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Neutrino flavor equilibration and νp process nucleosynthesis in core-collapse supernovae

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An enduring mystery in nuclear astrophysics pertains to the relatively high observed abundances of the proton-rich isotopes ^{92,94}Mo and ^{96,98}Ru. An attractive proposal to solve this problem is called the νp process. This process could operate in a core-collapse supernova (CCSN) hot bubble, which is formed by a neutrino-driven matter outflow from the surface of the proto-neutron star after the shock is launched. Under certain conditions, the outflow can be proton-rich, and electron antineutrino captures on protons can create a subdominant neutron population, triggering (n, γ) and (n, p) reactions, which combined with (p, γ) provide a pathway to make certain proton-rich nuclides considerably beyond the iron peak.

The precise outcome of νp process nucleosynthesis depends on the exact physical conditions in the outflow, such as entropy, expansion timescale, electron fraction, and neutrino emission characteristics (luminosities and spectra). Here, we examine the effects of neutrino flavor equilibration near a proto-neutron star on the yields of the νp process. Such flavor equilibration may arise, for instance, as a result of fast neutrino flavor conversions near a supernova core.

In-person or Virtual?

In-person

Primary authors: FRIEDLAND, Alexander (SLAC); PATWARDHAN, Amol (SLAC); MUKHOPADHYAY, Payel (Stanford University); Mr XIN, Shuo (Stanford University)

Presenter: PATWARDHAN, Amol (SLAC)

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