$$A = k/r \qquad (29)$$

and as the force due to wave action is shown, in works on physics, to be proportional to the square of the amplitude, we have for the force:

$$f = k^2/r^2 \qquad (30)$$

which is the form of law for gravitation, magnetism, and all similar forces of nature obeying the law of the inverse squares.

Now let the waves from magnet *B* interpenetrate the waves from magnet *A*. It will be seen that at every point of space the rotations of the elements of the two sets of waves are exactly opposite: the result is that the rotations from magnet *B* undo as far as possible the opposite rotations from magnet *A*. Accordingly the stresses in the medium due to rotations of the aether, in the field between *A* and *B*, and also beyond *A* and *B*, are reduced: the medium is thus everywhere less agitated than before, and shrinks, so as to collapse or contract between *A* and *B*. But a collapse of the aether is equivalent to a contraction, and thus the two bodies attract as if held together by a stretched mass of india rubber. This is a simple and direct explanation of attraction. Nothing is postulated except waves like those known to exist in light and heat, but here seen to be exactly parallel and somewhat differently directed from those of light and heat, which usually have their planes tilted in haphazard fashion.

B) The cause of repulsion is similar to that of attraction, but in this case the poles presented are like; and if we examine the above diagram, we discover that when the waves from magnet *B*, 2nd case, interpenetrate the waves from magnet *A*, the rotations at every point will be conformable and in the same direction. The medium therefore at every point is more agitated than before. The amplitudes of the disturbed waves are thereby increased, and hence there is an increase of stress; and under the elasticity of the aether the result is an expansion of the medium, which gives a mutual repulsion of the two bodies.

This is a simple explanation of repulsion, and it had never been worked out prior to the researches published by the writer in 1917. *Maxwell* was unable to conceive of any mechanism for the explanation of attraction and repulsion of magnets, though he found that mathematical stresses of a certain type, yielding tension along the lines of force and pressure at right angles thereto, thus dynamically equivalent to those outlined above, would account for the phenomena of magnetism.

It is true that *Maxwell* believed that there are rotations around the *Faraday* lines of force, as Lord *Kelvin* had also rendered probable as early as 1856; but neither *Kelvin* nor *Maxwell* had seen that this would arise from the type of waves here outlined, though *Faraday*'s experiment of 1845, on the rotation of the plane of a beam of polarized light, — when passed along the line of force, through a dense medium such as lead glass, — should have suggested the correct theory of the magnetic waves to *Kelvin* and *Maxwell*, as it did to me in 1916.

As *Maxwell* was unable to unlock the secret of magnetism, with both attraction and repulsion, it will not greatly surprise us to learn that he was utterly bewildered by the mystery of gravitation, and could not make a successful attack upon this most difficult problem.

In fact no considerable progress as to the cause of gravitation has been made by other investigators since the time of *Newton*. As the subject of gravitation is immense, we must not enter upon it here, except to say that the evidence is most conclusive that it is a wave-phenomenon, closely allied to that of magnetism, but differing from magnetism which has a parallel arrangement of the atoms and what *Airy* calls (Treatise on Magnetism, 1870, p. 10) a duality of powers — two poles — while gravitation is a central action only, owing to the haphazard arrangement of the planes of the atoms.

It is well known that about 1822 *Ampère* first made electro-magnets out of common steel, by means of an electric current sent through a solenoid. The way in which the wire is wound about the bar being magnetized suggests, and, in fact, proves that the wire bearing the current has a wave-field about it. There is proof that the waves are flat in the planes through the axis of the wire: this conception harmonizes all the known phenomena of magnetism, in relation to electro-dynamic action, and also harmonizes *Ampère*'s theory of elementary electric currents about the atoms with the wave-theory of magnetism above set forth.

The wave-theory of magnetism explains all the phenomena of terrestrial magnetism, in relation to the periodic influences of the sun and moon, such as magnetic storms, earth currents, the aurora, and the semi-diurnal magnetic tide depending on the moon, of which no other explanation is known. For the dependence of magnetic storms on sunspots consult a paper by the author, in the Bulletin Société Astr. de France, November, 1918.

There has been such a bewildering confusion of thought connected with the whole subject of physical action across space that it is necessary to bear in mind clearly the fundamental principles of natural philosophy. In the well known article on attraction, (Scientific Papers, vol. 2.487), *Maxwell* points out that in the Optical Queries included in the third edition of the Optics, 1721, *Newton* shows that if the pressure of the aethereal medium is less in the neighborhood of dense bodies than at great distances from them dense bodies will be drawn towards each other, and if the diminution of pressure is inversely as the distance from the dense body, the law will be that of gravitation. *Maxwell* considers that *Newton*'s conception rests largely on the idea of hydrostatic pressure, as in incompressible liquids. But we have shown that the amplitude of the waves, $A = k/r$, with forces $f = k^2/r^2$, fulfills the condition which *Newton* held to be essential.

10. Integration of the General Differential Equations of an Elastic Solid, which applies to the Aether, when this Medium is viewed as an Infinite Aeolotropic Elastic Solid propagating Waves.

As is usual in the theory of an elastic solid, let m denote a function of the bulk modulus k, and of the rigidity n, such that

$$m = k + {}^1/_3 n. \qquad (31)$$

Then $k = m - {}^1/_3 n$, and this bulk modulus measures the elastic force called out by, or the elastic resistance against, change of volume. On the other hand the »compressibility« is measured by

$$1/k = 1/(m - {}^1/_3 n). \qquad (32)$$