Contribution ID: **404** Type: **Parallel**

Latest results of the DSNB search at Super-Kamiokande

'DSNB'stands for Diffuse Supernova Neutrino Background, i.e. the continuous flux of neutrinos and antineutrinos emitted by all core-collapse supernovae (CCSNe) that have occurred in the observable universe. This elusive signal has yet to be observed and, with an estimated rate of ~1 Hz of CCSNe in the universe, it bears information on e.g. the explosion mechanism of supernovae, intrinsic neutrino properties, or the star and black hole formation history of the universe.
The detection of this signal is a primary step to accessing this rich phenomenology and is one of the main goals of the Super-Kamiokande (SK) experiment. Owing to its 39.3 m x 41.4 m tank filled with 50 kton of water, few DSNB electron antineutrinos are expected to interact in the fiducial volume via the inverse beta decay (IBD) channel. Since 2020, the DSNB search is a flagship program of the so-called SK-Gd experiment, that has been loading the water of the SK tank with gadolinium (Gd) in order to enhance the detection capability of the delayed signal stemming from the capture of the IBD neutron. To capitalize on the enhanced capability of this detector upgrade, a continuous effort is also deployed in refining the reconstruction routines to better discriminate signal from background.
In this talk, we propose to review all these efforts and report the latest hints for the DSNB signal at SK since 2021 and the analysis of the data of the pure water phase, with in particular a 2.3 sigma rejection of the no-DSNB hypothesis.

Secondary track

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Session Classification: T03

Track Classification: T03 - Neutrino Physics