Contribution ID: **119** Type: **Parallel Contributed Talk**

Supernova Model Discrimination with Hyper-Kamiokande

Friday, 19 February 2021 10:20 (20 minutes)

Core-collapse supernovae are among the most magnificent events in the observable universe. They produce many of the chemical elements necessary for life to exist and their remnants—neutron stars and black holes—are interesting astrophysical objects in their own right. However, despite millennia of observations and almost a century of astrophysical study, the explosion mechanism of core-collapse supernovae is not yet well understood.

Hyper-Kamiokande is a next-generation neutrino detector that will be able to observe the neutrino flux from the next galactic core-collapse supernova in unprecedented detail.
We focus on the first 500 ms of the neutrino burst, corresponding to the accretion phase, and use a newly-developed, high-precision supernova event generator to simulate Hyper-Kamiokande's response to five different supernova models. We show that Hyper-Kamiokande will be able to distinguish between these models with high accuracy for a supernova at a distance of up to 100 kpc.

Once the next galactic supernova happens, this ability will be a powerful tool for guiding simulations towards a precise reproduction of the explosion mechanism observed in nature.

Collaboration name

Hyper-Kamiokande

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Session Classification: Low Energy Neutrinos