STUDY OF THE (^{6}Li,d) REACTION AT E(Li) = 90 MeV

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We have begun a study of the (^{6}Li,d) α-transfer reaction at high bombarding energy. The reactions ^{12}C (^{6}Li,d)^{16}O and ^{208}Pb(^{6}Li,d)^{212}Po have been investigated thus far and rather complete data obtained for the former (Figs. 1 and 2). One observes a more selective population of "α-cluster" levels in ^{16}O (e.g. 6.9 MeV 2^+, 10.4 MeV 4^+, Fig.1) than is observed with (^{6}Li,d) at lower bombarding energies[1,2]. Also the angular distributions to α-cluster levels are much more forward-peaked (Fig.2) including a large enhancement at θ=0°. The study of ^{12}C(^{6}Li,d)^{16}O is of particular interest in that the α-widths of the $J^\pi = 1^-$ levels at E_x = 7.1 MeV and 9.6 MeV (Fig.1) are important in stellar helium fusion[2,3]. The data at E(Li) = 90 MeV should greatly help to clarify some anomalies observed at lower bombarding energies[2] including the α-decay width of the 9.6 MeV 1^- level.

Limited data have also been obtained for ^{208}Pb (^{6}Li,d)^{212}Po. A ground state cross section of about 0.15 μb/sr is observed at θ=11°. There appears to be considerable α-transfer strength (≈2 μb/sr) to excited levels in ^{212}Po at E_x = 2.2 to 3.0 MeV (Fig. 3). These may correspond to certain preferred high-spin levels with "stretched" configurations. Unfortunately contaminant buildup is a problem for heavy targets. Improvements of the targets and spectrometer vacuum system are planned and should permit further work on ^{208}Pb and other heavy nuclei.

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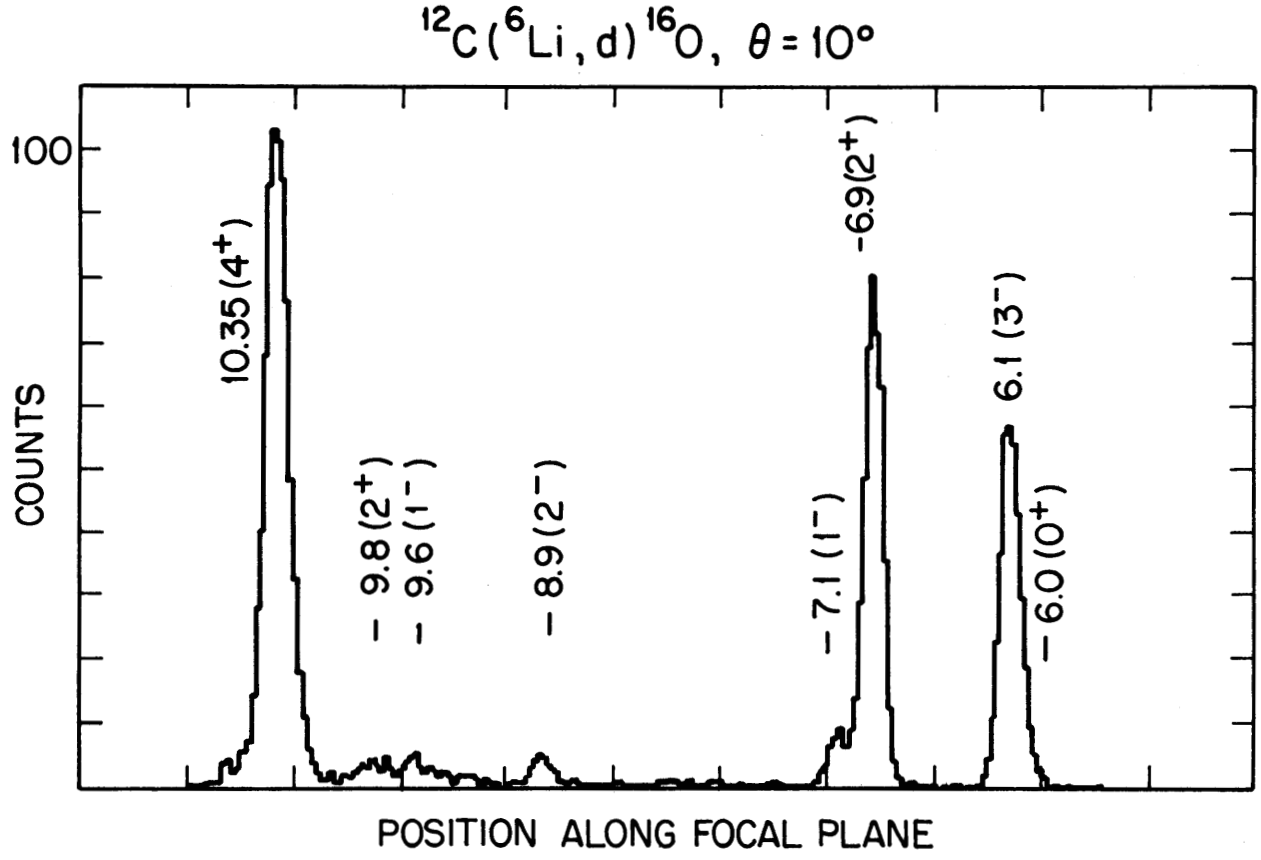

Figure 1. Portions of a deuteron spectrum from ^{12}C(^{6}Li,d)^{16}O in the vicinity of the 0+(6.0 MeV), 2+(6.9 MeV) and 4+(10.4 MeV) α-cluster rotational band in ^{16}O. Note strength to 2+(6.9 MeV) and 1^- (7.1 MeV) levels relative to 2^- (8.9 MeV) level. The latter is not allowed in a simple direct α-transfer.

1) F.D. Becchetti, Proc. 3rd Conf. on Clustering (Winnipeg, 1978) p. 308 and references cited therein.

2) F.D. Becchetti, J. Jänecke and C.E. Thorn, Nucl. Phys. A305 (1978) 313.

3) P. Dyer and C.A. Barnes, Nucl. Phys. A233 (1974) 495.

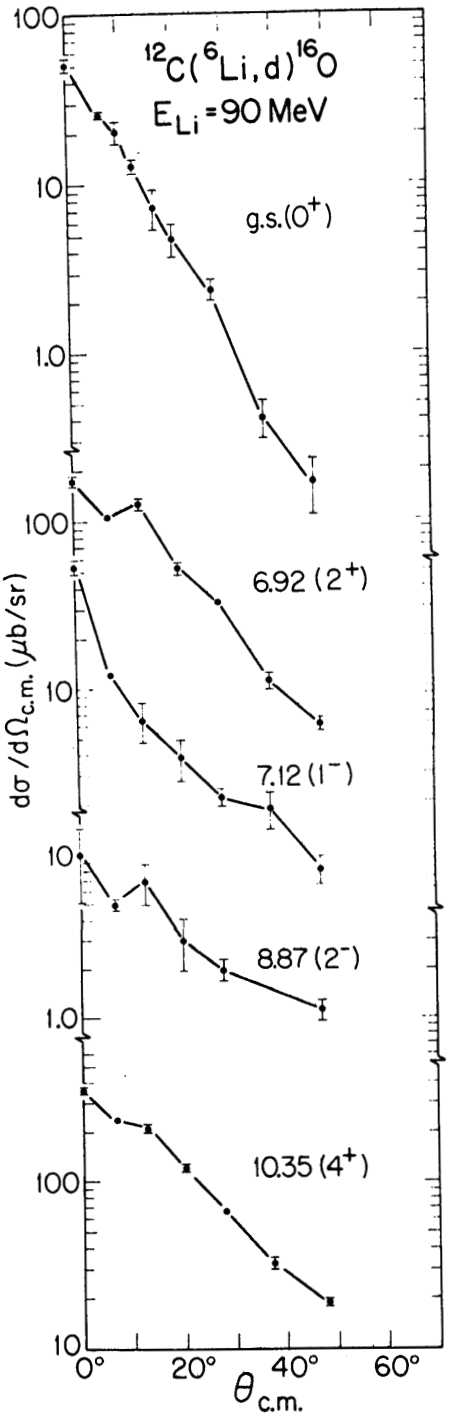

Figure 2. Experimental angular distributions. The curves shown connect data points and have no theoretical significance.

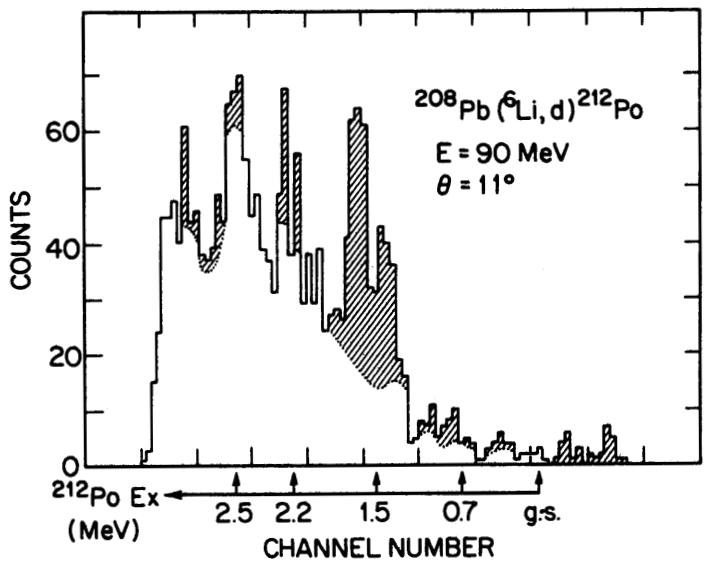

Figure 3. Spectrum from $^{208}Pb(^6Li,d)^{212}Po$. The shaded regions represent contributions from contaminants in the target, mainly $^{12}C(^6Li,d)$ and $^{16}O(^6Li,d)$.