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Muon-induced spallation backgrounds for MeV astrophysical neutrino signals in Super-Kamiokande

When muons travel through matter, their energy losses lead to nuclear breakup (“spallation”) processes. The subsequent decays of unstable daughter nuclei produced by cosmic-ray muons are important backgrounds for low-energy astrophysical neutrino experiments. Even though Super-Kamiokande has strong cuts to reduce these spallation-induced backgrounds, the remaining rate is much larger than the signal rates for energies 8 - 18 MeV. We show how muons induce showers in water, produce secondary particles, and how these secondaries produce isotopes. We outline how to implement more effective background rejection techniques using this information. This could lead to new physics results, as both solar and Diffuse Supernova Neutrino Background studies are background-limited, and reducing backgrounds by even a factor of a few could quickly lead to new discoveries. This work appeared in arXiv:1402.4687.

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