Momentum Transfer Dependence of Spin Isospin Modes in Quasielastic Region

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We report the momentum-transfer dependence of spin longitudinal ID_q, and spin-transverse ID_p, polarized cross sections which are relevant to spin-longitudinal R_L and spin-transverse R_T response functions, respectively. In the π+p+g′ model with a standard value of g′, the pion exchange produces a moderately attractive spin-longitudinal interaction for $q > 0.8$ fm^{-1} while the rho-meson exchange produces a repulsive spin-transverse interaction for the wide range of q. In the quasi-elastic region for $q > 1$ fm^{-1}, an interaction with these characteristics would lead to an enhancement and a softening (shift toward lower energy transfer) of R_L with respect to the free response function, and a quenching and a hardening (shift toward higher energy transfer) of R_T.

Figure 1 compares the experimental ID_q, and ID_p with the DWIA+RPA calculations. The solid curves axe the results of DWIA calculations with the RPA response functions employing (g'_{NN}, $g'_{N\Delta}$, $g'_{\Delta\Delta}$) = (0.6, 0.3, 0.5) and $m^*(O)=0.7m_N$. The dashed curves are the DWIA results with the free response functions employing $m^*(O) = m_N$. The DWIA+RPA calculations.could reproduce ID_q fairly well at the low energy-transfer region of $w_{lab} \leq 60$ MeV, while they fail to reproduce ID_q, at the high energy-transfer region of $W_{lab} > 60$ MeV. The calculations underestimate I D_p by a factor of 2 or so in the quasi-elastic region.

Recently, Nakaoka has pointed out that the two-step contribution for I D_p would be significantly larger than that for ID_p, in the present momentum-transfer region. He showed that the 1st- and 2nd-step contributions for ID_q, are partly destructive, while those for ID_p are wholly constructive. As a result, the two-step contribution for I D_p is more important than that for ID_q, Thus the two-step contribution would be partly responsible for the disagreement between experimental and theoretical results at the high energy-transfer region.

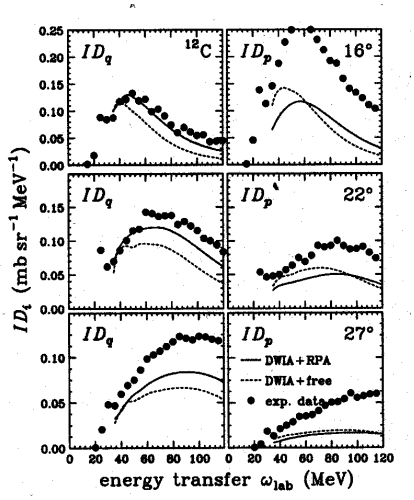

Figure 1: The spin-longitudinal ID_q, (left panels) and spin-transverse ID_p, (right panels) polarized cross sections for the $^{12}C(\vec{p}, \vec{n})$ reaction at $T_p = 346$ MoV and $\theta_{lab} = 16^o$ (top panels), 22^o (middle panels), and 27^o (bottom panels). The solid and dashed curves represent the results of DWIA cal- culations with RPA and free response functions, respectively.