focus, is replaced by a larger or a smaller circle, the contours of the image become less and less distinct, and with the possible light which we gain there is mingled much darkness, the source of many mistakes and errors. But the tendency of all scientific thought is towards clearer and clearer definition; it lies in the direction of a more and more extensive use of mathematical measurements, of mathematical formulæ.

There is probably no science which has come so perfectly under the control of this kind of mathematical expression as has astronomy since the time of Newton or of Laplace, and, we may add, there exists probably no mathematical formula which has stood the test of application to existing phenomena so long and so thoroughly as the gravitation formula of Newton. It possesses two unique properties which no other formula possesses—so far as we can now see—it is universal [1] and it is accurate.[2] These

[1] The law of gravitation can be called the first and most general physical law or statement of universal application. The laws of motion may be called mechanical or dynamical statements. Both the law of gravitation and the laws of motion describe facts, and have been found by experience; but the laws of motion contain no physical constant—*i.e.*, no quantity which requires to be fixed and measured by observation, and the absolute value of which has for us at present no ulterior meaning. The law of gravitation has one physical constant, the universal gravitation constant (see p. 320). As it measures what we call matter, it need not be determined, and its actual determination, which has been accurately made only in recent times, has not in any direction advanced our general physical knowledge. For all practical purposes of physics the unit of mass is a weight, just as for all commercial purposes gold is the standard of value. The astronomical view permits us to go a step further and express the mass of a pound of matter in units of time and space, and the political economist may seek for a real standard of value—for instance, an article of food like wheat. Other fundamental physical laws or general statements involve other physical constants, as we shall see later on.

[2] The accuracy of the so-called laws of nature, or, more correctly, of the expressions which science gives to the laws of nature, is a very important question. Little is said on this point in the ordinary text-books. It is only in very