Adopted Levels, Gammas

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh and Jun Chen	NDS 116, 1 (2014)	31-Dec-2013

Q(β^-)=−6894 *8*; S(n)=9825 *8*; S(p)=6570 *8*; Q(α)=−4071 *7* 2012Wa38
Q(εp)=187 *7*, S(2n)=23406 *9*, S(2p)=10954 *9* (2012Wa38).
^{85}Zr produced and identified (1963Bu06) in bombardment of Y and Sr by 230 MeV protons and measuring half-life by β and γ activity. Later decay studies: 1971Yu02, 1971Do01, 1972Tu07, 1976Ia01, 1977Ia01, 1982De36, 1992Bu10, 2005Ka39.
Additional information 1.
Many additional high-spin levels and gamma rays are proposed in ^{60}Ni(^{28}Si,2pnγ) reaction (2003WeZY). Due to the tentative nature of the results reported in this secondary reference, these levels and gamma rays are not adopted here. See ^{60}Ni(^{28}Si,2pnγ) dataset for this information.
Mass measurements: 2006Ka48, 2012Ka13 (Penning-trap method).

^{85}Zr Levels

Cross Reference (XREF) Flags

A	^{85}Zr IT decay (10.9 s)	D	^{56}Fe(^{35}Cl,apng)
B	^{85}Nb ε decay (20.5 s)	E	^{58}Ni(^{31}P,3pnγ),^{56}Fe(^{32}S,2pnγ)
C	^{85}Nb ε decay (3.3 s):?	F	^{60}Ni(^{28}Si,2pnγ)

E(level)[†]	J$^\pi$[‡]	T$_{1/2}$[a]	XREF	Comments
0.0	(7/2$^+$)	7.86 min *4*	ABCDEF	%ε+%β^+=100 J$^\pi$: possible allowed β feeding to (5/2$^+$) and (7/2)$^+$; 292γ from (1/2$^-$), 10.9-s isomer is most likely of multipolarity higher than quadrupole. T$_{1/2}$: from weighted average of 7.85 min *4* (1972Tu07, β counting) and 7.90 min *10* (1977Ia01). Others: 8.4 min *3* (1982De36), 7.92 min *15* (1976Ia01, same group as 1977Ia01), 6.0 min *10* (1971Yu02), 8.0 min *5* (1971AwZZ), 7.7 min *5* (1971Do01), 6 min (1963Bu06); inclusion of these other values in the averaging procedure does not change the adopted value.
50.12[b] *4*	(9/2$^+$)		BCDEF	J$^\pi$: M1+E2 γ to (7/2$^+$); β feeding from (9/2$^+$) state in ^{85}Nb.
292.2 *3*	(1/2$^-$)	10.9 s *3*	A C	%ε+%β^+>0; %IT<100 XREF: C(?). Both ε and IT decay modes have been observed but branching ratio is unknown. From relative photon intensities of 416.5γ in ^{85}Y from ε decay and 292.2γ in ^{85}Zr from IT decay, it seems IT decay mode is dominant. J$^\pi$: from analogy with other N=45 nuclei. T$_{1/2}$: from timing of 292γ; weighted average of 10.9 s *3* (1976Ia01) and 12 s *2* (2005Ka39).
790.1?[@] *9*	(9/2$^-$)		F	
854.0[&] *15*	(11/2$^+$)		DEF	
872.0[b] *15*	(13/2$^+$)		DEF	
1043.0?[@] *8*	(13/2$^+$)		F	
1176.2?[@] *8*	(11/2$^+$)		F	
1328.3?[@] *10*	(11/2$^-$)		F	
1394.2?[@] *8*			F	
1494.0 *11*	(13/2$^+$)		D F	
1758.5 *10*	(15/2$^+$)		D F	
1884.0[b] *18*	(17/2$^+$)		DEF	
1941.0[&] *18*	(15/2$^+$)		DEF	
2078.2 *9*	(15/2$^+$)		D F	
2555.9 *11*	(15/2$^-$)		D F	

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Adopted Levels, Gammas (continued)

^{85}Zr Levels (continued)

E(level)†	Jπ‡	$T_{1/2}$[a]	XREF	Comments
2625.0[d] *20*	(17/2⁻)		DEF	μ=11.1 *34* (2007Yu03,2011StZZ) μ: transient magnetic field IMPAD method.
2724.6 *10*	(17/2⁻)		D F	
2958.0[d] *23*	(19/2⁻)		DEF	μ=10.5 *29* (2007Yu03,2011StZZ) μ: transient magnetic field IMPAD method.
3018.0[b] *20*	(21/2⁺)	0.201 ps *+21−28*	DEF	Q(transition)=2.61 *+15−19* from lifetime (2002Ta11).
3073.0[#] *20*	(21/2⁺)		DEF	
3387.0[d] *24*	(21/2⁻)		DEF	μ=8.9 *26* (2007Yu03,2011StZZ) μ: transient magnetic field IMPAD method.
3456.5?[@] *12*	(21/2⁻)		F	
3516.0[#] *20*	(23/2⁺)		DEF	
3522.3?[@] *13*	(21/2⁻)		F	
3838.0[d] *24*	(23/2⁻)		DEF	μ=4.9 *31* (2007Yu03,2011StZZ) μ: transient magnetic field IMPAD method.
3958.0[b] *21*	(25/2⁺)	0.80 ps *+26−28*	DEF	Q(transition)=2.01 *+32−35* from lifetime (2002Ta11).
3992.7?[@] *13*	(23/2⁻)		F	
4204.8?[@] *14*	(25/2⁺)		F	
4374.0[d] *25*	(25/2⁻)		DEF	
4589.0[#] *21*	(27/2⁺)		DEF	
4887.0[d] *25*	(27/2⁻)		DEF	
4983.2?[@] *16*	(29/2⁻)		F	
4996.0[b] *22*	(29/2⁺)	0.291 ps *28*	DEF	Q(transition)=2.51 *13* from lifetime (2002Ta11).
5023.2?[@] *15*	(27/2⁻)		F	
5530.0?[@] *18*	(29/2⁻)		F	
5602[d] *3*	(29/2⁻)		E	
6003.2?[@] *18*	(33/2⁺)		F	
6076[d] *3*	(31/2⁻)		E	
6239.0[b] *24*	(33/2⁺)		DEF	
7482[#c] *3*	(37/2⁺)		EF	
7527[d] *3*	(35/2⁻)		E	
7720[b] *3*	(37/2⁺)		E	
8918[#c] *3*	(41/2⁺)		EF	
9232[d] *3*	(39/2⁻)		E	
9332[b] *3*	(41/2⁺)		E	
10828[#c] *3*	(45/2⁺)		E	
11141[b] *3*	(45/2⁺)		EF	

† From least-squares fit to Eγ data.
‡ From γγ(DCO) and γ(θ) data and band structures in high-spin datasets, unless otherwise noted.
# Level related to band 1, fork-type structure.
@ Level only from ^{60}Ni(^{28}Si,2pnγ), treated by the evaluators as tentative.
& Possible member of signature partner of band based on (9/2⁺).
a Above 292.2 level, values are from line-shape analysis in ^{58}Ni(^{31}P,3pnγ),^{56}Fe(^{32}S,2pnγ) (2002Ta11).
b Band(A): Band based on (9/2⁺). Band crossing at ħω=0.52 MeV due to alignment of a pair of $g_{9/2}$ protons. Second alignment at ħω=0.63 MeV due to crossing by a pair of neutrons. Fork-type structure above (19/2⁺) gives rise to doubling of levels at

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Adopted Levels, Gammas (continued)

^{85}Zr Levels (continued)

$(21/2^+)$, $(23/2^+)$, $(27/2^+)$, $(37/2^+)$, $(41/2^+)$ and $(45/2^+)$.

[c] Band(B): Band based on $(37/2^+)$. Levels related to band based on $(9/2^+)$, fork-type structure.

[d] Band(C): Band based on $(17/2^-)$. Interpreted as magnetic-dipole rotational band in 2007Yu03, based on their g factor measurements. 2002Ta11 and 1995Ju04 interpreted this band as strongly-coupled band.

$\gamma(^{85}Zr)$

E_i(level)	J_i^π	E_γ	I_γ [†]	E_f	J_f^π	Mult.	δ	α [#]	Comments
50.12	$(9/2^+)$	50.12 *4*	100	0.0	$(7/2^+)$	M1+E2	0.24 *6*	2.1 *4*	α(K)=1.72 *24*; α(L)=0.32 *9*; α(M)=0.055 *16*; α(N)=0.0073 *19*; α(O)=0.00031 *4* Mult.,δ: from α(K)exp in ^{85}Nb ε decay (20.5 s); Measured K/L=9.0 *18* (2005Ka39) gives δ(E2/M1)<0.12.
292.2	$(1/2^-)$	292.2 *3*	100	0.0	$(7/2^+)$	[E3]		0.0956	α(K)= 0.0801 *12*; α(L)=0.01289 *19*; α(M)=0.00227 *4*; α(N)=0.000303 *5*; α(O)=1.424×10^{-5} *21* B(E3)(W.u.)<0.0013
790.1?	$(9/2^-)$	790[‡@]		0.0	$(7/2^+)$				
854.0	$(11/2^+)$	804 *1*	100	50.12	$(9/2^+)$				
872.0	$(13/2^+)$	822 *1*	100	50.12	$(9/2^+)$				
1043.0?	$(13/2^+)$	993[‡@]		50.12	$(9/2^+)$				
1176.2?	$(11/2^+)$	1177[‡@]		0.0	$(7/2^+)$				
1328.3?	$(11/2^-)$	538[‡@]		790.1?	$(9/2^-)$				
1394.2?		1394[‡@]		0.0	$(7/2^+)$				
1494.0	$(13/2^+)$	640		854.0	$(11/2^+)$				
1758.5	$(15/2^+)$	716[‡@]		1043.0?	$(13/2^+)$				
		886		872.0	$(13/2^+)$				
1884.0	$(17/2^+)$	126		1758.5	$(15/2^+)$				
		1012 *1*	100.0 *6*	872.0	$(13/2^+)$				
1941.0	$(15/2^+)$	447		1494.0	$(13/2^+)$				
		766[‡@]		1176.2?	$(11/2^+)$				
		1069		872.0	$(13/2^+)$				
		1087 *1*	100.0 *22*	854.0	$(11/2^+)$				
2078.2	$(15/2^+)$	684[‡@]		1394.2?					
		750[‡@]		1328.3?	$(11/2^-)$				
		1206		872.0	$(13/2^+)$				
		1224		854.0	$(11/2^+)$				
2555.9	$(15/2^-)$	1684		872.0	$(13/2^+)$				
2625.0	$(17/2^-)$	547		2078.2	$(15/2^+)$				
		684 *1*	100.0 *23*	1941.0	$(15/2^+)$				
		741		1884.0	$(17/2^+)$				
		866		1758.5	$(15/2^+)$				
2724.6	$(17/2^-)$	100		2625.0	$(17/2^-)$				
		169		2555.9	$(15/2^-)$				
		646		2078.2	$(15/2^+)$				
		784		1941.0	$(15/2^+)$				
		840		1884.0	$(17/2^+)$				
		966[‡@]		1758.5	$(15/2^+)$				
2958.0	$(19/2^-)$	234		2724.6	$(17/2^-)$				
		333 *1*	100.0 *12*	2625.0	$(17/2^-)$				

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Adopted Levels, Gammas (continued)

γ(^{85}Zr) (continued)

E_i(level)	J_i^π	E_γ	I_γ [†]	E_f	J_f^π	Mult.	Comments
2958.0	(19/2$^-$)	1074[‡@]		1884.0	(17/2$^+$)		
3018.0	(21/2$^+$)	1134 *1*	100	1884.0	(17/2$^+$)	[E2]	B(E2)(W.u.)=67 *+11−7*
3073.0	(21/2$^+$)	1189 *1*	100	1884.0	(17/2$^+$)		
3387.0	(21/2$^-$)	429 *1*	100	2958.0	(19/2$^-$)		
		831[‡@]		2555.9	(15/2$^-$)		
3456.5?	(21/2$^-$)	498[‡@]		2958.0	(19/2$^-$)		
3516.0	(23/2$^+$)	443 *1*	100.0 *15*	3073.0	(21/2$^+$)		
		498 *1*	41.1 *10*	3018.0	(21/2$^+$)		
3522.3?	(21/2$^-$)	449[‡@]		3073.0	(21/2$^+$)		
3838.0	(23/2$^-$)	382[‡@]		3456.5?	(21/2$^-$)		
		451 *1*	100.0 *11*	3387.0	(21/2$^-$)		
		880 *1*	27.2 *11*	2958.0	(19/2$^-$)		
3958.0	(25/2$^+$)	437[‡@]		3522.3?	(21/2$^-$)		
		442 *1*	100.0 *16*	3516.0	(23/2$^+$)		
		940 *1*	78.3 *16*	3018.0	(21/2$^+$)	[E2]	B(E2)(W.u.)=19 *+10−5*
3992.7?	(23/2$^-$)	606[‡@]		3387.0	(21/2$^-$)		
4204.8?	(25/2$^+$)	688[‡@]		3516.0	(23/2$^+$)		
4374.0	(25/2$^-$)	382[‡@]		3992.7?	(23/2$^-$)		
		536 *1*	100.0 *22*	3838.0	(23/2$^-$)		
		987 *1*	57.1 *22*	3387.0	(21/2$^-$)		
4589.0	(27/2$^+$)	631 *1*	100.0 *18*	3958.0	(25/2$^+$)		
		1073 *1*	63.3 *18*	3516.0	(23/2$^+$)		
4887.0	(27/2$^-$)	513 *1*	100.0 *14*	4374.0	(25/2$^-$)		
		1049 *1*	54.8 *14*	3838.0	(23/2$^-$)		
4983.2?	(29/2$^-$)	1024[‡@]		3958.0	(25/2$^+$)		
4996.0	(29/2$^+$)	407 *1*	82.0 *16*	4589.0	(27/2$^+$)		
		1038 *1*	100.0 *16*	3958.0	(25/2$^+$)	[E2]	B(E2)(W.u.)=40 *4*
5023.2?	(27/2$^-$)	649[‡@]		4374.0	(25/2$^-$)		
5530.0?	(29/2$^-$)	643[‡@]		4887.0	(27/2$^-$)		
5602	(29/2$^-$)	715 *1*	74 *5*	4887.0	(27/2$^-$)		
		1228 *1*	100 *8*	4374.0	(25/2$^-$)		
6003.2?	(33/2$^+$)	1006[‡@]		4996.0	(29/2$^+$)		
6076	(31/2$^-$)	474 *1*	23.5 *20*	5602	(29/2$^-$)		
		1189 *1*	100.0 *20*	4887.0	(27/2$^-$)		
6239.0	(33/2$^+$)	1243 *1*	100	4996.0	(29/2$^+$)		
7482	(37/2$^+$)	1243 *1*	100	6239.0	(33/2$^+$)		
7527	(35/2$^-$)	1451 *1*	100	6076	(31/2$^-$)		
7720	(37/2$^+$)	1481 *1*	100	6239.0	(33/2$^+$)		
8918	(41/2$^+$)	1436 *1*	100	7482	(37/2$^+$)		
9232	(39/2$^-$)	1705 *1*	100	7527	(35/2$^-$)		
9332	(41/2$^+$)	1612 *1*	100	7720	(37/2$^+$)		
10828	(45/2$^+$)	1910 *1*	100	8918	(41/2$^+$)		
11141	(45/2$^+$)	1809 *1*	100	9332	(41/2$^+$)		

[†] Available only from ^{58}Ni(^{31}P,3pnγ),^{56}Fe(^{32}S,2pnγ).
[‡] Gamma only from ^{60}Ni(^{28}Si,2pnγ), treated by the evaluators as tentative.
[#] 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.

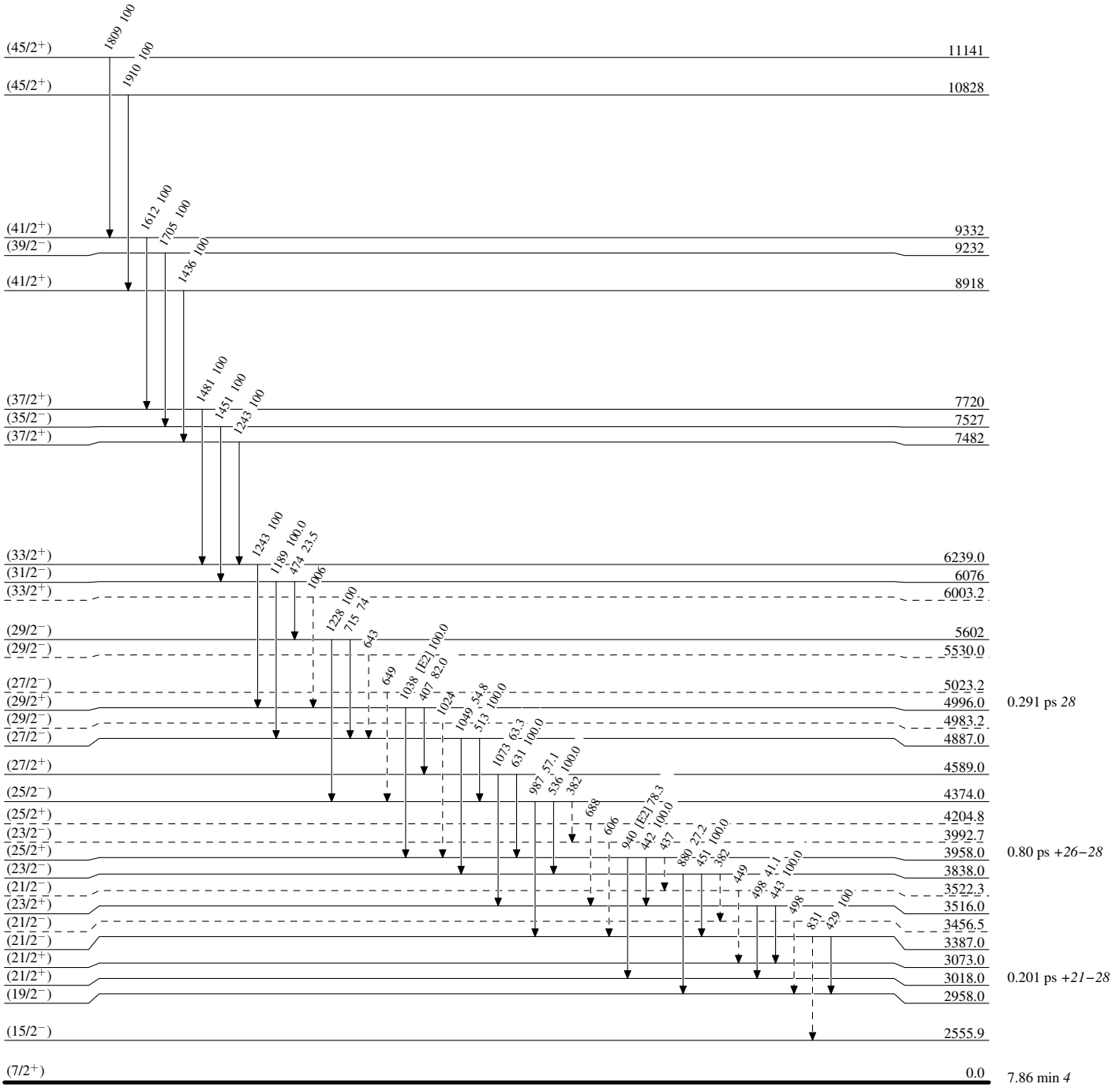
Adopted Levels, Gammas

Legend

Level Scheme

Intensities: Relative photon branching from each level

γ Decay (Uncertain)



$^{85}_{40}Zr_{45}$

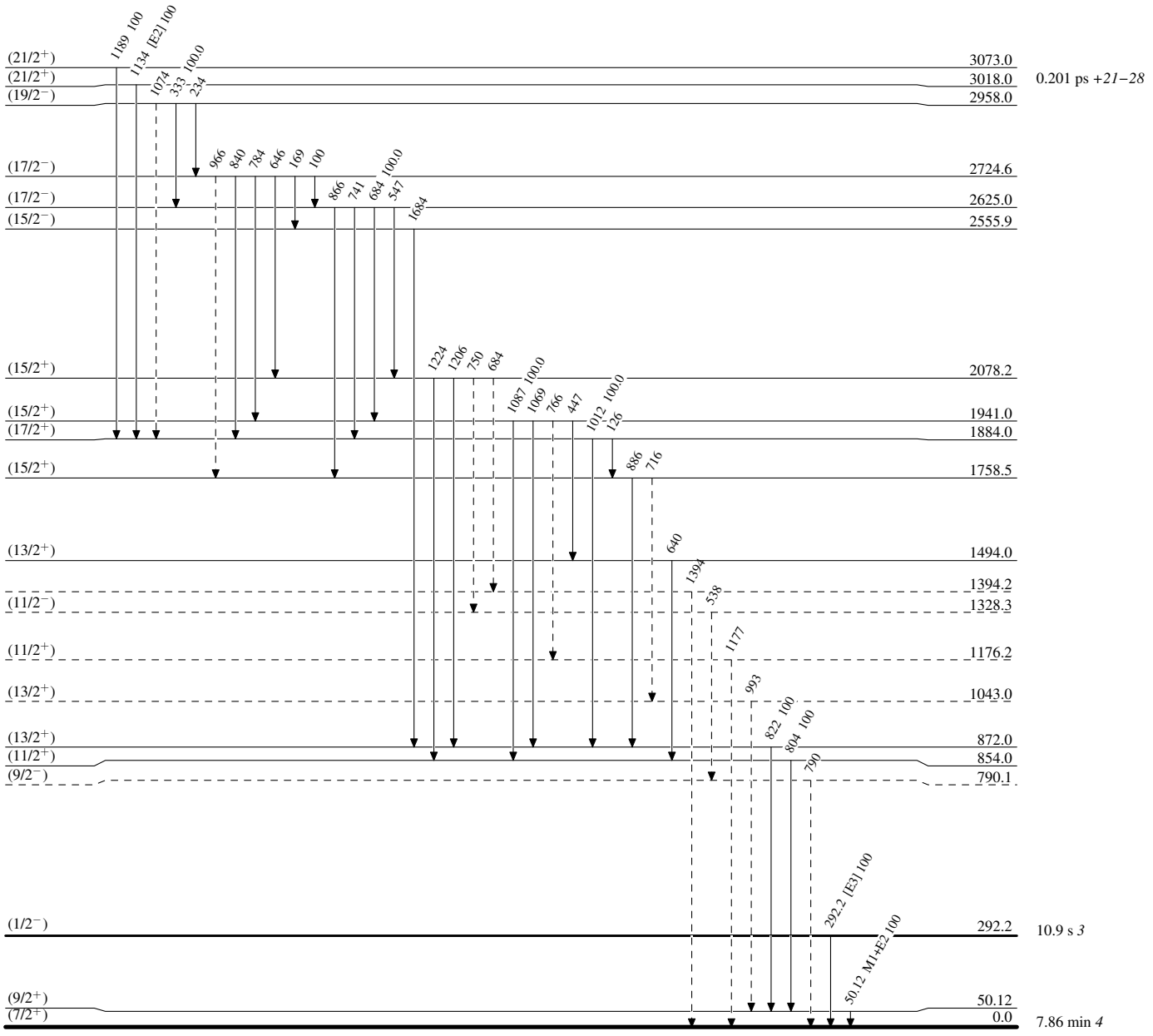
Adopted Levels, Gammas

Legend

Level Scheme (continued)

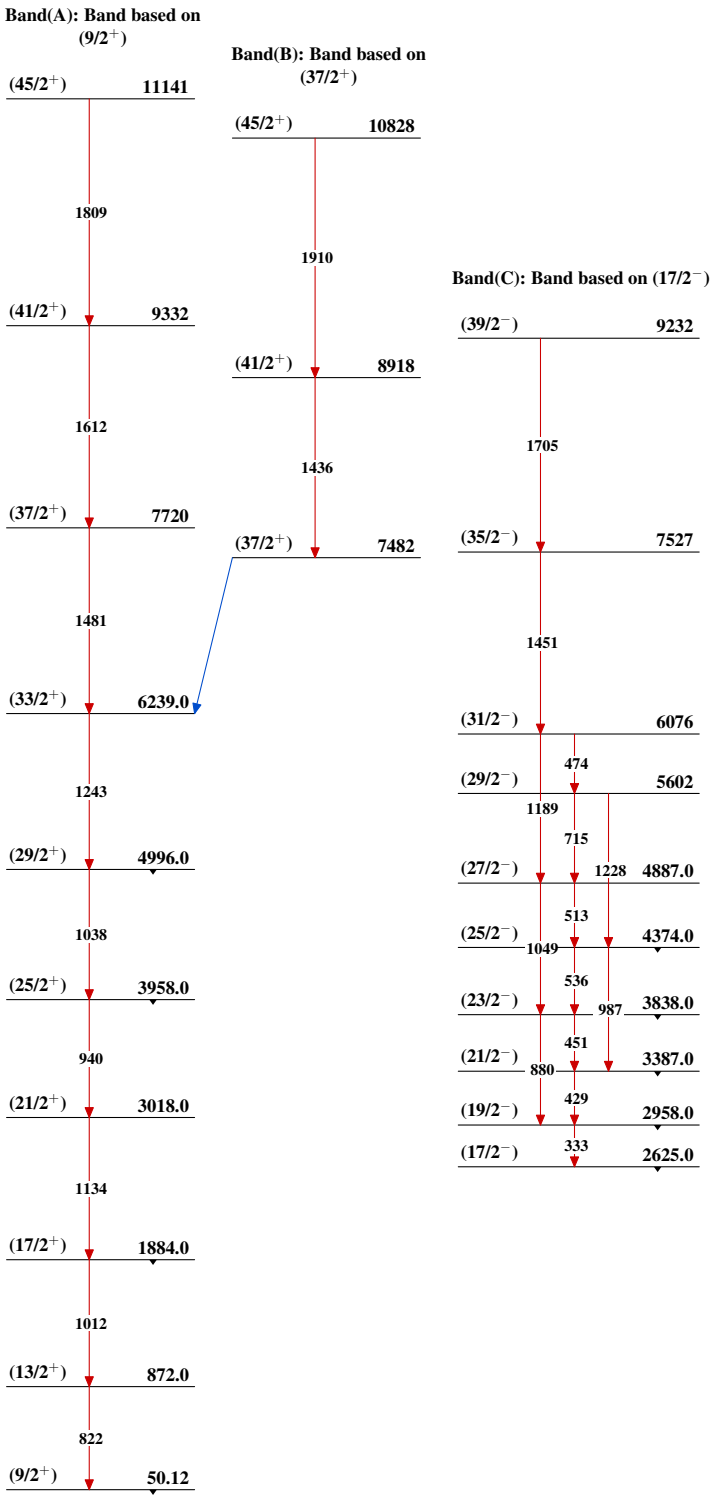
Intensities: Relative photon branching from each level

γ Decay (Uncertain)



$^{85}_{40}Zr_{45}$

Adopted Levels, Gammas



$^{85}_{40}Zr_{45}$