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Flavor evolution in astrophysical environments and nonlinear feedback

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Since the discovery of neutrino oscillations in 1998 and the assessment of the Mikheev-Smirnov-Wolfenstein (MSW) effect, steady progress had been made in understanding neutrino flavor conversions in astrophysical environments. Neutrino self-interactions have proven to complicate the problem, making the evolution equations intrinsically nonlinear, and have triggered a decade of theoretical investigations. A variety of flavor instabilities has been uncovered, depending on the physical conditions and the geometry of the environment considered. In anisotropic media, the most general mean-field equations include corrections to the relativistic limit, due to the nonzero neutrino mass. This contribution creates a coupling between neutrino and antineutrino referred as *helicity* or *spin coherence*.

In this talk, we focus on the progress made in neutrino flavor evolution in astrophysical environments, and we discuss the effects of helicity coherence on propagation in binary neutron star mergers and core-collapse supernovae [1]. Such studies are crucial to assess the actual impact on the supernova dynamics and on the nucleosynthetic abundances.

[1] A. Chatelain and C. Volpe, "Helicity coherence in binary neutron star mergers and nonlinear feedback", Phys.Rev. D95 (2017) no.4, 043005, arXiv:1611.01862 [hep-ph].

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