

Probing free nucleons with (anti)neutrinos

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We discuss a method to study free protons and neutrons using $\nu(\bar{\nu})$ -hydrogen (H) Charged Current (CC) inelastic interactions using ν and $\bar{\nu}$ CC interactions on both H and nuclear targets. Probing free nucleons with (anti)neutrinos provides information about their internal structure, as well as a crucial input for the modeling of $\nu(\bar{\nu})$ -nucleus (A) interactions. Such measurements can also represent a tool to address some of the limitations of accelerator-based neutrino scattering experiments on nuclear targets, originating from the combined effect of the unknown (anti)neutrino energy and of the nuclear smearing. We also discuss a method to impose constraints on nuclear effects and calibrate the (anti)neutrino energy scale in $\nu(\bar{\nu})$ -A interactions, which are two outstanding systematic uncertainties affecting present and future long-baseline neutrino experiments. The method uses $\nu(\bar{\nu})$ -H interactions as control samples and is based on the approach we recently proposed integrating both nuclear and “solid” hydrogen targets within a detector designed to provide an accurate control of the configuration, chemical composition and mass of the targets.

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No

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