

A Scientific Dispute

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Abstract

This short article is about the debate between 1882 and 1887 regarding Michelson's and Potier's opinions about light behavior, in the experiments that Michelson did together with Morley. The unhappy result of this debate had a devastating effect for the development of physics. The debate also caused Michelson a nervous breakdown.

Background

These experiments, (MMX), were supposed to detect small changes, in the time consumed, when light travelled forth and back between mirrors. It was assumed that the ether wind was the cause of these changes in propagation times. The measurements were done in two sets of equipment, oriented in perpendicular directions to each other. For comparison of the two round trip times a beam splitter was used.

These experiments are well known in physics, and many papers have been written about these tests. The experiments have (together with observations of stellar aberration) played an important role for the theory of relativity. However, the different theories of relativity contain paradoxes, like the twin paradox and the wave or particle paradox.

The ether wind

When we regard the ether wind, \mathbf{v} , light no longer moves transverse to wave fronts. \mathbf{c} – but not $\mathbf{c}+\mathbf{v}$ – is transverse to wave fronts. Mirrors are transparent to ether wind and relevant only to dynamic wave front, $c(1+w/c)$, (w is component in \mathbf{v} parallel to \mathbf{c}), because transverse ether wind cannot be detected based on phase in a coherent system. An interferometer can reveal only one component in the ether wind.

In Michelson's days an ether wind of 10^{-4} times c was assumed and motivated by planetary *translation*. Today we have strong indications that an effect of only 10^{-6} times c is more plausible, and caused by planetary *rotation*.

Michelson's prediction

Michelson regarded light as a wave motion. This means that light moves with constant speed, in relation to a supposed ether. Light is not dependent on the motion of the source. This assumption gave a 2-way light speed proportional to $1-v^2/c^2$ in the longitudinal arm, and no effect in the transverse arm.

An alternative interpretation is the particle model. According to the particle model source motion should be added to light speed.

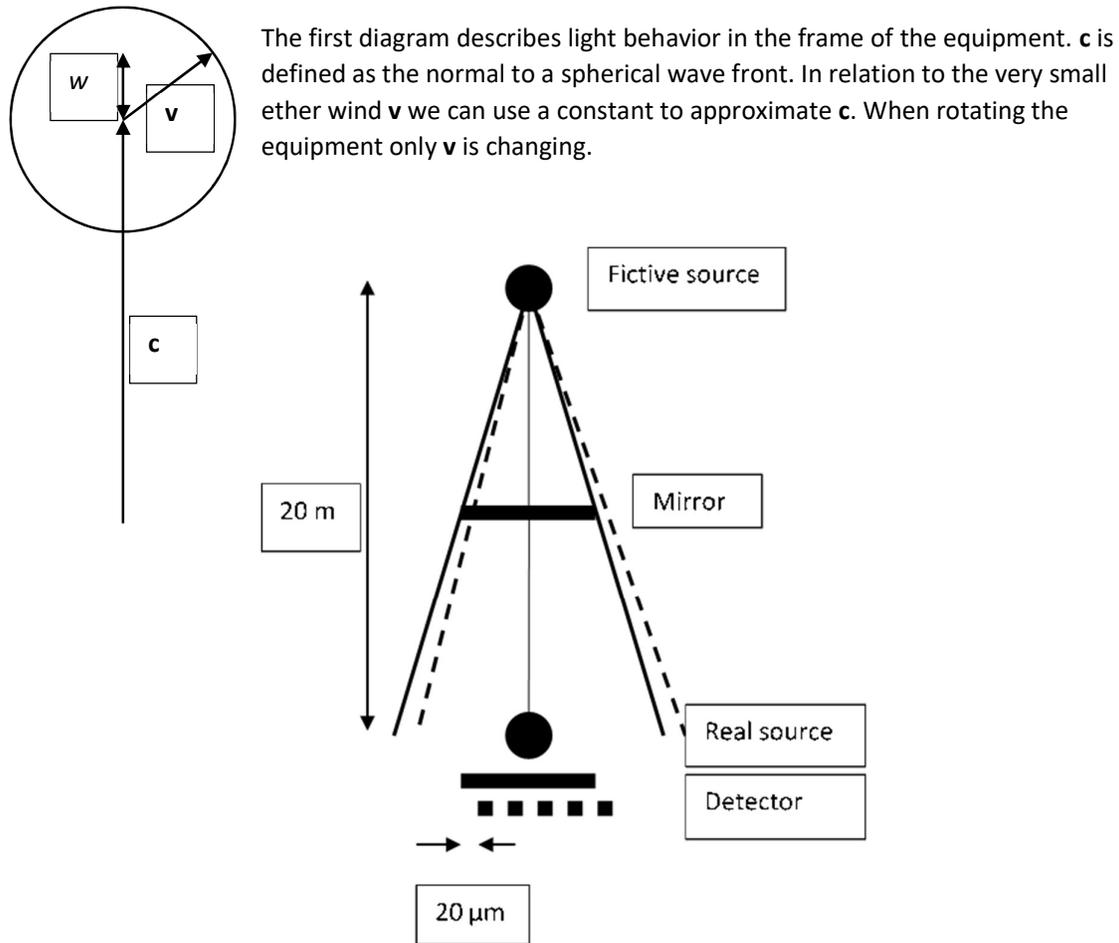
Potier's prediction

Potier assumed that light *always* must hit exactly the same point in the equipment apparently as some kind of necessity for interference effects. This looks like an idea only due to Potier's intuition and without logical motivation. The interferometer is a one-dimensional detector, and almost blind in two dimensions. If we assume a length of the arms of 10 m and an ether wind of 10^{-6} times c , we

can see that an ether wind in transverse direction can shift the returned light about $20\ \mu\text{m}$. Since the interferometer operates with fringes larger than $1\ \text{mm}$ such a small shift is completely irrelevant. (Nevertheless, the resolution is better than $0.1\ \mu\text{m}$ in longitudinal direction.) This demonstrates that Potier's idea is without logical motivation and perhaps wrong.

Potier's interpretation was a combination of wave and particle behavior. He did not add source motion to the vector \mathbf{c} . Instead he included source motion *inside* the light motion in such a way that speed c became constant. Therefore, light became dependent on source motion **and** ether wind. Direction was changed by source motion. This seems to be a peculiar combination of two light models. This inconsistency can be the cause of the twin paradox, and also contribute to the wave or particle paradox. Therefore, we find a more logical interpretation if we assume **velocity \mathbf{c}** – instead of only **speed c** – to be independent of source motion. This is very logical – at least in this experiment – since a spherical wave front is defined, and \mathbf{c} is the normal to this wave front. Therefore, we conclude that light finds the perpendicular point on the mirror independent of if the mirror has moved.

Potier's interpretation supports time dilation and the alternative interpretation presented here allows for Galilean transform. without dilation of time.



comparison. Therefore, **no** change in direction of interferometer's sensitivity and only a **small** effect in the 2 directions where the instrument is blind. So, no effect of ether wind can be detected in the transverse arm of MMX. Michelson was right.

The ray concept

Mirrors are transparent to the static ether wind, but related to the dynamic wave fronts. This means that ether wind inside the wave fronts is not relevant in phase detecting systems. So, we must describe light as the wave motion c together with the longitudinal component in the ether wind. So, if we want to describe a beam from a laser the vector sum can only describe the direction of max amplitude. In most experiments we must describe wave fronts by the normal to the wave fronts, and only the longitudinal component of the ether wind, $c(1+w/c)$, and this concept (the ray) is relevant in coherent systems based on phase. The ray is not physical, but a tool to describe the physical reality in the wave fronts.

The dispute

The conflict between Michelson and Potier lasted for about 5 years. After that time most scientists were against Michelson. He was therefore forced to give up. Potier's prediction is a peculiar combination of wave and particle behavior. Therefore, it is the opinion of this author that Michelson was right and that light is independent of source motion in speed **as well as** in direction. This seems to be the simplest solution that also opens a possibility to avoid the twin paradox and the wave or particle paradox.

Result

Michelson's prediction, $1-v^2/c^2$, can also apply to the separation between atoms in a crystal, since this separation is controlled by effects that the atoms imply on the ether. We can namely assume that these effects propagate with light speed. Therefore, we find that the MMX results can be explained by *compensated* effect in the longitudinal arm and *not existent* effect in the transverse arm in MMX.

Atomic clocks

A bound electron moves forth and back in relation to the ether wind, just like light in MMX. Therefore, we can see a possibility that the frequency in the clocks probably also can be proportional to $1-v^2/c^2$. This means that we have a dilation of clocks – and not of time. We can explain GPS clock's behavior due to speed in this way, if we regard the fact that satellites have no stabilization in direction of motion. So, we must divide by 2. We do not need SRT.

If we assume a radial ether wind (equal to the tangential that was caused by motion) we also can explain gravity. We do not need GRT. The radial ether wind is focused and produces gravity – the tangential ether wind is not focused, and produces no force.

The wave or particle confusion

The wave model is supported by:

- Destructive superposition in light
- MMX
- Mach Zehnder interferometer
- Double slit experiment

- Photoelectric effect (can be explained by *fast* electrons orbiting inside the wave front of light with a suitable frequency, making interference possible and thereby changing potential energy in the electrons)

The particle model is supported by phenomena that also support the wave model. Therefore, the support is very weak. This indicates that we only need the wave model for light.

Conclusions

Potier's mistake has had a devastating effect on physics and delayed development for a very long time. Michelson was right.

We have a possibility to avoid the twin paradox and the wave or particle paradox.

When many scientists go in one specific direction it is not easy to be in opposition to mainstream. This was true in Michelson's days and is true even today.

We can have a physics without SRT, GRT and photons.