

Does Newton's ether exist?

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Abstract

Newton's ether theory, where the ether is a medium through which light travels and celestial bodies move has been largely rejected in the scientific community because it failed to explain observations. Nevertheless, I claim that this rejection is problematic.

In this paper, I will:

- 1) Relate to known observations that led to special relativity and the reasoning for the ether rejection.
- 2) Suggest a structure of the universe that can explain the observations.

Part 1 - Observations and the reasoning for the ether rejection

The ether hypothesis was proposed by Aristotle as an immovable heavenly fluid in which celestial bodies move. This hypothesis has never lacked critics. On the other hand, it was accepted by many other philosophers and scientists, among them Newton. Although Newton could not explain the nature of the ether, he founded classical mechanics on the ether. In addition, the ether medium was accepted because it enables the propagation of electromagnetic waves and gravitational forces.

An example of such observation was stellar aberration, which is the apparent yearly shift in the positions of star Eltanin due to the Earth's motion around the Sun. The discovery of stellar aberration was made by the astronomer James Bradley in 1728. Bradley did consider the concept of the stationary ether where the stars were fixed. Bradley proved the heliocentric model and also succeeded in evaluating the speed of light.

While Bradley's explanation for stellar aberration provided a good model for understanding the phenomenon, it relied on the unproven assumption of the ether. But subsequent experiments, particularly the Michelson-Morley experiment in 1887, and many other experiments failed to detect the existence of the ether, ultimately leading to the abandonment of the luminiferous ether theory.

The Michelson-Morley experiment that was intended to prove the existence of the ether failed to detect any motion of the Earth through such an ether (in other words- "the null result"). Several hypotheses were suggested to explain the null result. They are based on the assumption that the ether near Earth is dragged by Earth. An example of such a hypothesis was Stokes' Earth dragged ether hypothesis, but it faced a downfall due to two main issues: experimental evidence and theoretical inconsistencies.

This situation led to the development of Einstein's theory of special relativity. Special relativity provides a mathematical and physical framework that explains the phenomena of stellar aberration and the Michelson-Morley experiment. Special relativity showed that the laws of physics are the same in all inertial reference frames and that the speed of light is constant in a vacuum. This undermined the need for an ether as a reference frame for light propagation. The prevailing current scientific understanding is that the ether does not exist.

Is the debate on ether existence over?

No. Some scientists claim that the ether exists.

The first who doubted the non-existence of the ether was Einstein himself. In a lecture he gave at Leiden University in 1920 (five years after he published General Relativity) he said: "Recapitulating, we may say that according to the general theory of relativity, space is endowed with physical qualities; in this sense, therefore, there exists an ether. According to the general theory of relativity space without ether is unthinkable"

<https://www.spaceandmotion.com/Physics-Albert-Einstein-Leiden-1920.htm>

Another who doubted special relativity claim that ether does not exist is the Nobel prize physicist Robert B. Laughlin who wrote: "It is ironic that Einstein's most creative work, the general theory of relativity, should boil down to conceptualizing space as a medium when his original premise [in special relativity] was that no such medium existed [...] The word 'ether' has extremely negative connotations in theoretical physics because of its past association with opposition to relativity. This is unfortunate because stripped of these connotations, it rather nicely captures the way most physicists actually think about the vacuum. . . studies of radioactivity began showing that the empty vacuum of space had spectroscopic structure similar to that of ordinary quantum solids and fluids..."

https://en.wikipedia.org/wiki/Aether_theories

An additional issue with using special relativity in our universe relates to its first postulate. The first postulate of special relativity is:

1. The laws of physics are invariant in all inertial frames of reference (that is, frames of reference with no acceleration or gravity)

Therefore, special relativity is not applicable to be used on Earth or measurements between celestial bodies. The explanation of the Michelson-Morley experiment by special relativity and its conclusion that there is no ether is doubtful.

Part 2- Suggested structure of the universe that can explain the above observations.

What is the ether?

It was noted above that the proponents of the ether theory, including Newton, could not describe the nature of the ether.

I claim that there is an ether. It relies on quantum physics. Quantum Field Theory (QFT) describes space as being non-empty at extremely small scales, even if all matter particles are removed. Vacuum space is endowed with fluctuating fields of energy such as electrical, magnetic, and quark fields. QFT teaches that any point in this vacuum space contains energy that has a minimum value designated as the vacuum energy. Its behavior is codified in Heisenberg's energy-time uncertainty principle. From the energy of the vacuum space, pairs of matter and antimatter particles are perpetually generated, e.g., an up quark and its up antiquark, a down quark, and its down antiquark, electron, and positron, etc. These pairs pop out in the vacuum, exist for a very short time, and then annihilate each other. Vacuum space has measurable physical properties such as electrical permittivity and magnetic permeability. Maxwell used these parameters to calculate the speed of light in a vacuum. I hypothesize that space has additional physical properties e.g., viscosity. I claim this because viscosity enables space to be dragged by matter. In other words, vacuum space is not a total void but is rather "something" as suggested by the ether theory. It has been suggested by [Paul Dirac](#) that this quantum vacuum may be the equivalent in modern physics of the ether.

Suggested structure of the universe

My conjuncture on the structure of the universe is based on Newton's ideas on space, time, motion, and matter and also is based on general relativity.

Newton postulated that:

1. Time is absolute, eternal, and passes uniformly without relation to anything external.
2. Space is absolute, eternal, infinite, permeates everywhere, and remains similar and immovable without relation to anything external.

3. Space is filled with a "stuff" called ether. The ether provides an absolute frame of reference for the motion of celestial bodies.
4. The matter is a finite island in space and is distinct from it.
5. Motion is the translation of a body from one absolute place to another; relative motion is the translation from one relative place to another.

However, there is a discrepancy between general relativity and Newton's theory. I concur with part of Newton's postulate 2, namely, "Space is absolute, eternal, infinite and it permeates everywhere". But the part in his claim that "space remains similar and immovable without relation to anything external". Einstein claimed that space is curved by the presence of a mass. There is a phenomenon called frame-dragging that is predicted by general relativity and validated by experiments that any spinning celestial body drags space, thus space is movable.

The following describes the structure of the universe:

There is an infinite stationary vacuum space that permeates everywhere. Somewhere in this infinite vacuum space, there is an isolated matter universe, which I designate the Pivot universe. It is composed of two parts: a massive spinning neutron star designated the Pivot and a ring-shaped visible Universe that orbits this Pivot. The Pivot, from the quantum physics point of view, is a neutron star. From the general relativity point of view, the Pivot is described as a Kerr black hole. Therefore, the ring-shaped visible Universe must reside outside the event horizon of the Pivot. The Pivot theory postulates that our Universe started as a spinning primeval nucleus. This primeval nucleus accumulated mass from the vacuum space energy. The growth of this nucleus stopped when the acceleration on its equator surface reached the maximum value in the universe and then it exploded into two distinct parts: The Pivot and a ring of the visible Universe.

The following figures describe generally the Pivot universe:

Fig. 1 shows the Pivot universe located in the stationary vacuum space. The Pivot at the center of the Pivot universe does not move but spins around an axis. By doing so it frame-draggs the vacuum space with it. The dragged vacuum space has a peculiar shape.

Fig. 2 is a cross-section of the Pivot universe.

Generally, dragged space is flat on the equatorial plane and has spirals at the poles. The formula used to draw this shape is the frame-dragging derived from general relativity.

$$\Omega = -\frac{g_{t\phi}}{g_{\phi\phi}} = \frac{r_s \alpha r c}{\rho^2 (r^2 + \alpha^2) + r_s \alpha^2 r \sin^2 \theta}$$

<https://en.wikipedia.org/wiki/Frame-dragging>

The stationary vacuum space engulfs the peculiar shape of the dragged space. Celestial bodies can exist only in dragged space. The figures show also the event horizon of the Pivot. Celestial bodies can only exist outside the event horizon. The part of the dragged space that fulfills these requirements is the flat disk on the equatorial plane. This equatorial plane outside the event horizon is the visible universe where all matter, galaxies, stars, and dust reside. It is shown, for example, the location of the Milky Way in the visible universe. As the Milky Way and the entire visible universe are located outside the event horizon of the Pivot, it is clear why it is not possible to see the Pivot from the Milky Way. **Celestial bodies are dragged by vacuum space rather than moving through it.** This explains why the celestial bodies do not lose momentum and eventually spiral into the Pivot. But if a celestial body 1, shown in Fig. 2, is located outside the region of dragged space it will be forced by gravity to spiral into the Pivot. The force of gravity between two celestial bodies is according to Newton's gravitational law but with one modification. The distance in Newton's law is not the straight line connecting the centers of the bodies but the geodesic length that is caused by the frame-dragging of space. See: [Could Newtons gravity theory be reconciled with Einsteins general relativity theory](#)

Finally, the two observations, that led to the derivation of special relativity can be explained without discarding the ether.

- 1) The stellar aberration that was explained by Bradley with the stationary ether, can be explained by the Pivot structure where celestial bodies are dragged simultaneously by vacuum space so that their relative position is not changed. In Fig. 1 the Milky Way galaxy and Galaxy-a are shown. Bradley explained it by claiming that the galaxies are fixed in the stationary ether.
- 2) The Michelson-Morley experiment can be explained by the fact that celestial bodies are dragged by vacuum space so that there is no relative velocity between the body and vacuum space. A known example is a boat that is dragged in a flowing river and has no relative velocity to the river.

This paper focuses on the derivation of special relativity. However, there are more details regarding the structure of the Pivot universe, including explanations such as the evolution of the Pivot universe from vacuum space, the size of the universe shown in Fig. 2, and other observations. The reader is referred to [The structure of the Pivot Universe](#)

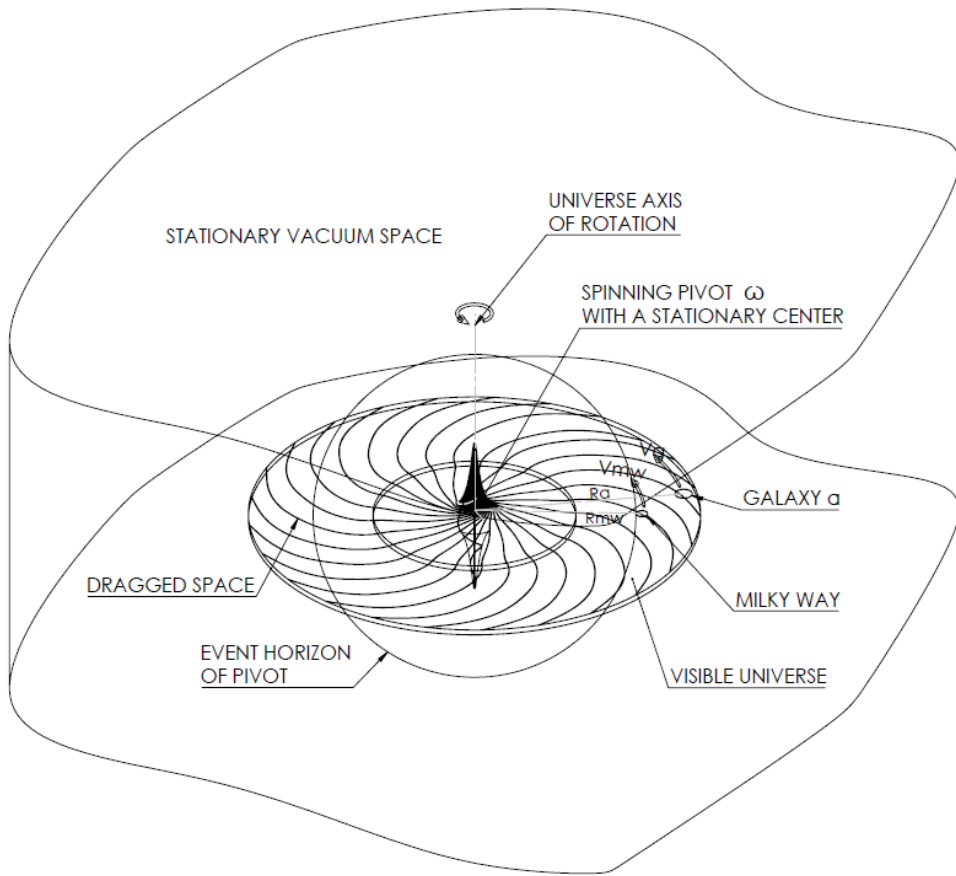


Fig. 1 –The Pivot universe in the stationary vacuum space

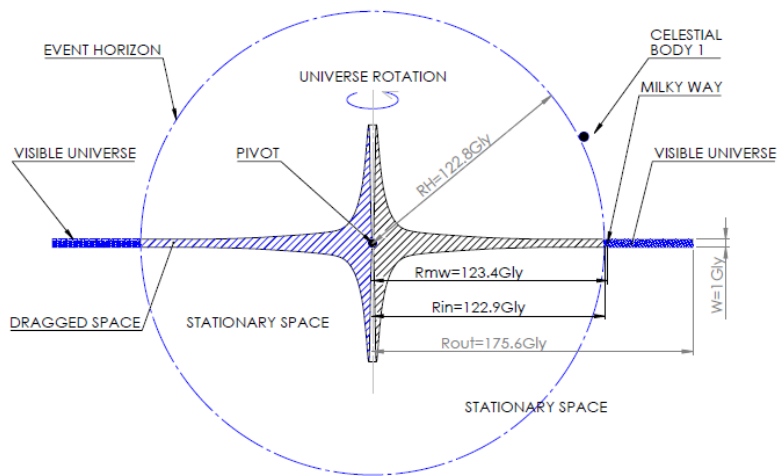


Fig. 2 – Cross section of the Pivot universe

Summary

The ether exists. It is stationary, as Newton claimed, in the vacuum space far away from any gravity. In the Pivot universe general relativity rules. The ether is dragged by the spinning Pivot and all celestial bodies are dragged by the ether.