the general science journal

# Wave-particle dualism in special relativity

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Special relativity (SRT) rests upon mainly two phenomena: stellar aberration and Michelson-Morley's experiment (MMX). Both phenomena appears to be interpreted mainly in the particle model for light. An alternative interpretation, based on the wave model including the property of transverse waves to conserve orientation in relation to changes in the ether-wind, is done. This renders both phenomena as **silent** in relation to the ether's state of motion. Since Sagnac effect is caused by translational motion, the effect on a rotating circle is the same as on a straight line in translational motion. This fact means that the effect is easily described, and that Sagnac effect in GPS (Global Positioning System) can give information about the ether's state of motion. A conflict between stellar aberration and entrained ether is here found to be wrong. An other conflict between entrained translation and not entrained rotation is given a possible explanation, which is of interest although not a proof.

## Background

The two main phenomena in the foundation for SRT have been debated in about hundred years The debate around MMX has dominated the debate, and, stellar aberration has been of less interest. Uncertainties are present in the interpretation of both phenomena, and in the behaviour of light. This is referred to as the wave and particle dualism. Abolishing the ether did not reduce the confusion. Abolishing was done after a reasoning in absurdum: it was based on models that later was demonstrated as nonexistent. There exists however strong arguments in favour of the wave model. One argument is the double slit experiment, and an other argument is the very sharp images from very, very distant fix stars. If the particle model was correct we would see blurred images. It is motivated with an interpretation of the two basic phenomena for SRT based on a strict wave model. Many attempts have been made to explain the Sagnac effect. However, contradictions and complexities are present in relativistic as well as in ether based interpretations.

## Stellar aberration

Due to finite speed of light it takes a finite time for light to move from focusing refractor to imaging detector. When light moves through the telescope with velocity *c* the telescope moves with velocity *u* transverse to light. Compensation for this effect means a pointing error of arctg*(u/c),* which we call aberration. (An illusion called raindrop effect.) A transverse ether-wind has the same effect on *all* points on the wave-front, and *the wave-front's orientation is therefore conserved in relation to changes in the ether-wind (v).* Conserved wave-front is a property of transverse waves, since an ether-wind *(v) inside* the plane of the oscillations can *not* change the orientation of these oscillations. This property is important. A telescope

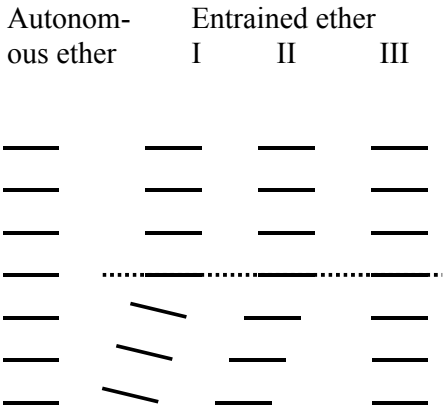


Fig 1 Behaviour of light when passing a limit where transverse ether-wind changes. For instance when ether-wind changes to related to Earth instead of Sun

detects the orientation of the wave-fronts and transverse ether-wind *(v)* is *irrelevant.* This is demonstrated in Fig 1. Three cases of interpretations of entrained ether are compared to an autonomous ether. (The fourth is trivial.) We see that the demand on conserved wave-front means that case I is impossible, but case II and III are both possible. Therefore, interpreting stellar aberration in strict relation to the wave model for light means that the entrained ether is *not* ruled out, and that both ether models have the same aberration. Stellar aberration is *silent* about ether model.

**Michelson-Morley's experiment (MMX)**
An optical resonator is constituted of two high precision mirrors in high precision parallelism. The resonator defines the orientation of produced wave-fronts and the waves are reflected many times before leaking out through one of the mirrors (high Q-value). Since *all* points on the wave-fronts behave equally the wave-fronts orientation is *conserved* in relation to transverse ether-winds. The same reasons as earlier stated in connection to stellar aberration are valid here also. This fact is proved by the fact that all mirrors,

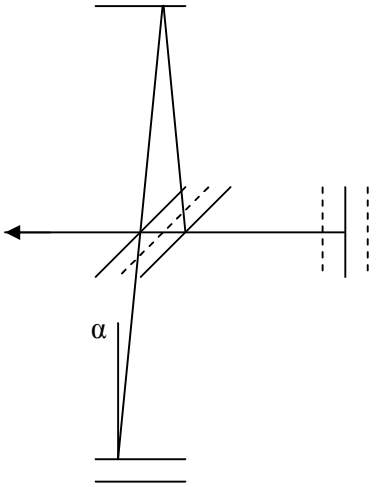


Fig 2 Light direction is supposed to change an angle α=1 μrad (not correct)

including the resonators, are *unchanged* during the test. An interferometer, (and a telescope) detects the orientation of the wave-front (and *not* the motion of a particle). The common interpretation (Fig 2) is wrong and instead (as in Fig 3) the normal to the wave-front is relevant. Therefore, MMX is *silent* about transverse ether-wind. Stokes' 'correction' to MMX prediction, by a reduction of 50%, is in error.

Two nearby atoms in a crystal communicate their relative positions by producing fields in the ether. These fields are dynamic due to the ether-wind and changes move with velocities *(c+v)* and *(c−v)* in relation to the crystal. This causes an asymmetry in the generated fields, as

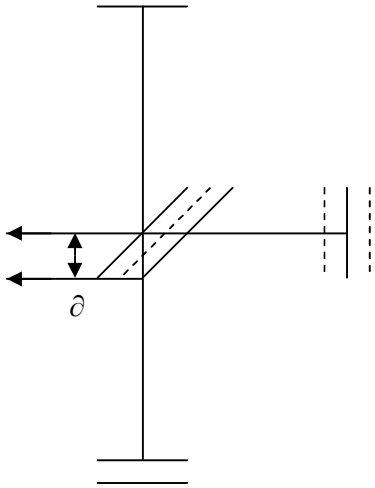


Fig 3 The light from the transverse arm is shifted side wards ∂=10 μm (correct)

described in Fig 4. These two contra directed effects add up to a *small* reduction in the separation of the atoms. The light (changes in the ether) used in MMX propagates also with velocities *(c+v)* and *(c−v*) in two opposite directions. So the testing field is *one* field going in *two opposite* directions and the previously mentioned separation defining fields are *two* fields going in *one* direction each. The *effects* of the separation defining fields are added together, and the testing fields *per se* are added together. This means that the ether-wind has the same effect on the testing field as on the sum of the effects on the separation defining fields. The small second order effect is therefore compensated by physical contraction of length without any effect on space, time or clock speed. The Lorentz transform should

therefore be substituted by the transform named after Palacios. This fact is probably less important, as we will see later, since the *real* contraction seems to be only in the order of $10^{-12}$ and constant. This is confirmed by measurements in [1] indicating an *observed* contraction of less than $10^{-14}$.

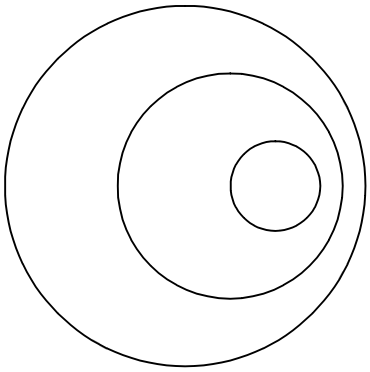

Fig 4 Asymmetry due to the ether-wind.

**Wave-front conservation and length-contraction**

The wave-fronts produced by a fix star and the wave-fronts produced in an optical resonator conserves their orientation in relation to changing ether-winds. Therefore, when we strict follow the wave model for light, we find that fix stars can *not* tell us anything about transverse ether-wind (only our own motion). A fact well supported by very sharp images of fix stars. Stokes' reduction of Michelson's prediction by 50% due to transverse ether-wind is also in error. To send information in two opposite directions between mirrors is *not* usable against the ether-wind. The atoms in a crystal send also information in opposite directions to control separations, so the assumed effect is compensated. The second order effect is not usable in search of an ether-wind. We conclude therefore that the ether's state of motion must be gained by the *first* order effect longitudinal to light. This means Roemer, Doppler and Sagnac effects. Sagnac effect can be utilized without relative motion between source and detector. This renders the most unambiguous interpretation, and Sagnac effect should be used. Einstein abolished this method due to the unsolvable clock synchronization problem. However, this problem can be *circumvented*.

**Sagnac effect**

The Sagnac effect is the time delay caused by the last point's motion in relation to the ether when light goes between two points. This means the ether-wind's effect on light speed. Sagnac used a rotating equipment when he, in 1913, discovered the effect named after him. The Sagnac effect was therefore classified as an effect of rotational motion. But the effect exists in every small part of a closed light path but *not* inside the area enclosed by this light path. This follows from the fact that the light can be limited by the walls of an optical fibre. We can conclude from this that Sagnac effect is caused by *translational* motion. The same effect exists therefore on a straight line in linear motion as on a rotating circle. Empirical verification to this fact is given by R Wang in [2], where he detected Sagnac effect in a translating equipment. Such detection was not possible in 1913.

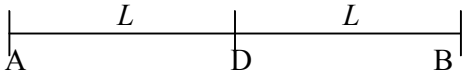


Fig 5 A simplified interpretation of the Sagnac effect

Fig 5 describes an equipment equivalent to Sagnac's. A and B are light sources emitting simultaneously, and D is an interferometer. This arrangement represents a method for circumvention of the clock synchronization problem. Assuming $v$ as the ether-wind's component in the direction of L we get, for propagation in vacuum:

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

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

The substitution:

$$v = \Omega R;\ A = \pi R^2;\ L = 2\pi R$$

Gives for the circular case:

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

Where Ω is angular velocity of circular area *A*. These two expressions are mathematically identical but the later can be misleading physically since Sagnac effect is *translational.*

**GPS**

The clock synchronization problem is circumvented in GPS. Redundancy in the number of involved satellites has made it possible to make a *constant* time error in the receiver's clock to be irrelevant. Positioning based on one-way signals is thereby possible, but one-way signals means that correction for Sagnac effect is needed. In GPS this correction is done in relation to the centre of our planet, and *not* in relation to the centre of our planetary (or galactic) system. This is a certain evidence for an ether translated by our planet, but probably not taking part in our planet's rotation. If the ether was rotated (as well as translated) by our planet we would not need Sagnac correction in GPS, and the planet's rotation would be irrelevant. Stellar aberration is of course more important than MMX if the ether is entrained.

**The ether**

We assume Le Sage's 250 years old model for gravity stating that a flow of particles with small masses are moving omni directionally with high velocities. When this flow penetrates our planet it is attenuated regarding number of particles by absorption. An asymmetry in the flow is produced. This means that the ether is falling towards the Earth and gravity is caused. The total number of particles is slightly reduced, and this can perhaps cause a *small* reduction in light speed. This can explain the gravitational slowing of clocks observed in GPS, and also the bending of light near the Sun as an effect of refraction by ether density (or by the atmosphere of the Sun). This model is called pushing gravity and is described in [3]. A numerical value on the attenuation factor would provide us with an upper limit on the gravitational force. Approximating the attenuation with zero would give us Newton's gravity. See [4].

It is assumed here, but not proved, that luminiferous and gravitational ethers are identical. Light is moving oscillations in the ether. Gravitation depends on *distribution* of mass only, which makes rotation irrelevant, in relation to gravity, for *spherical* bodies. The gravitational field does probably not take part in the rotation of our planet, although it is generated by mass. Therefore it is reasonable to assume that the ether is not rotated either, and that both phenomena can be explained by spherical symmetry. This idea is the reason why the ether was called generated in [5] from 2005.

**Detecting the ether-wind**

GPS has proved the ether's translation, but we should need more information about its rotation. Dr C C Su in Taiwan has suggested a method for this. The method detects linear effect of an ether-wind in a lab caused by the rotation of the Earth. This effect is only max 465 m/s blowing in western direction. Such detection in a lab would be very unambiguous and convincing. The method utilizes two HeNe gas lasers ($\lambda$=0.63 μm) separated 1-2 m and mounted on a rotating platform. The two signals are connected via an optical fibre and compared in an interferometer driving a counter and a computer. The ether-wind produces a cyclic function of azimuth angle and a *constant* frequency difference between the lasers gives a linear function. More details in [6]. The clock synchronization problem is thereby circumvented.

**Objections to the entrained ether**

After 250 years we have still not found a better *physical* ether model than Le Sage's model, a kind of pushing gravity. Le Sage's ether is not like anything else in the physical world, and we can nowhere find knowledge usable on the ether. The interaction between ether and matter is unknown, and we can not draw conclusions from gases, liquids, solids and potential-theory. Experiences from longitudinal waves can not be used on transverse waves. Vector addition between

constant ether-wind and propagating vibrations is *not* self evident. All we know is that light is transverse waves and that the images from very distant fix stars are extremely sharp, which supports conserved wave-front. The process of wave-propagation needs a reference for speed, but it is very reasonable to assume that the ether provides the same reference all over the wave-front. So the propagation process has a one-dimensional dependency on the ether's state of motion, and conserved wave-front is the most plausible theory. Something we can not prove or disprove. To change the orientation of the wave-front the speed of propagation *must* change over the wave-front, i e refraction.

Objections have been raised stating that an ether can not be translated without being rotated. This objection is based on mechanical relations which probably not exist and not can be known to be valid, since we do not know how the ether's interaction with matter. We know very little about light and almost nothing about the ether. Nevertheless we tend to apply knowledge from different fields on the unknown ether. This is an important mistake. No logical chain of reasoning can prove that a translated ether must rotate, and not that transverse waves must conserve wave-front either. However, the last statement is definitely the most plausible one.

**Some citations against entrained ether**

G B Malykin writes in [7]:

*…the 'luminiferous ether' has been shown above to lay down contradictory conditions. Specifically, it states that the ether must be totally dragged along by the Earth's translational motion but fails to be dragged by its rotation…*

A Einstein writes in [8]:

*…if the ether is to be carried along by bodies in space, than its velocity vector can not at all be free of rotation (and stable), as the Stokes' derivation of the aberration-law proposes. This follows from well-known propositions of the potential-theory.*

*In, truth, the hypothesis of an ether which moves with space-bodies is incompatible with the aberration law.*

**Conclusions**

**1** The idea of stellar aberration as an evidence against entrained ether is disproved and explained as a misinterpretation.

**2** Sagnac effect is an effect of *translational* motion, and transverse waves *conserve* the wave-fronts orientation.

**3** A possible idea, not a proof, to explain an ether that is entrained in translation but not in rotation is presented

**4** A consequent analysis of the empirical foundations behind SRT, based on the wave model of light, reveals that two *useless* phenomena have been accepted and one *important* phenomenon has been abolished. Therefore Bradley, Michelson and Sagnac were right about the entrained ether and Einstein was wrong.

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