Coulomb excitation 1989SvZZ

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	G. Gürdal and F. G. Kondev	NDS 113, 1315 (2012)	1-Aug-2011

1989SvZZ: Reactions: ^{110}Pd(^{16}O,^{16}O′), ^{110}Pd(^{58}Ni,^{58}Ni′), ^{110}Pd(^{108}Pb,^{108}Pb′).

^{110}Pd(^{16}O,^{16}O′): E(^{16}O)=48 MeV, Target:97.73% enriched ^{110}Pd. The γ-rays were detected using a Ge(Li) detector placed 9mm from the target and an annular NaI detector. Measured: Eγ, γ-γ.

^{110}Pd(^{58}Ni,^{58}Ni′): E(^{58}Ni)=165.5 MeV provided by tandem van de Graaff accelerator at the University of Rochester. 1.34 mg/cm^2 self-supporting, 97.3% enriched ^{110}Pd target was used. The scattered ^{58}Ni ions were detected using 5 circular Si detectors and one annular Si detector covering the θ-range from 163° to 175°. Two Ge(Li) detectors placed at θ=1.5° and θ=60° with respect to the beam direction used to detect the γ-rays. Measured: Eγ, Iγ, γ-γ-particle coinc.

^{110}Pd(^{208}Pb,^{208}Pb′): E(^{208}Pb)=954 MeV provided by Lawrence Berkeley Laboratory. 1.34 mg/cm^2 self-supporting, 97.3% enriched ^{110}Pd target was used. The scattered ^{208}Pb ions were detected using a circular Si detector at θ=0°. 3 Ge(Li) detectors placed at θ=0°,110°; ϕ=180° and θ=110°;ϕ=0° were used to detect the γ-rays. Measured: Eγ, Iγ, γ-γ-particle coinc.

Others: 2008De30, 1989Ko40, 1972Lu08, 1971Bo08, 1971Ha08, 1969Ro05, 1962Er05, 1962Ga10, 1962Ri09, 1961St02 and 1958St32.

E2 matrix elements are from 1989SvZZ.

^{110}Pd Levels

E(level)[†]	J$^\pi$[†]	T$_{1/2}$[‡]	Comments
0.0[#]	0$^+$		
374[#]	2$^+$	45.5 ps *17*	T$_{1/2}$: Others: 46 ps *6* from recoil distance Doppler shift technique in 2008De30. B(E2)↑: 0.85 *+2−7* from E2 matrix element of 0.919 *+12−35* in 1989SvZZ, 0.88 *6* in 1971Bo08, 0.82 *8* in 1971Ha08, 0.91 *6* in 1969Ro05, 0.91 *3* in 1962Ec01 (the weighted average of 0.92 *6*, 0.90 *6*, 0.91 *6* and 0.91 *6*), 0.78 in 1962Er05, 0.94 *8* in 1962Ga10, 0.91 in 1962Ri09 and 0.86 *6* in 1958St32. μ: +0.62 *6* (using dynamic field technique in 1980Br01). Others: +0.62 *6* (1974Hu01), +0.70 *6* (1985ThZX), 0.74 *6* (1979LaZL), 1980Ka34, and 1969He11. Q: −0.72 *14* or −0.60 *14* (using reorientation precession technique in 1976Ha21). Others: −0.55 *7* (1972Lu08), −0.72 *12* or −0.45 *12* (1971Ha08) and −0.48 *5* or −0.27 *5* (1970Be45).
814.0[@]	2$^+$	17.7 ps *8*	T$_{1/2}$: Others: 18.6 ps *+5−9* from 1989SvZZ and 14.0 ps *18* in 1969Ro05. B(E2)↑= 0.0128 *11* in 1969Ro05, 0.094 *4* in 1961St02.
921.0[#]	4$^+$	4.1 ps *3*	T$_{1/2}$: Others: 4.5 ps *+3−1* in 1989SvZZ and 3.8 ps *6* in 1969Ro05.
947.0[&]	0$^+$	7.9 ps *7*	T$_{1/2}$: Others: 10.6 ps *+4−8* in 1989SvZZ and 8.0 ps *14* in 1969Ro05.
1171.0[a]	0$^+$		
1212.0[@]	(3$^+$)		
1215.0[&]	2$^+$	9.1 ps *6*	B(E2)↑=0.005 *+4−5* Other:1969Ro05.
1398.0[@]	4$^+$	5.1 ps *6*	T$_{1/2}$: Other: 5.4 ps *+5−4* in 1989SvZZ.
1470.0[a]	2$^+$		
1574.0[#]	6$^+$	1.40 ps *14*	T$_{1/2}$: Other: 1.46 ps *+14−7* in 1989SvZZ.
1718.0[&]	4$^+$	2.2 ps *3*	T$_{1/2}$: Other: 1.9 ps *4* in 1989SvZZ.
1890.0	2$^+$		
1936.0[a]	4$^+$		
2015	3$^-$		E(level): From 1969Ro05. ε B(E3)↑=0.086 *12*, from weighted average of 0.083 *15* and 0.093 *21* in 1969Ro05. β_3=0.140 *11*, deduced from εB(E3) by assuming that the 3$^-$ state decays 100% to the first 2$^+$ state (ε=1).
2061.0[@]	6$^+$		
2089.0	(4$^+$)		
2141.0	(4$^+$)		
2296.0[#]	8$^+$		

Continued on next page (footnotes at end of table)

Coulomb excitation 1989SvZZ (continued)

^{110}Pd Levels (continued)

E(level)†	Jπ†	E(level)†	Jπ†	E(level)†	Jπ†	E(level)†	Jπ†
2335.0&	6^+	2903.0	10	3131.0#	10^+	3968?&	(10^+)
2775.0@	8^+	3109?&	(8^+)	3543.0?@	(10^+)	4030.0#	12^+

† From 1989SvZZ.
‡ From recoil-distance technique in 1989Ko40, unless otherwise stated.
# Band(A): g.s band.
@ Band(B): gamma band.
& Band(C): Based on $J^\pi=0^+$ 947 keV level.
a Band(D): Based on $J^\pi=0^+$ 1171 keV level.

$\gamma(^{110}Pd)$

E_γ†	I_γ‡	E_i(level)	J_i^π	E_f	J_f^π	Mult.	δ	Comments
(39)		2335.0	6^+	2296.0	8^+			E2 matrix element of 0.4 *+6−7*.
(44)		1215.0	2^+	1171.0	0^+			E2 matrix element of −0.4 *+1−3*.
(72)		1470.0	2^+	1398.0	4^+			E2 matrix element of −0.35 *+20−44*.
(107)		921.0	4^+	814.0	2^+			E2 matrix element of 0.51 *+11−32*.
(125)		2061.0	6^+	1936.0	4^+			E2 matrix element of −0.76 *+5−16*.
(133)		947.0	0^+	814.0	2^+			E2 matrix element of 0.44 *+10−6*.
(144)		1718.0	4^+	1574.0	6^+			E2 matrix element of 0.7 *2*.
(172)		1890.0	2^+	1718.0	4^+			E2 matrix element of 0.08 *+25−21*.
(176)		1574.0	6^+	1398.0	4^+			E2 matrix element of 0.06 *+18−16*.
(183)		1398.0	4^+	1215.0	2^+			E2 matrix element of 0.42 *14*.
(186)		1398.0	4^+	1212.0	(3^+)			E2 matrix element of −0.5 *16*.
(218)		1936.0	4^+	1718.0	4^+			E2 matrix element of 0.1 *+4−2*.
(235)		2296.0	8^+	2061.0	6^+			E2 matrix element of 0.55 *+30−44*.
(248)		1718.0	4^+	1470.0	2^+			E2 matrix element of −0.3 *+1−4*.
(255)		1470.0	2^+	1215.0	2^+			E2 matrix element of 0.08 *+19−17*.
268	12	1215.0	2^+	947.0	0^+			B(E2)=0.237 *+8−41* from matrix element of 1.09 *+2−10* if δ(841γ)=1.2 B(E2)=0.189 *+11−18* from matrix element of 0.97 *+3−5* if δ(841γ)=−0.21.
(274)		2335.0	6^+	2061.0	6^+			E2 matrix element of −1.73 *+20−18*.
(291)	10.34	1212.0	(3^+)	921.0	4^+			E2 matrix element of −0.52 *+4−7*.
294		1215.0	2^+	921.0	4^+			E2 matrix element of 0.81 *5*.
(299)	14.84	1470.0	2^+	1171.0	0^+			E2 matrix element of 0.64 *+9−6*.
(320)		1718.0	4^+	1398.0	4^+			E2 matrix element of −0.41 *+27−14*.
334@		3109?	(8^+)	2775.0	8^+			E2 matrix element of −0.2 *+20−13*.
(343)		2061.0	6^+	1718.0	4^+			E2 matrix element of 0.1 *+4−5*.
357	44.64	1171.0	0^+	814.0	2^+			E2 matrix element of −0.40 *+2−3*.
(362)		1936.0	4^+	1574.0	6^+			E2 matrix element of 0.005 *16*.
(371)		2089.0	(4^+)	1718.0	4^+			E2 matrix element of 0.37 *+38−19*.
373.80# *8*	100#	374	2^+	0.0	0^+			E2 matrix element of 0.919 *+12−35*. B(E2)= 0.182 *12* in 1969Ro05.
(398)	100	1212.0	(3^+)	814.0	2^+			E2 matrix element of −0.74 *+10−9*.
401	18	1215.0	2^+	814.0	2^+			E2 matrix element of −0.47 *+3−6*.
412@		3543.0?	(10^+)	3131.0	10^+			E2 matrix element of 0.4 *+6−12*.
(420)		1890.0	2^+	1470.0	2^+			E2 matrix element of 0.16 *+32−15*.
(423)		2141.0	(4^+)	1718.0	4^+			E2 matrix element of −0.2 *+2−6*.
439.76# *8*	100#	814.0	2^+	374	2^+	E2+M1	−4.6 *+19−12*	Mult.: A_2=−0.214 *37* using γ(θ) in 1969Ro05;

Continued on next page (footnotes at end of table)

Coulomb excitation 1989SvZZ (continued)

$\gamma(^{110}Pd)$ (continued)

E_γ[†]	I_γ[‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult.	Comments
							$\gamma\gamma(\theta)$ in 1969Ro03.
							δ: From $\gamma\gamma(\theta)$ in 1969Ro03. Other:−6.0 *+15−16* (1989SvZZ).
							E2 matrix element of 0.919 *+12−35*.
466	100	1936.0	4^+	1470.0	2^+		E2 matrix element of 0.91 *+9−6*.
477	35	1398.0	4^+	921.0	4^+		B(E2)=0.099 *+8−10* from E2 matrix element of −0.94 *+8−10* if δ(477)=11 B(E2)=0.064 *+24−2* from E2 matrix element of −0.76 *+1−14* if δ(477)=−1.3.
(487)		2061.0	6^+	1574.0	6^+		E2 matrix element of −0.4 *+5−2*.
(487)		4030.0	12^+	3543.0?	(10^+)		E2 matrix element of −0.4 *+5−2*.
(492)		1890.0	2^+	1398.0	4^+		E2 matrix element of −0.98 *+11−16*.
503		1718.0	4^+	1215.0	2^+		B(E2)=0.36 *+5−3* from E2 matrix element of 1.81 *+11−8* if $\delta(841\gamma)$=1.2 B(E2)=0.44 *2* from E2 matrix element of 1.98 *4* if $\delta(841\gamma)$=−0.21.
(515)		2089.0	(4^+)	1574.0	6^+		E2 matrix element of 0.91 *+38−17*.
(523)		1470.0	2^+	947.0	0^+		E2 matrix element of −0.28 *+10−8*.
(538)		1936.0	4^+	1398.0	4^+		E2 matrix element of 0.19 *+16−37*.
547.04[#] *10*	100[#]	921.0	4^+	374	2^+	E2	B(E2)=0.277 *+1−13* from E2 matrix element of 1.579 *+4−37* in 1989SvZZ and 0.31 *4* in 1969Ro05. Mult.: A_2=0.36 *7* and −0.31 *11* from $\gamma(\theta)$ in 1962Ec01.
(549)		1470.0	2^+	921.0	4^+		E2 matrix element of 0.51 *+13−6*.
(567)		2141.0	(4^+)	1574.0	6^+		E2 matrix element of 1.0 *4*.
572.89[#] *10*	100[#]	947.0	0^+	374	2^+		from E2 matrix element of 0.297 *+13−3* in 1989SvZZ and 0.115 *20* 0.115 *20* from Coulomb excitation in 1969Ro05.
584	100	1398.0	4^+	814.0	2^+		E2 matrix element of 0.97 *+4−3*.
607		2903.0	10	2296.0	8^+		
617		2335.0	6^+	1718.0	4^+		B(E2)=0.37 *+4−8* from E2 matrix element of 2.20 *+11−24* if $\delta(841\gamma)$=1.2 B(E2)=0.30 *+2−4* from E2 matrix element of 1.97 *+7−15* if $\delta(841\gamma)$=−0.21.
653		1574.0	6^+	921.0	4^+		E2 matrix element of 0.332 *+27−11*.
(656)	73.29	1470.0	2^+	814.0	2^+		E2 matrix element of 0.20 *+2−3*.
663		2061.0	6^+	1398.0	4^+		E2 matrix element of 1.12 *+15−48*.
(671)		2141.0	(4^+)	1470.0	2^+		E2 matrix element of 0.02 *8*.
691		2089.0	(4^+)	1398.0	4^+		E2 matrix element of −1.1 *+2−5*.
714		2775.0	8^+	2061.0	6^+		E2 matrix element of 2.2 *+2−11*.
(719)		1890.0	2^+	1171.0	0^+		E2 matrix element of −0.29 *+17−20*.
(721)		1936.0	4^+	1215.0	2^+		E2 matrix element of 0.47 *+17−24*.
722		2296.0	8^+	1574.0	6^+		E2 matrix element of 2.77 *+14−17*.
(724)	61	1936.0	4^+	1212.0	(3^+)		E2 matrix element of −0.24 *+4−5*.
(743)		2141.0	(4^+)	1398.0	4^+		E2 matrix element of 0.7 *+9−5*.
761		2335.0	6^+	1574.0	6^+		E2 matrix element of −0.23 *+19−24*.
768[@]		3543.0?	(10^+)	2775.0	8^+		
774[@]	100	3109?	(8^+)	2335.0	6^+		E2 matrix element of 2.64 *+26−19*.
797	100	1171.0	0^+	374	2^+		E2 matrix element of 0.080 *+3−6*.
797	25	1718.0	4^+	921.0	4^+		E2 matrix element of −0.28 *+7−9*.
813[@]		3109?	(8^+)	2296.0	8^+		E2 matrix element of −0.3 *+9−5*.
813.52[#] *10*	17.8[#] *13*	814.0	2^+	0.0	0^+		I_γ: 26.3 in 1989SvZZ. E2 matrix element of −0.096 *+2−3*.
835		3131.0	10^+	2296.0	8^+		E2 matrix element of 3.29 *+14−45*.
(838)	57.90	1212.0	(3^+)	374	2^+		E2 matrix element of −0.088 *+20−14*.
841	100	1215.0	2^+	374	2^+		B(E2)=0.0038 *+6−5* from matrix element of −0.138 if δ=1.2 B(E2)=0.00029 *+8−25* from matrix element of −0.038 *+23−5* if δ=−0.21. Origin of δ value not given by 1989SvZZ.

Continued on next page (footnotes at end of table)

Coulomb excitation 1989SvZZ (continued)

$\gamma(^{110}Pd)$ (continued)

E_γ[†]	I_γ[‡]	E_i(level)	J_i^π	E_f	J_f^π	Comments
859[@]		3968?	(10^+)	3109?	(8^+)	E2 matrix element of 3.6 *+9−4*.
899		4030.0	12^+	3131.0	10^+	E2 matrix element of 3.1 *+4−9*.
904	100	1718.0	4^+	814.0	2^+	E2 matrix element of 0.41 *3*.
(926)		2141.0	(4^+)	1215.0	2^+	E2 matrix element of −0.3 *+2−6*.
(929)		2141.0	(4^+)	1212.0	(3^+)	E2 matrix element of 0.86 *+15−17*.
(937)		2335.0	6^+	1398.0	4^+	E2 matrix element of −0.07 *+30−23*.
(943)	2.94	1890.0	2^+	947.0	0^+	E2 matrix element of 0.19 *+14−3*.
(969)		1890.0	2^+	921.0	4^+	E2 matrix element of −0.30 *+28−13*.
1015	76	1936.0	4^+	921.0	4^+	E2 matrix element of 0.03 *+5−9*.
1024		1398.0	4^+	374	2^+	E2 matrix element of −0.066+15-12.
1048[@]	15	3109?	(8^+)	2061.0	6^+	E2 matrix element of −0.5 *+12−2*.
(1076)	8.82	1890.0	2^+	814.0	2^+	E2 matrix element of 0.16 *+8−25*.
1096	100	1470.0	2^+	374	2^+	E2 matrix element of −0.064 *+8−7*.
(1122)	56	1936.0	4^+	814.0	2^+	E2 matrix element of 0.075 *+19−18*.
1127		4030.0	12^+	2903.0	10	
(1140)		2061.0	6^+	921.0	4^+	E2 matrix element of 0.03 *+23−20*.
1168		2089.0	(4^+)	921.0	4^+	E2 matrix element of −0.41 *+26−233*.
1201		2775.0	8^+	1574.0	6^+	
1215	90	1215.0	2^+	0.0	0^+	E2 matrix element of 0.069 *+2−4*.
1220	47	2141.0	(4^+)	921.0	4^+	E2 matrix element of 0.43 *+6−8*.
1247[@]		3543.0?	(10^+)	2296.0	8^+	E2 matrix element of 0.3 *+4−7*.
1275		2089.0	(4^+)	814.0	2^+	E2 matrix element of 0.47 *+8−5*.
(1327)		2141.0	(4^+)	814.0	2^+	E2 matrix element of 0.58 *+28−16*.
1344	26.4	1718.0	4^+	374	2^+	E2 matrix element of −0.079 *10*.
1377		2775.0	8^+	1398.0	4^+	
1414		2335.0	6^+	921.0	4^+	E2 matrix element of 0.26 *+8−6*.
(1470)	29.67	1470.0	2^+	0.0	0^+	E2 matrix element of −0.017 *+2−4*.
1516	100	1890.0	2^+	374	2^+	E2 matrix element of 0.20.
1535[@]		3109?	(8^+)	1574.0	6^+	E2 matrix element of 0.1 *+3−2*.
(1562)	76	1936.0	4^+	374	2^+	E2 matrix element of −0.038 *+8−9*.
1641 *16*		2015	3^-	374	2^+	E_γ: From 1969Ro05.
1715		2089.0	(4^+)	374	2^+	E2 matrix element of −0.23 *+5−11*.
1767	100	2141.0	(4^+)	374	2^+	E2 matrix element of 0.25 *+4−3*.
(1890)		1890.0	2^+	0.0	0^+	B(E2)=0.00084 *+19−25* from E2 matrix element of −0.065 *+11−7* if $\delta(477\gamma)$=11, B(E2)=0.0020 *+8−2* from E2 matrix element of −0.100 *+4−19* if $\delta(477\gamma)$=−1.3.

[†] Calculated by the evaluators based on the level energies given by 1989SvZZ, unless otherwise stated.
[‡] From the branching ratios given in 1989SvZZ.
[#] From adopted gammas.
[@] Placement of transition in the level scheme is uncertain.

Coulomb excitation 1989SvZZ

Level Scheme

Intensities: Relative I_γ

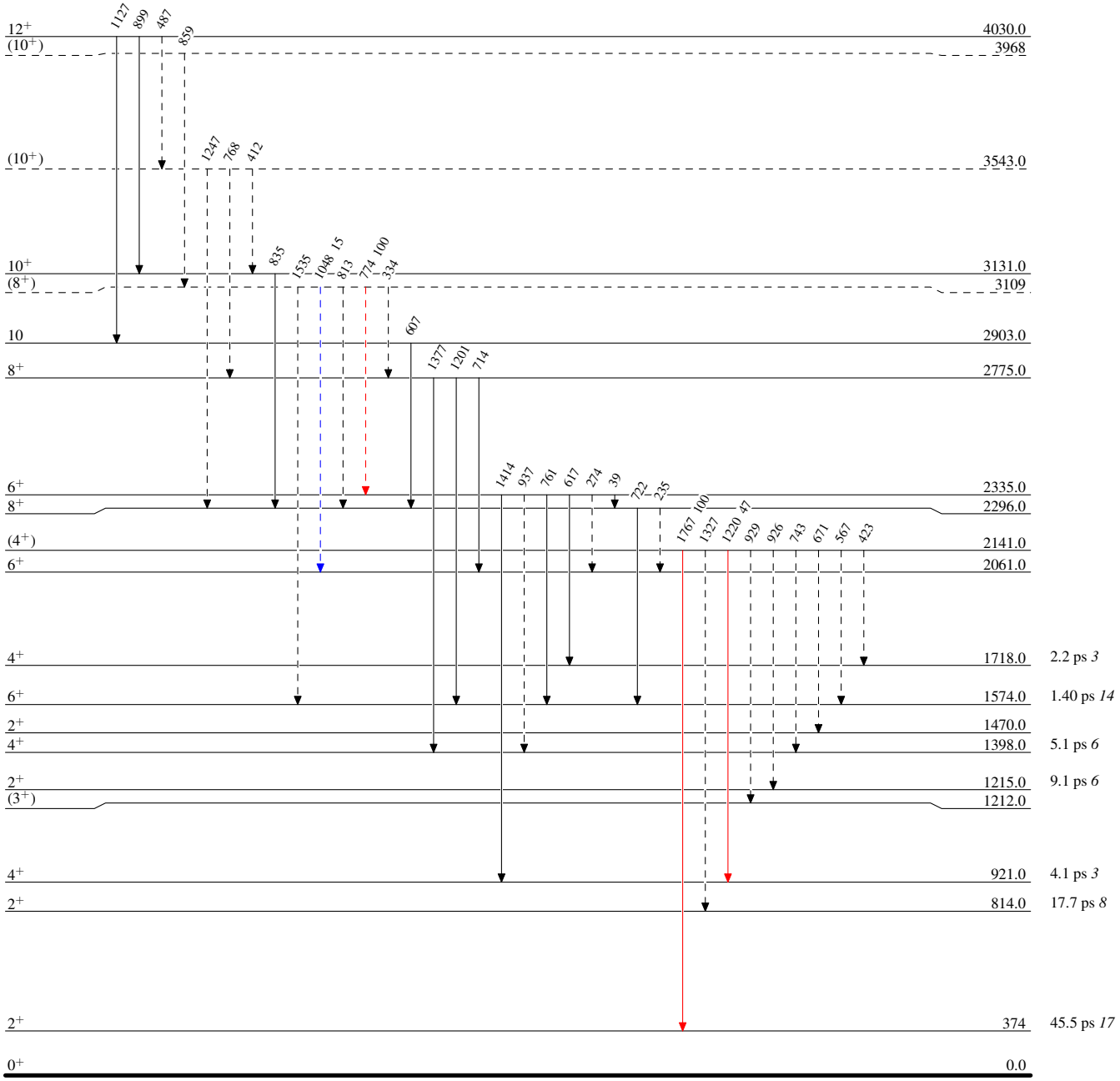
Legend

$I_\gamma < 2\% \times I_\gamma^{max}$

$I_\gamma < 10\% \times I_\gamma^{max}$

$I_\gamma > 10\% \times I_\gamma^{max}$

γ Decay (Uncertain)



$^{110}_{46}Pd_{64}$

Coulomb excitation 1989SvZZ

Level Scheme (continued)

Intensities: Relative I_γ

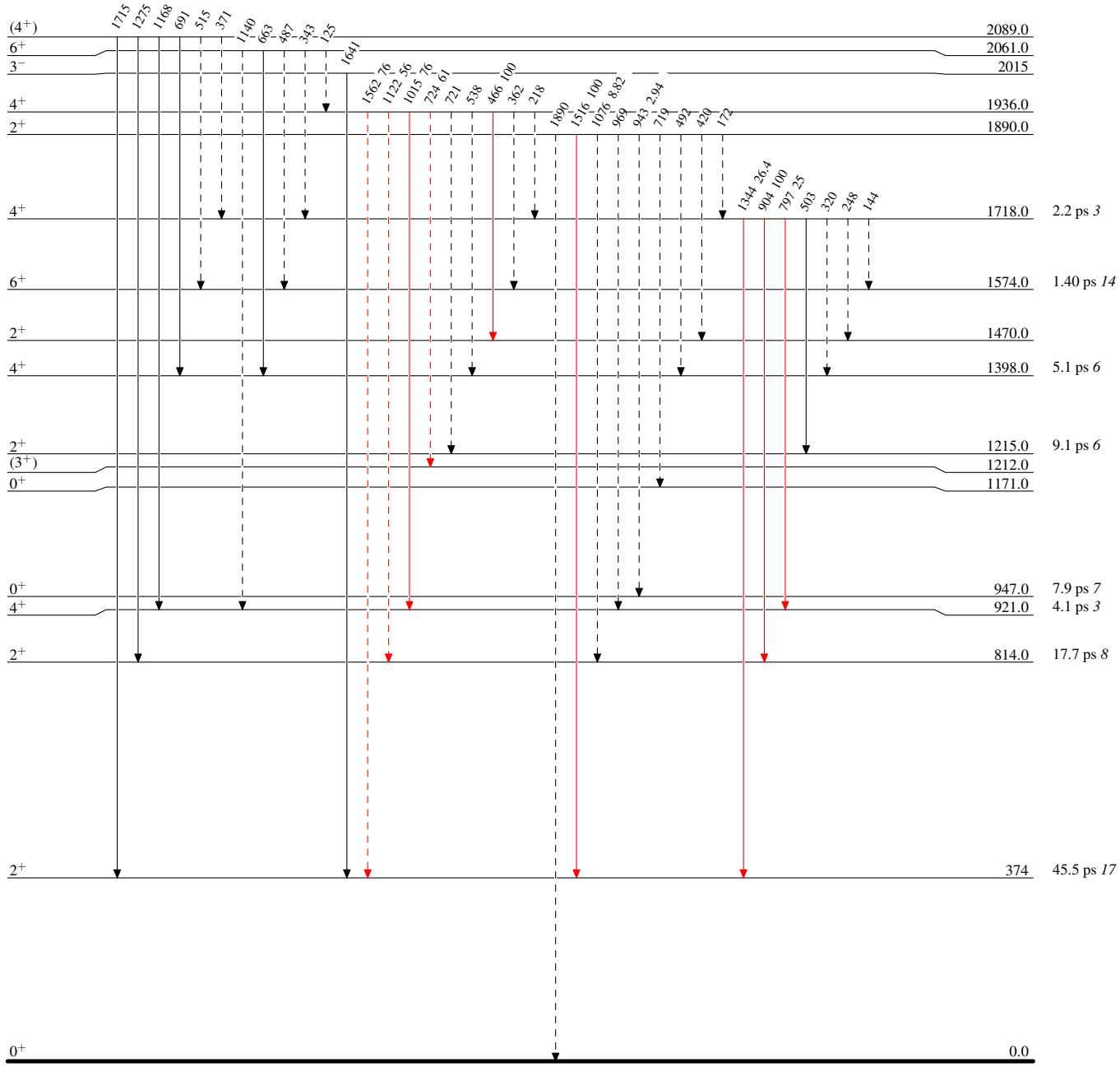
Legend

$I_\gamma < 2\% \times I_\gamma^{max}$

$I_\gamma < 10\% \times I_\gamma^{max}$

$I_\gamma > 10\% \times I_\gamma^{max}$

γ Decay (Uncertain)



$^{110}_{46}Pd_{64}$

Coulomb excitation 1989SvZZ

Level Scheme (continued)

Intensities: Relative I_γ

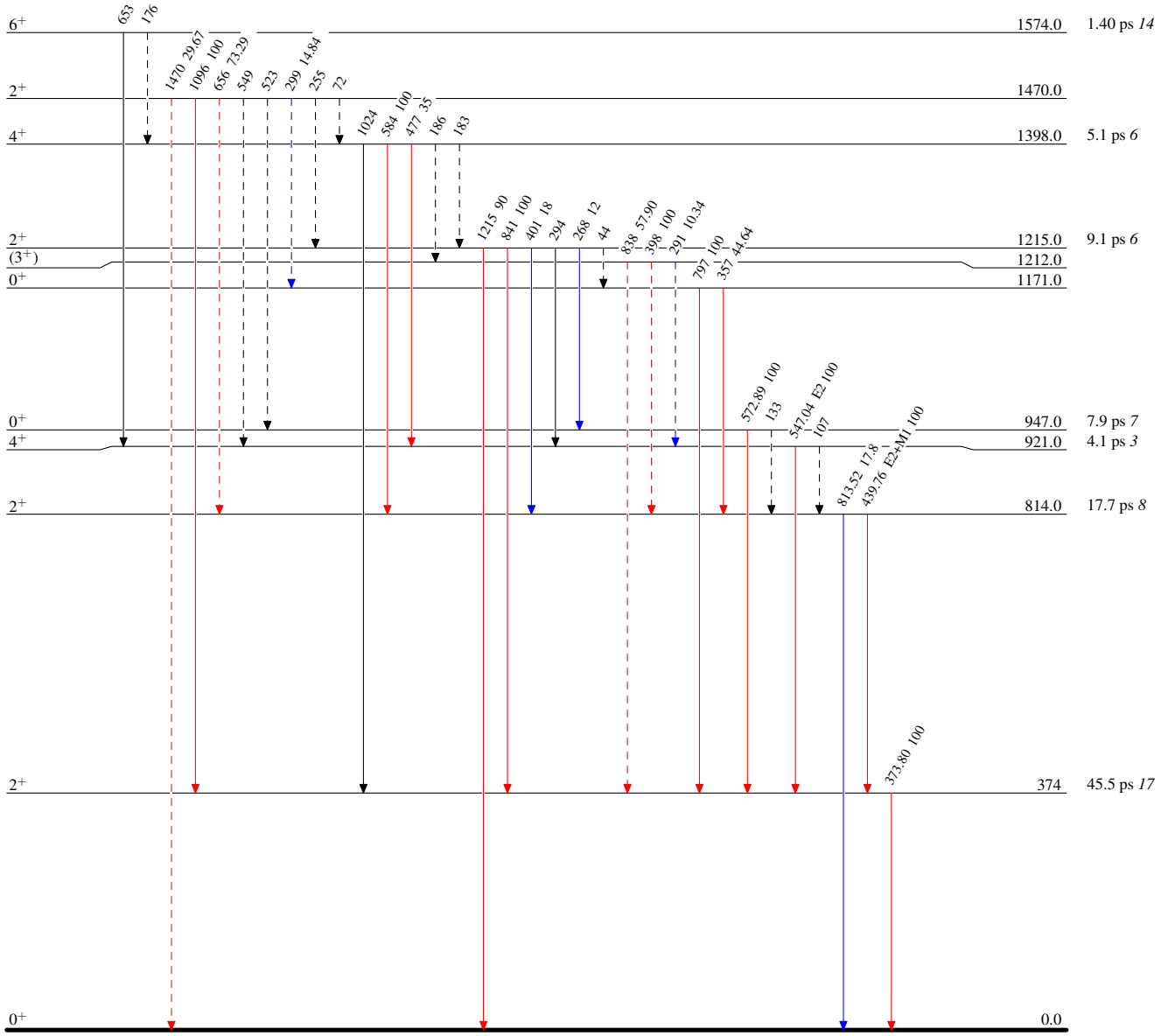
Legend

$I_\gamma < 2\% \times I_\gamma^{max}$

$I_\gamma < 10\% \times I_\gamma^{max}$

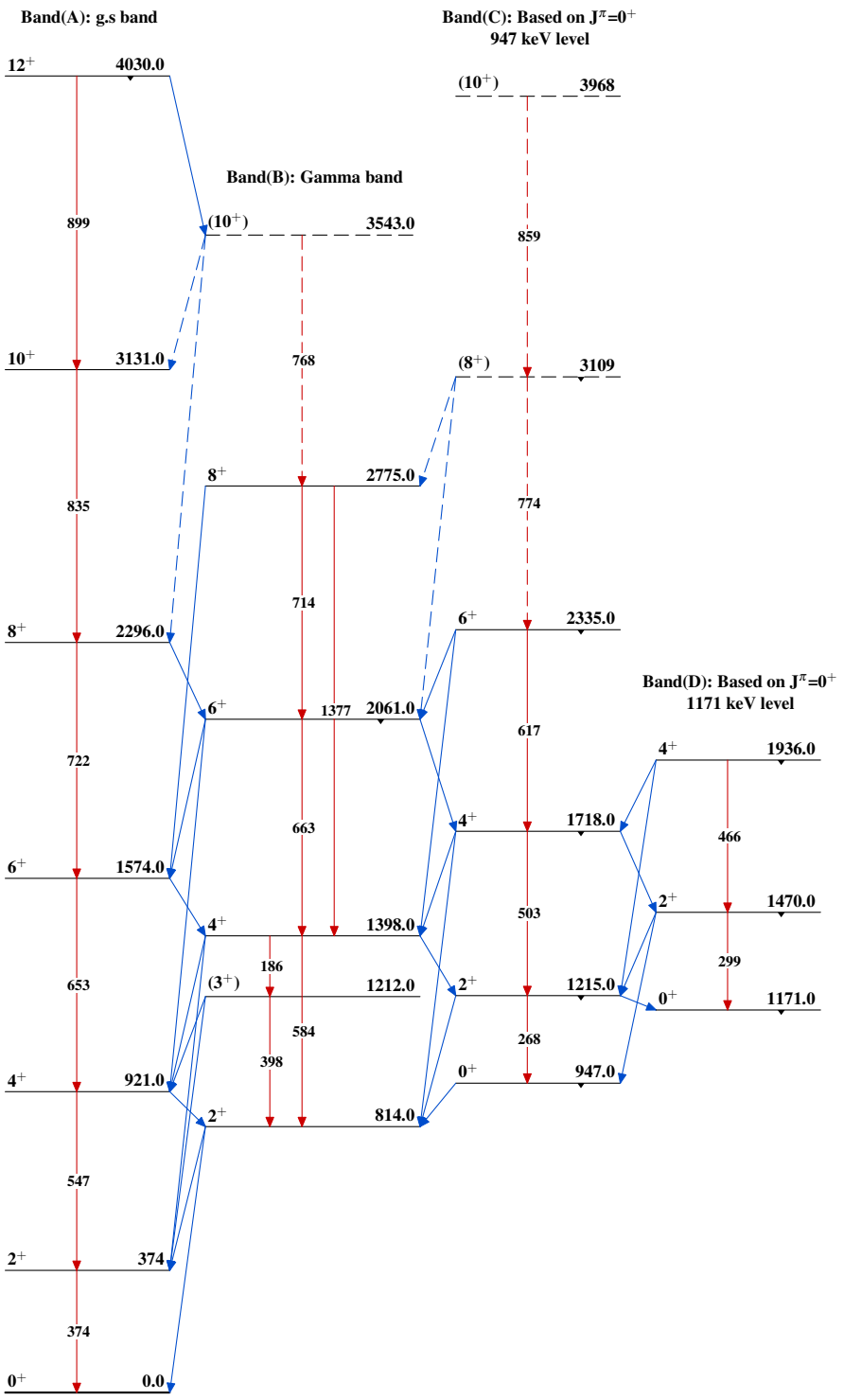
$I_\gamma > 10\% \times I_\gamma^{max}$

γ Decay (Uncertain)



$^{110}_{46}Pd_{64}$

Coulomb excitation 1989SvZZ



$^{110}_{46}Pd_{64}$