Angeli, Stefano Degli | Encyclopedia.com

(*b*. Venice, Italy, 21 September 1623; *d*. Venice, 11 October 1697) *mathematics, physics*.

Born Francesco degli Angeli, he entered the Order of the Gesuati of Saint Jerolamen. At twenty-one he was appointed reader of literature, philosophy, and theology in the faculty of his order at Ferrara. He remained in Ferrara for about three years, although he was in poor health, until his physicians concluded that the climate of the city was harmful to him. He was then transferred to Bologna, where he developed a deep interest in mathematics under the guidance of a member of the same religious order, Bonaventura Cavalieri, who taught at the University of Bologna. Cavalieri was soon able to appreciate Angeli's ability, and encouraged him in his studies and mathematical researches.

Toward the end of his life, when he was gravely ill, Cavalieri entrusted Angeli with the task of correcting and publishing his last work, *Exercitationes geometricae sex* (1647). After Cavalieri's death in 1647, Angeli was offered the opportunity to succeed his master as professor of mathematics, but he was too modest to accept. Instead, he went to Rome, where he zealously continued his mathematical studies and his religious activity. About 1652 he was appointed prior of the monastery of the Gesuati in Venice, and shortly afterward he was given the post of provincial definer, a position he held until Pope Clement IX suppressed the order in 1668. On 2 January 1663 the Republic of Venice offered him the professorship of mathematics at the University of Padua, a post that had been held by Galileo, which he filled until his death. The mathematician Jacopo Riccati was among Angeli's pupils.

Angeli's studies in mathematics include a further development of the methods of indivisibles—methods introduced by Cavalieri and Evangelista Torricelli—to solve problems dealing with infinitesimals and with the areas, volumes, and centers of gravity of given geometric figures. His mathematical works echo the polemics that took place in the seventeenth century between supporters of the method of indivisibles and those such as Paul Guldin and Andreas Tacquet, who defended the more rigorous but less cogent exhaustive method of the ancients. "Lectori benevolo," the introduction to Angeli's *De infitinitis parabolis* (1654), is interesting in this connection. To those who opposed Cavalieri's method by asserting that the continuous is not composed of indivisibles, Angeli replied, in agreement with his master, that the method in question does not depend on the composition of the continuous.

Angeli's work on mathematics, *De infinitorum spiralium spatiorum mensura* (1660), deals with curves that constitute a generalization of Archimedes' spiral. A moving point describes one of these curves when it is acted upon by two movements, one uniform and rectilinear starting from a point *A*, and the other rotational around the same point *A*. If the rotational motion is also uniform, one obtains Archimedes' spiral; if, on the other hand, it varies, the general condition studied by Angeli results. In particular, if the angles described by the rotational motion are proportional to the squares of the times, one obtains a quadratic spiral; if these angles are proportional to the cubes of the times, one obtains a cubic spiral, and so on. The *De infinitorum spiralium* is devoted to the areas of the figures bounded by arcs of these curves and to the centers of gravity of the figures themselves.

In his *De infinitarum cochlearum mensuris ac centris gravitatis* (1661), Angeli begins with the definition of the solid that he called a cochlea and with the results of the problem published by Torricelli:[1] Consider in a given plane a figure, *F*, with nonzero area, and a straight line, a. Let *F* be subjected to a double motion; a rotational motion around *a* and a translation motion along the a direction. The solid thus obtained is a cochlea. Torricelli concluded that the volume of the cochlea is equivalent to that of a rotational solid; he had intended to devote a small volume to the later developments of the cochlea, especially regarding centers of gravity, but he died before completing it. In *De infinitarum cochlearum* Angeli seeks to carry out Torricelli's plan.

In questions dealing with infinitesimals, Angeli remained faithful to the indivisibles of the school of Galileo. Indeed, he proves to be unfamiliar with the points of view that follow from the analytic geometry of Descartes and the infinitesimal calculus of Newton and Leibniz, even though he had read Newton's *Naturalis philosophiae principia mathematica*.

Four of Angeli's minor works, in the form of dialogues that reflect Galileo's style, form a lively but cautious polemic on the problems of the Ptolemaic and Copernican cosmological systems. G. B. Riccioli, in his *Almagestum novum*, had formulated some arguments against the Copernican system. Angeli asserted that "the earth is motionless, but Riccioli's reasons do not prove the point," and he devoted the first of these studies (1667) to demonstrating that Riccioli's anti-Copernican arguments were without foundation. Angeli replied to Riccioli's arguments with another work in 1668. G. A. Borelli, who later participated in the polemic, rejected Riccioli's arguments and pointed out that if Angeli's views were correct, falling bodies

should follow a vertical trajectory in the hypothesis of the earth's motion as well. In addition, he held that there must be a deviation to the east (as was experimentally proved by G. B. Guglielmini in 1791).[2]

Angeli's *Della gravità dell'aria e fluidi* is largely experimental in character. In it he examines the fluid statics, based on Archimedes' principle and on Torricelli's experiments. It also contains theories of capillary attraction.

In Angeli's works on physics, there are many references to Galileo's mechanics, as well as his acceptance of the experimental method.

NOTES

1. Torricelli's *Opere* I. pt. 1 (Faenza, 1919, 223–230.

2. M. Gliozzi, *Storia della fisica*, Vol. II *Storia delle scienze* (Turin, 1962). p. 89.

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Ettore Carruccio