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Sensitivity to Nucleon Decay in Theia

New developments in the production of water-based liquid scintillators and the separation of scintillation and Cherenkov light would make it possible for Theia to provide unique sensitivity to many modes of nucleon decay. While modes of decay with low-mass daughters, such as $p \rightarrow e^+ \pi^0$, are best studied with large Cherenkov detectors, decays with heavy products below the Cherenkov threshold ($p \rightarrow \nu K$) only are undetectable in pure Cherenkov detectors except through secondary interactions and nuclear deexcitations. The addition of scintillation light will lead to increased sensitivity and background rejection for $p \rightarrow \nu K$, where the K is always below the Cherenkov threshold. At the lower-end of the spectrum, nucleon decay through invisible modes are only detectable by their subsequent nuclear deexcitations which benefit most from increased energy resolution and background suppression.

Mini-abstract

Theia will offer competitive and leading sensitivity to various mode of nucleon decay.

Experiment/Collaboration

Theia

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