^{32}S(n,γ),(n,n):resonances 2018MuZY

History

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

All resonance parameters taken from 2018MuZY evaluation, unless otherwise stated.

2018MuZY: evaluation of neutron resonance energies, J^π values, width parameters, and resonance strengths for nuclei of Z=1-60.

1982Ju02: E=0.18-2.00 MeV neutrons were produced in a mercury-cooled uranium target and accelerated in the 150 MeV linear accelerator of CBNM, Geel. Target was natural sulphur (95% ^{32}S). Neutron-beam energy was measured by time-of-flight with six NE110 scintillators around the target for detecting the elastically scattered neutrons. Measured σ_n. Deduced levels, J, π, L, widths from the comparison of the multi-level Breit-Wigner calculation of the cross section with the data.

1980Ha04: E=2.5-1100 keV neutrons were produced from the Oak Ridge Electron Linear Accelerator (ORELA). Target was natural sulphur (95% ^{32}S). Neutron detected by a NE110 scintillators and energy was determined by time-of-flight. Measured σ_n. Deduced levels, J, π, L, widths from the comparison of the R-matrix prediction of the cross section with the data.

1964Ma49: E=10-80 keV neutrons were produced by ^{7}Li(p,n)^{7}Be with protons from the ORNL terminal-pulsed Van de Graaff. Target was sulphur (95% ^{32}S). Neutron energy was measured by time-of-flight. Measured σ_n. Deduced levels, resonance parameters from the comparison of the theoretical calculation of the cross section with the data.

2000Ab40: E=0.75-11.3 MeV neutrons were produced by ^{9}Be(d,n)^{10}B and ^{9}Be(p,n)^{9}B at the Ohio University Tandem Accelerator Laboratory. Target was natural sulphur (95% ^{32}S). Neutron beam detected by a NE213 liquid scintillator and energy was determined by time-of-flight. Measured σ_n. Deduced level widths from the fluctuation analysis of total neutron cross sections.

1980Jo04: re-analysis of resonance data of 1980Ha04 using single-level R-matrix theory.

1985Ra30: re-analysis of resonance data of 1980Ha04 using single-channel single-level R-matrix theory.

Others: 1950Ba88, 1979Ko09.

^{33}S Levels

All resonance parameters including resonance neutron energies, J^π, L, $g\Gamma_n$, Γ_γ and resonance strengths are from the compilation and evaluation in 2018MuZY, unless otherwise indicated.

$g\Gamma_n=(2J+1)\Gamma_n/2$.

E(level)[†]	J^π	$g\Gamma_n\Gamma_\gamma/\Gamma$	L	E_n(lab) (keV)	Comments
8639.8?	1/2$^-$	1.10 eV *6*	1		E(level): fictitious level from analysis of resonance spectrum below the S(n) threshold. Γ_γ=2.21 eV.
8671.090 *5*	1/2$^-$	1.10 eV *6*	1	30.380 *5*	$g\Gamma_n$=63.6 eV *11*, Γ_γ=1.12 eV *6*.
8683.424 *15*	3/2$^+$,5/2$^+$	0.085 eV *6*	2	43.103 *15*	$g\Gamma_n$=1.0 eV *2*.
8686.998 *15*	3/2$^+$,5/2$^+$	0.056 eV *5*	2	46.790 *15*	$g\Gamma_n$<1 eV.
8736.157 *11*	3/2$^-$	0.65 eV *5*	1	97.500 *11*	$g\Gamma_n$=234 eV *4*, Γ_γ=0.33 eV *2*.
8741.21 *2*	1/2$^+$	4.29 eV *32*	0	102.71 *2*	$g\Gamma_n$=15.000 keV *100*, Γ_γ=4.29 eV *32*.
8750.39 *2*	3/2$^-$	0.84 eV *7*	1	112.18 *2*	$g\Gamma_n$=1.116 keV *10*, Γ_γ=0.42 eV *3*.
8782.34 *7*		0.30 eV *2*		145.14 *7*	$g\Gamma_n$<3 eV.
8796.94 *2*	1/2$^-$,3/2$^-$	1.14 eV *8*	1	160.20 *2*	$g\Gamma_n$=9.4 eV *5*, $g\Gamma_\gamma$=1.14 eV *8* (since J is unknown).
8809.06 *7*		0.99 eV *6*		172.70 *7*	$g\Gamma_n$<4 eV.
8838.86 *4*	1/2$^-$	0.65 eV *7*	1	203.44 *4*	$g\Gamma_n$=3.120 keV *12*, Γ_γ=0.65 eV *7*.
8894.93 *4*	5/2$^+$	1.74 eV *11*	2	261.28 *4*	$g\Gamma_n$=11.8 eV *12*, Γ_γ=0.68 eV *4*.
8905.69 *4*	1/2$^-$	4.52 eV *33*	1	272.38 *4*	$g\Gamma_n$=1.628 keV *9*, Γ_γ=4.53 eV *33*.
8921.47 *5*	3/2$^-$	4.05 eV *33*	1	288.66 *5*	$g\Gamma_n$=2.284 keV *8*, Γ_γ=2.03 eV *17*.
8941.56 *5*	5/2$^+$	2.82 eV *22*	2	309.38 *5*	$g\Gamma_n$=22.8 eV *21*, Γ_γ=1.07 eV *7*.
8944.43 *5*		2.13 eV *17*		312.34 *5*	$g\Gamma_n$=4 eV *1*, $g\Gamma_\gamma$=2.13 eV *17* (since J is unknown).
8953.14 *5*		1.96 eV *17*		321.33 *5*	$g\Gamma_n$=5.6 eV 12.
8977.09 *6*	3/2$^-$	1.91 eV *17*	1	346.03 *6*	$g\Gamma_n$=43.4 eV *10*, Γ_γ=1.00 eV *9*.
8984.40 *6*	5/2$^+$	4.31 eV *33*	2	353.57 *6*	$g\Gamma_n$=20.7 eV *9*, Γ_γ=1.81 eV *11*.
9007.10 *6*	1/2$^+$	2.43 eV *61*	0	376.99 *6*	$g\Gamma_n$=7.969 keV *14*, Γ_γ=2.43 eV *61*.
9008.92 *6*		1.01 eV *13*		378.87 *6*	$g\Gamma_n$=18.8 eV *16*.
9012.05 *5*		0.72 eV *11*		382.10 *5*	$g\Gamma_n$<11 eV.

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^{32}S(n,γ),(n,n):resonances 2018MuZY (continued)

^{33}S Levels (continued)

E(level)[†]	J$^{\pi}$	g$\Gamma_n\Gamma_\gamma/\Gamma$	L	E_n(lab) (keV)	Comments
9030.75 *7*		1.69 eV *13*		401.39 *7*	gΓ_n=13.6 eV *10*, gΓ_γ=1.93 eV *15* (since J is unknown).
9041.70 *7*	3/2$^-$	1.98 eV *17*	1	412.68 *7*	gΓ_n=148.0 eV *28*, Γ_γ=1.00 eV *9*.
9054.42 *5*		0.51 eV *11*		425.80 *5*	gΓ_n<12 eV.
9087.59 *8*	3/2$^+$	2.26 eV *22*	2	460.02 *8*	gΓ_n=108.0 eV *26*, Γ_γ=1.15 eV *11*.
9090.60 *8*	5/2$^+$	1.45 eV *17*	2	463.12 *8*	gΓ_n=252 eV *3*, Γ_γ=0.49 eV *6*.
9139.66 *9*		3.10 eV *28*		513.73 *9*	gΓ_n=26.6 eV *19*.
9158.72 *10*		2.76 eV *28*		533.39 *10*	gΓ_n=28.7 eV *11*.
9200.35 *11*		1.92 eV *28*		576.34 *11*	gΓ_n=20.4 eV *22*.
9210.24 *11*	3/2$^-$	3.12 eV *31*	1	586.54 *11*	gΓ_n=322 eV *12*, Γ_γ=1.57 eV *16*.
9211.05 *11*	5/2$^+$	3.10 eV *31*	2	587.37 *11*	gΓ_n=3.855 keV *18*, Γ_γ=1.03 eV *10*.
9268.08 *13*		0.78 eV *22*		646.20 *13*	gΓ_n=18.5 eV *46*.
9271.53 *13*	5/2$^+$	3.45 eV *56*	2	649.76 *13*	gΓ_n=1.509 keV *11*, Γ_γ=1.15 eV *19*.
9287.78 *13*	3/2$^+$	1.53 eV *17*	2	666.52 *13*	gΓ_n=62.4 eV *32*, Γ_γ=0.78 eV *9*.
9296.89 *14*	3/2$^+$	1.34 eV *39*	2	675.92 *14*	gΓ_n=830 eV *16*, Γ_γ=0.67 eV *20*.
9308.4 *1*		0.96 eV *28*		687.8 *1*	gΓ_n<22 eV.
9316.43 *14*	1/2$^+$	2.23 eV *11*	0	696.08 *14*	gΓ_n=11.280 keV *880*, Γ_γ=2.23 eV *11*.
9345.44 *15*	1/2$^-$	1.00 eV *33*	1	726.00 *15*	gΓ_n=3.779 keV *49*, Γ_γ=1.00 eV *33*.
9357.1 *5*		0.45 eV *22*		738.0 *5*	gΓ_n<24 eV.
9360.54 *16*	3/2$^-$	0.78 eV *22*	1	741.58 *16*	gΓ_n=2.514 keV *32*, Γ_γ=0.39 eV *11*.
9394.68 *17*	5/2$^-$,7/2$^-$	1.67 eV *22*	3	776.80[#] *17*	gΓ_n=171 eV *36*.
9397.22 *17*	3/2$^-$	0.67 eV *22*	1	779.42[#] *17*	gΓ_n=2.954 keV *56*, Γ_γ=0.34 eV *11*.
9402.03 *17*	3/2$^+$	2.89 eV *33*	2	784.38[#] *17*	gΓ_n=296 eV *24*, Γ_γ=1.46 eV *16*.
9409.37 *17*	3/2$^+$		2	791.95 *17*	gΓ_n=48 eV *4*.
9435.93 *18*	5/2$^+$	1.22 eV *33*	2	819.35 *18*	gΓ_n=1.764 keV *15*, Γ_γ=0.41 eV *11*.
9450.45 *18*	5/2$^-$,7/2$^-$	2.45 eV *45*	3	834.33 *18*	gΓ_n=243 eV *9*.
9481.62 *19*		4.34 eV *45*		866.48 *19*	gΓ_n=50.7 eV *40*.
9484.51 *19*		3.79 eV *56*		869.46 *19*	gΓ_n=50.1 eV *40*.
9499.82 *20*	(7/2)$^-$	18.92 eV *11*	3	885.25 *20*	gΓ_n=237 eV *6*, Γ_γ=5.10 eV *4*.
9515.91 *20*		1.56 eV *33*	≥2	901.85 *20*	gΓ_n=130 eV *20*, gΓ_n=124 eV *6* (1982Ju02).
9524.3 *5*		0.56 eV *22*		910.5 *5*	gΓ_n<30 eV. Γ=4.9 keV *4* (2000Ab40).
9534.03 *21*	5/2$^+$	2.78 eV *28*	2	920.54[#] *21*	gΓ_n=2.142 keV *75*, Γ_γ=0.93 eV *10*.
9535.14 *21*	3/2$^-$	2.78 eV *28*	1	921.69[#] *21*	gΓ_n=6.020 keV *110*, Γ_γ=1.39 eV *14*.
9560.53 *21*	5/2$^+$	2.20 eV *56*	2	947.88 *22*	gΓ_n=3.270 keV *36*, Γ_γ=0.73 eV *20*.
9598.05 *22*	1/2$^-$	3.34 eV *11*	1	986.58 *23*	gΓ_n=6.948 eV *184*, Γ_γ=3.34 eV *11*.
9619.59 *23*	(3/2)$^-$	0.67 eV *67*	1	1008.80 *24*	gΓ_n=1.608 keV *58*, Γ_γ=0.34 eV *34*.
9655.26 *24*	5/2$^-$,7/2$^-$	5.40 eV *67*	3	1045.60[#] *25*	gΓ_n=209 eV *26*.
9657.10 *24*	1/2$^+$	0.56 eV *56*	0	1047.50[#] *25*	gΓ_n=1.556 keV *83*, Γ_γ=0.56 eV *56*.
9659.24 *24*	1/2$^-$	0.56 eV *56*	1	1049.70[#] *25*	gΓ_n=2.991 keV *114*, Γ_γ=0.56 eV *56*.
9665.54 *25*	5/2$^+$	5.34 eV *89*	2	1056.20[#] *26*	gΓ_n=4.668 keV *99*, Γ_γ=1.78 eV *30*.
9671.2 *3*		2.89 eV *11*		1062.0[#] *3*	gΓ_n<37 eV.
9674.94 *25*	1/2$^+$	3.34 eV *13*	0	1065.90 *26*	gΓ_n=276 eV *21*, Γ_γ=3.38 eV *13*.
9676.98 *25*			≥2	1068.00 *26*	gΓ_n=31.2 eV *200*.
9693.65 *26*	5/2$^-$,7/2$^-$	4.45 eV *11*	3	1085.20 *27*	gΓ_n=302 eV *27*.
9696.37 *26*			≥2	1088.00 *27*	gΓ_n=66.4 eV *280*.
9700.63 *26*	3/2$^-$	1.10 eV *56*	1	1092.40 *27*	gΓ_n=876 eV *28*, Γ_γ=0.55 eV *28*.
9715.46 *26*				1107.70 *27*	gΓ_n=32.2 eV *140*.
9722.93 *27*	3/2$^-$		1	1115.40 *28*	gΓ_n=1.620 keV *60*.
9747.45 *27*	1/2$^-$		1	1140.70 *28*	gΓ_n=1.544 keV *66*.
9757.34 *28*	3/2$^+$,5/2$^+$		2	1150.90 *29*	gΓ_n=159 eV *22*.
9767.52 *28*	1/2$^+$		0	1161.40 *29*	gΓ_n=1.233 keV *112*.
9771.79 *28*	3/2$^+$		2	1165.80 *29*	gΓ_n=858 eV *75*.
9780.2 *3*	5/2$^-$,7/2$^-$		3	1174.5 *3*	gΓ_n=370.5 eV *260*.

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^{32}S(n,γ),(n,n):resonances 2018MuZY (continued)

^{33}S Levels (continued)

E(level)[†]	J$^{\pi}$	L	E_n(lab) (keV)	Comments
9808.8 *3*	3/2$^-$	1	1204.0 *3*	gΓ_n=684 eV *23*.
9823.36 *30*	3/2$^+$	2	1219.00 *31*	gΓ_n=2.556 keV *50*.
9845.66 *31*	(7/2$^-$)	(3)	1242.00[#] *32*	gΓ_n=10.900 keV *252*.
9848.47 *31*	(3/2)$^-$	1	1244.90[#] *32*	gΓ_n=2.406 keV *190*.
9858.94 *32*	(5/2)$^-$	3	1255.70 *33*	gΓ_n=1.374 keV *54*.
9878.42 *32*	3/2$^-$	1	1275.80 *33*	gΓ_n=6.334 keV *170*.
9892.19 *33*	1/2$^+$	0	1290.00 *34*	gΓ_n=10.980 keV *654*.
9909.06 *34*	3/2$^+$	2	1307.40 *35*	gΓ_n=394 eV *50*.
9925.83 *34*	5/2$^+$	2	1324.70 *35*	gΓ_n=1.122 keV *84*.
9940.9 *4*	5/2$^+$	2	1340.2 *4*	gΓ_n=4.767 keV *90*. Γ=6.1 keV *4* (2000Ab40).
9952.5 *4*			1352.2 *4*	gΓ_n=172.5 eV *470*.
9960.7 *4*	7/2$^-$	3	1360.7 *4*	gΓ_n=5.068 keV *116*.
9978.0 *4*	5/2$^+$	2	1378.5 *4*	gΓ_n=341 eV *105*.
9984.3 *4*	3/2$^-$	1	1385.0 *4*	gΓ_n=5.510 keV *78*.
9997.1 *4*	1/2$^-$,3/2$^-$	1	1398.2[#] *4*	gΓ_n=681 eV *55*.
9999.9 *4*	5/2$^+$	2	1401.1[#] *4*	gΓ_n=1.116 keV *51*.
10017.6 *4*	1/2$^+$	0	1419.4 *4*	gΓ_n=873 eV *133*.
10024.1 *4*	3/2$^-$	1	1426.1 *4*	gΓ_n=6.120 keV *124*.
10053.2 *4*	5/2$^-$,7/2$^-$	3	1456.1 *4*	gΓ_n=756.6 eV *330*.
10070.7 *4*			1474.1 *4*	
10076.4 *4*			1480.0 *4*	
10083.5 *4*			1487.3 *4*	
10120.9 *4*	3/2$^+$	2	1525.9 *4*	gΓ_n=8.146 keV *180*.
10129.2 *5*			1534.5[#] *5*	gΓ_n=527.6 eV *730*.
10132.4 *5*			1537.8[#] *5*	gΓ_n=3.726 keV *123*.
10157.7 *5*	5/2$^-$,7/2$^-$	3	1563.9[#] *5*	gΓ_n=602.7 eV *970*.
10164.69 *44*	(5/2)$^+$	2	1571.1[#] *5*	gΓ_n=2.898 keV *129*.
10180.4 *5*			1587.3 *5*	gΓ_n=9.237 keV *756*. Doublet.
10198.1 *5*	1/2$^+$	0	1605.6 *5*	gΓ_n=602 eV *247*.
10217.1 *5*	5/2$^+$	2	1625.2 *5*	gΓ_n=22.090 keV *831*.
10250.3 *5*	1/2$^+$	0	1659.4 *5*	gΓ_n=2.785 keV *268*.
10910[‡]				Γ=21.1 keV *12* (2000Ab40).
11750[‡]				Γ=9.9 keV *7* (2000Ab40).
12760[‡]				Γ=25.5 keV *15* (2000Ab40).
14410[‡]				Γ=25.7 keV *20* (2000Ab40).
17360[‡]				Γ=58 keV *13* (2000Ab40).

[†] From $E_{c.m.}$+S(n) where S(n)=8641.6392 *5* (2021Wa16) and $E_{c.m.}=E_n(lab)\times m(^{32}S)/[m_n+m(^{32}S)]$.
[‡] From 2000Ab40.
[#] Resonance not completely resolved from its neighbor (2018MuZY).