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Search for proton decay via $p \to e^+\eta$ and $p \to \mu^+\eta$ in Super-Kamiokande

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Grand Unified Theories explain the unification of the electromagnetic, weak, and strong forces and most of them predict protons to decay into lighter particles. The latest result of the proton decay search for $p \to e^+/\mu^+ + \eta$ channels in Super-Kamiokande will be discussed in this presentation.
The cross sections of η nuclear effect are improved compared to previous work, resulting in reducing their uncertainties by a factor of two. We analyze the data exposure of 0.373 Mton·years (3244.4 live days) of Super-Kamiokande.
No significant data excess was found above the expected number of atmospheric neutrino background events and no indication of proton decay was observed for either mode.
The lower limits on the partial lifetimes of 1.4×10^{34} years for $p \to e^+\eta$ and 7.3×10^{33} years for $p \to \mu^+\eta$ were imposed at 90% CL, around 1.5 times longer limits than the previous study. These results set the most stringent limits in the world.

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