Coulomb excitation **2000Be07,1987Mc01,1984Mu19**

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	M. Shamsuzzoha Basunia	NDS 143, 1 (2017)	31-Mar-2017

The level scheme combines data from the following major sources:
2000Be07: E(^{58}Ni)=155, 180 MeV; E(^{65}Cu)=130 MeV; E(^{32}S)=100 MeV; E(^{16}O)=40 MeV. Natural Ir targets. Measured $\gamma(\theta$,H,t), recoil distance, particle-$\gamma(\theta)$, and g-factor (transient field IMPAC technique). Used particle-triaxial-rotor-model, U(6/4), and U(6/20) supersymmetry models to interpret level structure.
1987Mc01: E(^{40}Ar)=160 MeV; E(^{136}Xe)=617 MeV. Enriched ^{193}Ir targets (99.45%); measured γ-ray yields, particle-γ coin (annular solid-state surface-barrier detector, Ge(Li)); used triaxial rotor model to interpret level structure.
1986Ko20: E(^{32}S)=89, 118 MeV; measured $\gamma(\theta$,H), $\gamma(\theta$,H,t), recoil-distance.
1984Mu19: E(p),E(α)=5.0-6.0 MeV. Natural Ir targets; measured γ-ray yields, $\gamma(\theta)$ (large-volume Compton-suppressed Ge(Li) detector).
1972Pr04: E(^{16}O)=25 MeV, 40 MeV, 65 MeV. Enriched ^{193}Ir targets (98.0%); measured Eγ, Iγ (Ge(Li)), γ-ray yields.

Some data are from the following:
1971No01: E(d)=7.0 MeV; Eα=16.6 MeV.
1970Av02: E(^{16}O)≈40 MeV.
1969Av03: E(^{16}O)=9-30 MeV.
1958Mc02: E(p)=3.0-4.0 MeV.
Others: 1971Ow01, 1957Be56, 1957Mc34, 1956Da40, 1956Hu49.

^{193}Ir Levels

B(E2)↑: The values of 1972Pr04 have been renormalized to B(E2)↑(138.9 level)=0.75 *3*. The values of 1984Mu19 were obtained using B(E2)↑(^{194}Pt 0$^+$ to 2$^+$)=1.620 *15* (1978Ba38) for calibration and were renormalized to the currently adopted value 1.649 *15* (2007Si17).
g-factors: In the transient field IMPAC measurements of 1986Ko20 the value for g-factor(138.9 level)=+0.211 *12* was adopted for the calibration of the transient field; however, later measurements give g-factor(138.9 level)=+0.356 *16* ((Ni,Ni′) and (Cu,Cu′) 2000Be07, 1996St22).

E(level)[†]	J$^\pi$[‡]	T$_{1/2}$[#]	Comments
0.0[b]	3/2$^+$		
73.0[c]	1/2$^+$	4.1 ns *3*	B(E2)↑=0.110 *8* B(E2)↑: Weighted average of 0.11 *1* (1971No01), 0.111 *12* (1969Av03). T$_{1/2}$: In Adopted Levels: 6.09 ns *15* (from ^{193}Os β^- decay).
80.2	11/2$^-$	10.53[@] d *4*	
138.9[b]	5/2$^+$	69.7[&] ps *10*	B(E2)↑=0.75 *3* B(E2)↑: Limited weight method average of 0.81 *3* (2000Be07), 0.71 *7* (1971No01), 0.64 *6* (1969Av03), 0.74 *7* (1958Mc02). g-factor=+0.356 *16* transient field IMPAC measurements (2000Be07). Other: 0.211 *12* (static field), +0.215 *13* (transient field) IMPAC measurements (1986Ko20); 1970Av02. T$_{1/2}$: 2000Be07 (recoil-distance method). Others: 92 *4* ps (recoil-distance method, 1986Ko20); 78 *4* ps (from B(E2)).
180.1[c]	3/2$^+$	28 ps *4*	B(E2)↑=0.087 *8* B(E2)↑: Weighted average of 0.095 *14* (1972Pr04), 0.085 *10* (1971No01). Other: 0.25 *15* (1969Av01). T$_{1/2}$: Adopted value: 43 ps *16*.
299.4	7/2$^-$		
357.8[b]	7/2$^+$	18.7[&] ps *7*	B(E2)↑=0.518 *9* B(E2)↑: Weighted average of 0.50 *2* (2000Be07), 0.525 *10* (1984Mu19), 0.54 *8* (1972Pr04), 0.49 *7* (1971No01), 0.47 *5* (1969Av03), 0.61 *7* (1958Mc02).

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Coulomb excitation 2000Be07,1987Mc01,1984Mu19 (continued)

^{193}Ir Levels (continued)

E(level)[†]	Jπ[‡]	$T_{1/2}$[#]	Comments
			g-factor=+0.441 *16* transient field IMPAC measurements (2000Be07). Other: +0.41 *8* (static field), +0.62 *13* (transient field) IMPAC measurements, (1986Ko20). $T_{1/2}$: weighted average of 18.6 ps *7* (2000Be07) and 20.4 ps *24* (1986Ko20) (recoil-distance). Other: 14.9 ps *7* from B(E2), not included in the average because depends on Iγ(219) from 357.8 level seen as an unresolved doublet.
361.9[c]	5/2+	25 ps *3*	B(E2)↑=0.0162 *4* B(E2)↑: Weighted average of 0.0159 *5* (1984Mu19), 0.018 *3* (1972Pr04).
460.5	3/2+	13.8 ps *10*	B(E2)↑=0.0253 *5* B(E2)↑: Weighted average of 0.0252 *5* (1984Mu19), 0.030 *5* (1972Pr04).
516.4[c]	(7/2)+		
521.9[b]	(9/2)+	13.2[&] ps *19*	B(E2)=0.827 *30* (138.9 level to 521.9 level) (1987Mc01). g-factor=+0.54 *15* (transient field IMPAC measurement), 2000Be07 – unweighted average of ^{58}Ni runs at 155 and 180 MeV. Other: +0.84 *25* (transient field IMPAC measurement, 1986Ko20). $T_{1/2}$: weighted average of 13.9 ps *22* (2000Be07) and 11 ps *4* (1986Ko20) (recoil-distance); 10.4 ps *6* from B(E2) was not included because J is uncertain.
557.4	(1/2)+	34[@] ps *8*	1984Mu19 report B(E2)=0.046 *15*; however, assuming 557γ pure E2 to determine an upper limit, this B(E2) gives $T_{1/2}$ = 6 *2* ps, much smaller than the measured $T_{1/2}$.
559.3	5/2+	1.08[@] ps *16*	B(E2)↑=0.012 *6* (1984Mu19)
563.4	(9/2−)		
598.2	3/2−	2.8[@] ps *+28–9*	
621.0[d]	7/2+	4.3[a] ps *3*	B(E2)↑=0.106 *5* B(E2)↑: Weighted average of 0.110 *6* (1984Mu19), 0.121 *18* (1972Pr04), 0.090 *11* (1971No01). g-factor=+0.33 *4* (transient field IMPAC measurement, 2000Be07). Other:+0.15 *11* (transient field IMPAC measurement, 1986Ko20). $T_{1/2}$: weighted average of 4.4 ps *5* (2000Be07) and 6.1 ps *17* (1986Ko20) (recoil-distance method), and 4.2 ps *4* (from adopted B(E2)).
695.1	5/2+		B(E2)↑=0.0066 *22* (1987Mc01)
712.2	3/2+	15[@] ps *14*	
740.4	5/2−		
806.9	(5/2)+		B(E2)=0.013 *4* (1987Mc01). Jπ: (7/2+) assignment from 1987Mc01 not consistent with observation of 733.9γ (to 1/2+) in ^{193}Ir(n,n′γ).
838.9[c]	(9/2+)		
857.0[b]	(11/2)+	4.2 ps *4*	B(E2)=0.50 *3* (357.7 level to 857 level) (1987Mc01). g-factor=+0.49 *13* (transient field IMPAC measurement, 2000Be07).
892.3[d]	(9/2+)		
1035.5[b]	(13/2)+		
1169.2[d]	(11/2+)		
1460.0[b]	(15/2)+		
1651[b]	(17/2+)		
2179[b]	(19/2+)		
2404?[b]	(21/2+)		

[†] Rounded-off values from Adopted Levels.
[‡] From 1987Mc01. The Jπ assignments for J≥7/2 are based on band structure and similarities to ^{191}Ir.
[#] Calculated from adopted B(E2)↑ using the adopted δ, α, and branching ratios for the relevant γ's, unless otherwise noted.
[@] From Adopted Levels.

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Coulomb excitation **2000Be07,1987Mc01,1984Mu19** **(continued)**

^{193}Ir Levels (continued)

& From recoil-distance method, see comment.
[a] From recoil-distance method and B(E2), see comment.
[b] Band(A): $K^{\pi}=3/2^{+}$ band.
[c] Band(B): $K^{\pi}=1/2^{+}$ band.
[d] Band(C): $K^{\pi}=7/2^{+}$ band.

Coulomb excitation 2000Be07,1987Mc01,1984Mu19 **(continued)**

$\gamma(^{193}Ir)$

E_γ [†]	I_γ [‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	δ[#d]	α[c]	Comments
73		73.0	$1/2^+$	0.0	$3/2^+$	M1+E2	−0.558 *5*	6.11 *10*	E_γ: from 1969Av03. Masked by x-rays (1972Pr04); observation confirmed from analysis of x-ray spectrum (1969Av03).
(80.236[@] *7*)		80.2	$11/2^-$	0.0	$3/2^+$	M4		2.11×10^4	
[x]105.9[&] *2*									
107.0[&] *2*	6.5 *9*	180.1	$3/2^+$	73.0	$1/2^+$	M1+E2	+0.16 *1*	5.01 *8*	I_γ: subject to absorber and detector-efficiency corrections (priv. comm. from authors of 1987Mc01).
138.9[&] *2*	111 *3*	138.9	$5/2^+$	0.0	$3/2^+$	M1+E2	−0.362 *6*	2.26	δ: 2000Be07 (particle-$\gamma(\theta)$). Others: −0.44 *+2−4* (1970Av02); −0.75 *25* (1958Mc02); 0.329 *12* (β^- decay).
154	3.6 *5*	516.4	$(7/2)^+$	361.9	$5/2^+$	(M1)		1.79	
164.2[&] *2*	10.0 *7*	521.9	$(9/2)^+$	357.8	$7/2^+$	(M1)		1.492	I_γ: Iγ(164.2γ)/Iγ(382.9γ)=0.109 *20* (1972Pr04).
[x]168.4[&] *2*									
180.0[&] *2*	4.6 *5*	180.1	$3/2^+$	0.0	$3/2^+$	M1+E2	−0.48 *2*	1.029 *17*	I_γ: Iγ(180.0γ)/Iγ(107.0γ)=0.288 *19* (1972Pr04).
181.7[&] *2*	10.0 *7*	361.9	$5/2^+$	180.1	$3/2^+$	M1+E2	+0.149 *11*	1.108	I_γ: Iγ(181.7γ)/Iγ(361.8γ)=0.80 *25* (1972Pr04).
218.8[&] *2*	65.6 *22*	357.8	$7/2^+$	138.9	$5/2^+$	M1+E2	−0.280 *9*	0.639 *10*	I_γ: Iγ(218.8γ)/Iγ(357.7γ)=0.63 *4* (1972Pr04). I_γ: 219γ is also placed from the $7/2^-$ 299.4 keV level by 1987Mc01; however, all Iγ is shown here. Mult.,δ: 2000Be07 (particle-$\gamma(\theta)$). Others: −0.34 *4* ($\gamma(\theta)$, 1984Mu19); −0.22 *3* (1958Mc02); −0.42 *+8−14* (1970Av02).
(219)		299.4	$7/2^-$	80.2	$11/2^-$	E2		0.255	
234	1.2 *4*	695.1	$5/2^+$	460.5	$3/2^+$	(M1)		0.555	
263		563.4	$(9/2^-)$	299.4	$7/2^-$	(M1)		0.403	
263.2[&] *2*	3.9 *5*	621.0	$7/2^+$	357.8	$7/2^+$	M1+E2	−0.26[a] *11*	0.385 *16*	I_γ: Iγ(263.2γ)/Iγ(482.1γ)=0.122 *12* (1972Pr04), 0.17 (1984Mu19).
271	1.4 *5*	892.3	$(9/2^+)$	621.0	$7/2^+$				
280.4[&] *2*	1.3 *4*	460.5	$3/2^+$	180.1	$3/2^+$	M1+E2	−0.049 *12*	0.337	I_γ: Iγ(280.4γ)/Iγ(460.5γ)=0.194 *18* (1972Pr04).
288.7[&] *2*	5.5 *5*	361.9	$5/2^+$	73.0	$1/2^+$	(E2)		0.1064	I_γ: Iγ(288.7γ)/Iγ(361.8γ)=0.52 *17* (1972Pr04).
299	2.0 *4*	598.2	$3/2^-$	299.4	$7/2^-$	(E2)		0.0958	
312[b]		1169.2	$(11/2^+)$	857.0	$(11/2)^+$				I_γ: Iγ(312γ)/(Iγ(548γ)+Iγ(647γ))=0.19 *7* (from 617-MeV ^{136}Xe data, 1987Mc01).
321.6[&] *2*	1.1 *3*	460.5	$3/2^+$	138.9	$5/2^+$	M1+E2	+0.234 *10*	0.225	I_γ: Iγ(321.6γ)/Iγ(460.5γ)=0.24 *4* (1972Pr04).
323	1.7 *4*	838.9	$(9/2^+)$	516.4	$(7/2)^+$	(M1)		0.230	
[x]328.4[&] *2*									
335	8.6 *18*	857.0	$(11/2)^+$	521.9	$(9/2)^+$	[M1,E2]		0.14 *7*	
336	6.9 *14*	516.4	$(7/2)^+$	180.1	$3/2^+$	(E2)		0.0681	
[x]346.7[&] *2*									
357.7[&] *2*	100	357.8	$7/2^+$	0.0	$3/2^+$	E2		0.0571	Mult.: Q from $\gamma(\theta)$ (1958Mc02).

$^{193}_{77}Ir_{116}$-4

Coulomb excitation 2000Be07,1987Mc01,1984Mu19 **(continued)**

$\gamma(^{193}Ir)$ (continued)

E_γ †	I_γ ‡	E_i(level)	J_i^π	E_f	J_f^π	Mult.#	δ#d	α c	Comments
361.8& 2	12.0 8	361.9	5/2+	0.0	3/2+	M1+E2	−0.33 3	0.158 3	
370	1.5 4	892.3	(9/2+)	521.9	(9/2)+				
377	12.1 8	516.4	(7/2)+	138.9	5/2+	(M1)		0.1518	
377.4a		557.4	(1/2)+	180.1	3/2+	(M1+E2)	1.0 5	0.10 3	Iγ(377.4γ)/Iγ(557.4γ)=0.059 (1984Mu19).
382.9& 2	89 3	521.9	(9/2)+	138.9	5/2+	(E2)		0.0473	
387.5& 2	1.2 4	460.5	3/2+	73.0	1/2+	M1+E2	−0.24 4	0.136 3	I_γ: Iγ(387.5γ)/Iγ(460.5γ)=0.16 3 (1972Pr04).
420	2.1 4	559.3	5/2+	138.9	5/2+	M1		0.1139	
425b		1460.0	(15/2)+	1035.5	(13/2)+				I_γ: Iγ(425γ)/Iγ(603γ)=0.11 4 (from 617-MeV ^{136}Xe data, 1987Mc01).
441 1		740.4	5/2−	299.4	7/2−	M1+E2	−0.37 4	0.0919 22	
449	1.0 3	806.9	(5/2)+	357.8	7/2+	(M1)		0.0954	
x450.8& 2									
460.5& 2	3.3 4	460.5	3/2+	0.0	3/2+	M1+E2	−0.64 3	0.0718 16	
477	4.3 5	838.9	(9/2+)	361.9	5/2+	(E2)		0.0267	
482.1& 2	33.5 13	621.0	7/2+	138.9	5/2+	M1+E2	−0.93 11	0.054 4	δ: average of −0.89 13 (particle-γ(θ), 2000Be07) and −1.02 19 (γ(θ), 1984Mu19).
499	33.5 13	857.0	(11/2)+	357.8	7/2+	[E2]		0.0239	
513.6	15.3 8	1035.5	(13/2)+	521.9	(9/2)+	(E2)		0.0222	
514.9		695.1	5/2+	180.1	3/2+	(M1,E2)		0.044 23	E_γ: from 1984Mu19.
532.1		712.2	3/2+	180.1	3/2+	M1+E2	+0.48 +32−16	0.053 9	E_γ: from 1984Mu19.
534	2.3 4	892.3	(9/2+)	357.8	7/2+				
548	2.1 4	1169.2	(11/2+)	621.0	7/2+	(E2)		0.0190	
557.4a		557.4	(1/2)+	0.0	3/2+	(M1)		0.0541	
559	4.4 6	559.3	5/2+	0.0	3/2+	(M1)		0.0537	
603	3.3 4	1460.0	(15/2)+	857.0	(11/2)+				
615b		1651	(17/2+)	1035.5	(13/2)+				
621.0& 2	25.0 11	621.0	7/2+	0.0	3/2+	[E2]		0.01425	I_γ: Iγ(621.0γ)/Iγ(482.1γ)=0.76 6 (1972Pr04), 0.79 (1984Mu19).
647	3.0 5	1169.2	(11/2+)	521.9	(9/2)+				
654b		1169.2	(11/2+)	516.4	(7/2)+				I_γ: Iγ(654γ)/(Iγ(548γ)+Iγ(647γ))=0.15 5 (from 617-MeV ^{136}Xe data, 1987Mc01).
668	2.0 6	806.9	(5/2)+	138.9	5/2+				
695		695.1	5/2+	0.0	3/2+				
719b		2179	(19/2+)	1460.0	(15/2)+				
753	1.3 4	892.3	(9/2+)	138.9	5/2+				
753		2404?	(21/2+)	1651	(17/2+)				Possible second placement of γ in ^{136}Xe data of 1987Mc01.
807		806.9	(5/2)+	0.0	3/2+				
812b		1169.2	(11/2+)	357.8	7/2+				I_γ: Iγ(812γ)/(Iγ(548γ)+Iγ(647γ))=0.20 8 (from 617-MeV ^{136}Xe data, 1987Mc01).

$^{193}_{77}Ir_{116}$-5

Coulomb excitation **2000Be07,1987Mc01,1984Mu19 (continued)**

$\gamma(^{193}Ir)$ (continued)

† From 1987Mc01, unless otherwise noted.
‡ Arbitrary units for E(^{40}Ar)=160 MeV (1987Mc01).
# From Adopted Gammas, unless otherwise noted.
@ From Adopted Gammas.
& From 1972Pr04.
a From 1984Mu19.
b γ seen only with ^{136}Xe E=617 MeV reaction (1987Mc01).
c Additional information 1.
d If No value given it was assumed δ=1.00 for E2/M1, δ=1.00 for E3/M2 and δ=0.10 for the other multipolarities.
x γ ray not placed in level scheme.

$^{193}_{77}Ir_{116}$-6

Coulomb excitation 2000Be07,1987Mc01,1984Mu19

Level Scheme

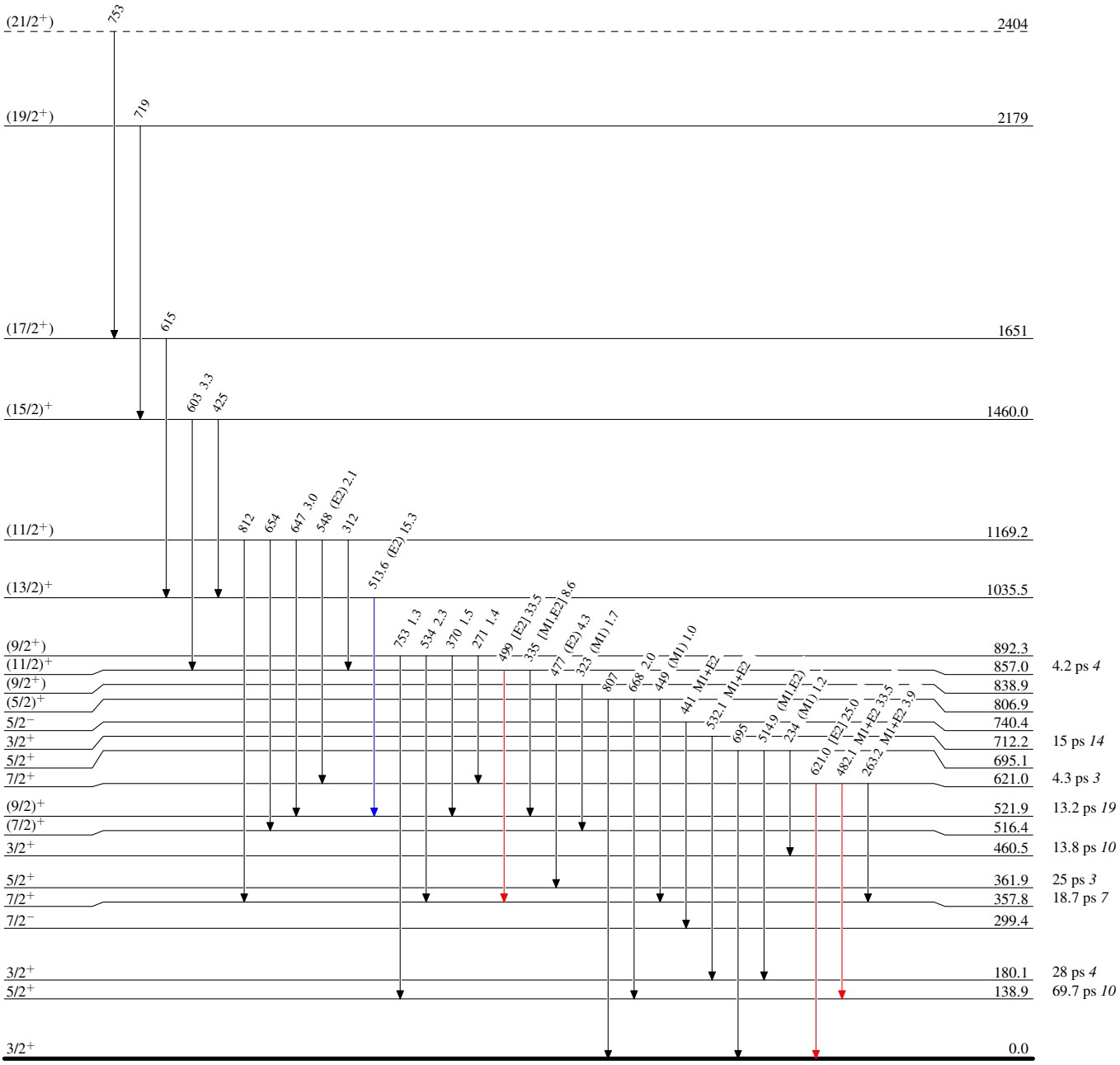
Intensities: Relative Iγ for E(^{40}Ar)=160 MeV

Legend

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

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

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



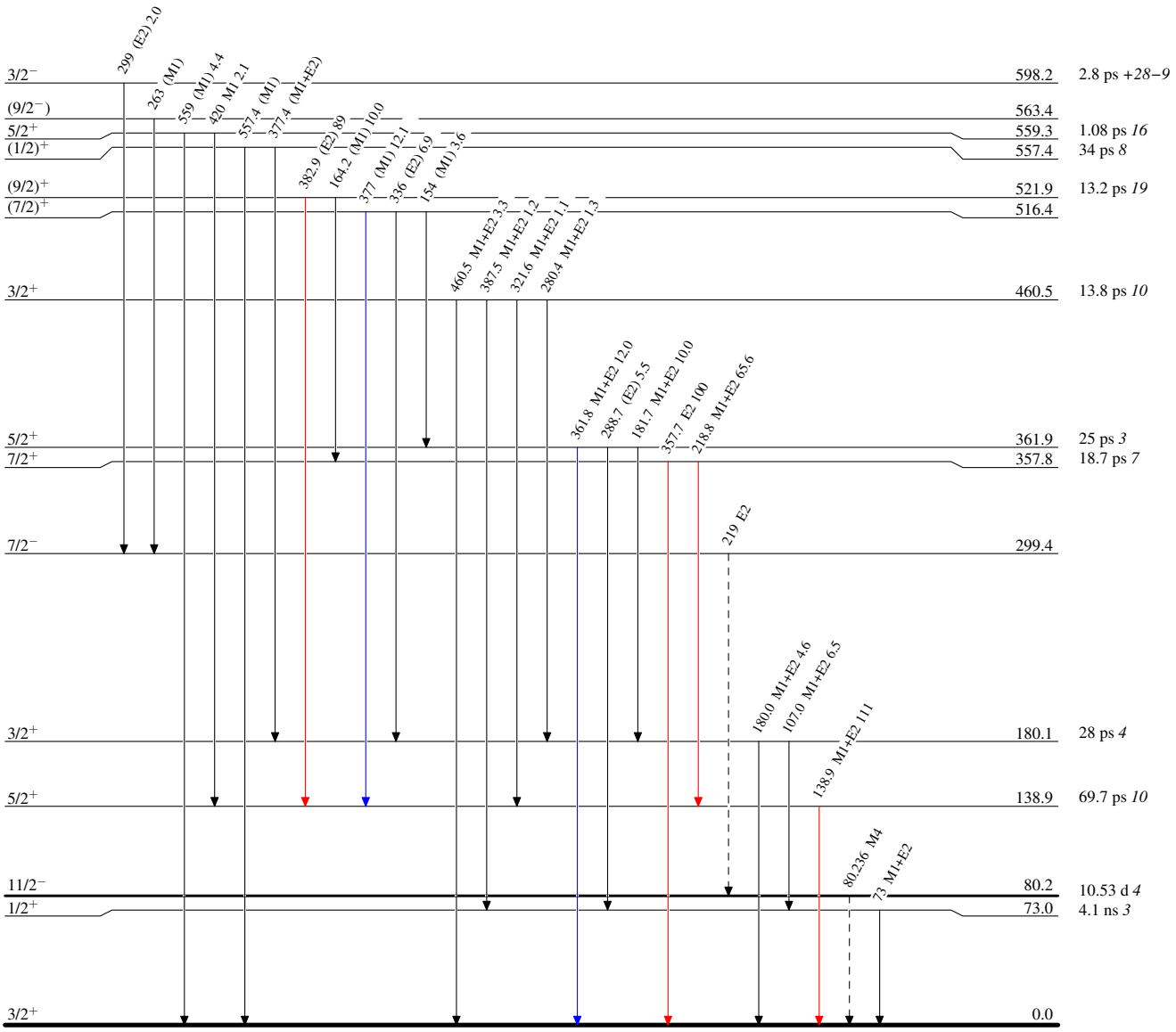
$^{193}_{77}Ir_{116}$

Coulomb excitation 2000Be07,1987Mc01,1984Mu19

Level Scheme (continued)

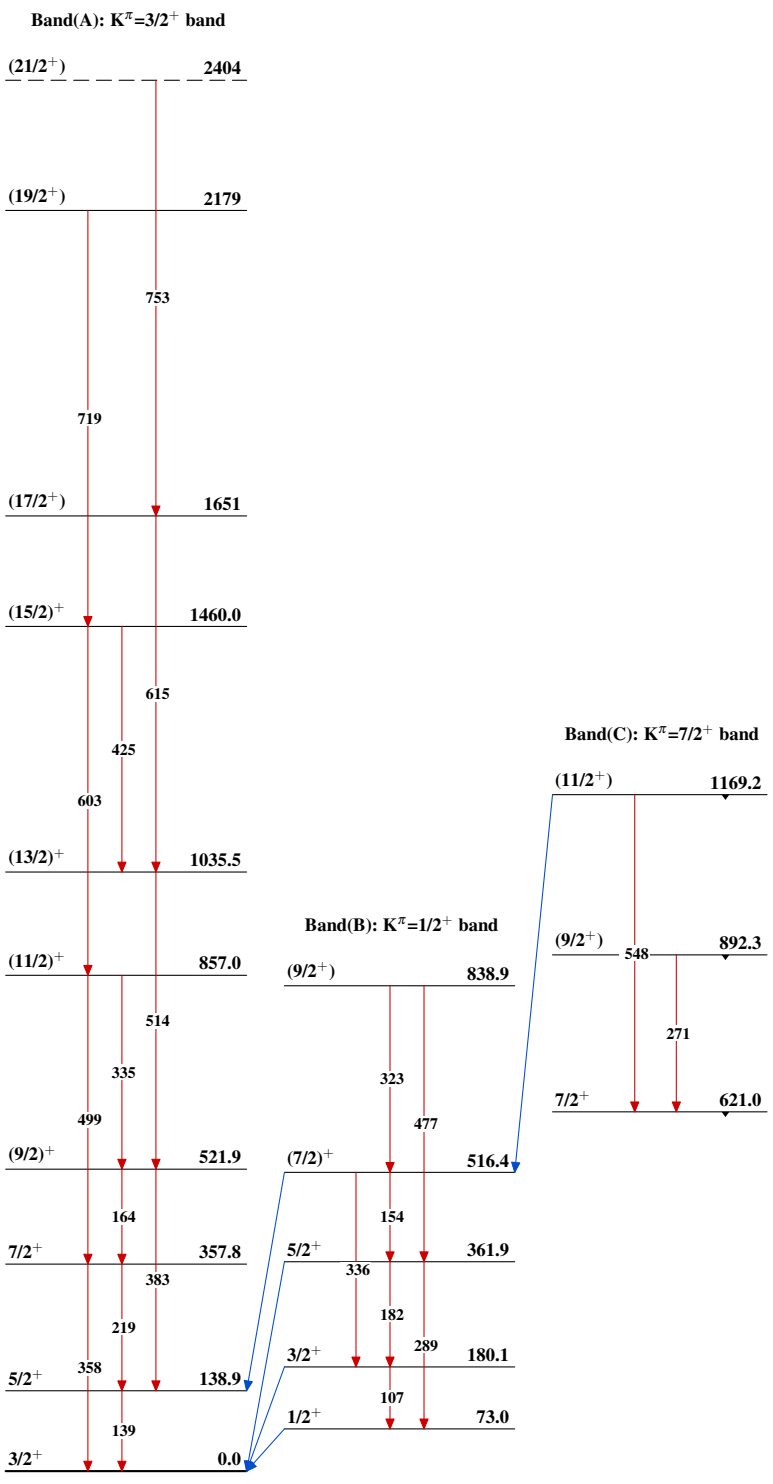
Intensities: Relative Iγ for E(^{40}Ar)=160 MeV

Legend
- $I_\gamma < 2\% \times I_\gamma^{max}$
- $I_\gamma < 10\% \times I_\gamma^{max}$
- $I_\gamma > 10\% \times I_\gamma^{max}$
- γ Decay (Uncertain)



$^{193}_{77}Ir_{116}$

Coulomb excitation 2000Be07,1987Mc01,1984Mu19



$^{193}_{77}Ir_{116}$