Adopted Levels, Gammas

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh and Jun Chen	NDS 191,1 (2023)	22-Aug-2023

Q(β^-)=−9430 *80*; S(n)=9140 *80*; S(p)=1.95×10^3 *12*; Q(α)=5980 *60* 2021Wa16
S(2n)=20900 *220* (syst), S(2p)=2220 *80*, Q(εp)=8100 *80*, Q(ε)=8340 *90* (syst) (2021Wa16).
Q(α): g.s. α transition assumed, with 60-keV uncertainty added because of lack of information concerning the energy of the daughter state populated in the α decay of ^{167}Os (2021Wa16).
1977Ca23, 1978Ca11, 1982De11: ^{167}Os produced and identified in ^{107,109}Ag,^{106,108,110}Cd,^{110}Pd,^{112,116}Sn,^{113}In(^{63}Cu,X),E(^{63}Cu)=245-320 MeV reaction at Orsay, followed by the assignment of α lines from the decay of ^{167}Os through cross-bombardments, excitation functions, and α-energy systematics.
1978MaYF: yield measurement of ^{167}Os in ^{58}Ni,^{63}Cu(^{58}Ni,X), E(^{58}Ni)=290 MeV reaction, and measurement of its α decay using the heavy-ion accelerator UNILAC at GSI.
1981Ho10: ^{167}Os identified from the decay of ^{171}Pt parent which was formed in Sn(^{58}Ni,X),E=4.4 MeV/nucleon, followed by separation of fragments using SHIP velocity filter at GSI.
1982En03: identification of ^{167}Os as the α daughter of ^{171}Pt.
Additional information 1.
No references were found in the NSR database for theoretical structure calculations for ^{167}Os.

^{167}Os Levels

All configurations are from 2009Od02.

Cross Reference (XREF) Flags

A	^{167}Os IT decay (700 ns)
B	^{171}Pt α decay (45.5 ms)
C	^{92}Mo(^{78}Kr,2pnγ)
D	^{112}Sn(^{58}Ni,2pnγ)

E(level)[†]	J$^\pi$[‡]	T$_{1/2}$	XREF	Comments
0.0[@]	(7/2$^-$)	839 ms *5*	ABC	%ε+%β^+=49 *5*; %α=51 *5* (2010Sc02) %α: others: 58% *12* (1981Ho10, from positions and intensities of correlated parent/daughter events); 76% *10* (1982En03, from matching of ^{171}Pt-^{167}Os velocity distributions following recoil-mass selection of the evaporation residues formed by 5-neutron emission from ^{176}Pt); and 49% *7* (1996Pa01). %ε+%β^+ from 100−%α. T$_{1/2}$: from 2010Sc02, measured from α-decay correlated with 3-s recoils. Others: 0.65 s *15* (1977Ca23,1978Ca11), 1.05 s *35* (1981Ho10), 0.8 s *2* (1982En03), 0.84 s *7* (1996Pa01). T$_{1/2}$: value of 835 ms *9* in Fig. 8 is a misprint as confirmed in an e-mail reply from C. Scholey on Feb 4, 2010. Additional information 2.
87.10[&] *10*	(9/2$^-$)		A C	
434.7[a] *8*	(13/2$^+$)	700 ns *10*	A CD	%IT=100 T$_{1/2}$: from 2010Sc02, measured from time differences between recoil implantations and delayed γ rays detected in the GREAT focal plane spectrometer. Delayed γ rays were observed at 86.7 and 347.6 keV. Note that T$_{1/2}$=672 ns *7* stated in level-scheme Fig. 11 of 2010Sc02 is a misprint, as communicated in an e-mail reply from C. Scholey on Feb 5, 2010.
451.50[@] *10*	(11/2$^-$)		C	
502.90[&] *22*	(13/2$^-$)		C	

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Adopted Levels, Gammas (continued)

^{167}Os Levels (continued)

E(level)[†]	Jπ[‡]	$T_{1/2}$	XREF	Comments
797.6[a] 8	(17/2+)	13.9 ps 28	CD	$T_{1/2}$: recoil-distance method in ^{92}Mo(^{78}Kr,2pnγ) (2009Od02).
1060.80[@] 14	(15/2−)		C	
1091.40[&] 25	(17/2−)		C	
1096.40 22			C	
1340.8[a] 8	(21/2+)		CD	
1758.20[@] 17	(19/2−)		C	
1789.9[&] 3	(21/2−)		C	
1811.2 3			C	
1995.9[a] 8	(25/2+)		CD	
2148.5[c] 8	(23/2−)		CD	Jπ: (21/2−) assigned by 2001Jo11 in ^{112}Sn(^{58}Ni,2pnγ).
2206.2[b] 8	(23/2−)		C	
2331.6[#] 8			CD	Jπ: (23/2−) assigned by 2001Jo11 in ^{112}Sn(^{58}Ni,2pnγ), but none assigned in 2009Od02 since mult(990.8γ) could not be established.
2417.2 10			C	
2509.8[b] 8	(27/2−)		C	
2556.8[&] 5	(25/2−)		C	
2627.7 11			C	
2628.3[c] 8	(27/2−)		CD	Jπ: (25/2−) assigned by 2001Jo11 in ^{112}Sn(^{58}Ni,2pnγ).
2680.0[a] 8	(29/2+)		CD	
2820.0[#] 9			CD	Jπ: (27/2−) assigned by 2001Jo11 in ^{112}Sn(^{58}Ni,2pnγ), but none assigned in 2009Od02 since mult(488.4γ) could not be established.
2897.2 9			C	
3044.1[b] 9	(31/2−)		C	
3125.9[c] 8	(31/2−)		C	
3317.9[a] 9	(33/2+)		C	
3716.4[b] 10	(35/2−)		C	
3984.1[a] 10	(37/2+)		C	

[†] From a least-squares fit to γ-ray energies. Normalized χ^2=4.1 in comparison to critical χ^2=3.8. It is possible that some of the uncertainties in Eγ values are underestimated.
[‡] As proposed by 2009Od02 in ^{92}Mo(^{78}Kr,2pnγ) based on systematics, comparisons with theoretical predictions, and angular distributions for selected transitions.
[#] Possible 3-quasineutron state.
[@] Band(A): $\nu(f_{7/2},h_{9/2}),\alpha=-1/2$.
[&] Band(a): $\nu(f_{7/2},h_{9/2}),\alpha=+1/2$.
[a] Band(B): $\nu i_{13/2}$, yrast band.
[b] Band(C): Possible 3-quasineutron band. Configuration=$\nu(f_{7/2},h_{9/2}\otimes i^2_{13/2})$.
[c] Band(D): Band based on (23/2−). Possible 3-quasineutron band.

γ(^{167}Os)

E_i(level)	J^π_i	E_γ[†]	I_γ[†]	E_f	J^π_f	Mult.[†]	α[‡]	Comments
87.10	(9/2−)	87.1 1	100	0.0	(7/2−)	M1	8.5 3	α(K)=6.99 22; α(L)=1.14 4; α(M)=0.263 8 α(N)=0.0641 20; α(O)=0.0111 4; α(P)=0.00082 3 Mult.: from ^{167}Os IT decay.
434.7	(13/2+)	347.6 8	100	87.10	(9/2−)	M2	0.629 10	α(K)=0.491 9; α(L)=0.1032; α(M)=0.0245; α(N)=0.00602 B(M2)(W.u.)=0.176 3 E_γ,Mult.: from ^{167}Os IT decay.

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Adopted Levels, Gammas (continued)

γ(^{167}Os) (continued)

E_i(level)	J^π_i	E_γ†	I_γ†	E_f	J^π_f	Mult.†	α‡	Comments
451.50	(11/2⁻)	451.5 *1*	100	0.0	(7/2⁻)	(Q)		
502.90	(13/2⁻)	415.8 *2*	100	87.10	(9/2⁻)	(Q)		
797.6	(17/2⁺)	362.9 *1*	100	434.7	(13/2⁺)	E2	0.0528 *8*	B(E2)(W.u.)=112 *23* E_γ: 362.8 *2* in ^{112}Sn(^{58}Ni,2pnγ).
1060.80	(15/2⁻)	609.3 *1*	100	451.50	(11/2⁻)	Q		
1091.40	(17/2⁻)	588.5 *1*	100	502.90	(13/2⁻)			
1096.40		644.9 *2*	100	451.50	(11/2⁻)			
1340.8	(21/2⁺)	543.2 *1*	100	797.6	(17/2⁺)	Q		E_γ: 542.8 *2* in ^{112}Sn(^{58}Ni,2pnγ).
1758.20	(19/2⁻)	697.4 *1*	100	1060.80	(15/2⁻)			
1789.9	(21/2⁻)	698.5 *1*	100	1091.40	(17/2⁻)			
1811.2		750.4 *3*	100	1060.80	(15/2⁻)			
1995.9	(25/2⁺)	655.3 *1*	100	1340.8	(21/2⁺)	Q		E_γ: 655.1 *2* in ^{112}Sn(^{58}Ni,2pnγ).
2148.5	(23/2⁻)	807.5 *1*	100	1340.8	(21/2⁺)	D		E_γ: 807.0 *3* in ^{112}Sn(^{58}Ni,2pnγ).
2206.2	(23/2⁻)	865.4 *2*	100	1340.8	(21/2⁺)	D		
2331.6		990.8 *1*	100	1340.8	(21/2⁺)			E_γ: 988.8 *3* in ^{112}Sn(^{58}Ni,2pnγ).
2417.2		1076.4 *6*	100	1340.8	(21/2⁺)			
2509.8	(27/2⁻)	303.6 *2*	100 *10*	2206.2	(23/2⁻)			
		513.9 *2*	51 *13*	1995.9	(25/2⁺)			
2556.8	(25/2⁻)	766.9 *4*	100	1789.9	(21/2⁻)			
2627.7		210.5 *4*	100	2417.2				
2628.3	(27/2⁻)	479.6 *1*	100 *10*	2148.5	(23/2⁻)			E_γ: 479.8 *3* in ^{112}Sn(^{58}Ni,2pnγ).
		632.5 *1*	98 *13*	1995.9	(25/2⁺)			E_γ: 631.5 *3* in ^{112}Sn(^{58}Ni,2pnγ). I_γ: other: 55 *14* in ^{112}Sn(^{58}Ni,2pnγ). Unweighted average is 77 *22*.
2680.0	(29/2⁺)	684.1 *1*	100	1995.9	(25/2⁺)	Q		E_γ: 683.4 *3* in ^{112}Sn(^{58}Ni,2pnγ).
2820.0		488.4 *4*	100	2331.6				E_γ: 487.6 *3* IN in ^{112}Sn(^{58}Ni,2pnγ).
2897.2		901.3 *4*	100	1995.9	(25/2⁺)			
3044.1	(31/2⁻)	534.3 *4*	100	2509.8	(27/2⁻)			
3125.9	(31/2⁻)	497.6 *1*	100	2628.3	(27/2⁻)			
3317.9	(33/2⁺)	637.9 *3*	100	2680.0	(29/2⁺)			
3716.4	(35/2⁻)	672.3 *2*	100	3044.1	(31/2⁻)			
3984.1	(37/2⁺)	666.2 *4*	100	3317.9	(33/2⁺)			

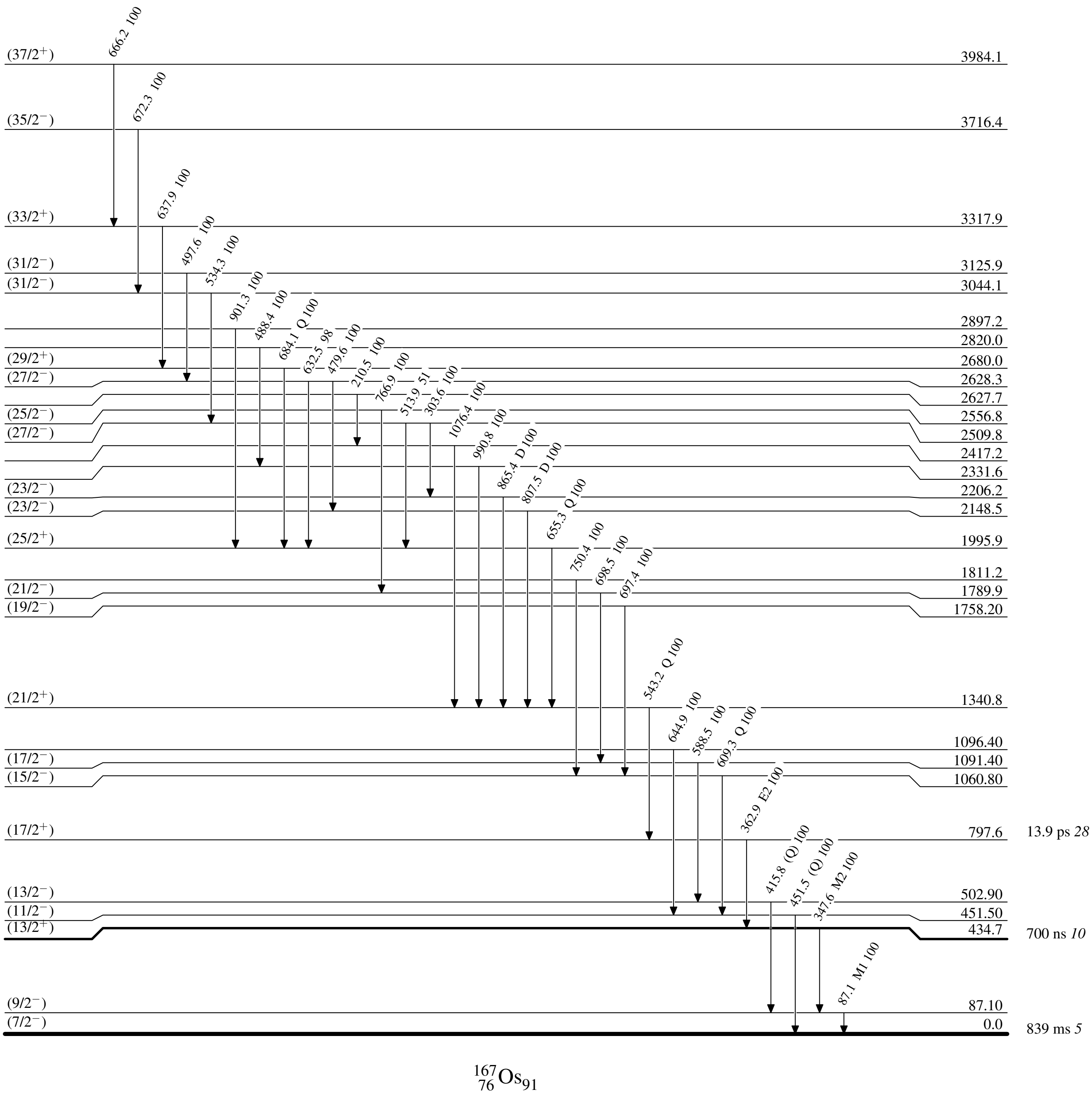
† From ^{92}Mo(^{78}Kr,2pnγ), with an exception for 347.6γ from 434.7 level which is from ^{167}Os IT decay. Eγ and Iγ values in ^{112}Sn(^{58}Ni,2pnγ) are in general agreement but much less complete. Also several authors share the two studies, the latter paper comments on some of the differences e.g. the ^{92}Mo(^{78}Kr,2pnγ) study involves $\gamma\gamma$ coincidences with characteristic α rays from ^{167}Os decay (recoil-decay tagging method) whereas ^{112}Sn(^{58}Ni,2pnγ) study involved $\gamma\gamma$ coincidences with recoils. The former study is, in principle, expected to be more precise and accurate, thus data are adopted from 2009Od02.

‡ 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.

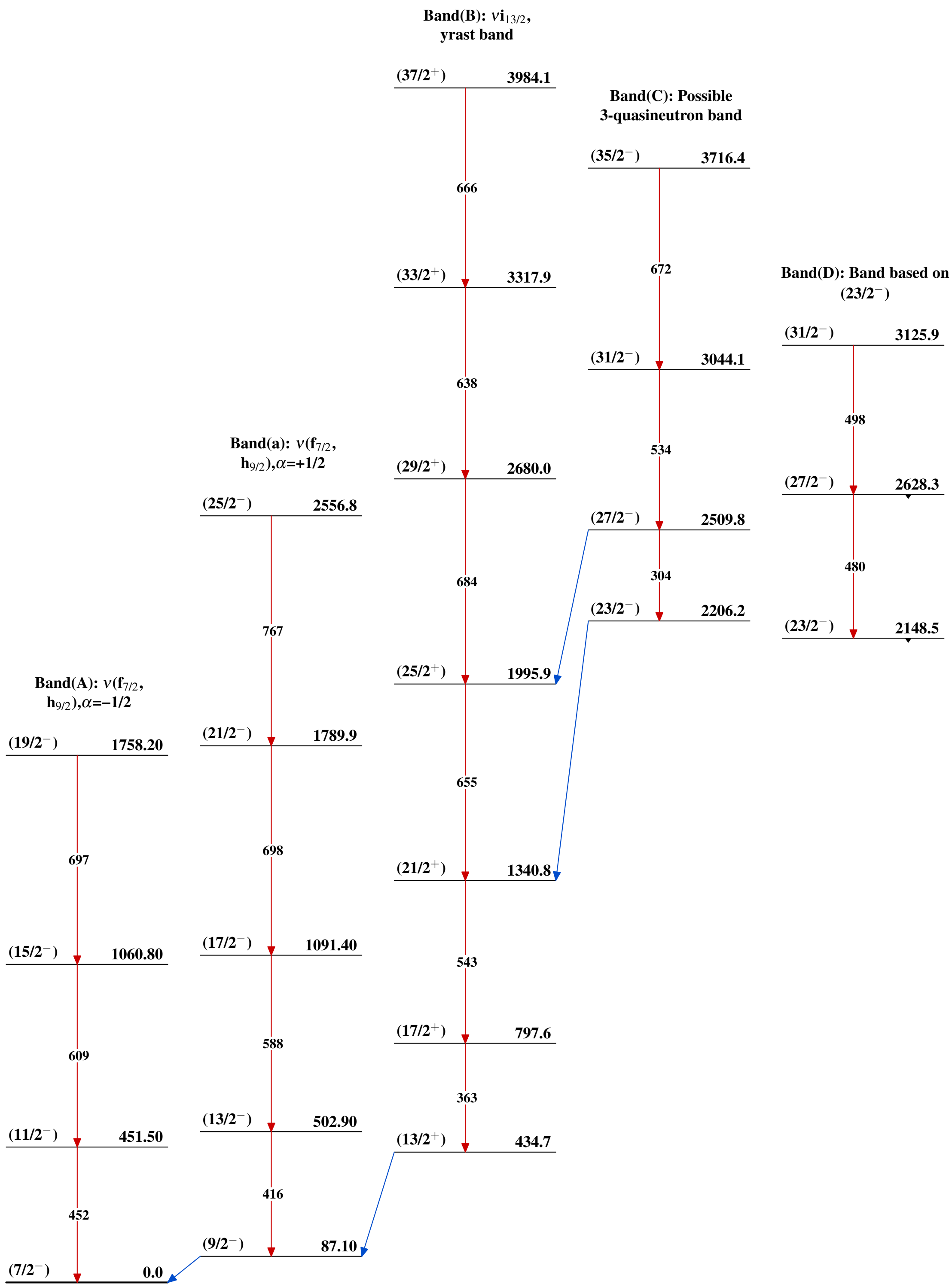
Adopted Levels, Gammas

Level Scheme

Intensities: Relative photon branching from each level



Adopted Levels, Gammas



$^{167}_{76}Os_{91}$