^{173}Lu ε decay 1992Ad08

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	V. S. Shirley	NDS 75,377 (1995)	1-Oct-1993

Parent: ^{173}Lu: E=0.0; J^π=7/2$^+$; $T_{1/2}$=1.37 y *1*; Q(ε)=670.8 *17*; %ε decay=100.0

The decay scheme and all data are from 1992Ad08, except where noted. Sources from spallation of tantalum by 660-MeV protons, chemical, mass separations; measured Eγ, Iγ (high-purity germanium detector, FWHM=500 eV at 122 keV; anti-Compton spect), E(ce), Ice (Si(Li) detector, FWHM=1.5 keV at 150 keV), differential-integral coin (Ge(Li)-NaI). Reference citations are given with data from other sources. Others: 1957Bo61, 1957Go78, 1958Dz96, 1958Go85, 1959Bi11, 1959Di44, 1960Ro14, 1960Wi06, 1961Be34, 1961Va36, 1963Ba28, 1966Ja16, 1979Dz02, 1984Se08.

^{173}Yb Levels

See ^{173}Yb Adopted Levels for magnetic moments from g-factors measured in ^{173}Lu ε decay (1983Ca28).

E(level)	J^π	$T_{1/2}$†	Comments
0.0‡	5/2$^-$	stable	
78.647‡ *12*	7/2$^-$	46 ps *5*	$T_{1/2}$: values from ^{173}Lu ε decay: 38 ps *5* (γce(t) (1961Be37)), 52 ps *6* (microwave pulsed beam (1971Da17)).
179.364‡ *9*	9/2$^-$	32 ps *4*	
301.859‡ *14*	11/2$^-$	16.7 ps *15*	
350.764# *10*	7/2$^+$	0.45 ns *2*	$T_{1/2}$: values from ^{173}Lu ε decay: 0.47 ns *3* (Xγ(t) (1961Be34)), 0.42 ns *7* (Xγ(t) (1961Va36)), 0.43 ns *3* (Xγ(t) (1966Ja16)).
412.967# *11*	9/2$^+$		
636.128 *11*	7/2$^-$	8.0 ps *26*	$T_{1/2}$: see ^{173}Yb Adopted Levels regarding half-life, as measured in ^{173}Lu ε decay.

† Adopted values.
‡ 5/2[512] band member.
# 7/2[633] band member.

ε radiations

g.s. feeding is from x-ray intensity data (1992Ad08); excited-state feedings, from intensity imbalance at each level.

E(decay)	E(level)	Iε†	Log *ft*	Comments
(34.7 *17*)	636.128	2.93 *6*	6.38 *7*	εL= 0.65 *9*; εM+= 0.35 *4*
(257.8 *17*)	412.967	3.04 *14*	8.94 *3*	εK= 0.759 *13*; εL= 0.183 *3*; εM+= 0.0584 *8*
(320.0 *17*)	350.764	22.1 *4*	8.30 *1*	εK= 0.777 *10*; εL= 0.1694 *19*; εM+= 0.0534 *6*
(491.4 *17*)	179.364	20.9 *7*	8.76 *2*	εK= 0.801 *6*; εL= 0.1523 *11*; εM+= 0.0472 *3*
(592.2 *17*)	78.647	50 *3*	8.56 *3*	εK= 0.807 *5*; εL= 0.1475 *9*; εM+= 0.0454 *3*
(670.8 *17*)	0.0	≤2.2	≥10.0	εK= 0.811 *5*; εL= 0.1448 *7*; εM+= 0.04443 *23* I($\varepsilon+\beta^+$): estimated from x-ray intensity data (1992Ad08).

† Absolute intensity per 100 decays.

γ(^{173}Yb)

Iγ normalization: from total I(γ+ce) to g.s.=98.9% 11 (ε feeding to g.s.≤2.2%).

K x ray data (1992Ad08); intensities relative to Iγ(272.1γ)=100.0.

	E(x ray)	I(x ray)	from decay scheme
Yb Kα_2 x ray	51.354	231.0 5	207 6
Yb Kα_1 x ray	52.389	365.0 8	364 10
Yb Kβ_1′ x ray	59.4	105.3 26	151 5 (Kβ_1′ x ray + Kβ_2′ x ray)
Yb Kβ_2′ x ray	61.0	27.6 10	

E$_\gamma$	I$_\gamma$[@]	E$_i$(level)	J$^\pi_i$	E$_f$	J$^\pi_f$	Mult.[†]	δ	α[&]	Comments
62.17 *3*	0.79 *4*	412.967	9/2$^+$	350.764	7/2$^+$	M1+E2	0.29 *4*	13.5	α(K)= 9.81; α(L)= 2.87; α(M)= 0.67; α(N+..)= 0.187 Mult.,δ: from α(L)exp=2.7 *4* (x-ray and γ intensity data, 1983Va20) and L1:L2:L3=0.83 *23*:0.34 *15*:0.41 *9* (1970BaYI). δ=0.26 +*6*−*7* from α(L)exp and δ=0.30 *5* from L1:L2:L3. δ=0.17 *14* (1992Ad08).
78.63 *3*	56.0 *8*	78.647	7/2$^-$	0.0	5/2$^-$	M1+E2	−0.224 *14*	7.01	α(K)= 5.59; α(L)= 1.09; α(M)= 0.250; α(N+..)= 0.0718 δ: magnitude from weighted average of 0.232 *14* (L1:L2:L3, 1959Ha09), 0.256 *10* ($\gamma\gamma(\theta)$, 1965Ho05), 0.220 *9* (L1:L2:L3, 1976KaYV), and 0.187 *11* ($\gamma\gamma(\theta)$, ce$\gamma(\theta)$, 1982Bu16); sign from nuclear orientation (1975Kr11,1983Kr18). Other values range from −0.14 to −0.26.
100.724 *20*	24.7 *4*	179.364	9/2$^-$	78.647	7/2$^-$	M1+E2	−0.205 *10*	3.38	α(K)= 2.76; α(L)= 0.481; α(M)= 0.109; α(N+..)= 0.0316 δ: magnitude from weighted average of 0.21 *2* (K:L1:L2:L3, 1970BaYI), 0.19 *2* (L1:L2:L3, 1969Ka34), 0.22 *2* (nuclear orientation, 1983Kr18), and 0.201 *19* ($\gamma\gamma(\theta)$, ce$\gamma(\theta)$, 1982Bu16); sign from nuclear orientation (1975Kr11,1983Kr18). Other values range from −0.12 to −0.3.
111.109 *12*	0.252 *10*	412.967	9/2$^+$	301.859	11/2$^-$	[E1]		0.261	α(K)= 0.216; α(L)= 0.0350; α(M)= 0.00777; α(N+..)= 0.00215
122.55 *3*	0.079 *3*	301.859	11/2$^-$	179.364	9/2$^-$	M1+E2	−0.22 *6*	1.92	α(K)= 1.58; α(L)= 0.266; α(M)= 0.060; α(N+..)= 0.0169 Mult.,δ: from Coulomb excitation. Other value for δ: −0.17 *11* (nuclear orientation (1975Kr11)).
171.393 *13*	13.7 *5*	350.764	7/2$^+$	179.364	9/2$^-$	E1+M2	≈−0.026	0.086 *4*	α(K)= 0.072 *3*; α(L)= 0.0112 *6*; α(M)= 0.00250 *13*; α(N+..)= 0.00067 *5* δ: magnitude from average of≈0.039 (L1:L2, 1976KaYW),≈0.021 (α(K)exp, 1970BaYI),≈0.031 (K:L1:L2:L3, 1970BaYI), and≈0.015 ($\gamma\gamma(\theta)$, ce$\gamma(\theta)$, 1982Bu16); sign from $\gamma\gamma(\theta)$, ce$\gamma(\theta)$ (1982Bu16). Other measurements indicate pure E1.

From ENSDF

$^{173}_{70}$Yb$_{103}$-2

γ(^{173}Yb) (continued)

E_γ	I_γ[@]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†]	δ	α[&]	Comments
179.365 *11*	6.49 *12*	179.364	9/2−	0.0	5/2−	E2		0.392	α(K)= 0.227; α(L)= 0.126; α(M)= 0.0305; α(N+..)= 0.00828
[x]208.78	≤0.003								
223.163[a] *20*	0.060[a] *12*	301.859	11/2−	78.647	7/2−	E2		0.189	α(K)= 0.122; α(L)= 0.0514; α(M)= 0.0123; α(N+..)= 0.00349 Mult.: from Coulomb excitation.
223.163[a] *20*	0.66[a] *3*	636.128	7/2−	412.967	9/2+	E1		0.0420	α(K)= 0.0352; α(L)= 0.00529; α(M)= 0.00118; α(N+..)= 0.000343
233.605 *12*	2.61 *5*	412.967	9/2+	179.364	9/2−	E1+M2	≈0.08	0.047 *12*	α(K)= 0.039 *9*; α(L)= 0.0063 *16*; α(M)= 0.0014 *4*; α(N+..)= 0.00042 *13* δ: average of 0.06 *+4−6* (α(K)exp, 1970BaYI) and 0.10 *3* (K:L, 1976KaYW).
272.105 *15*	100.0 *15*	350.764	7/2+	78.647	7/2−	E1		0.0254	α(K)= 0.0214; α(L)= 0.00317; α(M)= 0.000703; α(N+..)= 0.000220 Mult.: pure E1 deduced from ce subshell ratios of 1959Ha09, 1969Ka34, and 1976KaYW. M2/E1<0.001 (from particle parameter, 1965Ho05).
285.362 *6*	2.88 *8*	636.128	7/2−	350.764	7/2+	E1(+M2)	<0.026[‡]	0.0229 *12*	α(K)= 0.0192 *10*; α(L)= 0.00285 *17*; α(M)= 0.00063 *4*; α(N+..)= 0.000201 *14* δ: other values: 0.07 *+3−4* (α(K)exp (1970BaYI)), 0.034 *25* (γγ(θ), ceγ(θ) (1982Bu16)).
[x]319.4	≤0.0025								
334.263[b] *15*	<0.026	636.128	7/2−	301.859	11/2−				
334.321 *11*	0.514 *20*	412.967	9/2+	78.647	7/2−	E1(+M2)	<0.084[‡]	0.017 *7*	α(K)= 0.014 *6*; α(L)= 0.0021 *10*; α(M)= 0.00047 *22*; α(N+..)= 0.00015 *8*
350.774 *18*	1.42 *5*	350.764	7/2+	0.0	5/2−	E1+M2	0.090[‡] *45*	0.017 *4*	α(K)= 0.014 *3*; α(L)= 0.0021 *5*; α(M)= 0.00048 *11*; α(N+..)= 0.00015 *4*
412.9	<0.0008	412.967	9/2+	0.0	5/2−	[M2]		0.236	α(K)= 0.191; α(L)= 0.0348; α(M)= 0.00795; α(N+..)= 0.00240
[x]442.08	≤0.002								
456.79 *3*	0.663 *22*	636.128	7/2−	179.364	9/2−	M1+E2	+0.65[#] *+13−9*	0.0440 *17*	α(K)= 0.0365 *15*; α(L)= 0.00580 *23*; α(M)= 0.00130 *5*; α(N+..)= 0.000395 *11* δ: other value: 0.89 *15* (α(K)exp (1992Ad08)).
[x]543.24	≤0.003								
557.497 *25*	2.45 *9*	636.128	7/2−	78.647	7/2−	M1+E2	+1.81[#] *6*	0.0180	α(K)= 0.0146; α(L)= 0.00257 δ: other value: 2.2 *8* (α(K)exp (1992Ad08)).
[x]621.80	≤0.0008								
636.11 *3*	6.85 *22*	636.128	7/2−	0.0	5/2−	M1+E2	−0.54[#] *5*	0.0199	α(K)= 0.0166; α(L)= 0.00250 δ: other value: 0.83 *13* (α(K)exp (1992Ad08)).

From ENSDF

$^{173}_{70}Yb_{103}$-3

γ(^{173}Yb) (continued)

[†] From α(K)exp (1970BaYI,1976KaYW) except where noted. The photon and intensity scales were normalized through α(K)=0.0214 (E1 theory) for 272.1γ.
[‡] α(K)exp (1992Ad08).
[#] Nuclear orientation (1992KrZU); ce data give erratic results.
[@] For absolute intensity per 100 decays, multiply by 0.212 *7*.
[&] 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.
[a] Multiply placed with intensity suitably divided.
[b] Placement of transition in the level scheme is uncertain.
[x] γ ray not placed in level scheme.

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Decay Scheme

Intensities: $I_{(\gamma+ce)}$ per 100 parent decays
@ Multiply placed: intensity suitably divided