we speak, no accurate measure had been established; and Newton persuaded himself, by experiments made in the cloister of Trinity College, his residence, that his calculation was not far from the fact. When, afterwards, more exact experiments showed the velocity to be 1142 English feet, Newton attempted to explain the difference by various considerations, none of which were adequate to the purpose; —as, the dimensions of the solid particles of which the fluid air consists;—or the vapors which are mixed with it. Other writers offered other suggestions; but the true solution of the difficulty was reserved for a period considerably subsequent.

Newton's calculation of the motion of sound, though logically incomplete, was the great step in the solution of the problem; for mathematicians could not but presume that his result was not restricted to the hypothesis on which he had obtained it; and the extension of the solution required only mere ordinary talents. The logical defect of his solution was assailed, as might have been expected. Cranmer (professor at Geneva), in 1741, conceived that he was destroying the conclusiveness of Newton's reasoning, by showing that it applied equally to other modes of oscillation. This, indeed, contradicted the enunciation of the 48th Prop. of the Second Book of the *Principia;* but it confirmed and extended all the general results of the demonstration; for it left even the velocity of sound unaltered, and thus showed that the velocity did not depend mechanically on the type of the oscillation. But the satisfactory establishment of this physical generalization was to be supplied from the vast generalizations of analysis, which mathematicians were now becoming able to deal with. Accordingly this task was performed by the great master of analytical generalization, Lagrange, in 1759, when, at the age of twenty-three, he and two friends published the first volume of the *Turin Memoirs.* Euler, as his manner was, at once perceived the merit of the new solution, and pursued the subject on the views thus suggested. Various analytical improvements and extensions were introduced into the solution by the two great mathematicians; but none of these at all altered the formula by which the velocity of sound was expressed; and the discrepancy between calculation and observation, about one-sixth of the whole, which had perplexed Newton, remained still unaccounted for.

The merit of satisfactorily explaining this discrepancy belongs to Laplace. He was the first to remark[7] that the common law of the

[7] *Méc. Cél.* t. v. l. xii. p. 96.