Coulomb excitation **1992Ku15,2003Ha01,1986Ta02**

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	N. Nica	NDS 132, 1 (2016)	4-Dec-2015

The following references provide data for only two excited levels.
1955Ma77: E(p)=2.9 MeV on natural Gd; γ measured with NaI.
1956Bj41: E(p)=1.75 MeV and E(α)=1.75 MeV on natural Gd; ce measured in magnetic spectrometer.
1956He78: E(α) ≈ 6 MeV on enriched Gd; γ measured with NaI.
1957Be56: E(α)=3.25 MeV on natural Gd; ce measured.
1958Ch36: E(p) ≤ 3.7 MeV on natural Gd; γ measured with curved-crystal spectrometer.
1958Ra12: E(p)=4 MeV and E(d)=4 MeV; scattered particles measured in magnetic spectrometer.
1959De29: E(-p)=4 MeV on enriched Gd; measured γ yield and $\gamma(\theta)$.
1962Go23: E(-p) ≈ 3.2 MeV; γ measured with NaI and scattered p in magnetic spectrometer.
1963Al30: E(^{14}N)=52 MeV on enriched Gd; measured γ with NaI and scattered ^{14}N in Si detector.
The following references provide data for more than two excited levels.
1966Bo16: E(^{16}O)=42-47 MeV; measured γ's with Ge detector. Report 4 levels.
1986Ta02: E(p)=3.4-4.4 MeV; measured γ's with Ge detector. Report B(E2)'s for 7 levels up to 814 keV.
1992Ku15: E(^{58}Ni)=240 MeV and E(^{81}Br)=305 MeV; measured $\gamma\gamma$ coincidence and $\gamma(\theta)$ with Compton-suppressed Ge detectors, and level $T_{1/2}$ by Doppler-shift, recoil-distance method. Report 11 levels in ground-state band to 25/2$^-$ at 1630 keV.
2003Ha01: E(^{136}Xe)=516 MeV; measured $\gamma\gamma$ coincidences and $\gamma(\theta)$ in GEMINI array with 10 Compton-suppressed Ge detectors. E_γ. I_γ, and DCO's used to assemble decay scheme, but not reported. Levels reported to 29/2$^-$ and 29/2$^+$.
Additional information 1.

^{157}Gd Levels

BE2 values are from 1986Ta02, unless otherwise noted. Values from (d,d′) study (1971St03), which are given in comments, are subject to question since the relation of the (d,d′) cross section and B(E2) is complex in odd-A nuclei, so they are given here only for comparison. See Adopted Levels for values from muonic atom studies.
The authors of 1992Ku15 published an Erratum (Phys.Rev. C63, 029901 (2001)) where they replaced the lifetime values for levels with spin 9/2, 11/2, 13/2, 15/2, 17/2, 19/2, 21/2, and 23/2 erroneously published by 1992Ku15 with correct values.
Additional information 2.

E(level)[†]	J$^\pi$[‡]	$T_{1/2}$[#]	Comments
0.0[&]	3/2$^-$		
54.539[&] *10*	5/2$^-$	0.21 ns *8*	B(E2)↑=2.21 *10* $T_{1/2}$: Computed from B(E2)↑=2.21 *10* and δ(54 γ)=0.19 *4*. B(E2)↑: From 1958Ra12. Others: 1.8 *4* (1986Ta02) and 2.52 from (d,d′) study (1971St03). See also 1956Bj41 and 1959De29.
64.1[a]	5/2$^+$		
115.6[a]	7/2$^+$		
131.55[&] *7*	7/2$^-$	0.12 ns *1*	B(E2)↑=1.20 *9* $T_{1/2}$: Computed from BE2=1.20 *9*. B(E2)↑: Weighted average of 1.20 *9* (1986Ta02) and 1.21 *10* (1958Ra12). Other: 1.36 from (d,d′) study (1971St03).
180.2[a]	9/2$^+$		
227.29[&] *8*	9/2$^-$	67 ps *7*	$T_{1/2}$: from τ=96 ps *10* (erratum) replacing τ=24.1 ps *21* (1992Ku15).
272.3[a]	11/2$^+$		
347.27[&] *9*	11/2$^-$	35 ps *3*	$T_{1/2}$: from τ=50 ps *5* (erratum) replacing τ=17.6 ps *15* (1992Ku15).
361.2[a]	13/2$^+$		
434[b]	5/2$^-$	0.03 ps	B(E2)↑=0.0039 *8* B(E2)↑: Other: 0.013 from (d,d′) study (1971St03).

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Coulomb excitation 1992Ku15,2003Ha01,1986Ta02 (continued)

^{157}Gd Levels (continued)

E(level)[†]	J$^{\pi}$[‡]	T$_{1/2}$[#]	Comments
475[@]	3/2$^+$		
478.88[&] *10*	13/2$^-$	20 ps *2*	T$_{1/2}$: from τ=29 ps *3* (erratum) replacing τ=10.6 ps *9* (1992Ku15).
509.3[a]	15/2$^+$		
517[b]	7/2$^-$		B(E2)↑=0.0029 *7* B(E2)↑: Other: 0.014 from (d,d′) study (1971St03).
527[@]	5/2$^+$		
612.4[a]	17/2$^+$		
640.56[&] *11*	15/2$^-$	9.9 ps *10*	T$_{1/2}$: from τ=14.3 ps *14* (erratum) replacing τ=6.2 ps *5* (1992Ku15).
702[c]	1/2$^-$		B(E2)↑=0.014 *3* B(E2)↑: Other: 0.007 from (d,d′) study (1971St03).
720			B(E2)↑=0.053 B(E2)↑: From 1963Al30. This value might relate to level at 702 or that at 748 or a combination, but the value is much larger than those for these two levels.
748[c]	3/2$^-$		B(E2)↑=0.012 *5* B(E2)↑: Other: 0.002 from (d,d′) study (1971St03).
801.61[&] *12*	17/2$^-$	8.1 ps *8*	T$_{1/2}$: from τ=11.7 ps *12* (erratum) replacing τ=3.7 ps *3* (1992Ku15).
814[d]	3/2$^-$,5/2$^-$		B(E2)↑=0.063 *20* J$^{\pi}$: This level may be a combination of 3/2$^-$ and 5/2$^-$ states in the interval from 809.0 to 816.3 (see Adopted Levels). B(E2)↑: Other: 0.007 from (d,d′) study (1971St03).
832.0[a]	19/2$^+$		
939.5[a]	21/2$^+$		
1002.69[&] *13*	19/2$^-$	4.4 ps *4*	T$_{1/2}$: from τ=6.4 ps *6* (erratum) replacing τ=2.61 ps *23* (1992Ku15).
1185.91[&] *16*	21/2$^-$	3.1 ps *3*	T$_{1/2}$: from τ=4.5 ps *5* (erratum) replacing τ=1.66 ps *24* (1992Ku15).
1241.3[a]	23/2$^+$		
1345.0[a]	25/2$^+$		
1424.0[&]	23/2$^-$	1.9 ps *2*	T$_{1/2}$: from τ=2.7 ps *3* (erratum) replacing τ=0.86 ps *7* (1992Ku15).
1623.3[&]	25/2$^-$		
1732.7[a]	27/2$^+$		
1827.5[a]	29/2$^+$		
1896.5[&]	27/2$^-$		
2108.9[&]	29/2$^-$		

[†] From least-squares fit to γ energies.
[‡] From 1992Ku15 and 2003Ha01 and based on expected band structure and DCO′s; all assignments agree with those in the Adopted Levels.
[#] Values are from direct measurements of 1992Ku15 – Erratum, unless noted as computed from BE2 values given here. See ^{157}Gd Adopted Levels for results from other measurements.
[@] Observed only as the final state of a reported γ.
[&] Band(A): 3/2[521] band.
[a] Band(B): 5/2[642] band.
[b] Band(C): 5/2[523] band.
[c] Band(D): 1/2[521] band.
[d] Band(E): 1/2[530] band.

Coulomb excitation **1992Ku15,2003Ha01,1986Ta02** **(continued)**

$\gamma(^{157}Gd)$

E_i(level)	J_i^π	E_γ[†]	I_γ[‡]	E_f	J_f^π	Mult.[#]	δ[#]	α[a]	Comments
54.539	5/2$^-$	54.54 *1*	100	0.0	3/2$^-$	M1+E2	0.19 *4*	12.40	E_γ: From 1958Ch36.
64.1	5/2$^+$	64.3		0.0	3/2$^-$				
115.6	7/2$^+$	51.4		64.1	5/2$^+$				
131.55	7/2$^-$	67.3	0.7[@] *6*	64.1	5/2$^+$	E1			
		77.1 *1*	77 *2*	54.539	5/2$^-$	M1+E2	0.18	4.46	
		131.4 *1*	23 *2*	0.0	3/2$^-$	E2		0.95	I_γ: From 1992Ku15. Other: I_γ(77)=82 *1* and I_γ(131)= 18 *1* (1986Ta02).
180.2	9/2$^+$	64.3		115.6	7/2$^+$				
		116.2		64.1	5/2$^+$				
227.29	9/2$^-$	95.8 *1*	51 *2*	131.55	7/2$^-$				
		112.8	2.9[@] *10*	115.6	7/2$^+$	E1			
		172.8 *1*	47 *2*	54.539	5/2$^-$				I_γ: From 1992Ku15. Other I_γ(95)=54 *8* and I_γ(173)= 46 *8* (1966Bo16).
272.3	11/2$^+$	91.9		180.2	9/2$^+$				
		156.6		115.6	7/2$^+$				
347.27	11/2$^-$	120.1 *1*	41 *1*	227.29	9/2$^-$				
		166.8	4.8[@] *16*	180.2	9/2$^+$	E1			
		215.6 *1*	54 *1*	131.55	7/2$^-$				I_γ: From 1992Ku15. Other I_γ(120) 43 *12* and I_γ(215)= 57 *12* (1966Bo16).
361.2	13/2$^+$	88.8		272.3	11/2$^+$				
		180.9		180.2	9/2$^+$				
434	5/2$^-$	318	60[&] *8*	115.6	7/2$^+$	E1		0.014	
		370	32[&] *6*	64.1	5/2$^+$	E1		0.0095	
		380	5.0[&] *4*	54.539	5/2$^-$	[M1,E2]		0.041 *11*	
		434	3.0[&] *4*	0.0	3/2$^-$	[M1,E2]		0.029 *8*	
478.88	13/2$^-$	116.6	0.4[@] *2*	361.2	13/2$^+$	E1			
		131.6 *1*	27 *3*	347.27	11/2$^-$				
		206.4	6.3[@] *19*	272.3	11/2$^+$	E1			
		251.6 *1*	67 *3*	227.29	9/2$^-$				
509.3	15/2$^+$	148.8		361.2	13/2$^+$				
		236.9		272.3	11/2$^+$				
517	7/2$^-$	337	35[&] *7*	180.2	9/2$^+$				
		401	50[&] *6*	115.6	7/2$^+$				
		453	15[&] *4*	64.1	5/2$^+$				
		517		0.0	3/2$^-$				
612.4	17/2$^+$	103.2		509.3	15/2$^+$				
		251.4		361.2	13/2$^+$				
640.56	15/2$^-$	131.3	0.3[@] *1*	509.3	15/2$^+$	E1			
		161.7 *1*	24 *4*	478.88	13/2$^-$				
		279.4	9.3[@] *22*	361.2	13/2$^+$	E1			
		293.3 *1*	67 *4*	347.27	11/2$^-$				
702	1/2$^-$	268	18[&] *4*	434	5/2$^-$				
		638	12[&] *3*	64.1	5/2$^+$				
		702	70[&] *9*	0.0	3/2$^-$				
748	3/2$^-$	221	6[&] *2*	527	5/2$^+$				
		231	11[&] *2*	517	7/2$^-$				
		273	6[&] *2*	475	3/2$^+$				

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Coulomb excitation **1992Ku15,2003Ha01,1986Ta02** **(continued)**

$\gamma(^{157}Gd)$ (continued)

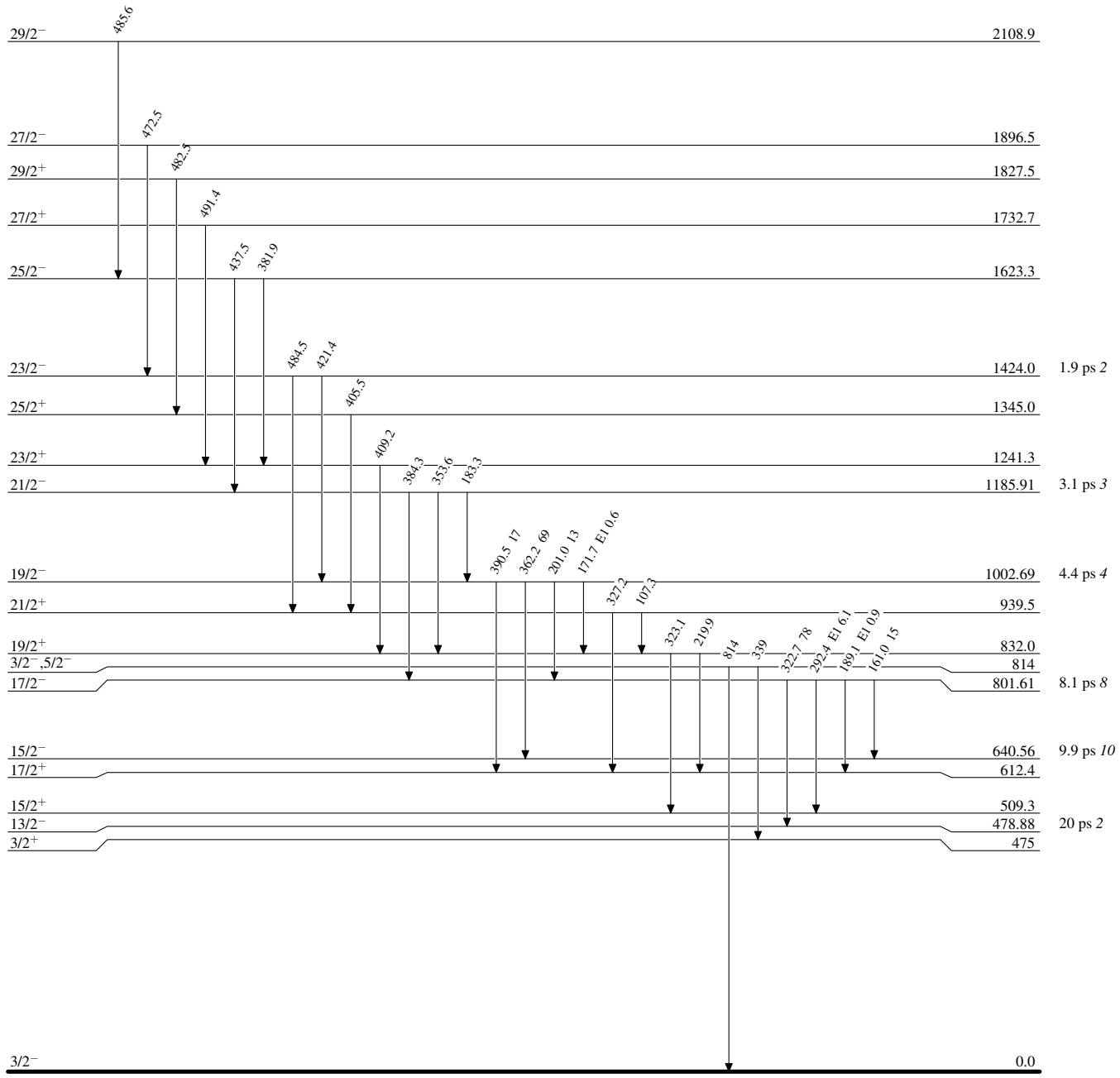
E_i(level)	J_i^π	E_γ[†]	I_γ[‡]	E_f	J_f^π	Mult.[#]	Comments
748	$3/2^-$	693	77[&] *8*	54.539	$5/2^-$		
		748		0.0	$3/2^-$		
801.61	$17/2^-$	161.0 *1*	15 *6*	640.56	$15/2^-$		
		189.1	0.9[@] *4*	612.4	$17/2^+$	E1	
		292.4	6.1[@] *13*	509.3	$15/2^+$	E1	
		322.7 *1*	78 *6*	478.88	$13/2^-$		
814	$3/2^-$,$5/2^-$	339		475	$3/2^+$		
		814		0.0	$3/2^-$		
832.0	$19/2^+$	219.9		612.4	$17/2^+$		
		323.1		509.3	$15/2^+$		
939.5	$21/2^+$	107.3		832.0	$19/2^+$		
		327.2		612.4	$17/2^+$		
1002.69	$19/2^-$	171.7	0.6[@] *2*	832.0	$19/2^+$	E1	
		201.0 *1*	13 *10*	801.61	$17/2^-$		
		362.2 *1*	69 *10*	640.56	$15/2^-$		
		390.5	17[@] *3*	612.4	$17/2^+$		
1185.91	$21/2^-$	183.3		1002.69	$19/2^-$		
		353.6		832.0	$19/2^+$		I_γ: 6.4% *13* of decays from this level (2003Ha01).
		384.3 *1*		801.61	$17/2^-$		
1241.3	$23/2^+$	409.2		832.0	$19/2^+$		
1345.0	$25/2^+$	405.5		939.5	$21/2^+$		
1424.0	$23/2^-$	421.4		1002.69	$19/2^-$		
		484.5		939.5	$21/2^+$		I_γ: 25% *7* of decays from this level (2003Ha01).
1623.3	$25/2^-$	381.9		1241.3	$23/2^+$		
		437.5		1185.91	$21/2^-$		
1732.7	$27/2^+$	491.4		1241.3	$23/2^+$		
1827.5	$29/2^+$	482.5		1345.0	$25/2^+$		
1896.5	$27/2^-$	472.5		1424.0	$23/2^-$		
2108.9	$29/2^-$	485.6		1623.3	$25/2^-$		

[†] Values with uncertainties are from 1992Ku15, those without uncertainties quoted to 0.1 keV are from 2003Ha01, and the others are rounded values from Adopted Levels, Gammas dataset.
[‡] From 1992Ku15, unless otherwise noted.
[#] From Adopted γ radiations.
[@] From 2003Ha01.
[&] From 1986Ta02.
[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.

Coulomb excitation 1992Ku15,2003Ha01,1986Ta02

Level Scheme

Intensities: % photon branching from each level

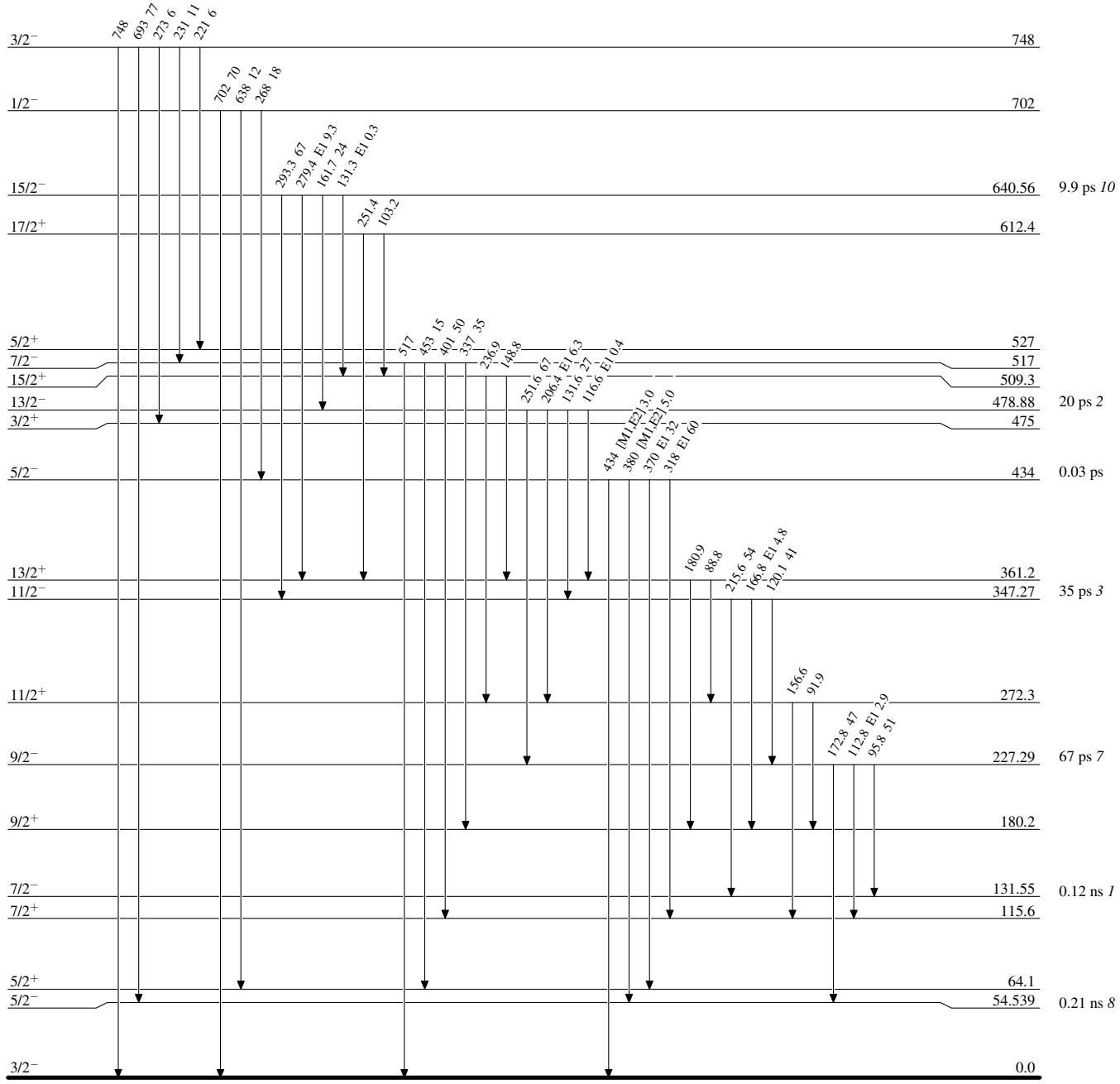


$^{157}_{64}Gd_{93}$

Coulomb excitation 1992Ku15,2003Ha01,1986Ta02

Level Scheme (continued)

Intensities: % photon branching from each level

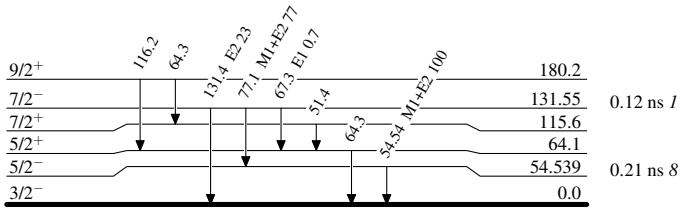


$^{157}_{64}Gd_{93}$

Coulomb excitation 1992Ku15,2003Ha01,1986Ta02

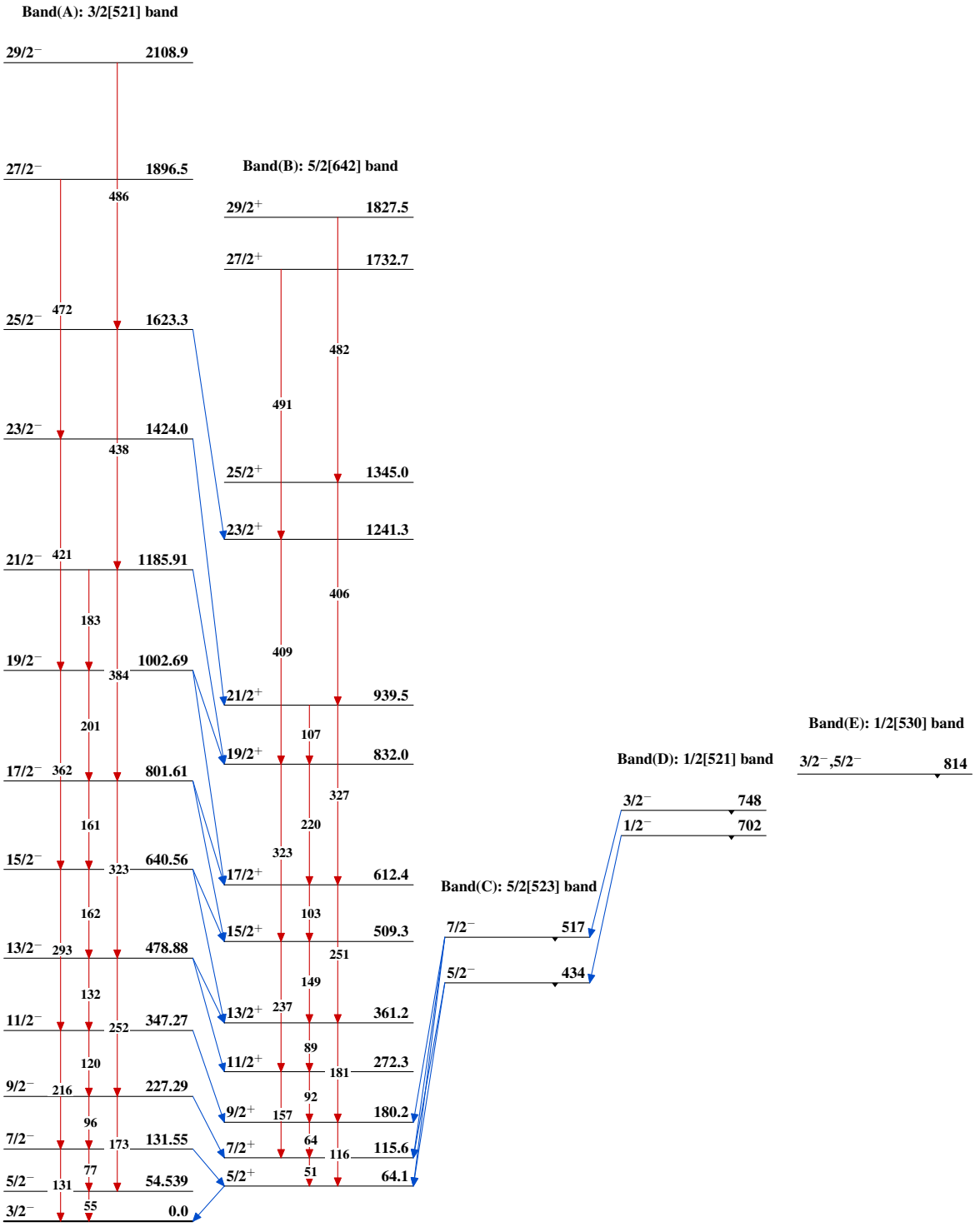
Level Scheme (continued)

Intensities: % photon branching from each level



$^{157}_{64}Gd_{93}$

Coulomb excitation 1992Ku15,2003Ha01,1986Ta02



$^{157}_{64}Gd_{93}$