NEUTRON KNOCKOUT REACTIONS

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We performed the first neutron knockout measurements at the IUCF in July 1980 when we studied the (p,n) reaction on ^{40}Ca and ^{48}Ca at 150 MeV. These measurements were performed in the QDDM spectrometer hall with a small scattering chamber installed at an intermediate focus on the beam line that goes into the swinger hall; the swinger system was used as a beam dump. The proton detector telescope consisted of a 2 mm silicon surface-barrier ΔE detector plus a 10 mm and a 15 mm intrinsic germanium detector. Neutron energies were measured by the time-of-flight method. Two 20 in. x 40 in. x 4 in. mean-timed NE-102 plastic-scintillator neutron detectors were used in a 40 in. x 40 in. array which was placed 19 m from the target at a fixed angle of 36° (near the QDDM spectrometer). Using this flight path we obtained both the solid angle (2.86 msr) and the energy resolution (~ 1 MeV) required for these measurements.

Figure 1 shows a preliminary separation-energy spectrum for the ^{40}Ca(p,pn)^{39}Ca reaction at 150 MeV with θ_p = 44° and θ_n = 36°. The $2s_{1/2}$, $1d_{5/2}$, and $1d_{3/2}$ hole strength in ^{39}Ca is clearly identified along with the 1p hole strength near 30 MeV. The overall separation-energy resolution for these measurements, combining both the proton energy resolution and neutron

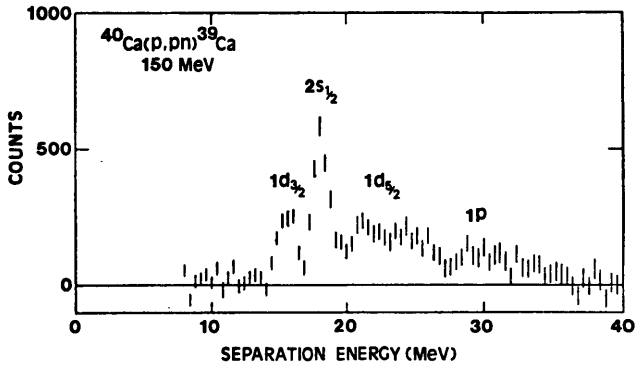

Figure 1. Separation-energy spectrum for the neutron-knockout reaction ^{40}Ca(p,pn)^{39}Ca at 150 MeV, for θ_p = 44° and θ_n = 36°.

energy resolution for a range of proton and neutron energies is about 1 MeV (fwhm). This resolution is comparable to that obtained in medium energy (p,2p) and (e,e'p) experiments prior to the recent work at the IUCF, and is a factor of five better than that achieved previously in (p,pn) work at other medium-energy laboratories.

Distorted momentum distributions will be extracted for the resolved shell-model states in ^{40}Ca and ^{48}Ca, and compared with distorted-wave impulse-approximation calculations.