^{139}La(^{20}Ne,6nγ) 2016Pr06

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	N. Nica	NDS 170, 1 (2020)	16-Aug-2020

Data set based on the XUNDL compilation of 2016Pr06 done by A. Chakraborty (Visva-Bharati), S. Bhattacharya (SINP), B. Singh (McMaster).

2016Pr06: E(^{20}Ne)=139 MeV. The experiment was carried out at the Variable Energy Cyclotron Centre (VECC), Kolkata, India. Measured Eγ, Iγ, $\gamma\gamma$-coin, $\gamma\gamma(\theta)$(DCO), $\gamma\gamma$(linear polarization), isomer half-life by (Rf)γ(t) spectra, two-time gated spectra for 200 ns and 800 ns using INGA array consisting of six Compton-suppressed Clover detectors; two detectors each at 40°, 90°, and 125°. Deduced high-spin levels, J^π, multipolarities. Total Routhian surface (TRS) calculations. Comparison of experimental transition probabilities and γ-ray mixing ratios with particle-rotor model calculations.

^{153}Ho Levels

E(level)[†]	J$^\pi$[‡]	$T_{1/2}$	Comments
0.0	11/2$^-$		
576.1 *5*	15/2$^-$		
726.9 *5*	15/2$^-$		
1091.0 *5*	15/2$^+$		
1206.9 *5*	19/2$^-$		
1359.6 *5*	(19/2)$^-$		
1646.1 *5*	19/2$^+$		
1872.9 *6*	23/2$^-$		
2001.9? *7*			
2030.8 *6*	(23/2)$^-$		
2124.9 *6*	23/2$^-$		
2202.9 *6*	23/2$^+$		
2296.9 *7*	27/2$^-$		
2357.9 *6*	25/2$^-$		
2735.9 *7*	27/2$^+$		
2771.9[#] *7*	31/2$^+$	251 ns *+54−38*	$T_{1/2}$: from RF-γ(t) spectra (2016Pr06).
3208.9 *8*	33/2$^+$		
3684.9[#] *8*	35/2$^+$		
4315.9[#] *10*	39/2$^+$		
4678.9[#] *11*	43/2$^+$		
5133.9[#] *12*	45/2$^+$		
5770.9 *13*	47/2$^{(+)}$		
6075.9 *14*	49/2$^{(+)}$		
6175.9[#] *13*	49/2$^+$		
6517.9 *15*	53/2$^{(+)}$		
6572.9 *15*	51/2$^{(+)}$		
6936.9[#] *14*	53/2$^+$		
7306.9 *16*	53/2$^{(-)}$		
7402.9[#] *15*	57/2$^+$		
7597.9[#] *16*	61/2$^+$		
7649.9? *17*			
8598.9 *16*	63/2$^-$		
8933.9 *17*	65/2$^-$		
9073.9 *16*	67/2$^-$		
9869.9 *17*	67/2$^-$		
10199.9 *17*	(69/2$^-$)		
10258.9 *17*	69/2$^-$		
10601.9 *17*	71/2$^-$		
10910.9 *17*	(73/2$^-$)		

Continued on next page (footnotes at end of table)

^{139}La(^{20}Ne,6nγ) 2016Pr06 (continued)

^{153}Ho Levels (continued)

E(level)[†]	J$^{\pi}$[‡]
11302.9 *17*	75/2$^{(-)}$
11678.9 *18*	79/2$^{(-)}$
12119.9 *19*	81/2$^{(-)}$

[†] From least-squares fit to γ energies, assuming 0.5 keV uncertainty for each Eγ value, as suggested in e-mail correspondence with the authors.
[‡] As given in 2016Pr06, based on their $\gamma\gamma(\theta)$ and polarization data, and previous assignments.
[#] Seq.(A): γ cascade based on 31/2^{+} level.

γ(^{153}Ho)

The DCO ratios (R_{DCO}) are for 40° and 90°. DCO(Q) is for gate on stretched quadrupole transition, and DCO(D) for gate on stretched dipole (M1 or E1). Spin alignment parameter σ/J=0.3 was used in the analysis.
The linear polarization asymmetry (POL) is positive for pure electric and negative for pure magnetic transitions. For mixed transitions, the value is close to zero and sign depends on the mixing ratio.

E$_{\gamma}$	I$_{\gamma}$[†]	E$_i$(level)	J$_i^{\pi}$	E$_f$	J$_f^{\pi}$	Mult.[#]	δ	Comments
36[‡]		2771.9	31/2^{+}	2735.9	27/2^{+}			
61[‡]		2357.9	25/2^{-}	2296.9	27/2^{-}			
140	32.7 *16*	9073.9	67/2^{-}	8933.9	65/2^{-}	(M1+E2)	+0.20 *+9−5*	R$_{DCO}$=1.21 *9*.
151[‡]		726.9	15/2^{-}	576.1	15/2^{-}			
153[‡]		1359.6	(19/2)$^{-}$	1206.9	19/2^{-}			
172[‡]		2202.9	23/2^{+}	2030.8	(23/2)$^{-}$			
195	75.4 *38*	7597.9	61/2^{+}	7402.9	57/2^{+}	E2		POL=+0.11 *1*. R$_{DCO}$=0.96 *3*.
233	6.80 *68*	2357.9	25/2^{-}	2124.9	23/2^{-}			
252	4.66 *47*	2124.9	23/2^{-}	1872.9	23/2^{-}			
287	4.82 *48*	1646.1	19/2^{+}	1359.6	(19/2)$^{-}$			
305	7.97 *80*	6075.9	49/2$^{(+)}$	5770.9	47/2$^{(+)}$	(M1+E2)	+0.11 *+11−5*	POL=−0.15 *1*. R$_{DCO}$=1.38 *8*.
330[‡]		2202.9	23/2^{+}	1872.9	23/2^{-}			
335	48.5 *24*	8933.9	65/2^{-}	8598.9	63/2^{-}	(M1+E2)	+0.10 *3*	POL=−0.03 *3*. R$_{DCO}$=1.39 *6*.
343[@]		7649.9?		7306.9	53/2$^{(-)}$			
343	11.05 *55*	10601.9	71/2^{-}	10258.9	69/2^{-}	(M1+E2)	+0.19 *+9−8*	POL=−0.07 *3*. R$_{DCO}$=1.24 *3*.
356[‡]		2357.9	25/2^{-}	2001.9?				
363	100 *5*	4678.9	43/2^{+}	4315.9	39/2^{+}	E2		POL=+0.18 *3*. R$_{DCO}$=0.86 *2*.
364[‡]		1091.0	15/2^{+}	726.9	15/2^{-}			
376	19.12 *96*	11678.9	79/2$^{(-)}$	11302.9	75/2$^{(-)}$	E2		POL=+0.04 *8*. R$_{DCO}$=0.89 *8*.
378	22.2 *11*	2735.9	27/2^{+}	2357.9	25/2^{-}			
389	9.68 *97*	10258.9	69/2^{-}	9869.9	67/2^{-}	(M1+E2)	+0.17 *+11−8*	POL=−0.02 *3*. R$_{DCO}$=1.27 *4*.
392[‡]		11302.9	75/2$^{(-)}$	10910.9	(73/2^{-})			
424	5.91 *59*	2296.9	27/2^{-}	1872.9	23/2^{-}			

Continued on next page (footnotes at end of table)

^{139}La(^{20}Ne,6nγ) 2016Pr06 (continued)

γ(^{153}Ho) (continued)

E_γ	I_γ[†]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	δ	Comments
437[‡]		3208.9	33/2$^+$	2771.9	31/2$^+$			
439[‡]		1646.1	19/2$^+$	1206.9	19/2$^-$			
439[‡]		2735.9	27/2$^+$	2296.9	27/2$^-$			
441	18.04 *90*	12119.9	81/2$^{(-)}$	11678.9	79/2$^{(-)}$			POL=−0.01 *10*. R_{DCO}=1.59 *3*. I_γ: the quoted intensity may have contribution from 442-keV transition from 6518 level (2016Pr06).
442		6517.9	53/2$^{(+)}$	6075.9	49/2$^{(+)}$			I_γ: could not be measured in 2016Pr06 due to doublet.
455	88.7 *44*	5133.9	45/2$^+$	4678.9	43/2$^+$	(M1+E2)	+0.33 *3*	POL=+0.09 *2*. R_{DCO}=1.07 *3*.
466	71.1 *36*	7402.9	57/2$^+$	6936.9	53/2$^+$	E2		POL=+0.08 *2*. R_{DCO}=0.84 *3*.
475[‡]		2771.9	31/2$^+$	2296.9	27/2$^-$			
476[‡]		3684.9	35/2$^+$	3208.9	33/2$^+$			
485[‡]		2357.9	25/2$^-$	1872.9	23/2$^-$			
497	2.44 *24*	6572.9	51/2$^{(+)}$	6075.9	49/2$^{(+)}$	(M1(+E2))	+0.3 *5*	POL=−0.01 *5*. R_{DCO}=0.79 *4*.
515	13.87 *69*	1091.0	15/2$^+$	576.1	15/2$^-$			
533	33.1 *17*	2735.9	27/2$^+$	2202.9	23/2$^+$			
555[‡]		1646.1	19/2$^+$	1091.0	15/2$^+$			
557	52.4 *26*	2202.9	23/2$^+$	1646.1	19/2$^+$			
576	36.2 *18*	576.1	15/2$^-$	0.0	11/2$^-$			
631[‡]		1206.9	19/2$^-$	576.1	15/2$^-$			
631	113.1 *57*	4315.9	39/2$^+$	3684.9	35/2$^+$	E2		POL=+0.02 *2*. R_{DCO}=0.91 *3*.
633[‡]		1359.6	(19/2)$^-$	726.9	15/2$^-$			
637	14.13 *71*	5770.9	47/2$^{(+)}$	5133.9	45/2$^+$	(M1(+E2))	+0.08 *+12−9*	POL=−0.17 *8*. R_{DCO}=1.43 *1*.
652[‡]		10910.9	(73/2$^-$)	10258.9	69/2$^-$			
666	8.31 *83*	1872.9	23/2$^-$	1206.9	19/2$^-$			
671[‡]		2030.8	(23/2)$^-$	1359.6	(19/2)$^-$			
701	12.03 *60*	11302.9	75/2$^{(-)}$	10601.9	71/2$^-$	E2		POL=+0.10 *8*. R_{DCO}=1.03 *1*.
711	7.87 *79*	10910.9	(73/2$^-$)	10199.9	(69/2$^-$)	E2		POL=+0.03 *8*. R_{DCO}=0.62 *7*.
727	11.99 *60*	726.9	15/2$^-$	0.0	11/2$^-$			
732	3.65 *37*	10601.9	71/2$^-$	9869.9	67/2$^-$	E2		R_{DCO}=0.31 *2*.
734	2.93 *29*	7306.9	53/2$^{(-)}$	6572.9	51/2$^{(+)}$	E1		POL=+0.42 *4*. R_{DCO}=0.85 *3*.
761	76.8 *38*	6936.9	53/2$^+$	6175.9	49/2$^+$	E2		POL=+0.01 *2*. R_{DCO}=0.89 *3*.
783	3.86 *39*	1359.6	(19/2)$^-$	576.1	15/2$^-$			
795[‡]		2001.9?		1206.9	19/2$^-$			
796	9.68 *97*	9869.9	67/2$^-$	9073.9	67/2$^-$			POL=−0.03 *2*. R_{DCO}=1.11 *8*.
824[‡]		2030.8	(23/2)$^-$	1206.9	19/2$^-$			
913[‡]		3684.9	35/2$^+$	2771.9	31/2$^+$			
918	8.26 *83*	2124.9	23/2$^-$	1206.9	19/2$^-$			
1001	51.8 *26*	8598.9	63/2$^-$	7597.9	61/2$^+$	(E1+M2)	+0.19 *+5−4*	POL=+0.05 *2*. R_{DCO}=1.24 *7*.

Continued on next page (footnotes at end of table)

^{139}La(^{20}Ne,6nγ) 2016Pr06 (continued)

γ(^{153}Ho) (continued)

E_γ	I_γ[†]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	δ	Comments
1042	77.3 *39*	6175.9	49/2$^+$	5133.9	45/2$^+$	E2		POL=+0.02 *3*. R_{DCO}=0.99 *3*.
1126	9.02 *90*	10199.9	(69/2$^-$)	9073.9	67/2$^-$	(M1+E2)	+0.17 *+14−11*	δ: uncertainty is from e-mail reply from the authors. POL=−0.11 *1*. R_{DCO}=1.02 *4*.
1185	1.89 *19*	10258.9	69/2$^-$	9073.9	67/2$^-$			
1325	4.60 *46*	10258.9	69/2$^-$	8933.9	65/2$^-$	E2		POL=+0.02 *8*. R_{DCO}=0.56 *9*.
1476	5.74 *57*	9073.9	67/2$^-$	7597.9	61/2$^+$	[E3]		
1528	6.09 *61*	10601.9	71/2$^-$	9073.9	67/2$^-$	E2		R_{DCO}=0.42 *7*.

[†] Uncertainties of 5% for strong γ rays (I$\gamma\geq$10) and 10% for weak γ rays (Iγ<10) assigned, based on e-mail correspondence with authors. Authors also give, in their Table II, intensities of 38 γ rays obtained from 200-ns and 800-ns time gated spectra and resultant matrices.

[‡] The transition shown in Fig. 6 of 2016Pr06, taken from literature (see ^{153}Ho Adopted dataset Dec 2005 update, same as presently adopted values). This γ is not listed in Tables I and II of 2016Pr06.

[#] (M1+E2) or (E1+M2) assigned by evaluator, as implied by mixing ratios and given J^π values.

[@] Placement of transition in the level scheme is uncertain.

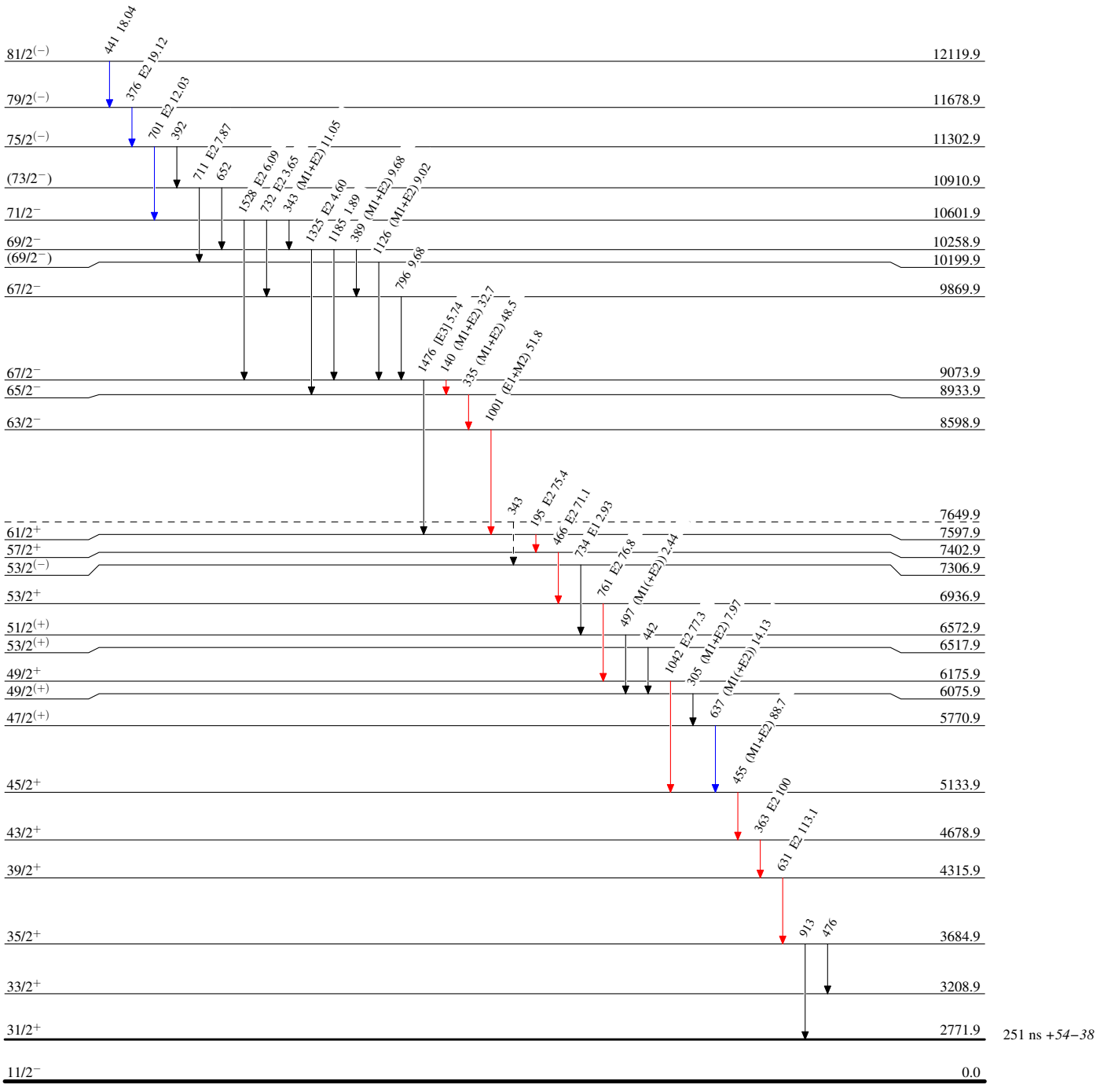
^{139}La(^{20}Ne,6nγ) 2016Pr06

Level Scheme

Intensities: Relative I_γ

Legend

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



$^{153}_{67}Ho_{86}$

^{139}La(^{20}Ne,6nγ) 2016Pr06

Level Scheme (continued)

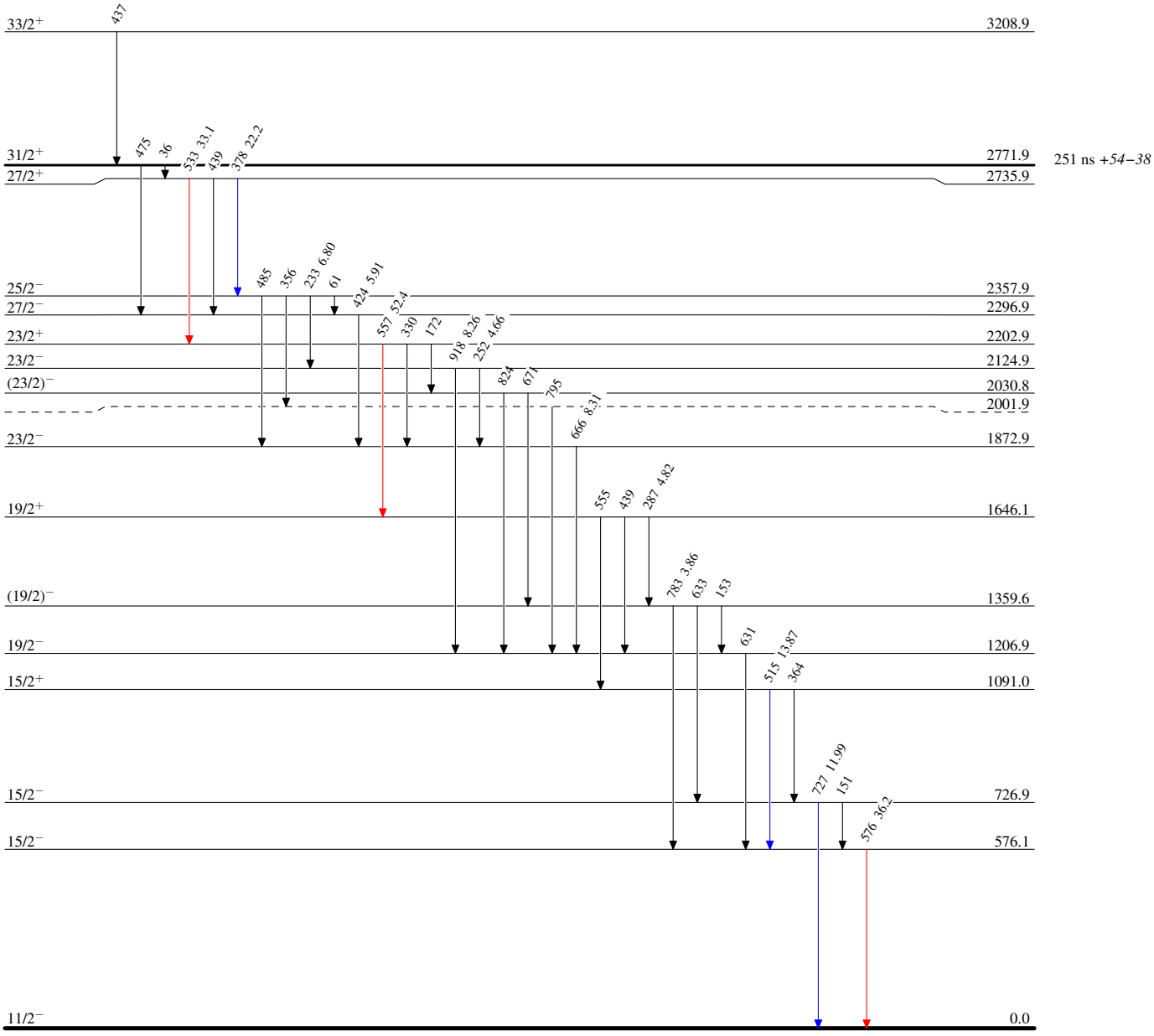
Intensities: Relative I_γ

Legend

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

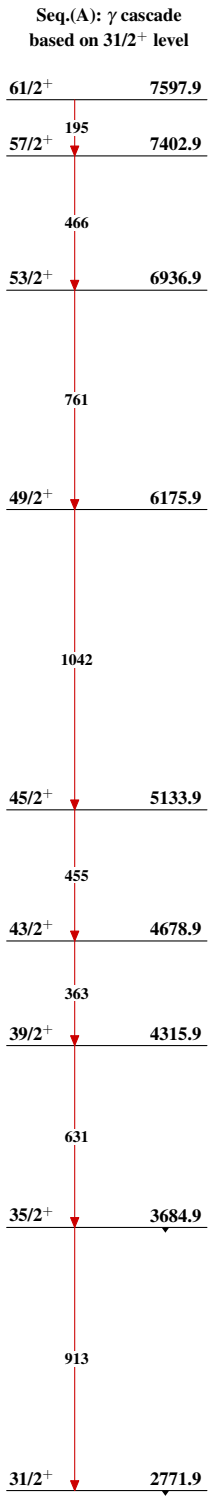
$I_\gamma < 10\% \times I_\gamma^{max}$

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



$^{153}_{67}Ho_{86}$

^{139}La(^{20}Ne,6nγ) 2016Pr06



$^{153}_{67}Ho_{86}$