

A Pedagogical Discussion on Neutrino Wave Packet Evolution

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We present a pedagogical discussion on the time evolution of neutrino wave packet in free space. A common treatment is to keep terms up to quadratic order in the energy expansion so that the Fourier transform can be evaluated analytically via Gaussian integral. This leads to a solution representing a "flat" Gaussian distribution with a constant longitudinal width and a spreading transverse width. It is tempting to conclude that special relativity is violated if the neutrino wave packet is detected on its edge. However, we demonstrate that by including higher order terms in the energy expansion the correct geometry of the wave packet will be restored. The corrected solution has a spherical wave front so that it complies with special relativity.

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