

The mystery of vacuum

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Abstract- Given the magical statements in physics about the speed of light in vacuum it seems to be difficult to form an image of the propagation of light in vacuum.

History

The very first impression of vacuum was the generally accepted idea that it contains an *intangible* medium in absolute rest, called ether, necessary for light to propagate through it. The negative result of the experiment of Michelson and Morley led to the conclusion that such a property of vacuum could not be maintained anymore.

For that reason Einstein rejected this idea in 1905 and postulated:

“Any ray of light moves in the “stationary” system of co-ordinates with the determined velocity c , whether the ray be emitted by a stationary or by a moving body”, in that “stationary” system.

Note: The italicized text is added by the author.

By introducing the mysterious “stationary” system, Einstein effectively reintroduced the ether concept, without the property of being in absolute rest.

Clarification of the mystery

Imagine an infinite space of vacuum with only one object in it: a light source L.

Consider two situations: one in which L is stationary and one in which L is moving.

In normal life on Earth we don't have any problem distinguishing a moving object from a stationary object. We all unconsciously take the Earth as our reference system for that observation, but in vacuum this is impossible.

This lack of a reference system in an imagined space of vacuum can be confusing and is most likely responsible for the misunderstanding of the concept of light propagating in vacuum.

Suppose L is emitting a short pulse P of light and that its length is, for example, 1 meter.

There are now two objects in that infinite vacuum, of which one moves relative to the other (with velocity c). It will be more difficult to imagine that L moves with c relative to P than the other way round, but it is the reality.

Suppose a third object O, not having any influence on the behaviour of the emission of L, at an arbitrary distance from L and with an arbitrary velocity relative to L. Now we can determine whether L is a stationary or a moving body, *however only relative to O!*

Obviously such an object neither has any influence on the relative velocity between P and L. The unavoidable conclusion thus is that this velocity must be independent of the velocity of L, relative to whatever reference this velocity is taken.

This conclusion inherently rejects Einstein's postulate.

Acknowledgment

I'm grateful to my grandson Scott Uitterdijk (18 years young, enrolled in university and not hindered by any knowledge of Electro-Magnetic radiation), who persistently kept on saying that one easily could distinguish a stationary body from a moving body in an infinite space of vacuum. Due to his attitude and the experiences of many discussions with physicists, I wrote this article. This article has solved the mystery for him.