We have made \( D_{NN}(0^\circ) \) and \( d\sigma/d\Omega(\theta) \) measurements on \(^{17}\text{O} \) and \(^{18}\text{O} \) gaseous targets at 120 and 185 MeV, respectively.

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

\[
\frac{\sigma_{\text{GT}}/B(\text{GT})}{\sigma_{\text{F}}/B(\text{F})} = \left( \frac{E}{E_0} \right)^2 \equiv R^2
\]

where \( E_0 = 55 \) MeV was empirically determined for even mass nuclei.\(^1\) \( D_{NN} \) measurements for the \(^{17}\text{O}(\vec{p},\vec{n})^{17}\text{F}(\text{g.s.})\) were motivated due to the unexpected determination of \( E_0 = 45 \) MeV for odd-mass nuclei.\(^2\) 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.
Figure 1. The $0^+$ spectra for the $^{17,18}\text{O}(\vec{p},\vec{n})^{17,18}\text{F}$ reactions at $E_p = 120$ MeV are shown. The peak located to the left of the $^{17}\text{O}(\vec{p},\vec{n})^{17}\text{F}(\text{g.s.})$ is contamination from $^{18}\text{O}$. The $^{17}\text{O}(\vec{p},\vec{n})^{17}\text{F}(\text{g.s.})$ peak also contains contaminations from low lying states from $^{18}\text{O}(\text{p,n})$.

We are interested in using $D_{NN}$ from the $^{18}\text{O}(\text{p,n})$ reaction to extract the cross section to the $0^-$ state at 1.08 MeV in $^{18}\text{F}$. The IAS cross section to the 1.04 MeV state may include some contribution from the $0^-$ state. Because these two states are only 40 keV apart, we cannot hope to differentiate them with our 500 keV energy resolution. However $D_{NN}$ is $+1$ for the IAS and $-1$ for the $0^-$ state. Thus we can use a $D_{NN}$ measurement to check the DWIA prediction of a 10% yield due to the $0^-$ state. Separation of these two states is of particular interest because it has a direct implication for determining the ratio of the interaction strengths $J_{\sigma\tau}/J_{\tau}$. 

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where $K(E_p)$ and $N_D$ are the kinematic factor and the distortion factor, respectively.

The experiment was performed at the Neutron-Time-of-Flight (NTOF) facility using a pressurized gas cell filled with oxygen: $^{17}\text{O}_2$ is a mixture of $(^{16}\text{O}, 17.7 \text{ atom%})$, $(^{17}\text{O}, 76.1 \text{ atom%})$, and $(^{18}\text{O}, 6.2 \text{ atom%})$; $^{18}\text{O}$ is $99\%^{18}\text{O}$ with a trace of $^{16}\text{O}$. The gas cell was previously used in a $^4\text{He}$ experiment at IUCF, and consists of a welded stainless steel box with 25-$\mu\text{m}$ thick Havar entrance and exit foils clamped between window frames that are also welded. At room temperature, 7 atm of pressure was easily contained in the cell, giving about 50 mg/cm$^2$ of oxygen target thickness. An energy resolution of about 500 keV was achieved. A sample of the excitation energy spectra obtained for the $^{17,18}\text{O}(\vec{p},\vec{n})^{17,18}\text{F}$ reactions are shown in Fig. 1.

A preliminary $D_{NN}$ value of $-0.1464 \pm 0.0345 \pm 0.0320$ was obtained for the $^{17}\text{O}(\vec{p},\vec{n})^{17}\text{F}(\text{g.s.})$, where the errors include both statistical and systematic uncertainties. This value was obtained after subtracting the $^{18}\text{O}$ background. Calculating the $E_p$ parameter associated with our preliminary data gives a value of 49.87. A more detailed analysis of the data is progressing, with the hope of reducing systematic errors.

Extraction of the $0^-$ (1.08 MeV) state of the $^{18}\text{O}(p,n)^{18}\text{F}$ transition has begun. A preliminary $D_{NN}$ value of $0.7263 \pm 0.0261 \pm 0.0568$ has been obtained for the $0^-$ and $0^+$ states combined. This $D_{NN}$ value suggests that 13.7$\%$ of the combined cross section is due to the $^{18}\text{O}(p,n)^{18}\text{F}(0^-)$ transition. This compares well with DWIA predictions of 10$\%$. Preliminary $D_{NN}$ values for higher excitation energy states have been obtained. A $D_{NN}$ value of $-0.2338 \pm 0.0389 \pm 0.0418$ has been calculated for the $^{18}\text{O}(p,n)^{18}\text{F}(1^+, 1.7 \text{ MeV})$ transition, and a $D_{NN}$ value of $-0.3937 \pm 0.0602 \pm 0.0444$ has been obtained for the $^{18}\text{O}(p,n)^{18}\text{F}(1^+, 3.7 \text{ MeV})$ transition. We are in the process of comparing these results with DWIA calculations. Further analysis is expected to reduce both the statistical and systematic errors.