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(*b*. Messina, Italy, 16 September 1494; *d*. near Messina, 21 or 22 July 1575)

mathematics, astronomy, optics.

Maurolico's name is variously transcribed as Maurolyco, Marulì, Marulli, and, in Latin, Maurolicus, Maurolycus, and Maurolycius. He was the son of Antonio Maurolico, master of the Messina mint, and his wife, Penuccia or Ranuccia. The family came from Greece, from which they had field to Sicily to escape the Turks; Maurolico learned Greek, as well as astronomy, from his father. In 1521 he was ordained priest; he later became a Benedictine. Except for short sojourns in Rome and Naples, he lived his whole life in Sicily.

Maurolico's patrons included Giovanni de Vega, Charles V's viceroy of Sicily, who entrusted him with the mathematical education of one of his sons; and Giovanni Ventimiglia and his son, Simon, both marquises of Geraci and princes of Castelbuono and governors ("stradigò") of Messina. In 1550 Simon confered upon Maurolico the abbey of Santa Maia del Parto (today also known as the Santuario di San Guglielmo), near Castelbuono. Maurolico also held a number of civil commissions in Messina; he served as head of the mint, he was in charge (with the architect Ferramolino) of maintaining the fortifications of the city on behalf of Charles V, and he was appointed to write a history of Sicily, which, as *Sicanicarum rerum Compendium*, was published in Messina in 1562. Most important, he gave public lectures on matematics at the University o Messina, where he was appointed professor in 1569.

Although Maurolico himself referred to a vast literary production (in his *Cosmographia* and *Opuscula*), only a few of his works were printed, although these are enough to show him as an outstanding scholar. In addition to writing his own books, Maurolico translated, commented upon, reconstructed, and edited works by a number of encient authors. His first work in this vein, published in Messina in 1558, included treatises on the sphere by Theodosius of Bythinia "ex traditione Maurolyci"; by Menelaus of Alexandria "ex traditione eiusdem"; and by Maurolico himself. The book also contained a work by Autolycus of Pitane on the moving sphere, translations of the *De habitationibus* of Theodosius and the *Phaenomena* of Euclid, trigonometric tables, a mathematical compendium, and a work entitled "Maurolyci de sphaera sermo."

This early book is especially noteworthy for two reasons. First, the Neapolitan Mathematician Giuseppe d'Auria furthered the dissemination of Maurolico's work by including his annotations in later editions of Autolycus' *Sphaera* and Theodosius' *De habitationibus* (Rome, 1588), as well as of Euclid's *Phaenomena* (Rome, 1591). Second, J.B.J. Delambre, in his *Histoire de l'astonomie du moyen âge*, stated that Maurolico had been the first to make use of the trigonometric function of the secant. Maurolico did give a table of numerical values for he secants o 0°to 45° (the "tabella benefica"), but Copernicus had certainly preceded him in its use.

Maurolico's two other major books on ancient mathematics—one on Apollonius' *Conics*, and the other a collection of the works of Archimedes—were published only after his death. In *Emendatio et restitutio conicorum Apollonii Pergaei* (Messina, 1654), Maurolio attempted to reconstruct books V and VI of the *Conics* from the brief references to them that Apollonius provided in his preface to the entire work. In Maurolico's time, only the first four books were known in the Greek original; he completed his restoration in 1547, and a similar reconstruction of book V was published by Vincenzo Viviani in 1659. (Although Maurolico's work is less famous than Viviani's, both Libri and Gino Loria cite it as an example of his genius.) Maurolico's collection of Archimedes' works, *Admirandi Archimedis Syracusani mounmena omnia mathematica quae extant … ex traditione doctissime viri* D. Francisci Maurolici (Palermo, 1685), was based upon an earlier partial edition by Borelli (Messina, 1670—1672), which was almost completely lost.

Among the most important of Maurolico's extant books are *Cosmographia* (Venice, 1543), written in the form of three dialogues; *Opuscula mathematica* (Venice, 1575), a collection of eight treatises; *Photismi de lumine et umbra ad perspectivam et radioum incidentiam faientes* (possible Venice, 1575, and certainly Naples, 1611); and *Problemata mechanica … et ad magnetem et ad pixidem nautiam pertinentia* (Messina, 1613). In addition to these, a number of Maurolico's manuscripts held by the Bibliothèque Nationale, Paris, were published by Federico Napoli in 1876; these include a letter of 8 August 1556, in which Maurolico reported on his mathematical studies to his patron Giovanni de Vega; a brief treatise, previously thought to be lost, entitled "Demonstration algebrae" ; books I and II of a 1555 "Geometicarm quaestionum"; and a "Brevis demonstratio centri in parabola," dated 1565.

Of the mathematical works edited by Napoli, the "Demonstratio algebrae" is elementary in its concerns, dealing with simple second-degree problems and derivations from them. "Geometricarum quaestionum" is primarily devoted to trigonometry and

solid geometry, but touches upon geodesy in offering a proposal for a new method for measuring the earth, a method previously discussed in the *Cosmographia* and later taken up by Jean Picard for measuring the meridian(1669–1671). In the "Brevis demonstratio centri in parabola," Maurolico chose to deal with a problem related to mechanics—which he also treated in his edition of Archimedes—the determination of the center of gravity of a segment of a paraboloib of revolution cut off by a plane perpendicular to its axis.

The greatest number of Maurolico's mathematical writings are gathered in the *Opuscula mathematica;* indeed, the second volume of that work, "Arithmeticorum libri duo," is wholly devoted to that subject and contains, among other things, some noteable research on the theory of numbers. This includes, in particular, a treatment of polygonal numbers that is more complete than that of Diophantus, to which Maurolico added a number of simple and ingenious proofs. L. E. Dickson has remarked upon Maurolico's argument that every perfect number in hexagonal, and therefore traingular, while Baldassarre Boncompagni noted his proof of a peculiarity of the succession of odd numbers. That property had been enunciated by Nicomachus of Gerasa, Iamblichus, and Boethius, among others.

Among the topics related to mathematics in the *Opuscula* are chronology (the treatise "Computus ecclesiasticus") and geomonics (in two treatises, both entitled "De lineis horariis," one of which also discusses conics). The work also contains writing on Euclid's *Elements* (for which see also the unpublished Bibliothèque Nationale, Paris, manuscript Fonds Latin 7463). Of particular interest, too is a passage on a correlation between regualr polyhedrons, which was commented upon by J.H.T. Müller, and later by Moritz Cantor. The balance of Maurolico's known mathematical work is contained in three manuscripts, mostly on geometrical problems, in the Biblioteca Nazionale Centrale Vittorio Emanuele in Rome; they have been described by Luigi De Marchi.

Maurolico's work in astronomy includes the first treatise collected in the *Opuscula*, "De sphaera liber unus," in which he criticized Copernicus. In another item of the collection, "De instrumentis astronomicis," Maurolico described the principal astronomical instruments and discussed their theory, use, and history—a subject similar to that treated in one of his first publications, the rare and little-known tract *Quadrati fabrica et eius usus* (Venice, 1546). In practical astronomy, Maurolico observed the nova that appeared in the constellation Cassiopeia in 1572. Until recently all that was known of this observation was contained in the short extracts from an unknown work by Maurolico that were published by Clavius in his *In Sphaeram Ioannis de Sacro Bosco commentarius* (Rome, 1581). In 1960, however, C. Doris Hellman published an apograph maunscript that she had found in the Biblioteca Nazionale of Naples. This manuscript contains a full account of Maurolico's observation; it is dated 6 November 1572, and is clear evidence that Maurolico's observation preceded by at least five days the move famour one made by Tycho Brahe.

Maurolico also did important work in optics;indeed, according to Libri, "it is in his research on optics, above all, that Maurolico showed the most sagacity" (*Histoire,* III, 116). The chief record of this research is *Photismi de lumine et umbra*, in which Maurolico discussed the rainbow, the theory of vision, the effects of lenses, the principal phenomena of dioptrics and catoptrics, radiant heat, photometry, and caustics. Maurolico's work on caustics was anticipated by that of Leonardo da Vinci (as was his research on centers of gravity), but Leonardo's work was not published until long after Maurolico's. Libri further characterized the *Photismi de lumine et umbra* as "full of curious facts and ingenious research" (*Histoire*, III, 118), and Sarton suggested that it might be the most remarkable optical treatise of the sixteenth century outside the tradition of Alhazen, or even the best optical book of the Renaissance (*Six Wings*,84, 85).

Maurolico applied his broad scientific knowledge to a number of other fields. One treatise in the *Opuscula*, "Musicae traditiones," is devoted to music. The *Problemata mechanica* published in 1613 is concerned with mechanics and magnetism, as is, to some degree, the "Brevis demonstratio." His contributions to geodesy have already been discussed; he made an additional contribution to georgraphy with a map of Sicily, drawn about 1541 at the request of Jacopo Gastaldo (who published it in 1575)— this map was also incorporated by Abraham Ortelius in his *Theatrum orbis terrarum*. Maurolico wrote on the fish of Sicily, in a letter or Pierre Gilles d'Albi, dated 1 March 1543 and published by Demonico Sestini in 1807, and on the euption of Mt. Etna, in a letter to Cardinal Pietro Bembo, dated 4 May 1546 and published by Giuseppe Spezi in 1862. Finally, he enjoyed some contemporary fame as a meteorologist, based upon a weather prediction that he made for John of Austria upon the latter's departure from Messina prior to the Battle of Lepanto (1571).

BIBLIOGRAPHY

I. Original Works. Almost all of Maurolico's writings have been mentioned in the text. For further informaion see Pietro Riardi, *Biblioteca matematica italiana* (Modena, 1870–1928; repr. Milan, 1952), articles "Arcimede," "Auria," "Maurilico"; and Feberico Napoli, "Intorno alla vita ed ai lavori di Francesco Maurolico," pref. to "Scritti inediti di Francesco Maurolico," in *Bullettino di bibliografia e di storia delle scienze matematiche e fisiche*, **9** (1876), 1–121, on p.5 of which is a list of codices of the Bibliothèque Nationale, Paris, containing autographs by Maurolico (Fonds Latin, nos. 6177, 7249, 7251, 7459, 7462–7468, 7471, 7472A, 7473). On this see also Federico Napoli, "Nota intorno ad alcuni manoscriti di Maurolico della Biblioteca Parigina," in *Rivista sicula di scienze, letterature ed arti*, **8** (1872), 185–192.

See also Luigi De Marchi, "Di tre manoscritti del Maurolicio che si trovano nella Biblioteca Vittoria Emanuele di Roma," in Eneström's *Bibliotheca mathematica* (1885), cols. 141–144, 193–195. In the codices described by De Marchi(marked 32, 33, 34; formerly S. pantaleo 115, 116, 117), there is a letter from Maurolico to Prince Barresi di pietraperzia, dated 11 Sept. 1571,

which was published by De Marchi in "Una lettera inedita di Francesco Maurilico a proposito della battaglia di Lepanto," in *Rendiconti dell' Istituto lombardo di scienze e lettere*, **16** (1883), 464–467; this letter, De Marchi observes, may be considered as Maurolico's scientific will.

Maurolico's letter to Cardinal Bembo of 4 May 1546 is in Giuseppe Spezi, *Lettere inedite del Card. Pietro Bembo e di altri scrittori del secolo XVI, tratte da codici Vaticani e Barberiniani* (Rome, 1862), pp. 79–84. A letter form Maurolico to Cardinal Antonio Amulio dated 1 Dec. 1568 is in Baldassarre Boncompagni, "Intorno ad una proprietà de' numeri dispari," *in Bullettino di bibliografia e di storia delle scienze matematiche e fisiche*, **8** (1875), 51–62, see pp. 55–56, where a MS on arithmetic by Maurolico is cited (Codex Vat. lat. no. 3131) and the dedicatory letter which precedes it is published.

The work on the nova of 1572 is in "Maurolyco's'Lost' Essay on the New Star of 1572" transcribed, translated, and edited by C.Doris Hellman, in *Isis*, **51** (1960), 322–336; the MS, in the Biblioteca Nazionale of Naples (cod. 1 E 56, fols. 2r–10r), perhaps a copy of an autograph version, is entitled "Super nova stella: Que hoc anno iuxta Cassiopes apparere cepit considerationes."

The work on Sicilian fish is in Domenico Sestini, *Viaggi e opuscoli diversi* (Berlin, 1807), 285–302, with notes on pp. 303–313 and mention of the MS used on p. xiii; see also *Tractatus per epistolam Francisci Maurolici ad Pertrum Gillium de piscibus siculis Codice manu auctoris exarato, Aloisius Facciolà messanensis nunc primum edidi* (Palermo, 1893). An English translation of the *Photismi is The Photismi de Lumine of Maurolycus. A Chapter in Late medieval Optics*, Henry Crew, trans. (New York, 1940).

The rare pamphlet on the quadrant is in the personal library of Dr. Carlo Viganò; Brescia, Italy. Its full title is *Quadrati fabrica et eius usus, ut hoc solo instrumento, caeteris praetermissis, uniusquisq. Mathematicus, contentus esse possit, Per Franciscum Maurolycum nuper edita. Illustriss. D. D.Ioanni Vigintimillio Ieraciensium Marchioni*, D. (Venice, 1546). In colophons to various parts of the text Maurolico gives the dates 6 Apr. 1541, 18 Apr. 1541, and 11 Jan. 1542. The work consists of eleven numbered pages and one unnumbered page with a table of stars.

II. Secondary Literature. Older biographies and bibliographies on Maurolico include Francesco della Foresta, *Vita Dell' abbate del Parto D. Francesco Maurolyco* (Messina, 1613), written by the nephew and namesake of the subject; Antonino Mongitore, "Maurolico," in *Biblioteca sicula*, I (palermo, 1707), 226–227; Domenico Scinà, *Elogio di Francesco Maurolico* (Palermo, 1808); and Girolame Tiraboschi, "Maurolico," in *Storia della letteratua italiana*, VII (Milan, 1824), 728–734.

Two valuable monographs from the late nineteenth century are Giuseppe Rossi, *Francesco Maurolico e il risorgimento filosofice e scientifico in Italia nel secolo XVI* (Messina, 1888); and Giacomo Macri, "Francesco Maurolico nella vita e negli scritti" in R. Accademia Peloritana, *Commemorazione del IV centenario di Francesco Maurolico MDCCCXCIV* (Messina, 1896), p. iii-iv, 1–198. The latter volume also contains "Ricordi inediti di Francesco Maurolico," illustrated by Giuseppe Arenaprimo di Montechiaro, p. 199–230, with three plates reproducing handwritten items by Maurolico.

Maurolico is discussed in the following standard histories of mathematics: J. E. Montucla, *Historie des mathèmatiques*, 2 vols. (paris, 1758), I 563, 571–572, 695–698; Guglielmo Libri, *Histoire des sciences mathèmatiques en ltalie*, 3 vols. (Paris, 1837–1841), III, 102–118; Moritz Cantor, *Vorlesungen über Geschichte der Mathematik*, 4 vols. (Leipzig, 1880–1908), II, 558–559, 575, *passim;* and David Eugene Smith, *History of Mathematics*, 2 vols. (Boston, 1924–1925), I, 301–302, and II 622. See also Florian Cajori, *A History of Mathematical Notations*, 2 vols. (La Salle, III., 1928–1929), I, 349, 362, 402, and II, 150.

Maurolico's work on mathematicians of antiquity is discussed in Vincenzo Flauti, "Sull'Archimede e l'Apollonio id Maurolico. Osservazioni stoicocritiche," in *Memorie della Accedemia delle scienze di Napoli*, **2** (1855– 1857), lxxxiv–xciv; and Gino Loria, *Le scienze esatte nell' antica Grecia* (Milan, 1914), 219, 354, 434, 435, 502, 510, 511, 513, 515. On Maurolico as editor of Autolycus, see the following works by Joseph Mogenet: "Piere Forcadel traducteur de Autolycus," in *Archives internationales d'histoire des sciences* (1950), 114–128; and "Autolycus de Pitane: Historie de texte, suivid de l'édition critique des traiteés De la sphère en mouvement et Des levers et couchers," in Université be Louvain, *Recueil de travaux d'histoire et de philologie*, 3rd ser., facs. 37(1950), 23, 26, 27, 30–36, 38–42, 48–50, 176.

Arithmetic is treated in Mariano Fontana, "Osservazioni storiche sopra l'aritmetica di Francesco Maurolico," in *Memorie dell' Istituto nazionale italiano* (Bologna), Fis.mat. cl., **2** pt. 1 (1808), 275–296; Baldassarre Boncompagni, "Inotno ad una proprietà de' numeri dispari" (see above); and Leonard Eugene Dickson, *History of the Theory of Numbers* (Washington, D.C.,1919; repr. New York, 1952, 1966), I, 9, 20, and II 5, 6.

On the use of the principle of mathematical induction by Maurolico, anticipated by Euclid, see the following writings by Giovanni Vacca: "Maurolycus, the First Discover of the Principle of Mathematical Induction," in *Bulletin of the American Mathematial Society*, **16** (1909–1910), 70–73; "Sulla storia del principio d'induzione completa," in Loria's *Bollettino di bibliografica e storia delle scienze matematiche*, **12** (1910), 33–35; and "Sur le principe d'induction mathématique," in *Revue de métaphysique et de morale*, **19** (1911), 30–33. See also W. H. Bussey, "The Origin of Mathematical Induction," in *American Mathematical Monthly*, **24** (1917), 199–207; Léon Brunschvicg, *Les étapes de la philosophie mathématique*, 3rd ed. (Paris, 1929), 481–484; and Hans Freudenthal, "Zur Geschichte der vollständigen Induktion," in *Archives internationales d'histoire des sciences* (1953), 17–37.

Maurolico's geometry in treated in Michel Chasles, *Apercu Historique sur i'origine et le développement des meéthodes en géometrie*, 2nd ed. (paris, 1875), 120, 291, 293, 345, 496, 516; J.H.T. Müllar, "Zur Geschichte des Dualismus in der Geometrie," in Grunert's *Arhiv der Mathematik und Physik*, **34** (1860), 1–6; and Federico Amodeo, "II trattato sulle coniche di Francesco Maurolico," in Eneström's *Bibliotheca mathematica* 3rd ser., **9** (1908–1909), 123–138.

On centers of gravity, see Margaret E. Baron, *The Origins of the Infinitesimal Calculus* (Oxford, 1969), 90–94.

Astronomy is discussed in J.B.J. Delambre, *Histoire de l'astronomie du moyen âge* (Aaris, 1819; repr.New York, 1965), 437–441; J.L.E. Dreyer, *A History of Astronomy From Thales to Kepler*. (New York, 1953), 257, 295, 356– 357, formerly entitled *History of the Planetary Systems from Thales to Kepler* (Cambridge, 1906); Lynn Thorndike, *A History of Magic and Experimental Sience*, V (New York, 1941), 304, 360, 421, 426, and VI (New York, 1941) 27, 74, 179–180, 382; and Edward Rosen, "Maurolico's Attitude Toward Copernicus," in *Proceedings of the American Philosophical Society*, ,**101** (1957), 177–194.

On Maurolico's contributions to geodesy, see Pietro Riccardi, "Cenni sulla storia della geodesia in Italia dalle prime epoce fin oltre all metà del secolo XIX," in *Memorie della Accedemia delle scienze di Bologna*, 3rd ser., **10** (1879), 431–528, see 518–519; and "Sopra un antico metodo per determinare il semidiametro della terra," *ibid*., 4th ser., **7** (1887), 17–22; and Ottavio Zanotti-Bianco, "Sopra una vecchia e poco nota misura del semidiametro terrestre," in *Atti della Accedemia delle scienze di Torino*, **19** (1883–1884), 791–794.

On optics, besides works by Libri, Crew, and Sarton already cited, see the following writings of Vasco Ronchi: *Optics, the Science of Vision*, trans. and rev. by Edward Rosen (New York, 1957), 39–40, 265; "L'optique au XVI^{e} siècle," in *La science au seizième siècle*. *Colloque international de Royaumont, 1–4 juillet* 1957 (Paris, 1960),47–65, and *The Nature of Light*, trans. by V. Barocas (London, 1970), 78, 99ss., 223. See also A. C. Crombie, "The Mechanistic Hypothesis and the Scientific Study of Vision," in S. Bradbury and G. L.'E. Turner, eds., *Historical Aspects of Microscopy* (Cambridge, 1967), 3–112 (see 43–46), and in *Proceedings of the Royal Microscopical Society*, 2, pt. 1 (1967)

On music, see Salvatore Pugliatti, "Le *Musicae traditiones* di Francesco Maurolico" in *Atti dell' Accademia peloritana*, **48** (1951–1967). On p. 336 is mentioned as MS, which contains three papers of Maurolico: "De divisione artium," "De quantitate," "De proportione." This MS was recently found by Monsignor Graziane Bellifemine in the Library and Museum of the Seminario Vescovile at Molfetta.

On Maurolico as a man of letters, historian, and philosopher, see G. Macri, "Francesco Maurolico nella vita e negli scrittai" (see above), pp. 48–62, 123–151; Valentino Labate, "Le fonti del *Sicanicarum rerum compendium* di Francesco Maurolico," in *Atti dell' Accademia peloritana*, **13** (1898–1899), 53–84; and L. Perroni-Grande, "F. Maurolio professore dell'Università messinese e dantista," in R. Accademia Peloritana, *CCCL anniversario della Università di Messina*. *Contributo storico* (Messina, 1900), 15–41, which includes the notarial act containing the nomination of Maurolico as professor at the University of Messina.

Other writing to be consulted are Luigi De Marchi, "Sull'ortografia del nome del matematico messinese Maurolico," in Eneström's *Biblioteca matematica* (1886), cols. 90–92; and several biobiliographical writings by Edward Rosen: "The Date of Maurolico's Death," in *Scripta mathematica*, **22** (1956), 285–286; "Maurolico Was an Abbot," in *Archives internationales d'historie des sciences* (1956), 349–350; "De Morgan's Incorrect Description of Maurolico's Books," in *Papers of the Bibliographical Society of America***51** (1957), 111–118; "Was Maurolico's Essay on the Nova of 1572 printed?," in *Isis*, **48** (1957), 171–175; "The Title of Maurolico's *Photismi*," in *American Journal of Physics*, **25** (1957), 226–228; and "The Editions of Maurolico's Mathematcial Works," in *Scripta mathemtical*, **24** (1959), 56–76.

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