Contribution ID: **26** Type: **not specified**

Gadolinium in water Cherenkov detectors improves detection of supernova electron neutrino

Saturday, March 12, 2016 9:20 AM (20 minutes)

Detecting supernova ν_e is essential for testing supernova and neutrino physics, but the yields are small and the backgrounds from other channels large, e.g., $\sim 10^2$ and $\sim 10^4$ events, respectively, in Super-Kamiokande. We develop a new way to isolate supernova ν_e, using gadolinium-loaded water Cherenkov detectors. The forward-peaked nature of $\nu_e + e^- \rightarrow \nu_e + e^-$ allows an angular cut that contains the majority of events. Even in a narrow cone, near-isotropic inverse beta events, $\bar{\nu}_e + p \rightarrow e^+ + n$, are a large background. With neutron detection by radiative capture on gadolinium, the background events can be individually identified with high efficiency. The remaining backgrounds are smaller and can be measured separately, so they can be statistically subtracted. Super-Kamiokande with gadolinium could measure the total and average energy of supernova ν_e with $\sim 20\%$ precision or better each (90% C.L.). Hyper-Kamiokande with gadolinium could improve this by a factor of ~ 5. This precision will allow powerful tests of supernova neutrino emission, neutrino mixing, and exotic physics. Unless very large liquid argon or liquid scintillator detectors are built, this is the only way to guarantee precise measurements of supernova ν_e.

Primary author: Dr LAHA, Ranjan (KIPAC, Stanford University)

Co-author: Prof. BEACOM, John (Ohio State University)

Presenter: Dr LAHA, Ranjan (KIPAC, Stanford University)

Session Classification: Multi-detector and multi-flavor prospects