^{32}S(n,γ) E=res 1974Ke18,1970Lu15,1967Be36

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Jun Chen and Balraj Singh	NDS 199,1 (2025)	30-Sep-2024

S(n)(^{33}S)=8641.6392 *5* (2021Wa16).

1974Ke18: E_R=30 and 43 keV neutrons were produced by ^{7}Li(p,n)^{7}Be. Target was natural S. Neutron energies measured by Time-Of-Flight. γ rays were detected with a 40 cm^3 Ge(Li) crystal, FWHM=2.3 keV at Eγ=1.33 MeV. Measured Eγ, Iγ. Deduced levels for resonances at E_R=30 and 43 keV.

1970Lu15: E_R=30 and 42 keV neutrons were produced by ^{7}Li(p,n)^{7}Be with protons of 5-7 μA from the 5.5 MeV pulsed Van de Graaff at Studsvik. Target was natural S. Neutron energies were measured by Time-Of-Flight with a resolution of 12 ns. γ rays were detected with a 22.6-cm-diam by 20.8-cm-long NaI(Tl) crystal (FWHM=9.2% for Eγ=0.662 MeV). Measured Eγ, Iγ. Deduced levels, branchings for resonances at E_R=30 and 42 keV.

1967Be36: E_R=30 and 111 keV neutrons were produced by ^{7}Li(p,n)^{7}Be with protons from the ORNL 3-MV terminal-pulsed-bunched Van de Graaff. Neutron energies measured by Time-Of-Flight. γ rays were detected with a 9-in. by 9-in. NaI(Tl) crystal. Measured Eγ, Iγ. Deduced levels, branchings for resonances at E_R=30 and 111 keV.

1992Ki03 (also 1988Ki02,1992Ki23): E_R=103 and 203 keV neutrons were produced by ^{7}Li(p,n)^{7}Be. Target was natural ^{32}S. γ rays were detected with a 76-mm-diam by 152-mm-long NaI(Tl) detector centered in a 254-mm-diam by 280-mm-long NaI(Tl) hollow anti-Compton detector for γ-rays; neutrons were detected by a 102-mm-diam by 6.4-mm-long ^{6}Li-glass scintillator with energies measured by Time-Of-Flight. Measured Eγ, Iγ. Deduced resonance levels, partial widths.

1965Be20: E_R=30 and 110 keV neutrons. Neutron energy measured by time-of-flight. γ rays were detected with a NaI spectrometer. Measured γ spectra.

1970Cv01: E_n=14 MeV neutron beam on different targets. Measured σ(E_γ).

^{33}S Levels

E(level)[†]	J$^\pi$[‡]	Comments
0	3/2$^+$	
842	1/2$^+$	
1968	5/2$^+$	
2313	3/2$^+$	
2870	5/2$^+$	E(level): from 1970Lu15.
3221	3/2$^-$	
3930		E(level): from 1992Ki03.
4050		E(level): from 1992Ki03.
4213	3/2$^-$	
4920		
5715	1/2$^-$	
5883		
8672	3/2$^-$	J$^\pi$: as proposed in 1967Be36 and 1970Lu15. E(level): E_R=30 keV (1974Ke18).
8685		E(level): E_R=43 keV (1974Ke18).
8745	1/2$^+$	E(level),J$^\pi$: E_R=103 keV, $s_{1/2}$-wave resonance from analysis of resonance data (1988Ki02,1992Ki03). The s-wave resonance at E_R=111 keV in 1967Be36 is considered as the same resonance based on agreements of energy and J^π as well as γ-decay pattern.
8845	1/2$^-$	E(level),J$^\pi$: from E_R=203, $p_{1/2}$-wave resonance from analysis of resonance data (1988Ki02,1992Ki03).

[†] From 1974Ke18, unless otherwise noted. E(level) of resonance is deduced from E(level)=E_R+S(n)(^{33}S), with S(n)=8641.6392 *5* (2021Wa16).

[‡] From the Adopted Levels, unless otherwise noted.

^{32}S(n,γ) E=res 1974Ke18,1970Lu15,1967Be36 (continued)

$\gamma(^{33}S)$

Values of B(EL)(W.u.) and B(M+L)(W.u.) given under comments are estimated values from 1974Ke18.

E_i(level)	J_i^π	E_γ[†]	I_γ[†&]	E_f	J_f^π	Mult.	Comments
842	$1/2^+$	840[#]		0	$3/2^+$		I_γ: 60 *10* and ≈45 *10* relative to 100 captures to E_R=30 and 42 keV resonances, respectively (1970Lu15); 90 *10* at E_R=30 resonances (1967Be36).
1968	$5/2^+$	1968		0	$3/2^+$		I_γ: 4 *1* and 0 relative to 100 captures to E_R=30 and 43 keV resonances, respectively (1974Ke18); 12 *3* at E_R=30 keV resonance (1970Lu15).
2313	$3/2^+$	1474		842	$1/2^+$		I_γ: 4 *1* and 8 relative to 100 captures to E_R=30 and 43 keV resonances, respectively (1974Ke18); 12 *3* at E_R=30 keV resonance (1970Lu15).
		2310		0	$3/2^+$		I_γ: 2 *1* and 5 *1* relative to 100 captures to E_R=30 and 43 keV resonances, respectively (1974Ke18); 13 *3* and 38 *6* at E_R=30 and 42 keV, respectively, for sum of 2371γ from 3221 level and this γ (1970Lu15).
2870	$5/2^+$	2870[#]		0	$3/2^+$		I_γ: 15 *3*, sum of this transition and 2959γ from 8672 level at E_R=30 keV resonance (1970Lu15).
3221	$3/2^-$	2371		842	$1/2^+$		I_γ: 15 *1* and 29 *3* relative to 100 captures to E_R=30 and 43 keV resonances, respectively (1974Ke18); 13 *3* and 38 *6* at E_R=30 and 42 keV, respectively, for sum of 2310γ to g.s. and this γ (1970Lu15); 31 *5* at E_R=111 keV resonances (1967Be36).
		3218		0	$3/2^+$		I_γ: 15 *1* and 31 *3* relative to 100 captures to E_R=30 and 43 keV resonances, respectively (1974Ke18); 6 *3* and 29 *6* at E_R=30 keV and 42 resonances, respectively (1970Lu15); 18 *8* at E_R=111 keV resonances (1967Be36).
4213	$3/2^-$	3363		842	$1/2^+$		I_γ: 2.5 *10* and 5 *1* relative to 100 captures to E_R=30 and 43 keV resonances, respectively (1974Ke18); 6 *2* at E_R=30 keV resonance (1970Lu15); 10 *5* for sum of 3400γ from 5712 level and this γ at E_R=30 resonance (1967Be36).
4920		1698		3221	$3/2^-$		I_γ: 2 *1* and 2 relative to 100 captures to E_R=30 and 43 keV resonances, respectively (1974Ke18); 6 *2* at E_R=30 keV resonance (1970Lu15).
5715	$1/2^-$	3400[‡]		2313	$3/2^+$		I_γ: 10 *5* for sum of 3360γ from 4213 level and this γ, relative to 100 captures to E_R=111 keV resonance (1967Be36).
		4862		842	$1/2^+$		I_γ: 5 *1* and 6 *1* relative to 100 captures to E_R=30 and 43 keV resonances, respectively (1974Ke18); 6 *2* and 12 *3* at E_R=30 and 42 keV resonances, respectively (1970Lu15); 10 *4* for a 4800γ at E_R=30 keV resonance in 1967Be36.
5883		5042	100	842	$1/2^+$		I_γ: 0.6 and 0.5 *5* relative to 100 captures to E_R=30 and 43 keV resonances, respectively (1974Ke18).
8672	$3/2^-$	2959	5.0 *15*	5715	$1/2^-$	[M1]	I_γ: other: 15 *3*, sum of this transition and that from 2870 keV to ground state (1970Lu15). B(M1)(W.u.)=0.047 (1974Ke18).
		3800[#]		4920			I_γ: 5 *2* (1970Lu15); not seen in 1974Ke18.
		4454	6.0 *15*	4213	$3/2^-$	[M1]	I_γ: other: 4 *2* for an unplaced 4380γ (1970Lu15). B(M1)(W.u.)=0.016 (1974Ke18).
		5445	27 *3*	3221	$3/2^-$	[M1]	I_γ: others: 8 *3* (1970Lu15), 8 *4* (1967Be36). Γ_γ≈40 meV (1967Be36). B(M1)(W.u.)=0.04 (1974Ke18).
		5800[#]		2870	$5/2^+$		I_γ: 4 *2* (1970Lu15); not seen in 1974Ke18.
		6355	4 *1*	2313	$3/2^+$	[E1]	I_γ: others: 10 *2* (1970Lu15), 10 *3* (1967Be36). Γ_γ=50 meV (1967Be36). B(E1)(W.u.)=1.0×10^{-4} (1974Ke18).

Continued on next page (footnotes at end of table)

^{32}S(n,γ) E=res 1974Ke18,1970Lu15,1967Be36 (continued)

$\gamma(^{33}S)$ (continued)

E_i(level)	J_i^π	E_γ †	I_γ †&	E_f	J_f^π	Mult.	Comments
8672	3/2$^-$	6701	4 *1*	1968	5/2$^+$	[E1]	I_γ: others: 10 *3* (1970Lu15), 6 *2* (1967Be36). Γ_γ=30 meV (1967Be36). B(E1)(W.u.)=1.0×10^{-4} (1974Ke18).
		7829	48 *3*	842	1/2$^+$	[E1]	I_γ: others: 50 *5* (1970Lu15), 60 *4* (1967Be36). Γ_γ=300 meV (1967Be36). B(E1)(W.u.)=7×10^{-4} (1974Ke18).
		8670	5.0 *15*	0	3/2$^+$	[E1]	I_γ: others: 3 *1* (1970Lu15), 8 *2* (1967Be36). Γ_γ=40 meV (1967Be36). B(E1)(W.u.)=6×10^{-5} (1974Ke18).
8685		2972	8 *2*	5715	1/2$^-$		I_γ: other: ≈7 (1970Lu15). B(E1)(W.u.)=0.0044, or B(M1)(W.u.)=0.148 (1974Ke18).
		4467	9 *2*	4213	3/2$^-$		B(E1)(W.u.)=0.0015, or B(M1)(W.u.)=0.049 (1974Ke18).
		5458	60 *4*	3221	3/2$^-$		I_γ: other: 66 *10* (1970Lu15). B(E1)(W.u.)=0.0054, or B(M1)(W.u.)=0.178 (1974Ke18).
		6368	9 *2*	2313	3/2$^+$		B(E1)(W.u.)=5.0×10^{-4}, or B(M1)(W.u.)=0.017 (1974Ke18).
		6715#*a*		1968	5/2$^+$		I_γ: ≈5 (1970Lu15); not seen in 1974Ke18.
		7842	6 *2*	842	1/2$^+$		I_γ: other: ≈10 (1970Lu15). B(E1)(W.u.)=2.0×10^{-4}, or B(M1)(W.u.)=0.006 (1974Ke18).
		8683	8 *2*	0	3/2$^+$		I_γ: other: 17 *2* (1970Lu15). B(E1)(W.u.)=2.0×10^{-4}, or B(M1)(W.u.)=0.006 (1974Ke18).
8745	1/2$^+$	3030@	10‡ *5*	5715	1/2$^-$		E_γ: other: 3000 (1967Be36). Γ_γ=0.27 eV *9* (1992Ki23).
		4532@	<20‡	4213	3/2$^-$		I_γ: intensity of unresolved structures in γ spectrum (Eγ=4.1-5.0 MeV) is about 20 (1967Be36), which is considered as upper limit by the evaluators. Γ_γ=0.66 eV *15*, quoted as upper limit in 1992Ki23.
		5524@	30‡ *4*	3221	3/2$^-$		E_γ: other: 5530 (1967Be36). Γ_γ=1.17 eV *12* (1988Ki02), 1.36 eV *15* (1992Ki23).
		7902@	19‡ *3*	842	1/2$^+$		E_γ: other: 7910 (1967Be36). Γ_γ=0.87 eV *13* (1988Ki02), 1.01 eV *15* (1992Ki23).
		8744@	21‡ *2*	0	3/2$^+$		E_γ: other: 8710 (1967Be36). Γ_γ=0.85 eV *11* (1988Ki02), 0.99 eV *15* (1992Ki23).
8845	1/2$^-$	4795@		4050			Γ_γ<0.08 eV (1992Ki03).
		4915@		3930			Γ_γ<0.08 eV (1992Ki03).
		5624@		3221	3/2$^-$		Γ_γ=0.08 eV *4* (1992Ki03).
		6531@		2313	3/2$^+$		
		8002@		842	1/2$^+$		Γ_γ=0.64 eV *22* (1988Ki02), 0.35 eV *4* (1992Ki03).
		8844@		0	3/2$^+$		Γ_γ=0.25 eV *5* (1988Ki02), 0.22 eV *4* (1992Ki03).

† From 1974Ke18, unless otherwise noted. Intensity values relative to 100 neutron captures to each resonance for secondary transitions are given under comments.
‡ From 1967Be36.
# From 1970Lu15.
@ Transition seen in 1992Ki03; energy not listed by the author and deduced from level-energy difference by the evaluators.
& Intensity per 100 neutron captures.
a Placement of transition in the level scheme is uncertain.
x γ ray not placed in level scheme.

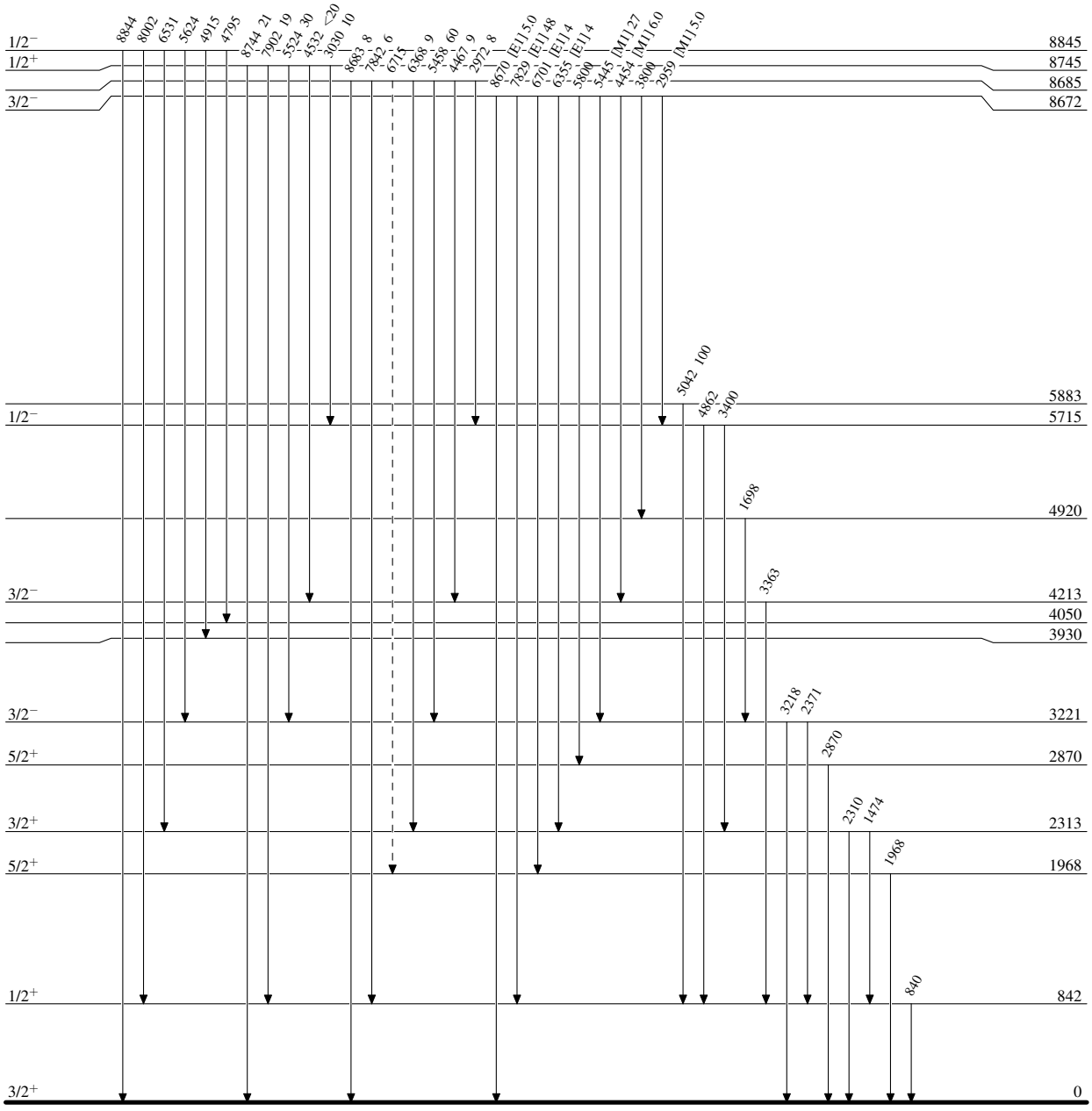
^{32}S(n,γ) E=res 1974Ke18,1970Lu15,1967Be36

Legend

Level Scheme

Intensities: % photon branching from each level

– – – – – – ► γ Decay (Uncertain)



$^{33}_{16}S_{17}$