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(*b*. Croisic, France, 16 February 1698; *d*. Paris, France, 15 August 1758)

geodesy, hydrography, physics.

The son of Jean Bouguer, royal professor of hydrography, Pierre Bouguer was a prodigy who at the age of fifteen, upon the death of his father, applied for and obtained the professorship. He quickly became the leading French theoretical authority on all things nautical, and by the time he was twenty-nine had won three prizes for essays on subjects set by the Académic Royale des Sciences: on the masts of ships (1727), on the best way of observing the altitudes of stars at sea (1729), and on the observation at sea of the magnetic declination (1731). In 1731 Bouguer was made an associate geometrician of the Académie Royale, and in 1735 he became a full Academician. In the same year he was sent, with Charles Marie de La Condamine, Louis Godin, and Joseph de Jussieu, on the celebrated expedition to Peru that was to measure an arc of the meridian near the equator.

Bouguer's work on this expedition, from which he did not return until 1744, was of high quality. Apart from the main geodetic program, he did an astonishing amount of other scientific work, measuring the dilatation of various solids by making use of the large range of temperatures found in the Cordillera, investigating the phenomena of atmospheric refraction and the measurement of heights with the barometer, devising a new type of ship's log, and undertaking a number of other researches, in spite of the very difficult physical conditions under which the geodetic measurements had to be carried out. The results of these measurements were published formally in 1749 as *La figure de la terre, déterminée par les observations de Messieurs De la Condamine el Bouguer*….

His work on naval architecture and navigation produced *Traite du navire* (1746), *Nouveau traité de navigation* (1753), and *De la manoeuvre des vaisseaux*… (1757), as well as several papers in the *Mémoires* of the Academy. These treatises seem to have been very useful to the naval services of the time—for example, his early paper on "lines of pursuit" (1732), one of several that display his considerable mathematical ability. He was also good with instruments, as is shown by his invention of the heliometer in 1748.

Nevertheless, in the twentieth century Pierre Bouguer is probably best known as the father of photometry, in spite of the fact that the subject seems to have been a part-time occupation, a hobby to which he returned in the last years of his life.

His interest in the measurement of light dates from about 1721, when J. J. d'Ortous de Mairan proposed a problem that necessitated a knowledge of the relative amount of light from the sun at two altitudes. Bouguer succeeded in making such a measurement of the light from the full moon on 23 November 1725, by comparing it with that of a candle.

Bouguer's achievement was to see that the eye could be used, not as a meter but as a null indicator, i.e., to establish the equality of brightness of two adjacent surfaces. He then made use of the law of inverse squares, first clearly set forth by Kepler. In his *Essai d'oplique sur la gradation de la lumiére* (1729), he showed how to compare lights in this way; he then went on to deal with the transmission of light through partly transparent substances. In the latter part of the *Essai*, Bouguer published the second of his great optical discoveries, often called Bouguer's law: In a medium of uniform transparency the light remaining in a collimated beam is an exponential function of the length of its path in the medium. This law was restated by J. H. Lambert in his *Photometria* (1760) and, perhaps because of the great rarity of copies of Bouguer's Essai, is sometimes unjustifiably referred to as Lambert's law.

Just before he died, Bouguer completed a much larger book on photometry, the *Tradé d'optique sur la gradation de la lumière*, published posthumously (1760) by his friend the Abbé Nicolas Louis de la Caille. The *Traité* goes far beyond the *Essai*, describing a number of ingenious kinds of photometers, including a method of goniophotometry, and even attempting an elaborate theory of the reflection of light from rough surfaces, although this was not successful. The third and last part of the book, however, gives a valid elementary theory of the horizontal visual range through an obscuring atmosphere, arriving at a law, usually credited to H. Koschmieder, considered to belong to the twentieth century. It is fair to consider Pierre Bouguer not only the inventor of the photometer but also the founder of an important branch of atmospheric optics. The eighteenth century is not an outstanding epoch in the history of optics, but Bouguer's contribution to that science is notable by any standard.

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