Proc. Sixth Int. Symp. Polar. Phenom. in Nucl. Phys., Osaka, 1985
J. Phys. Soc. Jpn. 55 (1986) Suppl. p. 748-749

1.98 **Analysing powers of the ^{28}Si($^{3}\vec{He}$,^{2}He)^{29}Si reaction**

O. Karban, I.M. Turkiewicz*, L. Potvin** and M.B. Becha

Department of Physics, University of Birmingham, P.O. Box 363,
Birmingham B15 2TT, England

*Institute for Nuclear Studies, Warsaw, Poland
** University of Lavel, Montreal, Canada

The ^{3}He breakup on ^{28}Si was studied at 52 MeV by the Groningen group[1-3] suggesting several possible mechanisms contributing to the (^{3}He,dp) channel and a dominance of a single-neutron stripping in the (^{3}He,pp) channel at small relative proton energies ϵ. The present experiment was undertaken to study these processes at a lower energy of 33 MeV and to measure the polarisation effects to provide additional tests for the proposed reaction models.

The polarised ^{3}He beam from the Birmingham University Radial Ridge cyclotron was incident on a 5 mg/cm^2 self-supporting silicon target and the reaction products were detected in four ΔE-E telescopes positioned in pairs symmetrically to the left and right of the beam. The telescopes in each pair were situated vertically above and below the median scattering plane at an angle of ±10°. For proton-proton coincidences within a given pair of detectors the relative proton energy along a locus varied between 0.7 and 2.5 MeV with an average value of ~1 MeV. In addition, some data were taken with all detectors in the same plane (coplanar geometry); these results are plotted as open circles in Fig.1 at angles $\theta=|\theta_1-\theta_2|/2$.

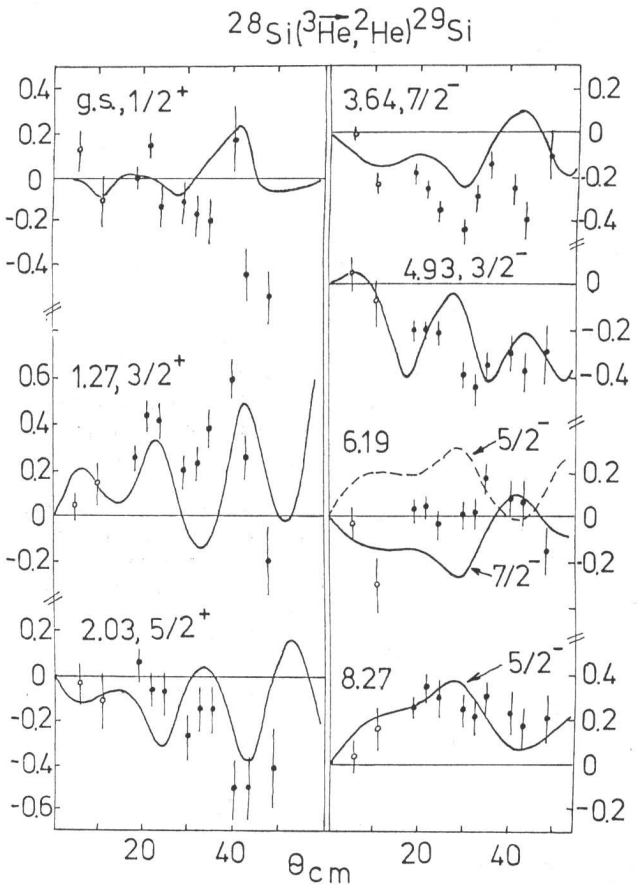

Fig.1 Analysing powers of the ^{28}Si($^{3}\vec{He}$,^{2}H)^{29}Si reaction.

The total energy spectra of the pp coincidences are dominated by seven groups indicating that the corresponding breakup process can be characterised by a constant Q-value defined by states in the residual nucleus ^{29}Si. In addition the spectra contain a strong continuum which cannot be associated with a ^{2}He cluster in the final state. Both these features are in excellent agreement with results of ref.1. Assuming a dominance of a direct neutron stripping mechanism the peaks in the total energy spectra were integrated and the analysing powers extracted as in the case of two-body reactions with single detectors in the median plane. The results are plotted as a function of the ^{2}He c.m. angle in Fig.1.

The observed polarisation effects are large, reaching values of ±0.5, and are clearly dependent on the characteristics of the ^{29}Si states. Moreoever, the analysing powers are evidently j-dependent, as can be seen when comparing e.g. the 1.27 and 2.03 data for ℓ=2: the values are predominantly positive

for $j=3/2^+$ and negative for $j=5/2^+$. Similarly, the analysing powers for the $\ell=3$ transitions[1] to the 3.64 and 8.27 MeV states have opposite signs and since J^π of the former is $7/2^-$ the latter can be assigned $J^\pi=5/2^-$. The analysing powers of the $3/2^-$ transition to the 4.93 MeV state also agree with this empirical rule, i.e. negative values for a $j=\ell+1/2$ transfer. Note that the same behaviour of the analysing powers was observed in the (^{3}He,α) reactions on 1p and 1d shell nuclei[4]. A possible explanation of this effect could be in the projectile-ejectile spin structure, i.e. in both cases the ejectile cluster is spinless.

In the framework of the sequential breakup model standard DWBA calculations for a neutron stripping were performed with the ^{3}He potential of ref[5] and replacing the unknown ^{2}He potential in the outgoing channel by a spinless deuteron potential derived from ref.[6], as suggested in ref.[1]. Results of these calculations are compared with the experimental breakup data in fig.1. It is evident, that this model can reproduce the magnitude of the observed analysing powers and also predicts correctly in all cases the above empirical j-dependence. It may be concluded that the present results give a strong support for the sequential breakup model of the (^{3}He,pp) reaction at small ϵ energies.

References

1) J. van Driel et al., Nucl. Phys. A342 (1980) 1
2) E.H.J. Aarts et al., Nucl. Phys. A380 (1982) 465
3) E.H.J. Aarts et al., Phys. Lett. 105B (1981) 130
4) Y.-W. Lui et al., Nucl. Phys. A333 (1980) 221
5) F. Entezami et al., Nucl. Phys. A366 (1981) 1
6) G.M. Perey and F.G. Perey, Nucl. Data 17 (1976) 1