

Diffuse Supernova Neutrino Background search at Super-Kamiokande with neutron tagging

Executive summary

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What is this contribution about? We present the neutron identification algorithm used in the search for the Diffuse Supernova Neutrino Background at Super-Kamiokande water-Cherenkov detector: its role in the current analysis, and prospects for future searches enhanced by the dissolution of Gadolinium in the SK water.

Why is it relevant / interesting? In recent years, limits on the DSNB flux have been approaching theoretical predictions. At SK, where the detection channel is the Inverse Beta Decay, with a positron and a neutron in the final state, detecting the weak signal from the neutron, in coincidence with the positron, is a powerful tool to improve our sensitivity. Further, a recent SK upgrade, which dissolved Gadolinium in the SK water, is specifically designed to enhance the signature of neutrons in the SK tank, providing a promising outlook for the sensitivity of upcoming searches.

What have we done? We fully incorporated neutron tagging into the DSNB search at SK using data from the SK-IV data-taking period, the first data-taking period in which neutron tagging was possible.

What is the result? We set limits on the DSNB flux (currently the most stringent experimental limits on the DSNB). We also provide preliminary projections of sensitivity for the SK periods with Gd.