Do The Observations of Superluminal Neutrinos Lead to The Model Where Light Speed Increases Over Time?

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Abstract

In the recent research the OPERA collaboration has reported the observation of superluminal neutrinos. They did not state what exact value they used as the speed of light *c*, but we could safely assume that in accordance to the SI system it was 299,792,458 m/s. In the following research A.G. Cohen and S. L. Glashow showed that "superluminal neutrinos would lose energy rapidly via the bremsstrahlung of electron-positron pairs" and that "most of the neutrinos would have suffered several pair emissions en route". This obvious paradox between experiment and theory can easily be resolved if the speed of light is slowly increasing and is now (or at least was during the experiment) higher than in 1970-1980 when mentioned that 299,792,458 m/s was measured. In this case the speed of neutrinos in the OPERA experiment can be higher than 299,792,458 m/s, but at the same time be lower or equal to the *current c*. Without subscribing to the model where *c* increases over time, it can still be a good idea to measure the speed of light *c* during the replication of the experiment. In addition, if slow increase of *c* will be proven, it may also explain the red shift of distant galaxies without the big-bang theory, since the more distant and earlier periods of time we observe - the slower the light speed there, and less is the energy of photons emitted there; what for current observer appears as a red shift in the spectrum.

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In the well-known research [1] the OPERA collaboration has reported the observation of superluminal neutrinos. The group reported that they had detected neutrinos, which arrived about 60 ns earlier than if they had traveled with the light speed in vacuum *c*. Quoting the research [1], "relative difference of the muon neutrino velocity with respect to the speed of light $(v-c)/c = (2.48 \pm 0.28\ (stat.) \pm 0.30\ (sys.))\ 10^{-5}$ "

Authors of the research [1] never stated what exact value they used as *c*, but we could safely assume that in accordance to SI system of units they used the value of 299,792,458 m/s [2].

On the other hand, authors of the research [3] showed that "such superluminal neutrinos would lose energy rapidly via the bremsstrahlung of electron-positron pairs". Research [3] also showed that "most of the neutrinos would have suffered several pair emissions en route, causing the beam to be depleted of higher energy neutrinos."

If we do not link the results published in [1] to some unaccounted systematic factors (which the authors of [1] analyzed very precisely) we have a paradox.

a. Neutrinos are traveling faster than 299,792,458 m/s (per [1])
   and at the same time
b. Neutrinos can not travel faster than light (per [3]).

These two conditions lead us to the only conclusion that the speed of light in vacuum is higher than 299,792,458 m/s.

But this value was precisely calculated in the experiments (see for example [4]) and is the base for SI system of units, which had even redefined the meter as "the length of the path traveled by light in vacuum during a time interval of 1/299 792 458 of a second" [2] .

But does precise calculation of *c* done several decades ago mean that *c* is really constant? Authors of research [1] did not measure the speed of light *c* during the experiment, assuming that it is always the same. However if it increased by (for example) 3×10^{-5} since the measurements of *c* in 1970-1980, the neutrinos speed may become greater than 299,792,458 m/s, but at the same time be less or equal to the *current* (or may be local) speed of light *c*.

In summary: without subscribing to the model where *c* increases over time, it still can be a good idea to measure the speed of light *c* during the replication of the experiment [1].

Addition. If the mentioned experiment [1] will be explained in terms of *c* constant increase, it may also influence cosmology. If it will be proven that light speed *c* is increasing over time, it allows us to explain the red shift of distant galaxies without the big-bang theory. The farther the observed galaxies are, the earlier period of time we observe - the slower the light speed there and less is the energy of photons emitted there. Observing these photons now, in the universe with a higher light speed we note the difference between current and observed energy of photons in the spectrum and name it as "red shift". However such red shift has a non-Doppler nature, and is simply the result of light speed increase over time. Of course we cannot answer the question “why is the speed of light increasing?” But we equally cannot answer the question “why is the speed of light constant?”

References

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Short abstract

The OPERA collaboration has reported recently observation of superluminal neutrinos. They did not state what value they used as *c*, but in accordance to the SI system it is 299,792,458 m/s. This paradox between experiment and theory can easily be resolved if the speed of light is slowly increasing and is now higher than in 1970-1980 when mentioned that 299,792,458 m/s was measured. In this case the speed of neutrinos can be higher than 299,792,458 m/s, but at the same time be lower than *current c*. Without subscribing to this hypothesis, it still makes sense to measure the *c* during the experiment replication. In addition, if slow increase of *c* will be proven, it may also explain the red shift of distant galaxies, since the more distant and earlier periods of time we observe - the slower the light speed there, and less is the energy of photons emitted there.