

The Entrained Ether and GPS

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This article suggests a type of ether called generated, that is translated by the Earth, but not rotated, which explains why GPS needs compensation for Sagnac effect. This ether defines light velocity c and provides reference for that velocity, but this ether cannot change orientation of the wave front's plane, which explains why this ether has the same starlight aberration as an absolute ether, and therefore not can be ruled out by starlight aberration. Michelson-Morley's failure is explained, and also why only **first** order effects of light's velocity, not direction, can provide manifestations concerning the ether-wind problem. The entrained ether, described here, adapts to distribution of matter, and provides thereby a kind of relativity. This allows time and space to be autonomous, and not absurd. The Sagnac effect has demonstrated the existence of an ether in different experiments. In the GPS system the Sagnac effect demonstrates entrainment also. These ideas are described earlier in [1].

1. Background

Starlight aberration and Michelson-Morley's experiments (MMX) are considered to provide the most important information about the possibility of an ether. However, logical weaknesses exist in both these methods. The common interpretation of starlight aberration has been accepted without much debate about alternatives. MMX has been widely debated but alternative interpretations seem nevertheless to be missed. But most serious is the compact silence around the Sagnac effect, discovered in 1913, and exploited in fiberoptic gyroscopes. One reason for this silence can possibly be that a wrong interpretation of the Sagnac effect as something taking place on a surface when it really happens at the edge. Stoke's rule states mathematical equality between an integration over a surface and another integration along a closed path around that surface. In this physical context only the last interpretation is correct and valid also for a part of this path. So Sagnac effect is valid for translational motion too.

2. Aberration

A hunter shooting at a moving target must compensate for targets transversal velocity v with a correction, an angle $\arctan(v/c)$, where c is the bullets velocity. The sound from an aeroplane with a speed of Mach 0.9 can be around 40 degrees behind the aeroplane. The image of the aeroplane is deviated an angle about one million times less, but is deviated anyhow. So we observe where the aeroplane was when light started from the aeroplane. If the hunter is shooting at a sitting duck from a moving vehicle, he must still compensate for relative velocity. The bullet will take a direction that deviates an angle $\arctan(v/c)$ from the gun's direction, since the bullet's direction is a vector sum of $\mathbf{c}$ and $\mathbf{v}$. An analogy exists between a bullet coming out of a moving gun, and light coming in through a moving telescope. When light passes the refractor it will be focused against a point in the image plane. It will not hit that point due to the motion of the telescope during the time light goes from refractor to image plane. We can compensate for this by tilting the telescope

an angle $\arctan(v/c)$, where c is light speed. This explanation come from Bradley, working centuries ago. A moving phenomenon (wave or particle) must be treated like a moving object. Therefore, a change of frame from Sun's to Earth' frame means a new direction of travel as a result of vector addition. Aberration is a **geometrical** effect of own motion in relation to light (not to ether). Aberration does **not** prove an ether-wind.

Detection of light's bending around the Sun failed in 1919 because the bending was many times less than the resolution of the telescope. Since the mass of the Earth is 300 000 times less than that of the Sun, we can conclude that aberration hardly can take place in the limit between ether entrained by the Sun and by the Earth. Observations on double stars provide no extra information about the aberration due to long distance, meaning zero angular velocity.

3. Ether-Wind

The dilemma between relativity and absoluteness can be solved by a combination of both. To do that we need an ether. The ether provides an absolute reference for the constant wave velocity, $\mathbf{c}$, and contains information about local conditions in the form of an ether-wind, $\mathbf{v}(\mathbf{r})$, substituting Einstein's relativity. It is logical, in a mathematical sense, to define both velocity and position, since we have a solution to a second order differential equation. So we need a preferred field instead of a preferred frame. This means an ether dependent on distribution of mass (entrained ether).

Light is a wave and the wave front is conserved by the fact that c is constant all over the wavefront. This explains the extreme resolution in images of very distant objects. Light has no mass and is **not** controlled by inertia. This means that a transversal ether-wind has no relevance for light's direction of travel. Light is a transversal wave motion with oscillations inside the wavefront's plane. An ether-wind blowing inside this plane cannot change orientation of that plane and can therefore not change **observable** direction of light (normal to wave front). See [2]. Vector addition of ether velocity and wave velocity $\mathbf{c}$ is therefore not allowed. (Perhaps a transversal ether-wind $\mathbf{v}$ can change direction of a narrow beam an angle $\arctan(v/c)$, but

that is not important since we can probably not observe it.) Transfer of light demands a media (ether) to define speed of propagation c and to provide reference for this speed. So ether waves conserve direction and the ether has control over speed only. This gives light a one-dimensional dependency on the ether. The generated ether has therefore the same starlight aberration as an absolute ether and cannot be ruled out by Bradley's observation. Starlight aberration just tells how much we must tilt our telescope to compensate for own velocity. (This is sometimes called duck hunter's model.) To find information about the ether-wind we must study velocity, **not** direction of light.

Since the ether affects light only in longitudinal direction only **differencies** in longitudinal ether-wind can affect light's direction. This means a second order effect that must be integrated a long way to be detectable. We have thereby explained the extremely small bending value found in 1919 as a two-dimensional effect of a changing longitudinal ether-wind (not of gravitation).

Since transversal ether-wind is irrelevant for light, we can conclude that Stokes' 'correction' to Michelson's prediction is not motivated. (This was a reduction by 50% of the prediction, motivated by a transversal ether-wind.) The probable reason for this is that velocities greater than c have a scaring effect. But this artefact depends only on what frame we are using to describe light.

4. GPS

GPS is a system based on one-way light velocity. In **differential** mode most system errors are compensated. It is therefore in this mode only that we can get certain and unambiguous information about the ether-wind problem. The calculation of spatial separation between a known and an unknown position is based on temporal separations in satellite signals. Different satellites are used and time of arrival in the two points is compared. Only two clocks (on the ground) are influencing the result, because the same signals are used in both positions and only time differences are relevant. Both clocks are running under equal conditions and a remaining, constant difference between the two clocks is **irrelevant** due to the differential mode. The experience from GPS is that the receiver's velocity in relation to the centre of the Earth must be compensated for (about 1 ppm of c). Manmade velocities, for instance by an aeroplane, also demand the same kind of compensation. Light velocity is therefore found to be constant in relation to the centre of the Earth. This ether-wind, caused by the rotation of the Earth, is about hundred times smaller than the Earth's orbital velocity. This smaller ether-wind is called Sagnac effect, and has not been identified as an ether-wind. The reason is that Sagnac effect has been described by a rotating surface instead of as a translating light path.

5. MMX

One reason for MMX' failure is that the ether-wind was about hundred times smaller than assumed (phase shift ten thousands), but not zero, according to GPS. Another reason for this failure is the use of a second order effect. The separation between two atoms in a crystal is defined by two fields, where one atom is in the field of the other. The searched second order effect between mirrors is probably compensated by the same effect between atoms in a crystal. This means length contraction without time

dilation, but this is not detectable. Therefore, only **first order** effects of light's velocity are useful for finding verdict concerning the ether-wind problem. Doppler (and Roemer) effects are first order effects. However, Einstein has explained these effects (with some difficulty) but not Sagnac effect. Sagnac effect is therefore the most important example of an ether-wind, clearly demonstrated by differential GPS. Sagnac has fulfilled Michelson's attempt. Sagnac effect is frequently exploited in fiberoptic gyroscopes. A translational Sagnac effect has been demonstrated in the experiments of R. Wang [3]. A translational Sagnac effect from the rotation of the Earth or from a vertical ether-wind can be detected without GPS according to [4].

6. Discussion

MMX and starlight aberration are silent about ether model. Doppler (and Roemer) effects give some kind of indication in favour of an existing ether. The Sagnac effect is the only phenomenon that provides a certain verdict for the ether's existence. Einstein's theory is thereby refuted. In the GPS system the Sagnac effect also demonstrates the ether's property of adapting its velocity to the velocity of nearby mass. The ether is translated but not rotated by the Earth and is therefore called generated. In the GPS system compensation is needed for velocity in relation to the Earth's centre of gravity but not for velocity in relation to the Sun. This gives a very strong argument for the adapting (or entrained) ether.

The fact that velocity in relation to the Sun is irrelevant in GPS can also be explained by a behaviour of clocks but this would reasonably mean irrelevance of velocity related to Earth also. This is in conflict with GPS experience. Arguments are searched by using signals from stabile pulsars as a reference clock but these results are very complex and difficult to interpret. The results are not independent of an entrained ether and seems to be in conflict with Lorentz' transformations.

A very simple alternative (demanding very high precision) is described in [4]. It is based on changes of wavelength in air and independent of clocks. Changes of wavelength inside two cables are balanced since both cables are moved in the same way. (Instead of counting the same **number** of wavelength' in both cable motions, as earlier described, we can count to N in the first and then move the second cable the same **distance** and count will be $2N + n$. v/c will be found to be $n/2N$, instead of $D/2L$.) This method could be used with light in the horizontal plane and give a certain and unambiguous verdict if the ether is entrained or absolute. The method could be used with microwaves in the vertical direction to search for a vertical ether-wind.

The generated ether is not rotating with the rotation of the Earth (for bodies having rotational symmetry) and has no influence on light's direction. These properties are very natural from a physical point of view. Mathematical dominance in our thinking and a desire for beautiful solutions is a probable reason for why they have not been discussed earlier. But they have been suggested in articles to Galilean Electrodynamics. See reference list belonging to [1]. The use of vector addition between static ether velocity and the dynamic field described by light velocity (c) is one example. The result is the illusion that entrained ether cannot be united with starlight aberration. Another example is the unfounded assumption that the ether must take part in the

rotation of the Earth. A third example is the belief that Sagnac effect is limited to rotational applications. We have thereby missed the best manifestation there is of an ether-wind.

With these new ether properties as a background is it interesting to speculate about what the ether really is. One possibility worth discussion is an omni directional flow of very small particles. They can be assumed to interact with a massive body in such a way that mean of particle velocity equals mean of mass velocity, explaining why the ether is not rotating. Adaptation of near ether velocity to the body's velocity means generating a wave function to accompany the body. To build up this wave function energy is needed, explaining inertia. The flow of particles coming from the body has passed the body and been attenuated. This can disturb spherical symmetry in the flow and create gravitation, and also define an upper limit on the gravitational field. The luminiferous and the gravitational ethers can be intimately related. Pioneer 10 gravitational anomaly can be an illusion created by an anomaly in the **luminiferous** ether. The ether can be falling, but not necessarily with 11.2 km/s.

7. Remarks

Gravitation on the surface of the Earth is about 2000 times greater than the Sun's contribution. In a geostationary satellite this value is reduced to about 50 times. It is reasonable to guess that these satellites are still in ether dominated by the Earth. Nevertheless they demonstrate the same aberration as starlight according to [5]. This fact is in line with the idea that aberration is an effect of observer's velocity in relation to light (not ether's in relation to light). However this interesting observation does **not** demonstrate an ether-wind.

If we had accepted Bradley's interpretation, that he had **not** detected an ether-wind, but rather measured his own velocity (in relation to light's velocity) we had not been fooled by nonlinear Lorentz transformations and not got any time dilation (or clock bias) either. But instead it was **decided** that the ether existed and was **invisible** according to another wrong interpretation of MMX. Since the ether-wind was 'known' but not 'seen' there was a need to explain its invisibility. To that cause the Lorentz transformations was invented. This was done by writing a double equality, $r^2 - c^2 t^2 = R^2 - c^2 T^2 = 0$, and than forget about the last equality. The Lorentz transformations are therefore founded on a **decision** about an absolute ether. Based on Lorentz transformations, it is therefore possible to demonstrate the

possibility of an absolute (or nonexistent) ether. But this is circular reasoning.

In [6] Einstein's time dilation has been substituted by clock bias, which is a step in the right direction. However, the Lorentz transformations are still there, so it looks like circular reasoning anyhow. In [6] there is a reference to [7], an interesting study comparing atomic clocks to signals from stabile pulsars. Due to complexity it is difficult to draw conclusions from [7] regarding absolute versus entrained ether, and the entrained ether is not discussed either. The result can also be used to promote Newton's time.

8. Conclusions

The Sagnac effect provides the only certain verdict for choosing ether model. In GPS this effect has demonstrated an ether that is translated but not rotated by the Earth.

If we accept the generated ether described here we can forget many mathematical inventions like: Lorentz transformations, time dilation, clock bias, different kinds of time. Length contraction will be 10 000 times less, constant and of no interest. Instead we must search for a wave function to describe adaptation of the ether to a moving nearby mass. New knowledge will be found.

The method described in [4] should be used to find certain and unambiguous verdict about entrained versus absolute ether.

References

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