

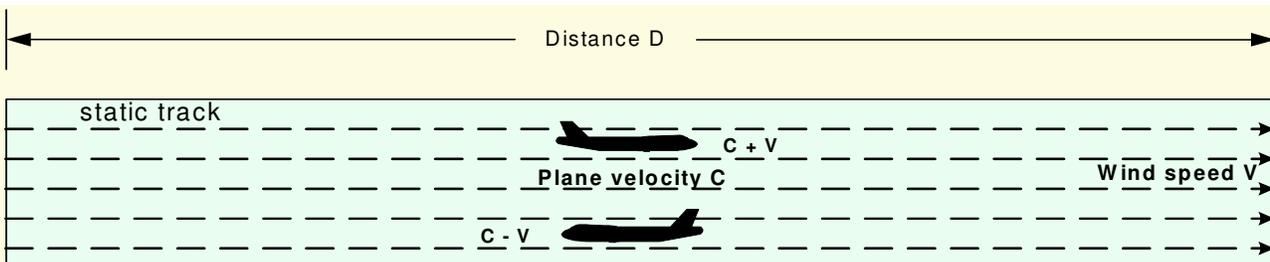
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A requiem for the Lorentz "gamma- factor"

A serious conceptual error has been committed along with the experiment performed by Michelson and Morley in the year 1887 conceived in order to detect the existence of an ether and whose null outcome gave rise to far-fetched speculations regarding the nature of light and the properties of space and time. The resulting fuss caught the attention of the physicist Hendrik Lorentz who, to cope with that result, suggested the introduction of an arbitrary correction factor to the equations describing the devised experimental model. In fact, this factor was introduced to suit an ill-conceived premise to an unexpected outcome and, since then, it has become a spook that's persistently being applied as a panacea to explain other little understood phenomena in the Physics and even the Cosmology domain, not to mention Relativity.

However, after more than a century, no one realized, still, that the initial conception of the experiment had been based on a wrong premise. It's amazing that during all this time, nobody bothered to analyze in depth the theoretical design under which the experiment was conceived; more precisely the mechanism by which the phenomenon is produced.

In the following years, other physicists repeated the experiment under the same wrong premise and using more accurate methods and instruments just to get to the same disappointing result. The M/M experiment has already been widely publicized and therefore universally known and it would be, certainly, superfluous to describe it here again in detail, however in brief terms, the concept model can be described as in Figure (1)*. It shows, in more familiar terms but equally valid, the basic assumptions on which the experimental layout was conceived. Here, the distance **d** pertains to a fixed frame (the laboratory) and the light being represented as an airplane flying with hypothetic velocity **c**, and being dragged by a wind with velocity **v**. The actual contrivance consisted of a device mounted inside a laboratory which, instead of moving through the Ether, is considered stationary in space, and the ether, in turn, is moving past the device to form of what they have called an ether wind. This schema allegedly simplified the understanding of the phenomenon without altering its physical interpretation. In this device, (actually an Interferometer) a coherent beam of light is emitted by a source in the direction of a detector located at a distance **d** from the source, being one trajectory of the beam of light, after being split, parallel to the direction of the presumed ether wind and to be compared to another light beam trajectory perpendicular to the first one and serving as a phase reference in order to measure the phase difference between the two after a common round-trip path. For the purpose of our analysis, it only interests us, now, the parallel trajectories because this is where the problem really lies. Look at figure (1)*. Here the wind speed stands for the ether wind and the airplane for the velocity of light. The analogy is perfectly pertinent to the one used in the famous experiment.



M/M wrong premise fig. (1)

Here, it's very important to keep in mind that light, once emitted by the source, travels in its own propagation medium and is not influenced by the movement of the source, the detector or the laboratory as a whole.

A phase reference point, such as a given wave crest of light propagating through space will take a time t to travel a distance d Eq. [1]

$$t = \frac{d}{c} \quad [1]$$

Accordingly, the light flowing through the ether wind and being dragged in the forward direction (the direction of the ether wind flow) will take

$$t_f = \frac{d}{c + v} \quad [2] \quad \Leftarrow \text{co-linear one way travel time in the wind direction (forward)}$$

and in the reverse direction

$$t_b = \frac{d}{c - v} \quad [3] \quad \Leftarrow \text{co-linear one way travel time in the opposite wind direction (backward)}$$

the expected round trip time should be

$$t_f + t_b = 2 \cdot d \cdot \frac{c}{c^2 - v^2} \quad [4]$$

instead the obtained experimental result was the no ether wind condition

$$\frac{2 \cdot d}{c} = 2 \cdot t \quad [5]$$

To cope with the unexpected result, Lorentz introduced a correction factor to suit into equations (2) and (3) forcing the result of the experiment to complain with [5]. That factor became universally known as the gamma factor and contains an additional error that crept in due to a miscalculation of the velocity of light in the orthogonal direction, consequence also of the original premise, and giving rise to the γ factor being put under a square root. The correct value of the factor is derived by

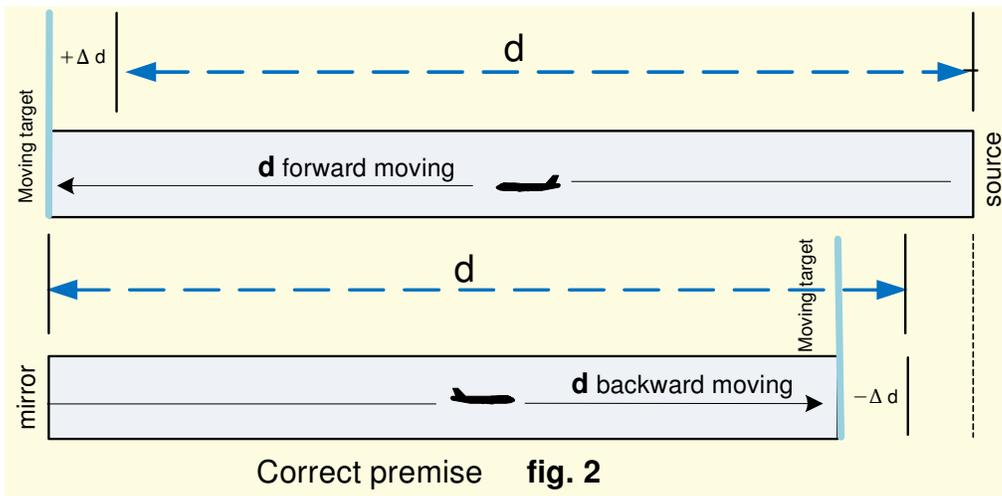
$$(t_f + t_b) \cdot \gamma = \frac{2 \cdot d}{c} \quad \text{solving for } \gamma \text{ and getting} \quad \gamma = 1 - \frac{v^2}{c^2} \quad [6]$$

Now, merging the corrected gamma factor of Prof. Lorentz, newly baptized as β factor, into equations [2] and [3] the real nature's framework will spring up as magic.

$$\frac{d}{c-v} \cdot \left(1 - \frac{v^2}{c^2}\right) = \frac{d \cdot (c+v)}{c^2} \implies \frac{d}{c} \cdot \left(1 + \frac{v}{c}\right) \quad \text{and since} \quad \frac{d}{c} = T \quad T_f = T + T \cdot \frac{v}{c} \quad [7]$$

$$\frac{d}{c+v} \cdot \left(1 - \frac{v^2}{c^2}\right) = \frac{d \cdot (c-v)}{c^2} \implies \frac{d}{c} \cdot \left(1 - \frac{v}{c}\right) \quad \text{and equally} \quad T_b = T - T \cdot \frac{v}{c} \quad [8]$$

doesn't it hint to a novel and real life picture on which the actual phenomenon resides?



$$T = \frac{d}{c} \quad \Delta d = v \cdot T \quad \text{so} \quad T_{\text{part}} = \frac{d}{c} \mp \frac{\Delta d}{c} \quad \text{or} \quad T_{\text{part}} = T \mp \frac{vT}{c}$$

Here, light, represented as a flying airplane, is emitted by the source with velocity c through its own propagation medium and the laboratory (moving target) carrying the instrumentation moves, independently, once in the forward and next in the backward direction with velocity v . And, based on the correct premise of fig.(2), the pertinent equations [7] and [8] produce the correct result without any fudge factor.

$$T_f + T_b \implies \left(T + T \cdot \frac{v}{c}\right) + \left(T - T \cdot \frac{v}{c}\right) = \frac{2 \cdot d}{c} \quad [9]$$

The result is also in perfect accord with the Sagnac effect

$$\left(T + T \cdot \frac{v}{c}\right) - \left(T - T \cdot \frac{v}{c}\right) = 2 \cdot T \cdot \frac{v}{c} \quad [10]$$

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Equations [2] and [3] are an incorrect description of the experiment. If the correct approach is to be taken, the gamma factor can be outright entombed. The virtual distances $\mathbf{d} \mp \Delta\mathbf{d}$ do not imply any material length expansion or contraction. That hypothesis can also be entombed together with the gamma factor

* Adaptation from "**Concepts of Modern Physics**" Arthur Beiser (the boat substituted for an airplane)
McGraw-Hill Book Company