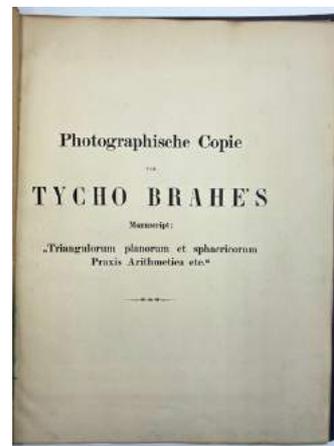
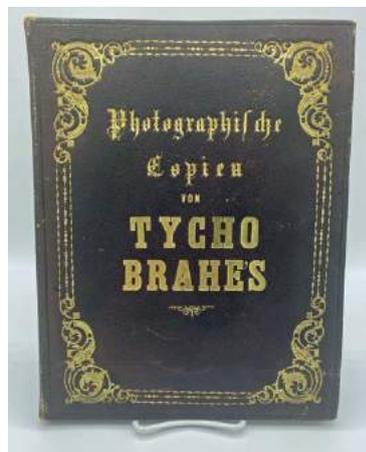
Introduction:

A remarkable publication and early example of a photographically illustrated book, of significant scholarly interest and potential not only to historians of science, astronomy and mathematics but also a valuable resource for scholars of photography, and to those studying the history of the book and book production. This is of the utmost rarity, one of only five copies produced, the only copy currently in private hands, with no copy currently in the US.

This beautiful volume, which was no doubt published at great expense, is the work of the Austrian astronomer, mathematician, and noted globe-maker Josef Georg Böhm (1807-1868), at the time Director of the Prague Observatory, and Professor of practical and theoretical astronomy at the University of Prague. As revealed by the preface, its production was a real personal labour of love, and



reproduces an important trigonometrical manuscript from Brahe's library, and which subsequently became the focus of much academic debate.

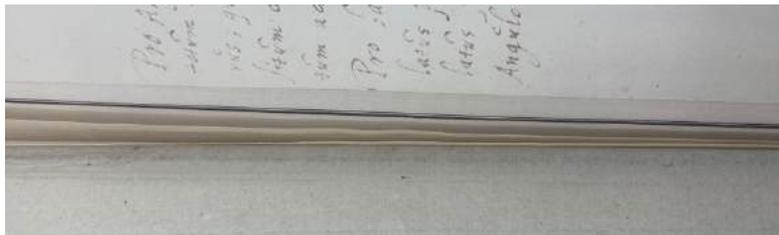
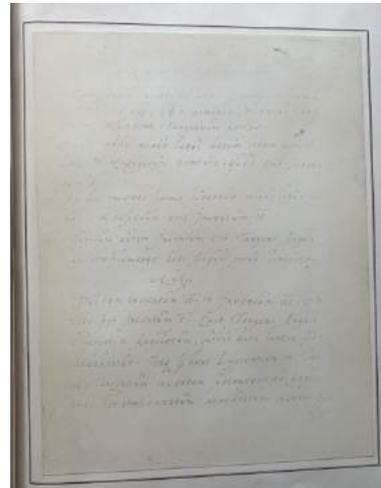


Contents:

After a one leaf introduction by Böhm, in which he gives a fascinating first-hand account of the challenges he faced in producing this photographic reproduction of the manuscript, the volume comprises 44 albumen photographs neatly mounted on card, themselves mounted on stubs. The original tissue guards all remain in place, a few of which are a little foxed with some occasional small tears, but nevertheless preserving the images as originally intended. Böhm included the blank manuscript pages as well, and as he noted himself in the preface, some of the handwriting is a little faint in a couple of the photographs - no doubt due to the photographic conditions on the day. A comparison with the digitised Dresden copy bears a remarkably resemblance, suggesting that the fading is not due to a deterioration of the photograph itself. The 'imperfections' as Böhm views them - such as the capturing of the clamps at the edges of a couple of images, to the modern eye merely add to the immediacy and visual appeal of the work, and provide a tangible reminder of the practical

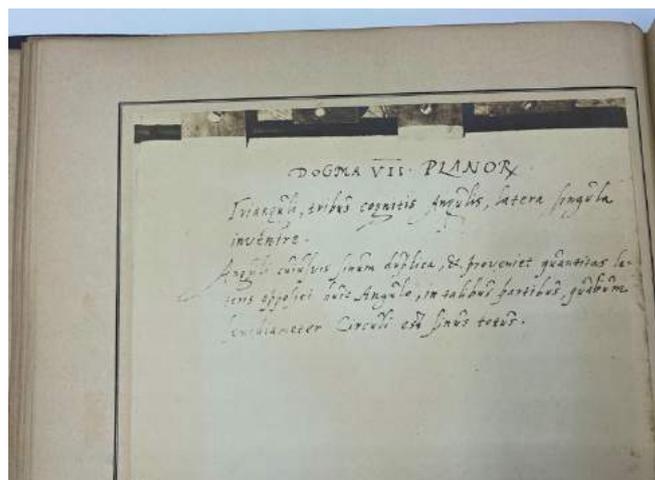


challenges faced by the early photographers. On closer inspection one can also see the wooden frame behind the manuscript sheet.



#### History of the original manuscript and its importance:

During the seventeenth century, the famous Clementinum Library in Prague acquired over 50 items associated with Tycho Brahe's library, of which two were particularly noteworthy and became the focus of much scholarly attention. The first is a well annotated copy 1566 edition of Copernicus' *De revolutionibus*, which for many years was believed to have been annotated by Brahe himself. The second is a short manuscript entitled 'Tychonis Brahe Triangulorum planorum et spaericorum Praxis arithmetica'. 'The putative identification of this latter item has played a crucial role in the subsequent claims concerning the hand-writing in the *De revolutionibus*' (Gingerich and Westman, 'The Wittich

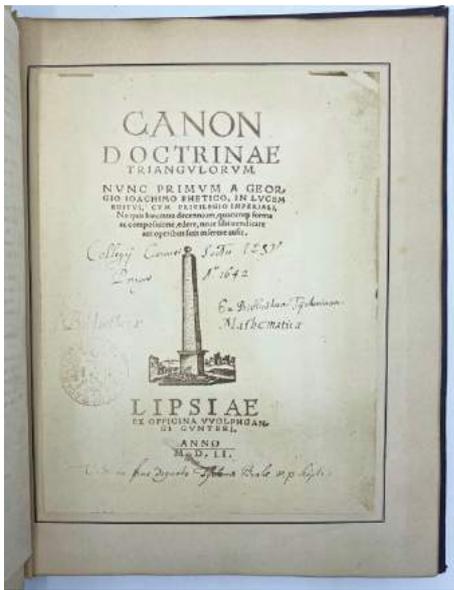




Connection: Conflict and Priority in Late Sixteenth Century Cosmology' p. 24 in *Transactions of the American Philosophical Society*, Vol. 78, No. 7, 1988).

It is this small manuscript manual, giving an important set of rules for solving plane and spherical triangles, which Böhm has chosen to reproduce here. The manuscript remains of considerable importance itself for the history of the trigonometric 'prosthaphaeresis method'. Comprised of 24 pages, shelf-mark XIV, C. 20, the manuscript is bound following a printed work, Rheticus's *Canon doctrinatle triangulorum* (Leipzig, 1551), which bears on its title page the inscription "Collegii Caesarei Societatis Jesu Pragae 1642, Ex Bibliotheca Tichoniana, Bibliotheca Mathematicae".

'Throughout his professional career, Tycho Brahe was much interested in novel trigonometrical techniques to ease the work of coordinate conversions. In a 1586 letter, he mentioned having multiple copies of trigonometrical rules in the library for the use of his assistants at the time Ursus was poking around his Uraniborg observatory (in 1582). Such a trigonometrical rule book, from Tycho's library and dated 1591, survives in the Clementinum of the Charles University' (Gingerich, Book Review: 'Tycho's Brahe *Triangulorum Planorum et Sphaericorum Praxis Arithmetica*' in *Journal for the History of Astronomy*. 1989; 20(2):141-142, reviewing the 1984 Sändig reprint of the Studnička facsimile of 1886).

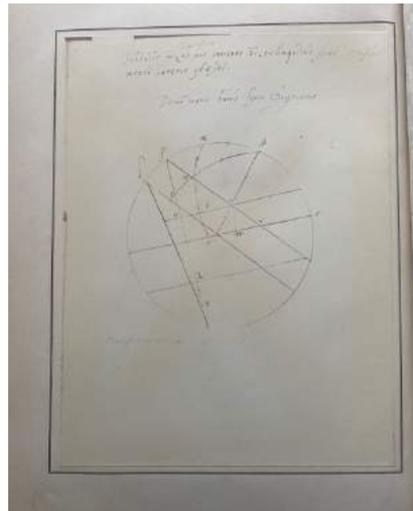


#### Scientific Controversy: Debate over authorship and hand-writing

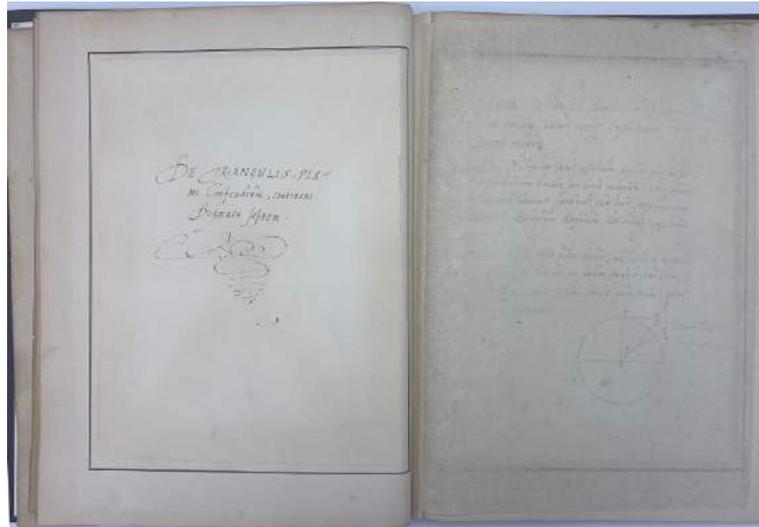
Like his predecessors, and indeed later historians, Böhm was certainly under the impression that the manuscript was the work of Brahe himself, and indeed this was based upon the early 1642 Jesuit descriptions when the works were acquired. The first seeds of doubt were in fact sown six years later, by the distinguished biographer of Brahe, Frederik Reinholdt Friis (1836-1910), writing in the *Danske Samlinger* IV (1868-1869), and who stated that neither the annotations in the Copernicus, nor the present manuscript, could be in the hand of the astronomer.



As becomes evident from reading Victor E. Thoren's article 'Prosthaphaeresis Revisted', whether the rule was in fact the work of Brahe himself, in collaboration with Paul Wittich, or merely a transcription of an earlier work by Nicolai Ursus, has been the subject of considerable conjecture and debate. Thoren cites various letters by Brahe which suggest that he claimed to have been the originator of the method, and indeed Brahe accused Ursus of plagiarism. Thoren gives no firm conclusion, however, though leans towards the belief that Brahe had the greater claim, whilst acknowledging that much work remained to be done.



Gingerich and Westman present a more definitive argument in their extensive work of 1988 looking specifically at the question of the true identify of the Copernicus *De revolutionibus* annotator, though they were unaware of this photographically produced version, referring instead to a subsequent 1886 photolithographic reproduction done by the Prague mathematician and amateur historian of science F. I. Studnička. ‘The *Triangulorum praxis* manuscript is bound following a printed work, Rheticus’s *Canon doctrinae triangulorum* (Leipzig, 1551), which bears on its title page the inscription “Collegii Caesarei Societatis Jesu Pragae 1642, Ex Bibliotheca Tichoniana, Bibliotheca Mathematicae”. In 1886, F. I. Studnička published a facsimile of the *Triangulorum praxis* under the assumption that it was an autograph manuscript of Brahe’s. In his 1890 biography of Tycho Brahe, J. L. E. Dreyer remarked that ‘Tycho has written his name under the title of the MS., but the handwriting of the remainder does not seem to be his’... Dreyer’s footnote prompted Studnička to defend the attribution more vigorously in his *Prager Tychoniana* (1901), and there he specifically mentioned his opinion that the hand of the *Triangulorum praxis* strongly resembled the writing of the *De revolutionibus* marginalia. Dreyer, in the *Opera omnia Tychonis Brahe* volume 1 (1913), responded that while the manuscript clearly belonged among the Tychonic material (Tycho having mentioned it in a letter of 14 March 1592 to Hagecius), it was surely not in Tycho’s hand. He noted in particular that the very characteristic two-stroke “M” appearing in the *Triangulorum praxis* was never used by Tycho; by this time Dreyer also doubted the authenticity of the signature on the manuscripts’ title-page, remarking that neither the “T”, “B”, nor “h” were typical of Brahe’s autograph. However, Dreyer’s comments, buried in the notes of the *Opera omnia*, were overlooked by a series of subsequent scholars, who continued to assign the *Triangulorum praxis* to Tycho’s hand. As a result, in an unwittingly circular argument, this manuscript served as a principal basis for attributing the *De Revolutionibus* marginalia to Tycho Brahe when the recent facsimile was published’ (ff. 24). After extensive analysis and research, Gingerich and Westman argue that, in fact the hands were not the same in both manuscripts, and neither are those of Brahe, and that the Copernicus volume was most likely annotated by Paul Wittich. Whilst confusion still seems to exist over authorship, if not the hand-writing, of these trigonometrical rules, the manuscript is nevertheless considered by Gingerich to be ‘of considerable importance for the history of the so-called “prosthaphaeresis method”, and since copies of the original facsimile have become quite scarce, we can be grateful that Sändig Reprint Verlag has reissued it’ (Gingerich review of the reprint). Böhm’s facsimile provides, therefore, yet another source for study of this notable, if controversial manuscript.

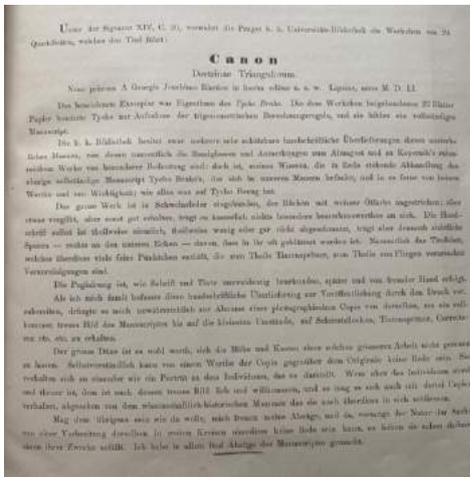


History of Photography: a valuable insight into early photographic procedures and technical challenges

According to Böhm in his preface, which is dated April 4th, 1862, whilst the library held several ‘very valuable handwritten records of this immortal man... the treatise in question is the only independent manuscript of Tycho Brahe that is within our walls, and so far away of great worth and importance’ (preface, catalogue’s translation). ‘The whole work is bound in pigskin... everything has yellowed a bit, but otherwise is well preserved, there is nothing remarkable about it on the outside’. He notes that the handwriting is still legible, and that it has been well leafed through, with the occasional splashes of ink. There is evidence of later annotation in ink ‘by a third party’ in the form of pagination. ‘I was irresistibly urged to take a photographic copy of it in order to get a completely faithful image of the manuscript down to the smallest detail, smudges, ink splatters, corrections’. The ‘Great Dane’ fully deserved the ‘trouble and expense of such a great labour. Of course there can be no question of the value of the copy compared to the original. They relate

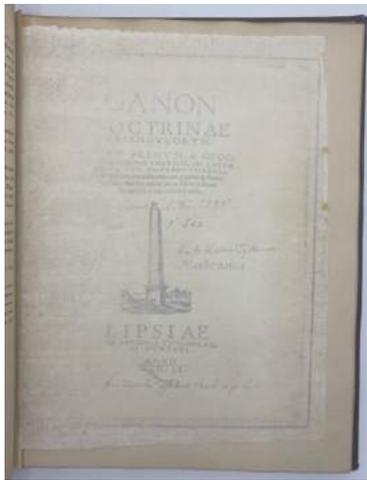
to one another like a portrait to the individual it represents’. Böhm hopes, however, that his attempts at a faithful image will be welcomed, and proudly announces that he is pleased with his efforts. Due to the laborious nature of the technique, there could be no question of a large dissemination or print run and so only five copies have been produced.

Böhm discusses further how he came to produce the volume, thus providing a fascinating insight into the many difficulties encountered by early photographers, as they battled with the elements in pursuit of their new art. He apologises for some ‘imperfections’, and various ‘defects of execution’, but asks for the readers’ indulgence as these were often due to circumstances beyond his control. The colour of the manuscript itself meant that only the brightest lighting could produce the necessary contrast between writing and paper. ‘The changeable summer of the previous year was not favourable, and unfortunately I felt compelled to work in very changeable light, if I wanted to finish at all’. This has led to ‘the dullness of some leaves, which were taken when the sky was cloudy, when clouds changed with sunshine etc... a further deficiency affects the images, in that here and there, the clamps are visible around the edges, where the manuscript was attached to the tripod (to protect it)’. The copies are exactly the size of the original, and ‘the coppery tone of the prints comes very close to the font colour of the original’. He included the title-page of the Rheticus and the first couple of pages, to give context, and to introduce that work to others should they be interested. He concludes by saying that whilst he can make no claim in terms of technical execution, his main desire was to make a faithful reproduction of the writings of a man, ‘whom we, as the father of modern astronomy, embrace with just reverence, and





of which we are all proud, and especially all those who have been fortunate enough to be able to call ours, even if only for a short time'.



### History of Book Production:

Whilst of potential research interest and value to historians of astronomy and mathematics, as well as to historians of photography therefore, for the book historian Böhm's publication is an extremely early attempt at a photographically illustrated book or 'facsimile', and as such a valuable and little known addition to that corpus of works. Fox Talbot's *The Pencil of Nature* (1844-6) is generally regarded to be one of the earliest attempts to reproduce a book or manuscript using photography. 'Though he was naturally determined in his search for possible applications (he had quickly seen the possibilities of using photography as a medium for typesetting, a process that was not to be applied in the commercial world until after the Second World War), his remark on the nineteenth-century image of the printed page presaged not just a new technique but a wholesale change in attitude. 'To the Antiquarian this application of the photographic art seems destined to be of great advantage'. But compared with the excitement that had greeted the development of the earliest photographs in the 1830s, the application was slow. It was only in 1856 that the British Museum published photographs by Roger Fenton of pages from the *Codex Alexandrinus*. This was a laborious album to produce, containing twenty-two salt prints from collodion negatives, a process recently developed and that allowed particularly high resolution of detail. For the *Codex Alexandrinus*, the impetus came both from theologians and from the Keeper of Manuscripts at the Museum, Sir Frederic Madden... Three years later, a much reduced photograph of a manuscript from Trinity College, Cambridge, was included in F. H. Scrivener's *Exact transcript of the Codex Augiensis*, this time an ordinary commercial proposition. The ability of the camera to capture works of art - whether pictures, manuscripts, or printed books -



transformed their study, enabling much more accurate comparisons than had been possible hitherto... The first extended photograph facsimiles of later manuscripts appeared in the early 1860s. First of all seems to have been a series of sixteen photographs of a manuscript in Turin by Francesco Filelfo on rhetoric, written in 1467 and reproduced as the *Manuscript Sforza*. The reproduction was the work of Camille Silvy, 'libraire photographique' in London in 1860... Then in 1862 the early sixteenth-century Flemish Grimani breviary was photographed and published by Antonio Perini in Venice, with commentaries in Italian and French: the market for facsimiles of manuscripts was always to be international.. His 110 albumen printes were laid down on thick card, and a commentary was provided in an accompanying volume' (McKitterick, *Old Books, New Technologies*, p. 119-20).



Josef Böhm originally intended to study theology and initially entered a seminary, before soon switching to the Philosophy faculty of Prague University, where he attended lectures in mathematics, physics and astronomy. After receiving his doctorate, he became an assistant at the Vienna observatory under Joseph Johann von Littrow in 1833, before working at the observatory in Buda (Pest), and from there was appointed professor at the University of Salzburg. In 1839 he received the chair for mathematics and practical physics in Innsbruck, where he was elected rector in 1848. He remained in Innsbruck until the end of March 1852, when he took over the vacated director's chair of the Prague observatory and became a full professor of practical and theoretical astronomy at the University of Prague, remaining there until the end of his life. He was an associate member of the Royal Bohemian Science Society in Prague and was a member of numerous foreign scientific societies. On January 26, 1868, he died of pulmonary tuberculosis in the Klementinum in Prague, having received numerous orders and medals throughout his life. Whilst his main focus was astronomy, he worked in a variety of different spheres during the course of his lifetime, and published works relating to agriculture, meteorology and ballistics. He is remembered for having developed a uranoscope for the simple identification of stars, and also produced a number of celestial globes.

*Provenance:* The book has been in private hands for nearly thirty years, and prior to that appears to have been in limited circulation within the Scandinavian trade. It is our opinion that Böhm distributed the five copies privately to colleagues, four of which found their way into European libraries, with the present copy remaining in private hands.

The four other copies are located at Dresden (digitised), Berlin ('lost in the war' i.e. destroyed), the National Library of Austrian (also digitised) and the Royal Danish Library; see Owen Gingerich and Robert S. Westman, 'The Wittich Connection: Conflict and Priority in Late Sixteenth Century Cosmology' in *Transactions of the American Philosophical Society*, Vol. 78, No. 7, 1988; see Owen Gingerich, 'Book Review: 'Trigonometry from Tycho's Library, Tychonis Brahe Triangulorum Planorum et Sphaericorum Praxis Arithmetica' in *Journal for the History of Astronomy*. 1989; 20 (2) :141-142; see Victor E. Thoren, *Prosthaphaeresis Revisited*, in *Historia Mathematica* 15 (1988), 32-39;



see Edward Rosen, 'Was Copernicus's "Revolutions" Annotated by Tycho Brahe', in *The Paper of the Bibliographical Society of America*, Vol. 74 (40, pp. 401-412, 1981; see David McKitterick, *Old Books, New Technologies* p. 119-20.

