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Constraining electron-capture rates in core-collapse supernovae near N=50 via the (t,3He) charge-exchange reaction

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Gamow-Teller strengths (B(GT)) are of importance for the estimation of weak reaction rates for a variety of astrophysical phenomena, such as thermonuclear and core-collapse supernovae, and the crustal heating of neutron stars. Direct measurements of B(GT) from β-decay experiments are limited by the Q-value window, if feasible at all. Data from charge-exchange (CE) reactions provides information about the full GT strength distribution based on the proportionality between GT strength and the cross section at vanishing momentum transfer. During the recent years, the (t,^{3}He) CE reaction has become an important tool for studying GT strengths. Such experiments have been routinely performed at the NSCL with the goal of benchmarking existing theoretical calculations of weak interaction rates in astrophysical phenomena.
Recent studies have shown that nuclei in the region N=50 contribute strongest to deleptonization of central zone in core-collapse supernovae. However, electron capture (EC) rates in this region are poorly constrained by theories. In recent (t,^{3}He) experiments performed at the NSCL, the B(GT) distributions for the ^{88}Sr and ^{93}Nb nuclei were extracted. Together with existing data for the ^{90}Zr, ^{96,100}Mo nuclei, a reasonable set of cases are available to test the theoretical models in this region from which EC rates are estimated. In this talk, results from the experiments, with a focus on ^{93}Nb(t,^{3}He), and possible implications for core-collapse supernovae will be discussed.

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