Contribution ID: **57** Type: **not specified**

Probing non-standard neutrino interactions from future supernova neutrino observations

Wednesday 27 July 2022 11:36 (18 minutes)

Non-standard neutrino interactions with a massive boson can produce the bosons in the core of core-collapse supernovae (SNe). After the emission of the bosons from the SN core, their subsequent decays into neutrinos can modify the SN neutrino flux. We show future observations of neutrinos in a next galactic SN in Super-Kamiokande (SK) and Hyper-Kamiokande (HK) can probe flavor-universal non-standard neutrino couplings with a boson sveral orders beyond the constraint from excessive energy loss of SN 1987A neutrino burst. We also discuss sensitivity of flavor-universal non-standard neutrino interactions in future observations of diffuse neutrinos from all past SNe, known as the diffuse supernova neutrino background (DSNB). In our analysis, observations of neutrinos in all past SNe in HK, JUNO and DUNE experiments can probe such couplings a factor of ~ 2 beyond the SN 1987A constraint. However, our prediction could include uncertainty lager than a factor of ~ 2 due to the difficulty of the estimation of diffuse neutrino flux from all past SNe.

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Session Classification: Parallel Session A

Track Classification: Astroparticle physics