^{108}Pd(^{19}F,4nγ),^{109}Ag(^{18}O,4nγ) 1992Hu02,1992Dr05

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	Jun Chen	NDS 174, 1 (2021)	15-Apr-2021

Measurements of ^{108}Pd(^{19}F,4nγ):

1992Hu02: E=76 MeV ^{19}F beam was produced from the Stony Brook FN tandem accelerator. Target was 2.5 mg/cm^2 ^{108}Pd rolled onto a Pb backing of 50 mg/cm^2. γ rays were detected with an array of six Ge detectors with BGO shields. Measured Eγ, Iγ, $\gamma\gamma$-coin, $\gamma(\theta)$. Deduced levels, J, π, band structures, configurations, γ ray multipolarities, mixing ratios. Comparisons with cranked-shell-model (CSM) calculations.

Measurements of ^{109}Ag(^{18}O,4nγ):

1992Dr05: E= 78 MeV ^{18}O beam was from the VICKSI accelerator at the Hahn-Meitner Institute. Target was 0.66 mg/cm^2 self-supporting ^{109}Ag (up to 99.4% enriched). Measured Doppler-shift recoil distance. Deduced $T_{1/2}$. Comparisons with theoretical calculations.

1987Ha03: E=82 MeV ^{18}O beam was from the Tandem van de Graaff in Riso, Denmark. γ rays were detected with four Compton-suppressed Ge detectors. Measured Eγ, $\gamma\gamma$-coin. Deduced yrast band.

Others: 1986ChZG, 1985ChZQ, 1984ChZV.

^{123}Cs Levels

$(7/2)^+$ bandhead of Band 1 and $(9/2^+)$ bandhead of Band 2: 1992Hu02 propose that the $(9/2^+)$ level (bandhead of Band 2) is at 296 keV and is de-excited by 201γ and 137γ with the latter assigned mult=E1 based on $\gamma(\theta)$ data and level scheme, and the $(7/2)^+$ level (bandhead of Band 1) is at a higher energy and linked to the 296 level by an unobserved and highly-converted low-energy transition. However, 2000Gi12 observed a preponderant M1 character for 137γ based on their ce data from ^{123}Ba ε decay. Together with the observations of both prompt and delayed transitions of 137γ and 201γ in their measurement of ^{115}In(^{12}C,4nγ), 2000Gi12 propose that the 137γ and 201γ de-excite a level at 231 keV with $J^\pi=7/2^+$, which is fed by an isomer at 231.7+x (x a few keV) with $T_{1/2}$=114 ns as the $(9/2^+)$ bandhead of Band 2. Later, 2004Si26 in ^{100}Mo(^{28}Si,4npγ) and 2004Si27 in ^{64}Ni(^{64}Ni,4npγ) propose the 328-keV level (proposed by 2000Gi12 as a separate level) to be the isomeric $(9/2^+)$ bandhead, based on the intensity balance of the feeding and de-exciting γ transitions (96.5γ and 233.5γ de-exciting the 328-keV level are seen in 2004Si26 with a thick target but not seen in 2004Si27 with a thin target due to ^{123}Cs nuclei recoiling into vacuum after reaction and decaying out of the detectors, supporting the 328-keV level being an isomer).

The level scheme here is based on that of 2000Gi12, 2004Si26 and 2004Si27, that is adopted in Adopted Levels, Gammas.

E(level)[†]	J^π[‡]	$T_{1/2}$[#]	Comments
0.0	$1/2^+$		
31.0 *6*	$(3/2,5/2)^+$		
95.0 *3*	$(5/2)^+$		
156.7[c] *11*	$(11/2)^-$	1.7 s *2*	$T_{1/2}$: from Adopted Levels.
231.7[&] *5*	$(7/2)^+$		E(level): see comments above. In 1992Hu02, this level feeds the $(9/2^+)$ level and has unknown energy.
327.5[a] *7*	$(9/2^+)$	114 ns *5*	E(level): bandhead of the band based on $1g_{9/2}$. 1992Hu02 propose the $(9/2^+)$ bandhead at a 296 level (also 1979Ga02 in ^{116}Sn(^{10}B,3nγ)), de-excited by the 137γ and 201γ. See detailed comments above. $T_{1/2}$: from Adopted Levels.
477.3[c] *11*	$(15/2^-)$	40 ps *2*	
596.5[b] *7*	$(11/2^+)$	6.2[@] ps *14*	
660.0[&] *5*	$(11/2)^+$	18[@] ps *3*	
900.1[a] *7*	$(13/2^+)$	1.8[@] ps *8*	
999.7[c] *11*	$(19/2)^-$	3.2 ps *+3−6*	
1160.2[d] *11*	$(17/2^-)$		
1236.9[b] *7*	$(15/2^+)$		
1260.3[&] *6*	$(15/2^+)$		

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^{108}Pd(^{19}F,4nγ),^{109}Ag(^{18}O,4nγ) 1992Hu02,1992Dr05 (continued)

^{123}Cs Levels (continued)

E(level)[†]	J$^\pi$[‡]	T$_{1/2}$[#]	Comments
1594.0[e] *11*	(19/2$^-$)		
1604.8[a] *7*	(17/2$^+$)		
1685.3[c] *11*	(23/2)$^-$	1.2 ps *6*	
1730.3[d] *11*	(21/2$^-$)	≤1.7 ps	
1994.5[b] *7*	(19/2$^+$)		
2003.5[&] *7*	(19/2$^+$)		
2197.1[e] *11*	(23/2$^-$)		
2410.6[a] *7*	(21/2$^+$)		
2436.9[d] *11*	(25/2$^-$)		
2486.1[c] *11*	(27/2)$^-$	≤1.4 ps	
2821.2[b] *7*	(23/2$^+$)		
2918.4[e] *11*	(27/2$^-$)		
3227.7[d] *12*	(29/2$^-$)		
3354.4[c] *12*	(31/2$^-$)		
3729.8[e] *12*	(31/2$^-$)		
4056.1[d] *12*	(33/2$^-$)		
4259.0[c] *12*	(35/2$^-$)		
4621.6[e] *12*	(35/2$^-$)		
5214.5[c] *12*	(39/2$^-$)		
6238.5[c] *12*	(43/2$^-$)		
7346.5[c] *16*	(47/2$^-$)		E(level),J$^\pi$: level from 1987Ha03.
8549.5[c] *19*	(51/2$^-$)		E(level),J$^\pi$: level from 1987Ha03.

[†] From a least-squares fit to γ-ray energies, unless otherwise noted.
[‡] Proposed in 1992Hu02, based on $\gamma(\theta)$, band assignments and RUL, unless otherwise noted.
[#] From recoil-distance method in 1992Dr05, unless otherwise noted.
[@] Effective half-life, not corrected for feeding lifetime (1992Dr05).
[&] Band(A): Band 1 based on 1g$_{7/2}$ (1992Hu02).
[a] Band(B): Band 2 based on 1g$_{9/2}$, α=+1/2 (1992Hu02).
[b] Band(b): Band 3 based on 1g$_{9/2}$, α=−1/2 (1992Hu02).
[c] Band(C): Band 4 based on 1h$_{11/2}$, α=−1/2 (1992Hu02).
[d] Band(c): Band 5 based on 1h$_{11/2}$, α=+1/2 (1992Hu02).
[e] Band(D): γ vibrational band based on 1h$_{11/2}$ (1992Hu02).

γ(^{123}Cs)

A$_2$ and A$_4$ under comments are from 1992Hu02.

E$_\gamma$[†]	I$_\gamma$[†]	E$_i$(level)	J$_i^\pi$	E$_f$	J$_f^\pi$	Mult.[@]	δ[@]	Comments
61.7		156.7	(11/2)$^-$	95.0	(5/2)$^+$	[E3]		E$_\gamma$: rounded value from Adopted Gammas; not observed in 1992Hu02.
95.0 *3*	20 *5*	95.0	(5/2)$^+$	0.0	1/2$^+$			
96.5[#]		327.5	(9/2$^+$)	231.7	(7/2)$^+$			
136.7[‡] *3*	27 *2*	231.7	(7/2)$^+$	95.0	(5/2)$^+$	D+Q	−0.04 *10*	Mult.: A$_2$=−0.09 *8*, A$_4$=0.03 *10*.

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^{108}Pd(^{19}F,4nγ),^{109}Ag(^{18}O,4nγ) 1992Hu02,1992Dr05 (continued)

γ(^{123}Cs) (continued)

E_γ[†]	I_γ[†]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[@]	δ[@]	α[&]	Comments
200.7[‡] *3*	55 *4*	231.7	(7/2)$^+$	31.0	(3/2,5/2)$^+$	(E2)		0.1640	Mult.: Q from A_2=+0.184 *57*, A_4=−0.038 *70*.
233.5[#]		327.5	(9/2$^+$)	95.0	(5/2)$^+$				
269.0 *2*	25 *1*	596.5	(11/2$^+$)	327.5	(9/2$^+$)	D+Q	+0.17 *2*		E_γ: from 1992Dr05. Other: 269.0 *3* (1992Hu02). Mult.: A_2=+0.027 *47*, A_4=+0.030 *97*.
303.7 *3*	14 *1*	900.1	(13/2$^+$)	596.5	(11/2$^+$)	D+Q	+0.14 *4*		E_γ: weighted average of 303.8 *3* (1992Hu02) and 303.6 *4* (1992Dr05). Mult.: A_2=−0.013 *49*, A_4=+0.039 *63*.
320.6 *2*	100	477.3	(15/2$^-$)	156.7	(11/2)$^-$	E2		0.0354	E_γ: weighted average of 320.5 *3* (1992Hu02) and 320.7 *2* (1992Dr05). Mult.: Q from A_2=+0.297 *28*, A_4=−0.043 *45*; M2 ruled out by RUL.
336.9 *3*	9 *1*	1236.9	(15/2$^+$)	900.1	(13/2$^+$)	D+Q	+0.18 *5*		Mult.: A_2=+0.044 *64*, A_4=+0.052 *81*.
367.9 *3*	4 *1*	1604.8	(17/2$^+$)	1236.9	(15/2$^+$)				
389.5 *3*	2 *1*	1994.5	(19/2$^+$)	1604.8	(17/2$^+$)				
410.5 *3*	1	2821.2	(23/2$^+$)	2410.6	(21/2$^+$)				
416.2 *3*	≈1	2410.6	(21/2$^+$)	1994.5	(19/2$^+$)				
428.3 *2*	34 *3*	660.0	(11/2)$^+$	231.7	(7/2)$^+$			0.0147	E_γ: from 1992Dr05. Other: 428.3 *3* (1992Hu02).
433.6 *3*	4 *1*	1594.0	(19/2$^-$)	1160.2	(17/2$^-$)				
466.6 *3*	≈1	2197.1	(23/2$^-$)	1730.3	(21/2$^-$)				
522.5 *2*	68 *3*	999.7	(19/2)$^-$	477.3	(15/2$^-$)	E2		0.00844	E_γ: from 1992Dr05. Other: 522.6 *3* (1992Hu02). Mult.: Q from A_2=+0.280 *40*, A_4=−0.024 *46*; M2 ruled out by RUL.
570.0 *3*	2 *1*	1730.3	(21/2$^-$)	1160.2	(17/2$^-$)				
572.4 *3*	<1	900.1	(13/2$^+$)	327.5	(9/2$^+$)				
600.3 *3*	30 *3*	1260.3	(15/2$^+$)	660.0	(11/2)$^+$				
602.9 *3*	2 *1*	2197.1	(23/2$^-$)	1594.0	(19/2$^-$)				
640.5 *3*	3 *1*	1236.9	(15/2$^+$)	596.5	(11/2$^+$)				
682.7 *3*	11 *2*	1160.2	(17/2$^-$)	477.3	(15/2$^-$)	D+Q	−0.36 *2*		Mult.: A_2=−0.653 *49*, A_4=+0.006 *67*.
685.6 *2*	43 *1*	1685.3	(23/2)$^-$	999.7	(19/2)$^-$	E2			E_γ: weighted average of 303.8 *3* (1992Hu02) and 303.6 *4* (1992Dr05). Mult.: Q from A_2=+0.429 *45*, A_4=+0.033 *51*; M2 ruled out by RUL.
701.7 *3*	≈1	4056.1	(33/2$^-$)	3354.4	(31/2$^-$)				
704.5 *3*	2 *1*	1604.8	(17/2$^+$)	900.1	(13/2$^+$)				
706.9 *3*	2 *1*	2436.9	(25/2$^-$)	1730.3	(21/2$^-$)				
721.0 *3*	2 *1*	2918.4	(27/2$^-$)	2197.1	(23/2$^-$)				
730.7 *2*	5 *1*	1730.3	(21/2$^-$)	999.7	(19/2)$^-$				E_γ: weighted average of 730.4 *3* (1992Hu02) and 730.9 *2* (1992Dr05).
734.2 *3*	5 *2*	1994.5	(19/2$^+$)	1260.3	(15/2$^+$)				E_γ: placed from a different (19/2$^+$) level by 1992Hu02.
741.4 *3*	≈1	3227.7	(29/2$^-$)	2486.1	(27/2)$^-$				

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^{108}Pd(^{19}F,4nγ),^{109}Ag(^{18}O,4nγ) 1992Hu02,1992Dr05 (continued)

γ(^{123}Cs) (continued)

E_γ[†]	I_γ[†]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[@]	Comments
743.2 *3*	6 *2*	2003.5	$(19/2^+)$	1260.3	$(15/2^+)$		
751.5 *3*	3 *1*	2436.9	$(25/2^-)$	1685.3	$(23/2)^-$		
757.9 *3*	2 *1*	1994.5	$(19/2^+)$	1236.9	$(15/2^+)$		
791.0 *3*	2 *1*	3227.7	$(29/2^-)$	2436.9	$(25/2^-)$		
800.6 *3*	18 *1*	2486.1	$(27/2)^-$	1685.3	$(23/2)^-$	E2	E_γ: 800.6 *2* (1992Dr05). Mult.: Q from A_2=+0.355 *51*, A_4=−0.043 *58*; M2 ruled out by RUL.
805.7 *3*	2 *1*	2410.6	$(21/2^+)$	1604.8	$(17/2^+)$		
811.4 *3*	≈1	3729.8	$(31/2^-)$	2918.4	$(27/2^-)$		
826.7 *3*	≈1	2821.2	$(23/2^+)$	1994.5	$(19/2^+)$		
828.4 *3*	≈1	4056.1	$(33/2^-)$	3227.7	$(29/2^-)$		
868.3 *3*	8 *1*	3354.4	$(31/2^-)$	2486.1	$(27/2)^-$	(E2)	Mult.: Q from A_2=+0.458 *48*, A_4=−0.057 *59*.
891.8 *3*	<1	4621.6	$(35/2^-)$	3729.8	$(31/2^-)$		
904.63 *3*	3 *1*	4259.0	$(35/2^-)$	3354.4	$(31/2^-)$		
955.5 *3*	≈1	5214.5	$(39/2^-)$	4259.0	$(35/2^-)$		
1024.0 *3*	<1	6238.5	$(43/2^-)$	5214.5	$(39/2^-)$		
1108		7346.5	$(47/2^-)$	6238.5	$(43/2^-)$		E_γ: from 1987Ha03.
1116.6 *3*	≈1	1594.0	$(19/2^-)$	477.3	$(15/2^-)$		
1197.7 *3*	≈1	2197.1	$(23/2^-)$	999.7	$(19/2)^-$		
1203		8549.5	$(51/2^-)$	7346.5	$(47/2^-)$		E_γ: from 1987Ha03.
1233.3 *3*	≈1	2918.4	$(27/2^-)$	1685.3	$(23/2)^-$		
1243.8 *3*	≈1	3729.8	$(31/2^-)$	2486.1	$(27/2)^-$		

[†] From 1992Hu02, unless otherwise noted.
[‡] This γ is placed from a 296-keV level by 1992Hu02 and the placement here is from 2000Gi12.
[#] Rounded values from Adopted Gammas. These γ rays are not reported by 1992Hu02, but unlabelled small peaks around these energies can be seen in the $\gamma\gamma$-coin spectrum gated on 304γ in Fig.1 of 1992Hu02, which match the peaks of these γ rays in the $\gamma\gamma$-coin spectrum gated on 304γ in Fig.2 of 2004Si26 in ^{100}Mo(^{28}Si,4npγ).
[@] From 1992Hu02, based on $\gamma(\theta)$ and RUL (where $T_{1/2}$ available), unless otherwise noted.
[&] 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.

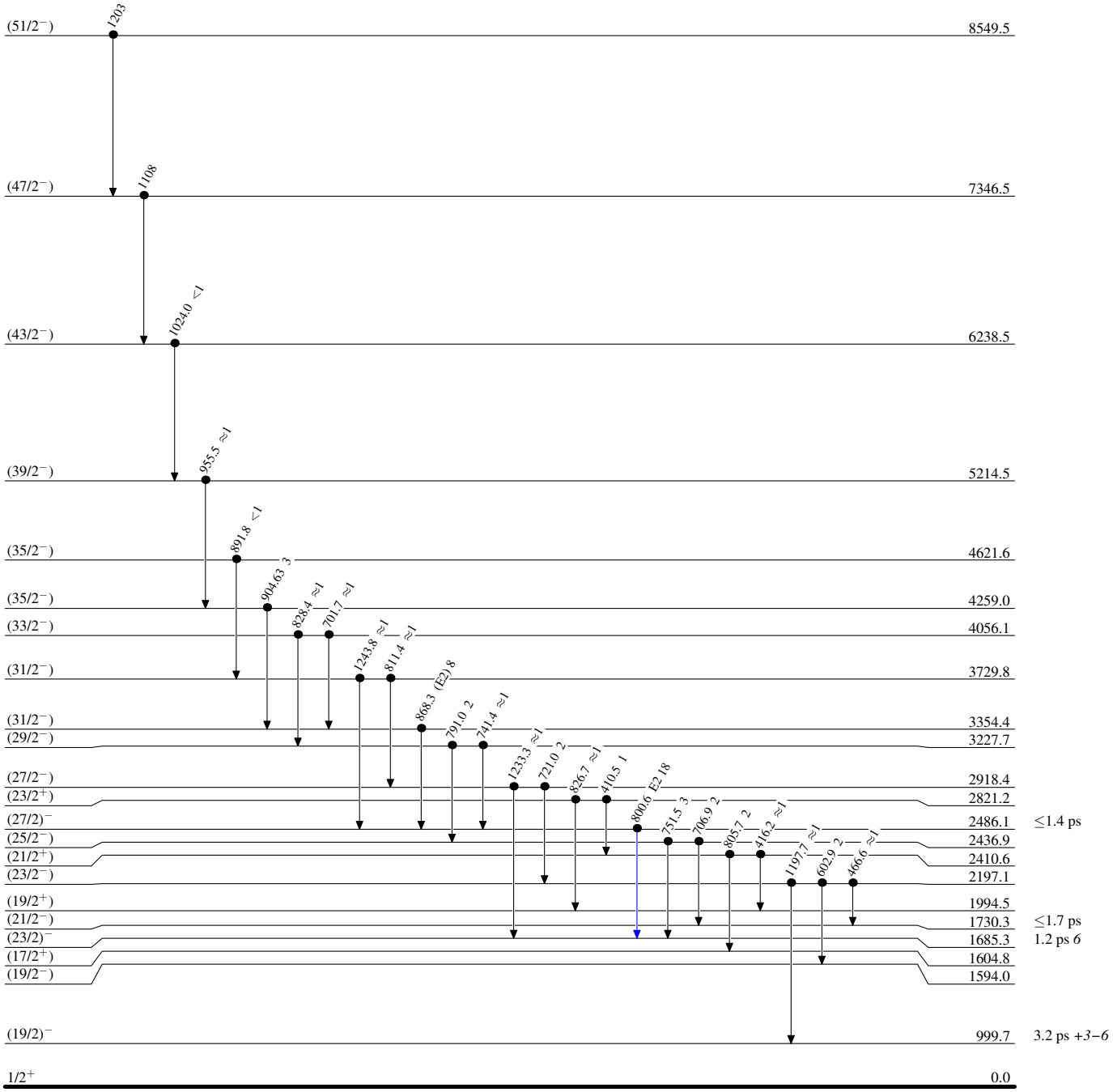
^{108}Pd(^{19}F,4nγ),^{109}Ag(^{18}O,4nγ) 1992Hu02,1992Dr05

Legend

$I_\gamma < 2\% \times I_\gamma^{max}$
$I_\gamma < 10\% \times I_\gamma^{max}$
$I_\gamma > 10\% \times I_\gamma^{max}$
Coincidence

Level Scheme

Intensities: Relative I_γ



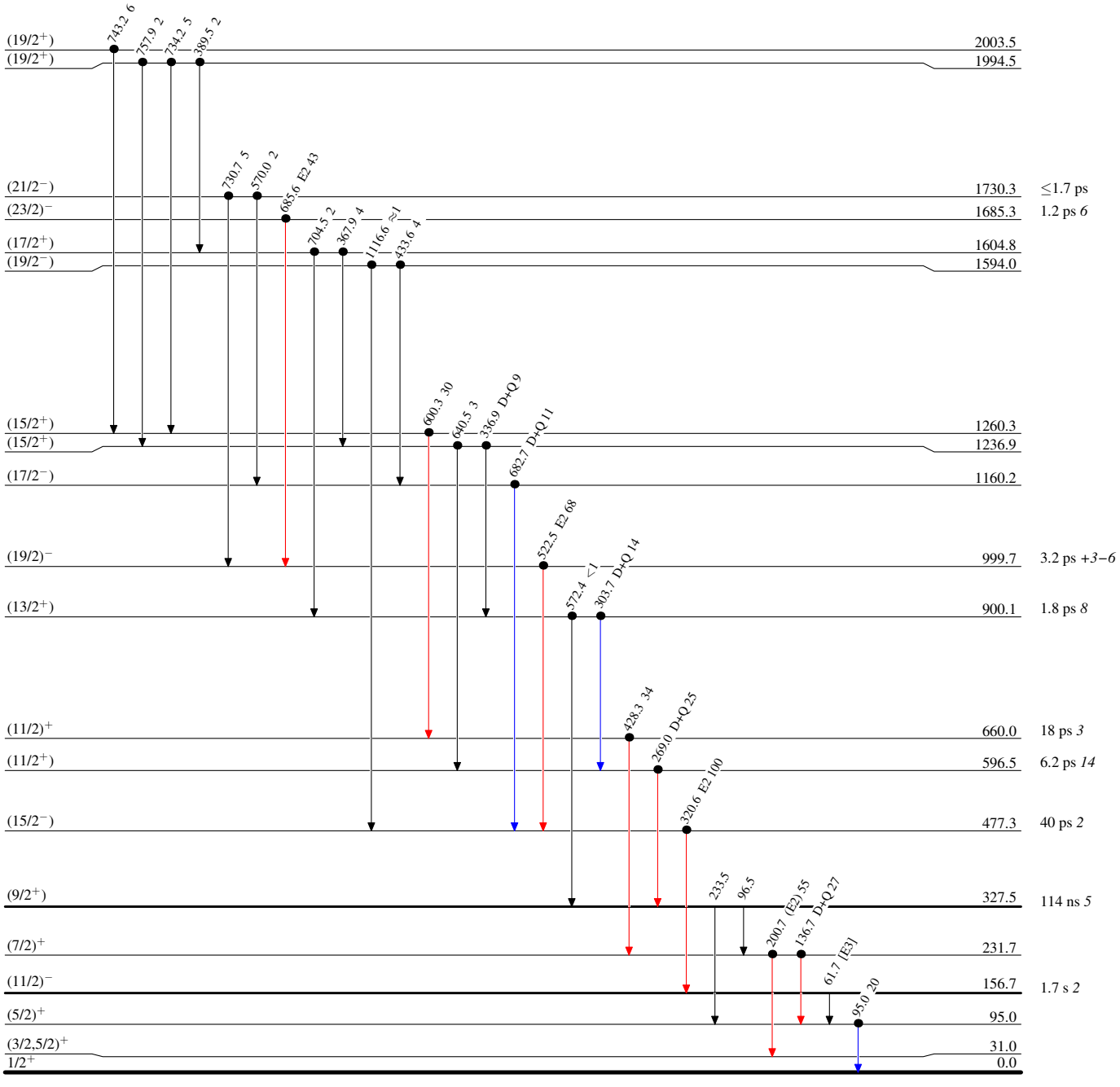
$^{123}_{55}Cs_{68}$

^{108}Pd(^{19}F,4nγ),^{109}Ag(^{18}O,4nγ) 1992Hu02,1992Dr05

Level Scheme (continued)

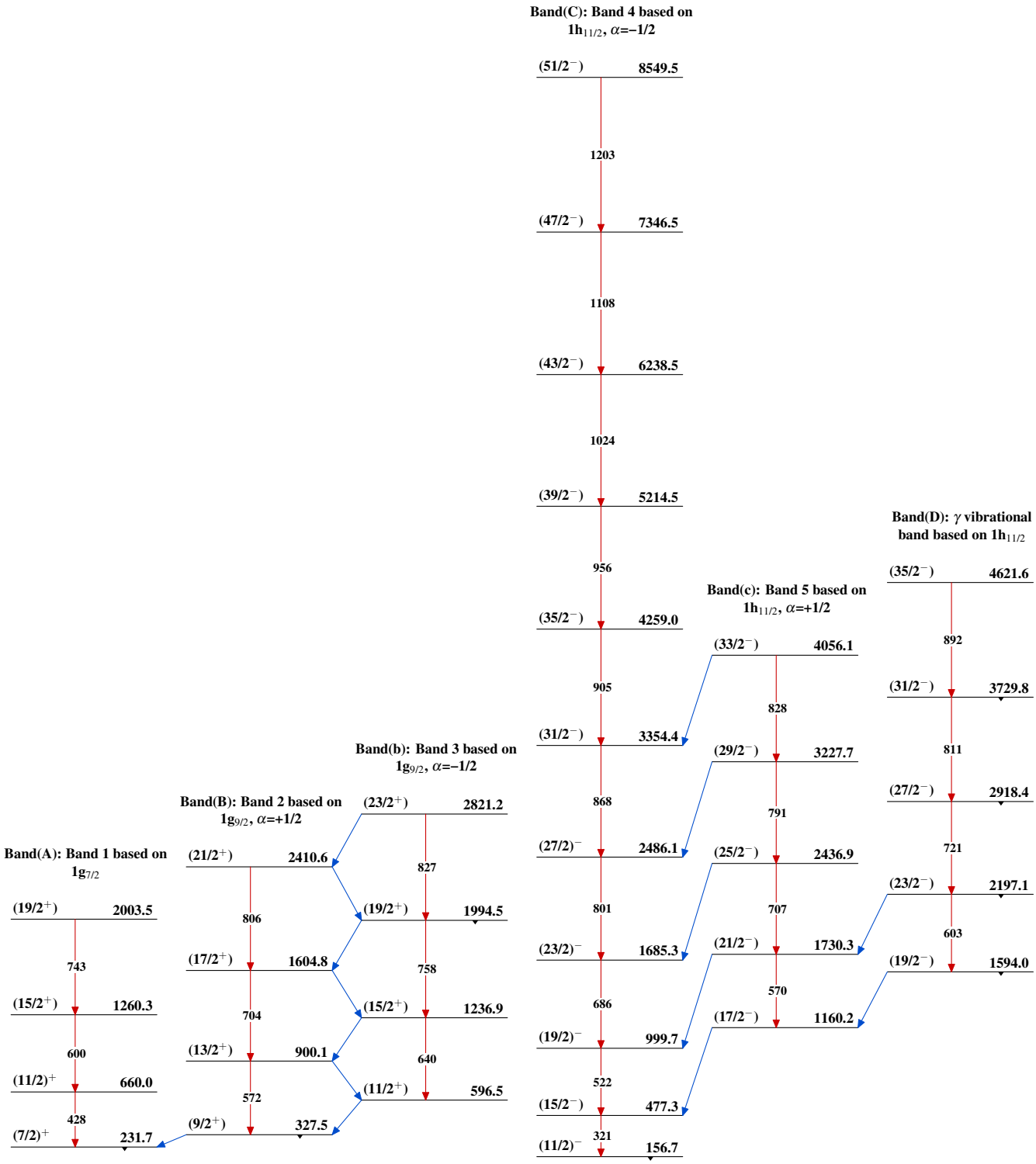
Intensities: Relative I_γ

Legend
- $I_\gamma < 2\% \times I_\gamma^{max}$
- $I_\gamma < 10\% \times I_\gamma^{max}$
- $I_\gamma > 10\% \times I_\gamma^{max}$
- Coincidence



$^{123}_{55}Cs_{68}$

^{108}Pd(^{19}F,4nγ),^{109}Ag(^{18}O,4nγ) 1992Hu02,1992Dr05



$^{123}_{55}Cs_{68}$