^{133}Cs(^{12}C,4nγ) 2004Bh01

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	N. Nica	NDS 187,1 (2023)	12-Oct-2022

2004Bh01: E=65 MeV, pulsed and 'dc' beam. Measured Eγ, Iγ, γγ, γγ(t), γγ(θ)(DCO) using an array of seven HPGe detectors with anti-Compton shields; and a multiplicity filter of 14 BGO detectors.

^{141}Pm Levels

Structures in ^{141}Pm are interpreted as coupling of positive- and negative-parity states in ^{140}Nd core with single-particle (proton) orbitals ($\pi h_{11/2}$, $\pi d_{5/2}$, $\pi g_{7/2}$).

E(level)[†]	Jπ[‡]	$T_{1/2}$[#]	Comments
0.0	5/2+		
196.90 *16*	7/2+		
628.50[@] *16*	11/2−	0.63 μs *2*	$T_{1/2}$: from Adopted Levels.
973.90 *17*	11/2+		
1312.70 *21*	13/2−		
1510.40[@] *17*	15/2−		
1891.40 *20*	19/2−		
1969.71 *18*	15/2+		
2137.71 *22*	13/2+		
2238.71[@] *19*	19/2−		
2349.21[a] *22*	19/2−	54 ns *5*	$T_{1/2}$: mentioned by authors as half-life on page 8, but as mean lifetime on page 17 in their paper. Comparison of lifetime of 822 level in ^{139}Pr measured by the authors suggests that the value of 54 ns is half-life, not mean life.
2381.21 *25*	15/2−		
2509.41[&] *25*	19/2−		
2530.4 *3*	(23/2−)		
2574.4 *4*		≥2 μs	$T_{1/2}$: from γ(t) of 381γ, 639γ and 882γ. E(level): energy of this level not well established, decaying 44γ observed in previous work of the same group (see γ table).
2622.91 *18*	17/2+		
2639.71 *25*	21/2−		
2641.31 *25*	17/2−		
2661.2[a] *3*	21/2−		
2702.91[@] *20*	21/2−		
2809.8[&] *3*	21/2−		
2824.2 *4*	25/2−		
2840.2 *4*	(23/2−)		
2899.41[@] *23*	23/2−	≤0.7 ns	
3098.2 *4*	(25/2−)	≤0.7 ns	
3122.2[&] *4*	25/2−	≤0.7 ns	
3157.2[a] *4*	23/2−	≤0.7 ns	
3246.51 *24*	25/2−	≤0.7 ns	
3465.51 *24*	25/2−	≤0.7 ns	
3476.7[&] *4*	27/2−	≤0.7 ns	
3702.31[b] *24*	25/2−	≤0.7 ns	
3879.7 *4*	(23/2−)	≤0.7 ns	
3884.3 *3*	27/2−	≤0.7 ns	
4063.4[b] *3*	27/2−	≤0.7 ns	
4075.2 *4*	(27/2−)	≤0.7 ns	

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^{133}Cs(^{12}C,4nγ) 2004Bh01 (continued)

^{141}Pm Levels (continued)

E(level)[†]	Jπ[‡]	T1/2[#]
4110.2[a] 4	(25/2⁻)	≤0.7 ns
4427.7[&] 4	(29/2⁻)	≤0.7 ns
4625.4[b] 3	29/2⁻	≤0.7 ns
4682.2[&] 5	(31/2⁻)	≤0.7 ns
4721.5 3	(29/2⁻)	≤0.7 ns
4861.9[b] 3	31/2⁻	≤0.7 ns
4916.4 3	(31/2⁻)	≤0.7 ns
5094.2[b] 3	33/2⁻	≤0.7 ns
5337.5[b] 4	(35/2⁻)	≤0.7 ns
5435.2 4		≤0.7 ns

† From least-squares fit to Eγ′s.
‡ From 2004Bh01 based on measured multipolarities, reaction type, and the implicit assumption that spin is generally increasing with increasing excitation energy. These J^π values can differ from those in Adopted Levels, Gammas dataset.
# For levels above 2899, $T_{1/2}$≤0.7 ns from generalized centroid-shift method.
@ Band(A): γ sequence based on 11/2⁻.
& Band(B): γ sequence based on 19/2⁻.
a Band(C): γ sequence based on 19/2⁻.
b Band(D): γ sequence based on 25/2⁻.

γ(^{141}Pm)

DCO′s correspond to gates on ΔJ=2, Q transitions, unless otherwise stated.

Eγ[†]	Iγ[‡]	Ei(level)	Jπi	Ef	Jπf	Mult.[#]	Comments
44.0 2		2574.4		2530.4	(23/2⁻)		Eγ: taken from authors′ earlier work in ^{133}Cs(^{13}C,5nγ) in 2000Bh08; not seen in the present work.
61.6 2		2702.91	21/2⁻	2641.31	17/2⁻		
80.0 2		2702.91	21/2⁻	2622.91	17/2⁺		
110.5 1	10.84	2349.21	19/2⁻	2238.71	19/2⁻	M1+E2	DCO=0.86 19
140.4 2	3.94	4861.9	31/2⁻	4721.5	(29/2⁻)	M1	DCO=0.59 24
163.0 2	1.25	2824.2	25/2⁻	2661.2	21/2⁻	(E2)	DCO=0.9 5
170.1 2	7.63	2809.8	21/2⁻	2639.71	21/2⁻	M1	DCO=0.48 8
x177.0 2	5.84						
179.0 2	5.87	2840.2	(23/2⁻)	2661.2	21/2⁻		
196.5 1	67.02	2899.41	23/2⁻	2702.91	21/2⁻		
196.9 2	≈70	196.90	7/2⁺	0.0	5/2⁺	[&]	Iγ: ≈70.
197.7 2	≈15	1510.40	15/2⁻	1312.70	13/2⁻		Iγ: ≈15.
219.0		3465.51	25/2⁻	3246.51	25/2⁻		Eγ: weak γ ray from authors′ figure 7.
232.3 1	11.99	5094.2	33/2⁻	4861.9	31/2⁻	M1	DCO=0.47 6
236.5 2	8.4	4861.9	31/2⁻	4625.4	29/2⁻	M1	DCO=0.55 6
236.8 2	8.4	3702.31	25/2⁻	3465.51	25/2⁻		
243.3 2	3.02	5337.5	(35/2⁻)	5094.2	33/2⁻	(M1+E2)[@]	DCO=1.1 7
254.5 2	4.28	4682.2	(31/2⁻)	4427.7	(29/2⁻)	(M1)	DCO=0.45 9
258.0 2	4.02	3098.2	(25/2⁻)	2840.2	(23/2⁻)	M1+E2	DCO=0.35 8
260.1 2	6.88	2641.31	17/2⁻	2381.21	15/2⁻	M1+E2[@]	DCO=1.44 25
291.0 2	2.76	4916.4	(31/2⁻)	4625.4	29/2⁻	(M1)[@]	DCO=1.0 6
300.4 2	2.11	2809.8	21/2⁻	2509.41	19/2⁻	M1	DCO=0.6 3
312.0 2	8.71	2661.2	21/2⁻	2349.21	19/2⁻	M1+E2	DCO=0.63 9 Iγ: for 312.0+312.4; intensity for 312.4γ seems 2 from authors′ figure 7. DCO for 312.0+312.4.
312.4		3122.2	25/2⁻	2809.8	21/2⁻		
341.0 2	1.84	5435.2		5094.2	33/2⁻		

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^{133}Cs(^{12}C,4nγ) 2004Bh01 (continued)

γ(^{141}Pm) (continued)

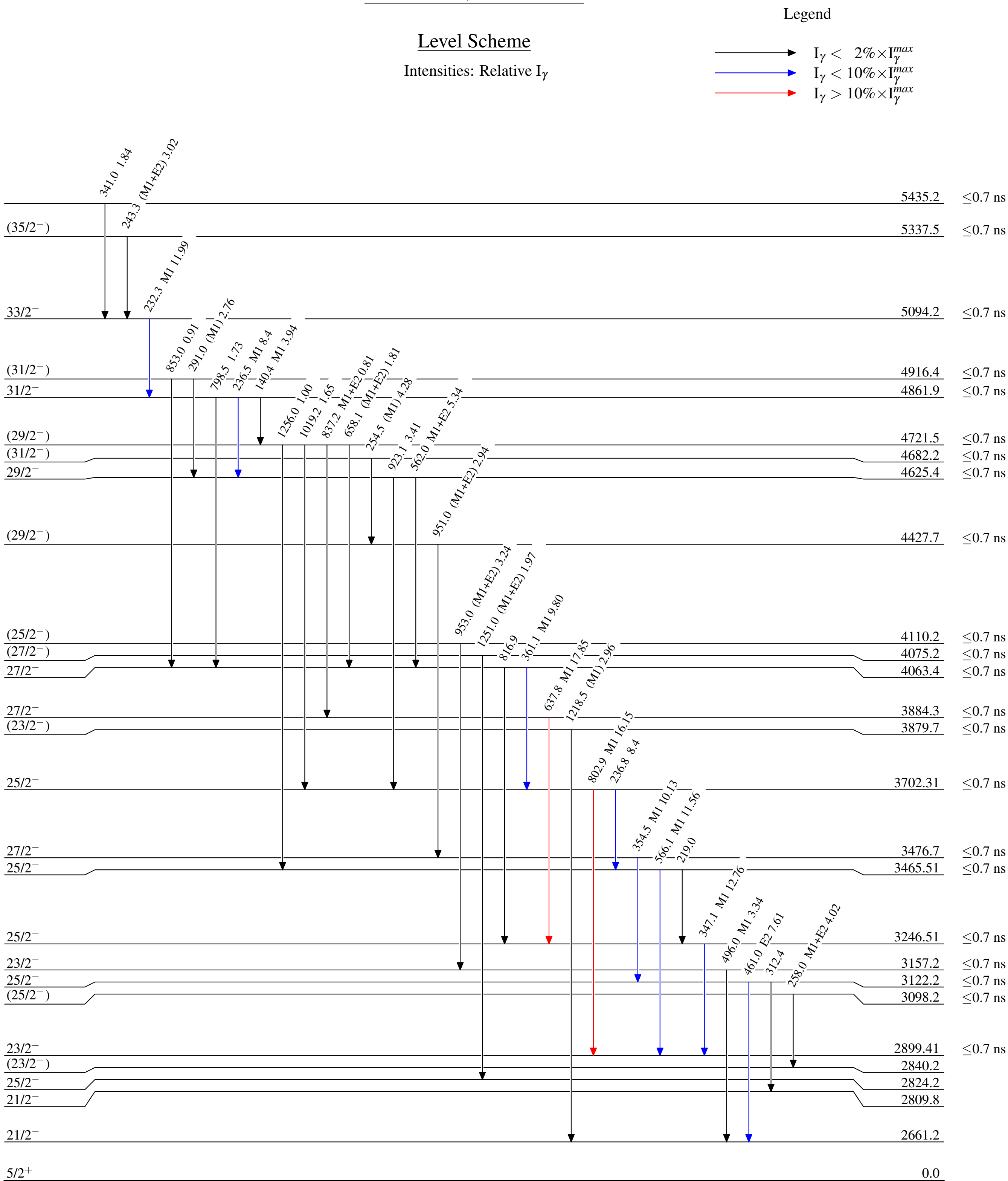
Eγ[†]	Iγ[‡]	Ei(level)	J^{π}_{i}	Ef	J^{π}_{f}	Mult.[#]	Comments
347.1 *1*	12.76	3246.51	25/2⁻	2899.41	23/2⁻	M1	DCO=0.53 *8*
354.5 *1*	10.13	3476.7	27/2⁻	3122.2	25/2⁻	M1	DCO=0.54 *6*
361.1 *2*	9.80	4063.4	27/2⁻	3702.31	25/2⁻	M1[@]	DCO=0.8 *6*
381.0 *1*	19.65	1891.40	19/2⁻	1510.40	15/2⁻	E2	DCO=0.94 *12*
401.0 *2*	7.18	2639.71	21/2⁻	2238.71	19/2⁻		
431.6 *2*	≈70	628.50	11/2⁻	196.90	7/2⁺	[&]	Iγ: ≈70.
461.0 *2*	7.61	3122.2	25/2⁻	2661.2	21/2⁻	E2	DCO=1.1 *3*
464.2 *1*	10.41	2702.91	21/2⁻	2238.71	19/2⁻	M1+E2	DCO=0.65 *10*
485.2 *2*	1.85	2622.91	17/2⁺	2137.71	13/2⁺	E2	DCO=0.7 *3*
496.0 *2*	3.34	3157.2	23/2⁻	2661.2	21/2⁻	M1	DCO=0.49 *21*
562.0 *2*	5.34	4625.4	29/2⁻	4063.4	27/2⁻	M1+E2[@]	DCO=1.4 *3*
566.1 *1*	11.56	3465.51	25/2⁻	2899.41	23/2⁻	M1	DCO=0.57 *18*
628.5 *2*	≈5	628.50	11/2⁻	0.0	5/2⁺	E3[&]	Iγ: ≈5.
637.8 *1*	17.85	3884.3	27/2⁻	3246.51	25/2⁻	M1[@]	DCO=0.95 *25*
639.0 *2*		2530.4	(23/2⁻)	1891.40	19/2⁻		
653.2 *1*	12.85	2622.91	17/2⁺	1969.71	15/2⁺	M1	DCO=0.45 *8*
658.1 *2*	1.81	4721.5	(29/2⁻)	4063.4	27/2⁻	(M1+E2)[@]	DCO=1.5 *10*
684.2 *2*	4.49	1312.70	13/2⁻	628.50	11/2⁻	M1+E2	DCO=0.7 *4*
728.3 *1*	44.89	2238.71	19/2⁻	1510.40	15/2⁻	E2	DCO=1.05 *9*
777.0 *1*	24.63	973.90	11/2⁺	196.90	7/2⁺	[&]	
798.5 *2*	1.73	4861.9	31/2⁻	4063.4	27/2⁻		
802.9 *1*	16.15	3702.31	25/2⁻	2899.41	23/2⁻	M1	DCO=0.50 *11*
816.9 *2*		4063.4	27/2⁻	3246.51	25/2⁻		
837.2 *2*	0.81	4721.5	(29/2⁻)	3884.3	27/2⁻	M1+E2[@]	DCO=1.0 *5*
853.0 *2*	0.91	4916.4	(31/2⁻)	4063.4	27/2⁻		
881.9 *1*	70.87	1510.40	15/2⁻	628.50	11/2⁻	[&]	
923.1 *2*	3.41	4625.4	29/2⁻	3702.31	25/2⁻		
951.0 *2*	2.94	4427.7	(29/2⁻)	3476.7	27/2⁻	(M1+E2)	DCO=0.75 *25*
953.0 *2*	3.24	4110.2	(25/2⁻)	3157.2	23/2⁻	(M1+E2)	DCO=1.2 *7*
995.8 *1*	13.18	1969.71	15/2⁺	973.90	11/2⁺	E2	DCO=0.91 *22*
999.0 *2*	8.12	2509.41	19/2⁻	1510.40	15/2⁻	E2	DCO=1.0 *7*
1019.2 *2*	1.65	4721.5	(29/2⁻)	3702.31	25/2⁻		
1068.5 *2*	4.54	2381.21	15/2⁻	1312.70	13/2⁻		
1112.5 *1*	17.81	2622.91	17/2⁺	1510.40	15/2⁻	D[&]	DCO=0.67 *23*
1163.8 *2*	2.66	2137.71	13/2⁺	973.90	11/2⁺	M1	DCO=0.6 *4*
1218.5 *2*	2.96	3879.7	(23/2⁻)	2661.2	21/2⁻	(M1)	DCO=0.6 *3*
1251.0 *2*	1.97	4075.2	(27/2⁻)	2824.2	25/2⁻	(M1+E2)	DCO=0.32 *16*
1256.0 *2*	1.00	4721.5	(29/2⁻)	3465.51	25/2⁻		

[†] Uncertainty of 0.1 keV assigned to Eγ′s with Iγ≥10 and 0.2 keV for Eγ′s with Iγ<10, based on a general comment by 2004Bh01.
[‡] Overall uncertainty is 10% for strong γ rays and 15-20% for weak transitions.
[#] From 2004Bh01 based on DCO ratio measurements, unless noted otherwise. They adopt E2 for Q transitions and M1 for D transitions (and M1+E2 for D+Q) based on the heavy ion type of reaction. These values can differ from those in Adopted Levels, Gammas dataset.
[@] DCO corresponds to gate on ΔJ=1, dipole transition.
[&] From literature.
[x] γ ray not placed in level scheme.

$^{133}Cs(^{12}C,4n\gamma)$ 2004Bh01

Level Scheme

Intensities: Relative I_γ

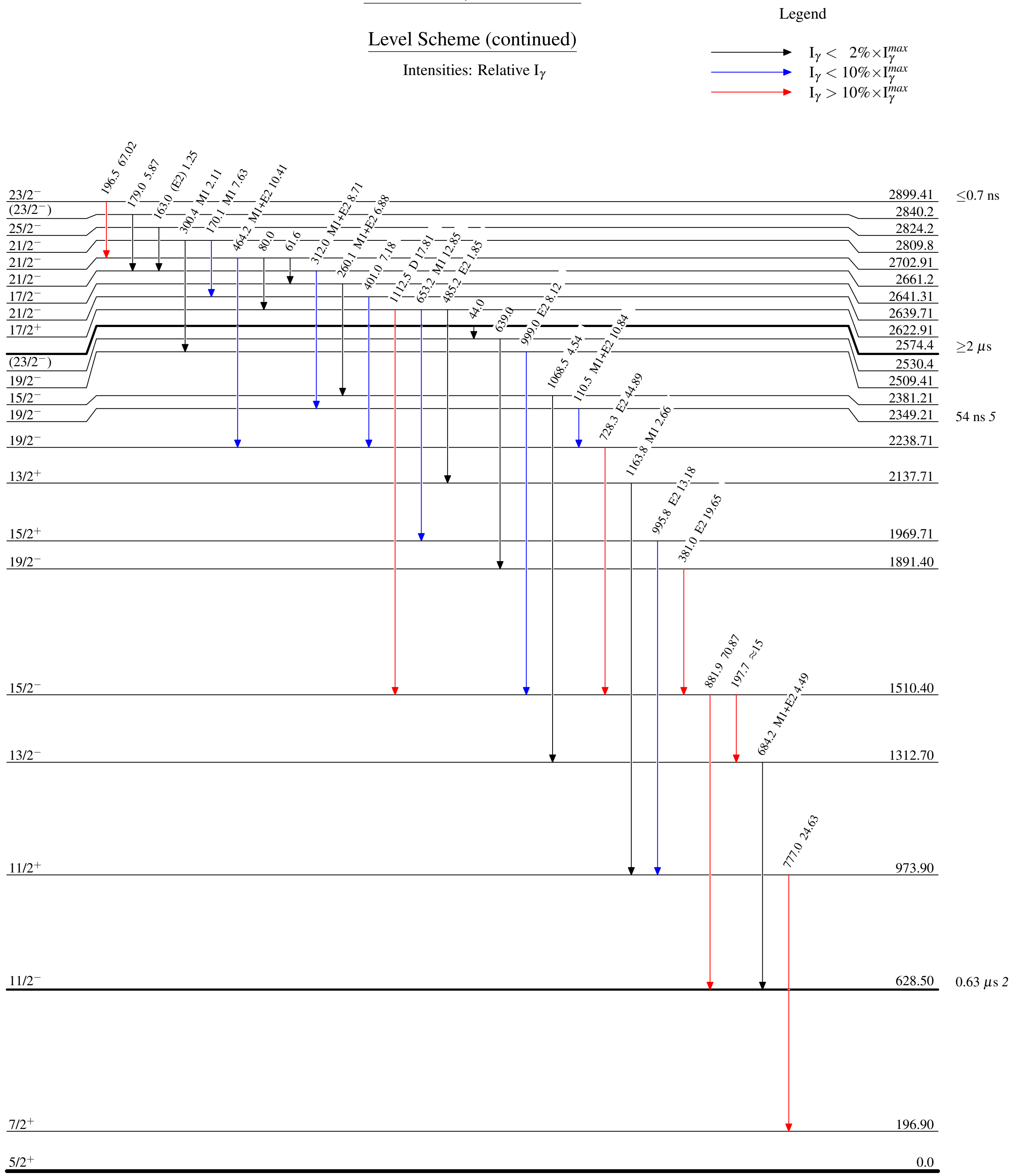


$^{141}_{61}Pm_{80}$

$^{133}Cs(^{12}C,4n\gamma)$ 2004Bh01

Level Scheme (continued)

Intensities: Relative I_γ

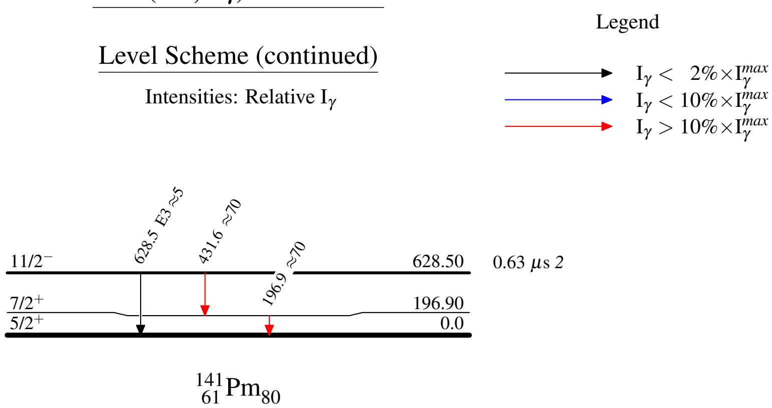


$^{141}_{61}Pm_{80}$

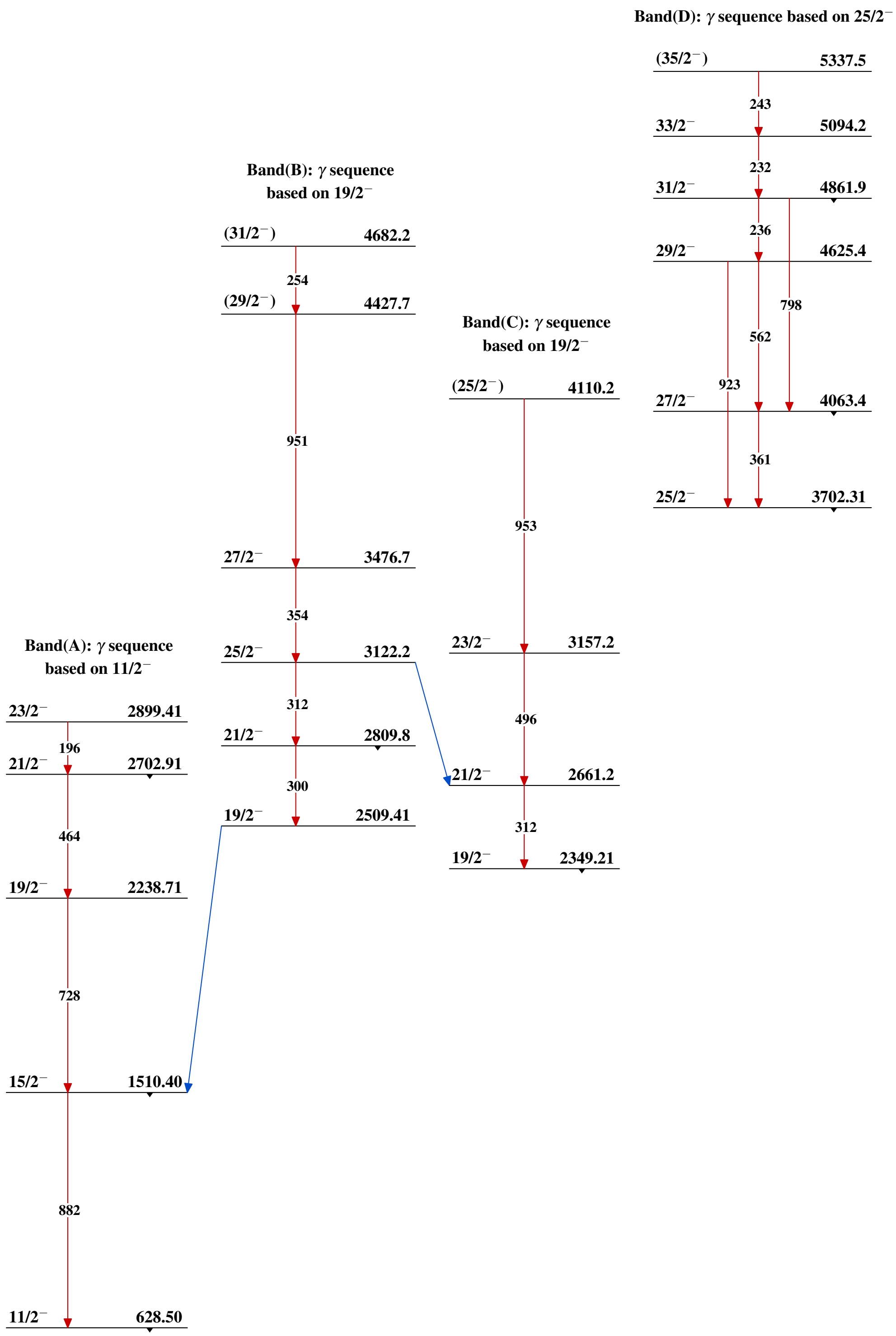
$^{133}Cs(^{12}C,4n\gamma)$ **2004Bh01**

Level Scheme (continued)

Intensities: Relative I_γ



^{133}Cs(^{12}C,4nγ) 2004Bh01



$^{141}_{61}Pm_{80}$