CHARGE EXCHANGE

$D_{NN}(0°)$ FOR THE $^{17,18}O(\vec{p},\vec{n})^{17,18}F$ REACTIONS AT $E_{\vec{p}} = 120$ MeV

S. Blanchard, G.R. Burleson, and B.K. Park
New Mexico State University, Las Cruces, New Mexico 88003

D.K. Dehnhard, C.M. Edwards, J.M. O'Donnell, and M. Palarczyk
University of Minnesota, Minneapolis, Minnesota 55455

C.C. Foster, C.D. Goodman, W. Lozowski, G. Savopulos,
A.H. Smith, and I. Van Heerden
Indiana University Cyclotron Facility, Bloomington, Indiana 47408

K. Hicks, J. Rapaport, L. Wang, and X. Yang
Ohio University, Athens, Ohio 45701

D. Cooper, B.A. Luther, D.L. Prout, and E.R. Sugarbaker
Ohio State University, Columbus, Ohio 43210

T.N. Taddeucci
Los Alamos National Laboratory, Los Alamos, New Mexico 87545

H. Ohnuma
Tokyo Institute of Technology, 2-12-1 Oh-Okayama, Tokyo, Japan

For the $^{17}O(\vec{p},\vec{n})^{17}F$(g.s.) transition, i.e., an odd mass T = 1/2 mirror transition, both GT and F amplitudes contribute to the cross section. The relative weighting of GT and Fermi cross sections in 0° (p,n) spectra can be parameterized as a function of bombarding energy in the 50 – 200 MeV region as

$$\frac{\sigma_{GT}/B(GT)}{\sigma_F/B(F)} = \left(\frac{E_p}{E_0}\right)^2 \equiv R^2 \qquad (1)$$

where $E_0 = 55$ MeV is an empirically determined quantity. D_{NN} measurements for the $^{17}O(\vec{p},\vec{n})^{17}F$(g.s.) were motivated by some unexpected fluctuations of the ratio R, especially in even-odd mass nuclei.[1,2] Transverse polarization transfer measurements yield direct determinations of the relative weighting of the GT and F contributions. Therefore, D_{NN} measurements will allow an independent check on the aforementioned empirical relationship.

We are interested in using D_{NN} from the ^{18}O(p,n) reaction to extract the cross section to the 0^- state at 1.08 MeV in ^{18}F. The IAS cross section to the 1.04 MeV state may include some contribution from the 0^- state, but we cannot hope to resolve the two. Since D_{NN}

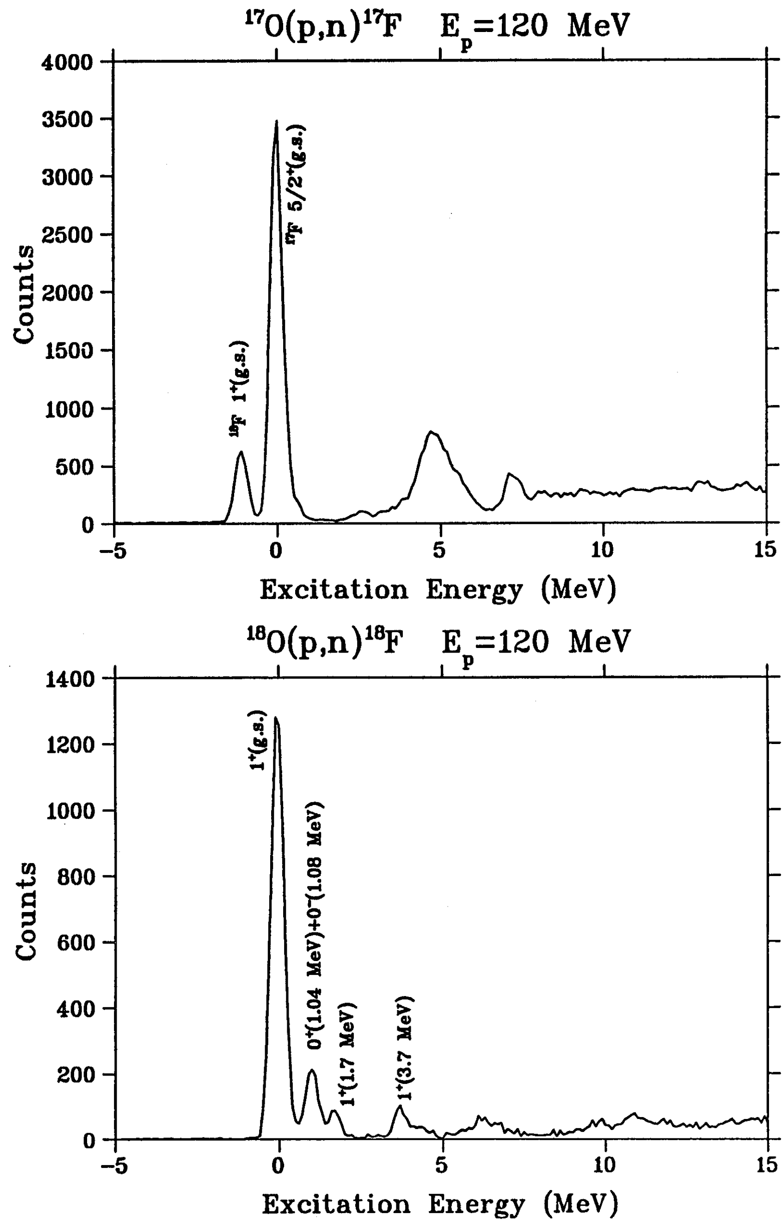

Figure 1. The 0°-spectra for the $^{17,18}O(\vec{p},\vec{n})^{17,18}F$ reactions at E_p = 120 MeV are shown. The peak located to the left of the $^{17}O(\vec{p},\vec{n})^{17}F$(g.s.) is contamination from ^{18}O. The $^{17}O(\vec{p},\vec{n})^{17}F$ (g.s.) peak also contains contaminations from low lying states in ^{18}O(p,n).

is +1 for the IAS and −1 for the 0^- state, a 0^- yield as small as 10% of the peak should be measurable (a 10% cross section is estimated from DWIA calculation). The ratio R is related to the parameters of the factorized DWIA expression for the (p,n) cross section through:

$$\frac{\hat{\sigma}_{GT}}{\hat{\sigma}_F} = \frac{\sigma_{GT}(q=0)}{\sigma_F(q=0)} \frac{B(F)}{B(GT)} \equiv R^2 = \left(\frac{E_p}{55}\right)^2 \tag{2}$$

$$\hat{\sigma}_\alpha = K(E_{\rm p}) N_\alpha^D |J_\alpha|^2; \alpha = GT, F \tag{3}$$

where $K(E_{\rm p})$ and N_α^D are the kinematic factor and distortion factor, respectively, and J_α is the GT or F effective interaction potential integrated over the nuclear volume.

The experiment was performed at the IUCF Beam Swinger facility using a pressurized gas cell filled with oxygen. The $^{17}O_2$ target was a mixture of ^{16}O (17.7 atom%), ^{17}O (76.1 atom%), and ^{18}O (6.2 atom%); the $^{18}O_2$ target was 99% ^{18}O with a trace of ^{16}O. The gas cell was a welded stainless steel box with 25-μm thick Havar entrance and exit foils clamped between window frames which were also welded. At room temperature, 7 atm of pressure was easily obtained in the cell, giving about 50 mg/cm^2 of oxygen target thickness. An energy resolution of about 500 keV was achieved.

Preliminary excitation energy spectra for the ^{17,18}O($\vec{\rm p}$,$\vec{\rm n}$)^{17,18}F reactions are shown in Fig. 1. A preliminary D_{NN} value of -0.099 ± 0.004 was obtained for the ^{17}O($\vec{\rm p}$,$\vec{\rm n}$)^{17}F(g.s.), where the error is statistical only. This preliminary result differs slightly from the expected value of −0.112. Data analysis is in progress to obtain D_{NN} for the peak that encompasses the 1.04 and 1.08 MeV states.

1 J. Wagner, Ph.D. thesis, Ohio State University (1989).

2 Y Wang, *et al.*, IUCF Sci. and Tech. Rep., May 1988 - June 1989, p. 48.