Cross Sections for the $s_{1/2}$ Proton Knockout in the ^{16}O$(p, 2p)$ Reaction

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Exclusive measurements of nucleon quasi-free scattering provide us with both the structure of bound state of struck nucleon and the nucleon-nucleon (NN) interaction in nucleus. The knockout of the deeply bound nucleons is of special interest, because it offers the opportunity to study the nuclear interior. Actually, medium modifications of the NN interaction have been strongly suggested through the density-dependent reduction of analyzing power (A_y) of $s_{1/2}$ knockout in $(p, 2p)$ reactions. [1] On the other hand, we have been investigating the structure and fragmentation of s-hole states in light nuclei, partly because of the relation with the hypernuclear physics and the nucleon decay search. [2]

One of the problems to study such knockout reaction for deeply bound nucleons, is how much such processes as the multi-step processes or correlated processes (e.g., $(p, 3p)$ and $(p, 2pn)$ reactions) other than simple direct knockout one, contribute the final excitation spectra. In this report, we show the result of cross section measurements on ^{16}O$(p, 2p)$ reaction around the excitation of the s-hole states in ^{15}N.

The measurements have been carried out using the two-arm spectrometer system, the Grand Raiden (GR) and the large acceptance spectrometer (LAS), at E_p= 392 MeV. The setting angle of the GR has been kept at 25.5° An iced water target has been employed for the ^{16}O target in the angular correlation measurements, whose absolute values are normalized to the previous data at $\theta_{LAS} = 51$ ° using the SiO_2 and Si target with small uncertainty of thicknesses. The excitation energy spectrum at $\theta_{LAS} = 51$ ° is shown in another part of this annual report by the same authors. [3]

In Fig. 1(a), the cross sections integrated over the excited energy region of 16 MeV $\leq E_x(^{15}\mathrm{N}) \leq 40$ MeV are plotted as a function of the angle of the LAS, which is equivalent the recoil momentum dependence. The energy byte of the GR (ΔE_{GR}) is restricted about a half of the full range in order to assure the flat momentum acceptance over the higher excitation energies in ^{15}N. At the point satisfying the zero-recoil momentum condition, the cross section takes the maximum value, which is the characteristic of the s-nucleon knockout case.

The experimental results are interpreted in terms of a factorized distorted-wave impulse approximation (DWIA) theory. The calculations are carried out using the code THREEDEE. [4] A curve of the DWIA calculation is also shown in Fig. 1(a), after adding the constant background cross section of 19.5 μb/sr^2 MeV at each point. A Good fit to the experimental value is obtained. The spectroscopic strength of $1s_{1/2}$ below $E_x = 40$ MeV ex-

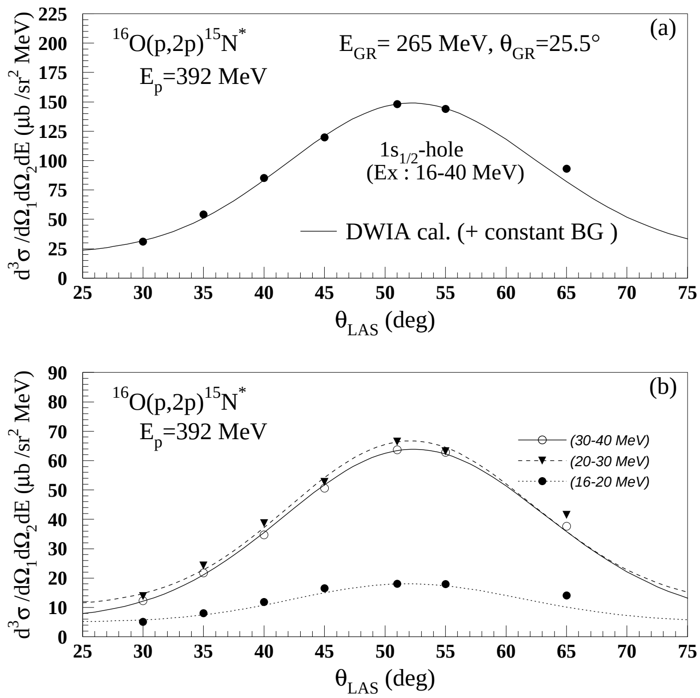

Figure 1: (a) Angular correlation of the cross section of the s-hole state in ^{15}N via the ^{16}O$(p,2p)$ reaction at $E_p = 392$ MeV. The central energy and scattering angle of the Grand Raiden are fixed ($E_{GR} = 265$ Mev and $\theta_{GR} = 25.5\ ^\circ$). The solid curve is the result of a DWIA calculation (see text). (b) Angular correlations of the cross sections of three different excitation energy regions in ^{15}N (E_x = 16-20 MeV, 20-30 MeV, and 30-40 MeV). Solid, dashed, and dotted curves are the results of DWIA calculations for different three regions.

hausts 80 % of the independent particle shell model. At the point of maximum cross section, the possible mixture of non-direct one-nucleon knockout processes can be estimated as about thirteen percent. This should be considered in deriving the partial decay widths from the particle decay measurement.

The microscopic structure of the s-hole state has recently discussed with the shell model calculations. [5] Experimentally, the 17 MeV bump with relatively narrow width and 30 MeV broad bump are recognized in ^{15}N excitation energy spectrum. We separate the bump region into three pieces: 16-20 MeV, 20-30 MeV and 30-40 MeV. In comparison with DWIA calculations, the angular correlation of each region is consistent with the s-hole state (see Fig. 1(b)), in which a flat distribution of the above background is assumed.

This measurement was performed in the E148 experiment.

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