High Energy Physics - Phenomenology

Triggering collective oscillations by three-flavor effects

Basudeb Dasgupta, Georg G. Raffelt (MPI for Physics, Munich), Irene Tamborra (U. of Bari, INFN Bari & MPI for Physics, Munich)

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Collective flavor transformations in supernovae, caused by neutrino-neutrino interactions, are essentially a two-flavor phenomenon driven by the atmospheric mass difference and the small mixing angle theta_13. In the two-flavor approximation, the initial evolution depends logarithmically on theta_13 and the system remains trapped in an unstable fixed point for theta_13 = 0. However, any effect breaking exact nu_mu-nu_tau equivalence triggers the conversion. Such three-flavor perturbations include radiative corrections to weak interactions, small differences between the nu_mu and nu_tau fluxes, or non-standard interactions. Therefore, extremely small values of theta_13 are in practice equivalent, the fate of the system depending only on the neutrino spectra and their mass ordering.

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