for the purpose of discovering the forces which exist in the universe between cosmic bodies we had been confined to experiments in the laboratory, as we are in all other departments of physics and chemistry, it is very doubtful whether this universal law of gravitation would ever have been discovered. And yet it stands there as almost the only formula universally applicable to all matter throughout the visible and tangible universe.

41. The Newtonian formula unique as to universality and accuracy.

In the foregoing pages I have sometimes spoken of this great discovery of Newton, on which is based the astronomical view of nature, as a formula, sometimes as a law. A formula is merely the expression in definite terms of certain relations of measurable quantities. By a law we are apt to understand something more—*viz.*, the statement of some fundamental, all-pervading property of the things of nature, which, so far as we are concerned, is final.[1] Whether the human mind is at all

this expression would give an infinite value for the force between electrical particles in motion. Weber replied that the same argument could be used against the gravitation formula, and hinted at the possibility that a correction might have to be added to the Newtonian formula to make it applicable to molecular distances ('Electrodyn. Maasb.,' 1871, p. 60). This idea was taken up by several Continental mathematicians (see Isenkrahe, 'Das Räthsel von der Schwerkraft,' p. 33, &c.; Paul du Bois-Reymond, 'Ueber die Grundlagen der Erkenntniss,' p. 50; Tisserand, 'Comptes Rendus,' September 1872).

[1] Helmholtz says, referring to Weber's so-called law: "If we are to consider Weber's law as an elementary law, as an expression of the ultimate cause of the phenomena to which it refers, and not merely as an approximately correct expression of facts within narrow limits, then we must demand that, if applied to objects of the largest imaginable dimensions, it should give results which are physically possible" (1873, 'Wissenschaftliche Abhandlungen,' vol. i. p. 658). This sentence raises a philosophical question as to the demands which we can legitimately expect to be satisfied by any so-called law of nature expressible in the symbols of human thought, be these words or algebraic signs. I venture to think that nowadays, and largely in consequence of discussions similar to those carried on over Weber's law, physicists do not any longer expect to find laws of that general and fundamental character which the words given above describe.