

Neutrinos and the discovery of the diffuse supernova neutrino background

The observation that neutrinos change flavor during propagation – termed neutrino oscillations - has shown that neutrinos are massive elementary particles with mixings which points to physics beyond the Standard Model and impacts astrophysics and cosmology. Neutrinos from core-collapse supernovae were observed only once, with SN1987A. Important open questions remain both on neutrino properties and on flavor evolution in dense environments.

The "Stage" is focussed on theoretical neutrino astrophysics and involves both theoretical and phenomenological aspects, in relation with the upcoming discovery of the diffuse supernova neutrino background (DSNB). The DSNB fluxes depend on the core-collapse supernova rate (related to the star formation rate) and on redshifted supernova neutrino fluxes. The latter involve flavor evolution in dense environments which requires further theoretical understanding, in particular due to the presence of significant neutrino self-interactions. During the stage the student will work on the predictions of the neutrino spectra and on what we will learn from such an observation. The upcoming measurement of the diffuse supernova neutrino background is expected from either by the Super-Kamiokande+Gd (just started) or the Hyper-Kamiokande (approved) experiments in Japan.

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