(HI,xnγ):SD 1995Ca15,1990Ca18,1989Mo08

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	M. S. Basunia	NDS 195,368 (2024)	1-Dec-2023

Others: 1995So17, 1998ReZV, 1998SiZZ, 1999Lu04, 1999SiZZ, 2000SiZZ, 2004SiZZ, 2004Si19 (supersedes 1998ReZV, 1998SiZZ, 1999SiZZ, 2000SiZZ, 2004SiZZ).

Insignificant change compared to the previous evaluation (2007Va21).

1995Ca15: ^{160}Gd(^{36}S,5nγ), E=172 MeV; ^{174}Yb(^{22}Ne,5n), E=120 MeV. Measured Eγ, Iγ, $\gamma\gamma$ coin. Gammasphere array of 36 Compton-suppressed Ge detectors. Identify fourth SD band (SD-4), proposed as signature partner to SD-1.

1990Ca18: Same reaction and experimental setup as for 1989Mo08. Analyze γ, $\gamma\gamma$, $\gamma\gamma(\theta)$, DSA data. Identify two further SD bands (SD-2 and SD-3) on the basis of $\gamma\gamma$ coincidences with known transitions between ND levels in ^{191}Hg, and excitation functions.

1989Mo08: ^{160}Gd(^{36}S,5nγ), E(beam)=172 MeV. Detection using the Argonne-Notre Dame BGO γ-ray facility, consisting in 50 BGO elements surrounded by 12 Compton-suppressed Ge spectrometers. First detection of the yrast SD band (SD-1). Obtain Eγ, Iγ, fractional Doppler shift; deduce quadrupole moment, γ-ray multipolarity.

1995So17: ^{160}Gd(^{36}S,5nγ) E=169 MeV and ^{130}Te(^{64}Ni,3nγ) E=257 MeV, at mid-target. Measured γ, $\gamma\gamma$ coin. Array of 12 Compton-suppressed Ge detectors and 50 BGO detectors. Deduced population intensity of 3 SD bands.

1999SiZZ, 1998ReZV (also 1998SiZZ, 2000SiZZ): ^{174}Yb(^{22}Ne,5nγ) E=120 MeV, from the 88-inch cyclotron at LBNL. GAMMASPHERE array with 96 Compton-suppressed Ge detectors. Identify two linking transitions from SD band 1 to ND negative parity states: 2778 keV (1998ReZV), 3310 keV (1999SiZZ). Deduced transition quadrupole moments for the SD-1, SD-2 bands (1998ReZV). Obtained angular distribution coefficient for the 2778-keV decay out transition (1999SiZZ).

2004Si19: same reaction and setup as for 1998ReZV and 1999SiZZ. Study quasi-continuum γ spectrum connecting SD and ND states, compare with the previously known one-step decay-out γ rays connecting the second level in the SD yrast (SD-1) band to levels in the ND lower energy part of the level scheme. Observe coincidences with γ rays both from the SD and the ND parts of the level scheme.

Other: 1999Lu04 (^{181}Ta(^{19}F,X), E(^{19}F)=120 MeV).

Theory: 2018Sh19, 2017Da18, 2005He21, 2004Gu14, 2003Sa27, 2001Sh11, 1999Zh12, 1999Ab21, 1997Vi07, 1997Hu13, 1995Ci05, 1994Ch33, 1994Xu03, 1993Ab08, 1992Wu06, 1992Wu01, 1991Wy01, 1990Be37.

^{191}Hg Levels

E(level)†	J$^\pi$	Comments
5817# 8	J≈(31/2)‡	Additional information 1. E(level): from y=5689+x (2004Si19,1999SiZZ), where "x" is the energy of the isomeric 13/2$^{(+)}$ level (see comments in the adopted dataset). Also see comments for 6128 level. J$^\pi$: 31/2 from linking transitions (2004Si19,1998ReZV,1999SiZZ) to ND states and supported by particle-number conserving (PNC) method calculations (2005He21).
6127.9# 7	J+2	E(level): 6000+x from observation (2004Si19,1998ReZV,1999SiZZ) of two linking transitions to normal bands: 2778γ to 3222+x (35/2$^-$), 3350 in the adopted dataset, and 3310γ to 2690.6+x (33/2$^-$), 2818.5 in the adopted dataset. See also comments for the 2778 and 3310 keV γ rays.
6479.4# 7	J+4	
6871.0# 9	J+6	
7302.3# 9	J+8	
7772.4# 9	J+10	
8280.8# 9	J+12	
8826.7# 9	J+14	
9409.1# 9	J+16	
10027.6# 9	J+18	
10681.3# 9	J+20	

Continued on next page (footnotes at end of table)

(HI,xnγ):SD 1995Ca15,1990Ca18,1989Mo08 (continued)

^{191}Hg Levels (continued)

E(level)[†]	J$^\pi$	Comments
11369.6[#] 10	J+22	
12091.8[#] 10	J+24	
12847.4[#] 11	J+26	
13636.2[#] 12	J+28	
z[@]	J1≈(21/2)[‡]	Additional information 2. J$^\pi$: Band head spin assignment was supported by nuclear softness (NS) analysis in combination of the ratio-R method (2017Da18).
252.4+z[@] 7	J1+2	
545.1+z[@] 7	J1+4	
878.2+z[@] 8	J1+6	
1250.9+z[@] 8	J1+8	
1662.7+z[@] 8	J1+10	
2113.0+z[@] 8	J1+12	
2601.1+z[@] 8	J1+14	
3126.3+z[@] 8	J1+16	
3687.9+z[@] 9	J1+18	
4285.1+z[@] 9	J1+20	
4917.2+z[@] 9	J1+22	
5583.4+z[@] 10	J1+24	
6283.3+z[@] 10	J1+26	
7016.0+z[@] 11	J1+28	
7781.2+z[@] 11	J1+30	
8577.7+z[@] 13	J1+32	
u[&]	J2≈(23/2)[‡]	Additional information 3. J$^\pi$: Band head spin 23/2 was supported by nuclear softness (NS) analysis in combination of the ratio-R method (2017Da18), although it was termed and ambiguous in 2017Da18.
272.0+u[&] 10	J2+2	
585.1+u[&] 11	J2+4	
937.6+u[&] 11	J2+6	
1329.1+u[&] 11	J2+8	
1758.8+u[&] 11	J2+10	
2225.9+u[&] 12	J2+12	
2729.8+u[&] 12	J2+14	
3269.5+u[&] 12	J2+16	
3844.5+u[&] 12	J2+18	
4454.0+u[&] 12	J2+20	
5096.7+u[&] 12	J2+22	
5772.8+u[&] 13	J2+24	
6481.3+u[&] 13	J2+26	
7221.3+u[&] 13	J2+28	
7992.6+u[&] 14	J2+30	
8793.2+u?[&] 17	J2+32	
v[a]	J3≈(25/2)[‡]	Additional information 4.
280.9+v[a] 6	J3+2	

Continued on next page (footnotes at end of table)

(HI,xnγ):SD 1995Ca15,1990Ca18,1989Mo08 (continued)

^{191}Hg Levels (continued)

E(level)[†]	J^π	E(level)[†]	J^π	E(level)[†]	J^π
604.5+v[a] *7*	J3+4	2328.6+v[a] *9*	J3+12	4704.1+v[a] *13*	J3+20
971.6+v[a] *7*	J3+6	2864.0+v[a] *9*	J3+14	5391.7+v[a] *15*	J3+22
1381.9+v[a] *8*	J3+8	3439.0+v[a] *10*	J3+16	6114.9+v[a] *17*	J3+24
1834.5+v[a] *9*	J3+10	4053.3+v[a] *11*	J3+18	6870.9+v[a] *21*	J3+26
				7659.9+v[a] *25*	J3+28

[†] From a least-squares fit to the γ-ray energies. The excited level energies of 5817 to 13636 keV are based on the isomeric state at 128 keV *8*, that links with 6128 keV level (see comments for 6128 level). For total uncertainty, propagate 8 keV in quadrature.

[‡] From least-squares fit to rotational-model formula (1990Be37,1992Wu01).

[#] Band(A): SD-1 yrast band. (1995So17,1995Ca15,1989Mo08). Q(intrinsic)=18 *3* (1989Mo08); 17.5 *+8−6* (1998ReZV). β_2=0.55 (1990Ca18). Favored (π,r)=(−,+), $j_{15/2}$ orbital (1990Ca18,1995Ca15). Calculations assign a configuration π3/2[761] (2005He21). Percent population=2.0 *3* (1995So17, ^{160}Gd(^{36}S,5n)), 1.2 *6* (1995So17, ^{130}Te(^{64}Ni,3nγ)), 2 (1989Mo08).

[@] Band(B): SD-2 band. (1995So17,1995Ca15,1990Ca18). Q(intrinsic)≈18 (1990Ca18), 17.5 *+8−6* (1998ReZV). Assumed signature partner of SD-3 (1990Ca18). Suggested configuration: 3/2[642] orbital, with (π,r)=(+,+) (1990Ca18). Percent population=0.8 *3* (1995So17), 1 (1990Ca18).

[&] Band(C): SD-3 band. (1995So17,1995Ca15,1990Ca18). Favored signature partner of SD-2, (π,r)=(+.−), 3/2[642] configuration. Percent population=0.8 *3* (1995So17), 1 (1990Ca18).

[a] Band(D): SD-4 band. (1995Ca15). Unfavored signature partner of SD-1, (π,r)=(−,+), $j_{15/2}$ orbital (1990Ca18,1995Ca15), Percent population=0.2 (1995Ca15).

γ(^{191}Hg)

E_γ[†]	I_γ[‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult.	Comments
252.4 *7*		252.4+z	J1+2	z	J1≈(21/2)		
272.0 *10*		272.0+u	J2+2	u	J2≈(23/2)		
280.9 *6*	0.22 *5*	280.9+v	J3+2	v	J3≈(25/2)		Additional information 42.
292.7 *1*	0.43 *7*	545.1+z	J1+4	252.4+z	J1+2		Additional information 19. Eγ=292.0 keV (1990Ca18).
310.9 *7*	0.14 *2*	6127.9	J+2	5817	J≈(31/2)		Additional information 5.
313.1 *2*	0.95 *16*	585.1+u	J2+4	272.0+u	J2+2		Additional information 31. Eγ=311.8 keV *12* (1990Ca18).
323.6 *2*	0.58 *9*	604.5+v	J3+4	280.9+v	J3+2		Additional information 43.
333.1 *1*	0.76 *10*	878.2+z	J1+6	545.1+z	J1+4		Additional information 20. Eγ=332.9 keV (1990Ca18).
351.5 *1*	0.83 *5*	6479.4	J+4	6127.9	J+2	Q[#]	Additional information 6. Eγ=350.6 keV, Iγ=0.70 *3* (1989Mo08).
352.5 *1*	0.96 *16*	937.6+u	J2+6	585.1+u	J2+4		Additional information 32. Eγ=351.6 keV (1990Ca18).
367.1 *2*	0.80 *12*	971.6+v	J3+6	604.5+v	J3+4		Additional information 44.
372.7 *1*	1.07 *14*	1250.9+z	J1+8	878.2+z	J1+6		Additional information 21. Eγ=372.5 keV (1990Ca18).
391.5 *4*	1.44 *19*	1329.1+u	J2+8	937.6+u	J2+6		Additional information 33. Eγ=390.2 keV (1990Ca18).
391.6 *4*	1.00 *9*	6871.0	J+6	6479.4	J+4	Q[#]	Additional information 7. Eγ=390.5 keV, Iγ=1.00 *4* (1989Mo08).
410.3 *4*	0.96 *17*	1381.9+v	J3+8	971.6+v	J3+6		Additional information 45.
411.8 *2*	0.87 *19*	1662.7+z	J1+10	1250.9+z	J1+8		Additional information 22. Eγ=411.5 keV (1990Ca18).
429.7 *1*		1758.8+u	J2+10	1329.1+u	J2+8		
431.3 *1*	0.98 *4*	7302.3	J+8	6871.0	J+6	Q[#]	Additional information 8. Eγ=430.3 keV, Iγ=0.80 *4* (1989Mo08).

Continued on next page (footnotes at end of table)

(HI,xnγ):SD 1995Ca15,1990Ca18,1989Mo08 (continued)

γ(^{191}Hg) (continued)

Eγ[†]	Iγ[‡]	Ei(level)	J^π_i	E_f	J^π_f	Mult.	Comments
450.3 *1*	0.97 *13*	2113.0+z	J1+12	1662.7+z	J1+10		Additional information 23. Eγ=449.9 keV (1990Ca18).
452.6 *3*	1.04 *15*	1834.5+v	J3+10	1381.9+v	J3+8		Additional information 46.
467.1 *2*	1.07 *19*	2225.9+u	J2+12	1758.8+u	J2+10		Additional information 34. Eγ=466.5 keV (1990Ca18).
470.1 *1*	1.02 *4*	7772.4	J+10	7302.3	J+8	Q[#]	Additional information 9. Eγ=469.6 keV, Iγ=0.80 *3* (1989Mo08). Eγ=470.7 keV (2004Si19,1999SiZZ).
488.1 *2*	0.83 *13*	2601.1+z	J1+14	2113.0+z	J1+12		Additional information 24. Eγ=488.1 keV (1990Ca18).
494.1 *2*	0.79 *12*	2328.6+v	J3+12	1834.5+v	J3+10		Additional information 47.
503.9 *1*	0.78 *14*	2729.8+u	J2+14	2225.9+u	J2+12		Additional information 35. Eγ=503.3 keV (1990Ca18).
508.4 *1*	0.97 *6*	8280.8	J+12	7772.4	J+10	Q[#]	Additional information 10. Eγ=508.1 keV, Iγ=0.63 *4* (1989Mo08).
525.2 *2*	0.57 *16*	3126.3+z	J1+16	2601.1+z	J1+14		Additional information 25. Eγ=525.1 keV (1990Ca18).
535.4 *3*	0.71 *15*	2864.0+v	J3+14	2328.6+v	J3+12		Additional information 48.
539.7 *3*	0.70 *10*	3269.5+u	J2+16	2729.8+u	J2+14		Additional information 36. Eγ=539.5 keV (1990Ca18).
545.9 *2*	0.88 *5*	8826.7	J+14	8280.8	J+12	Q[#]	Additional information 11. Eγ=545.3 keV, Iγ=0.67 *4* (1989Mo08).
561.6 *3*	0.65 *10*	3687.9+z	J1+18	3126.3+z	J1+16		Additional information 26. Eγ=561.8 keV (1990Ca18).
575.0 *1*	0.71 *12*	3844.5+u	J2+18	3269.5+u	J2+16		Additional information 37. Eγ=574.3 keV (1990Ca18).
575.0 *4*	0.73 *15*	3439.0+v	J3+16	2864.0+v	J3+14		Additional information 49.
582.4 *1*	0.77 *4*	9409.1	J+16	8826.7	J+14	Q[#]	Additional information 12. Eγ=582.1 keV, Iγ=0.56 *3* (1989Mo08).
597.2 *2*	0.97 *14*	4285.1+z	J1+20	3687.9+z	J1+18		Additional information 27. Eγ=596.9 keV (1990Ca18).
609.5 *1*	0.64 *8*	4454.0+u	J2+20	3844.5+u	J2+18		Additional information 38. Eγ=609.2 keV (1990Ca18).
614.3 *5*	0.58 *11*	4053.3+v	J3+18	3439.0+v	J3+16		Additional information 50.
618.5 *2*	0.73 *10*	10027.6	J+18	9409.1	J+16	Q[#]	Additional information 13. Eγ=617.8 keV, Iγ=0.53 *4* (1989Mo08).
632.1 *2*	0.55 *10*	4917.2+z	J1+22	4285.1+z	J1+20		Additional information 28. Eγ=631.9 keV (1990Ca18).
642.7 *2*	0.50 *5*	5096.7+u	J2+22	4454.0+u	J2+20		Additional information 39. Eγ=642.6 keV (1990Ca18).
650.8 *6*	0.50 *12*	4704.1+v	J3+20	4053.3+v	J3+18		Additional information 51.
653.7 *2*	0.61 *5*	10681.3	J+20	10027.6	J+18	Q[#]	Additional information 14. Eγ=653.0 keV, Iγ=0.49 *3* (1989Mo08).
666.2 *2*	0.53 *6*	5583.4+z	J1+24	4917.2+z	J1+22		Additional information 29. Eγ=666.0 keV (1990Ca18).
676.1 *3*	0.40 *5*	5772.8+u	J2+24	5096.7+u	J2+22		Additional information 40. Eγ=675.2 keV (1990Ca18).
687.6 *7*	0.46 *11*	5391.7+v	J3+22	4704.1+v	J3+20		Additional information 52.
688.3 *2*	0.53 *5*	11369.6	J+22	10681.3	J+20	Q[#]	Additional information 15. Eγ=687.4 keV, Iγ=0.37 *4* (1989Mo08).
699.9 *2*	0.40 *8*	6283.3+z	J1+26	5583.4+z	J1+24		Additional information 30. Eγ=699.2 keV (1990Ca18).
708.5 *3*	0.33 *6*	6481.3+u	J2+26	5772.8+u	J2+24		Additional information 41. Eγ=707.5 keV (1990Ca18).

Continued on next page (footnotes at end of table)

(HI,xnγ):SD 1995Ca15,1990Ca18,1989Mo08 (continued)

$\gamma(^{191}Hg)$ (continued)

E_γ [†]	I_γ [‡]	E_i(level)	J^π_i	E_f	J^π_f	Mult.	α [@]	Comments
722.2 *3*	0.34 *5*	12091.8	J+24	11369.6	J+22	Q [#]		Additional information 16. Eγ=721.8 keV, Iγ=0.25 *4* (1989Mo08).
723.2 *8*	0.41 *9*	6114.9+v	J3+24	5391.7+v	J3+22			Additional information 53.
732.7 *4*		7016.0+z	J1+28	6283.3+z	J1+26			
740.0 *3*		7221.3+u	J2+28	6481.3+u	J2+26			
755.6 *3*	0.17 *4*	12847.4	J+26	12091.8	J+24	Q [#]		Additional information 17. Eγ=754.3 keV, Iγ=0.14 *3* (1989Mo08).
756.0 *12*	0.32 *8*	6870.9+v	J3+26	6114.9+v	J3+24			Additional information 54.
765.2 *4*		7781.2+z	J1+30	7016.0+z	J1+28			
771.3 *3*		7992.6+u	J2+30	7221.3+u	J2+28			
788.8 *6*	0.09 *2*	13636.2	J+28	12847.4	J+26			Additional information 18.
789.0 *13*	0.19 *5*	7659.9+v	J3+28	6870.9+v	J3+26			Additional information 55.
796.5 *6*		8577.7+z	J1+32	7781.2+z	J1+30			
800.5 [&] *10*		8793.2+u?	J2+32	7992.6+u	J2+30			
^{x}2778						(M1)	0.00210	A_2=0.57 *48* (1999SiZZ) α(K)=0.000970 *14*; α(L)=0.0001518 *22*; α(M)=3.50×10^{-5} *5*; α(N+..)=0.000947 *14* α(N)=8.78×10^{-6} *13*; α(O)=1.667×10^{-6} *24*; α(P)=1.318×10^{-7} *19*; α(IPF)=0.000936 *14* Eγ: from 2004Si19,1998ReZV. This was the first one-step decay-out γ ray in ^{191}Hg identified as connecting a level in a SD band to the lower energy ND level scheme (2004Si19,1998ReZV). The assignment is based on coincidence data for high-energy primary γ rays connecting ND and SD states. The initial level is the 310.9+y keV (35/2$^-$) state in SD-1, and the final level is the 3222+x keV (35/2$^-$) state in the low-energy part of the level scheme (2004Si19,1999SiZZ), 3350 in the adopted dataset. Mult.: from angular distribution and parity assignment for the initial state, for which a $\nu j_{15/2}$ assignment has been proposed.
^{x}3310								Eγ: Second identified decay-out transition in ^{191}Hg connecting the SD-1 band level at 310.9+y keV with a level in the low energy (ND) part of the level scheme. Assignment from coincidence data. The final level is the (33/2$^-$) 2690.6+x keV state (1999SiZZ, see also comments for the 2778 keV γ ray), 2818.5 in the adopted dataset.

† From 1995Ca15. Other values noted in comments.
‡ Intensities are relative to the strongest transition within each band. The γ intensities and their uncertainties were estimated by the evaluators (2007Va21) from intensity plots: for SD-1, SD-4, from 1995Ca15; for SD-2, SD-3, from 1990Ca18. Values for SD-1 from 1989Mo08 are listed in comments. The quoted errors do not contain the contribution of the reference γ-ray intensity uncertainty.
\# Proposed by 1989Mo08, based on their DCO ratios (not listed by the authors).
@ Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation

Continued on next page (footnotes at end of table)

(HI,xnγ):SD 1995Ca15,1990Ca18,1989Mo08 (continued)

γ(^{191}Hg) (continued)

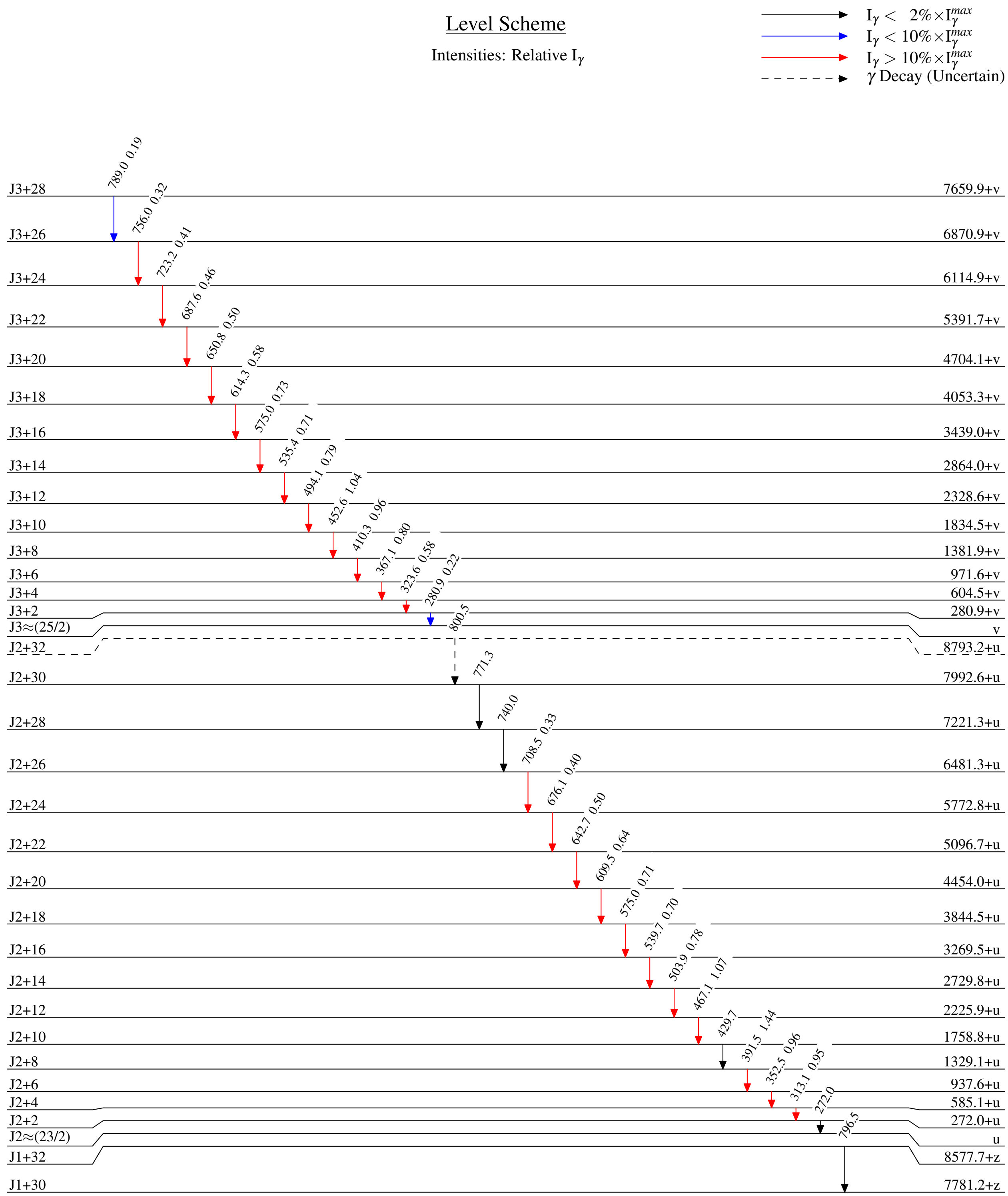
based on γ-ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.
[&] Placement of transition in the level scheme is uncertain.
[x] γ ray not placed in level scheme.

(HI,xnγ):SD 1995Ca15,1990Ca18,1989Mo08

Legend

Level Scheme

Intensities: Relative I_γ

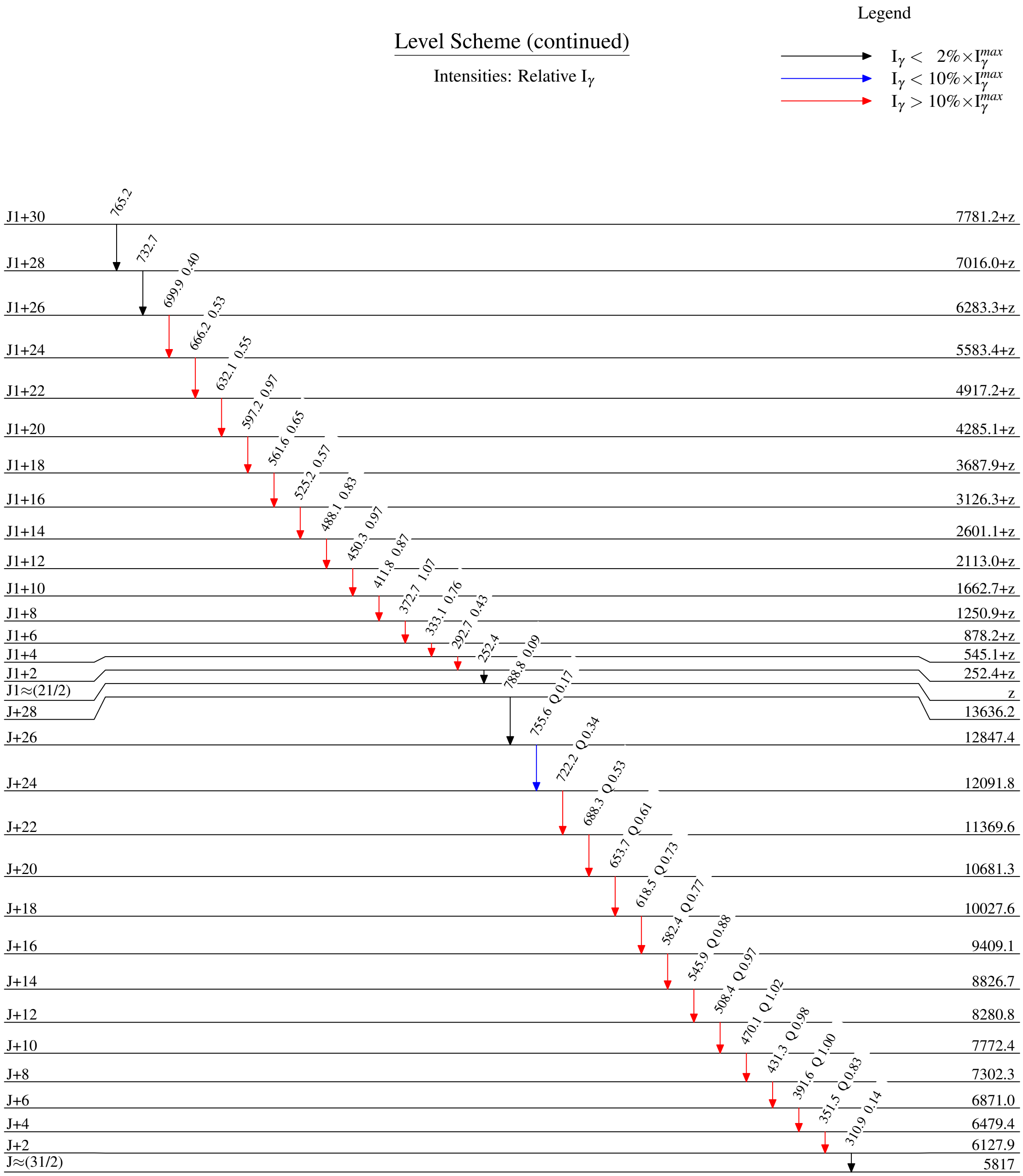


$^{191}_{80}Hg_{111}$

(HI,xnγ):SD 1995Ca15,1990Ca18,1989Mo08

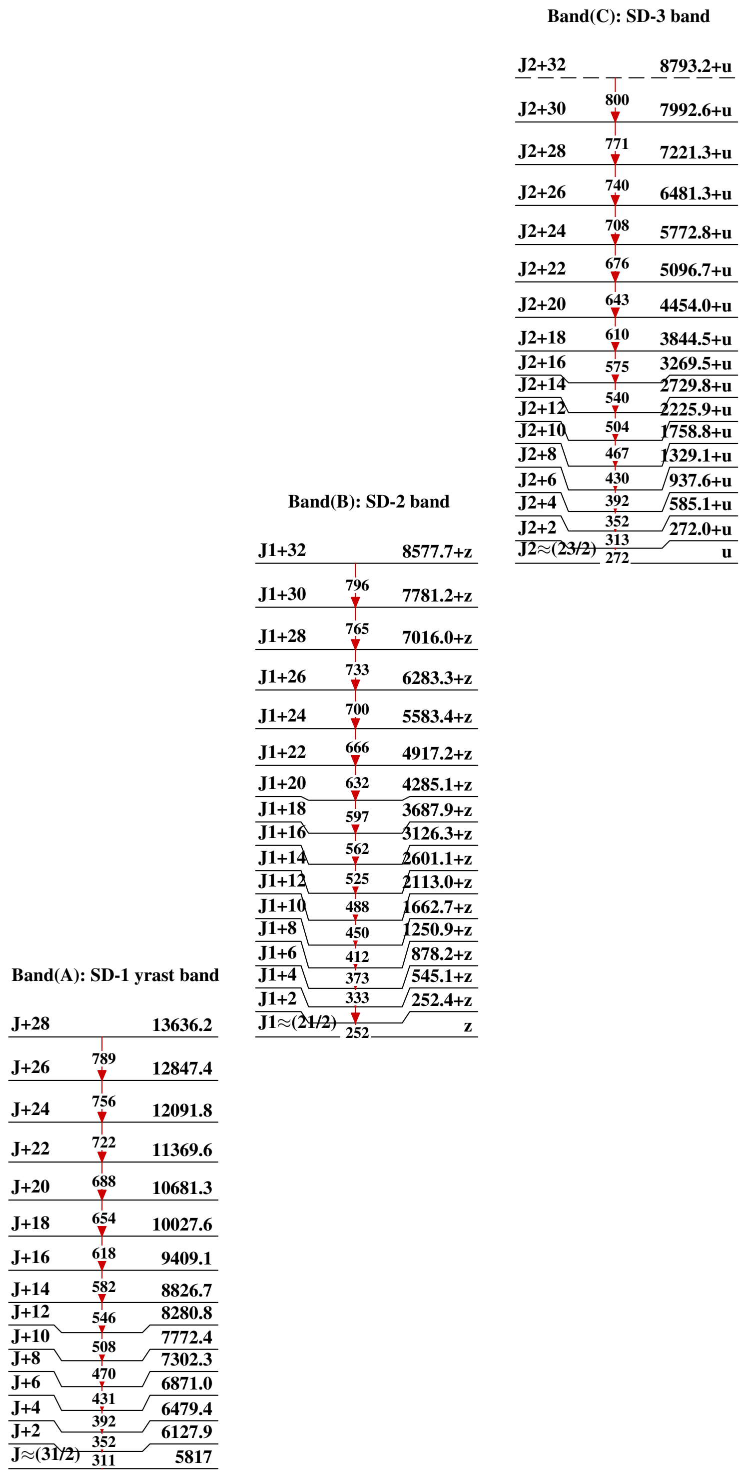
Level Scheme (continued)

Intensities: Relative I_γ



$^{191}_{80}Hg_{111}$

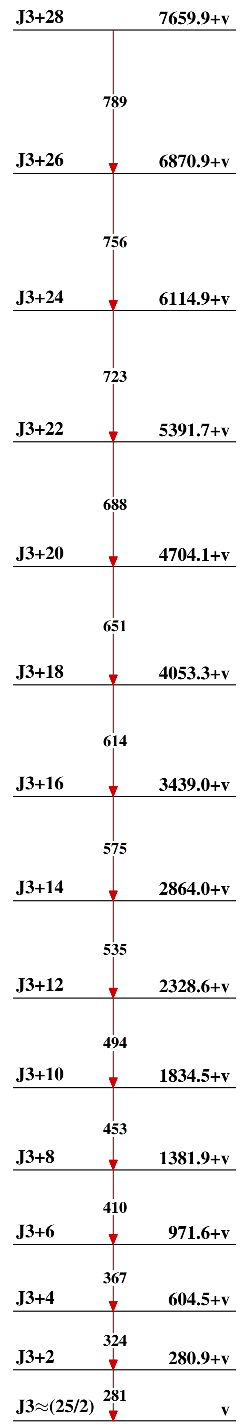
(HI,xnγ):SD 1995Ca15,1990Ca18,1989Mo08



$^{191}_{80}Hg_{111}$

(HI,xnγ):SD 1995Ca15,1990Ca18,1989Mo08 (continued)

Band(D): SD-4 band



$^{191}_{80}Hg_{111}$