THE $^{57,58}Fe(p,n)^{57,58}Co$ REACTION AT 120 MeV

J. Rapaport, D. Wang, R. Alarcon, T.P. Welch
Ohio University, Athens, Ohio 45701

D.J. Horen
Oak Ridge National Lab, Oak Ridge, Tennessee 37830

T.N. Taddeucci
Ohio University and Indiana University Cyclotron Facility

C.D. Goodman
Indiana University Cyclotron Facility, Bloomington, Indiana 47405

E. Sugarbaker
Ohio State University, Columbus, Ohio 43212

C. Gaarde
Niels Bohr Institute, 2100 Copenhagen, Denmark

The charge exchange reactions $^{57}Fe(p,n)$ and $^{58}Fe(p,n)$ have been studied at 120 MeV, using the IUCF time-of-flight facilities. Energy spectra up to about 18 MeV excitation energy have been obtained at $\Theta = 0°$, 4°, 8.2°, 10.5°, and 14.6°. The ^{58}Fe target was a (40 ± 1) mg/cm^2 foil, 91.9% enriched in ^{58}Fe and 8.1% ^{57}Fe. The ^{57}Fe target was a 90.24% enriched foil (37.7 ± 1.0) mg/cm^2 and 9.5% ^{56}Fe. Five large volume neutron detectors were located at 130 meters along the zero degree port of the beam swinger. Sub-nanosecond time resolution equivalent to an energy resolution of about 250 KeV has been obtained.

Angular distributions for low-lying discrete transitions up to 5 MeV excitation energy have been measured. For higher excited states, neutron angular distributions in 1.0 MeV energy bins have been obtained. The data have been used to estimate the Gamow-Teller strength up to about 16 MeV excitation energy in $^{57,58}Co$.

For the $^{58}Fe(p,n)^{58}Co$ reaction a B(GT) = 13.5 ± 2.0 has been estimated, in units such that the free neutron has a B(GT) = 3.0. The sum rule $S(\beta^-) - S(\beta^+) = 3(N-Z)$ gives a lower limit $S(\beta^-) = 18$. If we assume a value $S(\beta^+) = 8 - 10$ (based on Ni isotopes systematics) the calculated $S(\beta^-)$ is about 26 - 28, which would imply that up to 18 MeV excitation energy the (p,n) reaction excites about 50% of the predicted $S(\beta^-)$ value. This quenching agrees with values obtained in other $1f_{7/2}$ nuclei.