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Splitting of single particle configurations from a high resolution $^{144}Sm(\vec{d},p)$ study+)

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The $^{144}Sm(d,p)$ reaction[1] has been remeasured with vector polarized deuterons at E_d = 19 MeV. For an overall energy resolution up to 4.5 keV FWHM for excitation energies up to 4100 keV we used the Q3D magnetic spectrograph. With a multiwire focal plane detector we obtained overlapping spectra at different magnetic field settings, each covering 500 keV ranges.

The number of scattering angles varied from 11 to only 3 for excitation energies above E_x = 3700 keV. About 100 excited states have been identified in a reproduction of the spectra at different angles using a peak fitting program with an appropriate energy calibration. Spin assignments have been obtained for more than 60 of these states (see fig. 1) by comparison with angular distributions in $\sigma(\theta)$ and

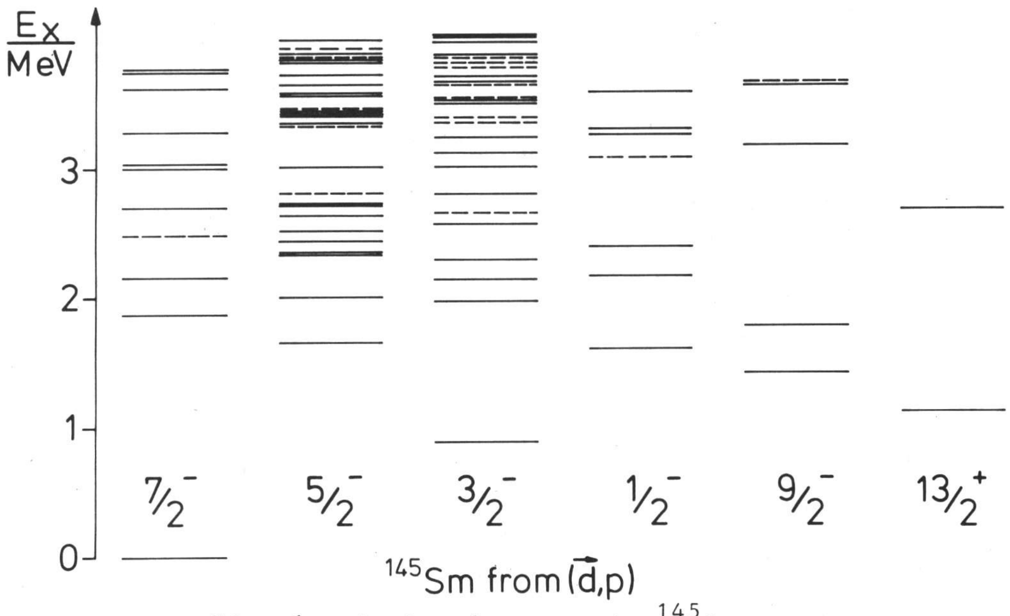
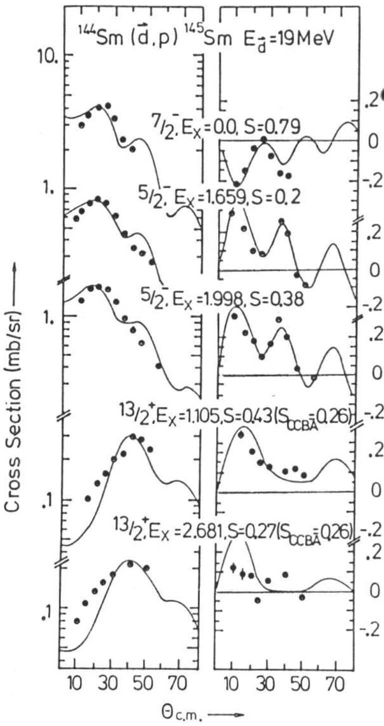


Fig. 1. Assigned states in ^{145}Sm

$iT_{11}(\theta)$ characteristic for 2f7/2, 2f5/2, 3p3/2, 3p1/2, 1h9/2 or 1i13/2 transfer (the neutron single particle configurations of the 82<N<126 shell, see also Fig. 2). For low lying levels the assignments confirm an isobaric analog study with polarized protons[2] and most of the findings of Booth et al.[1]. Untypical patterns may arise from unresolved doublets or especially in the case of weak transitions from the coherent superposition of inelastic transfer amplitudes. Thus it is not possible to assign quantum numbers to any state.

Spectroscopic factors result from comparison with DWBA. The deuteron potentials of Daehnick et al.[3] and of Lohr et al.[4] give different, sometimes good sometimes poor reproductions depending on (l,j).



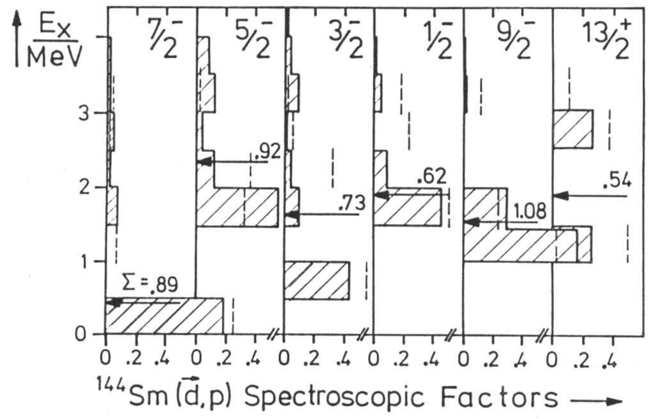


Fig. 3. Distribution of the spectroscopic strength

Fig. 2. Angular distributions of transitions with transfered orbital angular momentum l = 3 and 6

We had no success to determine an improved potential good for all (l,j) transitions, thus spectroscopic factors have to be taken as relative quantities.

The behaviour of transitions with transferred orbital angular momenta l=3 and 6 (with the deuteron potential of ref.3) are illustrated in Fig. 2.

For the 13/2+ states at E_x = 1105 keV and 2681 keV (see also Fig. 2) inelastic transfer (3^- core excitation followed by f7/2 neutron transfer and vice versa) interferes with different signs in the excitation of the two states[5,6] thus changing the DWBA spectroscopic factors from S = 0.43 and S = 0.27 to S = 0.26 and S = 0.26.

The distribution of spectroscopic strength for the six configurations is summarized in Fig. 3, displaying averages over 500 keV intervals. The weighted energies and the observed sums of spectroscopic factors are also indicated. The dashed lines indicate results of single particle core coupling calculations of K. Heyde[6], they underestimate in part the strength of mixing. Noticeable is e.g. for the case of the 25 resolved 5/2+ states the amount of 30% of the strength distributed over many of the weak states above 2500 keV.

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