

56.  
Difficulties  
of Maxwell's  
theory.

The theory of Maxwell had not only failed to give a definite meaning to the conception of a charge of electricity; it had also, in the general term "dielectric," somewhat obliterated the clear distinction between empty space and space filled with insulating matter, such as air. Empty space, *i.e.*, space devoid of matter, was supposed to be filled with some continuous substance, the ether, which was the seat or bearer of electric and magnetic actions, the electro-magnetic field. When the only clearly known property of this ether, the fact that it was the carrier of radiation or the luminiferous medium, was identified with its electro-magnetic nature—light being conceived to be an electro-magnetic disturbance—the new theory had to attack the great question of the relation and interaction of ether and matter, in which all the remaining problems of physical optics seemed centred.<sup>1</sup> How was the electro-magnetic theory of light,

lagen der Elektrodynamik,' published on the occasion of the unveiling at Göttingen, in 1899, of the monument erected in honour of Gauss and Wilhelm Weber. It is interesting to see how, from apparently quite independent beginnings, and in centres far removed from each other, the ideas of the atomic nature of electricity have almost simultaneously become crystallised, and have united themselves with the great experimental labours emanating from Plücker and Crookes to give rise, at the end of the century, to the modern theory of electrons.

<sup>1</sup> One of the most important of these problems is the question to what extent the ether takes part in the motion of ponderable matter through it. Astronomical aberration, discovered by Bradley, and

easily explained by the then current projectile theory of light (see above, chap. vi. p. 10, note), has caused great difficulty to the undulatory theory, and even Sir George Stokes, whose ideas on the subject have been very generally quoted and accepted, would, in his Burnett Lectures on Light (1883), say no more than that "according to the theory of undulations . . . it is not inexplicable" (ed. of 1887, p. 25). That the electro-dynamic view of the ether should take up the problem was most natural, and the discussion of it is accordingly placed at the opening of Lorentz's memoir of 1895; the effect of the motion of the earth on optical phenomena having already been treated by him in 1887. Dr Larmor treats very fully of this subject in the first section of his