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Two-body Weak Interactions Using Correlated Basis Theory SHANNON COWELL, JOSEPH CARLSON, LANL — In the last several decades it has become clear that neutrino interactions play an important role in many astrophysical environments from the dynamics of core-collapse supernovae to the cooling of neutron stars. Simulations of such processes require an accurate description of neutrino interactions with nucleon matter at a variety of temperatures, proton fractions and densities. Many previous calculations of the relevant neutrino cross sections are inconsistent, using empirical effective interactions together with bare weak operators. We address this inconsistency using correlated basis theory (CBT) which allows for a systematic definition of both effective interactions and effective weak operators. Previous CBT calculations of the one-body weak processes relevant in core collapse supernova have shown that short range correlations are important in both the effective interactions and operators. For example, neutrino mean free paths calculated using CBT and TDA are a factor of 2-4 larger than the simple non-interacting Fermi gas. In this talk, we will discuss the CBT two-body weak operators relevant for the highly asymmetric matter of neutron stars.

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