INVESTIGATION OF SPIN-FLIP AND ISOSPIN-FLIP IN (p,n) REACTIONS

G.L. Moake,* P.T. Debevec,** L.J. Gutay,* P.A. Quin,*** R.P. Scharenberg*

A study of $\Delta J = 1$, $\Delta T = 1$ transitions has been made on the Ad-hoc Neutron Time-of-flight Facility.[1] Angular distributions from 0 to 18, 14, and 12 degrees were obtained for (p,n) reaction on ^{6}Li, ^{12}C, and ^{14}N, respectively, at a bombarding energy of 144 MeV. The melamine ($C_3N_6H_6$) target, from which the ^{14}N spectra were obtained, was about 70 mg/cm^2 thick, whereas the ^{6}Li and natural carbon targets were about 50 mg/cm^2 thick.

The detector and its associated electronics were placed in a moveable house. The detector consisted of three parts: a 1/4" x 10" x 20" sheet of NE 102 which served as a charged particle trigger; two 1.75" dia x 18" Pilot U rods in which the neutrons interacted and which acted in parallel to increase the solid angle; and a 6" x 10" x 20" vat of NE 213 which collected recoiling charged particles from the rods. The underlined dimension was parallel to the entrant particles. Phototubes were placed on each end of both rods and a time spectrum between the RF and each phototube was stored. The total time-of-flight spectrum was then obtained by a software addition of the spectra from both ends of a rod. Pulse selection of 1 out of 4 beam bursts was usually used to reduce the background from previous beam bursts. The data was stored event by event, so requirements on the energy lost in the vat were used to eliminate the very slow particles still present after pulse selection. Energy cuts could also be placed on the rods to improve the time resolution. The observed time resolution was essentially that of the beam, even though monitor detectors were used to allow off-line correction for variations in the beam arrival time relative to the R.F. Typically, the time resolution was 800 ps after correction. A tagged neutron experiment is planned to measure the efficiency of the detector, although it is estimated to be 3.6%. A melamine time-of-flight spectrum is shown in Figure 1.

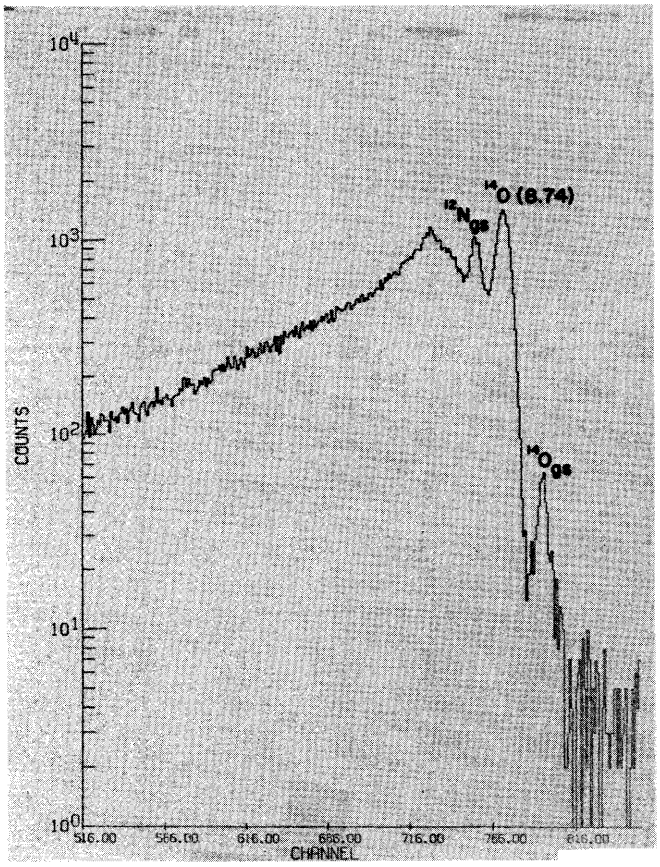

Figure 1.

Various angular distributions are shown in Figure 2, but the normalizations are only approximate. The ^{14}N data is in the preliminary stages of analysis, so that no estimate of the error bars is available. Since these reactions have $\Delta J = \Delta T = 1$, one-pion exchange can contribute to the reaction, and it may even dominate at small angles. Indeed, the angular distribution for ^{6}Li and ^{12}C are sharply peaked in the forward direction, which is characteristic of one-pion exchange. However, the ^{14}N distribution is substantially different, indicating that other processes may be involved.

Theoretical analysis of the data in terms of a DWBA calculation with a microscopic potential and in terms of the elementary particle model[2] are presently under way.

*Purdue University, Lafayette, Indiana 47907

**University of Illinois, Champaign, Illinois 61801

***University of Wisconsin, Madison, Wisconsin 53706

1) IUCF Technical and Scientific Report, 1975 to 1977, p. 61.

2) C.W. Kim and H. Primakoff, Phys. Rev. 139, B 1447 (1965).

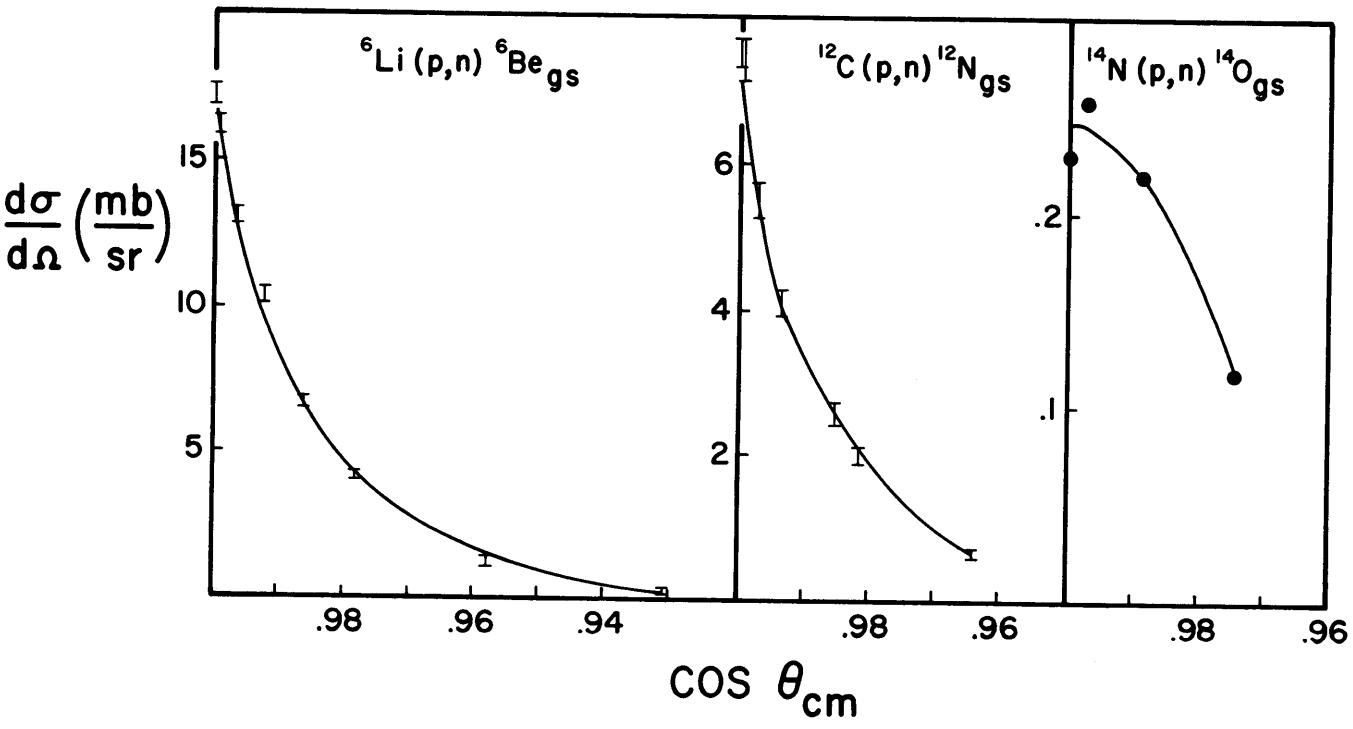

Figure 2