ESTIMATION OF SUPERNOVA-NEUTRINO NUCLEAR RESPONSES

Wafa Almosly [1] , Emanuel Ydrefors [1,2], Jouni Suhonen [1]
[1] University of Jyvaskyla, Department of Physics, P.O. Box 35, FI-40014, Finland
[2] Instituto Tecnológico de Aeronaáutica, DCTA, 12228-900, São José dos Campos, SP, Brazil

In a supernova explosion a huge amount of all three neutrino types and their antiparticles are emitted. These neutrinos are valuable probes of supernova mechanisms and physics beyond the standard model. Reliable theoretical estimation of the nuclear responses to supernova neutrinos for relevant nuclei are important for the studies of the neutrino properties and nucleoynthesis of heavy elements.

We have computed the cross sections for the neutral-current and charged-current (anti)neutrino scatterings off the stable cadmium isotopes. The main focus is on supernova neutrinos. The stable cadmium nuclei are interesting nuclei for experimental and theoretical activities. For example, ^{116}Cd is an interesting nucleus for the neutrinoless double beta decay. One presently running experiment for neutrino studies is the COBRA experiment which is based on stable cadmium isotopes.

The nuclear states of the even-mass and odd-mass cadmium isotopes have been constructed using the quasiparticle random-phase approximation (QRPA) and the microscopic quasiparticle-phonon model (MQPM), respectively. The nuclear response to supernova (anti)neutrinos has been estimated by folding the computed cross sections with a two parameter Fermi-Dirac neutrino-energy distribution.

Currently, we continue our work to study supernova-neutrino scattering off the stable lead isotopes. The theoretical estimates of neutrino-nucleus responses for the stable lead targets are essential for the interpretation of the results from HALO and similar detection experiments.