

physical actions, is, however, dependent on the mutual distances of the particles of matter, and can therefore be altered, but can as little as the existence of matter itself be removed. This view of Newton's explained or described clearly¹ the phenomena of moving and falling

¹ The distinction between an explanation and a description of the facts of nature has been slowly developed in the course of modern thought. Probably Leibniz was the first to insist on it, and to maintain in the abstract that all description of nature would be mechanical, but that the explanation or interpretation of nature must be spiritual. But the first practical instance of this important distinction is really to be found in Newton's philosophy. In many passages of the 'Principia,' and especially in the 'Optics,' the double view of the problems of philosophy is clearly indicated. The principles of science since the time of Newton are general facts, established by experience and put into mathematical language, admitting of constant verification by observation and by the deductions of the calculus. These principles are not the ultimate causes, but only a concise description of some of the phenomena of nature. These principles Newton calls mathematical—referring to measurable quantities—and distinguishes them from the philosophical principles ('Princ.,' 1st ed., p. 401). Especially as regards gravitation, Newton explains many times that he uses this term not as an explanation, but only as a mathematical description of the force with which bodies approach each other, whatever the cause of this phenomenon may be, which he leaves others (called with some irony metaphysicians) to determine ('Optics,' query 31). That

Newton, besides giving the precise mathematical principles of all future dynamical science, indulged also in further speculations, which he put into the form of queries and advanced with hesitation and merely tentatively, gave his opponents ample opportunity to attack the doubtful and uncertain statements in his philosophy. Instead of studying and understanding the mathematical truths of the 'Principia,' they attacked the doctrines which were fragmentarily put forward in the queries to the 'Optics' or added in the general scholium at the end of the second edition of the 'Principia.' Roger Cotes in his preface to the second edition of the 'Principia,' and Clarke in his correspondence with Leibniz, pointed out the difference between Newton's descriptive and calculating and the older or metaphysical philosophy. They were, however, more interested in disproving the atheistical consequences of which Newton's philosophy had been accused than in clearly insisting on the fundamental difference between mathematical and metaphysical principles—i.e., between the exact and the philosophical views of nature. And in Bentley's Boyle lectures, delivered in 1692 and 1693, the principles of Newton's philosophy were specially brought forward to refute atheism, an undertaking which Newton himself supported in his contemporary correspondence with Bentley, published half a century later, in 1756.