EXCLUSIVE STUDIES OF LIGHT-ION EMISSION IN THE REACTION OF E/A = 25 MeV ^{6}Li WITH ^{238}U

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In order to investigate the mechanisms by which incomplete linear momentum transfer processes proceed in complex nucleus reactions, light ions in coincidence with angle-correlated fission fragments have been measured for the ^{6}Li+^{238}U reaction at E/A=25 MeV. The angle between coincident fission fragments was detected with a 14cm x 14cm x-y position-sensitive multiwire proportional couinter and a 0.6cm x 5.0cm x-position-sensitive silicon detector. Coincident light ions were measured with four movable silicon-ΔE/NaI-E telescopes which covered the angular range from 9 to 150 deg in the laboratory system.

The inclusive fission-fission angular correlation measurements yielded a broad range of linear momentum transfers, with the average value $\langle p_\parallel \rangle$=840 MeV/c. This corresponds to a per nucleon value of $\langle p_\parallel \rangle$/A=140 MeV/c, in good agreement with the maximum values of $\langle p_\parallel \rangle$/A for heavy ions up to ^{40}Ar.

The angular distributions of the p, d, t and ^{4}He ions in coincidence with angle correlated fission fragments spectra are strongly forward-peaked. At forward angles more than half light-ion yield is in the form of ^{4}He ions, whereas at angles larger than 30 degrees, protons dominate the spectrum. The small-angle behavior appears to be related to the loosely-bound α-d structure of ^{6}Li, since it is noted that the d yields are also quite large at forward angles and the energy spectra of both are found to be peaked near the beam velocity (Fig. 1).

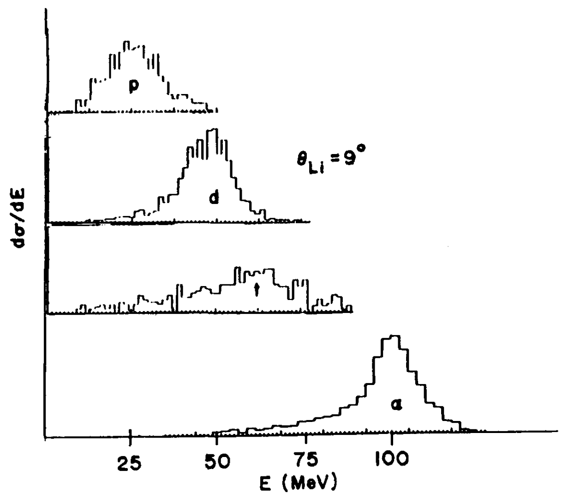

Figure 1. Energy spectra of p, d, t and ^{4}He ions observed at an angle of 9 deg. in coincidence with fission fragments produced in the reaction of E/A=25 MeV ^{6}Li with ^{238}U.

The proton dominance at larger angles most probably is accounted for in terms of more complex interactions. Two features of the proton coincidence data stand out. First, the beam velocity component in the proton gated folding angle spectrum, clearly shows two peaks at forward angles, one corresponding to capture of ^{4}He and ^{5}He ions and the other to much lower momentum transfers. In most cases the observation of protons implies a subsequent breakup of the uncaptured residue. Second, the most energetic protons appear to be associated with high momentum transfer sources. At forward angles these correspond to processes ranging between ^{4}He, ^{5}He capture and complete fusion-like events. Beam velocity protons may

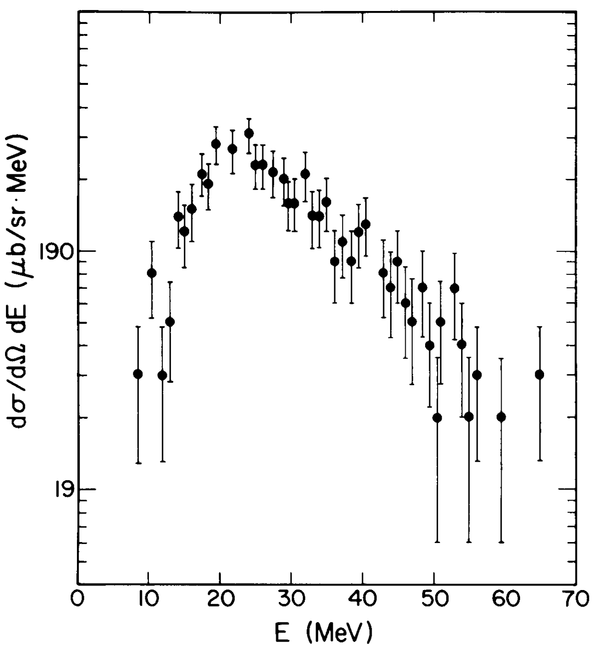

Figure 2. Energy spectrum of protons observed at 150° in coincidence with fission fragments with $p_{\|} > p_{beam}$ in reaction of E/A=25-MeV ^{6}Li ions with ^{238}U.

be produced by elastic, inelastic or absorbtive breakup channels (i.e. the α+p+n channel) or by neutron transfer followed by ^{5}Li breakup into α+p. In Fig. 2 the coincident proton spectrum at 150° is shown, indicating a highly energetic component well in excess of the expected evaporation spectrum. Similar results have been reported by Vigdor et al.[1] using 75-MeV ^{6}Li ions. At backward angles the energetic protons arise from events that are clearly fusion-like. These particles most likely have their origin in non-equilibrium central collision processes, but the mechanism is not readily explained.

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1) S. Vigdor et al., Phys. Rev. C 26, 1035 (1982).

ACTIVATION MEASUREMENTS OF THE A(p,^{7}Be)X REACTION AT INTERMEDIATE ENERGIES

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The formation of light mass fragments with A>6 produced in interactions of protons with a variety of light to heavy target elements is of much interest due to the uncertainty of the reaction mechanism. Recent studies at IUCF[1] and TRIUMF[2] have been investigating production of light elements with intermediate energy proton reactions on targets of Al, Si and Ag respectively. These counter studies have obtained high quality differential cross section data and energy spectra. Green, Korteling and Jackson[2] have studied the reaction Ag(p,IMF)X at energies of 210-480 MeV, where IMF refer to intermediate mass fragments. They found that the fragment spectra were little affected (except in overall magnitude) with changes in the incident proton energy. Furthermore, a major fraction of the IMF yield (> 75% for Li and > 98% for Oxygen) was non-evaporative and could be described in terms of an isotropic emission process in the rest frame of the