POLARIZATION TRANSFER IN ^{10}B(p,p$'$)^{10}B INELASTIC SCATTERING

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In November 1990, we measured the cross section, analyzing power A_y, induced polarization P, and polarization transfer coefficient $D_{NN'}$ for ^{10}B(p,p$'$)^{10}B inelastic scattering with a 200 MeV polarized proton beam. Scattered particles were momentum analyzed with the K600 magnetic spectrometer and polarizations measured with the focal plane polarimeter. Additional running in February 1991 completed the data acquisition for cross section and analyzing power at small angles. Cross section and analyzing power angular distributions for both elastic and inelastic scattering were measured between $\theta_{\rm LAB} = 7.5°$ and 80° in 2.5° steps. Longer runs were made at five angles (20°, 30°, 40°, 50° and 60°) to accumulate the statistics necessary for precise measurements of the induced polarization P and the polarization transfer coefficient $D_{NN'}$.

Figure 1 shows a sample focal plane spectrum taken at a laboratory angle of 30° with a 5 mg/cm^2 target. All known transitions below 6.5 MeV were observed. The spins, parities, and excitation energies of most of these transitions are indicated on Fig. 1. Though the targets consisted of enriched ^{10}B (about 99%), there was occasional interference from ^{11}B and ^{12}C contaminants. Extra peaks below 4 MeV arise from these contaminants. We intend to extract information for the strongest and best isolated of these transitions, including the elastic scattering.

Of particular interest is the $3^+ \rightarrow 0^+$ transition to the $T = 1$ state at 1.74 MeV. This represents a "stretched" $0\hbar\omega$ excitation that proceeds via spin recoupling within the $p_{3/2}$ shell. It has been studied in inelastic electron scattering,[1] and its form factor has been measured over a large momentum transfer range from 100 to 800 MeV/c. Because of its low excitation, yield measurements are essentially free of background, and this transition can be followed over a comparable momentum transfer range in proton inelastic scattering. This makes it a good candidate with which to test our knowledge of the reaction mechanism and the spin-dependent parts of the isovector effective interaction.

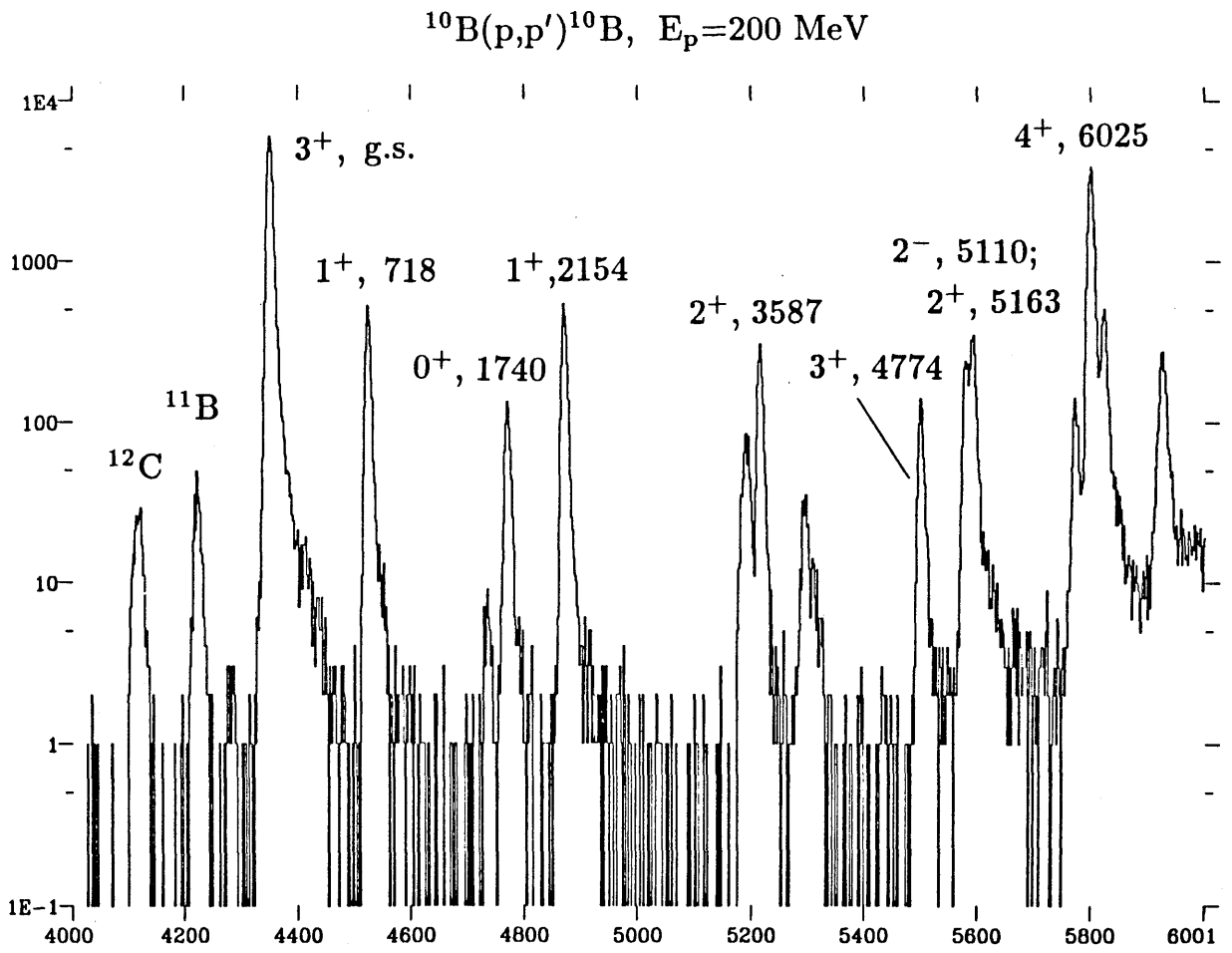

Figure 1. Focal plane position spectrum for ^{10}B(p,p')^{10}B at $\theta_{\rm lab} = 30°$. The spins, parities, and excitation energies in keV for most of the strong transitions are noted. The elastic peaks for ^{11}B and ^{12}C contaminants are noted. Extra peaks below 4 MeV excitation arise from contaminants.

Figure 2 shows the results of our analyzing power and polarization transfer measurements. The analyzing power has nearly constant value between 0.2 and 0.3, and $D_{NN'}$ is almost consistent with zero at all angles. The measurements of $D_{NN'}$ near 500 and 600 MeV/c are on-line results; their statistical precision should improve by about a factor of 2 when all of the data has been examined.

The calculation shown in Fig. 2 was made using the impulse approximation program DW86.[2] A pure $p_{3/2}$ $\Delta T = 1$ transition is assumed. Optical model parameters are from Lewis.[3] A reasonable description is obtained for the analyzing power. The calculation for $D_{NN'}$ is far from the data. In the vicinity of 300 MeV/c, these differences resemble

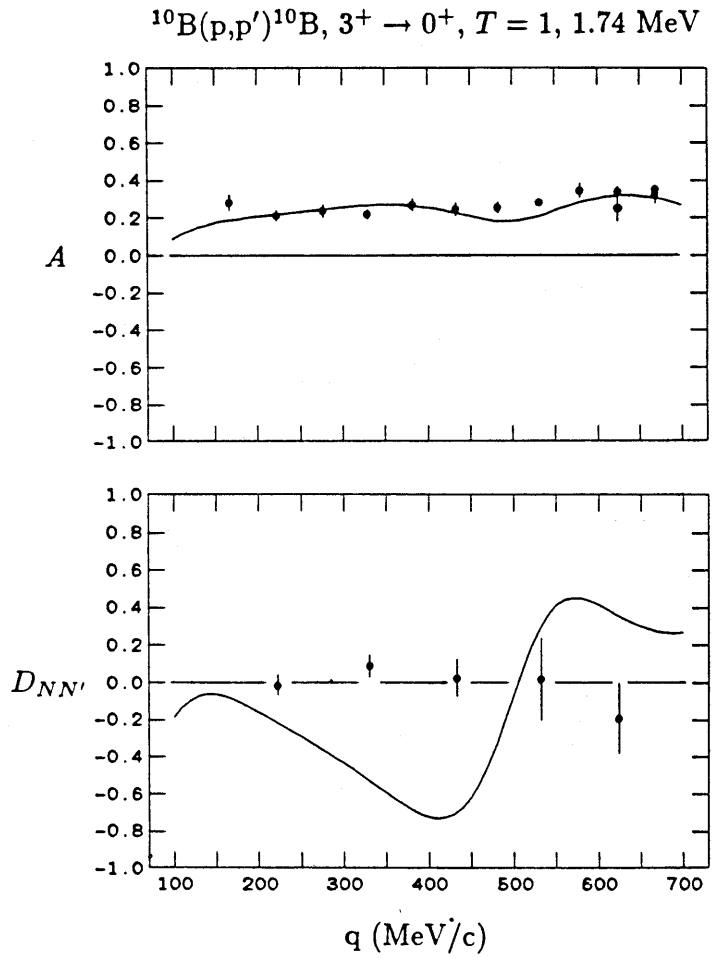

Figure 2. Measurements of the analyzing power A_y and the polarization transfer coefficient $D_{NN'}$ as a function of momentum transfer q for the $3^+ \rightarrow 0^+$, $T = 1$ transition in ^{10}B(p,p')^{10}B. The impulse approximation calculation is described in the text.

problems[4] noted for the 4^-, $T = 1$ transition to the state at 18.98 MeV in ^{16}O(p,p')^{16}O. A common explanation in terms of medium modifications to the effective isovector tensor interaction[5] is being sought.

1. R. S. Hicks, *et al.*, Phys. Rev. Lett. **60**, 905 (1988).
2. R. Schaeffer and J. Raynel, program DW70, as modified by S. M. Austin, W. G. Love, J. R. Comfort, and C. Olmer, private communication.
3. P. R. Lewis, Ph. D. thesis, University of Melbourne, May, 1990.
4. A. D. Bacher, *et al.*, IUCF Sci. and Tech. Report, May 1988 – April 1989, p. 12.
5. E. J. Stephenson and J. A. Tostevin, IUCF Sci. and Tech. Report, May 1990 – April, 1991.