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Matter Effects In Neutrino Chiral Oscillation

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Due to finite masses and mixing, for neutrinos propagate in space-time, there is a transition between left- and right- handed neutrinos, termed chiral rotation, besides the usual oscillation governed by the Dirac equation. The probability of chiral rotation is suppressed by a factor m^2/E^2. For non-relativistic neutrinos, this effects can be significant. In matter, the equation of motion is modified. This changes the behaviors of the oscillations. Neutrinos produced in weak interaction after passing through the matter, the effective energies are split into two different ones depending on the helicity of the neutrino. This results in different oscillation behavior for neutrinos with different helicity, in particular there is a resonant effect for the left-handed neutrino of negative helicity into right-handed neutrino of negative helicity. These effects will have important consequences in the early universe.

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