

Young and
Fresnel.

in the nineteenth century by Rumford and Young, were united into a consistent physical theory by Augustin Fresnel, who has been termed the Newton of optics, and who consistently, and all but completely, worked out one great example of this kind of reasoning. He has the glory of having not only established the undulatory theory of light on a firm foundation, but still more of having impressed natural philosophers with the importance of studying the laws of regular vibratory motion and the phenomena of periodicity in the most general manner. His work was carried through, as was that of Newton, by a combination of observation, measurement, and calculation; of experimental skill with mathematical ability.

tion of the same twenty-five years before in his Berlin memoir, "Sur la lumière et les couleurs" (1745). Euler was as much opposed to Descartes' and Leibniz's views as he was to those of Newton, and though he admits having forerunners, he hardly refers to the principal one, viz., Huygens, whose well-known and useful principle he absolutely ignores. In fact, in spite of his great name and reputation, his ideas on the ether as continuously filling space, and his attempts to explain the phenomena of light, heat, magnetism, and even gravitation by means of this continuum remained isolated, and had hardly any influence on physical science. His great friend and correspondent, Daniel Bernoulli, remained a firm believer in action at a distance, and thought Euler had put forward his hypotheses with too much assurance. It is, nevertheless, remarkable how closely the terms in which Euler, in his posthumous work 'Anleitung zur Naturlehre' (edited by the Petersburg Academy in the second

volume of the "Opera postuma . . . anno 1844 detecta," 1862), describes his ether as continuously filling empty space and existing in a strained (*gewaltsam*) condition, agree with quite modern ideas on the subject. Accordingly Euler's ether theory has in recent times been studied again by several writers abroad, of whom I will only mention E. Cherbuliez, 'Ueber einige physikalische Arbeiten Eulers' (Bern, 1872); F. Rosenberger, 'Die Geschichte der Physik' (vol. ii. 1884, p. 333 *sqq.*); C. Isenkrahe in 'Zeitschrift für Mathematik und Physik' (Hist. Lit. Abth., vol. xxvi.) and ('Abhandlungen zur Geschichte der Mathematik,' vi.; and E. Miething, 'L. Eulers Lehre vom Aether' (Berlin, 1894). The first-mentioned author tries to answer the question why Euler's ideas remained so isolated. He says (p. 49): "If we combine the results of Huygens' and Euler's investigations, we see that in the 'fifties of the eighteenth century the undulatory system formed a largely developed scientific doctrine. . . .