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1.81 Spins of States in ^{35}P and ^{35}S

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The knowledge on properties of excited states in ^{35}P and ^{35}S is scarce[1]. 52 MeV vector-polarized deuterons from the Karlsruhe cyclotron were used to study hole states of these nuclei via the ($\vec{d}$,^{3}He) and ($\vec{d}$,t) reactions on ^{36}S. We took a ^{208}Pb ^{36}S target on carbon backing with highly enriched ^{36}S (81.1%).

Fig. 1 gives the results for states observed in the ^{36}S($\vec{d}$,^{3}He)^{35}P reaction; those from the ^{36}S($\vec{d}$,t)^{35}S are not shown for brevity. Pronounced effects of the measured analysing powers which have been demonstrated to be widely stable against changes of target mass and Q-value[2] allow the determination of the transferred angular momentum j and hence the spins of final states in ^{35}P and ^{35}S. The qualitatively correct description of the data by local, zero-range DWBA-calculations confirms the empirically found assignments. As shown previously[3], the comparison of energies and spectroscopic factors from simultaneously measured (d,^{3}He) and (d,t) reactions enables the identification of states in ^{35}S with T = 5/2, which are the analog states of the parent states observed in ^{35}P. The remainder part of the ^{35}S spectrum represents the distribution of the T = 3/2 strength. The spectroscopic results (excitation energies, spins, parities, isospins and spectroscopic factors) are summarized in tables 1 and 2 for the ^{36}S($\vec{d}$,^{3}He)^{35}P and ^{36}S($\vec{d}$,t)^{35}S reactions, respectively.

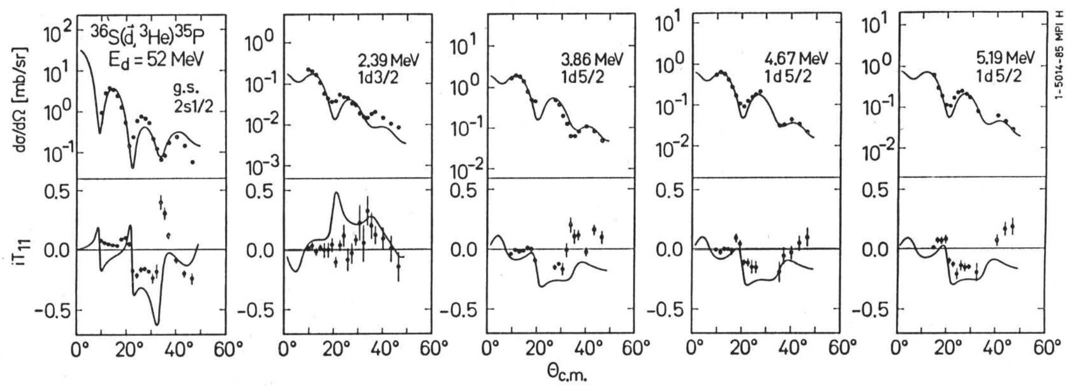

Fig. 1. Angular distributions of $\sigma(\theta)$ and $iT_{11}(\theta)$ from the ^{36}S($\vec{d}$,^{3}He)^{35}P reactions compared to DWBA calculations.

States in ^{35}P

Besides the transition to the ground state with known spin $I^{\pi} = 1/2^{+}$ we observe four excited states at 2386, 3857, 4665 and 5189 keV. We confirm the $1/2^{+}$ assignment for the ground state and assign spin and parity $I^{\pi} = 3/2^{+}$ to the weak first excited state at 2386 keV and $I^{\pi} = 5/2^{+}$ for the remaining ones. Compared to proton pick-up from ^{32}S and ^{34}S the fragmentation of the 2s, 1d-strength is distinctly reduced.

States in ^{35}S

The existing information on ^{35}S states is limited to $E_x < 3.5$ MeV; it is based on (n,γ) and (d,pγ) work[1] and is confimed by our measurements. We find additional states at 4975, 5779, 6662, 7380 and 7773 keV all with $I^{\pi} = 5/2^{+}$ and T = 3/2. Analog states with T = 5/2 are found at 9135 keV ($I^{\pi} = 1/2^{+}$), 12876, 13654 and 14020 keV (all with $I^{\pi} = 5/2^{+}$).

1) P.M. Endt, C. van der Leun, Nucl. Phys. A310 (1978) 127
2) G. Mairle et al., Nucl. Phys. A363 (1981) 413
3) G. Mairle et al., Nucl. Phys. A280 (1971) 97

$E_x(^{35}P)$ (keV)	I^{π}	nlj*	C^2S
g.s.	$1/2^+$	$2s_{1/2}$	1.63
2386(6)	$3/2^+$	$1d_{3/2}$	0.31
3857(2)	$5/2^+$	$1d_{5/2}$	2.91
4474(21)		$1d_{5/2}$	<0.2
4665(3)	$5/2^+$	$1d_{5/2}$	1.06
5189(13)	$5/2^+$	$1d_{5/2}$	1.38
7520(30)		$1d_{5/2}$	<0.4

$E_x(^{35}S)$ (keV)	I^{π}	T	nlj*	C^2S
g.s.	$3/2^+$	3/2	$1d_{3/2}$	3.65
1578(7)	$1/2^+$	3/2	$2s_{1/2}$	1.42
1965(35)		3/2	$1f_{7/2}$	0.42
			$1d_{5/2}$	0.40
2745(11)	$5/2^+$	3/2	$1d_{5/2}$	0.81
3447(18)	$5/2^+$	3/2	$1d_{5/2}$	0.72
4975(29)	$5/2^+$	3/2	$1d_{5/2}$	0.47
5779(20)	$5/2^+$	3/2	$1d_{5/2}$	1.30
6662(19)	$5/2^+$	3/2	$1d_{5/2}$	0.52
7380(11)	$5/2^+$	3/2	$1d_{5/2}$	0.74
7773(26)	$5/2^+$	3/2	$1d_{5/2}$	0.50
9135(26)	$1/2^+$	5/2	$2s_{1/2}$	0.31
12876(27)	$5/2^+$	5/2	$1d_{5/2}$	0.85
13654(44)	$5/2^+$	5/2	$1d_{5/2}$	<0.3
14020(70)	$5/2^+$	5/2	$1d_{5/2}$	<0.4

Table 1 and 2:
Spectroscopic results from the $^{36}S(\vec{d},{}^{3}He)^{35}P$ and the $^{36}S(\vec{d},t)^{35}S$ reactions.
*quantum numbers assumed in DWBA calculations