

Virtual Speed of Neutrino

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Abstract: Recently opera researchers found neutrino is travelling faster than light thus violating special theory of relativity. Here I have tried to show that it can also be explained without violating special theory of relativity.

Keywords: special theory of relativity, neutrino, antineutrino, infinitesimally small.

Theory

The Oscillation Project with Emulsion-tRacking Apparatus (OPERA) is a Scientific experiment for detecting tau neutrinos from muon neutrino oscillations. In September 2011, OPERA researchers observed muon neutrinos traveling apparently at faster than the speed of light

$$m = m_0 / \sqrt{1 - \frac{v^2}{c^2}}$$

where m_0 is the rest mass of the particle, m is the moving mass of the particle, v

is the velocity of the particle, c is the speed of light. Now as we can see if $v > c$ then the denominator becomes imaginary. Therefore it is impossible to travel or get velocity faster than light. In everyday usage, vacuum is a volume of space that is essentially empty of matter. But we can also think it as a space where neutrino and antineutrino constantly annihilating each other at almost time $t(t) \rightarrow 0$. Now let us consider this diagram

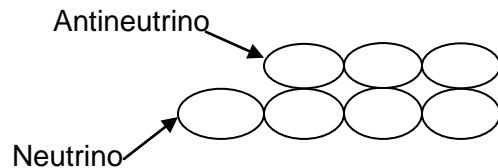


Fig:1

In the Fig:1 I have assumed neutrino and antineutrino are aligned with each other constantly popping in and out of existence in vacuum. Now if we insert a extra neutrino in vacuum as in Fig:1 the antineutrino will immediately try to annihilate the neutrino diagonally in order to maintain the system at lowest energy level. In this way all the antineutrino will diagonally annihilate the neutrinos as shown in Fig:2.

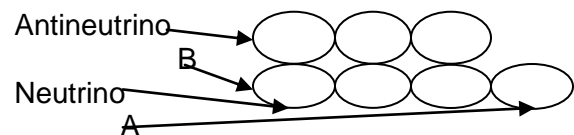


Fig:2

Thus from Fig:2 we can see that if we insert a neutrino at point A it may seem that it has travel to point B. Now if an antineutrino takes time $t(t) \rightarrow 0$ (infinitesimally small) to annihilate a neutrino, then for n number of neutrinos it will take time $(t_1) = n * t$. But as $t \rightarrow 0$, infinitesimally small, so even for large values of n , t_1 will also be tends to 0 (infinitesimally small). Thus in this way we can the problem of speed of neutrino without violating the special theory of relativity. It

may virtually seem that neutrino has exceed the speed of light but actually not since the neutrino at point B is always at point B, though it might seem that neutrino at point A has travelled to point B. But actually the neutrino at point A has got annihilated and neutrino at point B remains unannihilated. Though we will get time (t_1) slightly greater than 0 and not 0 since from Heisenberg uncertainty principle $\Delta E \Delta T \geq h$ where ΔE = change in energy and ΔT = change in time, h = planck's constant.

Conclusion: Thus I have shown that the anomaly in the speed of neutrino can also be solved without violating special theory of relativity.