Adopted Levels, Gammas

History

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

Q(β^-)=−5050 *10*; S(n)=10176 *7*; S(p)=8289 *8*; Q(α)=−2236 *6* 2017Wa10
S(2n)=18287 *6*, S(2p)=14008 *6* (2017Wa10).

Other measurements:
^{90}Zr(^{11}B,p2nγ): 1978Lu02, E=40 MeV. Measured γ, particle-γ coin. Six main γ rays reported from corresponding six levels.
^{96}Mo(^{32}S,^{30}Si): 1995He17, E=180 MeV. Measured $\sigma(\theta)$.
^{95}Mo(^{3}He,γ): 1996Be13, E=11-28 MeV, measured statistical γ production.
^{96}Ru(α,2pγ): 1985Be06, only four main γ rays reported.
Additional information 1.
(HI,X) (multi-nucleon transfer): 1974We04.
Mass measurements: 2008De16, 1963Da10.
Theory references: consult the NSR database (www.nndc.bnl.gov/nsr/) for 77 primary references dealing with nuclear structure calculations.
See (^{36}S,p2nγ) dataset (1998Kh01) for many additional possible levels and transitions, which have not been adopted due to severe disagreement with the higher statistics data in (^{36}S,α4nγ) from 2000Ti07. The orderings of the γ cascades, level energies and J^π values are adopted from 2000Ti07, since this experiment has about seven times more counting statistics for four-fold-γ-coin events than in 1998Kh01. Moreover, the results of (^{36}S,α4nγ) from 2000Ti07 and (α,4nγ) from 1981Du06 are in better agreement in the ordering of the γ cascades, and multipolarities of crucial interband transitions, as compared to those in (^{36}S,p2nγ) from 1998Kh01.

^{98}Ru Levels

Cross Reference (XREF) Flags

A	^{98}Tc β^- decay (4.2×10^6 y)	F	^{96}Mo(^{3}He,n)	K	^{99}Ru(d,t)
B	^{98}Rh ε decay (8.72 min)	G	^{96}Mo(α,2nγ)	L	^{100}Ru(p,t)
C	^{98}Rh ε decay (3.6 min)	H	^{97}Mo(^{3}He,2nγ)	M	Coulomb excitation
D	^{65}Cu(^{36}S,p2nγ)	I	^{98}Mo(α,4nγ)		
E	^{70}Zn(^{36}S,α4nγ)	J	^{98}Ru(p,p′),(p,p′γ)		

E(level)[†]	J$^\pi$[‡]	T$_{1/2}$[#]	XREF	Comments
0.0[@]	0$^+$	stable	ABCDEFGHIJKLM	Evaluated rms charge radius=4.4229 fm *55* (2013An02). Evaluated δ<r^2>(^{104}Ru,^{98}Ru)=−0.772 fm^2 *5* (2013An02). Hyperfine structure measurements, and deduced changes in rms charge radii by 2014Fo01 with the following results: δ<r^2>(^{96}Ru,^{98}Ru)=0.2874 fm^2 *20*; δ<r^2>(^{98}Ru,^{100}Ru)=0.2538 fm^2 *21*; δ<r^2>(^{98}Ru,^{99}Ru)=0.0917 fm^2 *15*.
652.46[@] *5*	2$^+$	5.96 ps *20*	ABCDE GHIJKLM	μ=+0.88 *6* Q=−0.21 *8* J$^\pi$: 652.44γ E2 to 0$^+$. T$_{1/2}$: from 2016Pr01 evaluation, based on weighted average of 5.79 ps *20* (2012Ra03, RDDS in Coul. ex.); 5.5 ps *8* (2000Kh02, RDDS in (^{36}S,p2nγ)); 6.42 ps *12* from B(E2)=0.373 *7*, and 6.16 ps *49* from B(E2)=0.389 *31* in Coul. ex. (1980La01); 5.83 ps *50* from B(E2)=0.411 *35* in Coul. ex. (1968Mc08); 5.04 ps *40* from B(E2)=0.475 *38* in Coul. ex. (1958St32). μ: from transient fields in Coulomb excitation (2011Ch23,2011Ta06). Other: +0.8 *6* (1974Hu01,1969He11) from $\gamma(\theta$,H) in Coulomb excitation. Compilation: 2014StZZ. Q: or −0.01 *9* from reorientation effect in Coulomb excitation (1980La01). Others: −0.03 *14* from constructive interference in Coulomb excitation (1977Ma41); −0.23 *14* from re-analysis of data in 1977Ma41 by 1998Hi01.

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Adopted Levels, Gammas (continued)

^{98}Ru Levels (continued)

E(level)[†]	Jπ[‡]	$T_{1/2}$[#]	XREF	Comments
1322.16 *7*	0^+	3.7 ps *+13−8*	FGH J LM	Jπ: L(^{3}He,n)=0 from 0^+; γ(θ) in (p,p′γ) is isotropic. $T_{1/2}$: from B(E2)(W.u.)=43 *11* in Coulomb excitation (2006Wi15).
1397.91[@] *7*	4^+	1.60 ps *11*	A CDE GHIJKLM	Jπ: 745.4γ ΔJ=2, E2 to 2^+; g.s. band member. $T_{1/2}$: from RDDS in Coulomb excitation (2012Ra03). Other: 1.68 ps *+12−9* from weighted average of all available values including those deduced from B(E2) values in Coulomb excitation; value of 7.6 ps *16* from RDDS in (^{36}S,p2nγ) (2000Kh02) seems discrepant.
1414.36 *6*	2^+	1.18 ps *14*	BC GHIJKLM	Jπ: 1414.3γ ΔJ=2, E2 to 0^+. $T_{1/2}$: from RDDS in Coulomb excitation (2012Ra03). Other: 1.2 ps *4* from B(E2) in Coulomb excitation (1980La01).
1797.03 *6*	3^+		BC GHIJK	Jπ: 382.66γ and 1144.2γ M1+E2 to 2^+, 399.0γ D+Q to 4^+; J=4 from γ excitation function in (^{3}He,2nγ) (1988Sa01).
1817.19 *7*	2^+		BC GH JKL	XREF: C(?). Jπ: L(d,t)=2 from $5/2^+$; 1164.8γ M1+E2 to 2^+, 1817.1γ to 0^+; J=2 from γγ(θ) in 2016Gi05 in (^{3}He,2nγ); 2004Ca42 in (α,2nγ) suggest 0^+ or 2^+ based on decay pattern and level population.
2012.81 *7*	3^+		C GHIJKL	Jπ: 598.5γ E2+M1 to 2^+, 614.9γ D+Q to 4^+.
2222.65[@] *9*	6^+	4.3 ps *5*	CDE GHI K	Jπ: 824.8γ ΔJ=2, E2 to 4^+; 324.4γ from 5^+; no γ to 2^+ and 3^+ levels.
2241.5 *3*	$(4^+,6^+)$		H	Jπ: suggested by 1988Sa01 in (^{3}He,2nγ) based on γ(θ), γ(lin pol) and excitation function.
2245.87 *21*	$2^{(+)}$		GH KL	Jπ: 2 from γγ(θ) (2016Gi05) and (1,2) from excitation function (1988Sa01) in (^{3}He,2nγ); L(d,t)=(2+0) from $5/2^+$. other: 0^+ proposed by 2004Ca42 in (α,2nγ).
2257.9 *4*			H	
2266.58 *7*	4^+		GHI	Jπ: 253.8γ and 469.5γ M1+E2 to 3^+, 868.7γ M1+E2 to 4^+; γ excitation functions consistent with J=4 in (^{3}He,2nγ) (1988Sa01).
2277.07 *11*	$(2)^+$		GH kL	Jπ: 2^+ from γ(θ,pol) and excitation function (1988Sa01) and 3^+,4^+ from γγ(θ) and ce data (2016Gi05, who list $(2)^+$ for 2277 level in Table I) in (^{3}He,2nγ); L(d,t)=2 from $5/2^+$ for a 2277 group.
2285 *10*	$(4)^+$		Jk	E(level): probably the same as 2267 level. Jπ: L(p,p′)=4 from 0^+.
2295.52 *21*			H	
2362.6 *3*			H K	XREF: K(2365).
2369.1 *3*			L	
2371.37 *22*	(0^+ to 4^+)		H K	Jπ: 1719γ to 2^+.
2373.9 *8*	0^+		G L	XREF: G(?). Jπ: from σ(θ) in (p,t).
2406.13 *14*	$(1^+,2^+)$		H K	XREF: K(2409). Jπ: L(d,t)=(2) from $5/2^+$; 1084.1γ to 0^+.
2427.09 *8*	2^+		GH KL	Jπ: 630.0γ M1(+E2) to 3^+, 1774.5γ M1+E2 to 2^+; J=2 from γγ(θ) in (^{3}He,2nγ) (2016Gi05); L(d,t)=(2+0) from $5/2^+$.
2435 *10*	(3^-)		J	Jπ: L(p,p′)=(3) from 0^+.
2468.35 *20*	$(2)^+$		B H K	Jπ: L(d,t)=0 from $5/2^+$; possible 2467.6γ to 0^+.
2547.07 *8*	5^+		E GHI	Jπ: spin=5 from γγ(θ) in (^{3}He,2nγ) (2016Gi05); 1149.2γ M1+E2 to 4^+.
2602.33 *13*	$(2^+,3^+,4^+)$		GH K	Jπ: 1949.1γ to 2^+, 1204.4γ to 4^+; L(d,t)=(2) from $5/2^+$.
2619.5 *3*	$(1,2^+)$		B H K	Jπ: 2619.2γ to 0^+.
2656.62 *8*	$(3,5^+)$		GHI	Jπ: (3,5) is suggested by γγ(θ) and γ(θ) (2016Gi05) and (3) suggested by excitation function (1988Sa01) in (^{3}He,2nγ); 643.9γ to 3^+. But (5^-) proposed by 1981Du06 in (α,4nγ) based

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Adopted Levels, Gammas (continued)

^{98}Ru Levels (continued)

E(level)†	Jπ‡	$T_{1/2}$#	XREF	Comments
				on possible band structure and theoretical predictions is in disagreement.
2659.73 *8*	(3+,4)		GH j	XREF: j(2671). Jπ: (2,3,4) from γ(θ) (2016Gi05) and (3+,4) from excitation function (1988Sa01) in (^{3}He,2nγ).
2670.39 *18*	(0+ to 3)		H j	XREF: j(2671). Jπ: from γ(θ) in (^{3}He,2nγ) (2016Gi05); 1256.1γ to 2+.
2707.35 *17*	(1,2+)		H	Jπ: 1385.6γ to 0+, 1293.0γ to 2+.
2720.17 *12*	(3,4+)		GH	Jπ: γ(θ) and excitation function.
2754.2 *3*			H	
2786.0 *4*			G	Jπ: (3) in (α,2nγ) inconsistent with 563.3γ to 6+.
2809.39 *9*	(3)		GH	Jπ: (3 to 6) from γ(θ) (2016Gi05) and (2,3) from excitation function (1988Sa01) in (^{3}He,2nγ). But (2+) proposed by 1988Sa01.
2811.59 *25*	(2+,3,4+)		H	Jπ: 1397.2γ to 2+, 1413.7γ to 4+.
2816.69 *20*	(2+,3,4+)		H	Jπ: 1418.9γ to 4+, 999.3γ and 2164.4γ to 2+.
2825.92 *21*			H	
2859.22 *21*			H	
2867.40 *12*	(6)+		GH	Jπ: 320.3γ M1(+E2) to 5+, 644.9γ M1,E2 to 6+; spin not 5 from γγ(θ) (2016Gi05) and J=(6,7,8) from excitation function (1988Sa01) in (^{3}He,2nγ).
2932.72 *21*	(4+)		H	Jπ: 710γ to 6+, 2280.8γ to 2+.
2954.5 *3*			H	
2997.8 *7*	(1,2+)		H	Jπ: 1675.6γ to 0+.
3014.5 *6*			H	
3016.9 *3*	(+)		H K	XREF: K(3020). Jπ: L(d,t)=(2) for a 3020 *5* level.
3026.7 *5*			H	
3046 *5*	2+,3+		K	Jπ: L(d,t)=0 from 5/2+.
3058.1 *4*			G	
3064.92 *11*	(3+)		GH K	XREF: K(3071). Jπ: (3,4,5) from γ(θ) (2016Gi05) and (3,4) from excitation function (1988Sa01); L(d,t)=(2+0) from 5/2+.
3069.25 *16*	(5,6)+		GH	Jπ: 846.6γ M1,E2 to 6+; (5,6) from γγ(θ) in (^{3}He,2nγ).
3069.5 *10*			C	
3074.73 *15*	(2+ to 5+)		H	Jπ: 1676.7γ to 4+, 1061.7γ to 3+.
3093.8 *4*	(2+,3,4+)		H	Jπ: 1679.6γ to 2+, 1695.7γ to 4+.
3097.63 *21*			H	
3109.15 *13*	(2+,3,4+)		H	Jπ: 682.2γ to 2+, 1710.7γ to 4+.
3120.36 *18*			H	
3126.61@ *13*	8+	13.9 ps *21*	DE GHI	Jπ: 904γ E2, ΔJ=2 to 6+; member of g.s. band.
3132.6 *3*			H	
3179.0 *6*	(1,2+)		B	Jπ: 3179.3γ to 0+.
3185.02 *11*	(4+,5+)		H	Jπ: 1172.2γ to 3+, 962.3γ to 6+.
3190.44a *11*	8+		DE GHI	Jπ: 967.7γ E2, ΔJ=2 to 6+; J=(7,8) from γγ(θ) and J=8 from excitation function in (^{3}He,2nγ). But $J^\pi=7^-$ proposed (by 1998Kh01) from 967.7γ ΔJ=1 to 6+ in (^{36}S,p2nγ) is in disagreement.
3205.2 *3*	(2+,3)		B H K	XREF: K(3209). Jπ: possible ε feeding from (2)+; 1807.2γ to 4+.
3245.24 *13*	(6)+		GH	Jπ: 978.9γ E2, ΔJ=(2) to 4+; (5,6) from γ(θ) (2016Gi05) and (6,7) from excitation function (1988Sa01) in (^{3}He,2nγ).
3251.05 *12*	(5)+		GH	Jπ: 984.6γ M1+E2 to 2267, 4+; 754.4γ from 4006 level, which is deexcited by a 879.6γ, (M1+E2) to 3126, 8+ level.
3279.32 *20*			H	

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Adopted Levels, Gammas (continued)

^{98}Ru Levels (continued)

E(level)[†]	Jπ[‡]	$T_{1/2}$[#]	XREF	Comments
3283.52 *11*	$(5,7)^+$		E GHI	Jπ: 1061.6γ M1+E2 to 6^+; (5,7) from γγ(θ) in (^{3}He,2nγ).
3284 *5*	$(2^+,3^+)$		K	Jπ: L(d,t)=(0) from $5/2^+$.
3288.06 *22*			H	
3350.4 *3*			H	
3366.8? *5*	$(1,2^+)$		B	Jπ: 3366.7γ to 0^+.
3382.97 *22*			H	
3442.22 *24*	$2^+,3^+$		C H K	XREF: C(?)K(3441). Jπ: L(d,t)=0 from $5/2^+$. A previously proposed 1428γ from this level in ^{98}Rh ε decay (3.6 min) not confirmed in (^{3}He,2nγ) (2016Gi05). Instead, 2016Gi05 have observed and placed a 1428γ from 2826 level.
3474.65 *25*	$(4^+,5,6^+)$		GH	Jπ: 2076.5γ to 4^+, 1252.8γ to 6^+.
3523.72 *20*	$(4^+,5,6^+)$		H	Jπ: 1301.2γ to 6^+, 803.0γ to $(3,4^+)$.
3537.0? *5*	$(1^+,2^+,3^+)$		B	Jπ: 1719.8γ to 2^+; possible ε feeding from $(2)^+$ in ^{98}Rh decay (8.72 min).
3538.79 *14*	$(6)^+$		E GHI	Jπ: 992.0γ M1+E2 to 5^+, 412.1γ to 8^+.
3562.2 *3*			H	
3578.72 *21*	$(4^+$ to $7^+)$		E GH	Jπ: 1456.3γ to 6^+, 1032.4γ to 5^+, 295.1γ to $(5,7)^+$. But (8^+) proposed in (^{36}S,α4nγ) and $(7^-,8^+)$ in (α,2nγ).
3620.56 *22*			H	
3624.02 *22*			H	
3637.9 *4*			H	
3671.22 *22*			H	
3703.22 *22*			H	
3721.88 *19*			H	
3851.72[&] *24*	9^-	≤6.0 ps	E GHI	Jπ: 725.1γ E1(+M2),ΔJ=1 to 8^+; band structure. Previous placement of a 272γ from this level was not confirmed by 2016Gi05 in their γγ-coin data, this γ remains unplaced. Previously reported 312γ from this level not seen by 2016Gi05. Previously reported 567.4 and 661.3 γ rays are observed by 2016Gi05 as 569.0 and 662.1 keV, respectively, and both placed from a new level at 3852.3 keV. $T_{1/2}$: from RDDS of the 725.7γ placed from a level at 7626 in (^{36}S,p2nγ).
3852.3 *3*	$(6^+$ to $9^+)$		e gHi	Jπ: 569.0γ to $(5,7)^+$, 662.1γ to 8^+. See comments for 3851.7 level.
3855.3 *4*			GH	
3945.2 *6*			GH	
3965.0 *4*			H	
3971.84 *23*			H	
4001.19[a] *17*	10^+	14.3 ps *21*	DE GHI	Jπ: 810.6γ and 874.8γ E2, ΔJ=2 to 8^+. $J^\pi=9^-$ proposed in (^{36}S,p2nγ) is in disagreement.
4005.98 *14*	(7^+)		GHI	E(level): only one level near this energy confirmed by 2016Gi05 in (^{3}He,2nγ), and not two at 4006.6 and 4007.4, as in (α,2nγ) (2004Ca42). Jπ: 879.6γ (E2+M1) to 3126, 8^+, 722.6γ to $(5,7)^+$; 754.4γ to 3251 level, which is deexcited by a 984.6γ, M1+E2 to 2267, 4^+ level.
4134.5 *4*			GH	
4213.90 *24*	$(6^+,7,8^+)$		H	Jπ: 1023.5γ to 8^+, 1144.6γ to $(5,6)^+$.
4215.26 *23*	(8^+)		G	Jπ: 214.3γ to 10^+, 1024.9γ to 8^+, 676.3γ to $(6)^+$.
4220.8? *5*			G	XREF: G(?). 2016Gi05 in (^{3}He,2nγ) did not confirm a 4221.9 level decaying by a 1030.4γ, as proposed by 2004Ca42in (α,2nγ).
4223.56 *20*	(10^+)		GHI	Jπ: (10) from γ(θ) in (α,2nγ) and (^{3}He,2nγ); 1097.2γ to 8^+.

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Adopted Levels, Gammas (continued)

^{98}Ru Levels (continued)

E(level)[†]	Jπ[‡]	$T_{1/2}$[#]	XREF	Comments
				Possible member of g.s. band (see 4001 level also).
4256.7 *7*			GH	
4415.8 *5*			G	
4562.8 *3*	(8$^+$,9,10$^+$)		G	Jπ: 339.0γ to (10$^+$), 1436.6γ to 8$^+$.
4633.9 *3*			G	
4673.4[&] *3*	11$^-$	6.4 ps *5*	DE G I	Jπ: 821.7γ E2, ΔJ=2 to 9$^-$; band member. $T_{1/2}$: from RDDS of 821.3γ placed from a level at 4798 in (^{36}S,p2nγ).
4823.19 *23*			E G	
4846.8 *3*	(9$^+$)		G I	Jπ: 840.6γ Q, ΔJ=2 to (7$^+$), 623.7γ to (10$^+$).
4915.0[a] *4*	12$^+$		DE G I	Jπ: 913.7γ E2, ΔJ=2 to 10$^+$; band member.
4988.6 *4*	(12$^+$)		DE G I	Jπ: 987.5γ (E2), ΔJ=(2) to 10$^+$.
5218.7 *4*	(12$^+$)		E G	Jπ: 303.5γ to 12$^+$, 1217.6γ to 10$^+$.
5348.4 *4*			G	
5521.8[&] *4*	13$^-$	4.6 ps *4*	DE G I	Jπ: 848.4γ E2, ΔJ=2 to 11$^-$; band member. $T_{1/2}$: from RDDS of 848.9γ placed from a level at 3977 in (^{36}S,p2nγ).
5613.8 *5*			G	
5625.7 *4*	(13$^+$)		DE G	Jπ: 710.6γ to 12$^+$.
5819.5[a] *4*	14$^+$		DE	Jπ: 904.6γ E2, DJ=2 to 12$^+$; band member.
5888.4 *5*			I	
6121.5 *6*	(14$^+$)		E	Jπ: 1206.4γ to 12$^+$, 302.2γ to 14$^+$.
6260.7 *7*	(14$^+$)		E	Jπ: 635.0γ to (13$^+$), 441.4γ to 14$^+$.
6591.8[&] *4*	15$^-$	3.1 ps *8*	DE G I	Jπ: 1070.0γ E2, ΔJ=2 to 13$^-$; band member. $T_{1/2}$: from RDDS of 1070γ placed from a level at 6900 in (^{36}S,p2nγ).
6593.8 *6*	(15$^+$)		E	Jπ: 774.6γ to 14$^+$; 968.2γ to (13$^+$).
6869.8[a] *6*	16$^+$		DE	Jπ: 1050.2γ E2, ΔJ=2 to 14$^+$; band member.
7623.5[&] *7*	17$^-$	1.46 ps *14*	DE I	Jπ: 1031.7γ E2, ΔJ=2 to 15$^-$; band member. $T_{1/2}$: from RDDS of 1032γ placed from a level at 5831 in (^{36}S,p2nγ).
8006.4 *8*	(17)		E	Jπ: 1136.5γ D to 16$^+$.
8449.5[&] *7*	19$^-$		DE	Jπ: 826.0γ E2, ΔJ=2 to 17$^-$; band member.
9930.5[&] *8*	21$^-$		DE	Jπ: 1480.9γ E2, ΔJ=2 to 19$^-$; band member.
11006.3 *8*	(22$^-$)		DE	Jπ: 1075.6γ (D) to 21$^-$.
11405.0[&] *9*	23$^-$		DE	Jπ: 1474.5γ E2, ΔJ=2 to 21$^-$; band member.
12282.3[&] *10*	25$^-$		DE	Jπ: 877.3γ E2, ΔJ=2 to 23$^-$; band member.
14285.3 *14*			E	
14476.1 *11*			DE	
14612.1 *11*			E	
14818.4 *14*			E	
14997.4 *14*			E	
15412.4 *14*			E	
15500.5 *11*			DE	
17238.5 *15*			DE	
17592.4 *18*			DE	
19892.5? *18*			E	

[†] From a least-squares fit to γ-ray energies, unless otherwise noted.

[‡] In general the assignments are from γ(θ), γγ(θ) (DCO) γ(lin pol) and ce data in (α,4nγ), (^{3}He,2nγ) and (^{36}S,p2nγ). An ascending order of spins is assumed for levels populated in in-beam γ-ray studies, that is supported by γ decay modes and yrast

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Adopted Levels, Gammas (continued)

^{98}Ru Levels (continued)

nature of such reactions.

[#] From recoil-distance Doppler-shift method (RDDS) in (^{36}S,p2nγ) (2000Kh02), unless otherwise stated. Since the gamma-cascade ordering is adopted from 2000Ti07, some of the level energies differ from those in 1998Kh01 and 2000Kh02. Absence of delayed γ rays with $T_{1/2}$ >0.5 ns in (α,4nγ) (1981Du06) suggests that the half-life of other levels populated in (α,4nγ) is <0.5 ns.

[@] Band(A): Ground state band.

[&] Band(B): Band based on 9^-.

[a] Band(C): Band based on 8^+. The ordering of the transitions in the cascade, level energies and J^π values in Band(B) and Band(C) are as proposed by 2000Ti07 in (^{36}S,α4nγ). Corresponding results in (^{36}S,p2nγ) study (1998Kh01) differ significantly.

Adopted Levels, Gammas (continued)

γ(^{98}Ru)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[‡]	δ[‡]	α[#]	Comments
652.46	2+	652.47 *5*	100	0.0	0+	E2		0.00253	B(E2)(W.u.)=29.8 *10* E_γ: weighted average of 652.41 *5* from ^{98}Tc β^- decay, 652.8 *1* from (^{36}S,α4nγ), 652.6 *2* from (α,2nγ), 652.45 *5* from (^{3}He,2nγ), and 652.4 *1* from Coulomb excitation. Others: 652.6 *4* from ^{98}Rh ε decay, 652.9 *4* from (^{36}S,p2nγ), and 652.6 *4* from (α,4nγ). Mult.: from γ(θ) and ce data in (α,4nγ), γ(θ) and γ(pol) in (^{3}He,2nγ), γ(DCO) and γ(pol) in (^{36}S,α4nγ).
1322.16	0+	669.70 *5*	100	652.46	2+	[E2]		0.00236	B(E2)(W.u.)=42 *+12−11* α(K)=0.00206 *3*; α(L)=0.000246 *4*; α(M)=4.52×10^{-5} *7* α(N)=7.26×10^{-6} *11*; α(O)=3.64×10^{-7} *5* E_γ: other: 668.1 *8* in (α,2nγ).
1397.91	4+	745.43 *7*	100	652.46	2+	E2		0.00179	B(E2)(W.u.)=57 *4* E_γ: weighted average of 745.35 *5* from ^{98}Tc β^- decay, 745.4 *4* from ^{98}Rh ε decay (3.6 min), 746.2 *4* from (^{36}S,p2nγ), 745.9 *1* from (^{36}S,α4nγ), 745.6 *2* from (α,2nγ), 745.37 *5* from (^{3}He,2nγ), 745.5 *4* from (α,4nγ), and 745.4 *5* from Coulomb excitation. Mult.: from γ(θ) and ce data in (α,4nγ), γ(θ) and γ(pol) in (^{3}He,2nγ), γ(DCO) and γ(pol) in (^{36}S,α4nγ).
1414.36	2+	761.87 *6*	100 *2*	652.46	2+	E2+M1	+13 *+4−2*	0.00169	B(M1)(W.u.)=1.7×10^{-4} *+10−8*; B(E2)(W.u.)=46 *+7−6* E_γ: weighted average of 761.9 *4* from ^{98}Rh ε decay (8.72 min), 761.5 *4* from ^{98}Rh ε decay (3.6 min), 762.3 *2* from (α,2nγ), 761.84 *5* from (^{3}He,2nγ), 762.2 *4* from (α,4nγ), and 762.5 *5* from Coulomb excitation. Mult.: Q+D from γ(θ) in (p,p′γ); M2+E1 ruled out by RUL. δ: weighted average of +13 *+4−3* from γ(θ) in (p,p′γ) and +11 *+8−3* from γγ(θ) in (^{3}He,2nγ).
		1414.31 *9*	49 *1*	0.0	0+	E2			B(E2)(W.u.)=1.04 *+17−14* E_γ: weighted average of 1414.2 *8* from ^{98}Rh ε decay (8.72 min), 1413.4 *4* from ^{98}Rh ε decay (3.6 min), 1415.0 *3* from (α,2nγ), 1414.29 *5* from (^{3}He,2nγ), 1415.1 *4* from (α,4nγ), and 1414.9 *5* from Coulomb excitation. I_γ: weighted average of 56 *5* from ^{98}Rh ε decay (8.72 min), 48.6 *20* from (α,2nγ) and 49 *1* from (^{3}He,2nγ). Others: 36 *3* in (α,4nγ), 20 *5* in Coulomb excitation, 70 *7* in ^{98}Rh ε decay (3.6 min).
1797.03	3+	382.66 *5*	25.3 *12*	1414.36	2+	M1+E2	+0.8 *+8−3*	0.0102 *11*	Mult.: Q from γ(θ) in (p,p′γ); M2 ruled out by RUL. α(K)=0.0088 *9*; α(L)=0.00108 *15*; α(M)=0.00020 *3* α(N)=3.2×10^{-5} *4*; α(O)=1.57×10^{-6} *13* E_γ: weighted average of 383.0 *5* from ^{98}Rh ε decay (3.6 min), 382.7 *3* from (α,2nγ), 382.65 *5* from (^{3}He,2nγ), and 382.7 *4* from (α,4nγ).

$^{98}_{44}Ru_{54}$-7

Adopted Levels, Gammas (continued)

γ(^{98}Ru) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[‡]	δ[‡]	α[#]	Comments
									I_γ: weighted average of 25.8 *11* from (α,2nγ), 25.7 *9* from (^{3}He,2nγ), and 19.5 *25* from (α,4nγ). Other: 42 *8* from ^{98}Rh ε decay (3.6 min). Mult.: from γ(θ) and ce data in (α,4nγ) and (^{3}He,2nγ). δ: weighted average of +0.4 *+17−3* from γ(θ) in (α,4nγ) and 0.9 *+8−5* from ce data in (^{3}He,2nγ).
1797.03	3$^+$	399.0 *2*	7.1 *9*	1397.91	4$^+$	(M1+E2)	−0.22 *+7−16*	0.0082	E_γ: weighted average of 399.1 *3* from (α,2nγ) and 398.9 *2* from (^{3}He,2nγ). I_γ: weighted average of 7.0 *11* from (α,2nγ) and 7.1 *9* from (^{3}He,2nγ). Mult.: D+Q from γ(θ) in (^{3}He,2nγ) (2016Gi05). δ: or −5.2 *+12−17* from γ(θ) in (^{3}He,2nγ) (2016Gi05).
		1144.55 *8*	100 *1*	652.46	2$^+$	M1+E2	<−0.2		E_γ: weighted average of 1144.2 *4* from ^{98}Rh ε decay (8.72 min), 1144.2 *4* from ^{98}Rh ε decay (3.6 min), 1145.1 *2* from (α,2nγ), 1144.52 *5* from (^{3}He,2nγ), and 1145.0 *4* from (α,4nγ). Mult.: from γ(θ) and ce data in (α,4nγ) and (^{3}He,2nγ). δ: from γ(θ) in (α,4nγ).
1817.19	2$^+$	494.7 *3*	3 *1*	1322.16	0$^+$				E_γ,I_γ: from (^{3}He,2nγ) only.
		1164.79 *7*	100 *5*	652.46	2$^+$	M1+E2	−0.27 *6*		E_γ: weighted average of 1164.3 *4* from ^{98}Rh ε decay (8.72 min), 1165.3 *3* from (α,2nγ), and 1164.78 *5* from (^{3}He,2nγ). Mult.,δ: mult from ce and δ from γγ(θ) data in (^{3}He,2nγ).
		1817.1 *3*	18 *3*	0.0	0$^+$				E_γ: weighted average of 1817.2 *4* from ^{98}Rh ε decay (8.72 min), and 1817.1 *3* from (^{3}He,2nγ). Others: 1818.4 *4* tentatively assigned to ^{98}Ru in (α,2nγ), I_γ: others: 38 *3* from ^{98}Rh ε decay (8.72 min), 14.1 *16* from (α,2nγ).
2012.81	3$^+$	598.47 *7*	80 *10*	1414.36	2$^+$	E2+M1	+0.14 *+6−10*		E_γ: weighted average of 599.0 *4* from ^{98}Rh ε decay (3.6 min), 598.9 *3* from (α,2nγ), 598.44 *5* from (^{3}He,2nγ), and 599.0 *4* from (α,4nγ). I_γ: unweighted average of 70 *4* from (^{3}He,2nγ) and 89 *4* from (α,2nγ). Others: 100 *10* from ^{98}Rh ε decay (3.6 min) and (α,4nγ). Mult.: from γ(θ) and ce in (α,4nγ) and γγ(θ) in (^{3}He,2nγ). δ: from γγ(θ) in (^{3}He,2nγ). Other: +2.8 *12* from γ(θ) and ce in (α,4nγ).
		614.89 *6*	100 *4*	1397.91	4$^+$	(M1+E2)	−0.35 *5*		E_γ: weighted average of 615.7 *4* from ^{98}Rh ε decay (3.6 min), 615.0 *3* from (α,2nγ), 614.87 *5* from (^{3}He,2nγ), and 615.1 *4* from (α,4nγ). I_γ: from (^{3}He,2nγ) and (α,2nγ). Others: 98 *10* from ^{98}Rh ε decay (3.6 min) and 48 *5* from (α,4nγ). Mult.: D+Q from γ(θ) and γγ(θ) in (^{3}He,2nγ); (E2+M1) from ce data in (α,4nγ). δ: from γγ(θ) in (^{3}He,2nγ) (2016Gi05).
		1360.6 *4*	8 *2*	652.46	2$^+$				E_γ: weighted average of 1360.9 *5* from ^{98}Rh ε decay (3.6 min), 1360.9 *4* from (α,2nγ), and 1360.1 *4* from (^{3}He,2nγ). I_γ: unweighted average of 10.1 *16* from (α,2nγ), and 6 *1* from (^{3}He,2nγ). Other: 16.3 *25* from ^{98}Rh ε decay (3.6 min).
2222.65	6$^+$	824.79 *8*	100	1397.91	4$^+$	E2			B(E2)(W.u.)=12.8 *+17−14*

$^{98}_{44}Ru_{54}$-8

Adopted Levels, Gammas (continued)

γ(^{98}Ru) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[‡]	δ[‡]	α[#]	Comments
									E_γ: weighted average of 824.4 *4* from ^{98}Rh ε decay (3.6 min), 825.3 *4* from (^{36}S,p2nγ), 825.1 *1* from (^{36}S,α4nγ), 825.1 *2* from (α,2nγ), 824.69 *5* from (^{3}He,2nγ), and 824.9 *4* from (α,4nγ). Mult.: from γ(DCO) and γ(pol) in (^{36}S,α4nγ), γ(θ,pol) and ce data in (^{3}He,2nγ), γ(θ) and ce data in (α,4nγ).
2241.5	(4$^+$,6$^+$)	843.6 *3*	100	1397.91	4$^+$				Mult.: γ(θ) and POL data in 1988Sa01 in (^{3}He,2nγ) suggest mult=E2 or E1 (if ΔJ=0).
2245.87	2$^{(+)}$	1593.4 *2*	100	652.46	2$^+$	D+Q	−0.19 *+10−11*		Mult.,δ: from γγ(θ) in (^{3}He,2nγ).
2257.9		843.5 *4*	100	1414.36	2$^+$				
2266.58	4$^+$	253.80 *5*	24.6 *17*	2012.81	3$^+$	M1+E2	−0.9 *5*	0.035 *7*	α(K)=0.030 *6*; α(L)=0.0040 *10*; α(M)=0.00073 *18* α(N)=0.00012 *3*; α(O)=5.2×10^{-6} *9* E_γ: others: 253.8 *3* from (α,2nγ), 253.9 *4* from (α,4nγ). I_γ: weighted average of 26.4 *11* from (α,2nγ), 21 *2* from (^{3}He,2nγ), and 21.7 *22* from (α,4nγ). Mult.: from γ(θ) and ce data in (^{3}He,2nγ) and γ(θ) in (α,4nγ). δ: from γ(θ) in (^{3}He,2nγ). Other: +3.5 *+20−12* from (α,4nγ).
		469.54 *5*	100 *3*	1797.03	3$^+$	M1+E2	−0.8 *+3−6*		E_γ: others: 469.6 *2* from (α,2nγ), 469.7 *4* from (α,4nγ). I_γ: others: 100 *4* from (α,2nγ), 100 *9* from (α,4nγ). Mult.: from γ(θ,pol) in (^{3}He,2nγ), γ(θ) and ce data in (α,4nγ). δ: from γ(θ) and ce data in (α,4nγ). Other: +0.45 *+14−8* or +4.20 *+6−13* from γ(θ) in (^{3}He,2nγ).
		868.7 *3*	28.7 *11*	1397.91	4$^+$	M1+E2	+2.3 *+15−8*		E_γ: weighted average of 869.2 *3* from (α,2nγ) and 868.5 *2* from (^{3}He,2nγ). I_γ: weighted average of 28.7 *11* from (α,2nγ) and 29 *3* from (^{3}He,2nγ). Mult.,δ: from γγ(θ) and γ(pol) in (^{3}He,2nγ).
2277.07	(2)$^+$	264.1 *4*	5 *1*	2012.81	3$^+$				
		879.2 *1*	57 *3*	1397.91	4$^+$	(E2)			E_γ: other: 879.6 *3* from (α,2nγ). Mult.: M1,E2 from γ(θ,pol) and ce data in (^{3}He,2nγ), but ΔJ^π requires E2.
		1624.3 *3*	100 *4*	652.46	2$^+$				E_γ: other: 1625.4 *3* from (α,2nγ).
2295.52		897.6 *2*	100	1397.91	4$^+$				
2362.6		1710.1 *3*	100	652.46	2$^+$				
2371.37	(0$^+$ to 4$^+$)	956.7 *3*	14 *4*	1414.36	2$^+$				
		1719.2 *3*	100 *10*	652.46	2$^+$				
2406.13	(1$^+$,2$^+$)	991.7 *2*	48 *10*	1414.36	2$^+$				
		1084.1 *2*	64 *6*	1322.16	0$^+$				
		1753.5 *3*	100 *16*	652.46	2$^+$				
2427.09	2$^+$	610.0 *1*	8.3 *18*	1817.19	2$^+$	D+Q	−1.5 *+8−53*		E_γ: weighted average of 609.9 *4* from (α,2nγ) and 610.0 *1*

$^{98}_{44}Ru_{54}$-9

Adopted Levels, Gammas (continued)

γ(^{98}Ru) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[‡]	δ[‡]	Comments
								from (^{3}He,2nγ).
								I_γ: unweighted average of 6.5 *10* from (α,2nγ) and 10 *1* from (^{3}He,2nγ).
								Mult.,δ: from γ(θ) in (^{3}He,2nγ).
2427.09	2+	630.0 *2*	8.1 *22*	1797.03	3+	M1(+E2)	−0.04 *45*	E_γ: weighted average of 630.3 *4* from (α,2nγ) and 629.9 *2* from (^{3}He,2nγ).
								I_γ: unweighted average of 6.0 *10* from (α,2nγ) and 10.3 *15* from (^{3}He,2nγ).
								Mult.: from γ(θ,pol) in (^{3}He,2nγ) (1988Sa01).
								δ: deduced by 2016Gi05 from A_2 in 1988Sa01 for J(2427)=2 in (^{3}He,2nγ).
		1012.7 *1*	11 *1*	1414.36	2+			
		1029.0 *2*	21 *1*	1397.91	4+			E_γ: weighted average of 1029.7 *4* from (α,2nγ) and 1029.0 *1* from (^{3}He,2nγ).
		1774.5 *3*	100 *2*	652.46	2+	M1+E2	+0.42 *+7−5*	E_γ: other: 1776.4 *6* from 2004Ca42 in (α,2nγ), transition identified as a doublet in 2004Ca42.
								Mult.,δ: mult from γ(θ,pol) (1988Sa01) and δ from γγ(θ) (2016Gi05) in (^{3}He,2nγ).
2468.35	(2)+	670.2[@] *7*		1797.03	3+			E_γ: from ^{98}Rh ε decay (8.72 m) only with I(670.2γ)/I(2467.6γ)=100/19.5; but its existence can not be confirmed by 2004Ca42 in (α,2nγ) and 2016Gi05 in (^{3}He,2nγ).
		1815.9 *2*		652.46	2+			E_γ: seen by 2016Gi05 in (^{3}He,2nγ) only.
		2467.6		0.0	0+			E_γ: from ^{98}Rh ε decay (8.72 m) only; this transition can not been seen by 2004Ca42 in (α,2nγ) and 2016Gi05 in (^{3}He,2nγ) due detector limit.
2547.07	5+	280.5 *2*	8 *2*	2266.58	4+			E_γ: other: 280.5 *4* from (α,2nγ).
								I_γ: unweighted average of 10 *2* from (^{3}He,2nγ) and 5.4 *9* from (α,2nγ).
		324.4 *1*	21.6 *9*	2222.65	6+			E_γ: others: 324.6 *3* from (α,2nγ), 323.9 *10* from (^{36}S,α4nγ).
								I_γ: weighted average of 21 *2* from (^{3}He,2nγ) and 21.7 *9* from (α,2nγ).
		534.2 *2*	11 *3*	2012.81	3+			I_γ: other: <3 in (α,2nγ).
		1149.21 *8*	100 *4*	1397.91	4+	M1+E2	+0.37 *5*	E_γ: weighted average of 1149.17 *5* from (^{3}He,2nγ), 1149.7 *2* from (α,2nγ), 1149.6 *4* from (α,4nγ) and 1149.1 *10* from (^{36}S,α4nγ).
								Mult.: E2 from γ(θ) and ce data in (α,4nγ), but ce data also agree with M1; D+Q from γγ(θ) in (^{3}He,2nγ) (2016Gi05).
								δ: from γγ(θ) in (^{3}He,2nγ) (2016Gi05).
2602.33	(2+,3+,4+)	325.2 *3*	23 *4*	2277.07	(2)+			
		589.5 *2*	100 *7*	2012.81	3+			E_γ: other: 589.6 *4* from (α,2nγ).
								I_γ: other: 52 *9* from (α,2nγ).
		785.3 *3*	12 *3*	1817.19	2+			
		1188.0 *3*	39 *5*	1414.36	2+			
		1204.4 *2*	67 *5*	1397.91	4+			E_γ: other: 1205.7 *4* from (α,2nγ).
								I_γ: other: 100 *15* from (α,2nγ).

$^{98}_{44}Ru_{54}$-10

Adopted Levels, Gammas (continued)

γ(^{98}Ru) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[‡]	δ[‡]	α[#]	Comments
2602.33	(2$^+$,3$^+$,4$^+$)	1949.1 *10*	40 *18*	652.46	2$^+$				
2619.5	(1,2$^+$)	802.2 *4*	10 *2*	1817.19	2$^+$				
		1967.3 *5*	100 *9*	652.46	2$^+$				
		2619.2	11.7 *12*	0.0	0$^+$				
2656.62	(3,5$^+$)	643.9 *2*	6 *1*	2012.81	3$^+$				
		1258.69 *5*	100 *2*	1397.91	4$^+$	D(+Q)	>−0.1		E_γ: others: 1259.3 *2* in (α,2nγ), 1259.4 *4* in (α,4nγ). Mult.,δ: from γ(θ) in (α,2nγ). Mult=D from γ(θ) in (^{3}He,2nγ).
2659.73	(3$^+$,4)	862.66 *5*	100	1797.03	3$^+$	D			E_γ: other: 863.2 *3* from (α,2nγ). Mult.: from γ(θ) in (^{3}He,2nγ).
2670.39	(0$^+$ to 3)	853.2 *2*	12 *2*	1817.19	2$^+$				
		1256.1 *5*	100 *4*	1414.36	2$^+$				
		2018.1 *7*	14 *3*	652.46	2$^+$				
2707.35	(1,2$^+$)	889.7 *4*	10 *3*	1817.19	2$^+$				
		1293.0 *2*	100 *16*	1414.36	2$^+$				
		1385.6 *4*	12 *3*	1322.16	0$^+$				
2720.17	(3,4$^+$)	1322.2 *1*	100 *3*	1397.91	4$^+$	D			E_γ: other: 1322.2 *4* from (α,2nγ). Mult.: from γ(θ) in (^{3}He,2nγ).
		2068.1 *5*	11 *2*	652.46	2$^+$				
2754.2		937.0 *3*	100	1817.19	2$^+$				
2786.0		563.3 *4*	100	2222.65	6$^+$				
2809.39	(3)	542.8 *1*	95 *5*	2266.58	4$^+$				E_γ: other: 542.8 *3* from (α,2nγ).
		796.4 *2*	19 *2*	2012.81	3$^+$				
		1012.4 *1*	100 *8*	1797.03	3$^+$				
		1411.5 *5*	33 *8*	1397.91	4$^+$				
2811.59	(2$^+$,3,4$^+$)	1397.2 *3*	100 *7*	1414.36	2$^+$				
		1413.7 *4*	58 *10*	1397.91	4$^+$				
2816.69	(2$^+$,3,4$^+$)	999.3 *4*	17 *4*	1817.19	2$^+$				
		1402.2 *4*	33 *8*	1414.36	2$^+$				
		1418.9 *3*	100 *11*	1397.91	4$^+$				
		2164.4 *6*	91 *15*	652.46	2$^+$				
2825.92		1428.0 *2*	100	1397.91	4$^+$				
2859.22		846.4 *2*	100	2012.81	3$^+$				
2867.40	(6)$^+$	320.3 *1*	100 *4*	2547.07	5$^+$	M1(+E2)	0.0 *5*	0.0139 *16*	α(K)=0.0122 *13*; α(L)=0.00142 *21*; α(M)=0.00026 *4* α(N)=4.2×10^{-5} *6*; α(O)=2.23×10^{-6} *19* E_γ: other: 320.6 *3* from (α,2nγ). Mult.,δ: from ce data (2016Gi05) in (^{3}He,2nγ).
		644.9 *2*	52 *3*	2222.65	6$^+$	M1,E2			E_γ: weighted average of 645.1 *4* from (α,2nγ) and 644.9 *2* from (^{3}He,2nγ). I_γ: other: 16 *2* from (α,2nγ). Mult.: from ce data in (^{3}He,2nγ).
		1469.2 *4*	8 *2*	1397.91	4$^+$				
2932.72	(4$^+$)	710.0 *2*	62 *13*	2222.65	6$^+$				
		2280.8 *6*	100 *27*	652.46	2$^+$				

$^{98}_{44}Ru_{54}$-11

Adopted Levels, Gammas (continued)

γ(^{98}Ru) (continued)

E_i(level)	J_i^π	E_γ †	I_γ †	E_f	J_f^π	Mult. ‡	Comments
2954.5		527.4 *3*	100	2427.09	2^+		
2997.8	$(1,2^+)$	1675.6 *7*	100	1322.16	0^+		
3014.5		1616.6 *6*	100	1397.91	4^+		
3016.9	$(^+)$	1619.0 *3*	100	1397.91	4^+		
3026.7		1013.9 *5*	100	2012.81	3^+		
3058.1		835.4 *4*	100	2222.65	6^+		E_γ: from (α,2nγ) only.
3064.92	(3^+)	408.3 *2*	7 *1*	2656.62	$(3,5^+)$		
		1052.1 *2*	10 *3*	2012.81	3^+		
		1667.0 *1*	100 *4*	1397.91	4^+	D	E_γ: other: 1668.5 *3* from (α,2nγ). Mult.: from $\gamma(\theta)$ in (^{3}He,2nγ).
3069.25	$(5,6)^+$	522.3 *2*	9 *1*	2547.07	5^+		E_γ: weighted average of 522.5 *4* from (α,2nγ) and 522.2 *2* from (^{3}He,2nγ).
		846.6 *3*	100 *6*	2222.65	6^+	M1,E2	Mult.: from ce data in (^{3}He,2nγ).
		1671.0 *3*	12 *1*	1397.91	4^+		
3069.5		2417 *1*	100	652.46	2^+		E_γ: from ^{98}Rh ε decay (3.6 min) only.
3074.73	$(2^+$ to $5^+)$	418.3 *2*	55 *6*	2656.62	$(3,5^+)$		
		1061.7 *3*	45 *9*	2012.81	3^+		
		1676.7 *2*	100 *12*	1397.91	4^+		
3093.8	$(2^+,3,4^+)$	1679.6 *4*	51 *16*	1414.36	2^+		
		1695.7 *5*	100 *18*	1397.91	4^+		
3097.63		1699.7 *2*	100	1397.91	4^+		
3109.15	$(2^+,3,4^+)$	452.3 *3*	16 *3*	2656.62	$(3,5^+)$		
		682.2 *2*	100 *8*	2427.09	2^+		
		1312.3 *2*	46 *7*	1797.03	3^+		
		1710.7 *3*	73 *4*	1397.91	4^+		
3120.36		1107.6 *3*	28 *7*	2012.81	3^+		
		1722.4 *2*	100 *8*	1397.91	4^+		
3126.61	8^+	904.16 *15*	100	2222.65	6^+	E2	B(E2)(W.u.)=2.5 *+5−3* E_γ: unweighted average of 904.1 *4* from (^{36}S,p2nγ), 904.7 *1* from (^{36}S,α4nγ), 904.1 *2* from (α,2nγ), 903.80 *5* from (^{3}He,2nγ), and 904.1 *4* from (α,4nγ). Mult.: from $\gamma(\theta$,pol) in (^{3}He,2nγ), γ(pol) and γ(DCO) in (^{36}S,α4nγ), $\gamma(\theta)$ and ce data in (α,4nγ).
3132.6		476.2 *5*	8 *2*	2656.62	$(3,5^+)$		
		1734.6 *3*	100 *5*	1397.91	4^+		
3179.0	$(1,2^+)$	1764.6	9 *1*	1414.36	2^+		E_γ,I_γ: from ^{98}Rh ε decay (3.6 min) only.
		2526.1	100 *7*	652.46	2^+		E_γ,I_γ: from ^{98}Rh ε decay (3.6 min) only.
		3179.3	50 *5*	0.0	0^+		E_γ,I_γ: from ^{98}Rh ε decay (3.6 min) only.
3185.02	$(4^+,5^+)$	638.0 *2*	48 *4*	2547.07	5^+		
		962.3 *2*	43 *3*	2222.65	6^+		
		1172.2 *1*	100 *5*	2012.81	3^+		
3190.44	8^+	967.73 *9*	100	2222.65	6^+	E2	E_γ: weighted average of 968.5 *3* from (^{36}S,α4nγ), 968.0 *2* from (α,2nγ), 967.69 *5* from (^{3}He,2nγ), and 968.0 *4* from (α,4nγ). Other: 969.4 *4* from (^{36}S,p2nγ). Mult.: from $\gamma(\theta$,pol) and ce data in (^{3}He,2nγ), γ(pol) and γ(DCO) in (^{36}S,α4nγ),

$^{98}_{44}Ru_{54}$-12

Adopted Levels, Gammas (continued)

γ(^{98}Ru) (continued)

E_i(level)	J_i^π	E_γ †	I_γ †	E_f	J_f^π	Mult. ‡	Comments
							γ(θ) and ce data in (α,4nγ). But ΔJ=1, dipole suggested from γ(DCO) in (^{36}S,p2nγ) (1998Kh01) is in disagreement.
3205.2	(2$^+$,3)	1388.5 *6*	44 *13*	1817.19	2$^+$		I_γ: from (^{3}He,2nγ) only, normalized to I(1792.3γ)=63 *8* in ^{98}Rh ε decay (8.72 min).
		1790.6 *4*	63 *8*	1414.36	2$^+$		E_γ: other: 1792.3 from ^{98}Rh ε decay (8.72 min).
		1807.2 *6*	88 *18*	1397.91	4$^+$		I_γ: from (^{3}He,2nγ) only, normalized to I(1792.3γ)=63 *8* in ^{98}Rh ε decay (8.72 min).
		2552.3	100 *11*	652.46	2$^+$		E_γ,I_γ: from ^{98}Rh ε decay (8.72 min) only. Not seen by 2016Gi05 in (^{3}He,2nγ) probably due to detector limit.
3245.24	(6)$^+$	698.1 *2*	12 *2*	2547.07	5$^+$		
		978.9 *2*	100 *4*	2266.58	4$^+$	(E2)	E_γ: weighted average of 979.2 *2* from (α,2nγ) and 978.8 *1* from (^{3}He,2nγ). Mult.: E2 from ce data in (^{3}He,2nγ), but also in overlap with M1.
		1022.3 *2*	15 *2*	2222.65	6$^+$		
3251.05	(5)$^+$	590.8 *2*	40 *4*	2659.73	(3$^+$,4)		E_γ: weighted average of 591.3 *4* from (α,2nγ) and 590.7 *2* from (^{3}He,2nγ). I_γ: weighted average of 46 *7* from (α,2nγ) and 38 *4* from (^{3}He,2nγ).
		594.3 *2*	46 *6*	2656.62	(3,5$^+$)		E_γ: weighted average of 594.7 *4* from (α,2nγ) and 594.2 *2* from (^{3}He,2nγ). I_γ: weighted average of 56 *8* from (α,2nγ) and 42 *5* from (^{3}He,2nγ).
		984.6 *2*	100 *6*	2266.58	4$^+$	M1+E2	E_γ: weighted average of 984.9 *3* from (α,2nγ) and 984.4 *2* from (^{3}He,2nγ). Mult.: from γ(θ) and ce data in (^{3}He,2nγ).
3279.32		1482.2 *5*	43 *12*	1797.03	3$^+$		
		1881.4 *2*	100 *6*	1397.91	4$^+$		
3283.52	(5,7)$^+$	626.9 *1*	25 *1*	2656.62	(3,5$^+$)		E_γ: weighted average of 627.1 *3* from (α,2nγ), 626.8 *4* from (α,4nγ), and 626.9 *1* from (^{3}He,2nγ). I_γ: weighted average of 25.5 *11* from (α,2nγ), 29 *4* from (α,4nγ), and 23 *2* from (^{3}He,2nγ).
		1061.6 *4*	100 *2*	2222.65	6$^+$	M1+E2	E_γ: weighted average of 1062.6 *10* from (^{36}S,α4nγ), 1061.2 *2* from (α,2nγ), 1060.6 *1* from (^{3}He,2nγ), and 1061.8 *4* from (α,4nγ). Mult.: from γ(θ) and ce data in (^{3}He,2nγ). But E1 suggested from γ(θ) and ce data in (α,4nγ).
3288.06		1065.4 *2*	100	2222.65	6$^+$		
3350.4		1084.0 *3*	61 *12*	2266.58	4$^+$		
		1553.0 *5*	100 *22*	1797.03	3$^+$		
3366.8?	(1,2$^+$)	3366.7 @	100	0.0	0$^+$		
3382.97		1106.0 *3*	58 *11*	2277.07	(2)$^+$		
		1370.0 *4*	48 *14*	2012.81	3$^+$		
		1585.9 *4*	100 *28*	1797.03	3$^+$		
3442.22	2$^+$,3$^+$	1014.8 *3*	42 *12*	2427.09	2$^+$		
		1625.1 *5*	22 *4*	1817.19	2$^+$		E_γ: weighted average of 1624.7 *6* from ^{98}Rh ε decay (3.6 min) and 1625.3 *5* from (^{3}He,2nγ).
		2045.1 *5*	100 *8*	1397.91	4$^+$		
3474.65	(4$^+$,5,6$^+$)	229.2 *3*	70 *9*	3245.24	(6)$^+$		E_γ: weighted average of 229.8 *4* from (α,2nγ) and 229.1 *2* from (^{3}He,2nγ). I_γ: weighted average of 66 *9* from (α,2nγ) and 78 *13* from (^{3}He,2nγ).
		1252.8 *5*	100 *13*	2222.65	6$^+$		E_γ: unweighted average of 1253.2 *4* from (α,2nγ) and 1252.3 *2* from (^{3}He,2nγ).
		2076.5 *5*	96 *21*	1397.91	4$^+$		

$^{98}_{44}Ru_{54}$-13

Adopted Levels, Gammas (continued)

γ(^{98}Ru) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[‡]	δ[‡]	Comments
3523.72	(4$^+$,5,6$^+$)	803.0 *4*	11 *3*	2720.17	(3,4$^+$)			
		1301.2 *2*	100 *6*	2222.65	6$^+$			
3537.0?	(1$^+$,2$^+$,3$^+$)	1719.8[@] *5*	100	1817.19	2$^+$			
3538.79	(6)$^+$	412.1 *1*	100 *4*	3126.61	8$^+$			E_γ: weighted average of 412.4 *3* from (α,2nγ), 412.1 *1* from (^{3}He,2nγ), 412.3 *4* from (α,4nγ) and , 412.0 *10* from (^{36}S,α4nγ). I_γ: from (α,2nγ). Others: 100 *6* from (^{3}He,2nγ), 81 *6* from (α,4nγ).
		992.0 *2*	72 *7*	2547.07	5$^+$	M1+E2		E_γ: weighted average of 992.0 *3* from (α,2nγ), 991.8 *2* from (^{3}He,2nγ), 992.3 *4* from (α,4nγ) and 993.0 *10* from (^{36}S,α4nγ). I_γ: unweighted average of 79 *3* from (α,2nγ) and 65 *5* from (^{3}He,2nγ). Other: 100 *13* from (α,4nγ). Mult.: from γ(θ) and ce data in (^{3}He,2nγ).
3562.2		1014.9 *3*	69 *13*	2547.07	5$^+$			
		1340.0 *4*	100 *11*	2222.65	6$^+$			
3578.72	(4$^+$ to 7$^+$)	295.1 *2*	23 *4*	3283.52	(5,7)$^+$			E_γ: weighted average of 295.1 *10* from (^{36}S,α4nγ), 295.5 *4* from (α,2nγ), and 295.0 *2* from (^{3}He,2nγ). E_γ: weighted average of 26 *4* from (α,2nγ), and 19 *4* from (^{3}He,2nγ).
		1032.4 *7*	100 *7*	2547.07	5$^+$			E_γ: unweighted average of 1033.7 *10* from (^{36}S,α4nγ), 1032.1 *3* from (α,2nγ), and 1031.5 *1* from (^{3}He,2nγ).
		1356.3 *5*	15 *3*	2222.65	6$^+$			E_γ: unweighted average of 1057.6 *10* from (^{36}S,α4nγ) and 1056.1 *4* from (^{3}He,2nγ).
3620.56		1397.9 *2*	100	2222.65	6$^+$			
3624.02		967.4 *2*	100	2656.62	(3,5$^+$)			
3637.9		1415.2 *3*	100	2222.65	6$^+$			
3671.22		1014.6 *2*	100	2656.62	(3,5$^+$)			
3703.22		1046.6 *2*	100	2656.62	(3,5$^+$)			
3721.88		438.5 *3*	46 *9*	3283.52	(5,7)$^+$			
		1065.2 *2*	100 *10*	2656.62	(3,5$^+$)			
3851.72	9$^-$	725.1 *2*	100	3126.61	8$^+$	E1(+M2)	+0.2 *2*	B(E1)(W.u.)>1.2×10^{-4} E_γ: unweighted average of 725.4 *1* from (^{36}S,α4nγ), 725.2 *2* from (α,2nγ), 724.7 *1* from (^{3}He,2nγ), and 724.9 *4* from (α,4nγ). Other: 725.7 *4* from (^{36}S,p2nγ), placed from a level 7626. Mult.: from γ(θ) and ce data in (^{3}He,2nγ). E1 from γ(DCO) and γ(pol) in (α,4nγ) and from γ(θ,pol) in (^{3}He,2nγ). δ: from γ(θ) in (^{3}He,2nγ).
3852.3	(6$^+$ to 9$^+$)	568.9 *3*	100 *23*	3283.52	(5,7)$^+$			E_γ: weighted average of 569.0 *2* from (^{3}He,2nγ) and 567.4 *10* (placed from the 3851, 9$^-$ level) from (^{36}S,α4nγ).
		661.6 *4*	51 *16*	3190.44	8$^+$			E_γ: weighted average of 662.1 *4* from (^{3}He,2nγ), 661.3 *5* from (^{36}S,α4nγ), and 661.3 *4* from (α,2nγ) and (α,4nγ) (placed from the 3851, 9$^-$ level except for the first one).
3855.3		316.8 *5*	100 *19*	3538.79	(6)$^+$			E_γ: unweighted average of 317.3 *3* from (α,2nγ) and 316.4 *1* from (^{3}He,2nγ).
		987.6 *5*	71 *16*	2867.40	(6)$^+$			

$^{98}_{44}Ru_{54}$-14

Adopted Levels, Gammas (continued)

γ(^{98}Ru) (continued)

E_i(level)	J_i^π	E_γ †	I_γ †	E_f	J_f^π	Mult. ‡	Comments
3945.2		1722.5 *6*	100	2222.65	6^+		E_γ: unweighted average of 1723.1 *4* from (α,2nγ) and 1721.9 *2* from (^{3}He,2nγ).
3965.0		1742.3 *4*	100	2222.65	6^+		
3971.84		1301.5 *3*	70 *11*	2670.39	(0^+ to 3)		
		1315.7 *4*	64 *12*	2656.62	($3,5^+$)		
		1958.4 *4*	100 *20*	2012.81	3^+		
4001.19	10^+	810.6 *2*	43 *2*	3190.44	8^+	E2	B(E2)(W.u.)=1.27 *+31−23* E_γ: weighted average of 811.4 *5* from (^{36}S,α4nγ), 810.7 *3* from (α,2nγ), 810.3 *2* from (^{3}He,2nγ), 810.5 *4* from (α,4nγ), and 810.9 *4* from (^{36}S,p2nγ). I_γ: weighted average of 75 *17* from (^{36}S,α4nγ), 42.5 *17* from (α,2nγ), 38 *4* from (^{3}He,2nγ), and 46 *3* from (α,4nγ). Mult.: from γ(DCO) and γ(pol) in (^{36}S,α4nγ), γ(θ) and ce data in (α,4nγ).
		874.8 *2*	100 *4*	3126.61	8^+	E2	B(E2)(W.u.)=2.0 *+4−3* E_γ: unweighted average of 875.4 *3* from (^{36}S,α4nγ), 874.7 *2* from (α,2nγ), 874.3 *1* from (^{3}He,2nγ), and 874.6 *4* from (α,4nγ). Mult.: from γ(DCO) and γ(pol) in (^{36}S,α4nγ), γ(θ) and ce data in (α,4nγ). In (^{36}S,p2nγ) it was suggested as ΔJ=1, E1 transition.
4005.98	(7^+)	722.6 *2*	100 *4*	3283.52	$(5,7)^+$		E_γ: weighted average of 722.4 *2* from (^{3}He,2nγ), 722.7 *4* from (α,4nγ), 722.9 *3* from (α,2nγ). I_γ: from (α,2nγ). Others: 100 *8* from (^{3}He,2nγ), 100 *9* from (α,4nγ).
		754.4 *2*	48 *15*	3251.05	$(5)^+$		E_γ: weighted average of 754.5 *3* from (α,2nγ) and 754.3 *2* from (^{3}He,2nγ).
		815.6 *3*	46 *2*	3190.44	8^+		E_γ: weighted average of 816.1 *3* from (α,2nγ) and 815.4 *2* from (^{3}He,2nγ). I_γ: weighted average of 45.7 *17* from (α,2nγ) and 48 *15* from (^{3}He,2nγ).
		879.6 *2*	38 *6*	3126.61	8^+	(E2+M1)	E_γ: weighted average of 879.5 *2* from (^{3}He,2nγ), 879.8 *4* from (α,4nγ), 879.6 *3* from (α,2nγ). I_γ: weighted average of 32 *5* from (α,2nγ) and 43 *5* from (^{3}He,2nγ). Other: 85 *7* from (α,4nγ). Mult.: from ce data in (α,4nγ).
4134.5		889.3 *3*	100	3245.24	$(6)^+$		E_γ: other: 889.3 *4* from (α,2nγ).
4213.90	$(6^+,7,8^+)$	1023.5 *3*	24 *4*	3190.44	8^+		
		1144.6 *3*	100 *8*	3069.25	$(5,6)^+$		
4215.26	(8^+)	214.3 *4*	44 *7*	4001.19	10^+		E_γ,I_γ: from (α,2nγ) only.
		676.3 *4*	40 *7*	3538.79	$(6)^+$		E_γ,I_γ: from (α,2nγ) only.
		1024.9 *4*	100 *14*	3190.44	8^+		E_γ,I_γ: from (α,2nγ) only.
		1088.5 *4*	60 *9*	3126.61	8^+		E_γ,I_γ: from (α,2nγ) only.
4220.8?		1030.4 *4*	100	3190.44	8^+		E_γ: from (α,2nγ) only, not confirmed by 2016Gi05 in (^{3}He,2nγ).
4223.56	(10^+)	1032.8 *3*	100 *4*	3190.44	8^+		E_γ: weighted average of 1033.3 *3* from (α,2nγ), 1032.5 *2* from (^{3}He,2nγ), and 1033.2 *4* from (α,4nγ). I_γ: from (α,2nγ). Others: 100 *10* from (^{3}He,2nγ), 100 *7* from (α,4nγ).
		1097.2 *3*	49 *3*	3126.61	8^+	(E2)	E_γ: weighted average of 1097.5 *3* from (α,2nγ), 1096.9 *4* from (^{3}He,2nγ), and 1096.9 *4* from (α,4nγ). I_γ: weighted average of 49.4 *19* from (α,2nγ) and 33 *9* from (^{3}He,2nγ). Other: 85 *7* from (α,4nγ). Mult.: M1,E2 suggested from ce data in (α,4nγ), E2 favored from level scheme.

$^{98}_{44}Ru_{54}$-15

Adopted Levels, Gammas (continued)

γ(^{98}Ru) (continued)

E_i(level)	J_i^π	E_γ †	I_γ †	E_f	J_f^π	Mult. ‡	Comments
4256.7		1011.5 *6*	100	3245.24	$(6)^+$		E_γ: unweighted average of 1012.1 *3* from (α,2nγ) and 1011.0 *3* from (^{3}He,2nγ).
4415.8		1225.4 *4*	100	3190.44	8^+		E_γ: from (α,2nγ) only.
4562.8	$(8^+,9,10^+)$	339.0 *3*	100 *4*	4223.56	(10^+)		E_γ,I_γ: from (α,2nγ) only.
		1436.6 *4*	29 *5*	3126.61	8^+		E_γ,I_γ: from (α,2nγ) only.
4633.9		410.7 *4*	94 *15*	4223.56	(10^+)		E_γ,I_γ: from (α,2nγ) only.
		632.6 *4*	100 *15*	4001.19	10^+		E_γ,I_γ: from (α,2nγ) only.
4673.4	11^-	821.7 *2*	100	3851.72	9^-	E2	B(E2)(W.u.)=8.8 +*8*−*7* E_γ: weighted average of 822.0 *1* from (^{36}S,α4nγ), 821.3 *2* from (α,2nγ), 821.1 *4* from (α,4nγ), 821.3 *2* from (^{36}S,p2nγ) (placed from a level at 4798). Mult.: from γ(DCO) and γ(pol) in (^{36}S,α4nγ), $\gamma(\theta)$ and ce data in (α,4nγ); also supported by $\gamma(\theta)$ in (α,2nγ) and γ(DCO) in (^{36}S,p2nγ).
4823.19		189.5 *4*	11 *2*	4633.9			E_γ,I_γ: from (α,2nγ) only.
		260.3 *4*	13 *2*	4562.8	$(8^+,9,10^+)$		E_γ,I_γ: from (α,2nγ) only.
		599.4 *3*	47 *6*	4223.56	(10^+)		E_γ,I_γ: from (α,2nγ) only.
		822.1 *3*	100 *4*	4001.19	10^+		E_γ,I_γ: from (α,2nγ). Other: Eγ=823.1 *10* from (^{36}S,α4nγ).
4846.8	(9^+)	623.7 *4*	15.8 *25*	4223.56	(10^+)		E_γ,I_γ: from (α,2nγ) only.
		840.6 *3*	100 *4*	4005.98	(7^+)	Q	E_γ: weighted average of 840.7 *3* from (α,2nγ) and 840.4 *4* from (α,4nγ). I_γ: from (α,2nγ). Mult.: from $\gamma(\theta)$ in (α,4nγ).
4915.0	12^+	913.7 *4*	100	4001.19	10^+	E2	E_γ: weighted average of 914.3 *3* from (^{36}S,α4nγ), 913.4 *3* from (α,2nγ), and 913.2 *4* from (α,4nγ). Other: 912.1 *4* in (^{36}S,p2nγ) placed from a different level at 11629. Mult.: from γ(DCO) and γ(pol) in (^{36}S,α4nγ), $\gamma(\theta)$ and ce data in (α,4nγ).
4988.6	(12^+)	987.5 *3*	100	4001.19	10^+	(E2)	E_γ: weighted average of 987.4 *3* from (^{36}S,α4nγ), 987.6 *3* from (α,2nγ), and 987.6 *4* from (α,4nγ). Other: 989.8 *4* in (^{36}S,p2nγ) placed from a different level at 14948. Mult.: from γ(pol) in (^{36}S,α4nγ), $\gamma(\theta)$ and ce data in (α,4nγ).
5218.7	(12^+)	303.5 *4*	68 *12*	4915.0	12^+		E_γ: weighted average of 303.9 *10* from (^{36}S,α4nγ) and 303.4 *4* from (α,2nγ). I_γ: weighted average of 50 *25* from (^{36}S,α4nγ) and 72 *12* from (α,2nγ).
		395.0 *10*	50 *25*	4823.19			E_γ,I_γ: γ from (^{36}S,α4nγ) only.
		1217.6 *4*	100 *14*	4001.19	10^+		E_γ: weighted average of 1218.1 *5* from (^{36}S,α4nγ) and 1217.3 *4* from (α,2nγ). I_γ: from (α,2nγ). Other: 100 *25* from (^{36}S,α4nγ).
5348.4		1124.8 *3*	100	4223.56	(10^+)		E_γ: from (α,2nγ) only.
5521.8	13^-	848.4 *1*	100	4673.4	11^-	E2	B(E2)(W.u.)=10.4 +*10*−*9* E_γ: weighted average of 848.5 *1* from (^{36}S,α4nγ), 848.0 *3* from (α,2nγ), 848.0 *4* from (α,4nγ), and 848.4 *4* from (^{36}S,p2nγ) (placed from a level at 3977). Mult.: from γ(DCO) and γ(pol) in (^{36}S,α4nγ), $\gamma(\theta)$ and ce data in (α,4nγ).
5613.8		940.4 *4*	100	4673.4	11^-		E_γ: from (α,2nγ) only.
5625.7	(13^+)	406.8 *4*	100 *25*	5218.7	(12^+)		E_γ: weighted average of 406.7 *5* from (^{36}S,α4nγ), 406.8 *4* from (α,2nγ), and 406.9 *4* from (^{36}S,p2nγ) (placed from a level at 12941). I_γ: from (^{36}S,α4nγ).
		637.5 *10*	50 *25*	4988.6	(12^+)		

$^{98}_{44}Ru_{54}$-16

Adopted Levels, Gammas (continued)

γ(^{98}Ru) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[‡]	Comments
5625.7	(13$^+$)	710.6 *10*	50 *25*	4915.0	12$^+$		
5819.5	14$^+$	193.6 *5*	18 *5*	5625.7	(13$^+$)		
		831.0 *5*	73 *18*	4988.6	(12$^+$)		
		904.6 *4*	100 *18*	4915.0	12$^+$	E2	E_γ: weighted average of 904.3 *3* from (^{36}S,α4nγ), and 905.0 *4* from (^{36}S,p2nγ) (placed from a level at 12534). I_γ: from (^{36}S,α4nγ) for 904.7+904.3 doublet. Mult.: from γ(DCO) and γ(pol) for 904.7+904.3 doublet in (^{36}S,α4nγ).
5888.4		899.8 *4*	100	4988.6	(12$^+$)		E_γ: from (α,4nγ) only.
6121.5	(14$^+$)	302.2 *10*	<100	5819.5	14$^+$		
		495.8 *10*	100	5625.7	(13$^+$)		
		1206.4 *10*	100	4915.0	12$^+$		
6260.7	(14$^+$)	441.4 *10*	100	5819.5	14$^+$		
		635.0 *10*	100	5625.7	(13$^+$)		
6591.8	15$^-$	1070.0 *1*	100	5521.8	13$^-$	E2	B(E2)(W.u.)=4.8 *+17−10* E_γ: weighted average of 1070.0 *1* from (^{36}S,α4nγ), 1069.3 *4* from (α,2nγ), 1069.9 *4* from (α,4nγ), and 1070.1 *4* from (^{36}S,p2nγ) (placed from a level at 6900). Mult.: from γ(DCO) and γ(pol) in (^{36}S,α4nγ), γ(θ) and ce data in (α,4nγ).
6593.8	(15$^+$)	333.2 *10*	25 *13*	6260.7	(14$^+$)		
		472.4 *10*	25 *13*	6121.5	(14$^+$)		
		774.6 *10*	100 *25*	5819.5	14$^+$		
		968.2 *10*	<25	5625.7	(13$^+$)		
6869.8	16$^+$	276.5 *8*	50 *13*	6593.8	(15$^+$)		E_γ: unweighted average of 275.7 *5* from (^{36}S,α4nγ), and 277.2 *4* from (^{36}S,p2nγ) (placed from a level at 11088).
		1050.2 *4*	100 *25*	5819.5	14$^+$	E2	E_γ: weighted average of 1050.3 *5* from (^{36}S,α4nγ), and 1050.1 *4* from (^{36}S,p2nγ) (placed from a level at 15998). I_γ: from (^{36}S,α4nγ) for 904.7+904.3 doublet. Mult.: from γ(DCO) and γ(pol) in (^{36}S,α4nγ).
7623.5	17$^-$	1031.7 *6*	100	6591.8	15$^-$	E2	B(E2)(W.u.)=12.3 *+14−11* E_γ: unweighted average of 1032.3 *1* from (^{36}S,α4nγ), 1030.6 *4* from (α,4nγ), 1032.2 *4* from (^{36}S,p2nγ) (placed from a level at 5831). Mult.: from γ(DCO) and γ(pol) in (^{36}S,α4nγ), also supported by γ(DCO) in (^{36}S,p2nγ).
8006.4	(17)	1136.5 *5*	100	6869.8	16$^+$	D	Mult.: from γ(DCO) in (^{36}S,α4nγ).
8449.5	19$^-$	826.0 *1*	100	7623.5	17$^-$	E2	E_γ: weighted average of 826.0 *1* from (^{36}S,α4nγ), and 826.1 *4* from (^{36}S,p2nγ). Mult.: from γ(DCO) and γ(pol) in (^{36}S,α4nγ), γ(DCO) in (^{36}S,p2nγ).
9930.5	21$^-$	1480.9 *2*	100	8449.5	19$^-$	E2	E_γ: weighted average of 1480.8 *1* from (^{36}S,α4nγ), and 1481.6 *4* from (^{36}S,p2nγ). Mult.: from γ(DCO) and γ(pol) in (^{36}S,α4nγ), γ(DCO) in (^{36}S,p2nγ).
11006.3	(22$^-$)	1075.9 *3*	100	9930.5	21$^-$	(D)	E_γ: weighted average of 1076.0 *3* from (^{36}S,α4nγ), and 1075.6 *4* from (^{36}S,p2nγ) (placed from a level at 12286). Mult.: from γ(DCO) in (^{36}S,p2nγ).
11405.0	23$^-$	398.8 *7*	93 *13*	11006.3	(22$^-$)	M1	E_γ: unweighted average of 398.1 *3* from (^{36}S,α4nγ), and 399.4 *4* from (^{36}S,p2nγ) (placed from a level at 12286). Mult.: from γ(DCO) and γ(pol) in (^{36}S,α4nγ), γ(DCO) in (^{36}S,p2nγ).

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Adopted Levels, Gammas (continued)

γ(^{98}Ru) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[‡]	Comments
11405.0	23$^-$	1474.5 *5*	100 *13*	9930.5	21$^-$	E2	E_γ: unweighted average of 1474.0 *3* from (^{36}S,α4nγ), and 1475.0 *4* from (^{36}S,p2nγ) (placed from a level at 12286). Mult.: from γ(DCO) and γ(pol) in (^{36}S,α4nγ), γ(DCO) in (^{36}S,p2nγ).
12282.3	25$^-$	877.3 *5*	100	11405.0	23$^-$	E2	E_γ: unweighted average of 877.6 *3* from (^{36}S,α4nγ), and 876.7 *4* from (^{36}S,p2nγ) (placed from a level at 9329). Mult.: from γ(DCO) and γ(pol) in (^{36}S,α4nγ), γ(DCO) in (^{36}S,p2nγ).
14285.3		2003 *1*	100	12282.3	25$^-$		
14476.1		2193.3 *7*	100	12282.3	25$^-$		E_γ: weighted average of 2193.6 *5* from (^{36}S,α4nγ), and 2192 *1* from (^{36}S,p2nγ) (placed from a level at 17240).
14612.1		2330.0 *5*	100	12282.3	25$^-$		
14818.4		2536 *1*	100	12282.3	25$^-$		
14997.4		2715 *1*	100	12282.3	25$^-$		
15412.4		3130 *1*	100	12282.3	25$^-$		
15500.5		888.5 *4*	67 *17*	14612.1			E_γ: weighted average of 888.1 *5* from (^{36}S,α4nγ), and 888.8 *4* from (^{36}S,p2nγ) (placed from a level at 12099).
		1024.2 *4*	100 *30*	14476.1		(Q)	E_γ: weighted average of 1024.0 *5* from (^{36}S,α4nγ), and 1024.3 *4* from (^{36}S,p2nγ) (placed from a level at 13310). Mult.: from γ(DCO) in (^{36}S,p2nγ).
17238.5		1738 *1*	100	15500.5		(Q)	E_γ: from (^{36}S,α4nγ), and also from (^{36}S,p2nγ) (placed from a level at 15048).
17592.4		2180 *1*	100	15412.4			E_γ: other: 2181 *1* from (^{36}S,p2nγ) (placed from a level at 23425).
19892.5?		2654[@] *1*	100	17238.5			

[†] From (^{3}He,2nγ) up to 4256 level and from (^{36}S,α4nγ) above that, unless otherwise noted. Weighted averages are taken when data of comparable precision from different reactions are available.

[‡] Mostly from γ(θ) and ce data in (α,4nγ) and (^{3}He,2nγ). Since $T_{1/2}$(level) is expected to be <0.5 ns for each level populated in in-beam γ-ray studies, (no delayed γ's with $T_{1/2}$>0.5 ns seen in (α,4nγ) by 1981Du06), ΔJ=2 transitions are assumed as E2 and ΔJ=0 or 1 transitions assumed as M1+E2, in cases where definitive ce and γ(lin pol) data are not available.

[#] 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.

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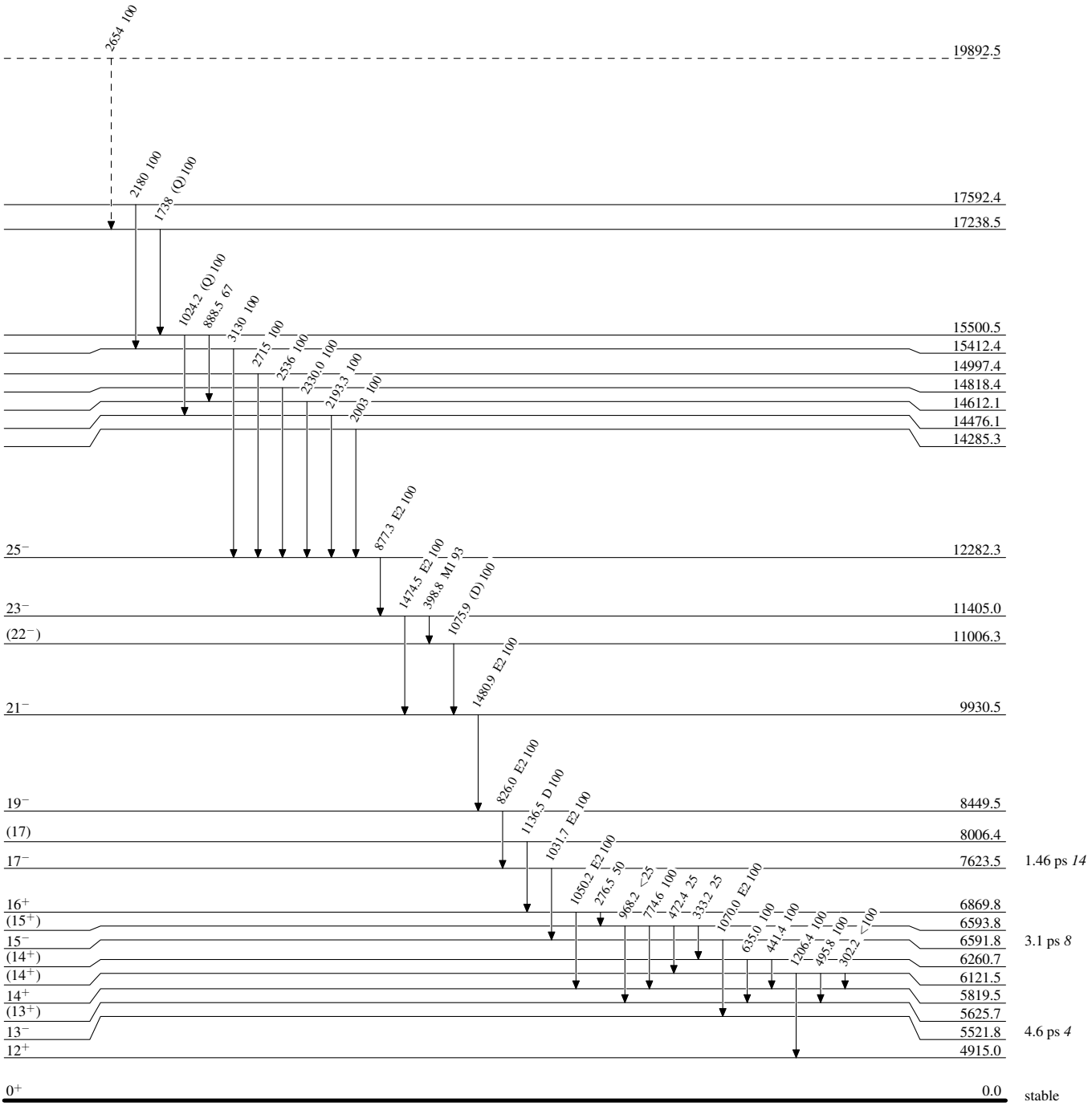
Adopted Levels, Gammas

Legend

Level Scheme

Intensities: Relative photon branching from each level

γ Decay (Uncertain)

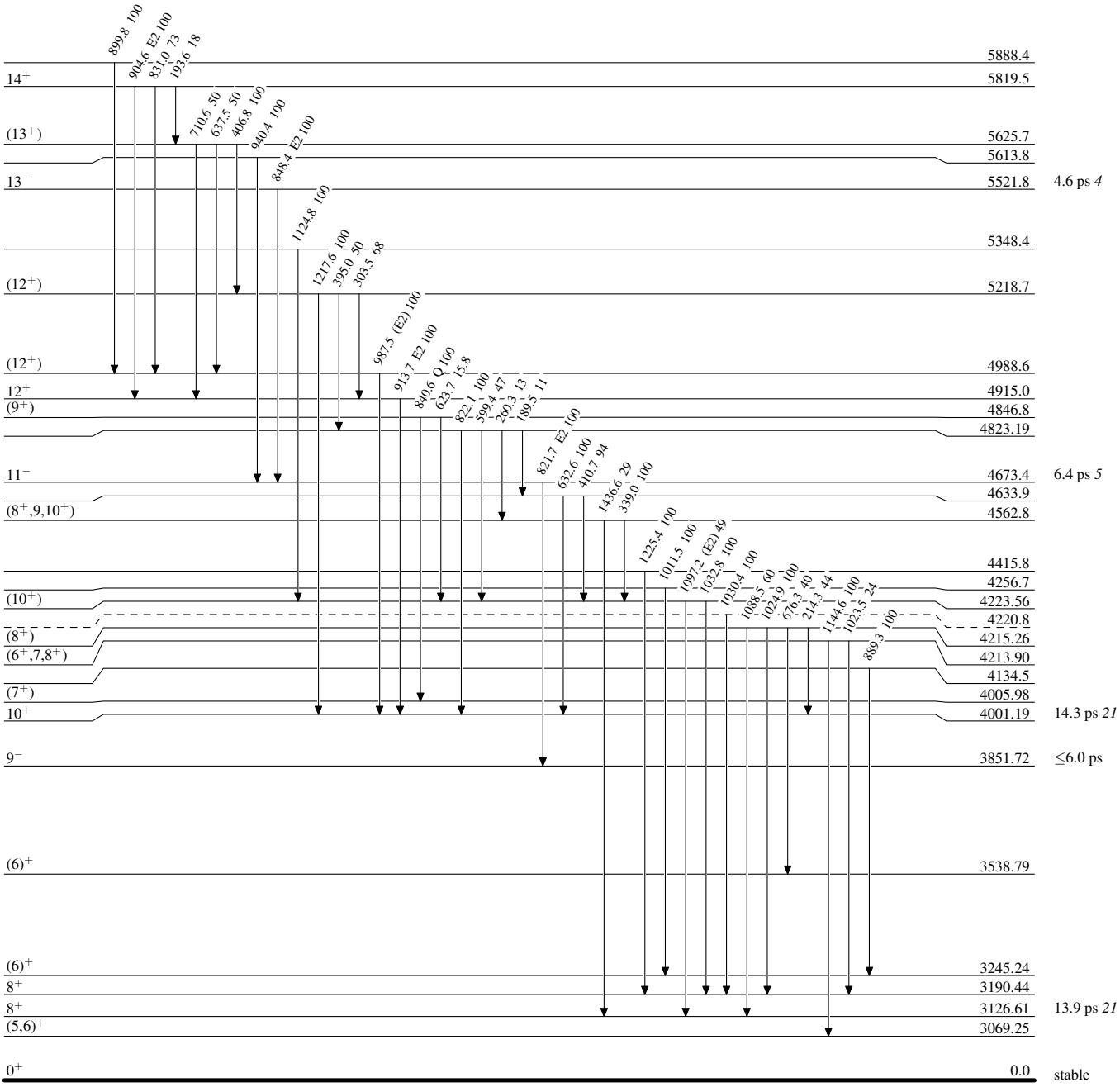


$^{98}_{44}Ru_{54}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level

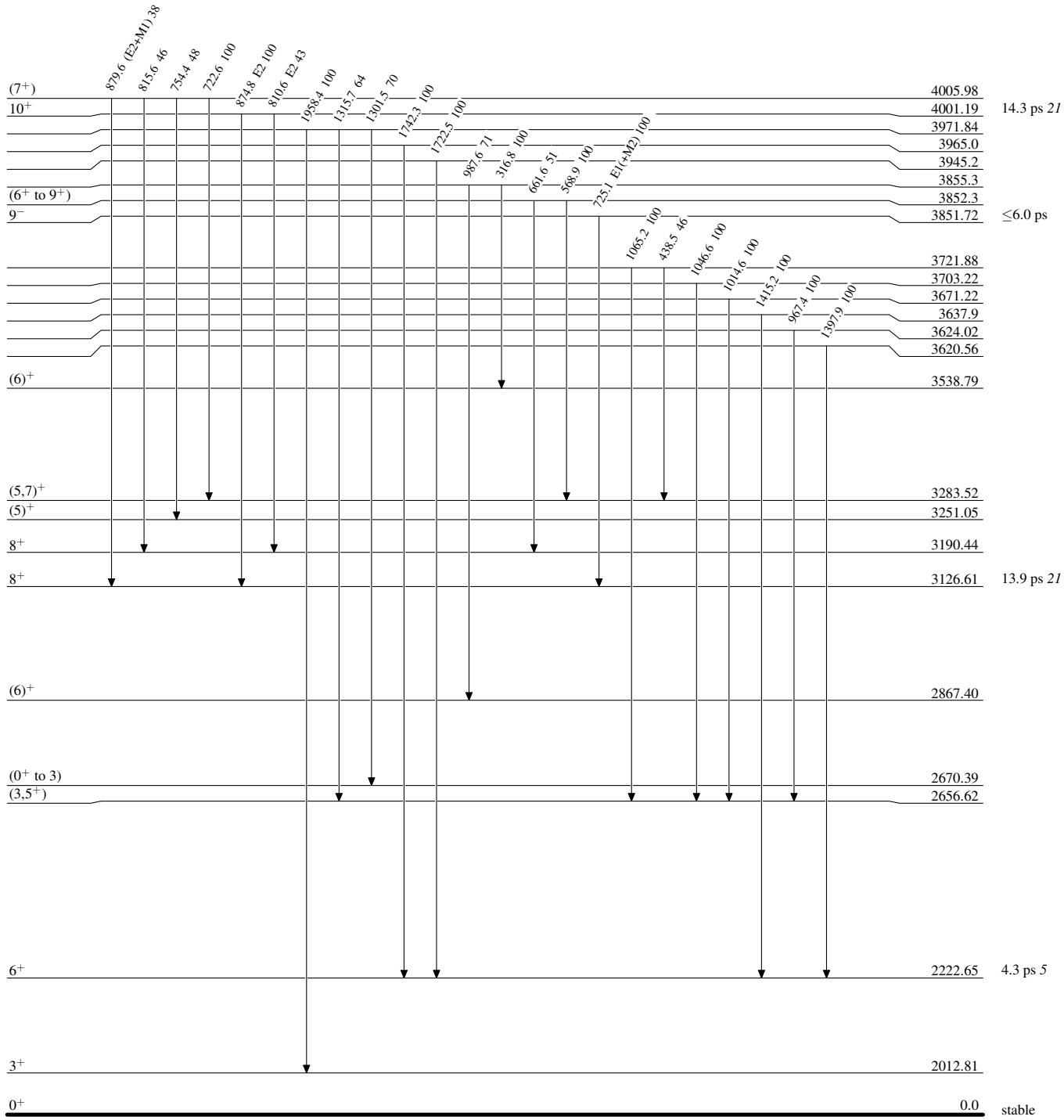


$^{98}_{44}Ru_{54}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level



$^{98}_{44}Ru_{54}$

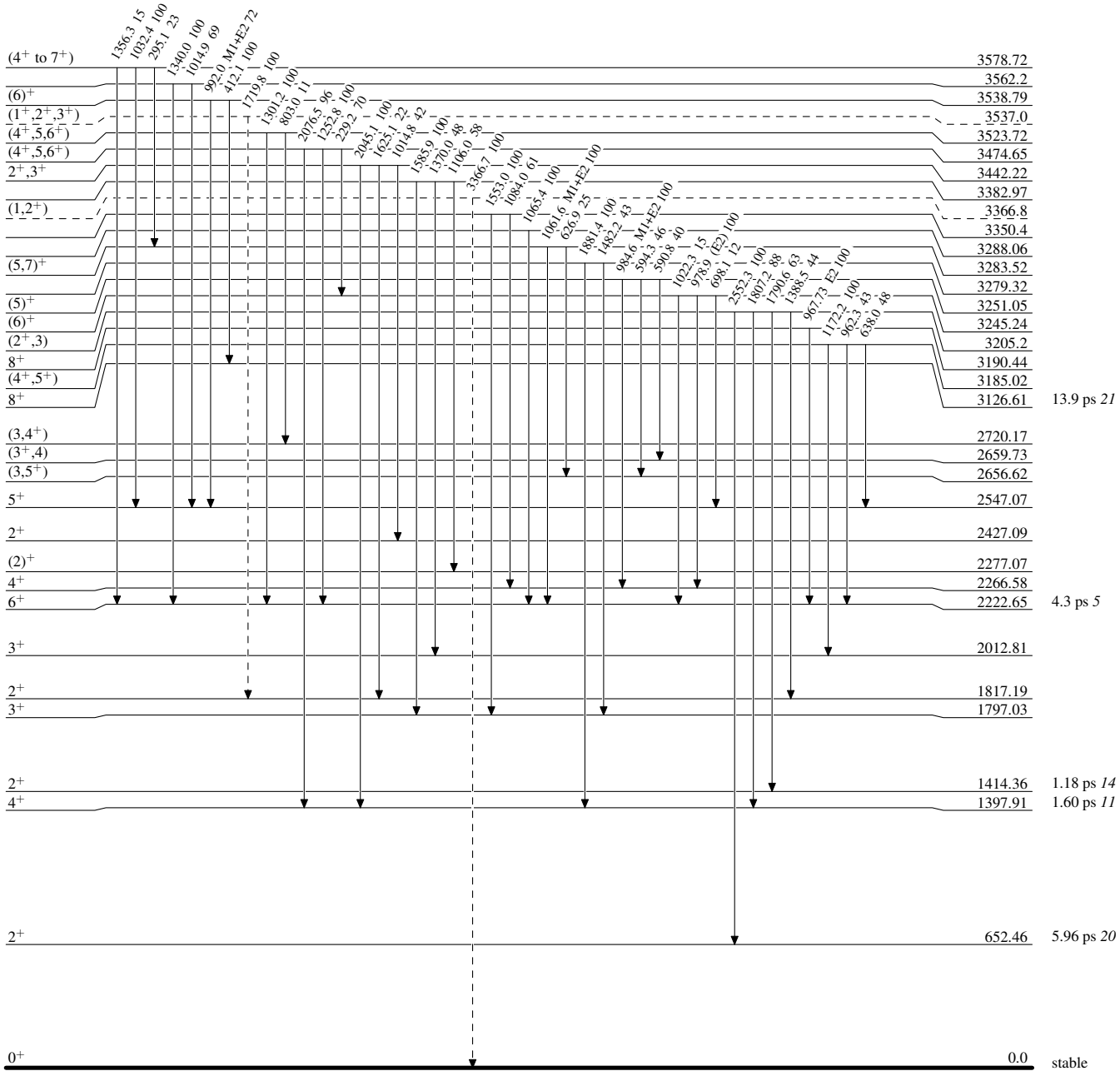
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

γ Decay (Uncertain)

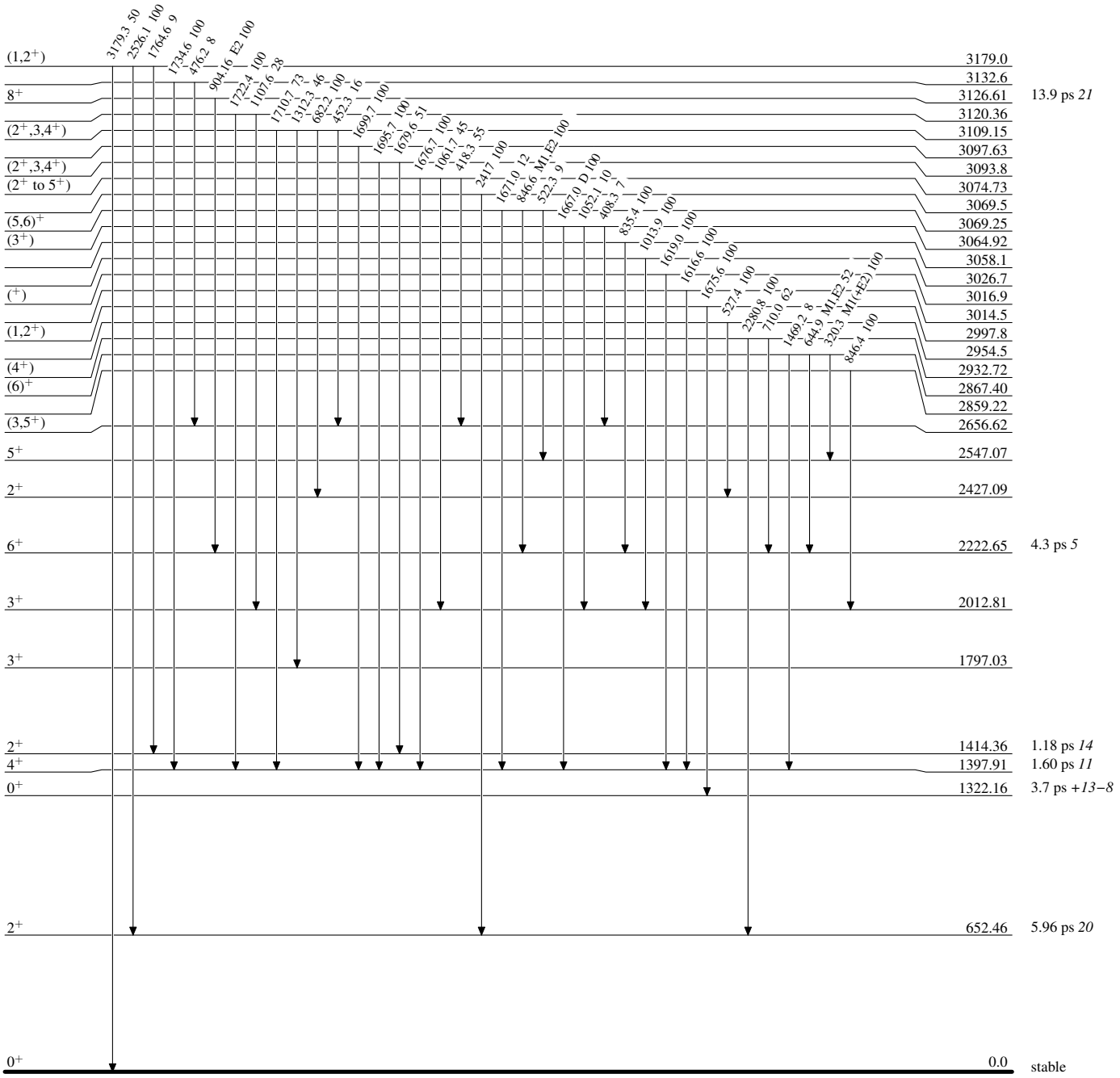


$^{98}_{44}Ru_{54}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level



$^{98}_{44}Ru_{54}$

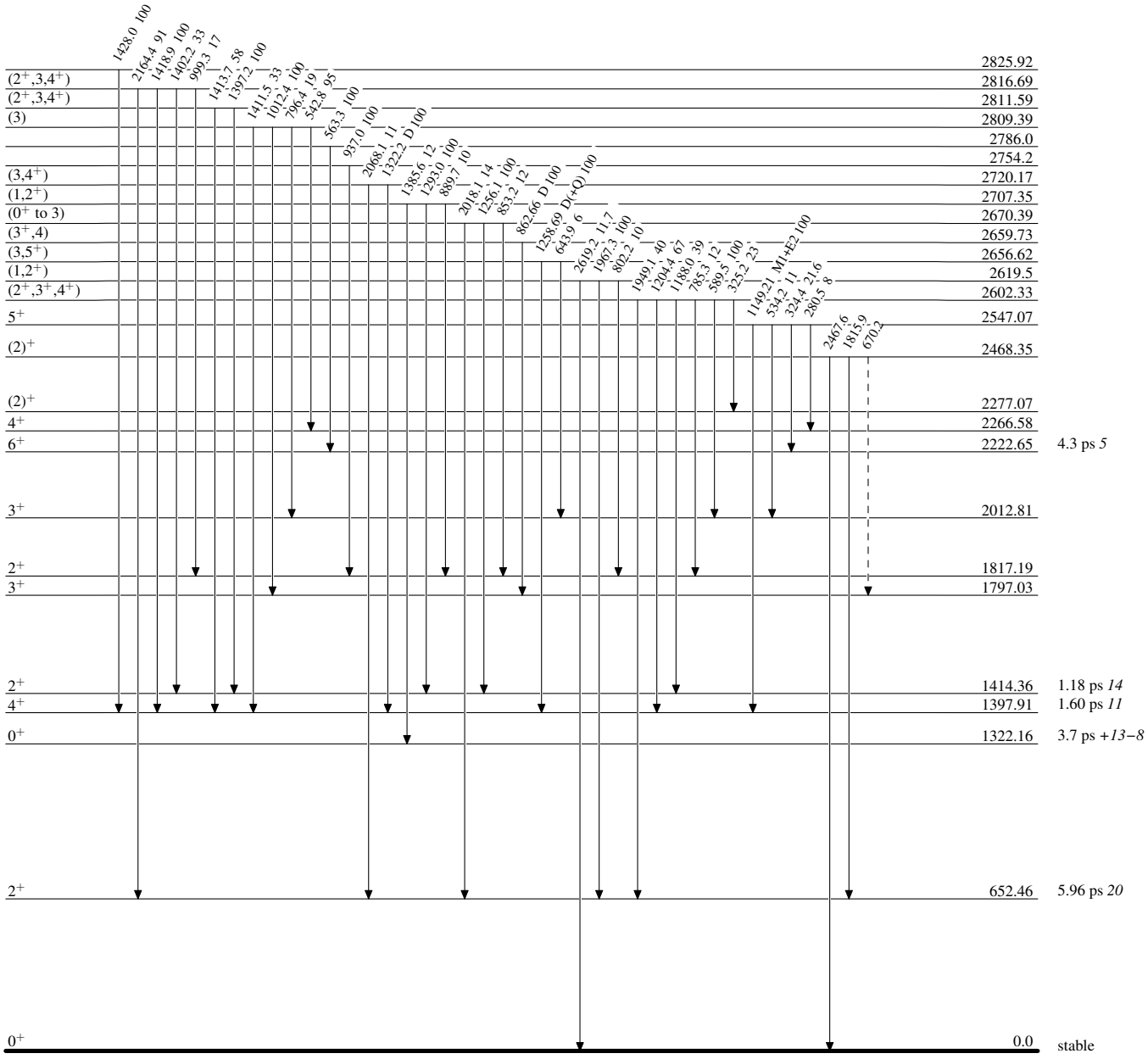
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

γ Decay (Uncertain)

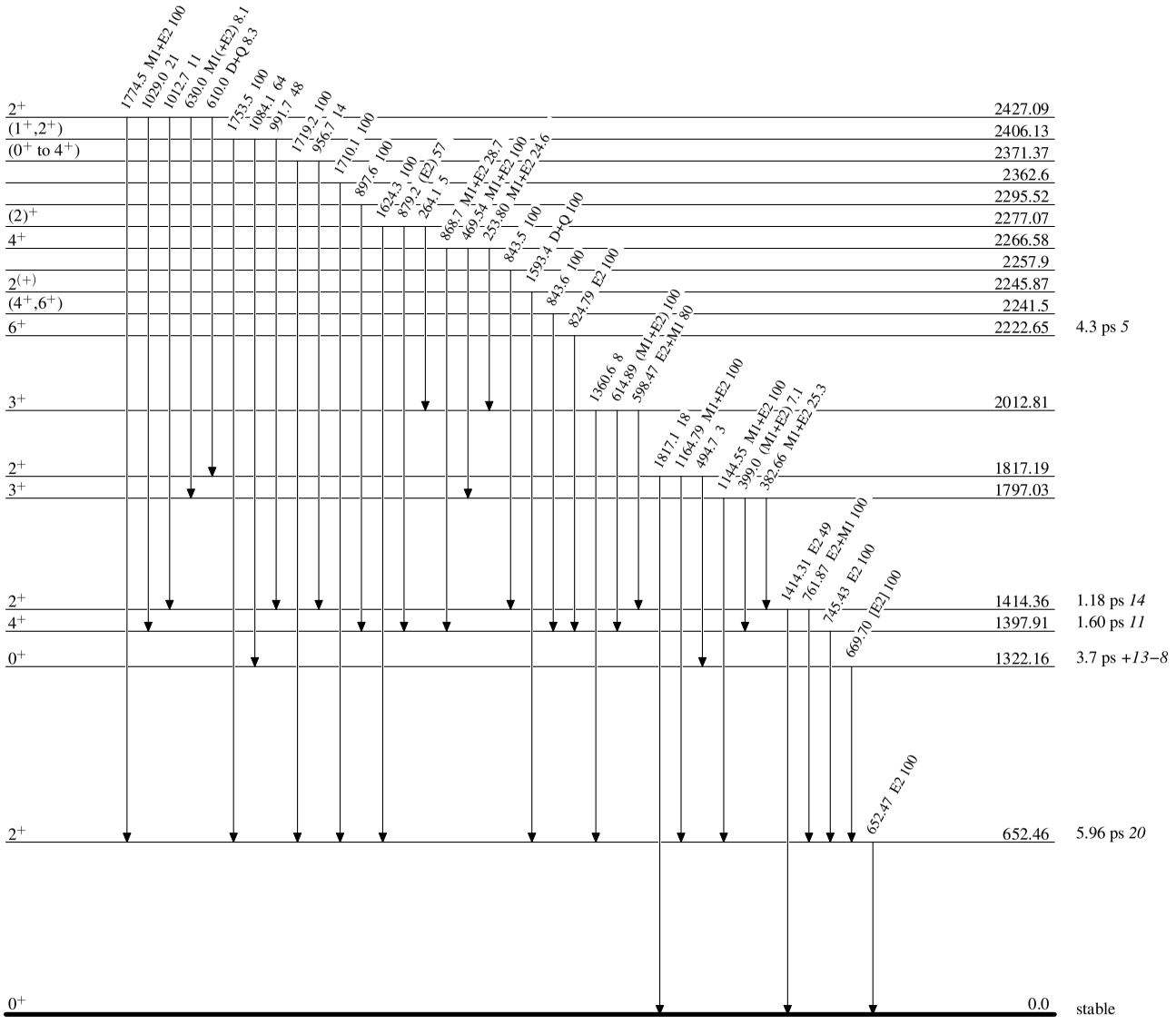


$^{98}_{44}Ru_{54}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level



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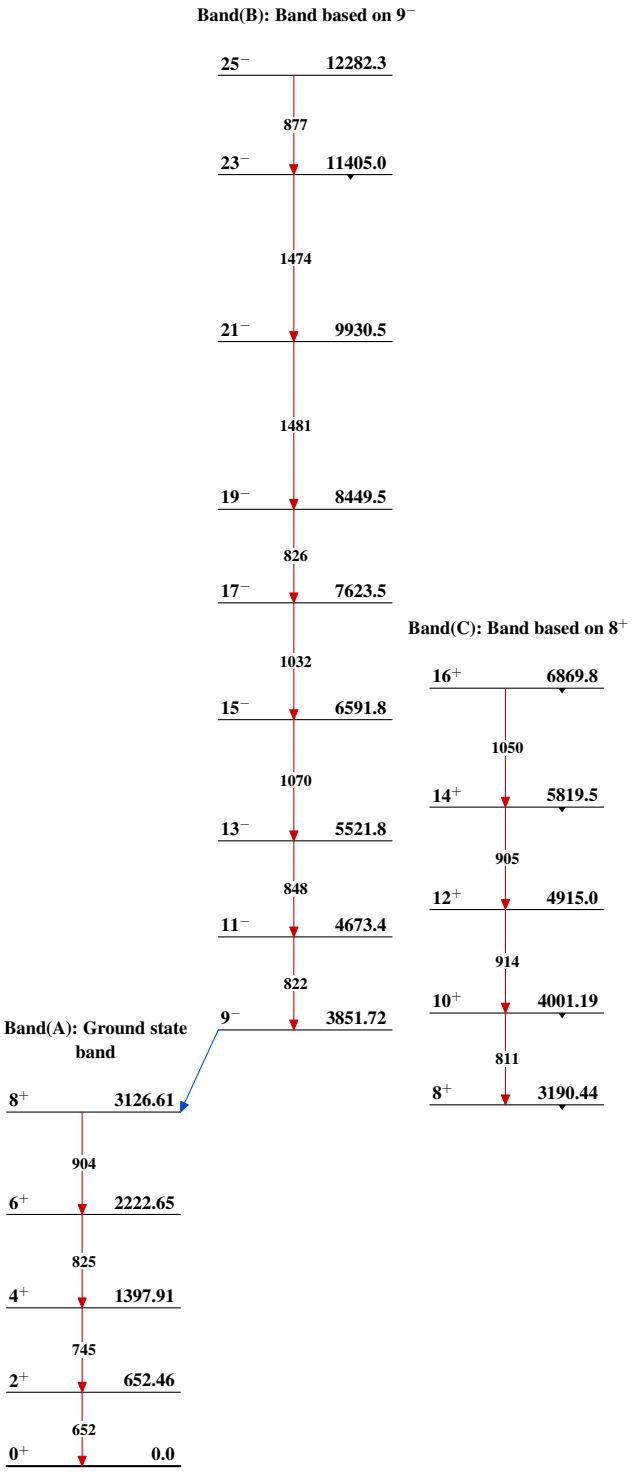
Adopted Levels, Gammas



$^{98}_{44}Ru_{54}$