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Capture of neutrinos from the accelerator by Iodine-127 nuclei

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Current studies of neutrino-nucleus interactions have come to a situation where it has become both possible and necessary to study in detail the capture of neutrinos by nuclei. In this paper we study the interaction of high-energy neutrinos from the SNS accelerator with the detector based on the Iodine-127 [1]. We calculate the resonance structure of the charge-exchange strength function *S(E)* and its influence on the neutrino capture cross sections of the ^{127}I nucleus. Three types of isobaric resonances: the giant Gamow-Teller resonance (GTR) [2], the analog resonance and the low lying pygmy resonances [3] are investigated in the framework of the self-consistent theory of finite Fermi systems [4]. The calculations of neutrino capture cross sections $\sigma(E)$ for the ^{127}I nucleus have been carried out taking into account the resonance structure of the strength function *S(E)* and the influence of GTR on the energy dependence of $\sigma(E)$ has been analyzed and it has been obtained that the contribution of GTR exceeds 80% in the calculations of the cross-section $\sigma(E)$. The contribution of high energy neutrinos to the neutron emission process with the formation of ^{126}I and ^{125}I isotopes has been analyzed.
These results can be used to interpret experimental data and modeling results for planning new-generation experiments on the detection of rare events, such as SNO+ [5], LEGEND [6], CUPID [7], and others.

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Section

Neutrino physics and nuclear astrophysics

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