Pt(α,xnγ) 1975Li16,1974Be11,1974Pr13

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Jun Chen and Balraj Singh	NDS 177, 1 (2021)	3-Sep-2021

Includes ^{194}Pt(α,4nγ), ^{195}Pt(α,5nγ), ^{196}Pt(α,6nγ); and ^{197}Au(p,4nγ) from 1974Ca30, 1967YaZY, 1967IsZZ.

Measurements using ^{195}Pt(α,5nγ), ^{196}Pt(α,6nγ) reactions:

1975Li16: E(α)=76 MeV α beam for (α,6nγ) and E=65 MeV α beam for (α,6nγ) measurement were produced from the Julich isochronous cyclotron JULIC. Targets were ≈20 mg/cm^2 self-supporting metal foils of ^{196}Pt (54.9% enriched) and ^{195}Pt (34.3% enriched) for (α,5nγ). The γ rays were detected by Ge(Li) detectors. Measured Eγ, Iγ, γγ-coin, γ(t) with (α,6nγ); γ(θ) with (α,5nγ). Deduced levels, J, π, γ-ray multipolarities. Systematics of neighboring Hg isotopes. See also 1974Be11 below for (α,4nγ) from the same group.

Other: 1974Pr13 for (α,5nγ) and (α,4nγ). See data in (α,4nγ).

Level scheme and placement of transitions are from Adopted Levels, Gammas. Level scheme of 1975Li16 is slightly different for transitions from the highest levels and noted under comments.

Measurements using ^{194}Pt(α,4nγ) reaction:

1974Be11: E(α)=65-108 MeV α beams were produced from the Julich isochronous cyclotron JULIC. Target was enriched metallic ^{194}Pt. γ rays were detected with Ge(Li) detectors. Measured Eγ, Iγ, γγ-coin. Deduced levels.

1974Pr13: E(α)=34-50 MeV α beams were produced from the 88-inch cyclotron at LBNL. Target was ≈5 mg/cm^2 self-supporting 60% enriched ^{194}Pt. γ rays were detected with Ge(Li) detectors. Measured Eγ, Iγ, γγ-coin, γ(θ), γ(t). Deduced levels, J, π, $T_{1/2}$, γ-ray multipolarities.

1977Gu05: E(α)=48 MeV from Bonn cyclotron. Target was self-supporting foils of 83% enriched ^{194}Pt (0.7<thickness<5 mg/cm^2). γ rays were detected with Ge(Li) detectors and conversion electrons were detected with an iron-free orange-type beta spectrometer. Measured Eγ, Iγ, γγ-coin, ce(t). Deduced $T_{1/2}$ of 4 levels.

1983Gu05: E(α)=50 MeV α beam from the Bonn cyclotron. Target was ≤1 mg/cm^2 self-supporting metal foil of 98% enriched ^{194}Pt. Conversion electrons were detected with an electron spectrometer consisting of a superconducting solenoid and Si(Li) detectors. Measured E(ce), I(ce), ce-ce coincidence, ce(t). Deduced $T_{1/2}$, ratios of conversion coefficients, γ-ray multipolarities. Systematics of neighboring Hg isotopes. Fig. 5 of (ce)(ce)-coin spectra shows 11 transitions in the g.s. band up to 10^+ and negative-parity levels up to 8^-.

Others (α,4nγ) measurements:

1985Ko13: E(α)=50 MeV from Bonn cyclotron. Measured ce, ce-ce, ce(t), ce-ce(t), ce-γ with an iron-free orange-type spectrometer. Deduced $T_{1/2}$ of 2475 level. Fig. 9 of (ce)γ-coin spectra shows population of levels in the g.s. band up to 18^+, and negative-parity levels of 5^-, 7^- and 9^-. The level scheme shown in Fig. 11 is taken from literature.

1984Gu29: E(α)=50 MeV from Bonn cyclotron. Measured ce-ce spectrum in a test measurement with a superconducting electron spectrometer. See 1983Gu05, 1984Gu29 of the same group.

1981HiZW: E(α)=51 MeV. Measured half-life of the 12^+ isomer by (ce)(t), and subshell ratios.

1981Kr04: E(α)=30, 48 MeV from Bonn cyclotron. Measured γ(t) of 233 keV, 9−→7^-, 280 keV, 10+→9^-, and 565 keV, 8+→6^+ transitions, showing superposition of two half-lives with $T_{1/2}$=2.9 ns *5* and 8.1 ns *5*. Authors suggest an unobserved 12^+ isomeric state above the 10^+ state. The 2.9 ns half-life assigned to the 10^+ level, and 8.1 ns to the 12^+ level.

1980Kr21: E(α)=48 MeV from Bonn cyclotron. Measured Eγ, Iγ, γ(θ) of five transitions in the g.s. band and the 9−→7^- transition. Measured g factor of the 10^+ state by IPAD method.

Measurements of ^{197}Au(p,4nγ):

1974Ca30: ^{197}Au(p,4n ce),E(p)=37 MeV: measured ce, γ spectrum, half-life of the 7^- level by ce(t). The g.s. band observed up to 6^+ and negative-parity levels of 5^- and 7^-.

1967YaZY (conference report): ^{197}Au(p,4nγ),E(p)=12-16 MeV: measured Eγ, γ(θ).

1967IsZZ (lab report). ^{197}Au(p,4n ce),E(p)=50,55 MeV: measured ce, ce(θ).

Pt(α,xnγ) 1975Li16,1974Be11,1974Pr13 (continued)

^{194}Hg Levels

E(level)[†]	J$^{\pi}$[#]	T$_{1/2}$	Comments
0.0[@]	0$^+$		
427.9[@] *3*	2$^+$		
1064.3[@] *5*	4$^+$		
1798.9[@] *5*	6$^+$		
1813.0[a] *5*	5$^-$		
1910.0[a] *6*	7$^-$	4.46 ns *11*	T$_{1/2}$: from ce(K)(t) for 749γ in ^{197}Au(p,4n ce) (1974Ca30). The authors did not correct for partial feeding from 12$^+$ isomer.
2137.7[b] *6*	8$^{(-)}$	912 ps *30*	T$_{1/2}$: from ce(t) (1977Gu05).
2142.8[a] *6*	9$^-$	291 ps *50*	T$_{1/2}$: from ce(t) (1977Gu05).
2363.5[&] *6*	8$^+$		
2423.0[&] *6*	10$^+$	2.9 ns *5*	T$_{1/2}$: from fitting of 233γ(t), 280γ(t), and 565γ(t) in terms of a two half-life pattern giving 2.9 ns for 10$^+$ isomer and 8.1 ns for 12$^+$ isomer (1981Kr04). Others: 4.0 ns *10* (1985Ko13, ce(L2)(52)(t) and ce(M)(59.5)(t)); 1977Gu05 assign 11.6 ns *10* half-life from ce(t), and also 1975Li16 assign 11 ns *2* from γ(t) to this level, which actually belongs to the half-life of the 2476, 12$^+$ level from studies by 1981Kr04 1985Ko13.
2475.2[&] *4*	(12$^+$)	8.1 ns *5*	E(level),J$^{\pi}$: from the Adopted Levels. 1975Li16 and 1974Pr13 assign this isomeric state to the 2424, 10$^+$ level, thus missing the 12$^+$ level at 2476 keV. T$_{1/2}$: from 1981Kr04. See T$_{1/2}$ comment for 2423.6 level. This value is consistent with 7.5 ns *20* from ce(L3)(52)(t) (1983Gu05). Others: 11.6 ns *10* (1977Gu05, ce(t)), 11 ns *2* (1975Li16, 280γ(t)), 10 ns *2* (1974Pr13, γ(t)). g factor=−0.24 *4* (1980Kr21). g: integral PAD method. 1980Kr21 used T$_{1/2}$=12 ns *1*. The g factor corresponds to both or either of the 12$^+$ and 10$^+$ isomers at 2476 and 2423, respectively.
2561.5[b] *7*	10$^{(-)}$		
2687.2[a] *7*	11$^-$		
2887.9[‡&] *8*	(14$^+$)		J$^{\pi}$: from the Adopted Levels. 1975Li16 assigned 12$^+$.
3172.5[b] *8*	12$^{(-)}$		
3393.1[a] *7*	13$^-$		
3530.9[‡&] *8*	(16$^+$)		J$^{\pi}$: from the Adopted Levels. 1975Li16 assigned 14$^+$.
3746.9[b] *8*	14$^{(-)}$		
3878.2[a] *8*	15$^-$		
3983.1[b] *9*	16$^{(-)}$	<500 ps	T$_{1/2}$: from ce(t) (1977Gu05).
4260.9[a] *9*	(17$^-$)		E(level): this level corresponds to 4498, (19$^-$) in the Adopted Levels. 1975Li16 missed the intermediate (17$^-$) level at 4115 keV.
4274.5[‡&] *9*	(18$^+$)		J$^{\pi}$: from the Adopted Levels. 1975Li16 assigned 16$^+$.
4289.1[b] *9*	18$^{(-)}$		
4984.8[‡&] *10*	(20$^+$)		

[†] From least-squares fit to Eγ values.
[‡] Level energy in 1975Li16 is lower by 52 keV, as the authors missed the 52-keV transition from the 12$^+$ level.
[#] As proposed by 1975Li16 and 1974Pr13 based on their $\gamma(\theta)$ data and band assignments, unless otherwise stated.
[@] Band(A): g.s. band.
[&] Band(B): Band based on 8$^+$. Extension of the g.s. band.
[a] Seq.(C): γ cascade based on 5$^-$.
[b] Seq.(D): γ cascade based on 8$^{(-)}$.

Pt(α,xnγ) 1975Li16,1974Be11,1974Pr13 (continued)

γ(^{194}Hg)

E_γ [†]	E_i(level)	J^π_i	E_f	J^π_f	Mult. [‡]	δ	α [@]	$I_{(\gamma+ce)}$ [†]	Comments
52.0 *2*	2475.2	(12⁺)	2423.0	10⁺	E2		112 *5*	26 *5*	L12/L3=1.1 *2* (1983Gu05) Transition observed in ce data (1983Gu05); energy uncertainty for this prominent line estimated by evaluators from ce spectrum in Fig. 5 of 1983Gu05. $I_{(\gamma+ce)}$: deduced from intensity balance at 2476 level, assuming no side feeding to this level.
(59.5)	2423.0	10⁺	2363.5	8⁺	E2		58.5 *13*	5 *5*	L12/L3=1.0 *4* (1983Gu05) Transition observed in ce data (1983Gu05); not observed in 1974Pr13. $I_{(\gamma+ce)}$: deduced from intensity balance at 2424 level, assuming no side feeding to this level.
97.0 *3*	1910.0	7⁻	1813.0	5⁻	E2		6.31 *13*	55 *7*	L12/L3=1.3 *2* (1983Gu05) A_2=+0.27 *4*; A_4=−0.08 *6* (1975Li16); A_2=+0.47 *15* (1974Pr13) Eγ=96.6, Iγ<5.6 in-beam, <8 out-of-beam (1974Pr13).
111.2 *3*	1910.0	7⁻	1798.9	6⁺	(E1) [#]		0.324	11 *3*	A_2=−0.08 *4*; A_4=−0.04 *6* (1975Li16); A_2=−0.16 *10* (1974Pr13) Eγ=110.8, Iγ=4 *1* in-beam, 6 *1* out-of-beam (1974Pr13).
227.6 *2*	2137.7	8⁽⁻⁾	1910.0	7⁻	M1+E2	0.25 *5*	0.740 *17*	16 *4*	K/L=3.5 *2* (1983Gu05); A_2=−0.63 *5*; A_4=+0.08 *8* (1975Li16) E_γ: from 1977Gu05. Other: 227.7 *3* (1975Li16). δ: from γ(θ) in 1975Li16.
232.7 *2*	2142.8	9⁻	1910.0	7⁻	E2		0.235	50 *8*	A_2=+0.24 *8*; A_4=−0.06 *12* (1975Li16) A_2=+0.45 *15* (1974Pr13); A_2=+0.23 *4* (1980Kr21) K/L=1.3 *2* (1983Gu05) Line contaminated by 232.2γ in ^{193}Hg. E_γ: from 1977Gu05. Other: 232.8 *3* (1975Li16). Eγ=233, Iγ=29 *4* (1980Kr21). Eγ=232.7, Iγ=24 *3* in-beam, 25 *2* out-of-beam (1974Pr13).
236.2 *2*	3983.1	16⁽⁻⁾	3746.9	14⁽⁻⁾	(E2)		0.224	14 *4*	A_2=+0.43 *7*; A_4=−0.10 *9* (1975Li16) E_γ: from 1977Gu05. Other: 236.2 *3* from 1975Li16.
280.2 *3*	2423.0	10⁺	2142.8	9⁻	(E1) [#]		0.0326	21 *4*	A_2=−0.15 *4*; A_4=−0.03 *7* (1975Li16); A_2=+0.02 *20* (1974Pr13) K/L=7 *2* (1983Gu05) A_2=+0.02 *20* (1974Pr13); A_2=−0.27 *15* (1980Kr21) Eγ=280, Iγ=17 *5* (1980Kr21). Eγ=279.7, Iγ=9 *3* in-beam, 32 *2* out-of-beam (1974Pr13).
306.0 *3*	4289.1	18⁽⁻⁾	3983.1	16⁽⁻⁾	(E2)		0.1004	6 *3*	A_2=+0.31 *11*; A_4=−0.07 *16* (1975Li16)
382.7 *3*	4260.9	(17⁻)	3878.2	15⁻				4 *2*	This γ is placed from 4498, (19⁻) to

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Pt(α,xnγ) 1975Li16,1974Be11,1974Pr13 (continued)

γ(^{194}Hg) (continued)

Eγ†	Iγ	Ei(level)	$J^π_i$	Ef	$J^π_f$	Mult.‡	α@	I(γ+ce)†	Comments
									4115, (17⁻) in the Adopted Levels, as 1975Li16 missed observing a 235.5γ above the 3879, 15⁻ level.
412.9 *3*		2887.9	(14⁺)	2475.2	(12⁺)	Q		26 *5*	A_2=+0.36 *5*; A_4=−0.06 *7* (1975Li16); A_2=+0.56 *15* (1974Pr13) Eγ=412.8, Iγ=16 *3* in-beam (1974Pr13).
418.5& *3*		2561.5	10⁽⁻⁾	2142.8	9⁻			3 *2*	Line is contaminated.
423.8 *3*		2561.5	10⁽⁻⁾	2137.7	8⁽⁻⁾	Q		12 *4*	A_2=+0.46 *8*; A_4=+0.02 *12* (1975Li16)
427.9 *3*		427.9	2⁺	0.0	0⁺	E2	0.0398	100 *8*	A_2=+0.26 *2*; A_4=−0.07 *3* (1975Li16) A_2=+0.45 *5* (1974Pr13); A_2=+0.17 *3* (1980Kr21) Eγ=428, Iγ=100 *5* (1980Kr21). Eγ=428.4, Iγ<100, in-beam and out-of-beam (1974Pr13).
485.1 *3*		3878.2	15⁻	3393.1	13⁻	E2	0.0290	7 *3*	A_2=+0.35 *10*; A_4=−0.01 *15* (1975Li16)
544.4 *3*		2687.2	11⁻	2142.8	9⁻	Q		23 *5*	A_2=+0.32 *6*; A_4=−0.08 *9* (1975Li16); A_2=+0.45 *10* (1974Pr13) Eγ=544.7, Iγ=16 *3* in-beam, 34 *2* out-of-beam (1974Pr13).
564.7 *3*		2363.5	8⁺	1798.9	6⁺	Q		33 *5*	A_2=+0.34 *4*; A_4=−0.04 *6* (1975Li16); A_2=+0.37 *15* (1974Pr13) A_2=+0.37 *15* (1974Pr13); A_2=+0.20 *5* (1980Kr21) Eγ=565, Iγ=22 *2* (1980Kr21). Eγ=565.0, Iγ=16 *3* in-beam, 34 *2* out-of-beam (1974Pr13).
574.4 *3*		3746.9	14⁽⁻⁾	3172.5	12⁽⁻⁾	Q		14 *4*	A_2=+0.32 *7*; A_4=−0.05 *10* (1975Li16)
611.0 *3*		3172.5	12⁽⁻⁾	2561.5	10⁽⁻⁾	(Q)		14 *5*	A_2=+0.31 *7*; A_4=−0.07 *10* (1975Li16) Line contaminated by 611.6γ from ^{195}Hg.
636.4 *3*		1064.3	4⁺	427.9	2⁺	E2	0.01541	100 *9*	A_2=+0.25 *3*; A_4=−0.02 *4* (1975Li16) A_2=+0.45 *5* (1974Pr13); A_2=+0.20 *3* (1980Kr21) Eγ=636, Iγ=95 *6* (1980Kr21). Eγ=636.8, Iγ<93, in-beam and out-of-beam (1974Pr13).
643.0 *3*		3530.9	(16⁺)	2887.9	(14⁺)	Q		13 *5*	A_2=+0.44 *9*; A_4=+0.01 *14* (1975Li16)
705.9 *3*		3393.1	13⁻	2687.2	11⁻	Q		9 *4*	A_2=+0.44 *12*; A_4=−0.06 *18* (1975Li16)
710.3 *3*		4984.8	(20⁺)	4274.5	(18⁺)			7 *3*	Line contaminated by 710.1γ from ^{195}Hg.
734.6 *3*		1798.9	6⁺	1064.3	4⁺	E2	0.01130	43 *6*	A_2=+0.30 *3*; A_4=−0.05 *5* (1975Li16) A_2=+0.42 *10* (1974Pr13); A_2=+0.26 *3* (1980Kr21) Eγ=735, Iγ=35 *3* (1980Kr21). Eγ=734.7, Iγ=28 *3* in-beam, 43 *4* out-of-beam (1974Pr13).
743.6 *3*	44 *3*	4274.5	(18⁺)	3530.9	(16⁺)	Q		13 *5*	A_2=+0.38 *12*; A_4=−0.10 *18* (1975Li16)
748.6 *3*		1813.0	5⁻	1064.3	4⁺	(E1)#	0.00395	51 *7*	A_2=−0.15 *3*; A_4=−0.01 *5* (1975Li16); A_2=−0.10 *10* (1974Pr13) Eγ=748.9, Iγ=40 *4* in-beam, 44 *4* out-of-beam (1974Pr13).

† From 1975Li16, unless otherwise noted. Available values for Eγ and Iγ from 1974Pr13 are listed under comments.
‡ From γ(θ) data in 1975Li16 and 1974Pr13, and ce data in 1983Gu05, unless otherwise noted. Evaluators assign mult=Q when only the γ(θ) data are available, with level half-life unknown, and when Eγ>400 keV or so, as in such cases, RUL for E2 and

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Pt(α,xnγ) 1975Li16,1974Be11,1974Pr13 (continued)

γ(^{194}Hg) (continued)

M2 favors E2, assuming that level half-life is less than the typical resolving time of few ns in $\gamma\gamma$-coin system. 1975Li16 assigned E2 from $\gamma(\theta)$ data, when consistent with stretched quadrupole.

E1 proposed by 1975Li16 based on $\gamma(\theta)$ and consistent with the level scheme, parentheses added by the evaluators due to no experimental evidence for electric nature of the transition.

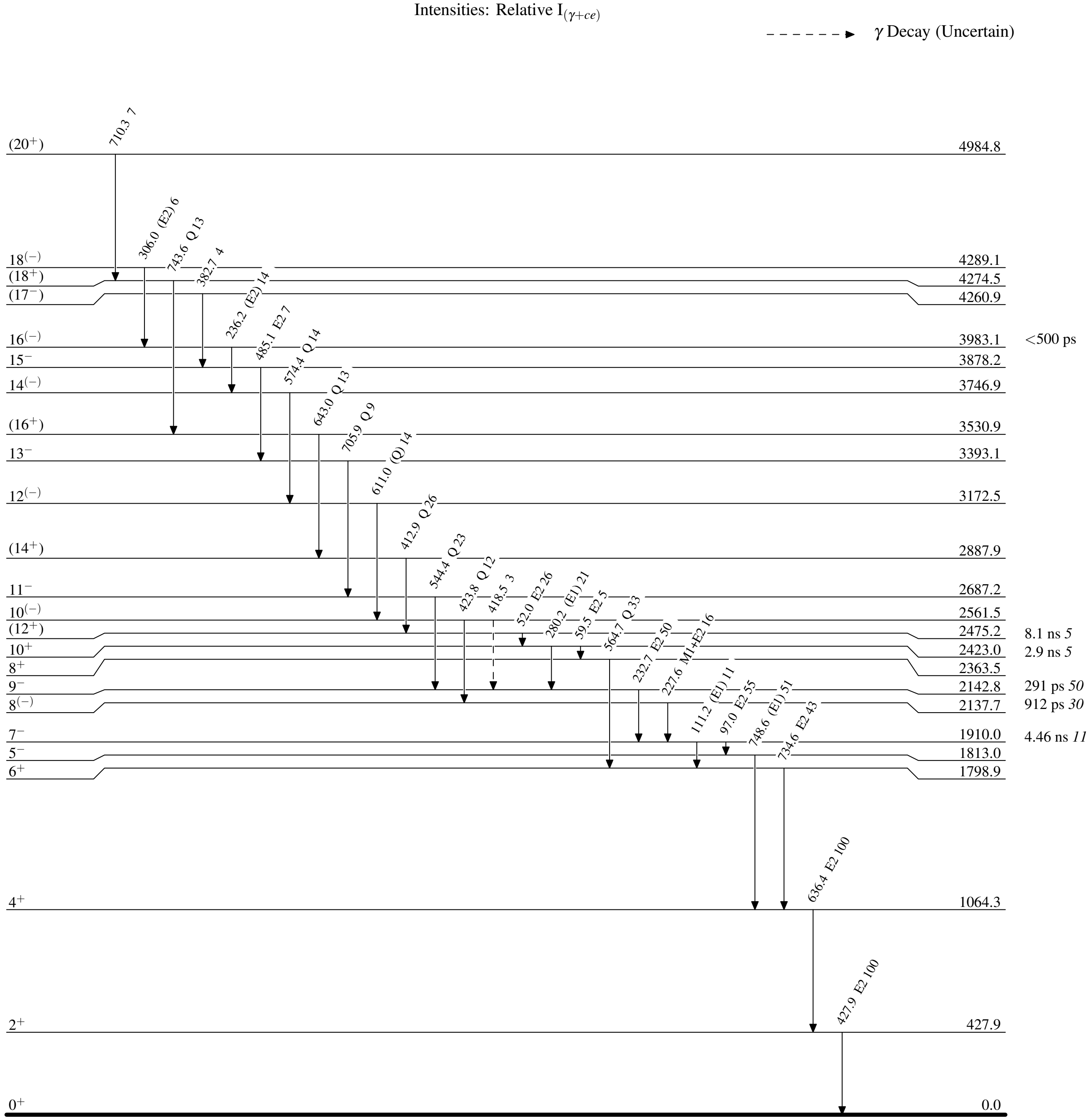
@ Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on γ-ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

& Placement of transition in the level scheme is uncertain.

Pt(α,xnγ) 1975Li16,1974Be11,1974Pr13

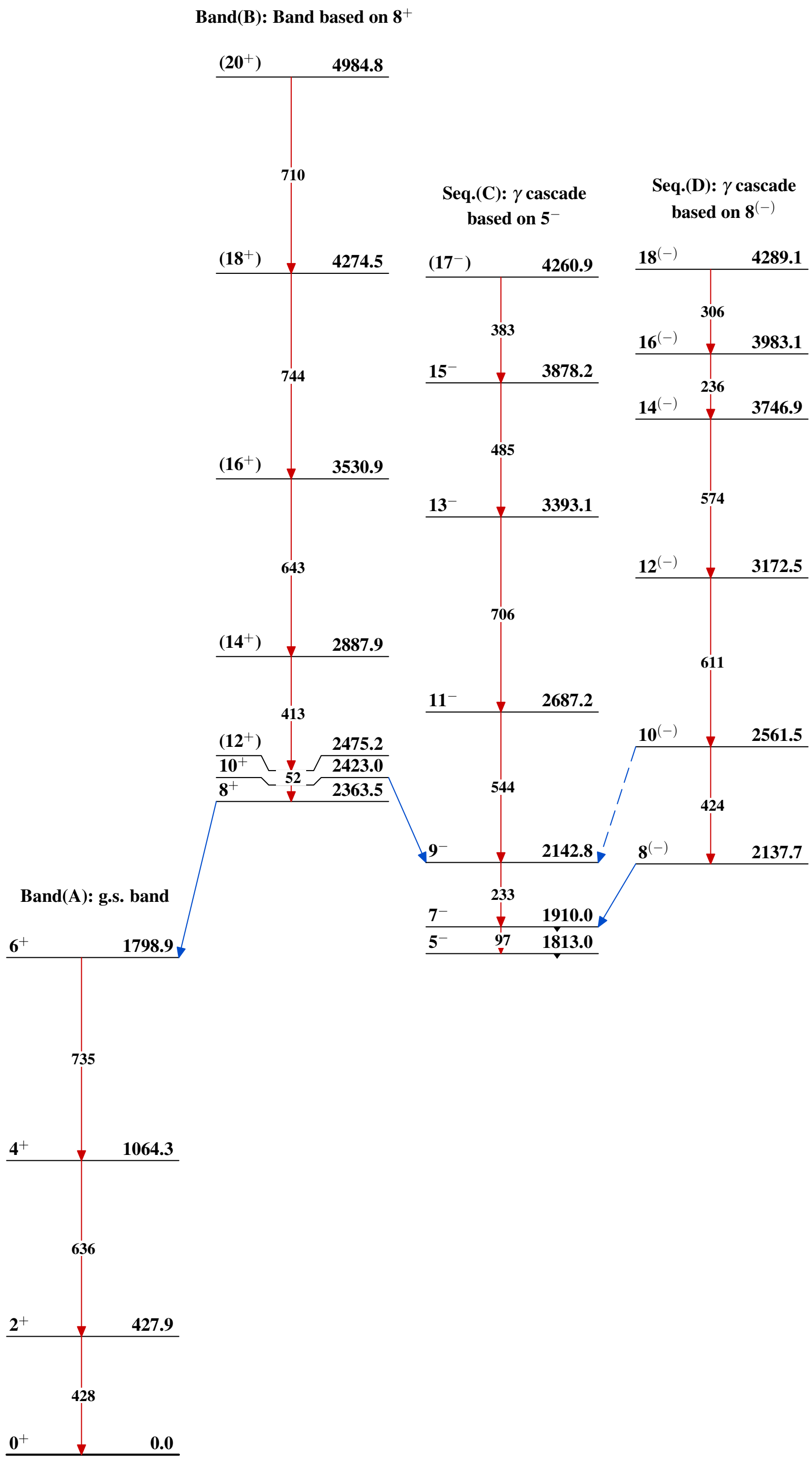
Level Scheme

Intensities: Relative $I_{(\gamma+ce)}$



$^{194}_{80}Hg_{114}$

Pt(α,xnγ) 1975Li16,1974Be11,1974Pr13



$^{194}_{80}Hg_{114}$