OPERA experiment: superluminals muonic neutrinos and Čerenkov radiation

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Abstract

In the paper recently published by the OPERA experiment team on the observation of a possible measurement of neutrinos nuonicos overlighting, seems to be a lack of radiation Cherenkov, which theoretically should show whether these neutrinos were moving at a speed higher than light. But it is possible that the absence of Cherenkov radiation is explained with the same mathematical apparatus of the experimentally satisfactory formulation of the same radiation.

1 Introduction

Cherenkov radiation, located in the ultraviolet spectrum of electromagnetic radiation, 10nm-600nm, approximately, can be calculated by the Frank-Tamm-Formula.

The number of photons emitted per track length dx is given by:

$$\frac{d^2N}{dxd\lambda} = \frac{2\pi\alpha}{\lambda^2}\left(1 - \frac{1}{\beta^2 n^2}\right) \quad (1)$$

Where α is the fine structure constant; $\beta = \frac{v}{c}$;$n = refractive\ index$;λ is the radiation wavelength.

The energy loss is:

$$\frac{dN}{dx}(E_\gamma) = \frac{dN}{dx}\frac{hc}{(\lambda)} \quad (ev/m) \qquad (2)$$

For the muonic neutrinos of OPERA experiment; the index of refraction is the one corresponding to the vacuum,$n = \sqrt{\epsilon_0\mu_0} = 1$; and $\beta = \frac{V(\nu_\mu)}{c}$;where $V(\nu_\mu) = (c + c \cdot 2.48 \times 10^{-5})$ is the speed of neutrinos as the average value of the OPERA experiment.

2 Calculations for the OPERA experiment by Frank-Tamm-Formula

If you keep the validity of the Frank-Tamm-Formula for the physical phenomenon of muonic neutrinos event, greater than the speed of light, then, maximizing the energy loss with a value of wavelength monochromatic of 10nm, you get a loss of energy compatible with the calculations made by Andrew G. Cohen and Sheldon L. Glashow in his paper on the OPERA experiment, given the choice of the minimum limit 10 nm for the Cherenkov radiation by applying the Frank-Tamm formula

2.1 Data

$n = \sqrt{\epsilon_0\mu_0} = 1 \qquad V(\nu_\mu) = (c + c \cdot 2.48 \times 10^{-5}) = 299799892.85296\, m/s$

$\lambda = 10 \times 10^{-9}\, m \quad L = 730\, Km$

Alleged energy lost in the 730 km away , by Cherenkov radiation:

$$\frac{dN}{dx}\frac{hc \cdot 730000\, m}{(\lambda)} = 20.5825\, Gev.$$

Since the muon neutrino experiment OPERA seem to be unaffected by a significant energy loss, corroborated by the recent experiment of ICARIUS; that compels us to increase the wavelength of the Cherenkov radiation alleged.

If you choose the upper limit, approximately, the wavelength of Cherenkov radiation with a value of 600nm, we obtain the energy loss:

$$\lambda = 600 \times 10^{-9} \quad \frac{dN}{dx}\frac{hc \cdot 730000\, m}{(\lambda)} = 5.7173 \times 10^{-3}\, Gev$$

An apparent interesting coincidence is:

$$2\pi\alpha\left(1-\frac{1}{\left(V(\nu_\mu)/c\right)^2 n}\right) \approxeq \frac{1}{\frac{246,22\,Gev}{5.109988\times10^{-4}\,Gev}}$$

where $246,22Gev$ is the vacuum Higss field energy, and $5.109988\times10^{-4}Gev$ is the electron energy

3 Conclusion

But as the recent ICARUS experiment did not detect Cherenkov radiation, so if there is some kind of loss of energy that is compatible with the OPERA and ICARUS experiment. the wavelength must be greater than 600nm, as long as the superluminal phenomenology of neutrinos is consistent with Cherenkov radiation according to the Frank-Tamm-Formula.

References

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