Adopted Levels, Gammas

History			
Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh	ENSDF	25-Oct-2019

Q(β^-)=−673 *7*; S(n)=6668 *6*; S(p)=4478 *5*; Q(α)=5935.1 *14* 2017Wa10
S(2n)=12331 *8*, S(2p)=11323 *5* (2017Wa10).
1947En03, 1947Ha02: ^{225}Ac identified from decay product of ^{233}U series.
1950Ha52: chemical separation of ^{225}Ac.
1972Ku26: fission isomer not observed in ^{226}Ra(d,3n),E=11.3 MeV.
1988Le13: level energies were calculated for a deformed shell model (including octupole deformation) coupled to a reflection-asymmetric rotor core. The quadrupole deformation of β_2=0.144 was used in calculations, and an octupole deformation of $\beta_3\approx$0.1 was suggested.
Theoretical studies: consult the NSR database at www.nndc.bnl.gov for 14 references dealing with theoretical calculations for structure (levels, J^π, transition probabilities, etc.), and 62 for radioactive decay modes, in particular about ^{14}C cluster emission.
Additional information 1.

^{225}Ac Levels

Cross Reference (XREF) Flags

A ^{225}Ra β^- decay (14.9 d)
B ^{229}Pa α decay (1.50 d)

E(level)[†]	J$^\pi$[‡]	T$_{1/2}$	XREF	Comments
0.0[#]	(3/2$^-$)	9.920 d *3*	AB	%α=100; %^{14}C=5.3×10^{-10} *13* (2001Gu33,1993Bo26) T$_{1/2}$: from 2012Po14 (from decay curves for α counting using a planar silicon detector at a defined solid angle and in a nearly 2π geometry, 4$\pi\alpha$+β counting using a windowless CsI spectrometer, and a pressurized proportional counter, gamma-ray counting with an HPGe detector and a NaI(Tl) well detector, followed for 59-141 days; final result is deduced from six detection methods, with consideration of statistical and systematic uncertainties). Previous measurements: 10.0 d *1* (1950Ha52), 10 d (1947En03). 2001Gu33: ^{14}C decay mode measurement at the CERN-ISOLDE mass-separator at CERN and nuclear track detector technique; $\lambda(^{14}C)/\lambda(\alpha)$=4.5×10^{-12} *14* or partial T$_{1/2}$(^{14}C)=1.9×10^{17} s *6* (2001Gu33). 1993Bo26 measured $\lambda(^{14}C)/\lambda(\alpha)$=6.0×10^{-10} *13* at CERN-ISOLDE. Hindrance factor as defined in 2001Gu33 is about unity for ^{14}C decay of ^{225}Ac, much lower than typical hindrance factor of 10-100 for other known cluster decays. This represents a case of a favored cluster decay. Adopted value of %^{14}C decay is the average of the values from 2001Gu33 and 1993Bo26, with corresponding partial T$_{1/2}$=1.6×10^{17} s *4*. J$^\pi$: from analogy with neighboring nuclei, expected low-lying levels are 3/2[532] and 3/2[651]; negative parity from E1 character of the 40.09γ from (3/2$^+$) level.
29.91[#] *6*	(5/2$^-$)		B	J$^\pi$: γ to (3/2$^-$); γ transitions from (5/2$^+$) and (7/2$^+$).
40.10[@] *4*	(3/2$^+$)	0.72 ns *3*	AB	T$_{1/2}$: β(ce for 40γ)(t) in ^{225}Ra β^- decay (1985Is03). J$^\pi$: 115.55γ, M1 from (5/2$^+$); systematics of Nilsson orbitals.
64.69[@] *5*	(5/2$^+$)		B	J$^\pi$: gammas to (3/2$^-$) and (5/2$^-$); γ from (7/2$^+$).
77.13[#] *9*	(7/2$^-$)		B	J$^\pi$: gammas from (7/2$^+$) and (9/2$^+$).
105.01[@] *7*	(7/2$^+$)		B	J$^\pi$: gammas from (7/2$^+$) and (9/2$^+$).
120.81[&] *4*	(5/2$^-$)		AB	XREF: A(?). J$^\pi$: 120.8γ, M1(+E2) to (3/2$^-$) g.s.; systematics of Nilsson orbitals.
144.96[@] *9*	(9/2$^+$)		B	J$^\pi$: γ to (7/2$^-$).
155.64[a] *5*	(5/2$^+$)		AB	XREF: A(?). J$^\pi$: favored α transition from (5/2$^+$) ^{229}Pa g.s.

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{225}Ac Levels (continued)

E(level)[†]	J$^{\pi}$[‡]	XREF	Comments
170.75[&] *8*	(7/2$^-$)	B	J$^{\pi}$: γ transitions to (5/2$^-$) and (7/2$^-$).
199.86[a] *6*	(7/2$^+$)	B	J$^{\pi}$: γ to (5/2$^-$), favored α transition from (5/2$^+$) parent state.
221 *7*		B	
235.53[&] *13*	(9/2$^-$)	B	J$^{\pi}$: γ to (7/2$^-$).
256.97[a] *9*	(9/2$^+$)	B	J$^{\pi}$: gammas to (7/2$^-$), (7/2$^+$) and (9/2$^+$); α hindrance factor.
≈318?		B	
327 *7*		B	
421? *7*		B	

[†] From ^{229}Pa α decay.
[‡] From probable band assignments, in addition to some other arguments.
[#] Band(A): π3/2[532] band.
[@] Band(B): π3/2[651] band.
[&] Band(C): π5/2[523] band.
[a] Band(D): π5/2[642] band.

γ(^{225}Ac)

E$_i$(level)	J$_i^{\pi}$	E$_{\gamma}$[†]	I$_{\gamma}$[†]	E$_f$	J$_f^{\pi}$	Mult.[†]	δ[†]	α[#]	Comments
29.91	(5/2$^-$)	30.0 *2*	100	0.0	(3/2$^-$)	[M1]		117	E$_{\gamma}$: from $\alpha\gamma$-coin (1973Ag01) in α decay. Note that 1987Ah05 interpreted this γ-ray peak as an escape line in their $\alpha\gamma$-coin spectrum.
40.10	(3/2$^+$)	40.09 *5*	100	0.0	(3/2$^-$)	E1		1.293	B(E1)(W.u.)=0.00171 *15* Mult.: from L-subshell ratios in ^{225}Ra β^- decay.
64.69	(5/2$^+$)	24.6[&]		40.10	(3/2$^+$)				
		34.8[@] *1*	≈5[@]	29.91	(5/2$^-$)	[E1]		1.88	
		64.70 *5*	100 *9*	0.0	(3/2$^-$)	[E1]		0.362	
105.01	(7/2$^+$)	75.12 *5*	100 *9*	29.91	(5/2$^-$)	[E1]		0.243	
120.81	(5/2$^-$)	80.6 *1*	5.0 *9*	40.10	(3/2$^+$)	[E1]		0.202	
		120.80 *5*	100 *9*	0.0	(3/2$^-$)	M1(+E2)	0.5 *5*	8.9 *16*	
144.96	(9/2$^+$)	67.80 *5*	100 *9*	77.13	(7/2$^-$)	[E1]		0.319	
155.64	(5/2$^+$)	34.8[@] *1*	≈13[@]	120.81	(5/2$^-$)	[E1]		1.88	
		115.55 *5*	100 *8*	40.10	(3/2$^+$)	M1		11.28	
		125.71 *7*	19.5 *19*	29.91	(5/2$^-$)	[E1]		0.281	
		155.65 *7*	≈5	0.0	(3/2$^-$)	[E1]		0.1680	
170.75	(7/2$^-$)	93.6 *1*	47 *7*	77.13	(7/2$^-$)	[M1+E2]		6.2[‡] *30*	
		140.85 *7*	100 *12*	29.91	(5/2$^-$)	[M1+E2]		5.6[‡] *12*	
199.86	(7/2$^+$)	79.00 *7*	50 *5*	120.81	(5/2$^-$)	[E1]		0.213	
		94.86 *7*	62 *7*	105.01	(7/2$^+$)	[M1]		4.00	
		122.8 *1*	24 *3*	77.13	(7/2$^-$)	[E1]		0.297	
		135.20 *7*	100 *10*	64.69	(5/2$^+$)	[M1]		7.22	
		169.9 *1*	56 *7*	29.91	(5/2$^-$)	[E1]		0.1362	
235.53	(9/2$^-$)	158.4 *1*	100	77.13	(7/2$^-$)	[M1]		4.61	
256.97	(9/2$^+$)	111.9 *1*	100 *17*	144.96	(9/2$^+$)	[M1]		12.33	
		152.0 *1*	92 *17*	105.01	(7/2$^+$)	[M1]		5.18	
		179.9 *1*	67 *17*	77.13	(7/2$^-$)	[E1]		0.1187	

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

$\gamma(^{225}Ac)$ (continued)

† From ^{229}Pa α decay, unless otherwise stated. Only the 40.09-keV transition is seen in ^{225}Ra β^- decay.
‡ For δ=0.5 *5* in analogy with the mixing ratio for 120.80γ.
# 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.
@ Multiply placed with intensity suitably divided.
& Placement of transition in the level scheme is uncertain.

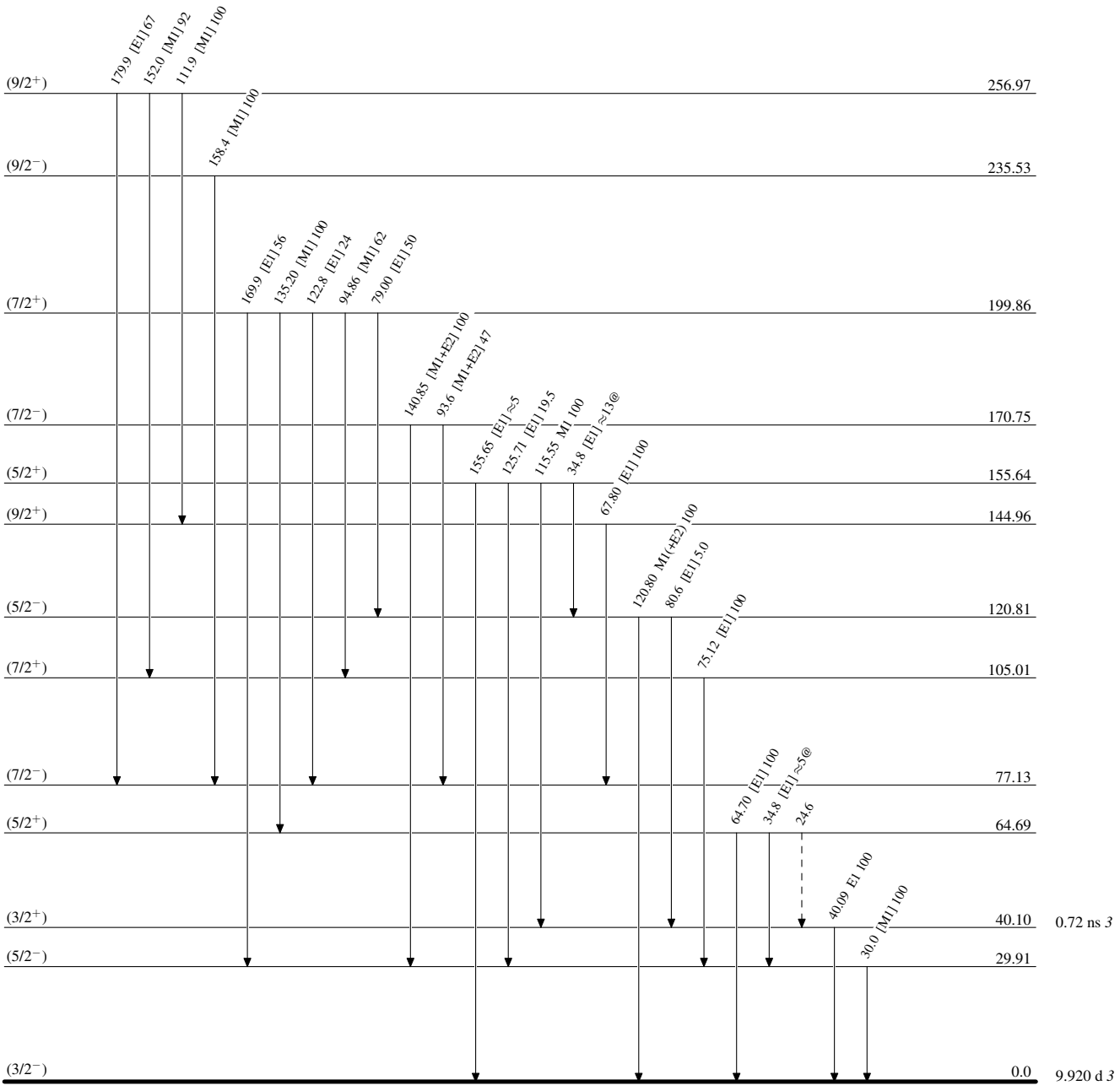
Adopted Levels, Gammas

Legend

Level Scheme

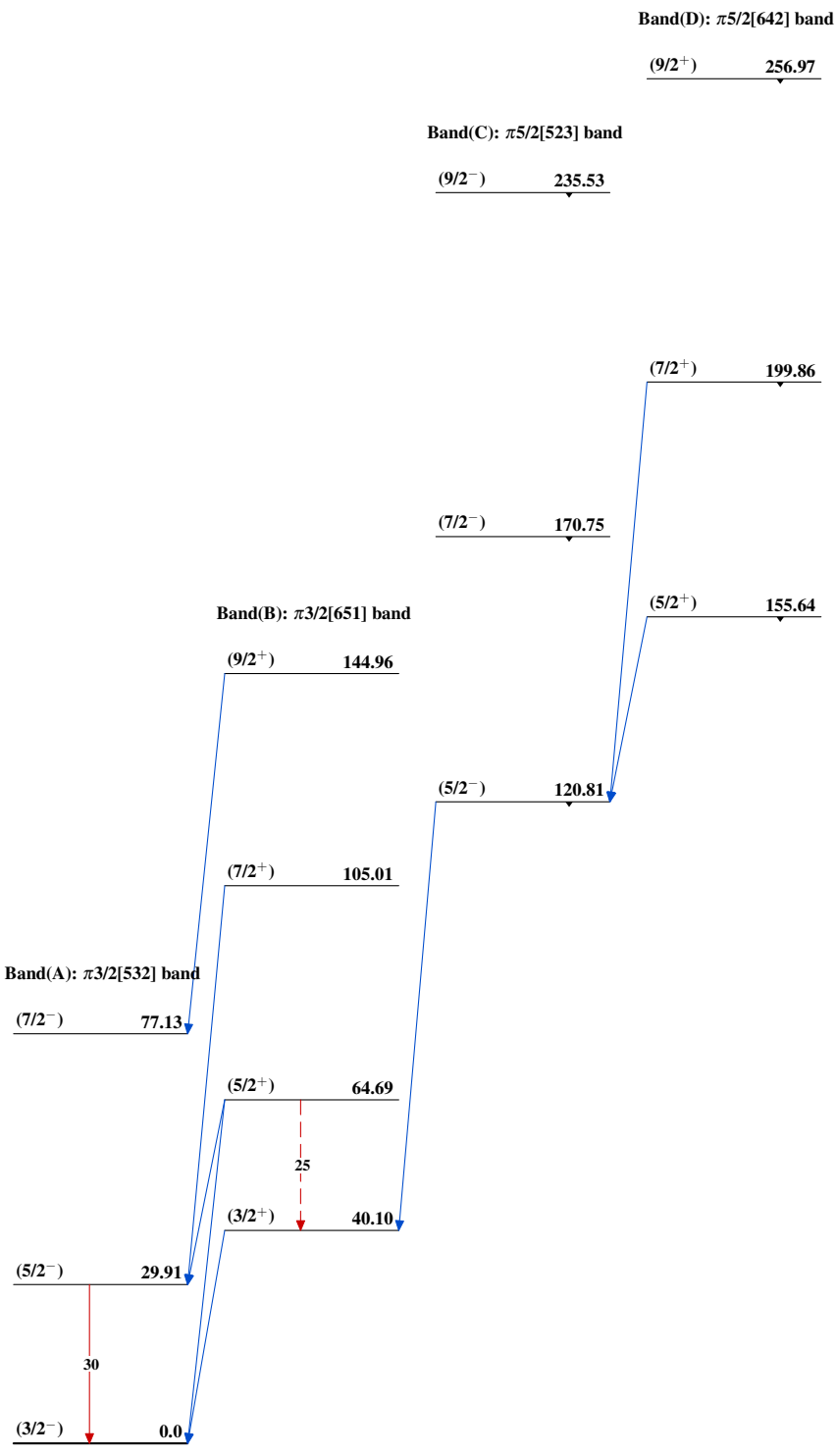
Intensities: Relative photon branching from each level
@ Multiply placed: intensity suitably divided

- - - - - - ► γ Decay (Uncertain)



$^{225}_{89}Ac_{136}$

Adopted Levels, Gammas



$^{225}_{89}Ac_{136}$