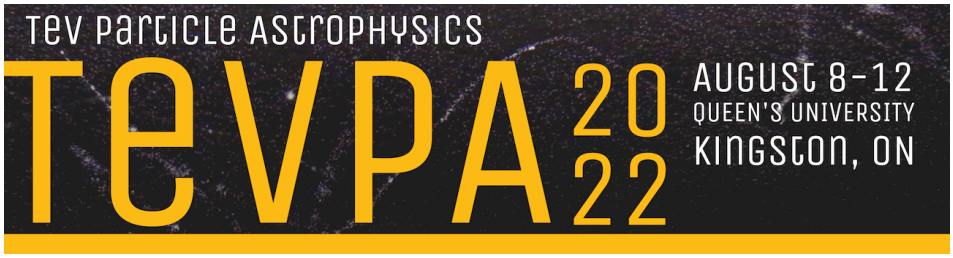

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Towards Powerful Probes of Neutrino Self-Interactions in Supernovae

Tuesday 9 August 2022 16:30 (20 minutes)

Neutrinos remain mysterious. As an example, enhanced self-interactions (νSI), which would have broad implications, are allowed. At the high neutrino densities within core-collapse supernovae, νSI should be important, but robust observables have been lacking. We show that νSI make neutrinos form a tightly coupled fluid that expands under relativistic hydrodynamics. The outflow becomes either a burst or a steady-state wind; which occurs here is uncertain. Though the diffusive environment where neutrinos are produced may make a wind more likely, further work is needed to determine when each case is realized. In the burst-outflow case, νSI increase the duration of the neutrino signal, and even a simple analysis of SN 1987A data has powerful sensitivity. For the wind-outflow case, we discuss several promising ideas that may lead to new observables. Combined, these results are important steps towards solving the 35-year-old puzzle of how νSI affect supernovae.

Collaboration name

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