DEEP HOLE STATES IN TWO PARTICLE TRANSFER REACTIONS

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The purpose of this experiment was to further explore the broad structure observed in (p,t) reactions in the tin isotopes at a bombarding energy of 42 MeV.[1] The experiment at IUCF was carried out in two runs in June and Dec. 1978 using the 90 MeV proton beam. A Si(ΔE) and intrinsic-Ge(E) detector telescope was used to detect the tritons. Deuteron spectra from the (p,d) reaction were recorded simultaneously. Elastic protons were excluded using a veto detector. Spectra were obtained from targets of ^{144}Sm, ^{124}Sn, ^{122}Sn, ^{120}Sn, ^{94}Mo, ^{90}Zr and ^{58}Ni. An angular distribution of the (p,t) and (p,d) reactions from 15° to 45° was measured on the ^{120}Sn target.

Structure similar to that observed at lower bombarding energy was clearly observed in the triton spectra on the Sn isotopes as shown in Fig. 1. Broad features were also observed in the spectra from the other isotopes studied except for the case of ^{58}Ni. The (p,d) spectra, also displayed in Fig. 1, showed a very clean excitation of the single hole states in the

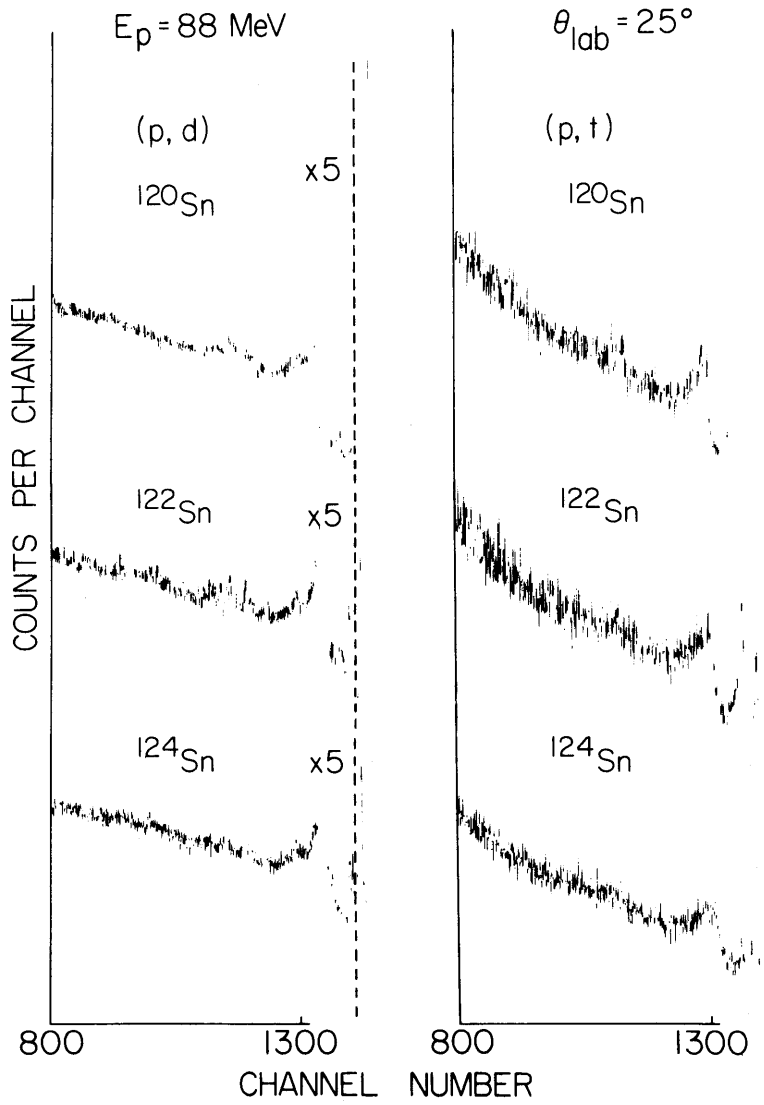

Figure 1. Spectra of deuterons and tritons at a laboratory angle of 25 degrees from bombardment of tin isotopes with 88 MeV protons. Strong excitation of the g 9/2 hole is observed near channel 1350 in the (p,d) spectra. A broad feature near channel 1300 is also observed in the triton spectra.

tin isotopes as well as the higher lying analogue states. Higher lying states were also observed in most of the isotopes studied. Perhaps the best example was the ^{90}Zr(p,d) reaction (a spectrum at 25° is shown in Fig. 2) where $g9/2^{-1}$, $f5/2^{-1}$, $f7/2^{-1}$ and three $T_>$ analogue states were observed. In addition, a broad peak can be seen at around 15 MeV excitation which might correspond to holes in the 2s1d shell.

Comparison of the measured angular distribution with the theorectical predictions from a DWBA calculation should help cast further light on the nature of these features at high excitation energy. A report of this work is being prepared for publication.

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1) G.M. Crawley, W. Benenson, D. Weber, and B. Zwieglinski, Phys. Rev. Letters 39, 1451 (1977).

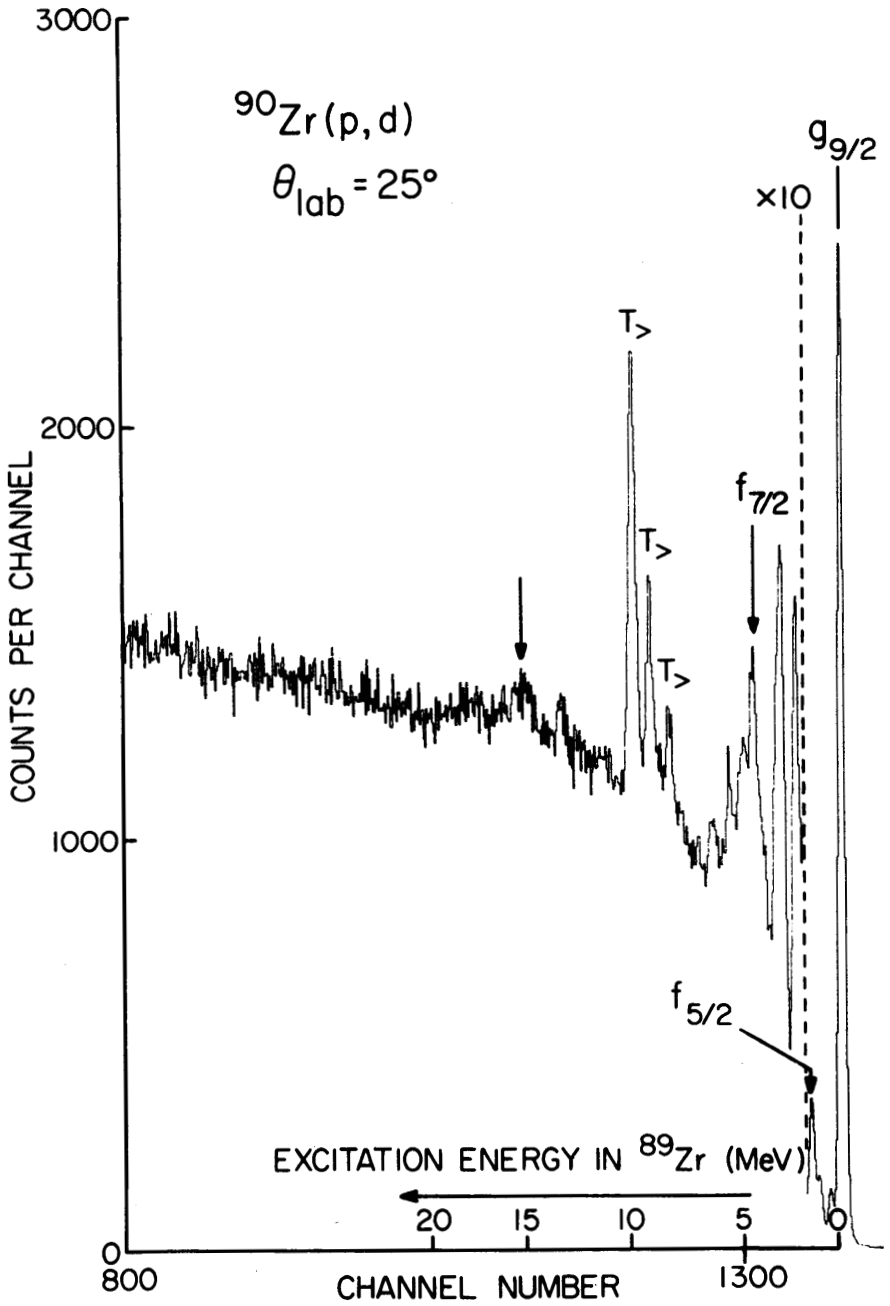

Figure 2. Spectra of deuterons from the ^{90}Zr (p,d) reaction at a bombarding energy of 88 MeV. Excitation of hole states below 5 MeV of excitation are marked as well as three strong $T_>$ states. A broad structure near 15 MeV excitation (marked by an arrow) could be due to holes in the 5d shell.