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Nucleon Decay in Super-Kamiokande: Results and Prospects

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The Standard Model of particle physics describes the strong and electroweak interactions among all known elementary particles. Despite its great success to explain many experimental results, it does not address the unification of these forces. Grand Unified Theories (GUTs) attempt to unify these forces by embedding the SM group into a larger gauge group. Typical grand unification energies are far beyond the reach of accelerators. However, a common feature of GUTs is nucleon decay, generating baryon number violating processes.
GUTs can be classified by the presence or absence of supersymmetry in the theory. Usually, in non-supersymmetric GUTs the gauge boson mediated mode where a proton decays into a positron and a neutral pion is preferred. However, in SUSY GUTs, another mode can become favored where the proton decays into an anti-neutrino and a charged Kaon.
The Super-Kamiokande (SK) experiment is a 50-kton deep underground water Cherenkov detector located in Mt. Ikenoyama in Japan. This multi-purpose detector is able to search for many different nucleon decay modes including the two benchmark modes mentioned above and it has been doing so for more than 20 years. In this talk, I will present SK results on nucleon decay and describe a new approach to reconstruct the SUSY favored proton decay mode using a new reconstruction algorithm and how it can improve the sensitivity for this mode.

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