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Current Status and Upgrade of the Super-Kamiokande experiment

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Super-Kamiokande (Super-K) is an already successful experiment in neutrino research, involved in the discovery of the neutrino oscillations, and performing analysis on a large spectrum of the neutrino physics: from atmospheric neutrinos to solar neutrinos, including neutrino produced by the J-PARC beam in the T2K experiment. The Super-K collaboration is now aiming at the detection of Supernova Relic Neutrino (SRN), a diffuse background of neutrinos produced by the past supernovae during the history of the universe. This SRN signal is expected to be $0.3sim1.5\ nu$/cm^2/s (17.3 MeV threshold) but has not been observed so far due to the high background level. Its discovery would be an important key to understand the history of star formations in the universe.

Due to the energy and the cross-sections of supernova neutrinos, most of the SRN interactions in the Super-K detector are expected to be inverse $beta$ decay reactions ($overline_e + prightarrown + e^+$). The detection of the neutron, in coincidence with the e^+ uerenkov light, would be a clear
signature of the SRN signal, helping reduce most of the background events affecting its detection. The Super-K collaboration is then planning to load 0.1% of Gadolinium in the Super-K water, in order to take benefit from its high thermal neutron capture cross-section and its clear neutron capture
signal. In this presentation, the last results of the Super-Kamiokande experiment are briefly presented, as well as the last studies of the feasibility of the Gadolinium loading and its physics interests.

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