

Abstract Submitted
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Neutrino Cross Section For Interaction With Helium-4 Nuclei¹

GEORGE K. FULLER, UC Santa Barbara and T-2 at LANL, ANNA C. HAYES, GERALD M. HALE, T-2 at LANL, UCSB AND LANL T-2 COLLABORATION — Using updated calculations of the energy eigenstates of the ${}^4\text{He}$ nucleus and the no core shell model of atomic nuclei, we have produced a more accurate calculation of the cross section for interaction between neutrinos/antineutrinos and ${}^4\text{He}$ for both neutral- and charged-current interactions. Previous calculations of this cross section were performed by only taking into account the strong contribution from Gamow-Teller transitions and neglecting the higher-order operators which allow transitions to other states. The Gamow-Teller-only approximation for the neutrino cross section is efficacious for the needs of most Standard Model Big Bang nucleosynthesis calculations, where the neutrino cross section of ${}^4\text{He}$ is not a significant contributor to neutron and deuterium abundance. However, using the Gamow-Teller-only approximation strains the bounds on the accuracy needed by newer calculations which aim to include Beyond-Standard Model effects for reproducing precise cosmological data. By including all energy eigenstates in the calculation and including the effects from the energy widths of each state, we can provide a neutrino energy-dependent ${}^4\text{He}$ cross section which meets these higher needs of precision.

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