Structure of the ^{6}He(s-hole) state and Ay of the ^{7}Li(p,2p) reaction

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We report the results of analysis of E204 which was done in November 2003 [1].

In general, it is said that light nuclei are described not only by the shell model, but also by the cluster model. In order to investigate their structure, we have measured decay particles from deep-hole states in light nuclei because the direct decay process is dominant and its decay mode gives us imformation on the structure of deep-hole states [2].

In case of ^{6}He, the threshold energy of decay to the channel α+2n, ^{5}He+n, and t+t are 0.973, 1.77, and 12.3MeV, respectively. Thus, the simple shell model calculation predicts that decay with neutron(s) is predominant for the s-hole state [3].

The experiment was carried out at RCNP, by using a 392MeV polarized proton beam and thin ^{7}Li targets (1.4mg/cm^2). The quasifree (p,2p) reaction was measured with the dual spectrometer system consisting of the Grand Raiden(GR) and the Large Acceptance Spectrometer(LAS). Charged decay particles were measured by fifteen telescopes of Si solid-state detectors (SSD) in coincidence with the (p,2p) reactions.

Fig.1(a) shows the excitation energy spectrum of ^{6}He* obtained by ^{7}Li(p,2p) reaction and the coincidence spectrum of t+t decay. The t+t decay yield in Fig.1(a) was converted into an ammount for 4π sr, assuming the isotropic decay. The branching ratio of this channel was 72.1% in the energy region corresponding to the s-hole state. Taking into account the lack of low energy tritons due to the energy loss in the target and the threshold energy of discriminators, we nextly restricted the energy region ($E_x \geq$ 16.6MeV) in which all tritons were detected. As a result, it was found that t+t branching ratio was 92.3% in this region.

The dominance of t+t decay means that 's-hole' state in ^{6}He has cluster strucure consisting of two tritons, and this state is generated by knocking out a proton from the α in ^{7}Li, which is considered to have an α+t cluster structure.

In addition, we measured analyzing power (Ay) for ^{7}Li(p.2p) reaction in the s-hole region. It was reported that Ay for quasi-elastic scattering in a nucleus is reduced compared with in free space [4] . They showed the dependence of this reduction on average density and claimed a sign of medium effect. On the other hand, there is another experimental result which suggests the dependence of Ay reduction on the Q-value of the reaction. Our result is shown in Fig.1(b). In the region of the s-hole state, Ay is smoothly decreasing as the excitation energy increases. It may support the dependence on the Q-value, although the reason is still not well understood.

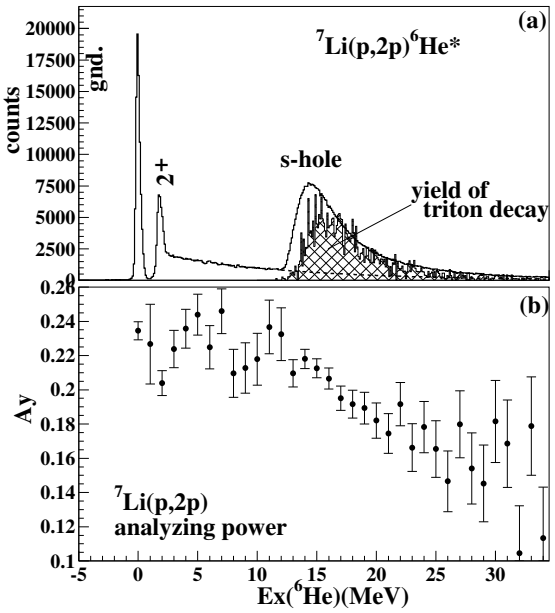

Figure 1: (a)Excitation spectrum of ^{6}He (solid line), and the hatched region is the yield of t+t decay. (b)Analyzing power for ^{7}Li(p,2p) reaction.

References

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