Spin-Dependent Transitions in Nuclei and Neutrino-Nucleus Reactions

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We have studied neutrino-nucleus reactions on light nuclei such as ^{12}C and ^{4}He based on new shell model Hamiltonians [1]. The new Hamiltonian take into account important roles of of spin-isospin interactions that leads to proper shell evolution [2]. An important general role of the tensor component of the interaction is pointed out [3]. Gamow-Teller and spin-dipole transitions are investigated with the use of the new Hamiltonian, and applied to neutrino-nucleus reactions induced by both DAR and supernova neutrinos. The neutrino-induced reaction cross sections for ^{4}He and ^{12}C have been found to be enhanced compared to those obtained by the conventional Hamiltonians. A possible enhancement of the production yields of ^{7}Li and ^{11}B during supernova explosions as well as the effects of neutrino oscillations is pointed out [1,4].

Neutrino-induced reactions on Fe and Ni isotopes are studied based on a new shell model Hamiltonian recently proposed for *fp*-shell, GXPF1J [5]. Gamow-Teller transitions and strength distributions are investigated, and applied to charge-exchange and neutral-current neutrino-nucleus reactions. Neutral current reaction cross sections induced by supernova neutrinos are found to be enhanced compared with those obtained by a modified KB3 Hamiltonian [6]. Neutron and proton knock-out reactions are investigated, and a possible implication on neutrino-induced nucleosynthesis processes is discussed.

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