^{34}S(d,pγ) 1972Fr11

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Jun Chen, John Cameron and Balraj Singh	NDS 112,2715 (2011)	20-Oct-2011

1972Fr11: E=3.5 and 4 MeV deuterons produced from the 4 MV Van de Graaff accelerator at the Nuclear Research Center of Strasbourg. Targets: a layer of antimony sulphide enriched to 85.6%, 550 μg/cm^2 on a 0.03 mm molybdenum layer for the first experiment and 150 μg/cm^2 on a 0.05 mm silver layer for the second experiment. Detectors: a 40 cm^3 Ge(Li) for γ-rays at 0°, 55° and 90°, FWHM=3.2 keV at Eγ=1.332 MeV in the first experiment, a NaI crystal for γ-rays at 0°, 30°, 45°, 60° and 90° in the second experiment, and a surface-barrier silicon detector at 180°. Measured Eγ, σ(E$_p$,E$_\gamma$,θ(pγ)). Deduced levels, J, branchings, mixing ratios. Deduced T$_{1/2}$ using the Doppler-Shift Attenuation Method (DSAM).

1970Bu18: E=2-3.25 MeV deuterons produced form the University of Arizona 5.5 MV Van de Graaff accelerator. Targets: Ag$_2$S of 480 *120* μg/cm^2 made by heating 67% enriched ^{34}S powder and silver foil. Detectors: an annular silicon surface barrier of 1 mm for proton detection and a 7.62 cm by 7.62 cm NaI(Tl) for γ-rays at 0°, 25°, 40°, 50°, 65° and 90°. Measured σ(E$_p$,E$_\gamma$,θ(pγ)). Deduced levels, J, branchings and mixing ratios. Deduced T$_{1/2}$ using the Doppler-Shift Attenuation Method (DSAM).

1971Pr11: E=4.48 deuterons produced from the ARL insulated-core transformer tandem accelerator at the Aerospace Research Laboratories (ARL). Targets: Ag^{2}S, enriched to 85.61% in ^{34}S. Detectors: a 500 μm, 50 mm^2 silicon detector for proton detection and a 1.5 in by 1 in NE111 scintillator for γ-rays. Measured pγ-delayed spectrum. Deduced T$_{1/2}$ for the level of 1.99 MeV from decay curve.

1972Va07: E=4.72 MeV deuteron beam of 172 nA produced from the Groningen 5 MV Van de Graaff generator. Target: a 80 μg/cm^2 Zn^{34}S enriched to 89% evaporated onto 10μg/cm^2 Formva plus 10μg/cm^2 carbon. Detectors: a 2 mm annular silicon detector for proton detection and a 7.6 cm by 7.6 cm NaI(Tl) for γ-rays. Measured Eγ, $\gamma(\theta)$. Deduced level energies, J, mixing ratios for the levels of 1575, 1993, 2351, 2720 and 2942 keV.

1975VaYG: E=4.72 MeV deuteron beam of 175 nA produced from the Groningen 5 MV Van de Graaff generator. Targets of ZnS (80% ^{34}S), thickness of about 80 μg/cm^2, evaporated onto 10 μg/cm^2 Formvar plus 10 μg/cm^2 carbon backings. Detectors: A 7.6-cm by 7.6-cm NaI(Tl) detector for detecting γ-rays and a 2 mm annular silicon surface barrier detector for detecting protons. Measured σ(E$_p$), Eγ, Iγ, p$\gamma(\theta)$-coin. Deduced levels, J^π, branchings, mixing ratios.

Additional information 1.

^{35}S Levels

E(level)†	J$^\pi$‡	T$_{1/2}$	Comments
0	3/2$^+$		
1572.5 *4*	1/2$^+$	>1.3 ps	E(level): weighted average from 1970Bu18, 1972Fr11 and 1975VaYG. T$_{1/2}$: from 1970Bu18.
1991.7 *4*	7/2$^-$	1.02 ns *5*	E(level): weighted average from 1970Bu18, 1972Fr11 and 1975VaYG. T$_{1/2}$: from 1971Pr11.
2348.2 *4*	3/2$^-$	0.71 ps *15*	E(level): weighted average from 1970Bu18, 1972Fr11 and 1975VaYG. T$_{1/2}$: weighted average from 1970Bu18 and 1972Fr11.
2718.4 *4*	(3/2,5/2,7/2)	69 fs *24*	T$_{1/2}$: from 1972Fr11.
2935.5 *4*	(3/2,5/2)		E(level): weighted average from 1972Fr11 and 1975VaYG. J$^\pi$: from 1972Va07.
3421.5 *4*	(3/2,5/2,7/2)	<70 fs	
3563.5 *6*			
3592.5 *5*			
3675			
3802.5 *5*	3/2$^-$	25 fs *18*	
3815.7 *11*			
3885.5 *5*			
4025.5 *5*			
4107.5 *5*		<55 fs	
4180 *3*			
4189.5 *4*		<35 fs	
4302 *4*			
4480.5 *4*		<62 fs	

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^{34}S(d,pγ) 1972Fr11 (continued)

^{35}S Levels (continued)

† Values with uncertainties from a least-squares fit to Eγ's and others from 1972Fr11, unless otherwise noted.
‡ From $\gamma(\theta)$ in 1972Fr11, unless otherwise noted.

$\gamma(^{35}S)$

E_i(level)	J_i^π	E_γ †	I_γ ‡	E_f	J_f^π	Mult.	δ	Comments
1572.5	1/2$^+$	1572	100	0	3/2$^+$			A_2=−0.09 *5*, A_4=+0.07 *6* (1972Fr11).
1991.7	7/2$^-$	1993	100	0	3/2$^+$			δ: +0.19 *7* for J=5/2, −0.11 *4* for J=7/2 (1970Bu18); −0.11 *4* for J^π=7/2$^-$ (1972Fr11); δ(M2/E1)=−0.43 *3* for J=5/2$^-$, B(E1)(W.u.)=6.8×10^{-8}, B(M2)(W.u.)=0.019 or δ(E3/M2)=+0.28 *3*, B(M2)(W.u.)=0.084, B(E3)(W.u.)=10 (1972Va07). B(M2)(W.u.)=0.089 *4*, B(E3)(W.u.)=1.6 *12* (1971Pr11). A_2=+0.35 *4*, A_4=−0.39 *4* (1972Fr11).
2348.2	3/2$^-$	776	27 *1*	1572.5	1/2$^+$	E1+M2	−0.01 *4*	Mult.,δ: from $\gamma(\theta)$ in 1972Fr11. δ: Other: +0<δ<+1.7 (1972Va07). A_2=−0.37 *3*, A_4=−0.03 *3* (1972Fr11).
		2350	73 *1*	0	3/2$^+$	E1+M2	−0.27 *12*	Mult.,δ: from $\gamma(\theta)$ in 1972Va07. A_2=+0.33 *2*, A_4=−0.05 *2* (1972Fr11). B(E1)(W.u.)=4×10^{-5} (1972Fr11);B(E1)(W.u.)=2.4×10^{-5}, B(M2)(W.u.)=3.9 (1972Va07).
2718.4	(3/2,5/2,7/2)	370.5	<5	2348.2	3/2$^-$			
		726.8	<5	1991.7	7/2$^-$			
		1145.7	<5	1572.5	1/2$^+$			
		2718	100	0	3/2$^+$			A_2=+0.47 *6*, A_4=−0.08 *7* (1972Fr11). δ: δ(M2/E1)>+0.5, B(M2)(W.u.)>45 or δ(E3/M2)=+0.18 *18*, B(M2)(W.u.)=300 *120* (1972Fr11).
2935.5	(3/2,5/2)	587.5	<10	2348.2	3/2$^-$			
		943.8	<20	1991.7	7/2$^-$			
		1362.7	<15	1572.5	1/2$^+$			
		2935	100	0	3/2$^+$			
3421.5	(3/2,5/2,7/2)	486	<4	2935.5	(3/2,5/2)			
		703	<6	2718.4	(3/2,5/2,7/2)			
		1073.5	<7	2348.2	3/2$^-$			
		1429.8	<30	1991.7	7/2$^-$			
		1848.7	<7	1572.5	1/2$^+$			
		3421	100	0	3/2$^+$			A_2=−0.54 *8*, A_4=−0.11 *7* (1972Fr11).
3592.5		657	<10	2935.5	(3/2,5/2)			
		874	<11	2718.4	(3/2,5/2,7/2)			
		1244.5	<15	2348.2	3/2$^-$			
		1601	<17	1991.7	7/2$^-$			
		2020	<17	1572.5	1/2$^+$			
		3592	100	0	3/2$^+$			
3802.5	3/2$^-$	867	<4	2935.5	(3/2,5/2)			
		1084	5 *2*	2718.4	(3/2,5/2,7/2)			
		1454.5	8 *3*	2348.2	3/2$^-$			
		1811	<4	1991.7	7/2$^-$			
		2230	42 *4*	1572.5	1/2$^+$			A_2=−0.56 *15*, A_4=0.0 *1* (1972Fr11).
		3802	45 *4*	0	3/2$^+$			A_2=+0.19 *12*, A_4=0.0 *1* (1972Fr11).
3815.7		1824	100	1991.7	7/2$^-$			

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^{34}S(d,pγ) 1972Fr11 (continued)

$\gamma(^{35}S)$ (continued)

E_i(level)	J_i^π	E_γ †	I_γ ‡	E_f	J_f^π
3885.5		464	<30	3421.5	(3/2,5/2,7/2)
		950	<12	2935.5	(3/2,5/2)
		1167	<15	2718.4	(3/2,5/2,7/2)
		1537.5	<18	2348.2	$3/2^-$
		1894	100	1991.7	$7/2^-$
		2313	<16	1572.5	$1/2^+$
		3885	<16	0	$3/2^+$
4025.5		462	<5	3563.5	
		604	<10	3421.5	(3/2,5/2,7/2)
		1090	31 *8*	2935.5	(3/2,5/2)
		1307	<8	2718.4	(3/2,5/2,7/2)
		1677.5	33 *12*	2348.2	$3/2^-$
		2034	<10	1991.7	$7/2^-$
		2453	36 *12*	1572.5	$1/2^+$
		4025	<13	0	$3/2^+$
4107.5		544	<4	3563.5	
		686	<4	3421.5	(3/2,5/2,7/2)
		1172	13 *6*	2935.5	(3/2,5/2)
		1389	<10	2718.4	(3/2,5/2,7/2)
		1759.5	<5	2348.2	$3/2^-$
		2116	<7	1991.7	$7/2^-$
		2535	<5	1572.5	$1/2^+$
4107.5		4107	87 *6*	0	$3/2^+$
4189.5		387	<4	3802.5	$3/2^-$
		597	<4	3592.5	
		626	<4	3563.5	
		768	<4	3421.5	(3/2,5/2,7/2)
		1254	<5	2935.5	(3/2,5/2)
		1471	<5	2718.4	(3/2,5/2,7/2)
		1841.5	48 *5*	2348.2	$3/2^-$
		2198	<8	1991.7	$7/2^-$
		2617	<6	1572.5	$1/2^+$
		4189	52 *5*	0	$3/2^+$
4480.5		595	<5	3885.5	
		678	<5	3802.5	$3/2^-$
		888	<5	3592.5	
		917	<5	3563.5	
		1059	<10	3421.5	(3/2,5/2,7/2)
		1545	<7	2935.5	(3/2,5/2)
		1762	61 *7*	2718.4	(3/2,5/2,7/2)
		2132.5	<8	2348.2	$3/2^-$
		2489	<10	1991.7	$7/2^-$
		2908	39 *7*	1572.5	$1/2^+$
		4480	<12	0	$3/2^+$

† From level energy difference (1972Fr11).
‡ From 1972Fr11, unless otherwise noted.

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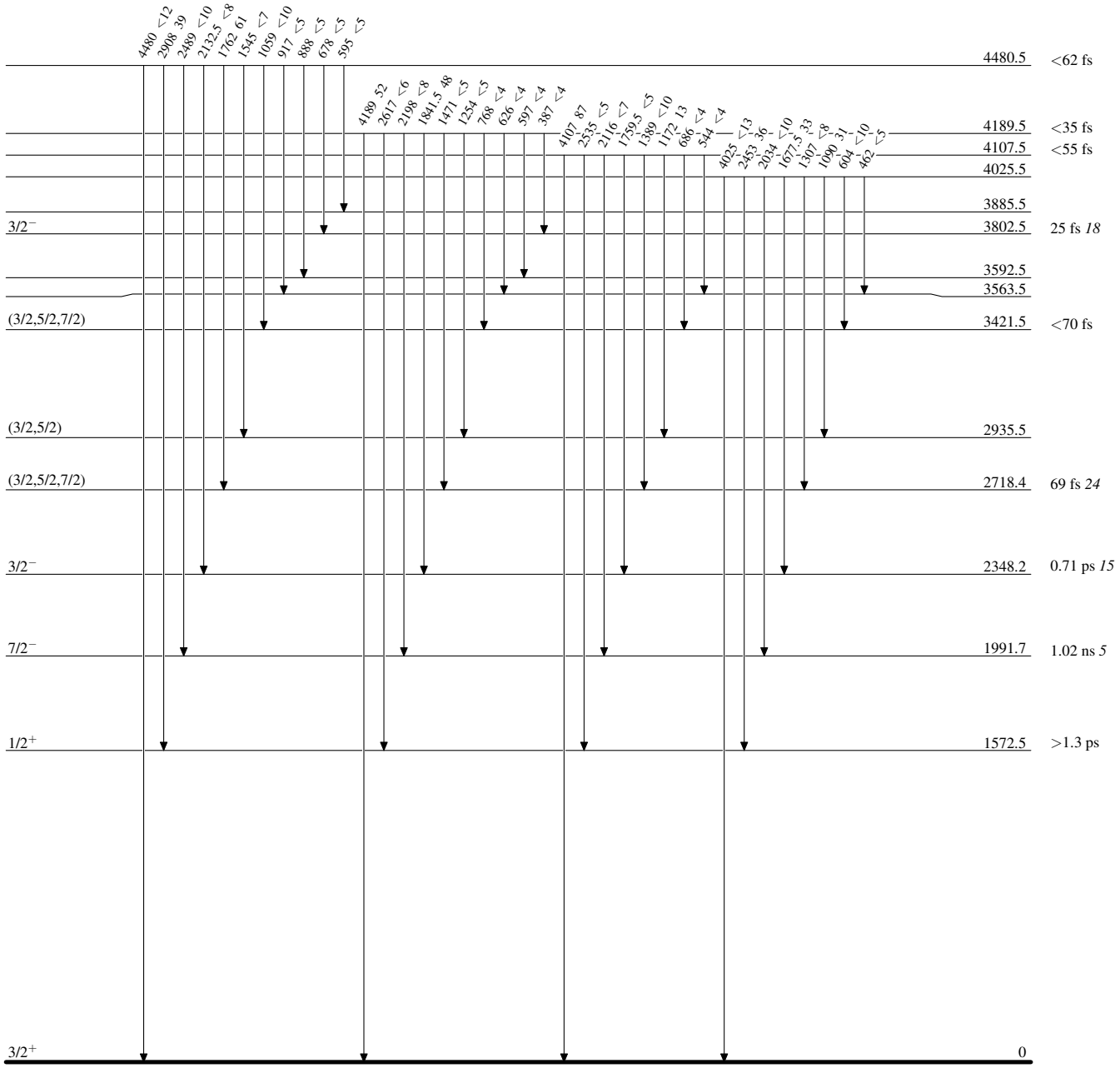
Level Scheme

Intensities: % photon branching from each level

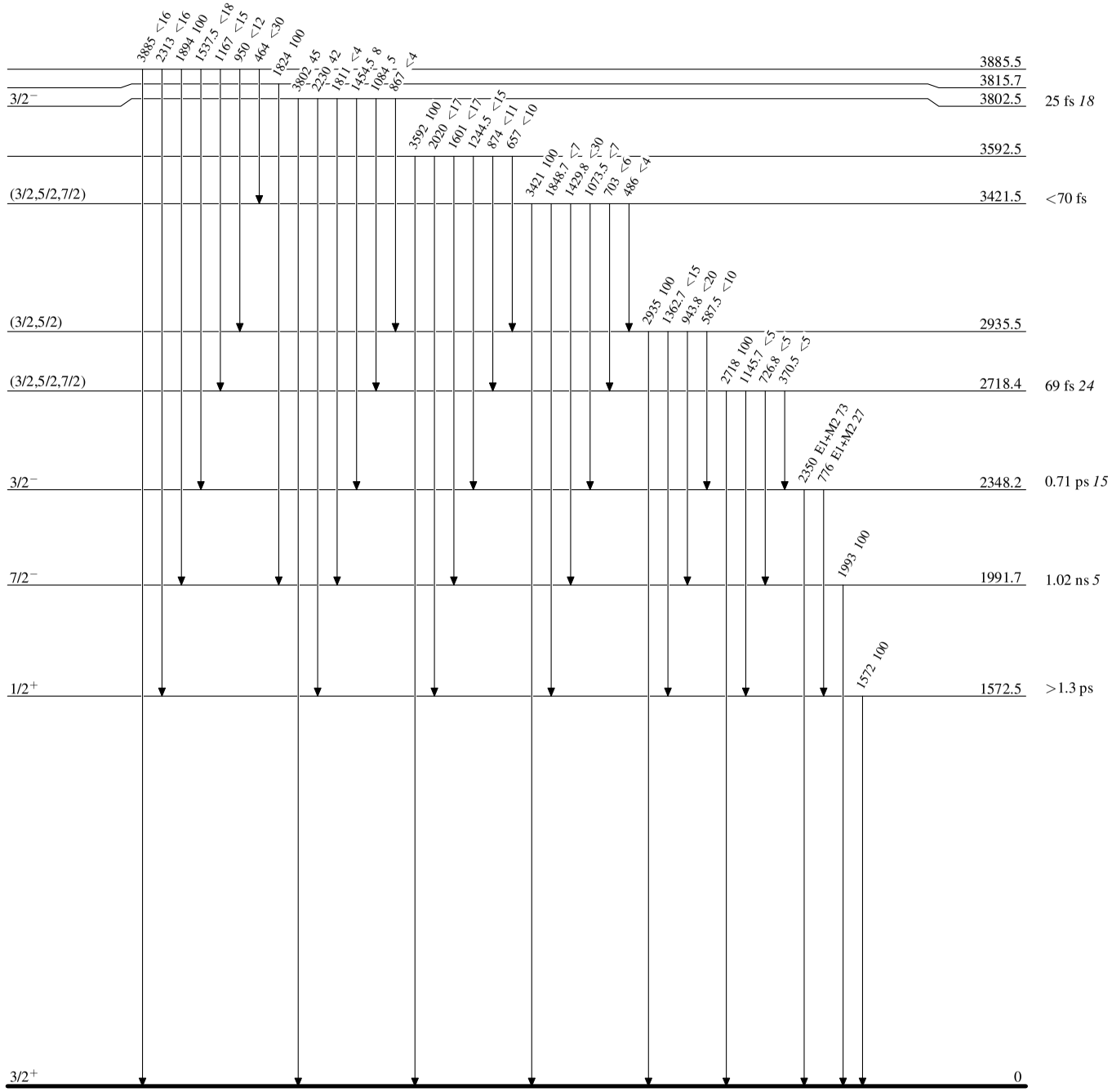


$^{35}_{16}S_{19}$

^{34}S(d,pγ) 1972Fr11

Level Scheme (continued)

Intensities: % photon branching from each level



$^{35}_{16}S_{19}$