^{160}Gd(^{34}S,4nγ):SD 1996Wi08,1995Cr02,2010Wi02

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh, [1] and Jun Chen[2]	NDS 169, 1 (2020)	15-Oct-2020

1996Wi08, 1995Cr02: E=158 MeV. Measured Eγ, Iγ, $\gamma\gamma\gamma$ coin, $\gamma\gamma(\theta)$(DCO), SD bands using EUROGAM array.
1994Cr08: E=163 MeV. Deduced SD bands using GAMMASPHERE array.
2010Wi02: E=156 MeV. Measured Eγ, Iγ, $\gamma\gamma$ using EUROBALL IV array. Deduced γ transitions linking the SD band to normal-deformed structures. Discussed 2-proton separation energies in SD state.
1991Dr04: E=159, 162 MeV. Measured γ, $\gamma\gamma$, $\gamma\gamma(\theta)$, DSA for γ rays assigned to a superdeformed band. Two additional γ rays reported by 1992BeZL (same group as 1991Dr04) at the top of the band. See also 1993Ca23.
2001Ko16 (also 2001Ha15,2000Ha63): E=156 MeV. Measured $\gamma(\theta)$, γ(lin pol) for transitions in SD-1 and SD-2 bands using four-element CLOVER detectors of EUROBALL IV array.
2000Zw03: ^{164}Dy(^{34}Si,4nγ) E=147 MeV. SD-1 reported.
1997Am06: E=159 MeV. Measured lifetimes by DSA method and centroid- shift analysis using Gammasphere array of 87 Compton-suppressed Ge detectors.
Additional information 1.

^{190}Hg Levels

E(level)[†]	J$^\pi$[‡]	T$_{1/2}$	Comments
0.0	0$^+$		
416.4 *2*	2$^+$		
1041.8 *3*	4$^+$		
1772.9 *4*	6$^+$		
1881.4 *2*	5$^-$		
2078.3 *4*	7$^-$		
2335.4 *5*	(9$^-$)		
2464.9 *4*	(8)$^+$		
2596.8 *5*	(10$^+$)		
2620.6 *7*	(12$^+$)	23 ns *1*	T$_{1/2}$: from the Adopted Levels.
2865.6 *6*	(11$^-$)		
3040.5 *8*	(14$^+$)		
3548.8 *6*	(13$^-$)		
5440.0[#] *14*	(12$^+$)		J$^\pi$: the spin of the lowest known SD band level may be 12 or 13, assuming that the linking transitions carry no more than 2 units of angular momentum, the former is preferred since it is consistent with the feeding of normal-deformed levels. Also the band may be considered as a quasivacuum band in an even-even nucleus, which makes odd spins for inband levels unlikely.
5756.9[#] *13*	(14$^+$)		
6116.9[#] *17*	(16$^+$)		
6519.2[#] *17*	(18$^+$)		
6962.2[#] *17*	(20$^+$)		
7444.9[#] *17*	(22$^+$)		
7966.2[#] *17*	(24$^+$)		
8395.8[@] *17*	(23$^-$)		
8524.8[#] *17*	(26$^+$)		
8877.1[@] *17*	(25$^-$)	76 fs *14*	T$_{1/2}$: from 911γ (1997Am06).
9119.7[#] *17*	(28$^+$)		
9388.5[@] *17*	(27$^-$)	69 fs *14*	T$_{1/2}$: from 864γ (1997Am06).
9749.8[#] *17*	(30$^+$)		
9931.7[@] *17*	(29$^-$)	90 fs *21*	T$_{1/2}$: from 812γ (1997Am06).
10413.9[#] *17*	(32$^+$)		

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^{160}Gd(^{34}S,4nγ):SD 1996Wi08,1995Cr02,2010Wi02 (continued)

^{190}Hg Levels (continued)

E(level)[†]	J$^{\pi}$[‡]	$T_{1/2}$	Comments
10507.2[@] *17*	(31$^-$)	76 fs *14*	$T_{1/2}$: from 757γ (1997Am06).
11110.8[#] *17*	(34$^+$)		
11115.3[@] *18*	(33$^-$)		
11756.9[@] *18*	(35$^-$)		
11839.3[#] *17*	(36$^+$)		
12431.4[@] *19*	(37$^-$)		
12596.7[#] *18*	(38$^+$)		
13138.5[@] *20*	(39$^-$)		
13380.2[#] *19*	(40$^+$)		
14182.0?[#] *21*	(42$^+$)		
y[&]	J2≈(14)		
279.0+y?[&] *10*	J2+2		
597.0+y[&] *11*	J2+4		
955.3+y[&] *12*	J2+6		
1352.7+y[&] *12*	J2+8		
1788.6+y[&] *13*	J2+10		
2262.6+y[&] *14*	J2+12		
2773.2+y[&] *14*	J2+14		
3320.9+y[&] *17*	J2+16		
3903.8+y[&] *18*	J2+18		
4521.7+y[&] *19*	J2+20		
5173.2+y[&] *21*	J2+22		
z[a]	J3		
446.3+z[a] *4*	J3+2		
912.8+z[a] *6*	J3+4		
1399.5+z[a] *7*	J3+6		
1914.5+z[a] *8*	J3+8		
2462.2+z[a] *9*	J3+10		
3044.9+z[a] *11*	J3+12		
3662.6+z[a] *11*	J3+14		
4316.2+z[a] *12*	J3+16		
5005.8+z[a] *14*	J3+18		
5729.1+z[a] *15*	J3+20		
6489.5+z[a] *16*	J3+22		
7280.5+z?[a]	J3+24		

[†] From least-squares fit to Eγ data.

[‡] From the Adopted Levels up to 5 MeV. For SD-1 and SD-2 bands, assignments are implied by connection to the normal-deformed bands, and from least-squares fit of Eγ data in SD-1 band to empirical expansion related to rotational model (1991Dr04).

[#] Band(A): SD-1 band. Band assignment from 1991Dr04, 1995Cr02, 1996Wi08, 2000Zw03. Q(Intrinsic)=17.7 *+10−12* (1997Am06), 18 *3* (1991Dr04). The systematic error in 1997Am06 could be as large as 10-15%. Percent population ≈0.8 (1991Dr04). See also 1992BeZL.

[@] Band(B): SD-2 band. Band assignment from 1995Cr02 and 1996Wi08. Q(Intrinsic)=17.6 *15* (1997Am06). The systematic error in this value could be as large as 10-15%. Population intensity=20% of SD-1 band (1994Cr08). See also 1992BeZL. Possible

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^{160}Gd(^{34}S,4nγ):SD 1996Wi08,1995Cr02,2010Wi02 (continued)

^{190}Hg Levels (continued)

mult=E1 for interband transitions suggests opposite parity for two bands. 1995Cr02 suggest positive parity for the yrast band and negative parity for the excited band. Deduced E1 strengths are interpreted (by 1996Wi08) as a support for octupole vibrational character of this band.

[&] Band(C): SD-3 band. Band assignment from 1996Wi08.

[a] Band(D): SD-4 band. Band assignment from 1996Wi08.

γ(^{190}Hg)

E_γ [†]	I_γ [@]	E_i(level)	J_i^π	E_f	J_f^π	Mult.	α [a]	Comments
23.9[‡] *5*		2620.6	(12$^+$)	2596.8	(10$^+$)			
131.9[‡] *3*		2596.8	(10$^+$)	2464.9	(8)$^+$			
196.9[‡] *2*		2078.3	7$^-$	1881.4	5$^-$			
257.1[‡] *2*		2335.4	(9$^-$)	2078.3	7$^-$			
279[b]	≤0.01	279.0+y?	J2+2	y	J2≈(14)			
305.4[‡] *2*		2078.3	7$^-$	1772.9	6$^+$			
316.9 *4*	0.059 *11*	5756.9	(14$^+$)	5440.0	(12$^+$)	(E2)	0.0906	DCO=1.24 *26* (1991Dr04)
318.0 *3*	0.022 *12*	597.0+y	J2+4	279.0+y?	J2+2			
358.3 *4*	0.030 *13*	955.3+y	J2+6	597.0+y	J2+4			
360 *1*	0.64 *3*	6116.9	(16$^+$)	5756.9	(14$^+$)	(E2)	0.0631 *10*	DCO=1.34 *19* (1991Dr04) E_γ: 360.0 *2* (1991Dr04). 1995Cr02 point out that it is an unresolved peak.
397.4 *4*	0.039 *10*	1352.7+y	J2+8	955.3+y	J2+6			
402.34 *4*	1.00 *17*	6519.2	(18$^+$)	6116.9	(16$^+$)	(E2)	0.0467	DCO=1.36 *23* (1991Dr04)
416.4[‡] *2*		416.4	2$^+$	0.0	0$^+$			
419.9[‡] *2*		3040.5	(14$^+$)	2620.6	(12$^+$)			
435.9 *4*	0.041 *10*	1788.6+y	J2+10	1352.7+y	J2+8			
442.98 *6*	1.00 *8*	6962.2	(20$^+$)	6519.2	(18$^+$)	E2[&]	0.0364	DCO=1.39 *26* (1991Dr04)
446.3 *4*	0.09 *2*	446.3+z	J3+2	z	J3			
466.5 *4*	0.14 *4*	912.8+z	J3+4	446.3+z	J3+2			
474.0 *5*	0.041 *11*	2262.6+y	J2+12	1788.6+y	J2+10			
481.1 *6*	0.031 *10*	8877.1	(25$^-$)	8395.8	(23$^-$)			
482.71 *6*	1.00 *9*	7444.9	(22$^+$)	6962.2	(20$^+$)	(E2)	0.0294	DCO=1.43 *35* (1991Dr04)
486.7 *4*	0.14 *4*	1399.5+z	J3+6	912.8+z	J3+4			
510.6 *4*	0.040 *10*	2773.2+y	J2+14	2262.6+y	J2+12			
511.4 *4*	0.08 *2*	9388.5	(27$^-$)	8877.1	(25$^-$)			
515.0 *4*	0.14 *3*	1914.5+z	J3+8	1399.5+z	J3+6			
521.30 *6*	1.00 *9*	7966.2	(24$^+$)	7444.9	(22$^+$)	E2[&]	0.0244	DCO=1.26 *29* (1991Dr04)
530.1[‡] *3*		2865.6	(11$^-$)	2335.4	(9$^-$)			
543.2 *3*	0.17 *3*	9931.7	(29$^-$)	9388.5	(27$^-$)			
547.7 *8*	0.032 *11*	3320.9+y	J2+16	2773.2+y	J2+14			
547.7 *4*	0.14 *3*	2462.2+z	J3+10	1914.5+z	J3+8			
558.6 *1*	0.81 *8*	8524.8	(26$^+$)	7966.2	(24$^+$)	E2[&]	0.0207	DCO=1.3 *4* (1991Dr04)
575.6 *2*	0.20 *4*	10507.2	(31$^-$)	9931.7	(29$^-$)			
582.7 *5*	0.14 *4*	3044.9+z	J3+12	2462.2+z	J3+10			
582.9 *7*	0.021 *12*	3903.8+y	J2+18	3320.9+y	J2+16			
594.9 *1*	0.70 *12*	9119.7	(28$^+$)	8524.8	(26$^+$)	Q		DCO=1.4 *4* (1991Dr04)
608.1 *3*	0.22 *4*	11115.3	(33$^-$)	10507.2	(31$^-$)			
617.7 *4*	0.14 *4*	3662.6+z	J3+14	3044.9+z	J3+12			
617.9 *7*	0.011 *9*	4521.7+y	J2+20	3903.8+y	J2+18			
625.4[‡] *2*		1041.8	4$^+$	416.4	2$^+$			
630.1 *1*	0.50 *14*	9749.8	(30$^+$)	9119.7	(28$^+$)	Q		DCO=1.3 *5* (1991Dr04)

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^{160}Gd(^{34}S,4nγ):SD 1996Wi08,1995Cr02,2010Wi02 (continued)

$\gamma(^{190}Hg)$ (continued)

E_γ[†]	I_γ[@]	E_i(level)	J_i^π	E_f	J_f^π	Mult.	α[a]	Comments
641.6 *3*	0.19 *4*	11756.9	(35$^-$)	11115.3	(33$^-$)			
651.5 *7*	≤0.005	5173.2+y	J2+22	4521.7+y	J2+20			
653.6 *4*	0.11 *3*	4316.2+z	J3+16	3662.6+z	J3+14			
664.1 *1*	0.40 *5*	10413.9	(32$^+$)	9749.8	(30$^+$)	Q		DCO=1.4 *7* (1991Dr04)
674.5 *5*	0.10 *3*	12431.4	(37$^-$)	11756.9	(35$^-$)			
683.2[‡] *3*		3548.8	(13$^-$)	2865.6	(11$^-$)			
689.6 *6*	0.06 *2*	5005.8+z	J3+18	4316.2+z	J3+16			
692.0[‡] *2*		2464.9	(8)$^+$	1772.9	6$^+$			
696.9 *1*	0.25 *4*	11110.8	(34$^+$)	10413.9	(32$^+$)			
702[b] *1*	0.03 *2*	11115.3	(33$^-$)	10413.9	(32$^+$)			B(E1)(W.u.)=0.0015 *10* (1996Wi08).
707.1 *6*	0.04 *1*	13138.5	(39$^-$)	12431.4	(37$^-$)			
723.3 *6*	0.039 *12*	5729.1+z	J3+20	5005.8+z	J3+18			
728.5 *4*	0.14 *4*	11839.3	(36$^+$)	11110.8	(34$^+$)	Q		DCO=1.5 *7* (1991Dr04) E_γ: 726.9 *7* (1991Dr04).
731.1[‡] *2*		1772.9	6$^+$	1041.8	4$^+$			
757 *1*	0.06 *2*	10507.2	(31$^-$)	9749.8	(30$^+$)			B(E1)(W.u.)=0.0016 *4* (2001Ko16). Branching ratio=0.23 *4* (2001Ko16), <0.3 (1995Cr02).
757.4 *4*	0.06 *2*	12596.7	(38$^+$)	11839.3	(36$^+$)			E_γ: 755.9 *15* (1991Dr04).
760.4 *6*	0.011 *10*	6489.5+z	J3+22	5729.1+z	J3+20			
783.5 *6*	0.021 *12*	13380.2	(40$^+$)	12596.7	(38$^+$)			
791[b]	≤0.01	7280.5+z?	J3+24	6489.5+z	J3+22			
801.8[b] *8*	≤0.01	14182.0?	(42$^+$)	13380.2	(40$^+$)			
812 *1*	0.07 *2*	9931.7	(29$^-$)	9119.7	(28$^+$)	(D)		B(E1)(W.u.)=0.0015 *3* (2001Ko16). E_γ: 811.7 *10* (1993Ca23) was assigned to SD-1 band. Mult.: from DCO measurement (1995Cr02). Branching ratio=0.29 *4* (1995Cr02), 0.35 *4* (2001Ko16).
839.6 *2*		1881.4	5$^-$	1041.8	4$^+$			
864 *1*	0.08 *2*	9388.5	(27$^-$)	8524.8	(26$^+$)	E1[&]	0.00301	B(E1)(W.u.)=0.0038 *8* (2001Ko16). Branching ratio=0.83 *8* (2001Ko16), 0.35 *4* (1995Cr02).
910.9 *3*	0.06 *2*	8877.1	(25$^-$)	7966.2	(24$^+$)	E1[&]	0.00273	B(E1)(W.u.)=0.0029 *13* (1996Wi08). Branching ratio >0.5 (1995Cr02).
950.8 *3*	0.03 *1*	8395.8	(23$^-$)	7444.9	(22$^+$)	E1[&]	0.00252	B(E1)(W.u.)≥0.0009 (1996Wi08).
2207[#] *2*		5756.9	(14$^+$)	3548.8	(13$^-$)			
2400[#] *2*		5440.0	(12$^+$)	3040.5	(14$^+$)			
2717[#] *2*		5756.9	(14$^+$)	3040.5	(14$^+$)			

[†] From 1995Cr02 and 1996Wi08, unless otherwise stated. See also 1994Cr08, 1991Dr04 and 1992BeZL for previous γ-ray energy measurements.
[‡] From the Adopted Gammas.
[#] γ from 2010Wi02.
[@] Relative I(γ+ce) values within the band and are from 1996Wi08. See also 1991Dr04 and 1993Ca23.
[&] From γ(lin pol) measurement of 2001Ko16.
[a] 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.
[b] Placement of transition in the level scheme is uncertain.

^{160}Gd(^{34}S,4nγ):SD 1996Wi08,1995Cr02,2010Wi02

Level Scheme

Intensities: Relative I_γ

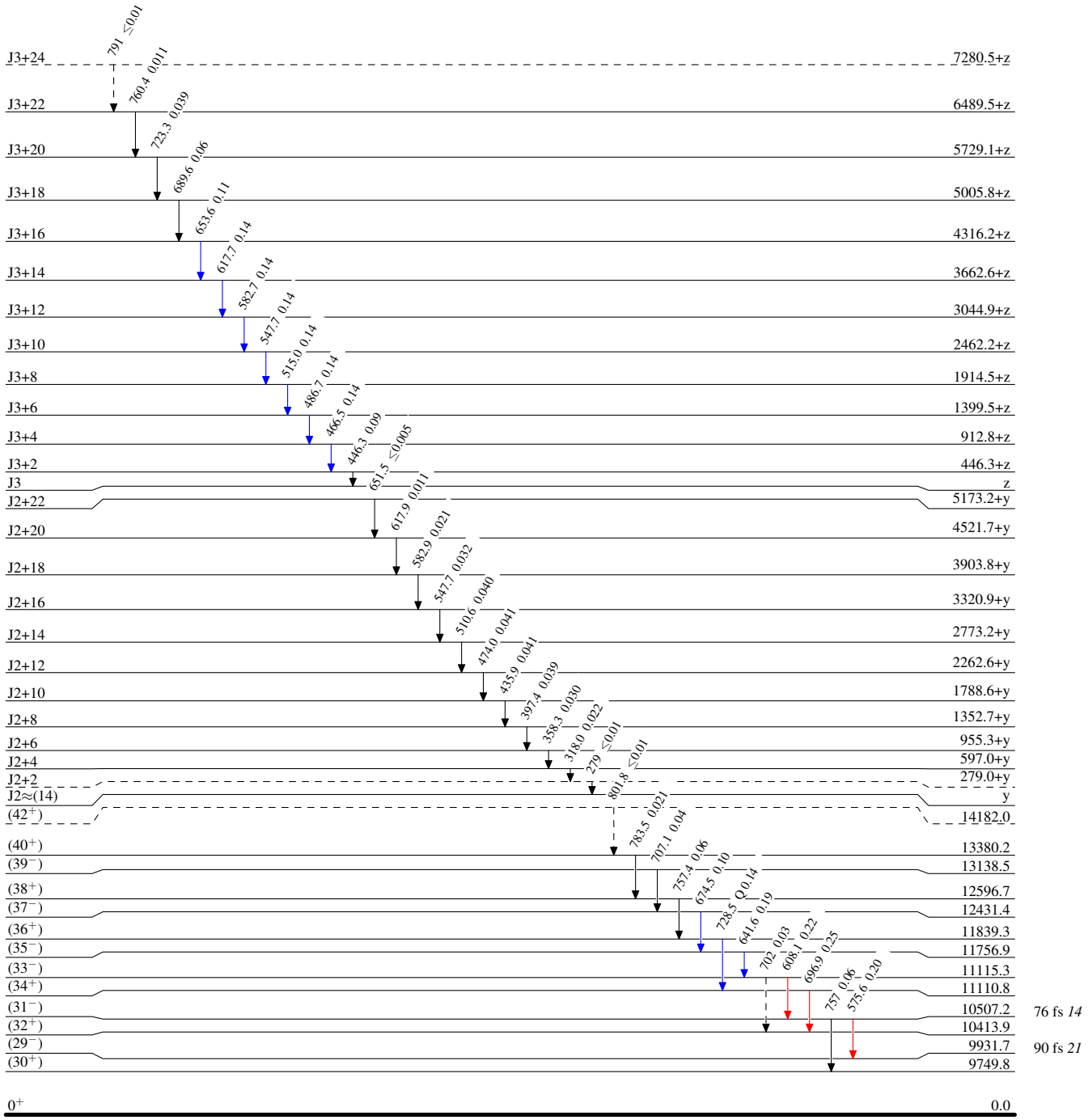
Legend

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

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

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

γ Decay (Uncertain)



$^{190}_{80}Hg_{110}$

^{160}Gd(^{34}S,4nγ):SD 1996Wi08,1995Cr02,2010Wi02

Level Scheme (continued)

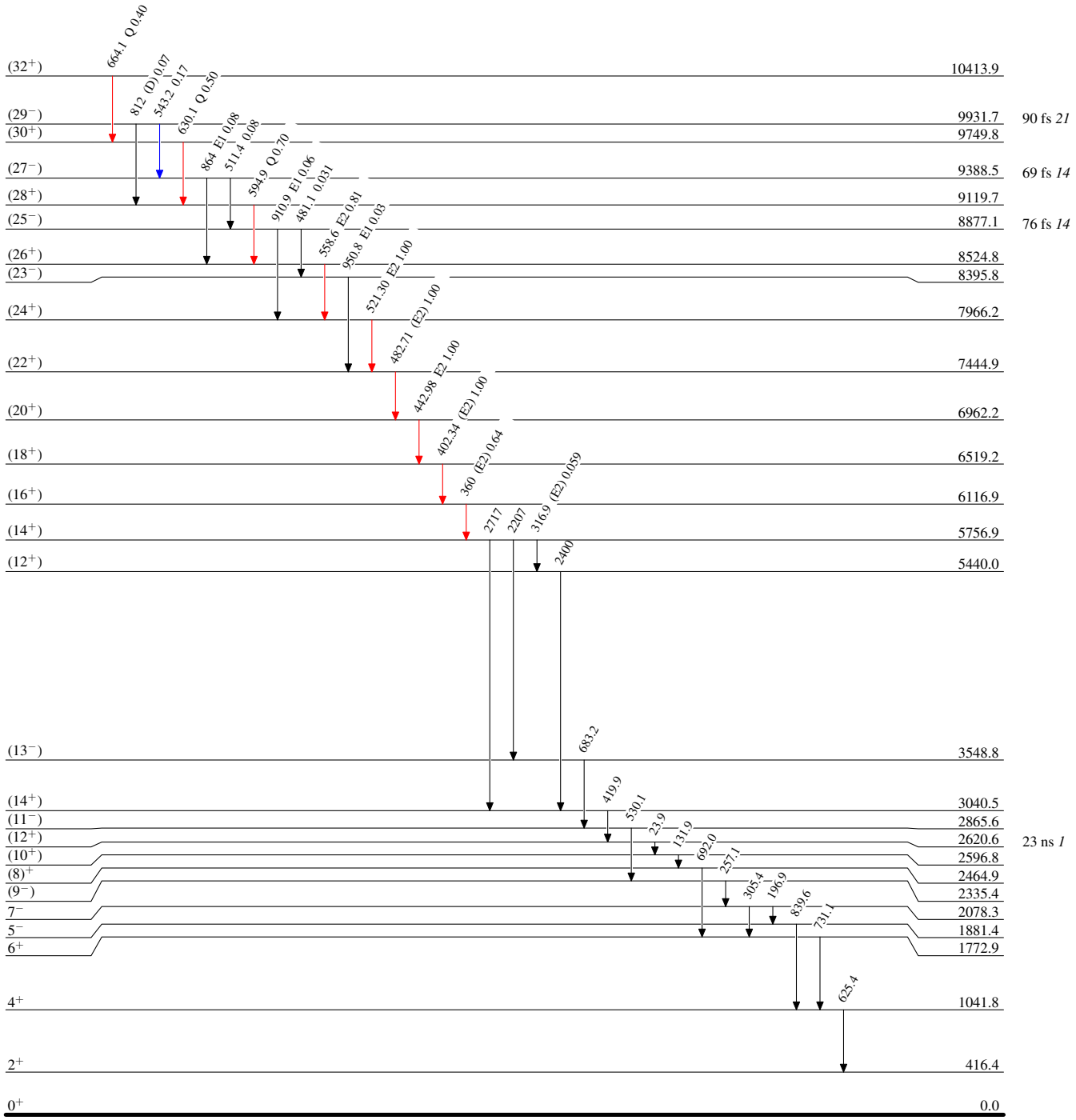
Intensities: Relative I_γ

Legend

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

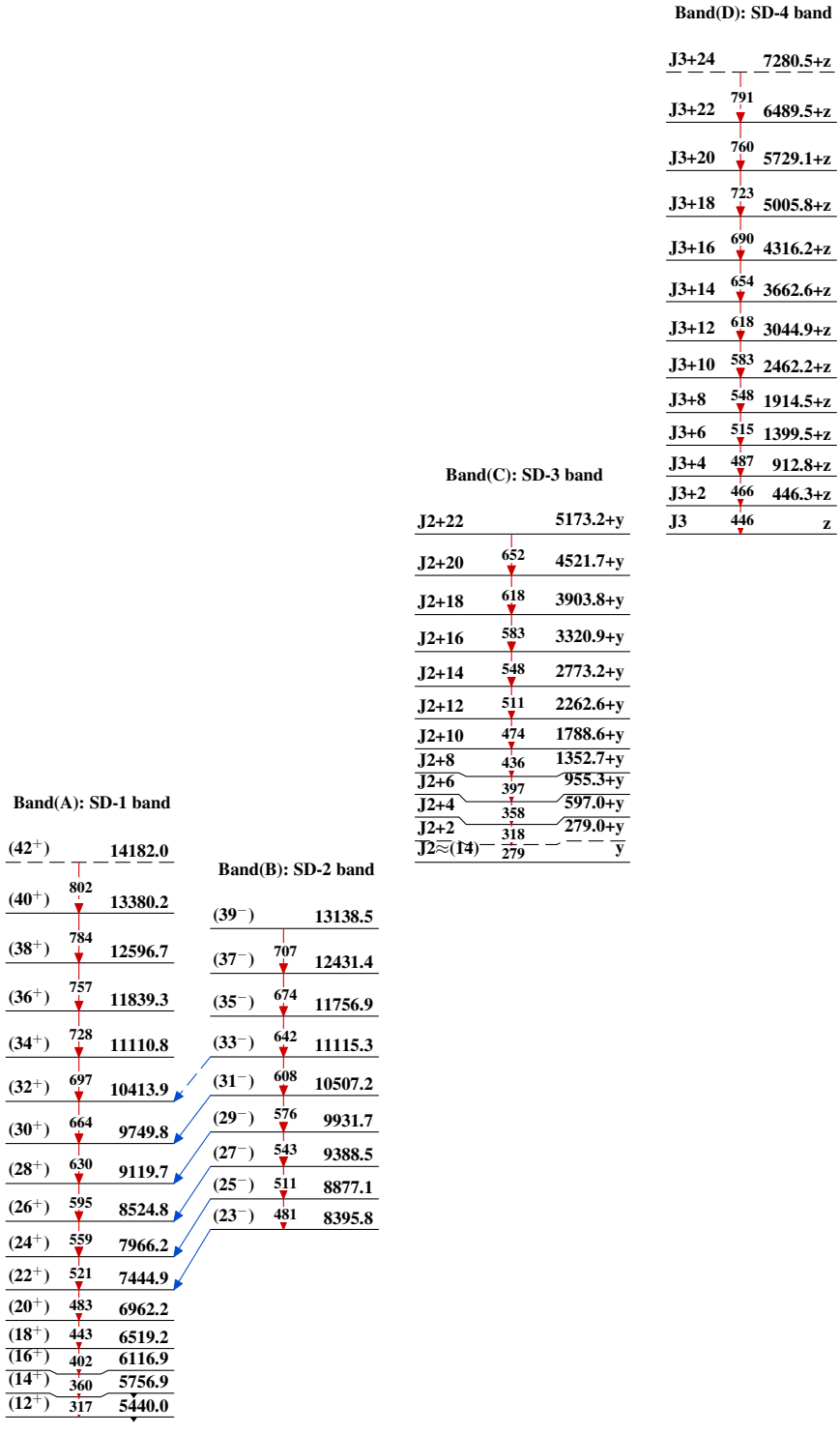
$I_\gamma < 10\% \times I_\gamma^{max}$

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



$^{190}_{80}Hg_{110}$

^{160}Gd(^{34}S,4nγ):SD 1996Wi08,1995Cr02,2010Wi02



$^{190}_{80}Hg_{110}$