^{238}U(n,γ) E=res: av 1984Ch05,1972Bo46

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	E. Browne, J. K. Tuli	NDS 122, 293 (2014)	30-Jun-2013

1984Ch05: Target: 99.999% depleted ^{238}U. Neutron beams of 2 keV, FWHM= 0.85 keV; and of 24 keV, FWHM= 1.9 keV. Measured Eγ, Iγ for primary γ rays. Detector: three-crystal pair spectrometer.

Other measurements: 1971Ar47, 1971Wa12, 1972Bo46, 1991Ma40, 1991Oi01, 1991Sz05, 1992Ja05, 1992Po13, 1992Qu01. 1992Vo13, 1992Zh12, 1993Ro25, 1997Gu17, 1997Li11.

1972Bo46: Target: >99.999% depleted ^{238}U. Measured Eγ, Iγ (per 100 captured neutrons) of primary γ rays. Detector: Annihilation-pair Ge(Li) spectrometer.

^{239}U Levels

E(level)‡	J$^{\pi}$†
0	$5/2^+$
133.9	$1/2^+,3/2^+$
145.6	$1/2^+,3/2^+$
193.6	$5/2^+$
538.6	$5/2^-$
687.6	$1/2^+,3/2^+$
694.7	5/2
715.9	$1/2^+,3/2^+,5/2^+$
726.5	$1/2^+,3/2^+$
735.7	$1/2^+,3/2^+,5/2^+$
739.1	$1/2^-,3/2^-$
745.8	$1/2^-,3/2^-$
756.7	$5/2^+$
784.0	$5/2^-$
815.3	$1/2^-,3/2^-$
823.7	$1/2^-,3/2^-$
852.8	$1/2^+,3/2^+$
858.8	$5/2^-$
887.4	$5/2^+$
892.3	5/2
932.5	$1/2^-,3/2^-$
961.9	$1/2^-,3/2^-$
965.4	1/2,3/2
982.9	$5/2^-$
988.1	
990.5	
1005.7	$1/2^+,3/2^+,5/2^+$
1018.6	$5/2^-$
1061.8	5/2
1066.9	$1/2^-,3/2^-$
1146.9	5/2
1150.4	
1152.7	
1155.2	$1/2^+,3/2^+$
1167.1	$1/2^+,3/2^+$
1195.5	$1/2^-,3/2^-$
1202.0	5/2
1206.0	5/2
1223.1	$1/2^-,3/2^-$
1225.5	$1/2^-,3/2^-$
1232.0	
1235.0	
1238.0	$1/2^+,3/2^+$

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^{238}U(n,γ) E=res: av 1984Ch05,1972Bo46 (continued)

^{239}U Levels (continued)

E(level)‡	Jπ†	Comments
1243.3	1/2⁻,3/2⁻	
1261.8	1/2,3/2	
1271.1	1/2,3/2	
1277.9	1/2,3/2	
1295.2	1/2,3/2,5/2	
1306.1	1/2⁻,3/2⁻	
1318.0		
1320.5		
1324.6	1/2⁻,3/2⁻	
1338.3	1/2⁻,3/2⁻,5/2⁺	
1360.9	1/2⁻,3/2⁻	
S(n)+x		S(n)= 4806.26 *21*; x=2 keV.
S(n)+y		S(n)= 4806.26 *21*; y=24 keV.

† Spins and parities of levels populated by primary γ rays from 2-keV resonances (with J^π=1/2⁺ for s-wave neutrons) are 1/2⁺, 1/2⁻, 3/2⁺, and 3/2⁻ based on the assumption that γ rays carry one unit of angular momentum (E1 or M1 multipolarities). Those of levels populated from 24-keV resonances (with J^π=1/2⁻ and 3/2⁻ for p-wave neutrons) are 1/2⁺, 3/2⁺, or 5/2⁺. Since s-wave neutron capture is dominant, and primary E1 γ rays are more intense than M1, the 1/2⁻ and 3/2⁻ levels are more strongly populated than 1/2⁺ and 3/2⁺. Population to 5/2 levels come from E1 primary γ rays from only 3/2⁻ resonances (p-wave neutrons), with a weak contribution from E2 primary γ rays from 1/2⁺ resonances (s-wave neutrons) and 1/2⁻ resonances (p-wave neutrons). Thus, reduced primary γ ray intensities (Iγ/Eγ^3), which are distributed into three categories defined by the spins and parities (1/2⁻, 3/2⁻), (1/2⁺, 3/2⁺), and (5/2), have provided the arguments for spin and parity assignments.

‡ ΔE≤ 1 keV (1984Ch05).

γ(^{239}U)

Eγ†	Iγ/Eγ^3‡	E_i(level)	E_f	J^π_f	Comments
3483.7#	2.72# *25*	S(n)+x	1324.6	1/2⁻,3/2⁻	
3487.8		S(n)+x	1320.5		
3490.3#	2.74# *24*	S(n)+x	1318.0		Iγ/Eγ^3: 3490.3γ + 3487.8γ.
3492.0@	0.34@ *8*	S(n)+y	1338.3	1/2⁻,3/2⁻,5/2⁺	
3502.2#	1.67# *24*	S(n)+x	1306.1	1/2⁻,3/2⁻	
3505.7@	0.72@ *9*	S(n)+y	1324.6	1/2⁻,3/2⁻	
3509.8		S(n)+y	1320.5		
3512.3@	0.68@ *9*	S(n)+y	1318.0		Iγ/Eγ^3: 3512.3γ + 3509.8γ.
3524.2		S(n)+y	1306.1	1/2⁻,3/2⁻	Weak.
3535.1@	0.23@ *8*	S(n)+y	1295.2	1/2,3/2,5/2	
3552.4@	0.48@ *7*	S(n)+y	1277.9	1/2,3/2	
3559.2@	0.51@ *7*	S(n)+y	1271.1	1/2,3/2	
3565.0#	2.56# *25*	S(n)+x	1243.3	1/2⁻,3/2⁻	
3568.5@	0.49@ *7*	S(n)+y	1261.8	1/2,3/2	
3570.3#	0.7# *3*	S(n)+x	1238.0	1/2⁺,3/2⁺	
3573.3		S(n)+x	1235.0		
3576.3#	0.9# *3*	S(n)+x	1232.0		Iγ/Eγ^3: 3573.3γ + 3576.3γ.
3582.8#	1.3# *9*	S(n)+x	1225.5	1/2⁻,3/2⁻	
3585.2#	3.4# *9*	S(n)+x	1223.1	1/2⁻,3/2⁻	
3587.0@	0.90@ *10*	S(n)+y	1243.3	1/2⁻,3/2⁻	

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^{238}U(n,γ) E=res: av 1984Ch05,1972Bo46 (continued)

γ(^{239}U) (continued)

E_γ[†]	$I\gamma/E\gamma^3$[‡]	E_i(level)	E_f	J_f^π	Comments
3592.3[@]	0.87[@] *11*	S(n)+y	1238.0	$1/2^+,3/2^+$	
3595.3		S(n)+y	1235.0		
3598.3[@]	0.48[@] *12*	S(n)+y	1232.0		$I\gamma/E\gamma^3$: 3598.3γ + 3595.3γ.
3604.8		S(n)+y	1225.5	$1/2^-,3/2^-$	
3607.2[@]	1.12[@] *7*	S(n)+y	1223.1	$1/2^-,3/2^-$	$I\gamma/E\gamma^3$: 3607.2 + 3604.8γ.
3612.8[#]	1.93[#] *20*	S(n)+x	1195.5	$1/2^-,3/2^-$	
3624.3[@]	0.17[@] *5*	S(n)+y	1206.0	5/2	
3628.3[@]	0.17[@] *5*	S(n)+y	1202.0	5/2	
3634.8[@]	0.77[@] *6*	S(n)+y	1195.5	$1/2^-,3/2^-$	
3641.2[#]	0.70[#] *16*	S(n)+x	1167.1	$1/2^+,3/2^+$	
3653.1[#]	1.07[#] *23*	S(n)+x	1155.2	$1/2^+,3/2^+$	
3655.6		S(n)+x	1152.7		
3657.9[#]	1.14[#] *23*	S(n)+x	1150.4		$I\gamma/E\gamma^3$: 3655.6γ + 3657.9γ.
3663.2[@]	0.28[@] *6*	S(n)+y	1167.1	$1/2^+,3/2^+$	
3675.1[@]	0.54[@] *25*	S(n)+y	1155.2	$1/2^+,3/2^+$	
3677.6		S(n)+y	1152.7		
3679.9[@]	0.76[@] *23*	S(n)+y	1150.4		$I\gamma/E\gamma^3$: 3679.9γ + 3677.6γ.
3683.4[@]	0.19[@] *8*	S(n)+y	1146.9	5/2	
3741.4[#]	1.05[#] *15*	S(n)+x	1066.9	$1/2^-,3/2^-$	
3763.4[@]	0.28[@] *6*	S(n)+y	1066.9	$1/2^-,3/2^-$	
3768.5[@]	0.23[@] *6*	S(n)+y	1061.8	5/2	
3802.6[#]	0.41[#] *12*	S(n)+x	1005.7	$1/2^+,3/2^+,5/2^+$	
3811.7[@]	0.15[@] *5*	S(n)+y	1018.6	$5/2^-$	
3817.8		S(n)+x	990.5		
3820.2[#]	1.21[#] *15*	S(n)+x	988.1		$I\gamma/E\gamma^3$: 3817.8γ + 3820.2γ.
3839.8		S(n)+y	990.5		
3842.2[@]	0.64[@] *5*	S(n)+y	988.1		$I\gamma/E\gamma^3$: 3842.2γ + 3839.8γ.
3842.9[#]	0.88[#] *22*	S(n)+x	965.4	1/2,3/2	
3846.4[#]	1.67[#] *24*	S(n)+x	961.9	$1/2^-,3/2^-$	
3847.4[@]	0.15[@] *5*	S(n)+y	982.9	$5/2^-$	
3864.9[@]	0.42[@] *9*	S(n)+y	965.4	1/2,3/2	
3868.4[@]	0.62[@] *9*	S(n)+y	961.9	$1/2^-,3/2^-$	
3875.8[#]	1.64[#] *14*	S(n)+x	932.5	$1/2^-,3/2^-$	
3897.8[@]	0.47[@] *4*	S(n)+y	932.5	$1/2^-,3/2^-$	
3938.0[@]	0.16[@] *6*	S(n)+y	892.3	5/2	
3942.9[@]	0.29[@] *6*	S(n)+y	887.4	$5/2^+$	
3955.5[#]	0.83[#] *11*	S(n)+x	852.8	$1/2^+,3/2^+$	
3971.5[@]	0.10[@] *5*	S(n)+y	858.8	$5/2^-$	
3977.5[@]	0.58[@] *11*	S(n)+y	852.8	$1/2^+,3/2^+$	
3984.6[#]	2.38[#] *18*	S(n)+x	823.7	$1/2^-,3/2^-$	
3993.0[#]	1.95[#] *14*	S(n)+x	815.3	$1/2^-,3/2^-$	
4006.6[@]	0.56[@] *4*	S(n)+y	823.7	$1/2^-,3/2^-$	
4015.0[@]	0.50[@] *4*	S(n)+y	815.3	$1/2^-,3/2^-$	
4046.3[@]	0.08[@] *3*	S(n)+y	784.0	$5/2^-$	
4062.5[#]	2.32[#] *15*	S(n)+x	745.8	$1/2^-,3/2^-$	
4069.2[#]	1.72[#] *25*	S(n)+x	739.1	$1/2^-,3/2^-$	

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^{238}U(n,γ) E=res: av 1984Ch05,1972Bo46 (continued)

γ(^{239}U) (continued)

E_γ †	$I\gamma/E\gamma^3$ ‡	E_i(level)	E_f	J^π_f	Comments
4072.6#	0.50# *21*	S(n)+x	735.7	$1/2^+,3/2^+,5/2^+$	
4073.6@	0.29@ *3*	S(n)+y	756.7	$5/2^+$	
4081.8#	0.71# *13*	S(n)+x	726.5	$1/2^+,3/2^+$	
4084.5@	0.61@ *4*	S(n)+y	745.8	$1/2^-,3/2^-$	
4091.2		S(n)+y	739.1	$1/2^-,3/2^-$	
4092.4#	0.54# *11*	S(n)+x	715.9	$1/2^+,3/2^+,5/2^+$	
4094.6@	0.71@ *4*	S(n)+y	735.7	$1/2^+,3/2^+,5/2^+$	$I\gamma/E\gamma^3$: 4094.6γ + 4091.2γ.
4103.8@	0.55@ *3*	S(n)+y	726.5	$1/2^+,3/2^+$	
4114.4@	0.42@ *4*	S(n)+y	715.9	$1/2^+,3/2^+,5/2^+$	
4120.7#	0.62# *10*	S(n)+x	687.6	$1/2^+,3/2^+$	
4135.6@	0.21@ *3*	S(n)+y	694.7	5/2	
4142.7@	0.55@ *4*	S(n)+y	687.6	$1/2^+,3/2^+$	
4291.7@	0.15@ *4*	S(n)+y	538.6	$5/2^-$	
4614.7#	0.39# *5*	S(n)+x	193.6	$5/2^+$	
4636.7@	0.49@ *3*	S(n)+y	193.6	$5/2^+$	
4662.4#	1.02# *7*	S(n)+x	145.6	$1/2^+,3/2^+$	
4674.4#	1.00# *7*	S(n)+x	133.9	$1/2^+,3/2^+$	
4684.7@	0.96@ *3*	S(n)+y	145.6	$1/2^+,3/2^+$	
4696.4@	1.00@ *2*	S(n)+y	133.9	$1/2^+,3/2^+$	
4808.3#	0.64# *6*	S(n)+x	0	$5/2^+$	
4830.3@	0.52@ *2*	S(n)+y	0	$5/2^+$	

† Nominal values deduced by evaluator from S(n)+x, S(n)+y, and level energies of 1984Ch05.
‡ Reduced average γ-ray intensity (1984Ch05).
# From 2-keV neutrons.
@ From 24-keV neutrons.

^{238}U(n,γ) E=res: av 1984Ch05,1972Bo46

Level Scheme

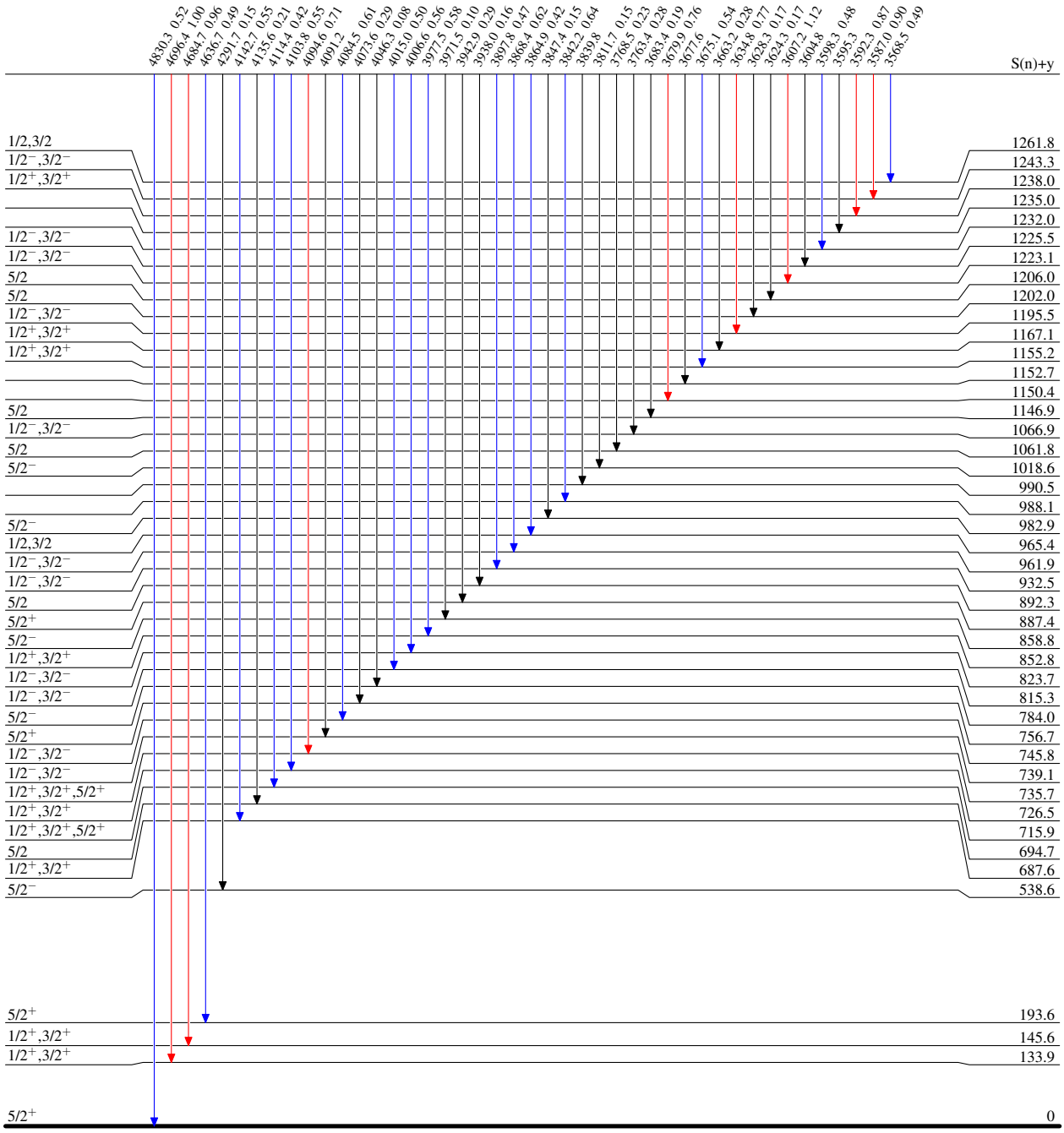
Intensities: Iγ/Eγ^3 reduced γ ray intensity

Legend

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

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

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



$^{239}_{92}U_{147}$

^{238}U(n,γ) E=res: av 1984Ch05,1972Bo46

Level Scheme (continued)

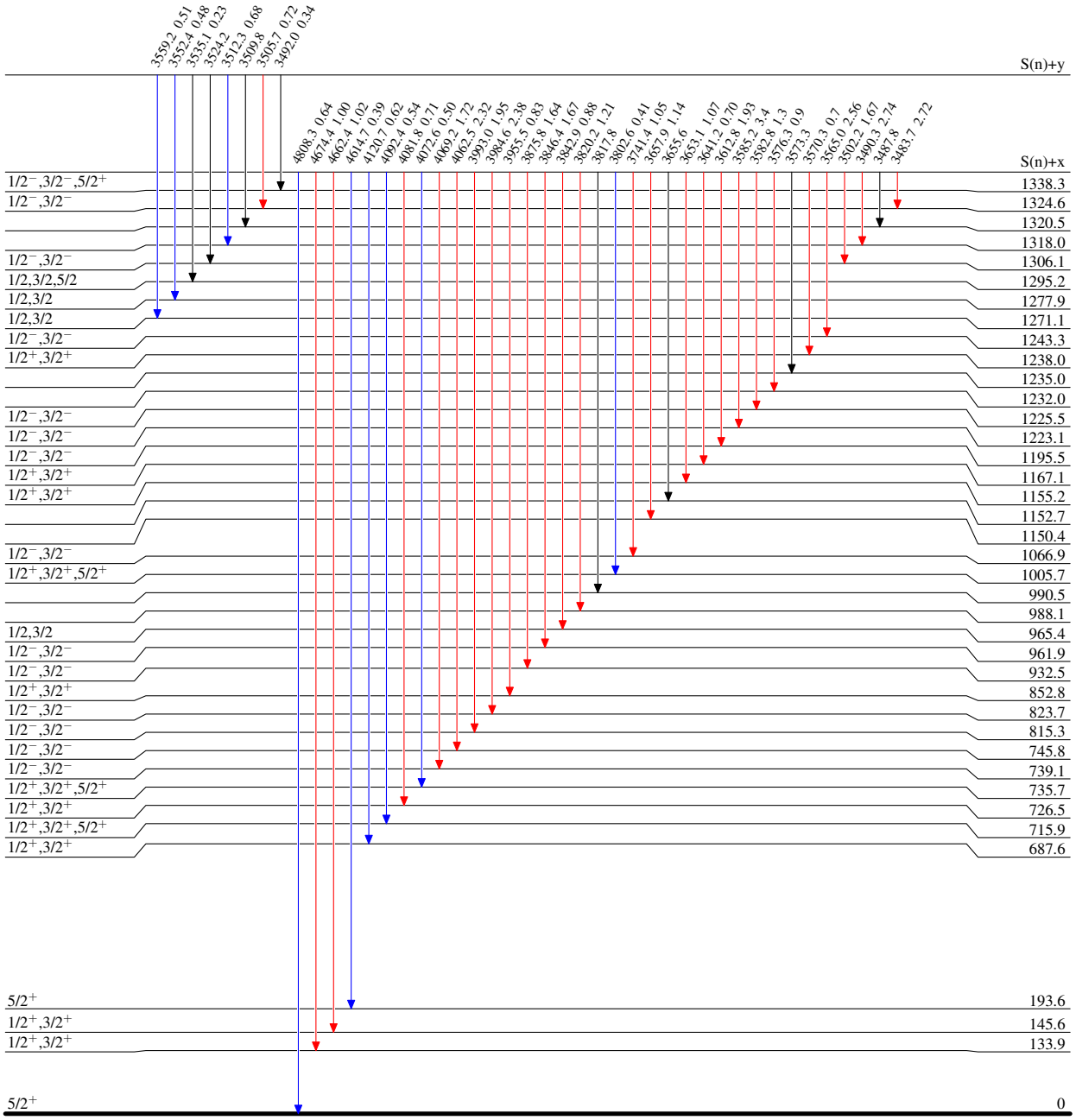
Intensities: Iγ/Eγ^3 reduced γ ray intensity

Legend

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

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

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



$^{239}_{92}U_{147}$