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Search for Invisible Nucleon Decay in the SNO+ Experiment

SNO+ is a multipurpose, large-scale neutrino experiment located deep underground in Sudbury, Ontario, whose aims include studies of neutrinoless double beta decay, solar neutrinos, reactor neutrinos and other more exotic physics. SNO+ is currently taking data in its initial water-fill phase, which will be used to commission upgrades to the electronics and calibration sources. During this phase, SNO+ has a unique sensitivity to certain invisible modes of nucleon decay, in which the nucleon decays to some undetected final state, such as n->3nu. Nucleon decay in O16 can lead to excited states of O15 or N15 which will deexcite, emitting a gamma which can be detected.

The current limits on this model-independent mode are from SNO and Kamland. However, SNO+ can improve upon these in its relatively short water phase as SNO's use of D2O brought higher backgrounds from the neutral current events while Kamland's limit suffers from the lower branching ratio to a visible signal in carbon. The major backgrounds to this search will come from solar and reactor neutrinos and radioactivity from the U and Th chains. With just 3 months of data taking, SNO+ expects to achieve world-leading sensitivity to these modes.

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