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WITTICH (OR WITTICHIUS), PAUL

(*b*. Breslau, Sliesia [now Wroc?aw, Poland], 1555 [?]; *d*. Breslau, 9 January 1587)

mathematics.

Little is known about Wittich's life. In the summer of 1580, with a letter of introduction from Hegecius, he went for a short time to Uraniborg to work with Tycho Brahe.[1] He soon showed himself to be a skillful mathematician, for with Tycho he discovered–or, more precisely, rediscovered–the method of prostaphaeresis, by which the products and quotients of trigonometric functions appearing in trigonometric formulas can be replaced by simpler sums and differences.[2] The two formulas involved in this method are sin a · sin b = ½(cos [a – b] – cos [a + b]) and cos a · cos b = ½(cos [a – b] + cos [a + b]).

The individual contributions of Tycho Brahe and Wittch cannot be established with certainly, but that of Wittich, who was the better mathematician, was probably the greater.[3] A letter is extant in which Tycho reported on this period of collaboration, during which each freely and fully shared his results with the other.[4] It is therefore understandable that he was very angry with Wittich when he learned that the method of prostaphaeresis had become known in Kassel, which Wittich had visited in 1584, and that Nicolai Reymers Bär (Ursus had published it as his own discovery in 1588.[5]

Actually, Ursus also had been at Uraniborg in 1584 and had secretly noted down the method, although he did not discover the proof, which Brahe kept more carefully concealed. Wittich, who taught mathematics in Breslau from 1582 to 1584, was in Kassel in 1584.[6] There he described to Joost Bürgi, the clockmaker for Landgrave Wilhelm IV, the instruments used by Tycho in his observatory,[7] which Bürgi reproduced and improved. Wittich also showed him the proof of prostaphaeresis; and it was from Bürgi that Ursus learned the *mysteria triangulorum*. Wittich left Kassel before 1586 and died in Breslau at the beginning of 1587. On learning of Wittich's death, Tycho regretted that he had doubted his honesty.[8]

The method of prostaphaeresis originated with Johann Werner, who developed it in conjunction with the law of cosines for sides of a spherical triangle. In Regiomontanus' formulation the law reads: Sinvers A: sinvers a – sinvers [b–c]=r^2; (sin b · sin c).[9] If one eliments the *sinus versus* and takes r=*sinus totus*=1, the result is

Here Werner, who preserved the *sinus versus*, used the first formula of prostaphaeresis in handling the term sin b · sin c; whereas Tycho and Wittich also knew the cosine law with the term cos b · cos c.[10] They also used prostaphaeresis for problems that Werner solved without this method.[11]

It is unlikely that Tycho and Wittich ever saw Werner's *De triangulis sphaericis libri quatuor.* Its manuscript, which Rheticus wanted to publish at Cracow in 1557, was not printed until 1907.[12] On the other hand, Tycho knew that such a work existed and sought, unsuccessfully, to obtain a copy of it.[13] He and Wittich might, therefore, have been encouraged by this knowledge to work out the details of such a method, which Ursus stole and published in 1588.[14]

In 1580 Tycho and Wittich probably had not seen Viéte's *Canon mathematicus* of 1579. Further evidence on this point is provided by Longomontanus, who was Tycho's assistant at Uraniborg from 1589 to 1597.[15] The method of converting products to sums or differences was further developed by Bürgi, Clavius, and Jöstel, among others, Specifically, Bürgi took as his staring point the relationship between arithmetic and geometric series and introduced logarithms.[16] He thereby definitively replaced the older method with an improved one that Pitiscus called *Modus Bhrgill*.[17] Kepler, who was thoroughly acquainted with Tycho's computations, mentions the *negotium prostaphaereticum Wittichianum* in his book on optics (1604).[18]

NOTES

1. Wittich, who left Uraniborg because of a matter concerning an inheritance, carried with him a letter from Brahe to Hagecius dated 4 Nov. 1580. Since Brahe received no answer, Wittich was suspected of not having delivered it. Hagecius later cleared up the matter (23 Sept. 1582). On this point see Brahe, *Opera*, VII, 72.

2. In the letter of 4 Nov. 1580 Brahe speaks of their efforts to develop this method, "quae per ????????????? procedit absque taediosa multiplicacione et divisione." *lbid*.,58.

3. See R. Wolf, *Hundbuch der Astronomie*, 2247 f.

4. See Brahe's letter to Hagecius of 14 Mar. 1592. Brahe, *Opera*, VII, 323.

5. See Brahe's letter to Hagecius of 1 July 1586, in which he writes that Wittich "agit sane minus sincere mecum." *lbid*., 108.

6. See J. L.E. Dreyer, *Tycho Brahe*, 121, n. 4.

7. Among these were the mural quadrnt with transverse calibration. On this see C. D. Hellman, "Brahe," 405.

8. See his letter of 14 Jan. 1595: "nec vivum nec defunctum suis privavi honoribus." *Opera*, VI, 327.

9. See A. von Braunmühl, *Vorlesungen über Geschichte der Trigonometrie*, 131; and J. Tropfke, *Geschichte der Elementar-Mathematik*, 139 ff.

10. In the process *cos* is replaced by the *sin* of the complement. see A. A. Björnbo, "Ioannis Verneri. . ." 169; and M. Cantor, *Vorlesungen über Geschichte der Mathematik*, 642f. Ibn Y?nus also knew prostaphaeresis for the operation involving See G. Sarton, *Introduction to the History of Science*, 716 ff. Traces of the law can be found in a special case in Indian

mathematics (see Braunmühl, 41), and in a more complete form in the work of al-Batt?n? (see Sarton, *op. cit*., 603: and Braunmühl, *op. cit*., 53). peuerbach also knew this law and derived it independently in *Compositio tabule altitudinis solis ad omnes horas*(in Codex Vindobonesis 5203, fols. 54r–55r).

11. See Björnbo, *op. cit*., 169.

12. It was published by Björnbo with the preface by Rheticus that was printed in 1557.

13. See Tycho's letter to Hagecius of 25 Aug. 1585. *Opera*, VII, 95.

14. See Bjönbo, *op. cit*., 171.

15. See Dreyer, *op. cit*.,361, n. 3, and 383.

16. Even before Stifel's *Arithmetica integra* (1544) others, including Chequet and Heinrich Grammateus, compared the two types of series. On this point see L. Nový, "Bürgi," 602.

17. See Bartholomeo Pitiscus, *Trigonometriae sive de dimensione triangulorum libri quinque*, 3rd ed. (Frankfurt, 1612), 177.

18. Kepler, *Gesammelte Werke*, II (Munich, 1939), 336.

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See A. A. Björnbo, "Ioannis Verneri De triangulis sphaericis libri quatuor, de meteoroscopiis libri sex cum prooemio Georgii Ioachimi Rhetici. I. De triangulis sphaericis," in *Abhandlungen zur Geschichte der mathematischen Wissenschaften*, **24** (1907), 150–175; A. von Braunmühl, *Vorlesungen über Geschichte der Trigonometrie*, I (Leipzig, 1900), 256; 260; and "Zur Geschichte der prosthaphaeretischen Methode in der Trigonometrie," in *Abhandlunger zur Geschichte der Mathematik*, **9** (1899), 15–29; M. Cantor, *Vorlesungen über Geschichte der Mathematik*, 2nd ed., II (Leipzig, 1913), 937; J. L. E. Dreyer, *Tycho Brahe, a Picture of Scientific Life and Work in the Sixteenth Century* (Edinburgh, 1890; New York, 1963), 405; and *Tychonis Brahe Opera omnia*, XV (Copenhagen, 1913; 1929), 50; C.D. Hellman, "Brahe," in *Dictionary of Scientific Biography* II, 401–416; L. Nový, "Bürgi," *ibid*., 602–603; G. Sarton, *Introduction to the History of Science*, I (Baltimore, 1927); J. Tropfke, *Geschichte der Elementar-Mathematik* 2nd ed., V (Berlin-Leipzig, 1923), 108 ff; and R. Wolf, *Handbuch der Astronomie, ihrer Geschichte und Litteratur*, I (Zurich, 1890).

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