



Contribution ID: 994

Type: **Poster Presentation**

Neutrino quantum decoherence due to entanglement with a magnetic field

The origin of neutrino oscillations phenomena emerges due to coherent superposition of different neutrino states. Such superposition can be destroyed by quantum decoherence that appears from entanglement of neutrino with environment. This quantum decoherence can cause suppression of different neutrino oscillations. In this work we study suppression of neutrino-antineutrino oscillations as a result of coupling with a magnetic field. For this aim we describe system composed of neutrinos and a magnetic field by density matrix. It gives an opportunity to trace out degrees of freedom of magnetic field and thus to get reduced system, which consists of only neutrinos. The reduced system is described by non-hermitian Hamiltonian that provides suppression of neutrino-antineutrino oscillations. It is shown that this new effect of quantum decoherence is important in strong magnetic fields peculiar for neutron stars.

Experimental Collaboration

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Session Classification: Poster session

Track Classification: Neutrino Physics