



## LXXVI. Extract from a letter dated Cleveland, Ohio, August 5th, 1904, to Lord Kelvin from Profs. Edward W. Morley and Dayton C. Miller

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LXXXVI. *Extract from a Letter dated Cleveland, Ohio, August 5th, 1904, to Lord Kelvin from Profs. EDWARD W. MORLEY and DAYTON C. MILLER.*

**I**N 1887 Michelson and Morley made an experiment on the relative motion of the earth and the luminiferous ether. They could detect no relative motion equal to one sixth of the earth's velocity in its orbit.

To explain this result, FitzGerald and Lorentz suggested that the stone slab on which the apparatus was constructed might have its dimensions changed by its drift through the ether.

There was a remote chance of detecting such an effect by repeating the experiment of 1887, but with different materials. If the FitzGerald-Lorentz effect exists, it may affect all materials to the same amount, independently of the nature of the material. But it is also possible that the effect is one which depends on the physical properties of the material, so that pine may be affected more than sandstone. In this case, if sandstone gives no displacement in an experiment like that of 1887, an apparatus supported by pine, which would be compressed more than sandstone, would give an effect of the sign opposite to that suggested by the original simple theory.

Such an experiment has now been made. We first made a structure of pine, which we floated on mercury as in 1887. While this structure was new, we obtained good observations with it. But after the wood had been affected by steam-heat for one season, it was not possible to maintain it in adjustment for five minutes. We therefore made a structure in which the distance of the mirrors depends on pine rods, but all other circumstances depend on steel. Two very stiff steel girders cross symmetrically, and are floated on mercury. Two holders, each carrying four mirrors, are fixed at the ends of two arms of this cross. Two other mirror-holders are suspended freely. Pine rods reach from the fixed holders to the free holders, and springs maintain stable contact. These pine rods are carried in brass tubes which constitute a sort of truss; the distance of the two sets of mirrors depends solely on these pine rods.

Observations were made by noting the place of the central black fringe on a kind of eyepiece micrometer. They were made at sixteen equidistant azimuths, and commonly at a rate of one revolution in little more than a minute, readings being made to the tenth of a wave-length. Two times were

selected in which the motion of the earth was in the plane of the apparatus. In the first part of July, the direction of motion at these two times apparently differed by  $115^{\circ}$ ; the morning and evening sets of observations were combined by taking into account this difference. In all, more than 250 turns were observed.

The velocity of the earth in July may be assumed to be 33·5 kilometres a second. The length of path in our apparatus was 32·2 metres, and the effect to be expected (on the original theory) is 1·4 wave-lengths.

We have established that, if there is any effect, it is not more than 0·015 wave-length.

### LXXVII. *Notices respecting New Books.*

*The Theory of Heat.* By THOMAS PRESTON, F.R.S. *Second Edition*, revised by L. ROGERSON COTTER, M.A. (Dubl.). Macmillan & Co., Ltd. 1904.

IN is nearly ten years since the late Professor T. Preston wrote his 'Theory of Heat.' The work was written in a marvellously short time, taking into account its wealth of carefully compiled abstracts from recent sources as well as its fresh and interesting treatment of the classical literature of this branch of science. The book, in short, had merits which placed it at once among the best textbooks on Heat in this or in other languages. There were, however, omissions, felt to be such even then; and, of course, these omissions have been growing with each important advance of the science.

The second edition of the textbook is now in our hands, and before offering any detailed remarks we heartily congratulate Mr. Cotter upon his editorial work as a whole. Mr. Cotter has added about 100 pages, not one of which is superfluous, to the work; as well as many references which will be of value to students, both old and young. We proceed to make some very brief comments upon the additions.

In the first chapter we find a much needed exposition of Maxwell's law of the distribution of molecular velocities in gases. In this chapter Preston discusses atomic theories ancient and modern. It is a pity, for the sake of completeness, that the editorial work on this chapter was hardly recent enough to permit of a paragraph on the modern evidence in favour of a highly complex kinetic atom. In chapter II. on Thermometry, Mr. Cotter's additions on the Lag of Thermometers, Pressure Coefficients and Errors due to Capillarity or to Emergent Column, are excellent. In Pyrometry and Low Temperature Thermometry, a *résumé* of recent methods depending on thermo-electric effects, viscosity of