culty arose of explaining how in refracting substances, be they fluid, amorphous (singly refracting), or crystalline (including doubly refracting), these different rays, with different wave-lengths, come to travel with different velocities, and hence take different courses; how, further, some of these rays come to be extinguished or reflected (or both) in varying degrees.

Now, although the complete answer to this general question has not yet been given, a principle has been recognised which gives us a clue to the possible explanation of a large class of phenomena, and which is thus of remarkable fruitfulness. It was first laid down by Euler,[1] a pure mathematician, whose physical reasoning was frequently suggestive but never particularly clear and definite; it was probably first applied to optical phenomena by Sir George Stokes;[2] and it was later on used by him

[1] In the last section of his treatise on light and colours ('Berlin Memoirs,' 1745; published in Latin, 1746), Euler treats of luminous, reflecting, refracting, and opaque bodies, and he there mentions the analogy which exists with musical resonance. "The smallest particles [of opaque bodies] are similar to stretched strings, which are, as it were, specially receptive for certain vibrations, which they can assume without being struck, if only they are affected by the undulatory movement of the air. "In his expositions upon light and colours, Euler always starts with the analogy of sound and light; he follows it with absolute consistency" (Cherbuliez, 'Euler's physicalische Arbeiten,' p. 44). This analogy was exactly what was absent in the investigations of Brewster, who remained to the end an adherent of the projectile theory. Balfour Stewart came nearest to the true explanation in his memoir of 1858 ('Trans. of the Royal Society of Edinburgh,' 1861); but this referred to radiant heat and to Prévost's theory of exchanges. It contains the words: "The absorption of a plate equals its radiation, and that for every description of heat" (p. 13). Had this statement been distinctly applied to luminous rays, spectrum analysis would have been his discovery, although his theoretical proof might be regarded as insufficient (see Scheiner's treatise on Astronomical Spectroscopy, transl. by Frost, 1894, p. 112; also Rosenberger's 'Geschichte der Physik,' vol. iii., 1890, p. 482 *sq.*)

[2] See the references given on p. 277 of the first volume of this history.