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Neutrino oscillation in curved spacetime

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According to General Relativity spacetime is curved in the presence of matter. Einstein-Cartan theory is a simple extension of GR where the spin of the matter also affects the curvature of spacetime. This new structure of spacetime requires an affine connection which is no longer torsionless. So, the connection becomes an independent variable alongside the metric. If we want to include fermions in the theory it is convenient to introduce the tetrads and spin connections. In this discussion, we will try to describe a first order theory of fermions under gravity in terms of tetrads and spin connections. The torsion is not included by hand but the fermions themselves act as a source of torsion. As we vary the action we see that fermionic torsion has no dynamics and gives an effective GR with a four fermi spin-torsion interaction. Although in literature the spin-torsion interaction described is of the form of axial current-axial current coupling, it has been recently proposed that in the most general case it could be a chiral current-chiral current coupling. One of the consequences of spin-torsion chiral coupling is that it can give rise to a force on fermions which in turn can contribute to the mass of the fermion. We calculated the effect of this coupling on propagation of ultra fast neutrinos through matter. We will try to show the effects of the spin-torsion coupling on neutrino oscillation probabilities.

Session

Neutrino Physics

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