Study of nuclear correlation effects via ^{12}C$(\vec{p},\vec{n})^{12}$N(g.s.;1^+) at 296 MeV

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Nuclear correlation effects are of considerable interest in nuclear physics. At large momentum transfers of $q \simeq 1$–3 fm^{-1}, Alberico *et al.* [1] have shown that the isovector response of the spin-longitudinal (pionic) mode should be enhanced due to nuclear correlation effects, while that of the spin-transverse (rho-mesonic) mode should be quenched. In the measurement of quasielastic (p,n) reactions [2], the enhancement of the pionic mode has been observed, which supports the existence of nuclear correlations. However, the enhancement of the rho-mesonic mode has been also observed, which contradicts the prediction. Thus, we measured the Gamow-Teller (GT) ^{12}C$(\vec{p},\vec{n})^{12}$N(g.s.;1^+) reaction in order to investigate (1) whether there is another evidence of the pionic enhancement in nuclei, and (2) whether the discrepancy in the rho-mesonic mode is a unique phenomenon of the quasielasitic (p,n) reaction.

In this experiment, a complete set of polarization transfer coefficients was measured for the first time in order to separate the cross section into pionic (ID_q), rho-mesonic (ID_p), and the other (ID_n and ID_0) polarized cross sections. The proton beam energy was 296 MeV where distortion effects become minimum and GT transitions are predominantly excited. The neutron energy and its polarization were measured by the neutron detector/polarimeter NPOL3 [3].

Figure 1 shows the experimental results for ID_q and ID_p. We compared the experimental results with DWIA calculations using the computer code CRDW [4] in order to investigate nuclear correlation effects. The dashed curves represent DWIA results with the free response function (= without nuclear correlations). Significant differences between experimental and theoretical results are observed especially at large momentum transfers of $q \simeq 1.6$ fm^{-1}. The solid curves represent DWIA calculations with RPA response functions (= with nuclear correlations). These calculations reproduce the experimental data at large momentum transfers, which supports the existence of nuclear correlation effects in both pionic and rho-mesonic modes.

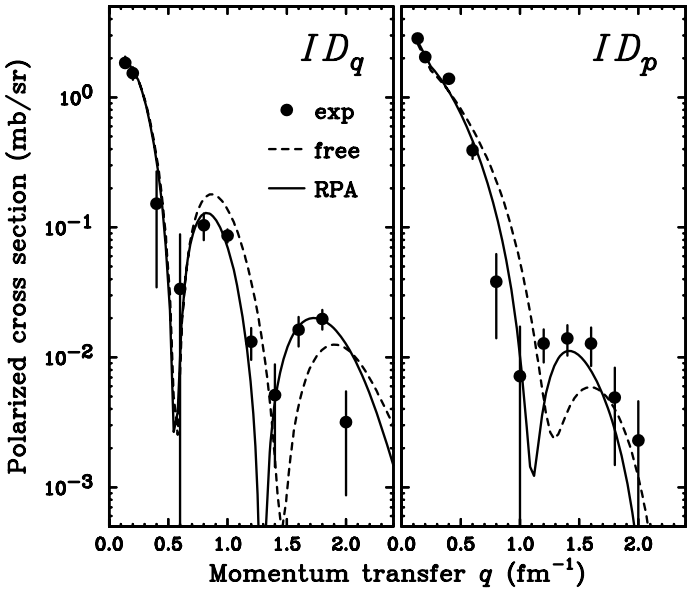

Figure 1: Measured polarized cross sections ID_q (left) and ID_p (right) for ^{12}C$(\vec{p},\vec{n})^{12}$N(g.s.;1^+) at 296 MeV. The solid and dashed curves are the DWIA results with RPA and free response functions, respectively.

References

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