

LETTERS TO PROGRESS IN PHYSICS**A Blind Pilot: Who is a Super-Luminal Observer?**

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This paper discusses the nature of a hypothetical super-luminal observer who, as well as a real (sub-light speed) observer, perceives the world by light waves. This consideration is due to that fact that the theory of relativity permits different frames of reference, including light-like and super-luminal reference frames. In analogy with a blind pilot on board a supersonic jet aeroplane (or missile), perceived by blind people, it is concluded that the light barrier is observed in the framework of only the light signal exchange experiment.

We outline a few types of the frames of reference which may exist in the space-time of General Relativity — the four-dimensional pseudo-Riemannian space with Minkowski's signature $(+---)$ or $(-+++)$. Particles, including the observer himself, that travel at sub-luminal speed ("inside" the light cone), bear real relativistic mass. In other words, the particles, the body of reference and the observer are in the state of matter commonly referred to as "substance". Therefore any observer whose frame of reference is one of this kind is referred to as a *sub-luminal speed observer*, or as a *substantial observer*.

Particles and the observer that travel at the speed of light (i. e. over the surface of a light hypercone) bear zero rest-mass $m_0 = 0$ but their relativistic mass (mass of motion) is nonzero $m \neq 0$. They are in the light-like state of matter. In other words, such an observer accompanies the light. We therefore call such an observer a *light-like observer*.

Accordingly, we will call particles and the observer that travel at a super-luminal speed *super-luminal* particles and observer respectively. They are in the state of matter for which rest-mass is definitely zero $m_0 = 0$ but the relativistic mass is imaginary.

It is intuitively clear who a sub-luminal speed observer is: this term requires no further explanation. The same more or less applies to a light-like observer. From the point of view of a light-like observer the world around looks like a colourful system of light waves. But who is a super-light observer? To understand this let us give an example.

Imagine a new supersonic jet aeroplane (or missile) to be commissioned into operation. All members of the ground crew are blind, and so is the pilot. Thus we may assume that all information about the surrounding world the pilot and the members of the ground crew gain is from sound, that is, from transverse waves traveling in air. It is sound waves that build a picture that those people will perceive as their "real world".

The aeroplane takes off and begins to accelerate. As long as its speed is less than the speed of sound in air, the blind members of the ground crew will match its "heard" position in the sky to the one we can see. But once the sound barrier is overcome, everything changes. The blind members

of the ground crew will still perceive the speed of the plane equal to the speed of sound regardless of its real speed. The speed of propagation of sound waves in air will be the *maximum speed of propagation of information*, while the real supersonic jet plane will be beyond their "real world", in the world of "imaginary objects", and all its properties will be imaginary too. The blind pilot will hear nothing as well. Not a single sound will reach him from his past reality and only local sounds from the cockpit (which also travels at the supersonic speed) will break his silence. Once the speed of sound is overcome, the blind pilot leaves the subsonic world for a new supersonic one. From his new viewpoint (the supersonic frame of reference) the old subsonic fixed world that contains the airport and the members of the ground crew will simply disappear to become a realm of "imaginary quantities".

What is light? — Transverse waves that run across a certain medium at a constant speed. We perceive the world around through eyesight, receiving light waves from other objects. It is waves of light that build our picture of the "truly real world".

Now imagine a spaceship that accelerates faster and faster to eventually overcome the light barrier at still growing speed. From the purely mathematical viewpoint this is quite possible in the space-time of General Relativity. For us the speed of the spaceship will be still equal to the speed of light whatever is its real speed. For us the speed of light will be the maximum speed of propagation of information, and the real spaceship for us will stay in another "unreal" world of super-light speeds where all properties are imaginary. The same is true for the spaceship's pilot. From his viewpoint, overcoming the light barrier brings him into a new super-light world that becomes his "true reality". And the old world of sub-light speeds is banished to the realm of "imaginary reality".

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