

of refraction, such as conical refraction, were mathematically foretold and experimentally verified.¹ The real physical question, however, remained unanswered; and it remains only partially answered up to the present day.² How is it that the luminiferous ether, when existing inside ponderable matter, like air permeating a grove of trees—as Young put it—is so changed that its waves travel with variously altered speeds, that in different directions the rays acquire different properties, are differently maintained or partially extinguished (absorbed)? It was natural to suppose that the particles of ponderable matter must in some way affect the ether, changing its density or its rigidity, and that they themselves are affected by the movements of the ether which fills their interstices. The question can only be exhaustively answered by a complete know-

¹ The subsequent suggestion of the phenomena of inner and outer conical refraction, experimentally verified by Humphrey Lloyd in 1833 (see his 'Miscellaneous Papers,' No. 1, or Transactions, Royal Irish Academy, vol. xvii.), was popularly regarded as a complete proof of the correctness of the wave-surface, and of Fresnel's entire theory. But as to the first point, Sir G. G. Stokes showed (Brit. Assoc. Report on Double Refraction, 1862, p. 270) that conical refraction "must be a property of the wave-surface resulting from any reasonable theory." And as the wave-surface itself can be geometrically constructed without any reference to the mechanical theory of the ether (as Mr Fletcher has most exhaustively shown), the prediction of conical refraction cannot be regarded as a proof of Fresnel's

theory. Todhunter-Pearson says: "But for Cauchy's magnificent molecular researches, it might have been possible for Fresnel to completely sacrifice the infant theory of elasticity to that flimsy superstition, the mechanical dogma, on which he has endeavoured to base his great discoveries in light. Cauchy inspired Green, and Green and his followers have done something, if not all, to reconcile Fresnel's results with the now fully developed theory of elasticity, the growth of which his dogma at one time seriously threatened to check" ('Hist. of Elasticity,' vol. i. p. 167).

² In 1862 Sir G. G. Stokes "expressed his belief that the true dynamical theory of double refraction had yet to be found" (Report, p. 268).