Sagnac experiment proves the existence of the luminiferous ether

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Waves can only be generated and propagate in a medium. The propagation of waves in the medium is independent of the motion of the source. In the empty space no waves can exist. In empty space only motions relative to the source and relative to the observer can be defined, therefore it has no sense to assume an independence of the motion of the emitted objects from the motion of the source (in empty space only particles can propagate). The velocity of the emitted objects in the empty space relative to the observer is always relative. The assumption of an absolute velocity is meaningless.

If space is not empty, then waves can move in it besides particles and the speed of the waves depends on the properties of this medium. Maxwell calculated the velocity of the electromagnetic waves relative to the ether by taking the electromagnetic properties of the ether as a basis for his calculation.

The experimental setup developed by Sagnac was able to detect the variation of the speed of light relative to the moving observer when the observer is moving relative to the ether. It does not matter whether the ether or the arrangement is turning in a circle. The same law is valid also for the propagation of sound in air and for all other waves.

Sagnac (1913): „*...In a system collectively moving with respect to the ether, the propagation time between two arbitrary points of the system must be altered in the same way as it would be in a stationary system subjected to the action of an ether wind, whose relative velocity at each point of the system would be equal and directly opposed to the velocity of that point, and which would carry the light waves in the same manner as atmospheric wind carrying sound waves. The observation of the optical effect of such a relative ether wind constitutes a proof of the ether, just as the observation of the influence of the relative wind of the atmosphere on the velocity of sound in a moving system would allow, in the absence of other significant effects, proof of the existence of a stationary atmosphere surrounding the moving system... "*

In the Sagnac arrangement, two light beams are sent from the same place and at exactly the same time. In this way, absolute simultaneity is established without the use of clocks. As a Sagnac arrangement with clocks (which is extremely large) can be considered the GPS. With GPS it is possible to determine the one-way speed of light at the Earth's surface because the GPS clocks are absolutely synchronous. It was found that the speed of light eastward is $c - v$ and westward $c + v$, which had already been observed by Michelson and Gale. The result shows that the earth rotates in the ether - for this reason the synchronization of the GPS clocks is established using the variable speed of light. With a co-rotating ether, east and west velocities would be equal. The same is the case for sound in the air atmosphere when there is no wind.

In order to prove that two equivalent frames of reference are not equivalent, so that he can justify his "time dilation", Einstein has invented a "thought experiment".

Einstein (1905): „...*If at the points A and B of K there are stationary clocks which, viewed in the stationary system, are synchronous; and if the clock at A is moved with the velocity v along the line AB to B, then on its arrival at B the two clocks no longer synchronize, but the clock moved from A to B lags behind the other which has remained at B by $\frac{1}{2}tv^2/c^2$ (up to magnitudes of fourth and higher order), t being the time occupied in the journey from A to B.*

It is at once apparent that this result still holds good if the clock moves from A to B in any polygonal line, and also when the points A and B coincide.

If we assume that the result proved for a polygonal line is also valid for a continuously curved line, we arrive at this result: If one of two synchronous clocks at A is moved in a closed curve with constant velocity until it returns to A, the journey lasting t seconds, then by the clock which has remained at rest the travelled clock on its arrival at A will be $\frac{1}{2}tv^2/c^2$ second slow… "

It is obvious that the motion along each side of the polygon must lead to the same results for the "stationary" observer as for the "moving" observer. It should be noted that Einstein himself claimed in an earlier sentence: *"…. It is clear that the same results hold good of bodies at rest in the "stationary" system, viewed from a system in uniform motion…"*. Einstein distinguishes again something that is not distinguishable, namely "rest" and "motion" relative to empty space.
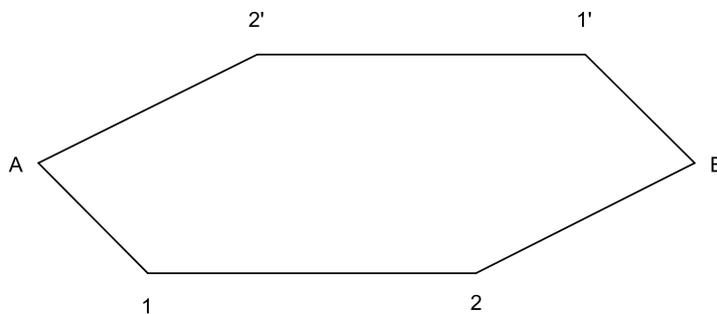

Figure 1: The motion of a clock from A to B along A-1-2-B is equivalent to the motion of a clock from B to A along B-1'-2'-A. Both clocks can be regarded as stationary or as moved in empty space. In empty space does not exist a "stationary" coordinate frame, all frames are equivalent.

If the space is empty each observer can consider himself as stationary. This also applies to the case when the sides of the polygon are infinitely small, i.e. when the motion is circular. Thus, motion of an infinitesimal distance at the circle, can be considered as "inertial". Because of Einstein's theorem

of addition of velocities, a displacement of the interference fringes in such an arrangement cannot be expected, because along each infinitesimal section the velocity of light must be the same in both directions (this is the main statement of the special theory of relativity). Whatever is valid in an infinitesimal segment is also valid in the whole circle, because the circle is the sum of all infinitesimal segments.
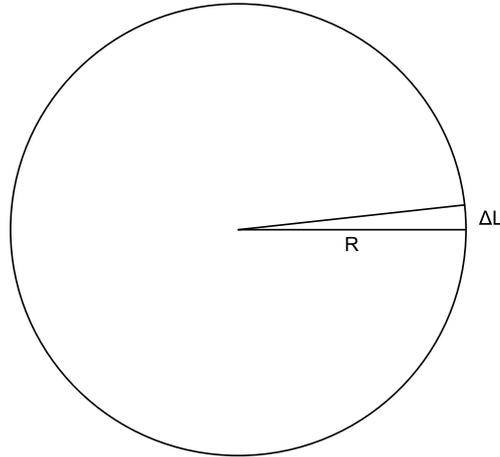

Figure 2: Simplified Sagnac interferometer. All infinitesimal sections ΔL are equivalent. If the speed of light were constant along ΔL, it would be constant along the entire circle.

If the Sagnac arrangement rotates in a medium, a different result is obtained than if the transparent medium rotates (for example fibre-optic gyroscope).

Rotation in a transparent medium: $\Delta t = \dfrac{L}{\frac{c}{n}-v} - \dfrac{L}{\frac{c}{n}+v} \approx \dfrac{2\,L\,n^2 v}{c^2}$

Rotating transparent medium (FOG): $\Delta t = \dfrac{L}{\frac{c}{n}+v\left(1-\frac{1}{n^2}\right)-v} - \dfrac{L}{\frac{c}{n}-v\left(1-\frac{1}{n^2}\right)+v} \approx \dfrac{2\,L\,v}{c^2}$

Rotation in vacuum (or air: $n \approx 1$): $\Delta t = \dfrac{L}{c-v} - \dfrac{L}{c+v} \approx \dfrac{2\,L\,v}{c^2}$

Rotation in absolutely empty space (emission theory): $\Delta t = \dfrac{L}{c} - \dfrac{L}{c} = 0$

Einstein's special relativity theory: $\Delta t = \dfrac{L}{\frac{c-v}{1-\frac{cv}{c^2}}} - \dfrac{L}{\frac{c+v}{1+\frac{cv}{c^2}}} = \dfrac{L}{c} - \dfrac{L}{c} = 0$

To save the theory of relativity Laue declared rotating arrangements as "illegitimate". He claimed that also according to relativity theory in such systems $c \pm v$ would be expected, although the "addition theorem" disproves exactly this claim. Moreover, Laue has overlooked that according to

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his assertion the motion of the earth around the sun would be an "illegitimate" system and $c \pm v$ would have to be measured. But it is known from GPS that this is not the case.

Many relativists (including Malykin, Langevin, and many others) have attempted to derive the Sagnac effect "relativistically", but all of these attempts can be considered failures because they are all classically derived. It is interesting that Lorentz never commented on Sagnac experiment. Only in 1916 he tried to convince Einstein in a letter that because of the earth's rotation the speed of light at the earth's surface cannot be constant.

Lorentz (1916): „… *But I have now come to a consideration which I would like to put before you, and which is based on the consideration of a fictitious experiment. We can imagine that one makes the Lecher's experiment with two perfectly conducting wires, which are tightened at the equator around the earth, and each of which is closed in itself.*
…
After all that we know, we can probably say with certainty what we would observe with sufficiently refined means. Waves generated at the same instant in A, and passing through the circle in opposite directions, will not return to A at the same instant…"

Einstein answered something that is not directly related to this remark of Lorentz. He said among other things: "*I admit to you that the general relativity theory is closer to the ether hypothesis than the special relativity theory. But this new ether theory would not violate the principle of relativity any more.*"

Obviously, Einstein did never really understand the principle of relativity.

References

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2. Albert Einstein: "Zur Elektrodynamik bewegter Körper". Annalen der Physik **17** (1905) 891-921.