Adopted Levels, Gammas 2000Sc31,2000WeZZ,1994He28

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	Coral M. Baglin	NDS 112,1163 (2011)	15-Dec-2010

Q(β^-)=−1.29×10^4 *syst*; S(n)=1.21×10^4 *syst*; S(p)=3.4×10^3 *syst*; Q(α)=−3.5×10^3 *syst* 2012Wa38

Note: Current evaluation has used the following Q record −12600 syst 12440 syst 3730 syst −3280 syst 2003Au03,2009AuZZ.

Q(β^-), S(n), S(p), Q(α): from 2009AuZZ (cf. −12920 *720* (syst.), 12270 *640* (syst.), 3630 *570*, −2610 *640* (syst.), respectively, from 2003Au03).

ΔQ-=720, ΔS(n)=640, ΔS(p)=400, ΔQ(α)=640 (2009AuZZ).

Q(ε-p)=7570 *400* from systematics (2009AuZZ) (cf. 7420 *590* from systematics (2003Au03)).

2008Ka30 deduce a mass excess of −59440 *160* for ^{93}Pd (cf. −59700 *400* from systematics in 2003Au03) based on an interpolation of S(2p) values for N=47 isotones and they estimate S(p)=3730 *160* and S(2p)=5780 *160*. 2009AuZZ adopt mass excess of −59440 *400* and S(p)=3730 *400*.

Production:

2000Sc31: ^{58}Ni(^{40}Ca,αn), E=188 MeV; enriched ^{58}Ni target, online mass separation; Si E-ΔE telescope, plastic scin and 12 Ge detectors; measured direct and ε-delayed protons, Eγ, Iγ, $\gamma\beta$+ coin and $\gamma\gamma\beta$+ coin; shell−model calculations.

2000WeZZ: ^{112}Sn bombardment of Be, E(^{112}Sn)=112 GeV; fragment mass separation, time of flight for identification; four double-sided Si strip detectors, Si β detectors, segmented-clover Ge γ detector; measured $T_{1/2}$.

1994He28: Ni+^{106}Cd, E(^{106}Cd)=60 MeV/A; ^{93}Pd separated and identified using projectile fragment separator with 150 ns flight path; data also reported by 1995He39 and 1995Mo26.

Others: 1995Le08 (63 MeV/A ^{112}Sn on Ni); 1976FaZW (^{60}Ni(^{40}Ca,α3n), E=147 MeV).

The adopted level scheme is based on the schemes deduced in ^{94}Ag p decay and in ^{58}Ni(^{40}Ca,αnγ). The scheme proposed in ^{40}Ca(^{58}Ni,αnγ) is less extensive, but includes all but the 516γ in the cascade to the g.s. from the 7280 level; however, it reverses the order of the 984γ-1096γ cascade and reorders the 349γ-167γ-275γ cascade.

^{93}Pd Levels

Cross Reference (XREF) Flags

- A ^{94}Ag p decay (0.39 s)
- B ^{40}Ca(^{58}Ni,αnγ)
- C ^{58}Ni(^{40}Ca,αnγ)

E(level)†	J$^\pi$‡	$T_{1/2}$	XREF	Comments
0.0&	(9/2$^+$)	1.00@ s *9*	ABC	%ε+%β^+=100; %εp=? J$^\pi$: 7/2$^+$ or 9/2$^+$ based on shell-model calculations in ($1g_{9/2}$, $2p_{1/2}$) model space (2000Sc31) and on systematics of J^π(g.s.) in neighboring odd-N nuclides. 2001Xu05 favor 9/2$^+$ based on statistical model calculation of proton branching to different final states in the ^{92}Ru εp decay daughter as a function of assumed J^π(^{93}Pd). Shell-model calculations by 2004Ru02 also favor a 9/2$^+$ g.s.
983.5& *3*	(13/2$^+$)		ABC	E(level): a different value (1096) was proposed in (^{58}Ni,αnγ); there, I(984γ) and I(1096γ) were too similar to define the cascade order and the 205γ and 887γ, now known from (^{40}Ca,αnγ), were unobserved.
1870.8 *5*	(15/2$^+$)		A C	
2079.3& *5*	(17/2$^+$)		ABC	
2232.2 *5*	(17/2$^+$)		A C	
2428.5 *6*	(19/2$^+$)		ABC	
2595.5& *6*	(21/2$^+$)		ABC	
2870.9& *7*	(25/2$^+$)		ABC	

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Adopted Levels, Gammas 2000Sc31,2000WeZZ,1994He28 (continued)

^{93}Pd Levels (continued)

E(level)[†]	J$^{\pi}$[‡]	XREF	Comments
3386.0?[a] *11*	(25/2$^-$,27/2$^-$)[#]	A C	J$^{\pi}$: (D) 515γ to (25/2$^+$) 2871; probably feeds level of equal or lower J; member of sequence analogous to π=− yrast sequences in the ^{89}Mo and ^{91}Ru N=47 isotones.
3735.1?[a] *11*	(29/2$^-$,31/2$^-$)[#]	A C	
3863.2[&] *8*	(29/2$^+$)	ABC	
4138.7?[a] *11*	(29/2$^-$,31/2$^-$)[#]	A	
4752.7?[a] *15*	(33/2$^-$,35/2$^-$)[#]	A	
4995.6[&] *9*	(33/2$^+$)	ABC	
5649.0[&] *10*	(37/2$^+$)	BC	
6994.9 *11*	(39/2$^+$)	C	
7280.8[&] *12*	(41/2$^+$)	BC	
7662.9[&] *12*	(45/2$^+$)	C	

[†] From least-squares fit to adopted Eγ, assigning 1 keV uncertainty to Eγ data for which the authors did not state an uncertainty.

[‡] From ^{58}Ni(^{40}Ca,αnγ), except as noted, based on measured DCO ratios and on comparison of deduced structure with that for isotones ^{87}Zr, ^{89}Mo and ^{91}Ru and with predictions from shell-model calculations performed in the restricted model space of $g_{9/2}$ and $p_{1/2}$ for proton and neutron holes (2004Ru02). These values assume J^{π}(g.s.)=9/2$^+$.

[#] Tentative π=− level sequence built on (25/2$^-$,27/2$^-$) 3386 level; proposed because observed proton branches with similar strength to 4994 and 4751 levels in ^{94}Ag p decay make it unlikely that the latter levels belong in the even-parity yrast sequence (2005Mu15).

[@] Unweighted average of 0.7 s *+2−1* from ε-delayed proton decay and 1.0 s *3* from γ(t) for ε-delayed 240γ (2000Sc31), 1.0 s *2* (2001Ki13), 1.3 s *2* (2001Xu05 and 2005Xu04) and 1.0 s *+3−2*; supported by $T_{1/2}$=0.9 s *6* and 0.9 s *4*, respectively, for 382γ and $\gamma^{\pm}$ from 2000Sc31. The evaluator's assignment of this $T_{1/2}$ to the ^{93}Pd g.s. is consistent with shell-model $T_{1/2}$ predictions by 1997He24 (1.4 s). Note that $T_{1/2}$=9.3 s *+25−17*, tentatively assigned to ^{93}Pd by 2000WeZZ, appears to have been erroneous (see 2007WeZX). An E≈660−keV 1/2$^-$ state is predicted also (2000Sc31) and this possibly may Be isomeric. Other $T_{1/2}$: 1976FaZW report a 60 s *20* proton activity in coincidence with x rays that suggest a ^{93}Pd precursor; this tentative assignment to ^{93}Pd remains unconfirmed and is probably not correct.

[&] Band(A): π=(+) ΔJ=2 yrast sequence.

[a] Band(B): π=(−) sequence. Based on (25/2$^-$,27/2$^-$) 3386 level; analogous to π=− yrast sequences in N=47 isotones ^{89}Mo and ^{91}Ru.

γ(^{93}Pd)

E$_i$(level)	J$_i^{\pi}$	E$_{\gamma}$[†]	I$_{\gamma}$[†]	E$_f$	J$_f^{\pi}$	Mult.[‡]	Comments
983.5	(13/2$^+$)	983.5 *3*	100	0.0	(9/2$^+$)	Q[#]	Other Eγ:984.8 *3* from (^{58}Ni,αnγ).
1870.8	(15/2$^+$)	887.3 *5*	100	983.5	(13/2$^+$)	(D)[#]	
2079.3	(17/2$^+$)	208.4 *3*	12.8 *23*	1870.8	(15/2$^+$)		
		1095.7 *5*	100 *10*	983.5	(13/2$^+$)	Q	Other Eγ: 1097.4 *3* from (^{58}Ni,αnγ).
2232.2	(17/2$^+$)	152.8 *3*	25 *6*	2079.3	(17/2$^+$)		
		361.5 *3*	100 *13*	1870.8	(15/2$^+$)	(D)[#]	
2428.5	(19/2$^+$)	196.3 *3*	52 *17*	2232.2	(17/2$^+$)	(D)[#]	I$_{\gamma}$: I(196γ)/I(349γ)=0.52 *17* from p-γ spectra gated on 1010-keV protons in ^{94}Ag p decay. Other data: 1.0 *3* from p-γ spectra gated on 790-keV protons in ^{94}Ag p decay; 0.18 *4* from (^{40}Ca,αnγ).
		349.3 *3*	100 *5*	2079.3	(17/2$^+$)	(D)[#]	Other mult.: Q for doublet in ^{40}Ca(^{58}Ni,αnγ).
2595.5	(21/2$^+$)	167.0 *3*	100 *7*	2428.5	(19/2$^+$)	D	
		516.3 *5*	58 *16*	2079.3	(17/2$^+$)	(Q)[#]	
2870.9	(25/2$^+$)	275.4 *3*	100	2595.5	(21/2$^+$)		Mult.: DCO in (^{40}Ca,αnγ) suggests Q or D+Q but γ

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Adopted Levels, Gammas 2000Sc31,2000WeZZ,1994He28 (continued)

$\gamma(^{93}Pd)$ (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[‡]	α[@]	Comments
								asymmetry in (^{58}Ni,αnγ) is consistent with pure D. Possibly γ is a doublet, as suggested in ^{94}Ag p decay (0.39 s).
3386.0?	(25/2$^-$,27/2$^-$)	514.5[&] *10*	100	2870.9	(25/2$^+$)	(D)[#]		Mult.: possibly E1; connects π=(+) and π=(−) level sequences.
3735.1?	(29/2$^-$,31/2$^-$)	349.0 *5*	100	3386.0?	(25/2$^-$,27/2$^-$)			Mult.: (D) for doublet in ^{40}Ca(^{58}Ni,αnγ).
3863.2	(29/2$^+$)	992.4 *4*	100	2870.9	(25/2$^+$)	Q		Eγ: from (^{58}Ni,αnγ). Other Eγ: 991.2 *7* from (^{40}Ca,αnγ).
4138.7?	(29/2$^-$,31/2$^-$)	276[&]		3863.2	(29/2$^+$)	[E1]	0.00868 *13*	α(K)=0.00759 *11*; α(L)=0.000889 *13*; α(M)=0.0001662 *24*; α(N+..)=2.78×10^{-5} α(N)=2.78×10^{-5} *4* Eγ: from ^{94}Ag p decay (0.39 s). Mult.: possibly E1; connects π=(+) and π=(−) level sequences. However, see comment on 275γ from 2871 level.
		403		3735.1?	(29/2$^-$,31/2$^-$)			Eγ: from ^{94}Ag p decay (0.39 s).
4752.7?	(33/2$^-$,35/2$^-$)	614	100	4138.7?	(29/2$^-$,31/2$^-$)			Eγ: from ^{94}Ag p decay (0.39 s).
4995.6	(33/2$^+$)	1132.3 *5*	100	3863.2	(29/2$^+$)	Q		Other Eγ: 1133.9 *4* in (^{58}Ni,αnγ).
5649.0	(37/2$^+$)	653.4 *4*	100	4995.6	(33/2$^+$)	Q		
6994.9	(39/2$^+$)	1346.0 *5*	100	5649.0	(37/2$^+$)			
7280.8	(41/2$^+$)	286.0 *5*	50 *20*	6994.9	(39/2$^+$)			
		1631.6 *10*	100 *20*	5649.0	(37/2$^+$)	Q		Other Eγ: 1635.3 *6* in (^{58}Ni,αnγ).
7662.9	(45/2$^+$)	382.1 *4*	100	7280.8	(41/2$^+$)			

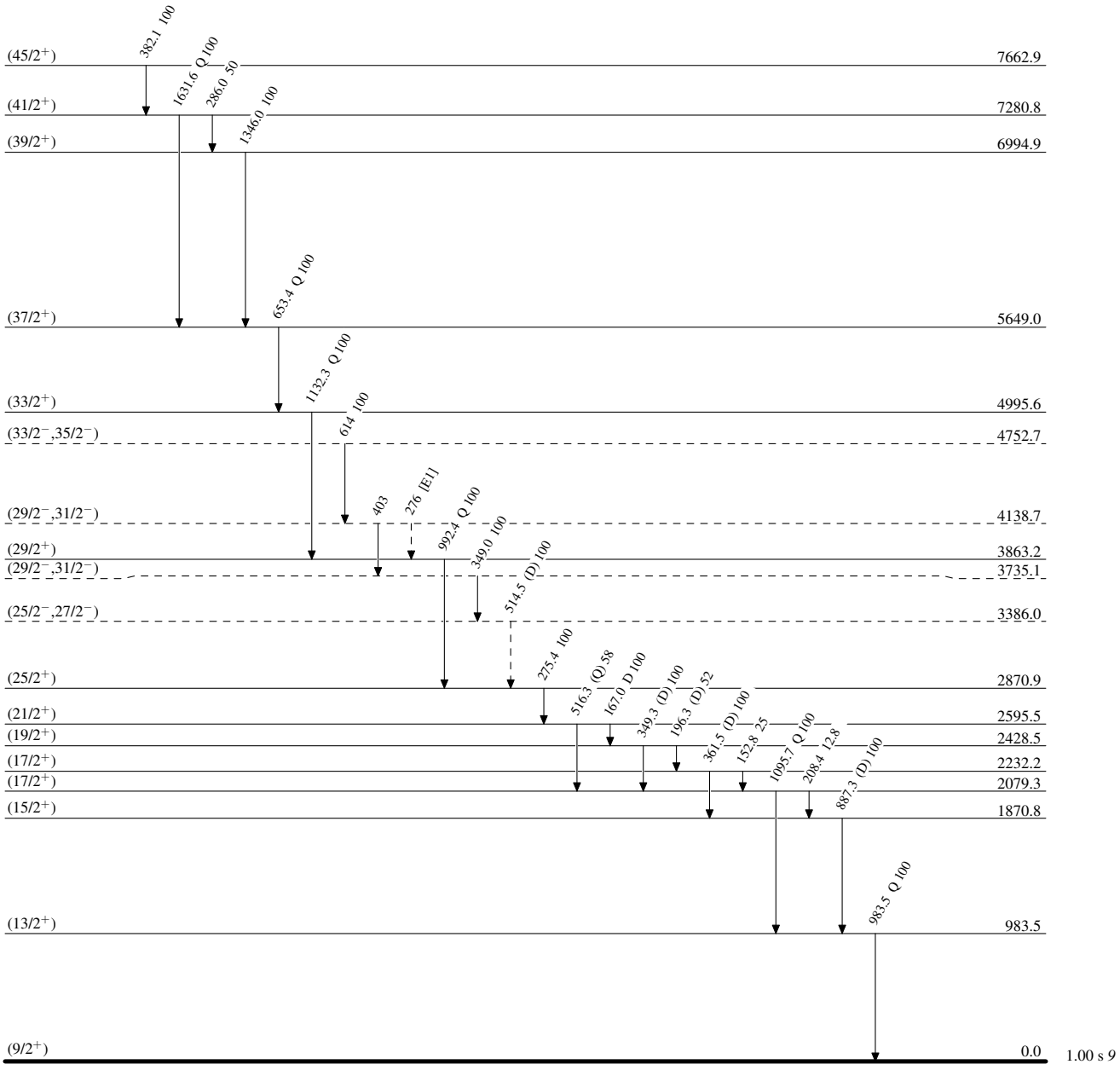
[†] From ^{58}Ni(^{40}Ca,αnγ), except as noted.
[‡] From γ asymmetry ratio in ^{40}Ca(^{58}Ni,αnγ), except as noted.
[#] From DCO ratio in ^{58}Ni(^{40}Ca,αnγ).
[@] Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on γ-ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.
[&] Placement of transition in the level scheme is uncertain.

Adopted Levels, Gammas 2000Sc31,2000WeZZ,1994He28 Legend

Level Scheme

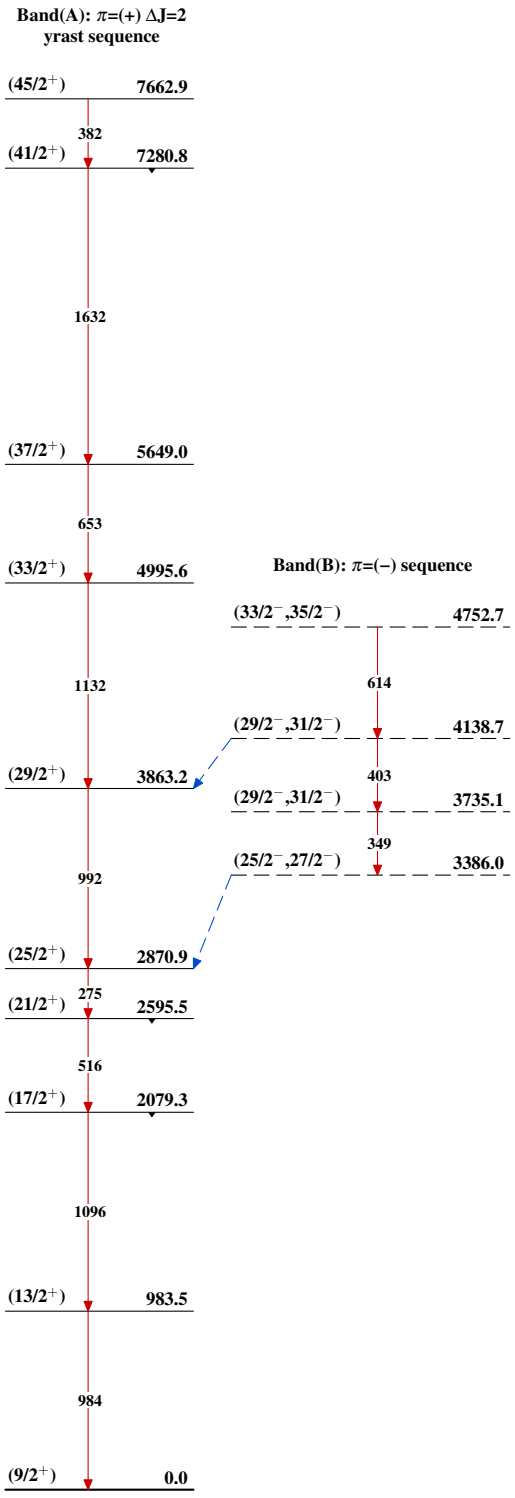
Intensities: Relative photon branching from each level

- - - - - - ► γ Decay (Uncertain)



$^{93}_{46}Pd_{47}$

Adopted Levels, Gammas 2000Sc31,2000WeZZ,1994He28



$^{93}_{46}Pd_{47}$