



Contribution ID: 3

Type: Oral

Neutrino-induced reactions on ^{13}C and ^{16}O at supernova neutrino energies

Friday, 28 February 2020 09:40 (20 minutes)

Neutrino-nucleus reactions on ^{13}C and ^{16}O at supernova (SN) energies are investigated by shell-model calculations with the use of new Hamiltonian, which can describe spin responses of nuclei quite well. Carbon-based scintillators and water-Cherenkov scintillators relevant to SN observation and experiments at the spallation neutron sources are now available. Cross sections for various particle and γ emission channels are evaluated by the statistical Hauser-Feshbach method.

For ^{13}C , total reaction cross sections at reactor and solar neutrino energies were studied [1]. Here, we extend our study to SN neutrino energies up to ≈ 50 MeV, and evaluations of partial cross sections for proton and neutron emission channels within the Standard Model [2]. Among them, a reaction channel $^{13}\text{C}(\bar{\nu}, \bar{\nu}'n)^{12}\text{C}(2^+, 4.44 \text{ MeV})$ followed by prompt 4.44 MeV γ emission is discussed in relation to the shape distortion in the 5-7 MeV range in the measured neutrino spectrum in the short-baseline reactor neutrino experiments [3]. The cross section is too small to explain the extra enhancement in the spectrum.

Coherent elastic scattering cross section is obtained for ^{13}C , and compared with that for ^{12}C . Nuclear structure effects in the cross sections are pointed out [2]. Possible merit of large recoil momenta in light nuclei for the study of neutron distributions in nuclei is discussed.

For ^{16}O , spin-dipole strength, which are the dominant contributions to the cross sections, and neutrino-induced reaction cross sections on ^{16}O are investigated [4]. Charged-current cross sections induced by SN neutrinos and their dependence on Mikheyev-Smirnov-Wolfenstein neutrino oscillations are discussed for a future SN burst [5].

[1] T. Suzuki, A. B. Balantekin and T. Kajino, Phys. Rev. C 86, 015502 (2012).

[2] T. Suzuki, A. B. Balantekin, T. Kajino and S. Chiba, J. Phys. G 46, 075103 (2019).

[3] J. M. Berryman, V. Brdar and P. Huber, Phys. Rev. D 99, 055045 (2019).

[4] T. Suzuki, S. Chiba, T. Yoshida, K. Takahashi and H. Umeda, Phys. Rev. C 98, 034613 (2018).

[5] K. Nakazato, T. Suzuki and M. Sakuda, PTEP 2018, 123E02 (2018).

Primary authors: SUZUKI, Toshio (Nihon University); Prof. BALANTEKIN, A. Baha (Wisconsin University); Prof. KAJINO, Toshitaka (Beihun University & The University of Tokyo); Prof. CHIBA, Satoshi (Tokyo Institute of Technology)

Presenter: SUZUKI, Toshio (Nihon University)

Session Classification: Contributed Talks