Neutrino-^{12}C Interactions within the PQRPA

F. Krmpotić, A. Mariano, A. Samana

Departamento de Física, Facultad de Ciencias Exactas, Universidad Nacional de La Plata, CC 67, 1900 La Plata, Argentina

The $^{12}C(\nu_e, e^-)^{12}N$ and $^{12}C(\nu_\mu, \mu^-)^{12}N$ cross sections are just tools in neutrino oscillation experiments with liquid scintillators. As such, and to be useful, they must be accurately accounted for by nuclear structure models. From the recent works [1-3] we have learned, however, that:(i) the RPA is unable to explain by itself the weak processes (β-decay, μ-capture, and ν induced reactions) among the ground states of the triad $^{12}B - {}^{12}C - {}^{12}N$, and (ii) the agreement between the theory and the data is significantly improved when the RPA is supplemented with the pairing correlations, which smear the Fermi surface. Initially this has been put into practice *ad hoc* [1,2], and later self-consistently in the framework of a full QRPA [3]. But, because of the degeneracy of the nuclear states, which is inherent in the BCS treatment of a $N = Z$ nucleus, there are difficulties within the QRPA in choosing the ground states for ^{12}B and ^{12}N. This problem is circumvented when the particle number projected QRPA (PQRPA) is used [4]. A thorough discussion of weak observables in ^{12}C within the PQRPA is presented.

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