of mass, which in the Newtonian formula meant merely the quantity of matter, had indeed to be enlarged, and to the attracting forces had to be added those of repulsion; still, though physically the phenomena were entirely different, the mathematical expression which ruled the two electric and the two magnetic quantities, usually termed fluids, looked very much like the Newtonian gravitation formula: it betrayed philosophers into thinking they possessed an explanation where really they had only a measurement and a description.[1]

Newton's elementary law of gravitation, Laplace as it were summing up the evidence in his great work. What Laplace did for Newton was done by Poisson for Coulomb's elementary law of electric and magnetic action, and on a still larger scale by Gauss, who worked out the mathematical theory and applied it to the case of the magnetic distribution on the earth's surface. In England, already before Coulomb's researches were published, Cavendish had, likewise by a combination of experiment and calculation, established the elementary formulæ and properties of electrical phenomena. See note to the following page.

[1] The exact measurements of Coulomb and the mathematical analysis of Poisson and Gauss superseded the vaguer discussions on the nature of electricity and magnetism which were very frequent before that period, just as the mathematical principles of Newton and Laplace drove into the background the discussion on the nature and cause of gravity. Coulomb himself does not profess to settle the controversy carried on between the two schools of which Dufay and Franklin can be considered as the principal representatives—*viz.*, whether there existed two electric fluids or only one. Coulomb judged the rival views simply as to their usefulness in describing and measuring phenomena: "Comme ces deux explications n'ont qu'un degré de probabilité plus ou moins grand je préviens, pour mettre la théorie . . . à l'abri de toute dispute systématique, que dans la supposition des deux fluides électriques je n'ai d'autre intention que de présenter avec le moins d'éléments possibles, les résultats du calcul et de l'expérience, et non d'indiquer les véritables causes de l'électricité" ('Collection de Mémoires,' vol. i. p. 252). He had previously, in 1777, rejected the theory of vortices to explain magnetic phenomena: "Il semble qu'il résulte de l'expérience que ce ne sont point des tourbillons qui produisent les différents phénomènes aimantains, et que, pour les expliquer, il faut nécessairement recourir à des forces attractives et répulsives de la nature de celles, dont on est obligé de se servir pour expliquer la pesanteur des corps et la physique céleste" (vol. i. p. 8). And in 1789 he is still more cautious: "Pour éviter toute discussion, j'avertis . . . que toute hypothèse d'attraction et de répul-