^{148}Sm(^{20}Ne,5nγ) 1987Bl06

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh	ENSDF	31-Dec-2014

1987Bl06: ^{148}Sm(^{20}Ne,5nγ) E=106-117 MeV. OSIRIS. Measured γ's, $\gamma\gamma$-coin, $\gamma\gamma(\theta)$(DCO). Multiplicity filters. γ's assigned to ^{163}Hf on the basis of excitation functions and on the dependence of Iγ's on the γ-ray multiplicity.

1998We02: ^{128}Te(^{40}Ca,5nγ), ^{126}Te(^{40}Ca,3nγ) E=175 MeV. Measured lifetime of first excited state by recoil-distance method and average g factors (for transitions from $29/2^+$ to $13/2^+$) by transient-field technique using Gd layer.

^{163}Hf Levels

E(level)[†]	J$^\pi$[‡]	$T_{1/2}$	Comments
0+x[#]	$(13/2^+)$		E(level): x=150.9 according to the level scheme proposed by 2014Ya30, and also Adopted Levels.
255.4+x[#] *3*	$(17/2^+)$	103 ps *8*	g=0.05 *8* $T_{1/2}$: recoil-distance method (1998We02). g: estimated experimental value (1998We02).
689.9+x[#] *5*	$(21/2^+)$		
1253.7+x[#] *5*	$(25/2^+)$		
1816.8+x[&] *5*	$(23/2^-)$		
1912.3+x[#] *6*	$(29/2^+)$		
2171.0+x[&] *6*	$(27/2^-)$		
2512.2+x[&] *6*	$(31/2^-)$		
2642.0+x[#] *7*	$(33/2^+)$		
2981.3+x[&] *7*	$(35/2^-)$		
3405.5+x[#] *7*	$(37/2^+)$		
3581.2+x[&] *7*	$(39/2^-)$		
4120.2+x[@] *8*	$(41/2^+)$		
4289.4+x[&] *8*	$(43/2^-)$		
4813.3+x[@] *9*	$(45/2^+)$		
5077.4+x[&] *9*	$(47/2^-)$		
5554.1+x[@] *9*	$(49/2^+)$		
5940.2+x[&] *9*	$(51/2^-)$		
6360.0+x[@] *10*	$(53/2^+)$		
6903.0+x?[&] *10*	$(55/2^-)$		
7234.1+x[@] *10*	$(57/2^+)$		

[†] 1987Bl06 observed a number of weaker γ rays which might be members of a band built on the g.s. or the unfavored members of the $13/2^+$ band, but the coincidence relationships were too ambiguous to make firm assignments.

[‡] In neighboring odd-A nuclei the $\nu i_{13/2}$ sequence is most strongly populated in (HI,xn) reactions. Therefore, 1987Bl06 assume that this band is observed, built on the $13/2^+$ state. Parentheses are added by the evaluators for all levels up to 53/2.

[#] Band(A): Band A: π=+,α=+1/2. $\nu i_{13/2}$, $K^\pi=13/2^+$. Band assignment is from systematics of the neighboring nuclei (1987Bl06). Band crossing occurs at h\‘$\omega\approx$0.36 due to the alignment of a pair of neutrons, giving rise to ABC configuration. Average g factor=+0.18 *4*(stat) *2*(syst) (1998We02) for 434.5γ ($21/2^+$ to $17/2^+$) and 658.6γ ($29/2^+$ to $25/2^+$).

[@] Band(B): Band ABC: π=+,α=+1/2.

[&] Band(C): Band ABF: π=−,α=−1/2.

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$\gamma(^{163}Hf)$

DCO is ratio of intensities measured in $\gamma\gamma$ coin with detectors at 30° and 90° gated on known E2 transitions.

E_γ	I_γ[†]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	α[a]	Comments
255.4 *3*	80 *4*	255.4+x	(17/2$^+$)	0+x	(13/2$^+$)	(E2)	0.1299	DCO=0.76 *3* I_γ: from $\gamma\gamma$ projection spectrum. Mult.: DCO suggests ΔJ=1, dipole; but in ^{94}Zr(^{74}Ge,5nγ) (2014Ya30), DCO is consistent with ΔJ=2, quadrupole.
[x]308.9 *3*	4.3 *9*					D[&]		DCO=0.51 *6*
341.3 *3*	14.6 *15*	2512.2+x	(31/2$^-$)	2171.0+x	(27/2$^-$)	(E2)[@]	0.0542	DCO=0.98 *8*
354.2 *3*	3.3 *7*	2171.0+x	(27/2$^-$)	1816.8+x	(23/2$^-$)	(E2)[@]		DCO=1.01 *9*
[x]389.0 *3*	7.5 *8*					D[&]		DCO=0.78 *9*
434.5 *3*	100[‡] *5*	689.9+x	(21/2$^+$)	255.4+x	(17/2$^+$)	(E2)[@]		DCO=0.99 *3*
469.1 *3*	25.8 *13*	2981.3+x	(35/2$^-$)	2512.2+x	(31/2$^-$)	(E2)[@]		DCO=1.06 *7*
[x]513.4 *3*	7.7 *8*					Q[@]		DCO=1.06 *12*
[x]536.8 *3*	6.8 *7*					Q[@]		DCO=1.46 *19*
563.7 *3*	69 *3*	1253.7+x	(25/2$^+$)	689.9+x	(21/2$^+$)	Q[@]		DCO=1.01 *4*
599.9[b] *3*	25.5[b] *13*	2512.2+x	(31/2$^-$)	1912.3+x	(29/2$^+$)	(Q)		
599.9[b] *3*	25.5[b] *13*	3581.2+x	(39/2$^-$)	2981.3+x	(35/2$^-$)	(Q)		DCO=1.04 *8* Mult.: DCO for doublet consistent with ΔJ=2, quadrupole.
[x]619.0 *3*	5.6 *6*					Q[@]		DCO=1.07 *21*
658.6 *3*	40.3 *20*	1912.3+x	(29/2$^+$)	1253.7+x	(25/2$^+$)	Q[@]		DCO=1.02 *5*
693.1 *3*	6.9[‡] *7*	4813.3+x	(45/2$^+$)	4120.2+x	(41/2$^+$)	Q[@]		DCO=1.03 *13*
708.2 *3*	9.7 *10*	4289.4+x	(43/2$^-$)	3581.2+x	(39/2$^-$)	Q[@]		DCO=1.07 *9*
714.7 *3*	12.7[‡] *13*	4120.2+x	(41/2$^+$)	3405.5+x	(37/2$^+$)	Q[@]		DCO=1.06 *9*
729.7 *3*	30.0 *15*	2642.0+x	(33/2$^+$)	1912.3+x	(29/2$^+$)	Q[@]		DCO=0.99 *10*
740.8 *3*	5.7[‡] *6*	5554.1+x	(49/2$^+$)	4813.3+x	(45/2$^+$)	Q[@]		DCO=1.26 *17*
763.5 *3*	18.8[‡] *19*	3405.5+x	(37/2$^+$)	2642.0+x	(33/2$^+$)	Q[@]		DCO=0.94 *18*
787.9 *10*	4.8 *10*	5077.4+x	(47/2$^-$)	4289.4+x	(43/2$^-$)	Q[@]		DCO=0.85 *13*
805.9 *10*	3.5[‡] *7*	6360.0+x	(53/2$^+$)	5554.1+x	(49/2$^+$)	Q[@]		DCO=0.93 *22*
862.8 *10*	2.4 *5*	5940.2+x	(51/2$^-$)	5077.4+x	(47/2$^-$)	Q[@]		DCO=1.2 *3*
[x]869.0 *3*	6.1 *6*					Q[@]		DCO=1.43 *34*
874.1 *10*	<2.9[‡]	7234.1+x	(57/2$^+$)	6360.0+x	(53/2$^+$)			DCO=0.9 *6*
917.3 *3*	12.0 *12*	2171.0+x	(27/2$^-$)	1253.7+x	(25/2$^+$)	D[&]		DCO=0.51 *6*
962.8[c] *10*	<2.7	6903.0+x?	(55/2$^-$)	5940.2+x	(51/2$^-$)			
1127.0 *10*	3.1 *6*	1816.8+x	(23/2$^-$)	689.9+x	(21/2$^+$)	D[&]		DCO=0.50 *29*
[x]1164.0 *10*	2.7 *5*							

[†] Relative intensities from spectra in coincidence with 255.4 or 434.5 γ rays, except as noted. The quoted uncertainties represent upper limits.

[‡] From $\gamma\gamma$, gated with other than 255γ or 434γ.

[#] Assigned by the evaluator based on DCO ratios, where mult=Q indicates ΔJ=2, quadrupole (most likely E2) transition and mult=D indicates ΔJ=1, dipole or dipole with some quadrupole admixture. In a few cases, as noted, mult=D indicates ΔJ=0, dipole or dipole with some quadrupole admixture. For transitions below 500 keV, ΔJ=2, quadrupole transitions are assigned (E2) from RUL=1 for M2, assuming level half-life <10 ns.

[@] DCO≈1 or >1 consistent with ΔJ=2, quadrupole.

Continued on next page (footnotes at end of table)

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γ(^{163}Hf) (continued)

& DCO<1 consistent with ΔJ=1, dipole or D+Q.
[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] Multiply placed with undivided intensity.
[c] Placement of transition in the level scheme is uncertain.
[x] γ ray not placed in level scheme.

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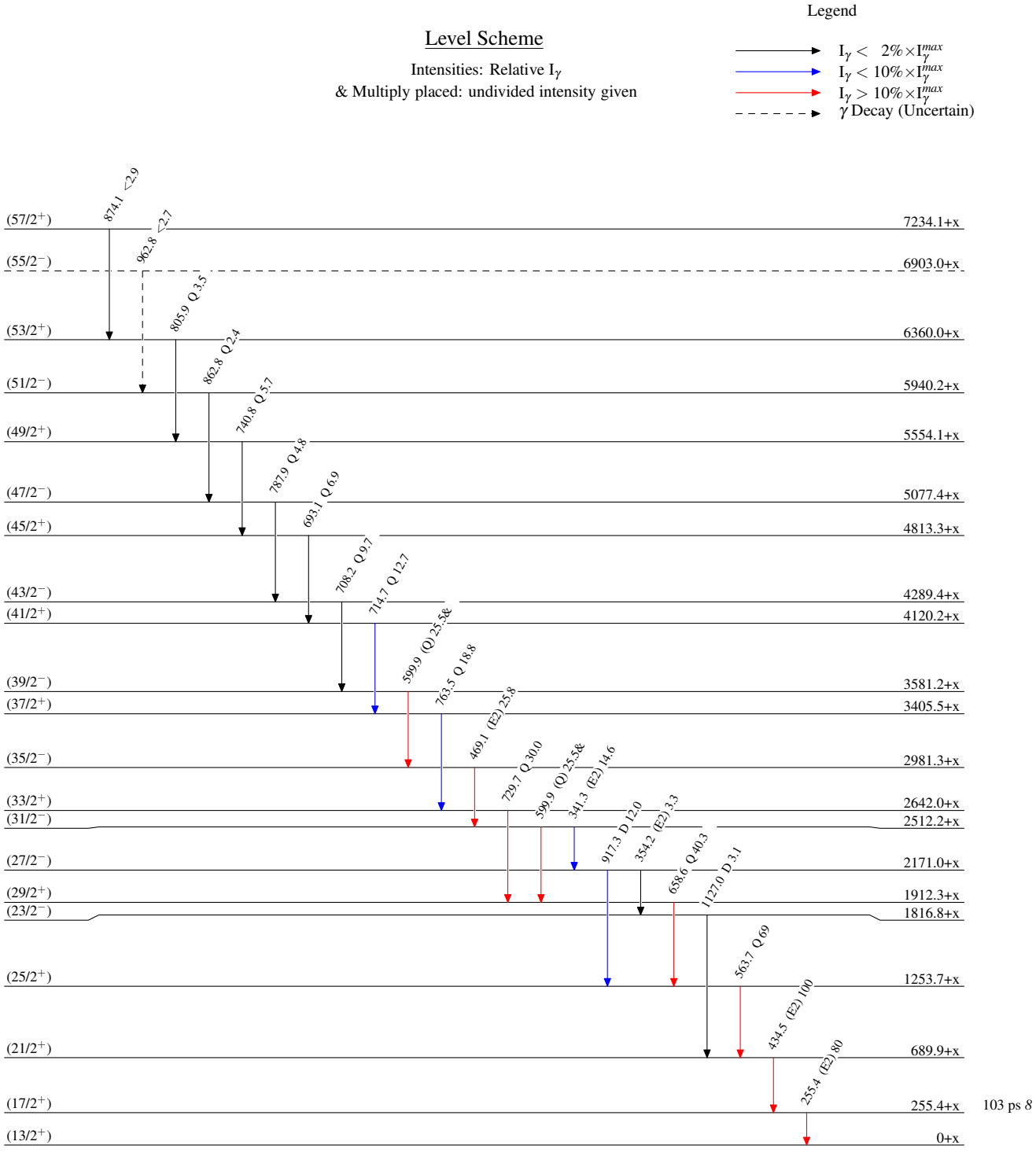
Level Scheme

Intensities: Relative I_γ

& Multiply placed: undivided intensity given



$^{163}_{72}Hf_{91}$

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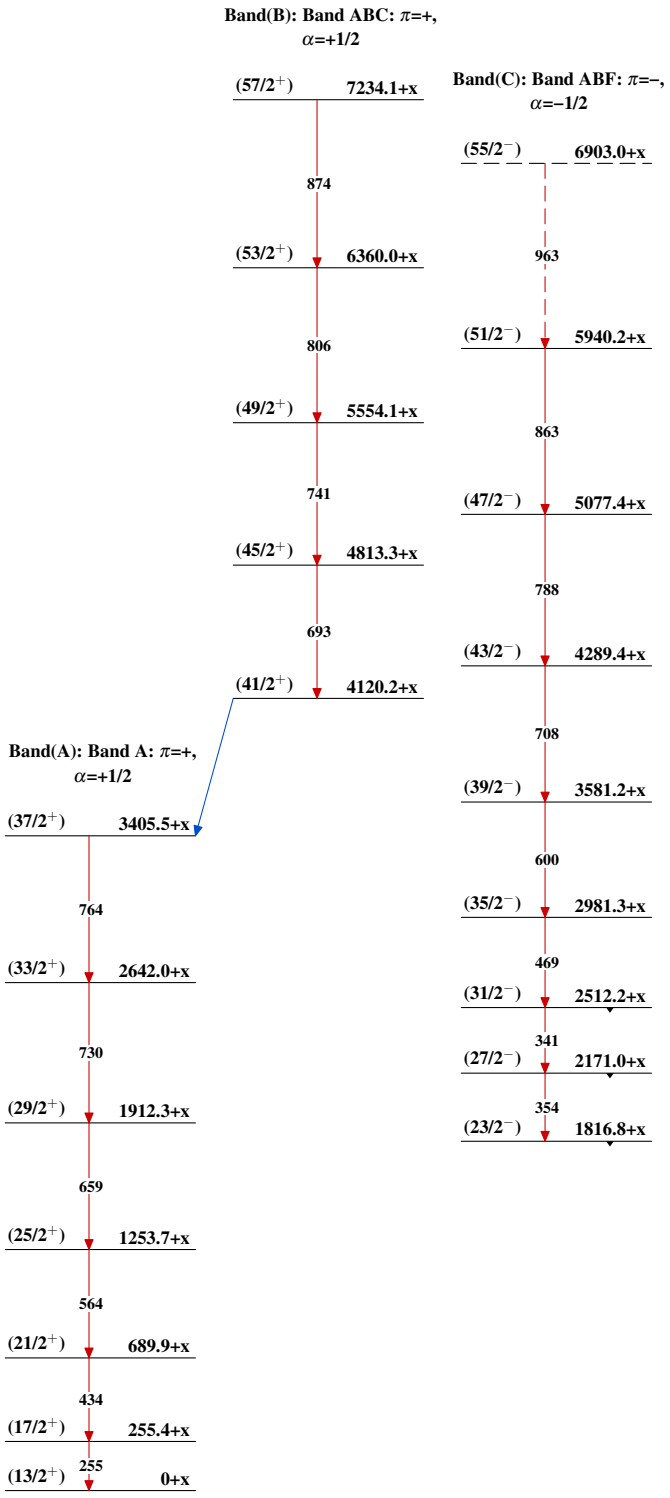

$^{163}_{72}Hf_{91}$