$^{11}B(\vec{d},n)^{12}C$ REACTION STUDIES AT 79 MeV

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Analysis of the differential cross section angular distributions measured[1] for the $^{11}Be(d,n)^{12}C$ reaction at 79 MeV is complete and has been accepted for publication.[2] The overall conclusion was that adiabatic[3] calculations gave better fits to the angular distributions than conventional calculations.

In order to investigate whether this improvement is also reflected in the vector analyzing powers, measurements were made recently with polarized deuterons at the same energy. Adiabatic calculations resulted in improved fits to the analyzing power data but, as can be seen from Figure 1 for the ground state, such calculations with exact finite range and deuteron D state included still do not fit the vector analyzing power distributions very well. This is typical of the quality of agreement between calculated and measured analyzing power angular distributions for each of the states studied except for the 2^+ state at 4.44 MeV where the disagreement is even more striking as seen in Fig 2. If one focusses only on the data for these two states both of which are populated by ℓ=1 transfers, with the ground state involving J=ℓ+1/2 and the 4.4 MeV state J=ℓ-1/2, one sees an example of a trend in the data. The analyzing power distributions for states where J=ℓ+1/2 are qualitatively better fit than those where J=ℓ-1/2 in that the data for the latter case rises much more rapidly at angles greater than 20

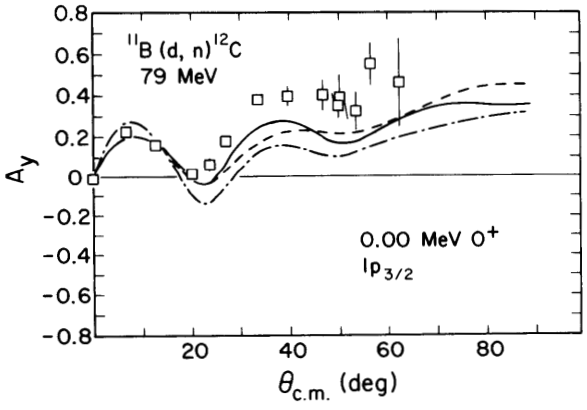

Figure 1. Experimental and calculated analyzing powers for the 0.00 MeV 0^+ state in ^{12}C excited in $^{11}B(d,n)$ at 79 MeV. The solid, dashed and dot-dash curves correspond respectively to adiabatic calculations in approximate finite range, in exact finite range (EFR) with deuteron S-state only, and in EFR with deuteron S- and D-state contributions added coherently.

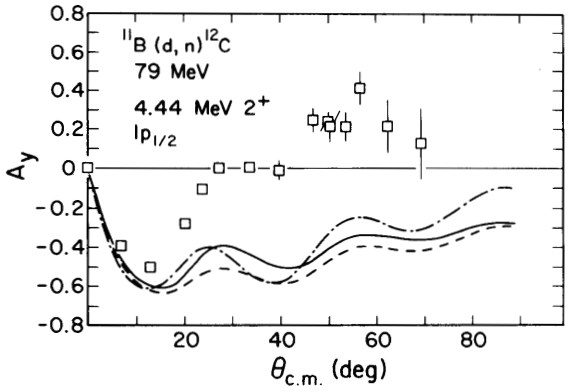

Figure 2. Experimental and calculated analyzing powers for the 4.44 MeV 2^+ state in ^{12}C. The curves represent the equivalent calculations for the 2^+ state as those in Fig. 1.

degrees than the calculations despite the inclusion of exact finite range and the deuteron D state.

The effects of two step processes in the transition to the 4.44 MeV state have been investigated as was the use of a bound state geometry obtained from elastic scattering form factors but the results were not significantly different from those using single step transfers or a standard bound state geometry.

A paper summarizing these results in more detail has been prepared but the inability to achieve good fits to the data is unaccounted for at present.

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1) C.C. Foster et al., IUCF Scientific and Technical Report 1982, p. 128.

2) P.B. Foot et al., Phys. Rev. C, in press.

3) R.C. Johnson and P.J.R. Soper, Phys. Rev. C 1, 976 (1970).

(d,n) REACTION STUDIES AT 80 MeV

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Spectroscipic factors have been extracted for the 0.0, 1.78, 4.61, 4.97, and 6.28 MeV states excited by the $^{27}Al(d,n)^{28}Si$ reaction at 78.9 MeV incident deuteron energy. Adiabatic calculations using the method of Johnson and Soper[1] have been found to fit the cross section angular distributions well and better than standard DWUCK4[2] calculations[3]. In addition, it has been possible to determine the spectroscopic factors for the 6^-, T=0 state at 11.57 MeV and the 6^-, T=1 state at 14.36 MeV from this data with about 20 percent uncertainties. A few details must be clarified before this work, which is in preprint form, is ready for publication.

Vector analyzing powers for the $^{48}Ca(d,n)^{49}Sc$ reaction at 78.7 MeV have been measured to complement the cross section data measured previously.[1] Analysis of the full set of data has been carried out in terms of DWBA and Johnson-Soper adiabatic approximation (JSAA) calculations. The JSAA calculations generally provided a better description of the data, with reasonable absolute spectroscopic factors. An upper limit (<5%) to the amount of proton two-particle-two-hole ground state correlations is obtained from the cross sections for the unresolved doublet of positive parity states near 2.3 MeV of excitation. This work is in preprint form.

The quality of agreement between the calculated and measured vector analyzing power angular distributions is not very good for the dominant $7/2^-$ ground state excitation although the general trend of the data is reproduced as seen in Fig. 1. It is clear from this data and from the $^{11}B(d,n)^{12}C$ vector analyzing power data[4] that it is not possible to obtain good fits to analyzing power data for (d,n) reactions