Adopted Levels, Gammas

History			
Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh	ENSDF	18-March-2022

Q(β^-)=−14050 *SY*; S(n)=12990 *SY*; S(p)=1840 *70*; Q(α)=−2080 *80* 2021Wa16
Estimated uncertainties (2021Wa16): 310 for Q(β^-), 210 for S(n).
Q(e)=10010 *70*, Q(εp)=7740 *70*, S(2n)=29700 *310* (syst), S(2p)=4680 *70* (2021Wa16).
1994Ba50: ^{67}Se produced in Zr(p,X),E=600 MeV at ISOLDE-CERN. Measured $T_{1/2}$ and Eγ from decay of ^{67}Se to ^{67}As.
1995Bl23: ^{67}Se produced in Ni(^{78}Kr,X),E=73 MeV/nucleon at the SISSI/LISE facility of GANIL. Measured half-life of decay of ^{67}Se and β^+-delayed protons.
Additional information 1.
2002Lo13 (also 2002Bl17): from the same experimental group at GANIL as 1995Bl23 using the same reaction to produce ^{67}Se. Measured $T_{1/2}$ of ^{67}Se decay.
2005St29 (also 2005St34): ^{67}Se isotope produced in the fragmentation of 140 MeV/nucleon ^{78}Kr beam with ^{9}Be target at NSCL-MSU facility, with secondary fragments unambiguously identified after separation in the A1900 fragment separator.
2014Ro14: ^{67}Se isotope produced in the fragmentation of 70 MeV/nucleon ^{78}Kr beam with Ni target. Fragments selected with the LISE3 separator at GANIL and identified by time-of-flight and energy loss. Measured half-life of ^{67}Se ground-state decay by (fragment)β, (fragment)γ correlations using set of four Si detectors (an energy loss ΔE detector, and DSSD and Si(Li)) for particles surrounded by four HPGe Clover detectors, three EXOGAM and one mini-clover Ge detector for γ rays.
Mass measurement: 2011Tu02.
2012Bi10, 2011Ka07, 2010Ka32: authors analyzed origins of observed asymmetry of B(E1) strengths, and high-spin states for ^{67}Se and ^{67}As mirror nuclei.
Theoretical calculations dealing with structure and half-lives and decay modes in radioactivity: NSR database has 13 references, listed here in document records.

^{67}Se Levels

No evidence was found by 2009Or02 for a long-lived isomer in ^{67}Se.

Cross Reference (XREF) Flags

A ^{40}Ca(^{32}S,αnγ)

E(level)†	J$^\pi$‡	$T_{1/2}$	XREF	Comments
0.0	(5/2$^-$)	133 ms *4*	A	%ε+%β^+=100; %εp=0.5 *1* (1995Bl23) T_z=−1/2. Production σ=0.11 μb *5* in ^{9}Be(^{78}Kr,X),E=140 MeV/nucleon (2005St29), compared with theoretical cross sections. J$^\pi$: analogy to mirror g.s. state of ^{67}As with J^π=(5/2$^-$). $T_{1/2}$: weighted average of 133 ms *4* (2014Ro14, fragment-β, and fragment-γ correlations); and 136 ms *12* (2002Lo13,2002Bl17; previous $T_{1/2}$=60 ms *+17−11* in 1995Bl23); and 107 ms *35* (1994Ba50).
26.0 *17*	(3/2$^-$)		A	
647.0 *9*	(7/2$^-$)		A	
1061.0 *13*	(7/2$^-$)		A	
1364.0# *9*	(9/2$^+$)	1.04 ns *42*	A	$T_{1/2}$: measured mean lifetime τ=1.5 ns *6* (2009Or02, time spectra gated above and below the 9/2$^+$ state).
2224.0@ *13*	(11/2$^+$)		A	
2279.0# *13*	(13/2$^+$)		A	
3062.0@ *17*	(15/2$^+$)		A	
3505.0# *17*	(17/2$^+$)		A	

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{67}Se Levels (continued)

E(level)[†]	J$^{\pi}$[‡]	XREF
3776.0[@] *20*	(17/2$^+$)	A
4416.0[@] *19*	(19/2$^+$)	A
4794.0[#] *19*	(21/2$^+$)	A
5561.0[#] *21*	(25/2$^+$)	A

[†] From least-squares fit to Eγ data, assuming uncertainty of 1 keV for each γ ray.
[‡] As given by 2009Or02 and 2009WiZX, based on analogous states in mirror nucleus ^{67}As.
[#] Seq.(A): γ cascade based on 9/2$^+$.
[@] Seq.(B): γ cascade based on 11/2$^{(+)}$. This sequence is from level-scheme Fig. 1 in 2009WiZX, only the (19/2$^+$) member of this sequence is given in 2009Or02.

γ(^{67}Se)

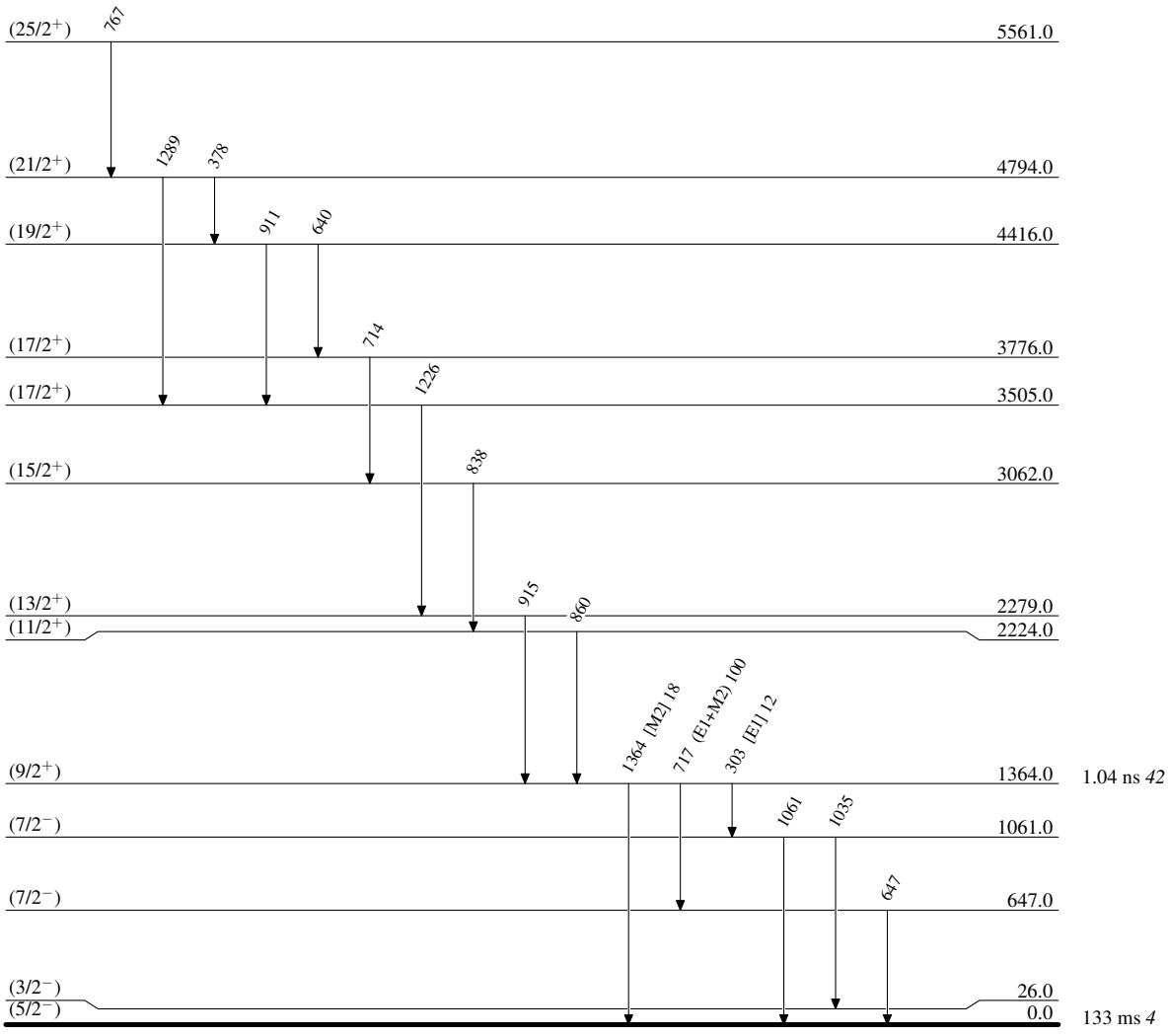
E$_i$(level)	J$_i^{\pi}$	E$_\gamma$[†]	I$_\gamma$[†]	E$_f$	J$_f^{\pi}$	Mult.	δ	Comments
647.0	(7/2$^-$)	647		0.0	(5/2$^-$)			
1061.0	(7/2$^-$)	1035		26.0	(3/2$^-$)			
		1061		0.0	(5/2$^-$)			Weaker γ than the 1035γ, according to Fig. 1 in 2009WiZX.
1364.0	(9/2$^+$)	303	12 *7*	1061.0	(7/2$^-$)	[E1]		If E1, B(E1)(W.u.)<4.3×10^{-6}. If M2, B(M2)(W.u.)<216, suggesting that transition should be dominantly E1, as RUL(M2)=1.
		717	100 *21*	647.0	(7/2$^-$)	(E1+M2)	<0.40	B(E1)(W.u.)=1.6×10^{-7} *+34−11*; B(M2)(W.u.)=5.9 *+35−29* δ(M2/E1)=+0.47<δ<+3.49 in 2009Or02. ADO=1.7 *6*. B(M2)(W.u.) is greater than RUL(M2)=1, suggesting that δ(M2/E1) should be <0.40.
		1364	18 *10*	0.0	(5/2$^-$)	[M2]		B(M2)(W.u.)=0.053 *+49−26*
2224.0	(11/2$^+$)	860		1364.0	(9/2$^+$)			
2279.0	(13/2$^+$)	915		1364.0	(9/2$^+$)			
3062.0	(15/2$^+$)	838		2224.0	(11/2$^+$)			
3505.0	(17/2$^+$)	1226		2279.0	(13/2$^+$)			
3776.0	(17/2$^+$)	714		3062.0	(15/2$^+$)			
4416.0	(19/2$^+$)	640		3776.0	(17/2$^+$)			
		911		3505.0	(17/2$^+$)			
4794.0	(21/2$^+$)	378		4416.0	(19/2$^+$)			
		1289		3505.0	(17/2$^+$)			
5561.0	(25/2$^+$)	767		4794.0	(21/2$^+$)			

[†] From ^{40}Ca(^{32}S,αnγ) (2009Or02,2009WiZX).

Adopted Levels, Gammas

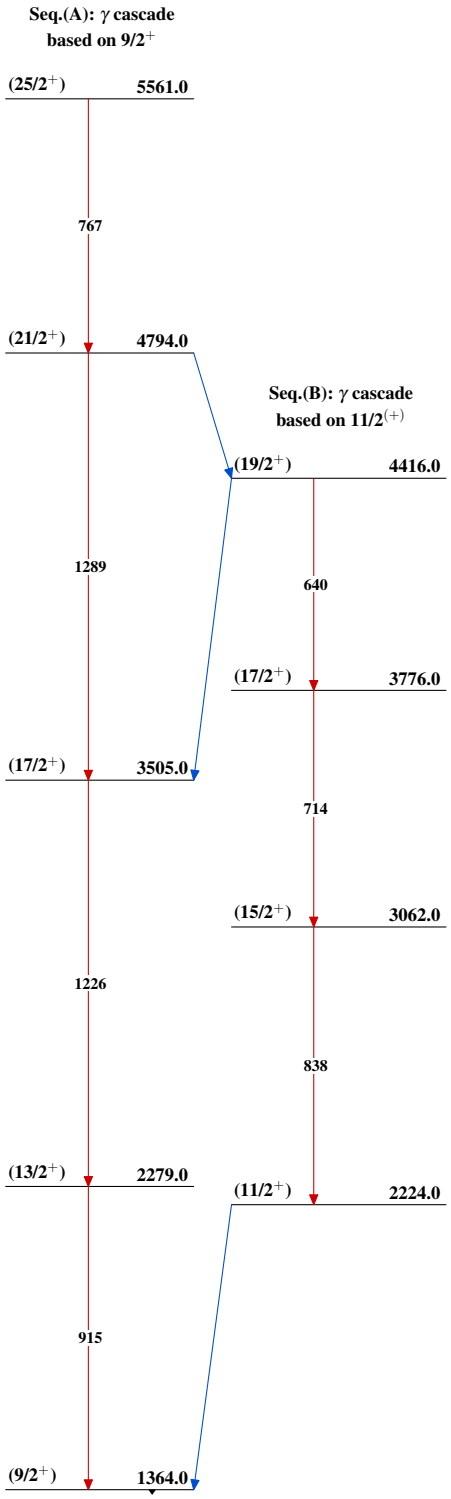
Level Scheme

Intensities: Relative photon branching from each level



$^{67}_{34}Se_{33}$

Adopted Levels, Gammas



$^{67}_{34}Se_{33}$