

ETHER DYNAMICS

ENERGY OF ETHER STRAIN; RADIATION; LIGHT

SECTION I

INTRODUCTION

276. Owing to the peculiarity of the subject to be treated in this, the third and final natural division of Physics, it is deemed expedient to state at the outset some leading propositions, whose truth must be assumed as the basis for the study of a large group of natural phenomena. The demonstrations of the validity of these several assumptions must, however, be deferred to their proper place in connection with the study of the phenomena themselves.

277. The ether. We know matter by its properties as perceived by means of our senses; in other words, the existence of any form of matter is to us only an inference from the phenomena to which it gives rise. By evidence of precisely similar nature we are led to believe in the existence of a medium called *the ether*, pervading all space and penetrating between the molecules of matter, and even between the atoms in the molecules. We cannot see, hear, feel, taste, smell, exhaust, or weigh it, and yet all this, paradoxical as it may seem, furnishes no proof that it does not exist. Briefly stated, the proof of its existence is this. *It furnishes the basis for the sole conceivable explanation of very many physical phenomena.*

Phenomena occur just as they would occur if all space were filled with an intangible and invisible medium capable of transmitting motion and energy, and we can account for all these phenomena on no other hypothesis; hence our belief in the existence of the medium. The evidence of the existence of ether is in some instances as strong and direct as that of the existence of air. The eye is an ether sense organ just as the ear may be called an air sense organ, or the hand a sense organ for the appreciation of grosser forms of matter. *The ether is a medium for the transmission of a special form of energy by means of transverse wave motion.*

In its structure the ether is assumed to be excessively finely grained, "differing from water, glass, and metals in being very much more finely grained in its structure" (Lord Kelvin). It possesses rigidity,¹ and in this respect is like a solid. Bodies of matter, even so large as the planets, pass freely through it encountering little resistance; therein it is like a perfect fluid. It is almost perfectly elastic and incompressible.

278. Radiation. The transmission of energy by means of periodic disturbances in the ether is called *radiation*, energy so transmitted is called *radiant energy*, and the body emitting energy in this manner is called a *radiator*. The precise nature of the periodic disturbances, whether they be due to changes of position in the ether or to alternation between opposite conditions (e.g. such as successive local states of strain or distortion and release therefrom), is unknown to us. We do know, however, that the laws according to which these changes take place are those of *wave motion*. Space is traversed at all times and in all directions by myriads of ether waves of a very wide range of lengths. The all-pervading ether can be set in vibration by the motion of the molecules or atoms of ordinary matter. This local disturbance creates ether waves, and by these waves energy

¹ Calculation leads us to infer that its rigidity is about 10^{-9} that of steel, and its density 936×10^{-21} that of water at 4°C ., or equal to that of our atmosphere at a height of 210 miles, — a density vastly greater than that of the same atmosphere in the interstellar spaces. — Maxwell.

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