Adopted Levels, Gammas

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh	ENSDF	28-Feb-2018

Q(β^-)=3089 *3*; S(n)=7353 *4*; S(p)=15810 *3*; Q(α)=−11730 *8* 2017Wa10
S(2n)=12557.0 *27*, S(2p)=30007 *22* (2017Wa10).
Mass measurement (Penning-trap spectrometer): 2013Va12, 2012Ha25, 2008Dw01, 2005Si34.
2007Kl05, 2005Ad29 (also 2007Kl06): ^{9}Be(^{238}U,X), E=500 MeV/nucleon. Measured pygmy dipole resonance (PDR) strength, neutron skin thickness, symmetry parameters. Energies of PDR and GDR extracted as 9.8 MeV *7* (FWHM<2.5 MeV), and 16.1 MeV *7* (FWHM=4.7 MeV *21*).
2015Ko05: deduced energy of the $i_{13/2}$ neutron single-particle energy as 2669 keV *70* in the ^{132}Sn core potential.
Charge radius, hyperfine structure, isotope shifts measured by LASER spectroscopy: 2002Le30, 2005Le34.
Additional information 1.
Theoretical nuclear structure calculations for ^{132}Sn: consult Nuclear Science References (NSR) database at www.nndc.bnl.gov/nsr/ for about 430 articles.

^{132}Sn Levels

Cross Reference (XREF) Flags

A	^{132}In β^- decay (0.200 s)	D	^{248}Cm SF decay
B	^{132}Sn IT decay (2.080 μs)	E	Coulomb excitation
C	^{133}In β^-n decay (165 ms)		

E(level)[‡]	J$^\pi$[#]	$T_{1/2}$[†]	XREF	Comments
0.0	0$^+$	39.7 s *8*	ABCDE	%β^-=100 The rms charge radius (<r^2>)$^{1/2}$: 4.7093 fm *76* (2013An02 evaluation). See also 2009An12 for trends in nuclear radii. Measured isotope shift=1.140 GHz *6* (relative to ^{120}Sn, 2005Le34). Measured δ<r^2>(^{120}Sn,^{132}Sn)=0.534 fm^2 *69* (2005Le34). Deduced charge radius=4.709 fm *7* (2005Le34). J$^\pi$: hyperfine structure measurement (2005Le34) shows only one peak consistent with J=0. $T_{1/2}$: weighted average of 38.0 s *8* (1975Ba36), 41.0 s *15* (1974Gr29), 41.1 s *13* (1972Iz01,1978Iz03), 40 s *1* (1972Ke20), 39.0 s *10* (1972Na10), 40.6 s *8* (1972Nu04). Others: ≈47 s (1974Fo06), 1970Li14, 60 s *10* (1966St25), 50 s *10* (1963Gr13), 2.2 min (1956Pa20). 2011Jo08, 2010Jo03: deduced doubly closed shell nature of ^{132}Sn in ^{2}H(^{132}Sn,p)^{133}Sn,E=630 MeV experiment.
4041.20[&] *15*	2$^+$	2.4 fs *+9−5*	AB DE	B(E2)↑=0.11 *3* J$^\pi$: γ to 0$^+$; level is Coulomb excited from 0$^+$ g.s. $T_{1/2}$: from B(E2) value. Other: <0.4 ns (from ^{132}Sn IT decay). B(E2)↑: preliminary result from Coulomb excitation (2005Va31,2005Ra09,2004Be56,2004Ra27).
4351.94 *14*	(3$^-$)	<5.0 ps	A D	J$^\pi$: (E1) γ to 2$^+$, γ to 0$^+$; systematics.
4416.29[&] *14*	(4$^+$)	3.95 ns *13*	AB D	J$^\pi$: (E2) γ to 2$^+$; γ to (3$^-$).
4715.91[&] *17*	(6$^+$)	20.1 ns *5*	AB D	J$^\pi$: (E2) γ to (4$^+$); log *ft*=6.1 from (7$^-$).
4830.97[a] *17*	(4$^-$)	26.0 ps *5*	A D	J$^\pi$: (M1) γ to (3$^-$); γ to (4$^+$).
4848.52[&] *20*	(8$^+$)	2.080 μs *17*	AB D	%IT=100 J$^\pi$: (E2) γ to (6$^+$); log *ft*=5.7 from (7$^-$). $T_{1/2}$: from γ(t) in IT decay; weighted average of 2.15 μs *16* (2017Ch51, (132γ+299γ+374γ)(t) in ^{235}U(n,F),E=thermal); 2.088 μs *17* (2012Ka36) and

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{132}Sn Levels (continued)

E(level)‡	Jπ#	$T_{1/2}$†	XREF	Comments
				2.03 μs *4* (1994Fo14). Other: 1.7 μs *2* (1982Ka25). 2017Ch51 measured isomeric ratios as a function of kinetic energy of ^{132}Sn fragments in ^{235}U(n,F),E=thermal using Lohengrin spectrometer at Grenoble.
4885.21& *19*	(5⁺)	<40.0 ps	A D	Jπ: γ's to (4⁺) and (6⁺); log $f^{1u}t$=9.4 from (7⁻).
4919.00& *20*	(7⁺)	62.0 ps *7*	A D	Jπ: (M1) γ to (6⁺); γ to (8⁺); log *ft*=6.5 from (7⁻).
4942.53a *16*	(5⁻)	17.0 ps *5*	A D	Jπ: (E1) γ to (4⁺); γ's to (3⁻) and (6⁺).
5279.5& *11*	(9⁺)		D	Jπ: γ to (8⁺).
5387.89 *20*	(4⁻)		A	Jπ: configuration=$\nu(g_{7/2}s^{-1}_{1/2})$; γ from (6⁻), γ to (3⁻).
5399.22@ *21*	(6⁺)		A	Jπ: γ to (6⁺); log *ft*=6.3 from (7⁻).
5478.98@ *23*	(8⁺)		A	Jπ: γ to (8⁺); log *ft*=6.2 from (7⁻).
5629.26@ *19*	(7⁺)	13.0 ps *5*	A	Jπ: γ's to (6⁺) and (8⁺); log *ft*=5.6 from (7⁻).
6173.20 *20*	(5,6,7)		A	Jπ: γ to (6⁺); γ from (6⁻).
6235.9 *3*	(6,7,8⁺)		A	Jπ: γ to (6⁺); log *ft*=7.0 from (7⁻).
6598.5 *3*	(6,7⁻)		A	Jπ: log *ft*=6.0 from (7⁻); γ to (5⁻).
6630.3 *3*	(6,7,8⁺)		A	Jπ: γ to (6⁺), log *ft*=6.3 from (7⁻).
6709.04 *21*	(6,7⁻)		A	Jπ: γ to (5⁻), log *ft*=6.1 from (7⁻).
6896.0 *3*	(6,7,8)		A	Jπ: γ to (7⁺); log *ft*=7.0 from (7⁻).
7211.14 *17*	(6⁻)		A	Jπ: log *ft*=4.6 from (7⁻); γ's to (5⁺) and (7⁺); configuration=$\nu(f_{7/2}g^{-1}_{7/2})$.
7244.06 *20*	(7⁻)		A	Jπ: γ's to (6⁺) and (8⁺); log *ft*=5.6 from (7⁻).
≈7550?			A	Possibly decays by neutrons.

† From βγγ(t) (1994Fo14) in ^{132}In β⁻, unless otherwise stated.
‡ From least-squares fit to Eγ data, assuming 0.2 keV uncertainty for Eγ quoted to nearest tenth of a keV and 1 keV for others. See ^{132}In β⁻ data set for explanation.
# In addition to arguments given under comments, probable shell-model configurations proposed by 1994Fo14 are used to restrict Jπ choices.
@ Member of configuration=$\nu(g_{7/2}g^{-1}_{9/2})$.
& Member of configuration=$\nu(f_{7/2}h^{-1}_{11/2})$.
a Possible member of configuration=$\nu(f_{7/2}d^{-1}_{3/2})$.

γ(^{132}Sn)

For transition strengths, uncertainty for gamma-ray branching ratio has been assumed to be 10%, when not stated for levels which deexcite by multiple transitions.

E_i(level)	J^π_i	Eγ†	Iγ‡	E_f	J^π_f	Mult.	α#	Comments
4041.20	2⁺	4041.1	100	0.0	0⁺			B(E2)(W.u.)=5.5 *15*
4351.94	(3⁻)	310.7	11.0	4041.20	2⁺	(E1)		B(E1)(W.u.)>0.00017
		4351.9	100	0.0	0⁺	[E3]		B(E3)(W.u.)>7.1
4416.29	(4⁺)	64.4	1.3	4351.94	(3⁻)	[E1]	0.625	B(E1)(W.u.)=2.66×10⁻⁶ *32*
		375.1	100 *3*	4041.20	2⁺	(E2)	0.01739	B(E2)(W.u.)=0.400 *24*
		4416.2	17 *3*	0.0	0⁺	[E4]		B(E4)(W.u.)=8.0 *15*
4715.91	(6⁺)	299.6	100	4416.29	(4⁺)	(E2)	0.0356	B(E2)(W.u.)=0.292 *9*
4830.97	(4⁻)	414.6	2.1	4416.29	(4⁺)	[E1]		B(E1)(W.u.)=2.90×10⁻⁶ *29*
		479.1	100	4351.94	(3⁻)	(M1)		B(M1)(W.u.)=0.0075 *8*
4848.52	(8⁺)	132.5	100	4715.91	(6⁺)	(E2)	0.589	B(E2)(W.u.)=0.104 *2* α(K)=0.456 *7*; α(L)=0.1071 *15*; α(M)=0.0217 *3* α(N)=0.00387 *6*; α(O)=0.000198 *3*

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

$\gamma(^{132}Sn)$ (continued)

E_i(level)	J^π_i	E_γ[†]	I_γ[‡]	E_f	J^π_f	Mult.	α[#]	Comments
4885.21	(5$^+$)	169.0	20	4715.91	(6$^+$)			
		469.1	100	4416.29	(4$^+$)			
4919.00	(7$^+$)	70.4	2.7	4848.52	(8$^+$)	[M1]	1.534	B(M1)(W.u.)=0.0239 *26* α(K)=1.324 *19*; α(L)=0.1698 *24*; α(M)=0.0333 *5* α(N)=0.00626 *9*; α(O)=0.000540 *8*
		88.9[@]		4830.97	(4$^-$)	[E3]		
		203.1	100	4715.91	(6$^+$)	(M1)	0.0797	B(M1)(W.u.)=0.0369 *37* α(K)=0.0690 *10*; α(L)=0.00865 *13*; α(M)=0.001695 *24* α(N)=0.000319 *5*; α(O)=2.78×10^{-5} *4*
4942.53	(5$^-$)	111.5	9.1	4830.97	(4$^-$)	[M1]	0.414	B(M1)(W.u.)=0.069 *8* α(K)=0.357 *5*; α(L)=0.0455 *7*; α(M)=0.00893 *13* α(N)=0.001679 *24*; α(O)=0.0001453 *21*
		226.7	2.8	4715.91	(6$^+$)	[E1]	0.0182	B(E1)(W.u.)=2.93×10^{-5} *32*
		526.2	100	4416.29	(4$^+$)	(E1)		B(E1)(W.u.)=8.4×10^{-5} *9*
		590.6	6.6	4351.94	(3$^-$)	[E2]		B(E2)(W.u.)=0.61 *7*
5279.5	(9$^+$)	431	100	4848.52	(8$^+$)			E_γ: from ^{248}Cm SF decay.
5387.89	(4$^-$)	1035.8	100	4351.94	(3$^-$)			
5399.22	(6$^+$)	683.3	100	4715.91	(6$^+$)			
5478.98	(8$^+$)	630.5	100	4848.52	(8$^+$)			
5629.26	(7$^+$)	230.0	7.1	5399.22	(6$^+$)			
		710.3	23	4919.00	(7$^+$)			
		780.8	29	4848.52	(8$^+$)			
		913.3	100	4715.91	(6$^+$)			
6173.20	(5,6,7)	774.0	20	5399.22	(6$^+$)			
		1457.5	100	4715.91	(6$^+$)			
6235.9	(6,7,8$^+$)	1520.0	100	4715.91	(6$^+$)			
6598.5	(6,7$^-$)	1656.0	100	4942.53	(5$^-$)			
6630.3	(6,7,8$^+$)	1914.4	100	4715.91	(6$^+$)			
6709.04	(6,7$^-$)	1766.5	100	4942.53	(5$^-$)			
6896.0	(6,7,8)	1977.0	100	4919.00	(7$^+$)			
7211.14	(6$^-$)	502.1	2.9	6709.04	(6,7$^-$)			
		1038.2	3.6	6173.20	(5,6,7)			
		1581.9	3.1	5629.26	(7$^+$)			
		1823.1	3.1	5387.89	(4$^-$)			
		2268.6	67	4942.53	(5$^-$)			
		2292.0	3.1	4919.00	(7$^+$)			
		2325.8	1.9	4885.21	(5$^+$)			
		2380.2	100	4830.97	(4$^-$)			
7244.06	(7$^-$)	1765.1	88	5478.98	(8$^+$)			
		2301.5	79	4942.53	(5$^-$)			
		2395.4	100	4848.52	(8$^+$)			
		2528.2	75	4715.91	(6$^+$)			

† From ^{132}In β^- decay, unless otherwise stated.

‡ Relative photon branching from each level deduced from ^{132}In β^- decay. The uncertainties are expected to be from 5-15%.

\# Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on γ-ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

@ Placement of transition in the level scheme is uncertain.

Adopted Levels, Gammas

Legend

Level Scheme

Intensities: Relative photon branching from each level

- - - - - - ► γ Decay (Uncertain)