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1.80 Excitation of Isovector Giant Resonances of ^{90}Y by the (d,^{2}He) Reaction

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Importance of the (n,p) type reactions has been stressed because they excite only $T=T_0+1$ final states (T_0 denotes the isospin of the target) whereas the (p,n) type reaction excite both $T=T_0$ and $T=T_0-1$ states for the targets with N>Z. The (d,^{2}He) reaction has an additional advantage of exciting selectively spin flip final states. Therefore the (d,^{2}He) reaction would be useful in investigating the spin flip isovector giant resonances. Moreover, the vector analyzing power A_y of the (d,^{2}He) reaction was proven to be sensitive to the structure of the final state in our preliminary results on light nuclei[1]. Therefore vector analyzing powers of the (d,^{2}He) reaction were measured besides the cross sections for the ^{90}Zr target to investigate the nature of the isovector giant resonances of ^{90}Y which have been studied by the (n,p) reaction[2].

Vector polarized deuterons at the energy of 70 MeV provided from the RCNP cyclotron were used to bombard ^{90}Zr target set inside a small scattering chamber. Outgoing two protons were detected outside the chamber through a thin mylar window by two sets of the counter array which consists of 4 ΔE-E counter telescopes in square geometry. Each array has 6 combinations of coincidence for ^{2}He detection. This system has about 10 times larger detection efficiency than in case of using only two sets of the counter telescope. Data of ΔE, E and timing were recorded only when more than two counters are fired. CAMAC data acquisition system was employed to match these rather complex requirement of the data taking.

Energy spectra of the ^{90}Zr(d,^{2}He)^{90}Y reaction are shown in fig. 1 together with the analyzing power for the detection angle of 20°. In every spectrum two bumps peaked at about 7 and 12 MeV are seen. They correspond to those observed by King and Ullmann[3] in the (n,p) reaction at E_n=60 MeV. They assign the first bump of lower incident energy to the E1 isovector giant resonance and the second one of higher exciting energy to the E2 resonance by the comparison with the results of (p,γ) and (e,e') reactions. However the spin flip dipole resonances (Δl=1 Δs=1) are expected to have about the same excitation energy as that of the E1 resonsance, and also the 2$\hbar\omega$ jump Gamow-Teller resonance (Δl=0 Δs=1) should locate in the energy region of E2 resonance. The bumps observed in the present experiment would contain considerable contributions from the spin flip dipole and 2$\hbar\omega$ jump GT strength because the (d,^{2}He) reaction favours the spin flip transitions. Values of vector anayzing power for the first bump vary from about 0.2 in lower excitation region to 0.08 in higher excitation region. This suggests that the first bump contains two or more kind of the strength with different natures and it is not the simple E1 giant resonance. More deteailed and quantitative arguments are necessary to ex ract the spin flip component for these two bumps, especially it is important to predict the A_y values.

References

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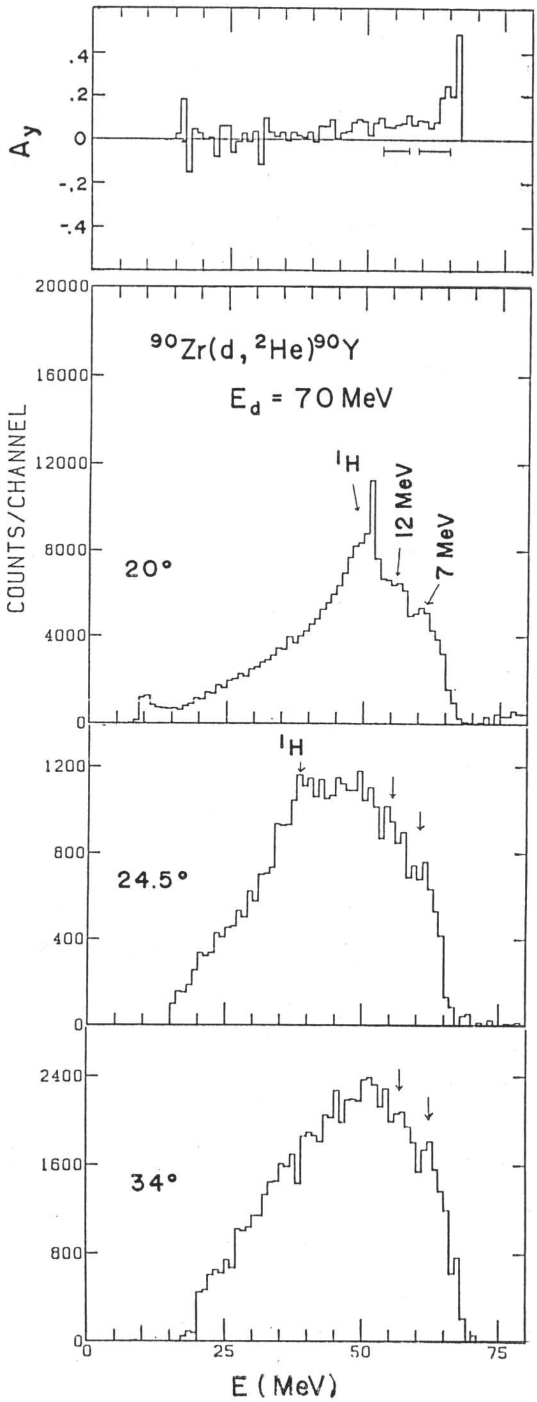

Fig. 1 Energy spectra and vector analyzing power of the $^{90}Zr(d,^{2}He)^{90}Y$ reaction at 70 MeV. The detection angle is indicated in each spectrum. Positions of two bumps with 7 and 12 MeV excitation energies are indicated in the figure of analyzing power.