# Why Stellar Aberration is Forcing Physics Back to Newtonian Roots - a Path to Quantum Gravity

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**Abstract**

The concepts of modern physics concerning light, gravitation and particles seem to be precisely confirmed by observation and are well founded in complex and sophisticated theories - the more experiments the more confirmation. But, as unbelievable as it may sound for every scientist, two simple experiments are able to shatter the basics of modern physics. These decisive tests are aberration experiments using laser beams whereof the most important doesn't need any other means than a blank sheet, a pencil and pure logic. The conclusions to be drawn disprove fundamental theories and force us to rethink our concepts of light, gravitation, and particles. The acceptance of the implications presented here poses less a logical but far more a psychological challenge. This issue, if managed successfully, will lead to realistic physics that probably opens the path to quantum gravity too.

## 1. Introduction

Since Einstein introduced his famous theory of relativity a hundred years ago the concepts of space and time, gravity, light and particles were changed in many ways. Some remarkable aspects are:

- space and time are merged into space-time, whose curvatures explain gravity and create strange black holes and wormholes
- light has an absolute speed, is bended by gravity and its photons have no rest mass
- the speed of light is insurmountable for any body and even for information
- particle physics assumes that gauge bosons are massless like photons (for mathematical reasons) and get their mass via the Higgs field

A lot of observations confirm or at least seem to confirm the theory of relativity, which is an essential part of modern physics. However, general theory of relativity (GRT) is incompatible with quantum physics so far. This article analyzes fundamental errors that block the concept of quantum gravity. It presents some conclusions to be drawn and it finally opens the path to quantum gravity and to a deeper insight into nature.

Quantum physics is considered to be an adequate description for nature in the micro-scale, but is theory of relativity, despite all experimental confirmations, indeed a sound foundation for theories of gravity? GRT explains gravity as a result of curvature of space. It is a generalization of the principle of relativity and founded on the special theory of relativity (SRT) which is, as Einstein described it (1), in principle based on kinematic considerations concerning the speed of light in different Galilean frames of reference. He claimed two postulates: the Galilean relativity and the constant speed of light, and asked himself: What are the correct transformations of coordinates in space and time that guarantee a constant speed of light as it was observed in terrestrial tests such as the experiment of Michelson and Morley. The problem here was that the earth is a fast moving system, therefore the speed of light should depend on the direction of the measured light beam but it apparently didn't.

As a solution to this task Einstein derived the Lorentz transformations that should replace the Galilean transformations in moving systems. But hereby he was forced to two assumptions: The length contraction and the local time in moving systems. Otherwise the two postulates of the SRT would be in contradiction.

The speed of any object is describable as a vector that is composed of a certain value and of a certain direction in space. For the first component, the value of the speed, the application of the Lorentz transformations works perfectly: c is constant in every uniformly moving system. For the second component, the direction, the Lorentz transformations predict a change depending on the velocity v of the moving system. Einstein regarded this change in orientation related to the moving inertial frame as an explanation of the stellar aberration (2). Indeed, inserting v = 29.7 km/s and c = 300,000 km/s in the Lorentz transformations yields to the observed angle of 20.5“ for stars perpendicular to the earth vector. Einstein regarded this result as a first confirmation of his new theory, however, it gives a hint to an overlooked but fundamental problem in SRT.

The following figure shows two frames of reference S and S', one is defined to be at rest, the other is uniformly moving. Whilst the light beam is moving from the emitting source to the target, the system S' is moving by the distance $\Delta x = v \cdot t$ expressed in coordinates of S or $\Delta x' = \gamma \cdot v \cdot t$ in coordinates of S'. This generates a change of the light beam's direction related to S' (dashed line).

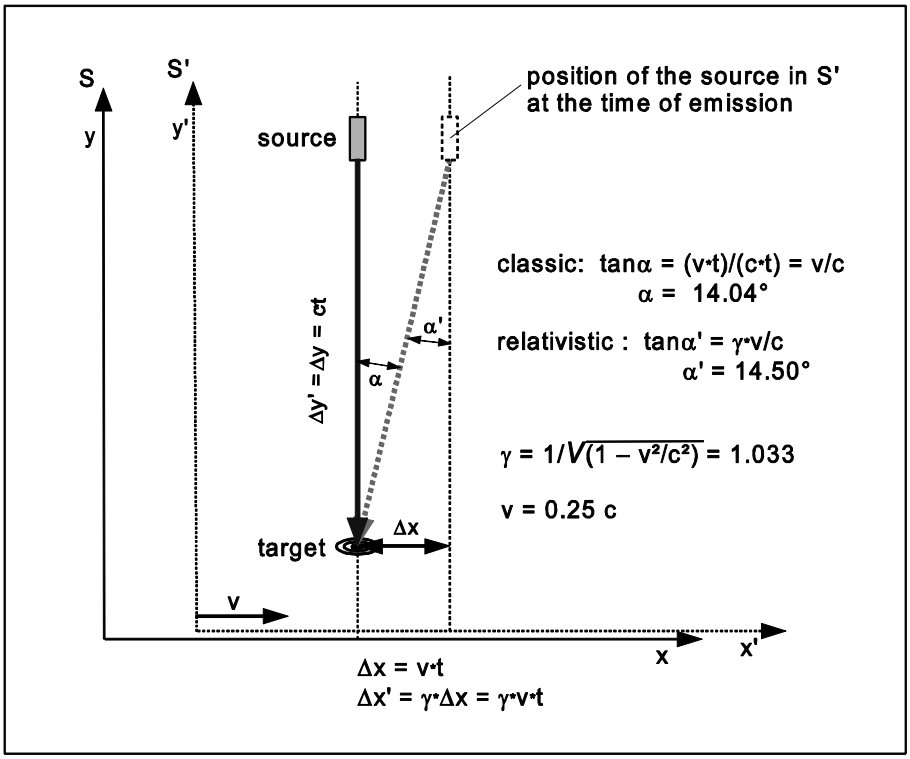


Fig. 1

Figure 1 shows the derivation of the classic and the relativistic aberration. It is easy to obtain by comparing the coordinates at the time of emission and at the time of reception in the moving system S'.

First, let us recall what the two postulates of the SRT mean. In the first paper (1) relating to his new theory Einstein defined two principles that he postulated to be true:

1. The laws, by which the states of a physical system change, are independent of which of two reference systems, being in translational motion, they refer to (= Galilean relativity).
2. Every light beam is moving with a certain speed (c) relative to the „resting“ reference system and its motion is independent of the motion of the emitting body (= constant or absolute speed of light).

The first principle is daily experience at least in mechanics, the second is a direct consequence of the electrodynamic theory of light that is regarded as a self-propagating wave. The latter means, it has no relevance for the vector of a light beam whether the emitting body is at rest or moving ($v > 0$).

But does Einstein's solution, the introduction of the Lorentz transformations, really hold up even if the aberration effect depending on v is taken into account? The following gedankenexperiment was developed to recheck this matter. Its execution should be very easy, without any calculations and with a maximal clear result so everybody would be able to comprehend the crucial point.

**2.1 The experimentum crucis**

The experimental scheme is illustrated by the following two figures each posing a particular task. In the experiment a very high speed of v = 0.25c is presumed to show clearly the expected effects. To enable an easy understanding, all figures show the local displacements of the objects in the x/y-plane like Einstein used it to do in his 1905 paper. Because the light rays are perpendicular to the relative motion of the two reference systems, the use of spacetime diagrams does not lead to any appreciable advantage, what everybody will confirm who is familiar with such diagrams. The question here is not, in which exact coordinates the two observers being in relative translational motion describe the events of the experiment. The calculation of the coordinates of the objects according to the Lorentz transformations leads to the same results.

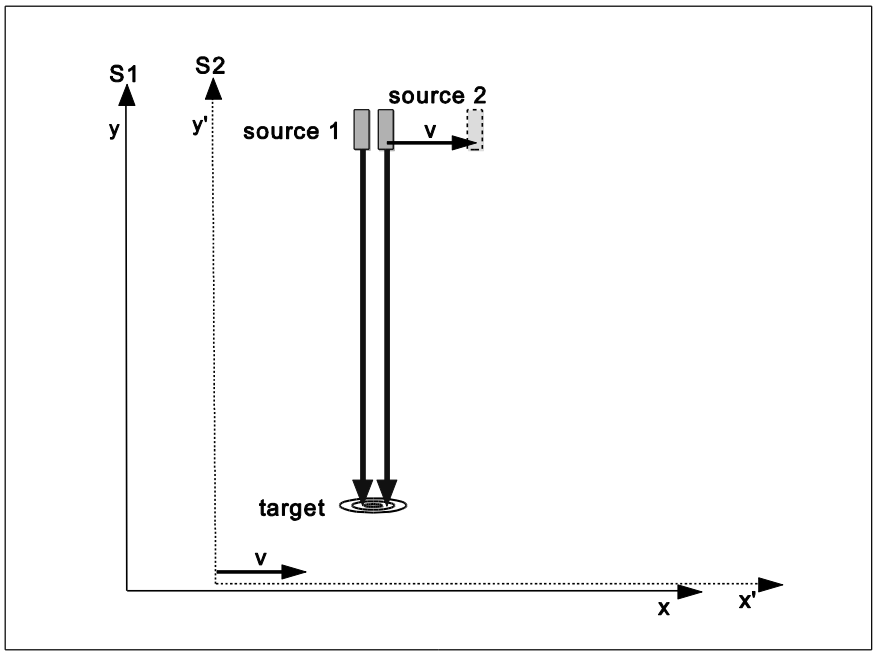


Fig. 2

Figure 2: Figure 2 shows the first laser aberration gedankenexperiment. A laser that is at rest in the reference system S1 emits a flash parallel to the y-axis in the direction of a target which is at rest too. A second laser is resting in a second reference system S2 that is moving with constant speed v parallel to the x-axis. The second laser emits a flash in the same direction at the moment as it passes the first laser. Both flashes are emitted simultaneously and the optical axes of both laser sources are parallel to each other. According to postulate 2, both emitted flashes should move in parallel and hit the target (continuous lines). It has no relevance that the second laser is moving.

Let us now analyze a different experiment:

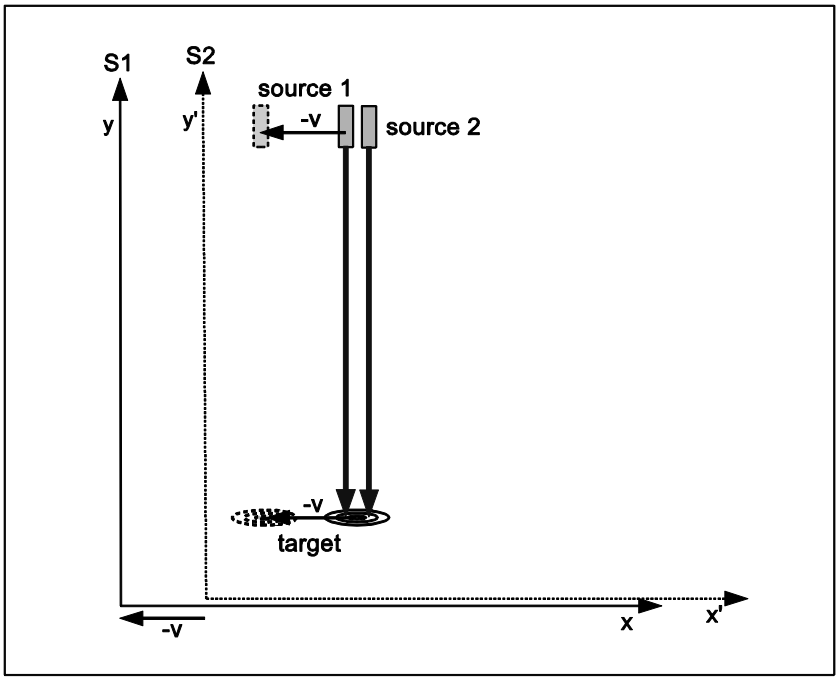


Fig. 3

Figure 3 shows the second gedankenexperiment. A laser (source 2) that is at rest in the reference system S2 emits a flash parallel to the y-axis in the direction of a target that is moving laterally with high speed. Another laser (source 1) is moving in parallel to the x-axis with the same speed as the target. It emits a flash in the same direction whilst passing the resting laser. Both flashes are emitted simultaneously and the optical axes of both laser sources are parallel to each other. According to postulate 2 both emitted flashes should move in parallel and miss the moving target. It has no relevance that one of the lasers is moving.

However, the figures 2 and 3 show the same physical situation: In fig. 2 from the perspective of the reference system S1 and in fig. 3 from the perspective of the system S2. The flashes hit the target in the first case, and they miss it in the second case. According to postulate 1 both inertial systems should be equivalent for the description of the physical process but they aren't. They lead to contradictory results. In fact, it is crucial, which of the two reference systems is defined to be at rest. The experiment shows clearly that at most only one of the two postulates of the special theory of relativity can be valid, not both. There is no way out, no loophole left even if the Lorentz transformations are applied: Aberration is a steady, time-independent effect, the moving target (v = 0.25c) would shrink by about 3 percent in the x-axis, but this doesn't resolve the conflict.

**2.2 The emission theory of light matches to Galilean relativity**

Which of the two principles applies for light? Is there after all a preferred reference system that defines the speed of light or are all inertial systems equivalent even for the description of light and optics? A first hint is given in fig. 4, which combines the two previous fig. 2 and fig. 3:

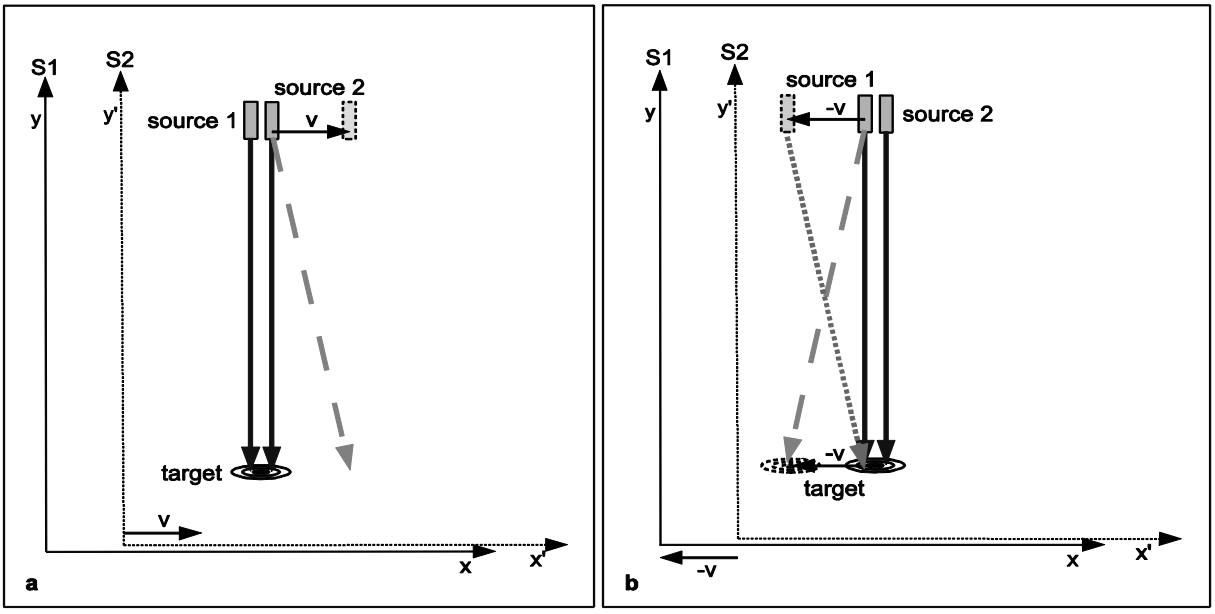


Fig. 4

Figure 4 compares the two experiments. a: from the perspective of source 1 resting in the reference system S1. b: from the perspective of source 2 resting in the reference system S2. In contrast to postulate 2, the theory of light as an emitted particle would predict movements on the dashed lines for the laser flashes of the moving bodies. This would make both inertial systems equivalent, because the flash of source 2 misses the target in both cases whereas the flash of source 1 always hits.

But are inertial systems really equivalent even in optics? To answer this question another experiment is important.

### 2.3 The laser aberration test

This experiment is often but mostly unconsciously conducted by geodesists using laser beams. If postulate 2 is true, meaning it has no relevance for the propagation of light whether a light source is moving or not, then laser beams should show a daily recurrent aberration. This, because the earth is a moving and rotating system, in which v is changing daily into -v and vice versa for a point on its surface. To give numbers: a 100 m long laser beam should move laterally in both directions by the quotient of v/c * 100 m = +/- 10 mm. This daily shift is not observed. The experiment on the right side in fig. 4 also shows this experimental case: the dashed line that corresponds with a light speed depending on the speed of the emitting body hits the moving target as it is observed on the moving earth, whilst the continuous lines representing postulate 2, miss it (aberration). The system defining the speed of light is obvious the laboratory.

Most physicists declare here that aberration isn't expected within the same inertial system, in which the light source has an equal speed vector as the target. Yes, it isn't expected and never observed but it is nonetheless in contradiction to postulate 2 as it is demonstrated in the previous experiment (fig. 4). There has to be an aberration in the moving system (e.g. the earth ), despite source and target being at rest in respect to each other, if postulate 2 is true. The dotted line connects the position of the source 1 with that of the laser flash at the moment, in which the flash misses the target. From the perspective of the moving system S1, a laser flash that is independent of the motion of source 1 should follow the dotted line (mirrored aberration according to fig. 1).

Hence, postulate 2 is in contradiction to the laser beam aberration experiment that therefore disproves the hypotheses of length contraction and local time in moving systems. This because the explanation of the null result of the Michelson-Morley experiment by these hypotheses is possible only if an anisotropic speed of light is presumed in the moving inertial system:

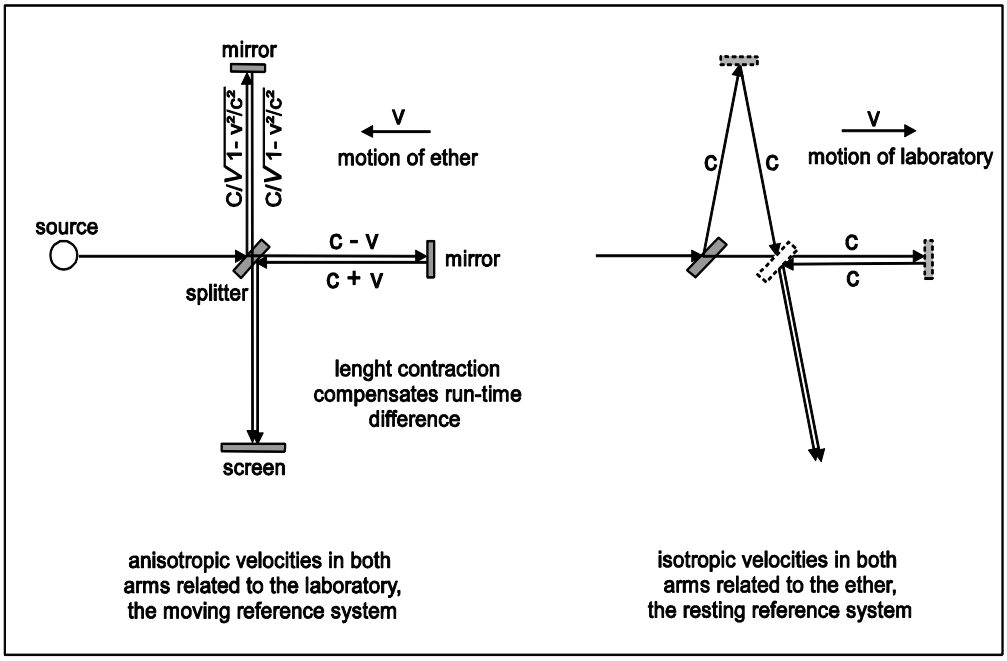


Fig. 5

Figure 5 shows the Michelson-Morley experiment. The speed of light is anisotropic in the moving inertial system and isotropic in the resting inertial system.

The above laser aberration experiments reveal: At least in the terrestrial laboratory, the speed of light is really isotropic and not an artefact of measurement by length-contracted rulers and by clocks showing the local time according to the Lorentz transformation.

**3. Discussion**

The experiment described by fig.2 and fig.3 gives a first remarkable result because it refutes the SRT. Can the GRT regarded as well founded then? Hardly, so physics is forced to explain gravity in another way. Physics has to go back to the Newtonian roots, to the separation of space and time and, at least as the most plausible assumption, to their invariability. Moreover, physics has to accept that Einstein's intent to generalize the Galilean principle failed and that his attempt was a rejection of the Copernican revolution, which has shown the absolute character of the celestial bodies motions.

The experiment described in chapter 2.3 reveals the second important result: There is no system that carries the electromagnetic light waves and through that the earth is moving as it was assumed by Michelson and Morley and even by Einstein explaining the relativity of simultaneity and the aberration of starlight. Classical electrodynamics isn't compatible with optical aberration experiments.

Neither the two fundamental postulates of theory of relativity are conformable to each other, nor electrodynamics, as the origin of Einstein's theory, is a correct explication of light, nor the general relativity of motion is adequate to reality. Newton's former concepts of light, space and time turn out to be more reliable than the more recent theories.

The findings of the experiments are easy to understand but hard to believe, because there is a huge gap between these results and what science deeply believed to be true. Theory of relativity that seemed to be very consistent and ingenious is disproved and the classical electromagnetism supposing an ether or vacuum system, through which the earth is moving and which defines the speed of self-propagating light waves, fails too. Physics erred herein over many decades. Why?

The explanation is very complex and far more sociologically, politically and historically founded than in arguments of physics. One important physical point is: Laser beams were available only more than 50 years after the development of the theory of relativity. They are a consequence of the real revolutionary hypothesis of light quanta introduced by Einstein. Another major reason is that the particle properties of light appeared step by step in the last hundred years. Nowadays interactions of photons are observed at the nanoscale, photons can be slowed down and even be trapped in special equipment whilst the electrodynamic explanation of light in the meaning of Maxwell was more or less abandoned in the 1920ies. Quantum statistics is used to explain interference patterns. Slowly but surely, physics, adhering to electrodynamic light waves, drifted into a dead end. What are the consequences?

A reset of major parts of physics probably impends. Optics, particle physics, gravity physics, astronomy and cosmology are affected. The task of researching light without the misleading relativistic perspective, which has mystified the light and its speed, is most important. Using aberration experiments on earth and in space, it will be possible to define the properties of light much better. There are no more relativistic restrictions, e.g.: Now light can have a rest mass, its velocity can be added and is not anymore an insuperable limitation, photons can be a real particle (but not necessarily). It is now time to really abandon the electrodynamic explanation of light that was always in contradiction to the observations: Light as a photon transfers energy from one atom to another without dispersion or loss. In contrast, electromagnetic waves spread their energy spherically in space. Sharp laser light beams, which cut metal sheets, can’t be explained in electrodynamics.

But there arise a lot of questions that have to be answered by new explanations. What about $E = mc^2$, the Doppler shift, the de Sitter’s twin star observations, the bending of light near big masses like the sun, the Einstein rings? And if light consists of real particles, how can interference patterns be explained? Surely better answers have to be found.

On the other hand, there is no more need for complicated unifying theories that try to merge contradictory models. That is the good news. Gravity is one of the fundamental forces in nature, not a curvature of space. This force might be transferred by gravitons that should be identified. The path to quantum gravity is open. Perhaps quantum gravity liberated from misleading concepts will guide us to gravity manipulation in the end.

**References**

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