The Aether as seen by Albert

In 1905, Albert Einstein, in his article on relativity,[1] suppressed the ether, the medium that supported electromagnetic waves in the 19th century, which was supposed to be immobile, which was the fatal mistake.

He re-established it in 1920[2]. Relativity forbade its immobility, but he could not specify its motion and declared it indeterminate.

He did not use his own theory of general relativity to explain this motion. We did it and the result is stunning... simplicity.

The support of electromagnetic waves

When Maxwell made the junction between light waves and electromagnetic waves, the certainty that light was a wave was acquired. Waves need a medium. Physicists in the 19th century sought this medium to fill the entire universe. They imagined it associated with the fixed stars and the Sun, which was their big mistake.

The 19th century ether

Maxwell calculated the velocity of electromagnetic waves in a vacuum using the dielectric permittivity e0 and the magnetic permeability μ0, and found about 300,000 km/s, or the speed of light. It was confirmed that the light was a wave electromagnetic.

$$c = \frac{1}{\sqrt{\varepsilon 0 . \mu 0}}$$

If space were empty, these values would be zero and the velocity would tend to infinity. A vacuum filled with energy and quantum fluctuations! A curious way of defining emptiness.
The ether was considered immobile with the Sun and the fixed stars. Galaxies were not discovered until the twentieth century.

The Luminiferous Ether

Michelson and Morley will seek to detect the motion of the Earth in relation to the ether.

Woldemar, Voigt and then Lorentz imagined a contraction of matter with the velocity inspired by the Heaviside ellipsoid.

Poincaré finalized the calculations.

Henri Poincare's contribution in 1905

Poincaré notes the impossibility of demonstrating the absolute motion of the Earth (Principle of Relativity) - He proves the shape invariance of the Maxwell-Lorentz equations under the Lorentz transformations. He wrote a generalization of the Newtonian law of gravitational attraction that is covariant under the Lorentz group and deduced that the propagation of gravitation is not instantaneous but occurs at the speed of light. These are gravity waves.

He shows that x2 + y2 + z2 – t2 is invariant and considers (x, y, z, it) as a point in a 4-dimensional space.

Source: Poincaré and the theory of relativity, by Thibault Damour[3].

1905 The Wonderful Year the Great Works of Albert Einstein

1) Photovoltaic effect, for which he will have the Nobel Prize
2) Brownian motion explained with Newtonian mechanics and the hypothesis of the existence of atoms still disputed at the time
3) Special relativity
4) $E = mc^2$
5) In 1906, he published his doctoral thesis "A New Determination of Molecular Dimensions". His work on thermodynamics, kinetic theory, and Brownian mechanics and motion made it possible to calculate the Avogadro constant, which can be used to determine the size of molecules

Founding article of special relativity (1905)

Einstein posits two postulates[1].

First postulate: In the case of the influence of a magnet on a conductor, the phenomenon depends solely on the relative motion of the conductor and the magnet. This is the principle of relativity applied to electromagnetism.

Second postulate: The speed of light does not depend on the speed of the object that produces it, so it is a universal constant, the same in all frames of reference regardless of their speed.

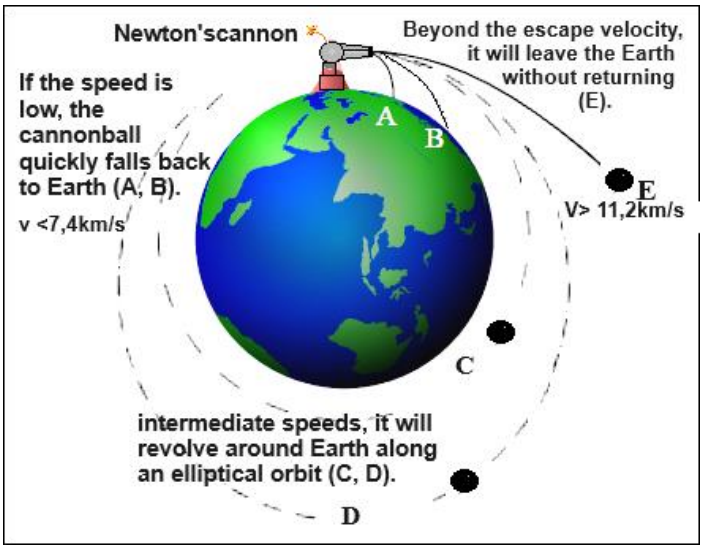
He specifies that his first postulate contradicts Maxwell's equations and that the second contradicts the first. His intellectual honesty makes him emphasize the problems posed.

No wonder this article could have caused a scandal and not the others.

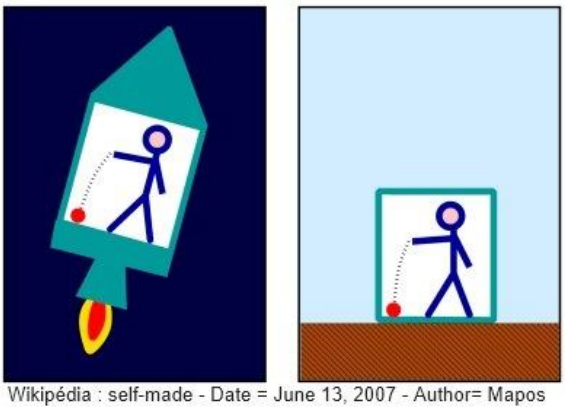
Beginnings of general relativity

The 1905 article on relativity caused a scandal. He is reproached for abandoning the ether. Waves without support do not exist. The contradiction between the constant speed of light and the notion of relativity is also unanswered. The others did not, his article on the photoelectric effect earned him the Nobel Prize.

Einstein, in 1907[4], to the idea that free fall takes place without us feeling our own weight and, without external landmarks, the objects that accompany us are as if immobile. It's like an inertial movement. Einstein thought about what acceleration is, and here too he made it an equivalence with gravitation.



Newton's "cannon" allows us to understand free fall: the shell is in free fall, its speed allows it to travel through a parabola before falling to the ground. At a high speed it is satellited and at the escape velocity, it escapes the Earth's gravitation.



Wikipédia : self-made - Date = June 13, 2007 - Author= Mapos

Acceleration and gravitation are equivalent

A turn of events!

In 1916, after the publication of general relativity, Lorentz managed to convince Einstein of the necessity of the ether. Einstein rejected the rigidity and immobility of the ether.

The "new ether" cannot be rigid or at rest, this is our first clue

He admits that "this new aether would determine the motion of physical objects, whose metric behavior would be described by the metric tensor g_{ij} of his equation. But he admits it's not very clear. Under pressure from Philipp Lenard, Einstein endowed space with a state field that interacted with matter and was influenced by it.

"Interaction with matter" is our second clue. Matter and energy react with matter, this is gravitation![2]

Conclusion of the Reception Speech at Leiden University in 1920

Einstein: "In summary, we can say, according to the theory of general relativity, that space is endowed with physical properties; and therefore, that the ether exists. [...] A space without ether is inconceivable, not only would the propagation of light be impossible, there would even be no possibility of existence [...] of spatio-temporal distances [...] However, the notion of movement should not be applied to it. This speech was published in 1921 under the title "The Ether and the Theory of Relativity"[2]

New hypothesis for ether

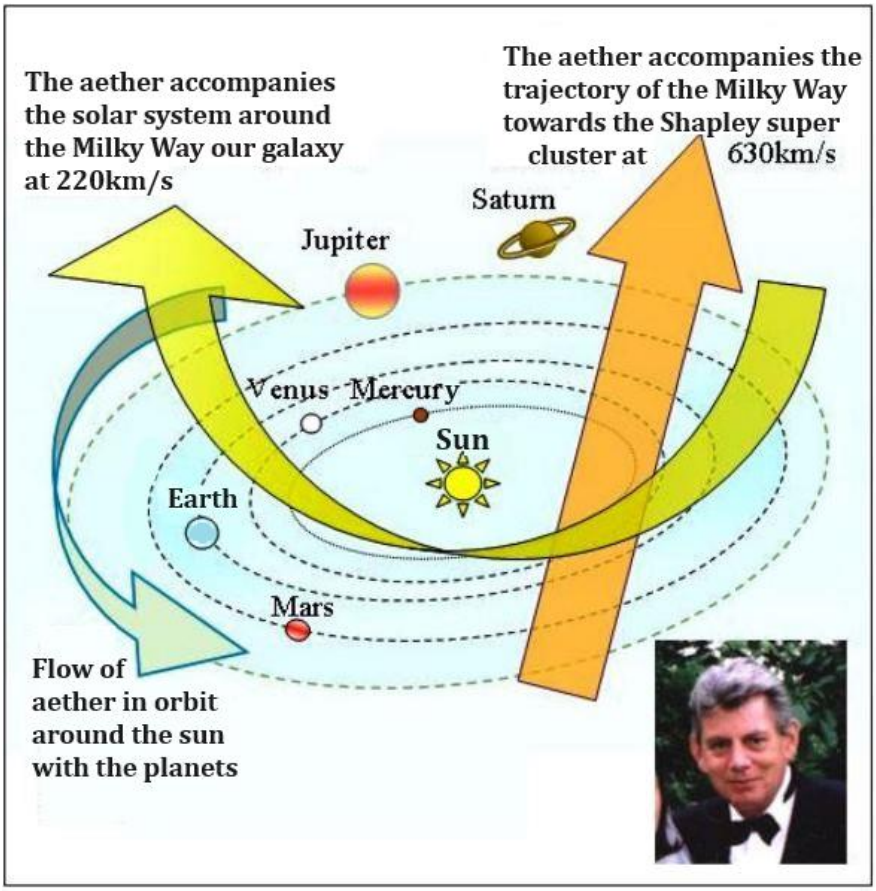
Let us suppose that the ether obeys the laws of gravitation. In relativistic language, "the ether follows the geodesics of space-time", and therefore accompanies all bodies in free fall that fall at the same speed, independent of their mass.

Albert Einstein made free fall in a gravitational field an inertial motion. The ether accompanies the Earth in free fall as well as all the planets, stars or galaxies.

Near the Earth, locally, the ether is immobile in the Earth's frame of reference. This is true for all celestial bodies.

Would it be that easy and as simple?

Einstein's ether is in free fall with all the celestial bodies in the universe



No friction.

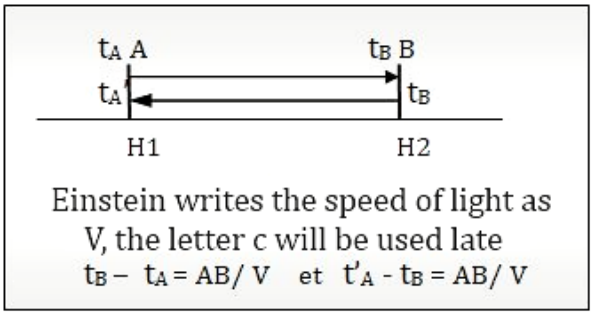
Experiments to be carried out

To check whether the ether accompanies the Earth, it is sufficient to use a frame of reference moving close to it with sufficient speed for the generated aether wind to be detected. This frame of reference must be devoid of mass capable of dragging the ether with it.

In his 1905 article, Einstein studied the measurement of a rod AB in its own frame of reference, and then from another frame of reference that observes the frame of reference of the rod that is in motion relative to it. Let's see what he says.

§ 1. Definition of simultaneity

The notion of simultaneity is fundamental for the measurement of moving objects. An observer placed at A with a clock can assign a time to events in the vicinity of A. With a clock set at B, an observer at B can do the same.

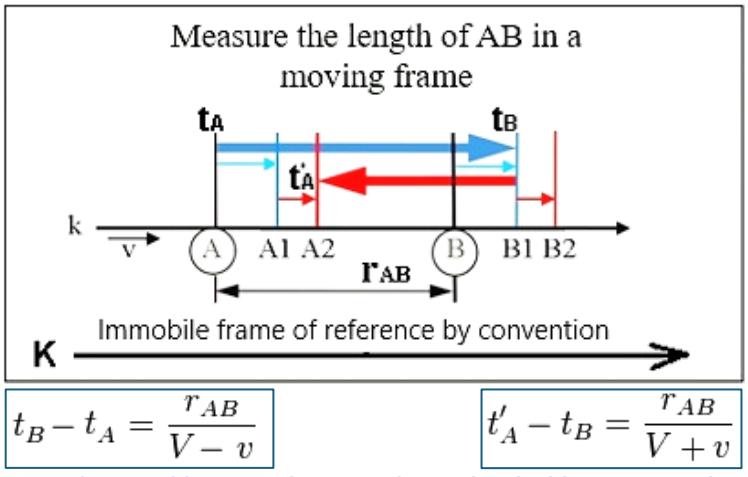


If we posit by definition that the time taken by light to go from A to B is equivalent to the time it takes to return from B to A. The quantity 2AB / (t'a-ta) = V is a universal constant: the speed of light in a vacuum.

§ 2. On the relativity of lengths and times

Let be a rod AB of length L, at rest in the frame of reference k which is in motion at the speed v with respect to K,

a) An observer moves with the stem and measures its length. They are resting. The length L is unchanged.
b) An observer of K determines at which points in his frame of reference are the ends of the rod to be measured at time t, using the clocks of K. When the light goes from A to B, from K, he sees B moving away. When the light returns from B to A, he sees A approaching. The ruler measurement will give a different value



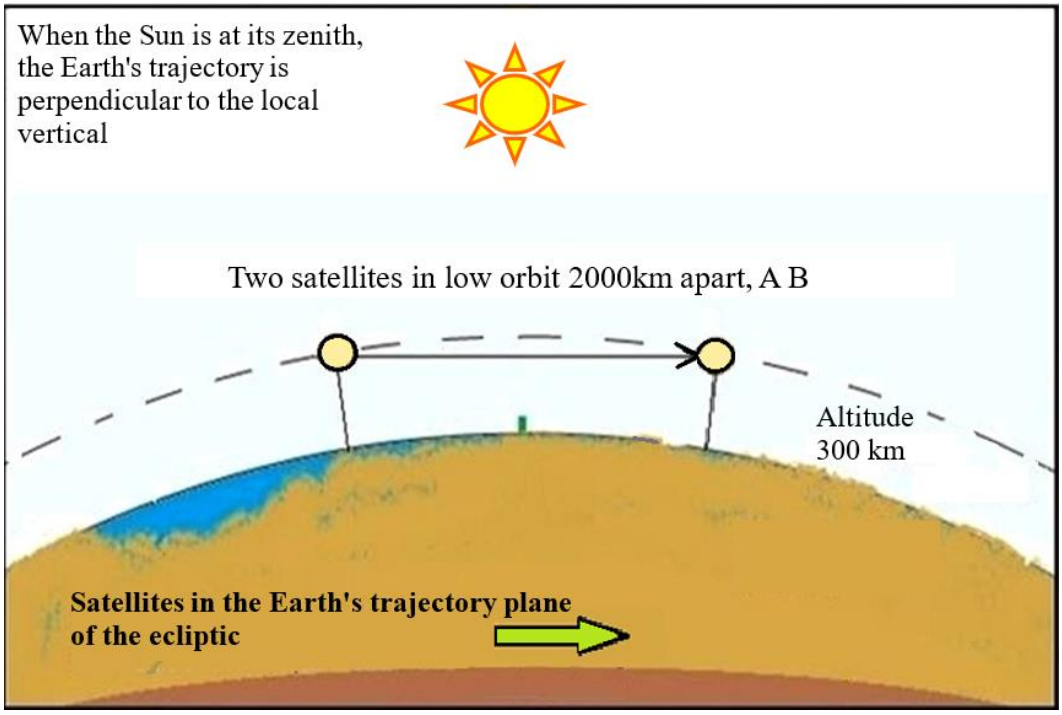
$$t_B - t_A = \frac{r_{AB}}{V - v} \qquad t'_A - t_B = \frac{r_{AB}}{V + v}$$

Seen from K, the length L is denoted by r_{AB}. The round trip divided by 2 gives the average.

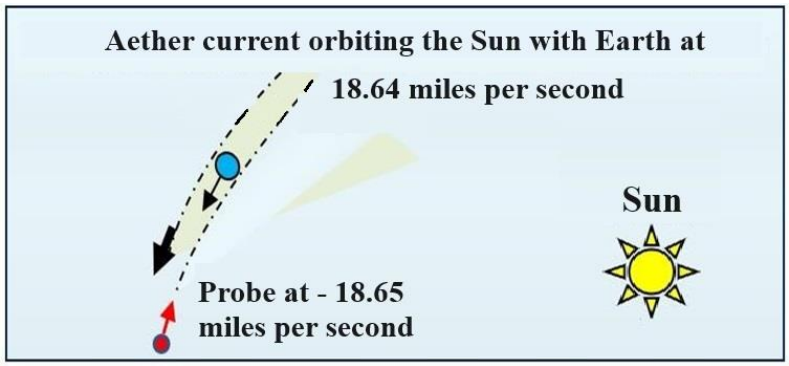
Einstein took the average to correspond to the measurement of the interferometer along its branch parallel to the Earth's movement. For our experience, this is irrelevant.

Two satellites orbiting in the plane of the ecliptic

Let's replace the rigid AB rod with two satellites, A and B, 2000 km apart. If the ether accompanies the Earth, but not the AB frame of reference of the satellites, the ether will not be stationary in this frame of reference and its motion relative to the ether will be measurable.



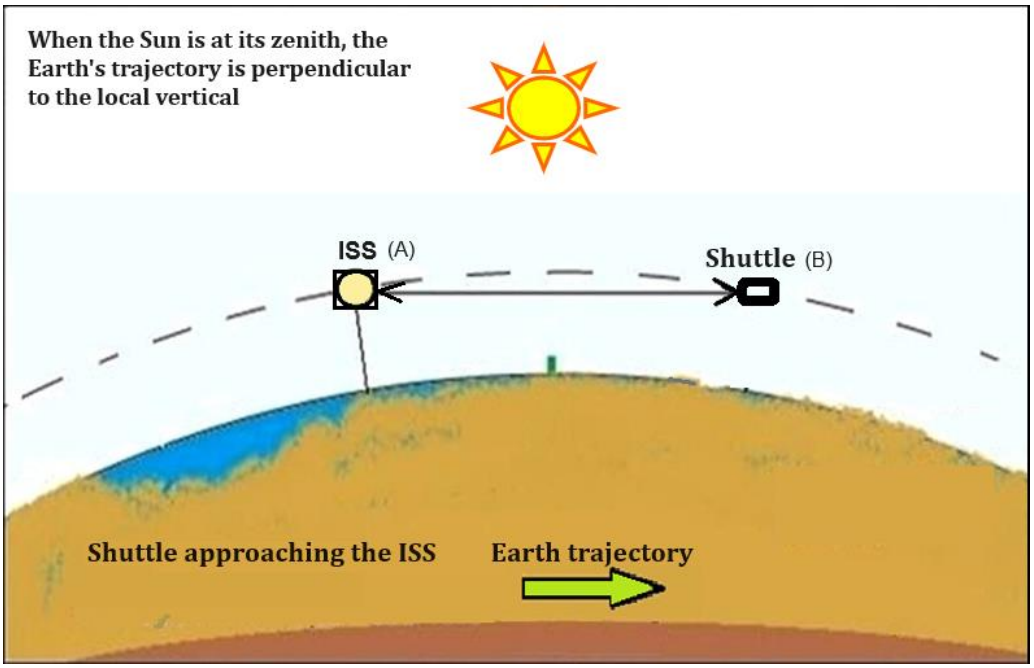
The best: a probe rotating in the Earth's orbit but in the opposite direction with a difference of 60 km/s



The problem will be the great energy required to accelerate by 60 km/s. Perhaps a U-turn around Jupiter would be a solution?

The easiest!

When a crew joins or leaves the ISS, they may be in a favorable approach position about 2000 km from the ISS, parallel to the Earth's movement around the sun at that time.



It's so simple that it would be a shame not to try.

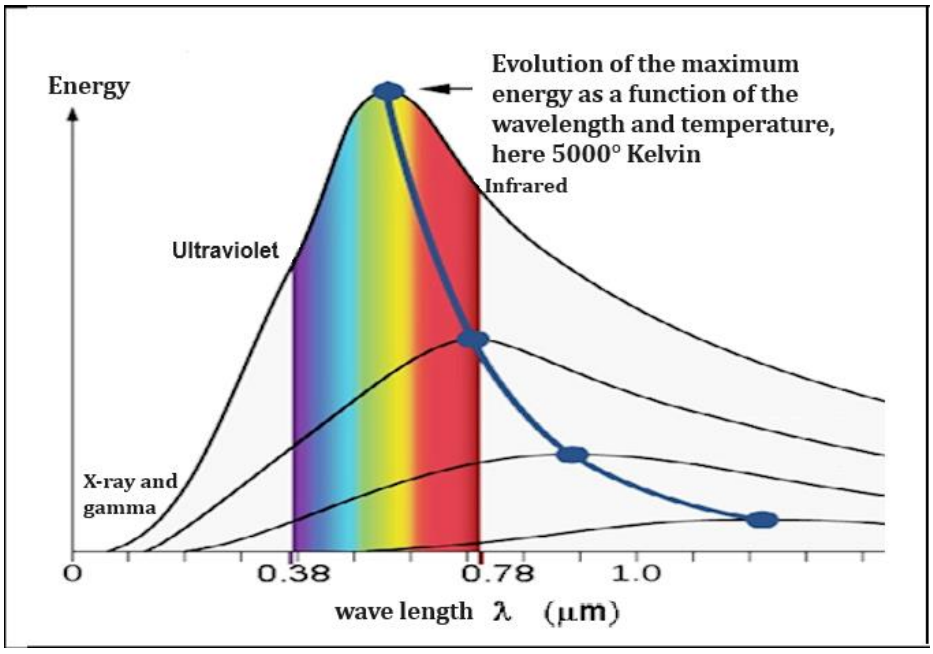
What if the experiments highlighted the accompaniment of celestial bodies by the ether?

Is it permissible to think about what the medium supporting electromagnetic and gravitational waves could look like? If we reason in relation to the sounds that propagate in different materials, we know that it is the molecules of these materials that collide as they vibrate and that these shocks propagate the energy of the wave from one step to the next until they bounce back or crash into an obstacle. The size of atoms and molecules is about $^{10\text{-}15}$ m, compared to us.
The vibrating corpuscles of the medium supporting electromagnetic waves could correspond to Max Planck's quantum of action and be located $^{10\text{-}35}$ m from us. They are currently undetectable. A ray of light at a frequency of 500 THz would represent 500 1012 corpuscles. This allows us to apply probabilities of presence to these corpuscles. The phenomena that drive them will be to be discovered.

Can we imagine what the ether would look like

Max Planck solved the mystery of blackbody radiation by breaking down its electromagnetic radiation into a large number of individual oscillators all using the same amount of energy, very small but not zero, multiplied by their frequency. He calculated the value, which, when added together, reproduces in a remarkable way the curve of blackbody radiation measured experimentally.

Let us imagine that this quantum of energy corresponds to the energy transmitted by collision between corpuscles vibrating at the speed of electromagnetic waves. This would perfectly explain the notion of a threshold, which represents the momentum of each corpuscle at the speed c, hence a mass of the order of h/c.



This is what happens with the molecules of the gases that make up the atmosphere which have random speeds and directions whose average gives 1200km/h at sea level under 1 atmosphere, which can be reminiscent of quantum mechanics, and which transport the momentum produced by sound at this speed.

All that remains is to fill the universe with these corpuscles. Do they constitute an obstacle to the movement of celestial bodies? No, since they accompany them, moreover their smallness, which makes them undetectable, for the moment, works in their favor.

Bibliography

1) Albert Einstein, On the electrodynamics of moving bodies https://users.physics.ox.ac.uk/~rtaylor/teaching/specrel.pdf
2) Albert Einstein, "The Ether and Relativity. https://mathshistory.st-andrews.ac.uk/Extras/Einstein_ether/..... https://www.academia.edu/76409235/Ether_and_Relativity
3) poincare.pptx (ihes.fr) https://www.ihes.fr/~vanhove/Slides/damour-IHES-novembre2012.pdf
4) Equivalence principe : https://en.wikipedia.org/wiki/Equivalence_principle

To find out more : the ether of albert einstein https://librairie.bod.fr/the-ether-of-albert-einstein-robert-jobard-9782322455959
https://librairie.bod.fr/lether-quantique-dalbert-robert-j-9782322521401