Study of spin dipole strengths in ^{12}N via ^{12}C$(\vec{p},\vec{n})$ reaction at 296 MeV and 0°

M. Dozono[1], T. Wakasa[1], E. Ihara[1], T. Noro[1], T. Ishida[2], S. Asaji[1], Y. Nagasue[1], H. Takeda[1], Y. Yamada[1], K. Hatanaka[3], Y. Sakemi[2], A. Tamii[3], Y. Shimizu[4], K. Fujita[3], Y. Tameshige[3], H. Matsubara[3] and T. Kaneda[3]

[1] *Department of Physics, Kyushu University, Fukuoka 812-8581, Japan*
[2] *Cyclotron and Radioisotope Center, Tohoku University, Miyagi 980-8578, Japan*
[3] *Research Center for Nuclear Physics, Osaka University, Osaka 567-0047, Japan*
[4] *Center for Nuclear Study, The university of Tokyo, Tokyo 133-0033, Japan*

The charge exchange reaction at intermediate energies is one of the best probes to study spin–isospin excitations in nuclei, such as spin–dipole (SD) excitations characterized by $\Delta L = 1$, $\Delta S = 1$, and $\Delta J^\pi = 0^-$, 1^-, and 2^-. In previous (p,n) and (n,p) experiments on ^{12}C [1,2], spin–dipole resonances (SDRs) were found at $E_x \simeq 4$ and 7 MeV. Analysis of the angular distributions of the SDRs at $E_x \simeq 4$ and 7 MeV indicate that they consist of mainly 2^- and 1^- components, respectively. However, recent ^{12}C$(\vec{d},{}^2$He$)^{12}$B and ^{12}C$(^{12}$C$,{}^{12}$N$)^{12}$B experiments [3,4] suggested that the SDR at $E_x \simeq 7$ MeV in ^{12}B has more 2^- components than 1^- components. Theoretical calculations including tensor correlations [5] have also supported this suggestion.

We investigated SD strengths in ^{12}N up to $E_x \simeq 10$ MeV with complete polarization transfer measurements for ^{12}C$(\vec{p},\vec{n})$ at 296 MeV and 0°. Figure 1 shows the experimental results for the unpolarized (I), spin-longitudinal ($ID_L \equiv ID_q$), and spin-transverse ($ID_T \equiv ID_p + ID_n$) cross sections. It is expected that 0^- and 1^- states appear only in the ID_L and ID_T spectra, respectively, while 2^- states appear in both spectra. Solid curves show the results of peak fitting where the peak positions and widths were taken from Ref. [2]. It should be noted that the 2^- state at $E_x \simeq 4$ MeV forms its peak in both ID_i spectra as expected. The SDR at $E_x \simeq 7$ MeV is reproduced with two peaks ($E_x = 6.4$ and 7.5 MeV), and these peaks appear prominently in both ID_i spectra. This result means that the SDR at $E_x \simeq 7$ MeV consists of mainly 2^- components and supports previous ^{12}C$(\vec{d},{}^2$He$)^{12}$B and ^{12}C$(^{12}$C$,{}^{12}$N$)^{12}$B experiments [3,4]. A large difference is seen at $E_x = 8.4$ MeV between the ID_i spectra; a clear peak appears in the ID_L spectrum but dissapears in the ID_T spectrum. Therefore, we assigned the J^π of the state at 8.4 MeV to be 0^-. The peaks at $E_x = 9.1$ and 10.2 MeV are seen only in ID_T spectrum, which shows the predominace of the 1^- strength in this energy region. The SD strength distributions obtained from the present data are consistent with the results of the theoretical calculations including tensor correlations [5].

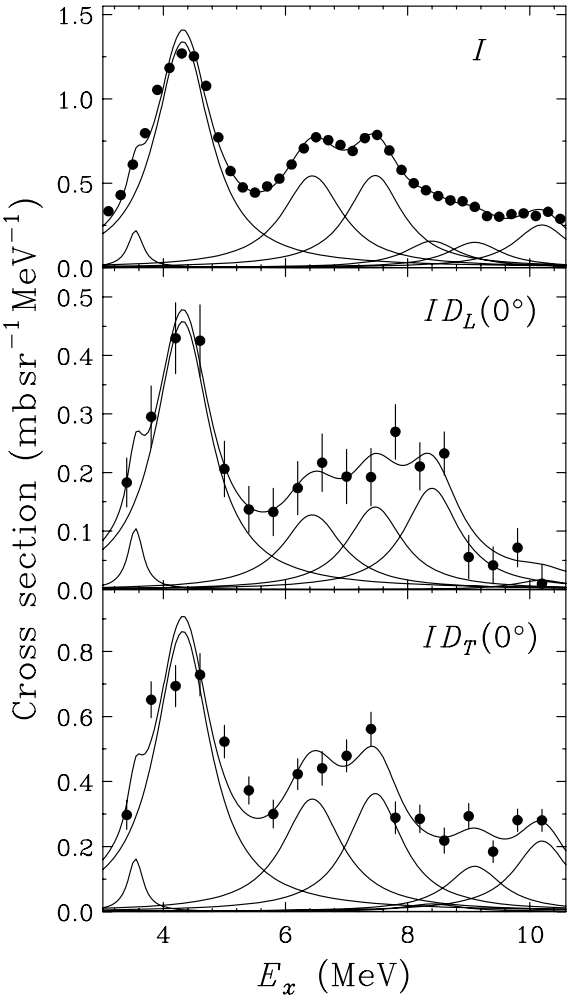

Figure 1: I (top), ID_L (middle), and ID_T (bottom) for the ^{12}C$(\vec{p},\vec{n})$ reaction at 296 MeV and 0°.

References

[1] X. Yang, *et al.*, Phy. Rev. C **48** (1993) 1158.
[2] B. D. Anderson, *et al.*, Phys. Rev. C **54** (1996) 237.
[3] H. Okamura, *et al.*, Phys. Rev. C **66** (2002) 054602.
[4] T. Ichihara, *et al.*, Nucl. Phys. A **577** (1994) 93c.
[5] T. Suzuki, *et al.*, Nucl. Phys. A **637** (1998) 547.