^{235}U(n,Fγ),^{241}Pu(n,Fγ) 2004Br14,2005Pi13,2017Is03

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Jun Chen, Balraj Singh	NDS 164, 1 (2020)	15-Feb-2020

2004Br14 (also 2002PfZZ,1986LhZW,1985LhZY): ^{235}U(n,Fγ) E=thermal. Measured Eγ, Iγ, $\gamma\gamma$, $\gamma\gamma$(t), conversion coefficients from fluorescence and intensity balance, (fragment)γ-coin at JOSEF facility.

2005Pi13: ^{98}Y produced in ^{241}Pu(n,fγ) reaction. E=thermal. Measured Eγ, Iγ, $\gamma\gamma$, ce-γ-coin, lifetimes with two different setups installed at the focal plane of the Lohengrin mass spectrometer that was used to separate fission fragments (FFs). The first consisted of a gas detector to detect FFs, behind which were two adjacent Si(Li) detectors for ce and x-rays, while γ rays were detected by two Ge detectors placed perpendicular to the beam. In the second setup, the FFs were detected in an ionization chamber. γ rays deexciting isomeric states were detected by Clover Ge detector and three single Ge crystals of the Miniball array.

2013RuZX: ^{233},^{235}U,^{241}Pu,^{241}Am(n,F),E=thermal. Measured γ(t), $\gamma\gamma$(t). Deduced half-lives of three isomers at Lohengrin-ILL-Grenoble reactor facility.

2017Is03: E(n)=cold−neutron beam from PF1B facility at Institut Laue-Langevin (ILL) in Grenoble. Measured Eγ, Iγ, $\gamma\gamma$-coin, and half-lives of isomers by fast-timing $\gamma\gamma$(t) method. For γ detection, EXILL array (eight EXOGAM clovers, six large volume GASP detectors and two ILL Clovers) of HPGe detectors was used. For isomer half-life measurements, GASP and ILL detectors were replaced by FATIMA array of 16 $LaBr_3$(Ce) detectors for fast timing measurements. Deduced B(E2), transition quadrupole moments, quadrupole deformation. Level scheme is taken from 2004Br14.

1999Ge01: ^{241}Pu(n,F) E=thermal, measured lifetime and yield of 7.6−μs isomer.

1970Gr38: ^{235}U(n,Fγ) E=thermal. Measured Eγ, Iγ, $\gamma\gamma$, γ(t), $\gamma\gamma$(t).

Others: 1976SeZN, 1975Si23, 1970Jo20, 1969WaZS.

See also ^{235}U(n,Fγ):delayed γ for data from 2017Ur03.

^{98}Y Levels

E(level)[‡]	J^{π}[†]	$T_{1/2}$	Comments
0.0	0^-		
119.2 *3*	1^-		
170.5 *3*	2^-	0.61 μs *1*	%IT=100 $T_{1/2}$: from $\gamma\gamma$(t) (2013RuZX). Others: 0.62 μs *8* (1972GrYM,1970Gr38), 0.62 μs (1970Jo20).
374.2 *4*	4^-	35.8 ns *8*	$T_{1/2}$: from $\gamma\gamma$(t) in 2002PfZZ, 2004Br14.
445.6 *4*	$(3)^+$	<0.7 ns	$T_{1/2}$: from $\gamma\gamma$(t) in 2002PfZZ, 2004Br14.
495.4[@] *4*	$(4)^-$	6.87 μs *5*	%IT=100 $T_{1/2}$: from γ(t) (2013RuZX). Others: 7.2 μs *1* (1999Ge01) and 8.0 μs *2* (1972GrYM,1970Gr38). 1999Ge01 measured 204.2γ(t), the reported value could be affected by the short half-life component from $T_{1/2}$(374)=35.8 ns.
596.0[@] *5*	$(5)^-$	175[#] ps *25*	$T_{1/2}$: other: <0.5 ns from γ(t) in 2002PfZZ, 2004Br14.
725.8[@] *5*	(6^-)	51[#] ps *10*	$T_{1/2}$: other: <0.5 ns from γ(t) in 2002PfZZ, 2004Br14. Transition quadrupole moment=4.4 *14*, β=0.49 *16* (2017Is03).
883.5[@] *5*	(7^-)	45[#] ps *15*	$T_{1/2}$: other: <1.0 ns from γ(t) in 2002PfZZ, 2004Br14. Transition quadrupole moment=2.9 *11*, β=0.32 *12* (2017Is03).
1069.3[@] *5*	(8^-)	<15[#] ps	$T_{1/2}$: other: <1.5 ns from γ(t) in 2002PfZZ, 2004Br14. Transition quadrupole moment>3.4, β>0.38 (2017Is03).
1180.1 *6*	(10^-)	0.80 μs *2*	%IT=100 $T_{1/2}$: from γ(t) (2013RuZX). Other: 0.83 μs *10* (1972GrYM,1970Gr38).

[†] From Adopted Levels.
[‡] From least-squares fit to Eγ data.
[#] From 2017Is03 for levels above 4^-, presumably from fast-timing $\gamma\gamma$(t) method.
[@] Band(A): Band based on $(4)^-$. Band assignment from 1989Br31.

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γ(^{98}Y)

All α(K)exp and α(exp) values are from 2004Br14.

E_γ[†]	I_γ	E_i(level)	J_i^π	E_f	J_f^π	Mult.[@]	δ[&]	α[a]	Comments
49.8 3	3.8[#] 9	495.4	(4)$^-$	445.6	(3)$^+$	E1		0.816 19	α(exp)=0.55 25 α(K)=0.716 16; α(L)=0.0835 19; α(M)=0.0141 4 α(N)=0.00182 5; α(O)=0.0001048 23
51.4 1	22[#] 3	170.5	2$^-$	119.2	1$^-$	M1+E2	0.40 +11−12	2.7 8	α(K)exp=2.1 5 α(K)=2.1 6; α(L)=0.46 17; α(M)=0.08 3 α(N)=0.010 4; α(O)=0.00033 7
71.3 2	0.4[#] 1	445.6	(3)$^+$	374.2	4$^-$	(E1)		0.289 5	α(K)exp=1.2 6 α(K)=0.255 5; α(L)=0.0289 5; α(M)=0.00490 8 α(N)=0.000639 11; α(O)=3.89×10^{-5} 7 Mult.: α(K)exp gives M1+E2 with δ=0.7 4 to 374, 4$^-$ level but it contradicts 49.8γ E1 from 495, 4$^-$ level; E1+M2 with δ=0.5 2, but it would require an unreasonably large B(M2)(W.u.) exceeding RUL=1. So it is most probable that 71.3γ is pure E1, by combining all considerations. Note that 71.3γ is very weak (the weakest transition in 2004Br14) and 2017Ur03 also state that this transition is too weak to determine its conversion in their data including ^{235}U(n,fγ), ^{248}Cm,^{248}Cf SF decay, and ^{98}Sr β^- decay.
100.7 2	100.0[‡] 25	596.0	(5)$^-$	495.4	(4)$^-$	M1(+E2)	<0.15	0.187 10	α(exp)=0.22 7 (2002PfZZ) α(K)=0.164 9; α(L)=0.0195 15; α(M)=0.00333 25 α(N)=0.00044 3; α(O)=2.93×10^{-5} 12 I_γ: 10.0 4 (2004Br14). δ: <0.4 from α(total)exp, but from RUL, δ(E2/M1)<0.15.
110.8 2	69.0[‡] 14	1180.1	(10$^-$)	1069.3	(8$^-$)	(E2)		0.732 12	α(exp)=0.66 6 α(K)=0.614 10; α(L)=0.0985 16; α(M)=0.0169 3 α(N)=0.00211 4; α(O)=9.25×10^{-5} 15 I_γ: 8.2 8 (2004Br14). α(exp) gives δ(E2/M1)>1.8; also give E1+M2 with

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^{235}U(n,Fγ),^{241}Pu(n,Fγ) 2004Br14,2005Pi13,2017Is03 (continued)

γ(^{98}Y) (continued)

E_γ[†]	I_γ	E_i(level)	J_i^π	E_f	J_f^π	Mult.[@]	α[a]	Comments
								δ=0.95 *10*, but it would require an unreasonably large B(M2)(W.u.) exceeding RUL=1.
119.4 *1*	56[#] *6*	119.2	1^-	0.0	0^-	M1	0.1114	α(K)exp=0.10 *1* α(K)=0.0979 *14*; α(L)=0.01125 *16*; α(M)=0.00193 *3* α(N)=0.000258 *4*; α(O)=1.762×10^{-5} *25* Mult.: α(K)exp gives δ(E2/M1)<0.2, but ΔJ^π requires pure M1.
121.3 *1*	100[#] *4*	495.4	$(4)^-$	374.2	4^-	(M1)	0.1067	α(K)exp=0.09 *1* α(K)=0.0938 *14*; α(L)=0.01077 *16*; α(M)=0.00185 *3* α(N)=0.000247 *4*; α(O)=1.687×10^{-5} *24* Mult.: α(K)exp also M1+E2 with δ<0.15; it also gives E1+M2 with δ=1.22 *4*, but it is inconsistent with $\Delta\pi$=no.
129.7 *2*	95.8[‡] *17*	725.8	(6^-)	596.0	$(5)^-$	[M1]	0.0889	α(K)=0.0782 *12*; α(L)=0.00896 *14*; α(M)=0.001535 *23* α(N)=0.000206 *3*; α(O)=1.406×10^{-5} *21* From RUL (B(E2)(W.u.)<300), δ(E2/M1)<0.15. I_γ: 10.1 *7* (2004Br14).
157.8 *2*	80.6[‡] *6*	883.5	(7^-)	725.8	(6^-)	[M1]	0.0525	α(K)=0.0462 *7*; α(L)=0.00526 *8*; α(M)=0.000901 *13* α(N)=0.0001208 *18*; α(O)=8.29×10^{-6} *12* From RUL (B(E2)(W.u.)<300), δ(E2/M1)<0.25. I_γ: 9.4 *11* (2004Br14).
170.8 *1*	116[#] *12*	170.5	2^-	0.0	0^-	E2	0.1507	α(K)exp=0.10 *3* α(K)=0.1296 *19*; α(L)=0.0177 *3*; α(M)=0.00302 *5* α(N)=0.000388 *6*; α(O)=2.05×10^{-5} *3* Mult.: α(K)exp gives δ(E2/M1)>0.7, but ΔJ^π requires pure E2.
186.1 *2*	94.4[‡] *12*	1069.3	(8^-)	883.5	(7^-)	[M1]	0.0339	α(K)=0.0299 *5*; α(L)=0.00339 *5*; α(M)=0.000580 *9* α(N)=7.78×10^{-5} *12*; α(O)=5.35×10^{-6} *8* From RUL (B(E2)(W.u.)<300), δ(E2/M1)<0.23. I_γ: 9.9 *10* (2004Br14).
204.2 *1*	100[#] *1*	374.2	4^-	170.5	2^-	E2	0.0791	α(K)exp=0.08 *2* (2004Br14) α(K)=0.0684 *10*; α(L)=0.00892 *13*; α(M)=0.001525 *22* α(N)=0.000197 *3*; α(O)=1.102×10^{-5} *16* Mult.: α(K)exp also gives E1+M2 with δ=1.1 *+5−4*, but it would require an unreasonably large B(M2)(W.u.) exceeding RUL=1.
230.4 *3*	6.9[‡] *4*	725.8	(6^-)	495.4	$(4)^-$	[E2]	0.0514	α(K)=0.0446 *7*; α(L)=0.00567 *9*; α(M)=0.000970 *15* α(N)=0.0001260 *19*; α(O)=7.27×10^{-6} *11* I_γ: 0.8 *2* (2004Br14).
275.2 *3*	5.8[#] *7*	445.6	$(3)^+$	170.5	2^-			
287.5 *3*	19.8[‡] *8*	883.5	(7^-)	596.0	$(5)^-$	[E2]	0.0237	α(K)=0.0207 *3*; α(L)=0.00253 *4*; α(M)=0.000432 *7* α(N)=5.66×10^{-5} *9*; α(O)=3.42×10^{-6} *5* I_γ: 1.8 *3* (2004Br14).
344.3 *3*	27.2[‡] *5*	1069.3	(8^-)	725.8	(6^-)	[E2]	0.01285	α(K)=0.01124 *16*; α(L)=0.001344 *20*; α(M)=0.000230 *4* α(N)=3.02×10^{-5} *5*; α(O)=1.89×10^{-6} *3* I_γ: 3.3 *4* (2004Br14).

[†] From 2004Br14 (see also 1986LhZW). 1972GrYM assigned γ rays to ^{97}Y but later, 1975Si23 correctly assigned these to ^{98}Y.

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^{235}U(n,Fγ),^{241}Pu(n,Fγ) 2004Br14,2005Pi13,2017Is03 (continued)

γ(^{98}Y) (continued)

‡ From 2005Pi13, normalized to 100.0 for 100.7γ. Values from 2004Br14 are less precise and given under comments.
# From 2004Br14, normalized to 100 for 121.3γ.
@ From total and K-conversion coefficients in 2004Br14 (fluorescence method or intensity balance).
& Deduced by evaluators from conversion coefficients in 2004Br14 and 2017Ur03 using the BrIccMixing code.
[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.

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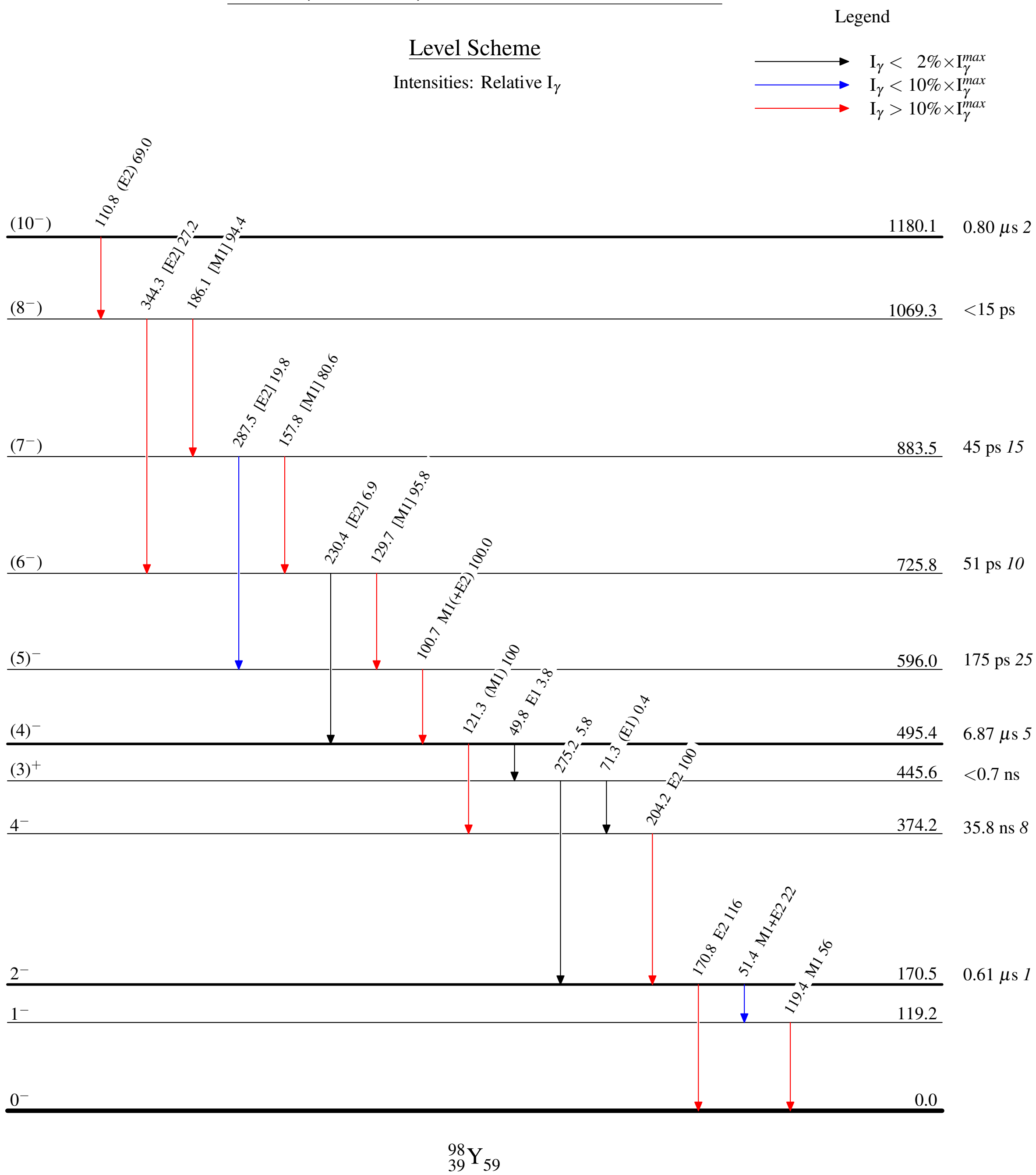

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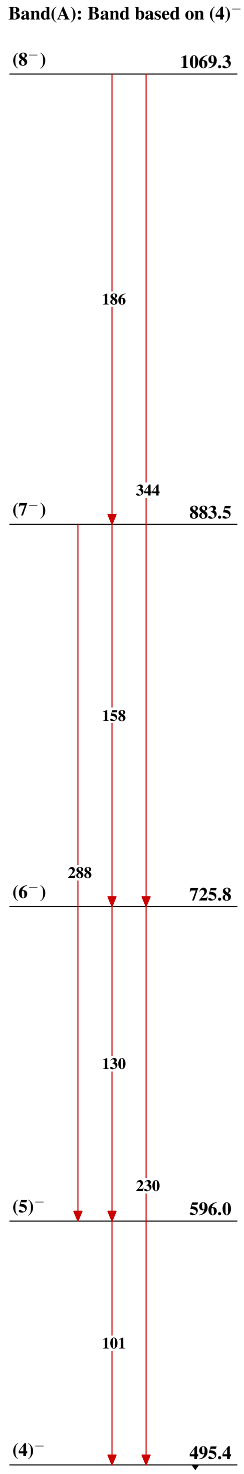

$^{98}_{39}Y_{59}$