Contribution ID: **29** Type: **Contributed Talk**

Development of early warning method using pre-supernova neutrino light curves

Thursday, October 2, 2025 8:50 AM (20 minutes)

Pre-supernova neutrinos are predominantly produced through thermal processes and nuclear weak interactions in massive stars during the final stages of stellar evolution, with increasing energy and luminosity. The detection of these neutrinos provides an early warning of core-collapse supernovae to neutrino, gravitational wave, and electromagnetic telescopes.
KamLAND, a 1-kiloton liquid scintillator detector, and Super-Kamiokande, a 22.5-kiloton water Cherenkov detector, are both capable of detecting electron antineutrinos through inverse beta decay under low-background conditions, using delayed coincidence technique. Both detectors are sensitive to pre-supernova neutrinos from stars within $\mathcal{O}(100)$ parsecs and have already implemented pre-supernova neutrino alarm systems. These alarm systems are based on the significance of statistical excess over the background event rate.
To enable earlier warning, we develop new alarm method incorporating the time evolution of the expected pre-supernova neutrino flux. In this presentation, we report the latest status of this new method, including the alarm significance evaluations based on Monte Carlo simulations assuming KamLAND and Super-Kamiokande.

Neutrino Properties

No

Neutrino Telescopes & Multi-messenger

Neutrino Telescopes & Multi-messenger

Neutrino Theory & Cosmology

No

Data Science and Detector R&D

No

Author: SAITO, Keita (Tohoku university)

Co-authors: Dr ICHIMURA, Koichi (Research Center for Neutrino Science, Tohoku University); ISHIDOSHIRO, Koji (Tohoku University); MARTI MAGRO, Lluis (University of tokyo); NASCIMENTO MACHADO, Lucas (University of Glasgow); IKEDA, Motoyasu (University of tokyo); KAWADA, Nanami (RCNS, Tohoku Univ.); WENDELL, Roger Alexandre (Kyoto University); HU, Zhuojun (Kyoto University)

Presenter: SAITO, Keita (Tohoku university)

Session Classification: Data Science and Detector R&D

Track Classification: Data Science and Detector R&D