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Neutral-current background induced by atmospheric neutrinos at large liquid-scintillator detectors

Atmospheric neutrinos contribute significantly to irreducible backgrounds through their neutral-current (NC) interactions with ^{12}C nuclei in liquid-scintillator (LS) detectors, impacting measurements of diffuse supernova neutrino background (DSNB), nucleon decay, and reactor neutrinos. This talk extends our preceding paper [Phys. Rev. D. 103. 053001], by conducting a first-time systematic exploration of NC backgrounds towards MeV region of reactor neutrinos. We employ up-to-date neutrino generator models from GENIE and NuWro, a TALYS-based nuclear deexcitation package and a Geant4-based detector simulation for our calculations. Our primary focus is predicting NC background in experimental searches for inverse-beta-decay signals below 100 MeV visible energy. Furthermore, to gain a deeper understanding of the characteristics of atmospheric neutrino NC background in LS, we investigate model dependence in our NC background predictions using various data-driven models. Factors like initial neutrino-nucleon NC interaction, nuclear model, final-state interaction model, nucleus deexcitation, and secondary interactions on final-state particles are considered. Finally, the implications of NC backgrounds for the detection of reactor neutrino and DSNB are also discussed.

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