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Sagnac and the Ether

John-Erik Persson
Fastlagsvägen 2, 12648 Hägersten, SWEDEN
e-mail: mail0110261847@yahoo.com

Abstract

By applying Stokes' rule the derivation of Sagnac effect can be changed from an integration over a surface to an integration along a line, which is correct in relation to where the light *really* is. This demonstrates that Sagnac effect is *translational*, and that an ether-wind has been detected by Sagnac and by the GPS system. Stellar aberration is demonstrated to be *silent*, since wave-fronts' orientations are conserved in changing ether-wind.

Keywords: Sagnac effect, entrained ether, stellar aberration.

Background

The Sagnac effect was discovered in 1913 but has not got a sufficient explanation yet. Many different interpretations has been tested by many theoretical physicists. Sagnac effect is a change in propagation time for light going in a closed path. The time delay Δt appears when a test equipment is rotated with an angular velocity Ω. Sagnac effect is frequently used in rate gyros in navigational systems. Fiber optics is used with light-speed c inside the fiber in a circular light path. The difference in propagation time Δt for two opposite directions of light is described as

$$\Delta t \approx \frac{4\Omega A}{c^2}$$

Where A is enclosed area. Δt is derived based on an integration of Ω over A.

An Alternative Interpretation

According to Stokes' rule can an integration of *angular* velocity Ω over an area A be substituted by an integration of tangential component of *translational* velocity v along the closed line of length L *limiting* the given area. This interpretation gives

$$\Delta t \approx \frac{2vL}{c^2}$$

producing the same value as the earlier expression. This can also be demonstrated by geometrical relations. These two integrations have different *physical* implications. We must therefore decide which one is correct from a physical aspect. Mathematics can not tell us that. So the decision is whether the effect is caused by a rotating area or by a translating line. Since Sagnac effect is an effect in light that is enclosed inside an optical fiber we can conclude that Sagnac effect is *distributed along a line and not over an area.* No light and no rotation exists in the enclosed area. Sagnac detected therefore an effect of *translation* although he had to rotate the equipment to produce the effect inside the fiber. By this solution Sagnac found a method to circumvent Einstein's clock synchronization problem. The Sagnac effect is distributed in every small part of the line. We conclude that the later expression

$$\Delta t \approx \frac{2vL}{c^2}$$

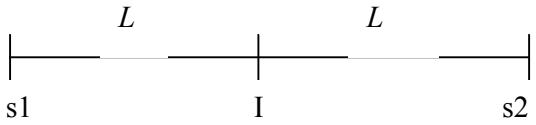
is the correct interpretation. The fact that Sagnac effect is caused by translation means that the same effect as in a rotating circle also

must exist in a translating straight line.

The effect in a straight line of length 2L can therefore be derived according to Fig 1, where s1 and s2 are synchronized sources and I is an interferometer, where velocity of equipment in relation to the ether is v in the direction of L. We get

$$\Delta t = \frac{L}{c}\left[\frac{1}{1-v/c} - \frac{1}{1+v/c}\right]$$

$$\Delta t = \frac{2vL}{c^2} \times \frac{1}{1-v^2/c^2} \approx \frac{2vL}{c^2}$$



F ig 1 Sagnac effect in a straight line

These results are still valid when we consider the circular case where s1, s2 and I are in the same point. The synchronization problem is thereby circumvented.

Detecting the Ether-Wind

In the Global Positioning System (GPS) compensation is done for Sagnac effect caused by the rotation of the Earth. This is necessary since GPS positioning is based on one-way signals. Since Sagnac effect is translational it has relevance for the ether's state of motion, or in other words: ether-wind detection. Correction for Sagnac effect in GPS is done in relation to the center of our planet. This fact indicates an ether translated, but not rotated, by our planet.

A very unambiguous verdict to this fact can be found by detecting the (first order) effect of the ether-wind from the rotation of our planet in a laboratory. A method for this is based on two gas lasers with high frequency stability separated a couple of meters and mounted on a slowly rotating platform with good stability. The lasers are connected with optical fibers to an interferometer. The measurements can be done in such a way that a *constant and small* frequency difference between the lasers can be made irrelevant. The method is described in [1]. This means a way of circumvention of the synchronization problem.

Discussion

The *translational* Sagnac effect has been classified as *rotational.* This identification error is the reason why Sagnac effect has not got a good explanation although many have tried since 1913. The error is related to Stokes' rule that is valid in mathematics but not in physics. With a correct classification of Sagnac effect we can conclude that scientists dream of detecting first order effect of a natural ether-wind has been fulfilled by engineers in the GPS system. (Sagnac could only detect a man-made ether-wind.) The most unambiguous evidence for this fact can be found by detecting, in a laboratory, the rotation of our planet. This can be done by simple laser equipment on a platform with high mechanical stability. See [1].

The most debated phenomenon in relation to the ether-wind is Michelson-Morley's experiments (MMX). This method aims at detecting second order effect in *one two-way* light communication. Separation between atoms in a crystal controlled by their effects on the ether. These effects are changes in the ether, just like light, and are therefore transferred by the ether with velocities ($c \pm v$), that is *two one-way* communications. MMX means addition of propagation times and in atomic positioning forces are added together. This means a high plausibility that the wanted effect can be compensated by contraction of length (without dilation of time). An other problem is the low precision in second order detection, especially in relation to an entrained ether with a speed in the order of only $10^{-6} \cdot c$ and a second order effect of 10^{-12}.

An other phenomenon used in the study of the

ether-wind is a supposed effect on light due to an ether-wind in transverse direction to light. It has been assumed that the observed aberration of starlight should be compensated if the ether was entrained. This reasoning is wrong. Stellar aberration is caused by the detector's motion when light goes from refractor to detector. Easily seen for the particle model for light. For the wave model we just replace the track of a particle with wave-front normal. This is valid for *both* ether models since wave-front normal is *conserved* in relation to changing ether-wind. Light goes from an ether controlled by the Sun to an ether controlled by the Earth with conserved wave-front. The ether-wind's translation of the ether can *not* cause a rotation of the ether's internal behavior or wave-front's orientation. The wave motion can be described as $\mathbf{c}(1+v(\mathbf{r})/c)$ and not as $\mathbf{c}+\mathbf{v}(\mathbf{r})$. The entrained ether is united with stellar aberration also.

Remarks

Interpretation errors regarding Sagnac effect and stellar aberration have both mathematical aspects. Stokes' rule gave the same effect to two different causes. The dimension of speed can express very incompatible phenomena not allowing vector addition. Interpretation errors in MMX are physical in nature and less important.

The denial of the ether seems related to the wave or particle confusion. When light is considered, as here, to be a pure wave behavior, it is possible to describe the ether as moving bodies. This raises a question: Can Le Sage's particle model explain propagation of light as well as gravity?

Conclusions

Sagnac effect is caused by *translation* and *supports* an entrained ether. Stellar aberration is *silent* about ether model and MMX is *unimportant* and probably silent.

GPS has detected an ether-wind from an ether *entrained* in translation, but not in rotation by our planet. The rotation of the Earth can be detected in a laboratory by means of the ether-wind.

Reference

[1] J. E. Persson, “The Forbidden Ether”, **16:th** Annual Conference of the *Natural Philosophy Alliance* (2009).