

Adopted Levels, Gammas

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

$Q(\beta^-) = -1854$ 13; $S(n) = 8650$ 40; $S(p) = 4344$ 12; $Q(\alpha) = 1442$ 13 [2017Wa10](#)

$S(2n) = 19630$ 16, $S(2p) = 11932$ 13 ([2017Wa10](#)).

Other reactions: $^{94}\text{Mo}(^{14}\text{N}, ^{10}\text{Be})$ $E = 97$ MeV and $^{92}\text{Mo}(^{12}\text{C}, ^6\text{Li})$ $E = 90$ keV ([1976Mi13](#)).

Other measurements:

[1978Lu02](#): $^{90}\text{Zr}(^{11}\text{B}, 3n\gamma)$ $E = 56$ MeV. Three most intense γ rays of 841, 725 and 994 keV reported, but not assigned in a level scheme.

[1973Sc14](#): $^{90}\text{Zr}(^{12}\text{C}, p3n\gamma)$ $E = 71$ MeV. The authors assigned 841.3, 1567.2, 2561.4, 3541.3 levels to ^{98}Pd , incorrectly, by assuming $(^{12}\text{C}, 4n\gamma)$ reaction instead of $(^{12}\text{C}, p3n\gamma)$.

[1976Mi13](#): $^{94}\text{Mo}(^{14}\text{N}, ^{10}\text{Be})$ $E = 97$ MeV and $^{92}\text{Mo}(^{12}\text{C}, ^6\text{Li})$ $E = 90$ keV. Measured energy spectra of recoils. Deduced Q values.

Mass measurement: [2007HeZV](#).

[Additional information 1](#).

Theory references: consult the NSR database (www.nndc.bnl.gov/nsr/) for 6 primary references, 5 dealing with nuclear structure calculations and one with decay modes and half-lives.

See [2002Ti02](#) and [2004Zh26](#) for discussion of rotational structures in Rh nuclides.

The high-spin structures are known from $^{70}\text{Ge}(^{32}\text{S}, 3p\gamma)$ ([1998Ch04](#)), $^{65}\text{Cu}(^{36}\text{S}, 3n\gamma)$ ([1998Gh07](#)) and $^{75}\text{As}(^{28}\text{Si}, 2p3n\gamma)$

([2014Ku04](#)). However, the level schemes from these studies differ significantly from each other. Here in this dataset, the level scheme is mainly adopted from [2014Ku04](#), as it is the most detailed level scheme established with highest statistics. But note that since there are problems with intensity imbalances at some levels in data from $^{75}\text{As}(^{28}\text{Si}, 2p3n\gamma)$ reaction, in the opinion of the evaluators, problems may lie elsewhere, e.g. incorrect placement of some of the transitions, and further experimental investigations should be made to confirm the high-spin structures.

Note that the level scheme from [2014Ku04](#) is based on the placement of the 841 γ to a level at $E = 56$ keV with $J^\pi = (5^+)$, while previous high-spin studies ([1998Ch04](#), [1998Gh07](#)) have adopted the placement of 841 γ to $(2)^+$ ground state as proposed by [1983Be63](#) via $(\alpha, n\gamma)$ and $(d, 3n\gamma)$. So levels based on the placement of 841 γ in previous studies have energies and spins lower by about 56 keV and 3 spin units, respectively, than those in [2014Ku04](#) but are considered as the same levels here if they are from the same cascade ending with 841 γ .

 ^{98}Rh LevelsCross Reference (XREF) Flags

A	^{98}Pd ε decay (17.7 min)	E	$^{96}\text{Ru}(\alpha, p\gamma)$
B	$^{65}\text{Cu}(^{36}\text{S}, 3n\gamma)$	F	$^{98}\text{Ru}(p, n\gamma)$
C	$^{70}\text{Ge}(^{32}\text{S}, 3p\gamma)$	G	$^{99}\text{Ru}(d, 3n\gamma)$
D	$^{75}\text{As}(^{28}\text{Si}, 2p3n\gamma)$		

E(level) [†]	J^π [#]	$T_{1/2}$	XREF	Comments
0.0	$(2)^+$	8.72 min 12	ABCDEF	$\% \varepsilon + \% \beta^+ = 100$ XREF: B(?)C(?)E(?)G(?). J^π : $\log ft = 5.4$ to 2^+ in ^{98}Ru (^{98}Rh ε decay (8.72 min)), 112 γ M1 from 1^+ and analogy with 2^+ isomer in ^{96}Rh . $J=1$ is not ruled out. $T_{1/2}$: weighted average of 8.7 min 1 (1956Ka25), 9.05 min 30 (1970As08), 8.3 min 2 (1972Ba37), 8.90 min 15 (2001SeZY).
48.5 10			D	
56.3 @ 10	(5^+)	3.6 min 2	D	$\% IT = 89$ 5; $\% \varepsilon + \% \beta^+ = 11$ 5 E(level): 2014Ku04 in $^{75}\text{As}(^{28}\text{Si}, 2p3n\gamma)$ point out that this (5^+) level, most likely, is not the same as the 3.6-min isomer with $J^\pi = (5^+)$, however, evaluators assume here that the two levels are the same. This level is consistent with isomer energy $E \leq 100$ keV if $\text{mult}(\gamma \text{ to g.s.}) = M3$. This isomer does not seem related to a 6-keV level

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Adopted Levels, Gammas (continued) ^{98}Rh Levels (continued)

E(level) [†]	J ^π #	XREF	Comments
			quoted by 1974Si18 from an unpublished $^{96}\text{Ru}(\alpha, \text{pn}\gamma)$ study, the details of which are not available and whose existence has not been confirmed in any of the later in-beam γ -ray studies. 2017Au03 suggest 60 keV 50 from systematic trend.
			J ^π : in analogy with (5 ⁺) isomers in ^{96}Rh and ^{100}Rh . J ^π =5 ⁺ is consistent with evidence of β^+, ϵ feeding ($\log ft \approx 5.6$ in ^{98}Rh ϵ decay (3.6 min)) to 4 ⁺ state in ^{98}Ru .
			T _{1/2} : weighted average of 3.6 min 2 (1978Ki17), 3.5 min 3 (1974Si18). Other: 3 min 1 (1966At02).
			%IT from 1978Ki17 , deduced from intensities of γ lines in ^{98}Ru associated with the decays of the 3.6-min isomer and the 8.72-min ground state.
106.75 8	(3 ⁺)	A DEFG	XREF: E(?)G(?). Note that there is a large intensity imbalance at this level in data from $^{75}\text{As}(^{28}\text{Si}, 2\text{p}3\text{n}\gamma)$ reaction, on the basis of which 2014Ku04 suggest that this level is likely to be different from the one populated in ^{98}Pd ϵ decay, where no intensity imbalance is found.
			J ^π : M1 γ to (2 ⁺) ⁺ gives (1,2,3) ⁺ ; no β feeding from 0 ⁺ parent and absence of transitions from 1 ⁺ states favors 3 ⁺ .
112.01 9	1 ⁺	A EFG	XREF: E(?)G(?). J ^π : $\log ft=4.0$ from 0 ⁺ in ^{98}Pd ϵ decay.
174.45 8	(2 ⁺)	A EFG	XREF: E(?)G(?). J ^π : 67.7 γ (M1) to (3 ⁺), 174.5 γ (M1) to (2 ⁺) ⁺ , 661.9 γ (M1,E2) from 1 ⁺ .
194.0? 11		D	E(level): since ordering of 206-146 γ cascade is not established in 2014Ku04 , this level is either at 194.0 or 254.9 keV.
214.10 20		F	
271.9? 10		D	E(level): since ordering of 139-223 γ cascade is not established, this level is either at 271.9 or 187.5 keV.
283.6? 10		D	J ^π : note that 227.1 γ D ($\Delta J=1$) to (5 ⁺) is inconsistent with the 117.0 γ Q ($\Delta J=2$) from (5 ⁺), which could indicate the placements of those related γ rays by 2014Ku04 in $^{75}\text{As}(^{28}\text{Si}, 2\text{p}3\text{n}\gamma)$ are problematic, assuming the multipolarities are correct.
291.27 18		F	
400.5 10	(5 ⁺)	D	J ^π : 515.6 γ D ($\Delta J=1$) from (6 ⁻), assumed to be (E1) in 2014Ku04 ; 594.9 γ D ($\Delta J=1$) from (6 ⁺), assumed to be (M1).
410.9 9	(5 ⁺)	D	J ^π : 594.9 γ D ($\Delta J=1$) from (6 ⁺), 304.1 γ to (3 ⁺).
836.67 11	1 ⁺	A	J ^π : $\log ft=3.9$ from 0 ⁺ in ^{98}Pd ϵ decay.
897.9 [@] 10	(7 ⁺)	BCDE G	J ^π : 841.6 γ E2 to (5 ⁺). Based on the detailed level scheme from their high-spin study, 2014Ku04 in $^{75}\text{As}(^{28}\text{Si}, 2\text{p}3\text{n}\gamma)$ deduce that the 841 γ feeds a level at E=56 keV with J ^π =(5 ⁺) rather than the (2 ⁺) ⁺ ground state as proposed by 1983Be63 via ($\alpha, \text{pn}\gamma$) and ($d, 3\text{n}\gamma$) and adopted in other high-spin studies, which results in a level at 841 with J ^π =(4 ⁺). Note that the argument for the placement in 1983Be63 does not take into account that the 3.6-min isomer decays mostly to the g.s. by %IT=89. The evaluators have adopted the placement by 2014Ku04 .
916.1 10	(6 ⁻)	D	J ^π : 1066.0 γ D ($\Delta J=1$) from (7 ⁺), assumed to be (E1) in 2014Ku04 .
956.2 ^b 11		D	
1005.8 9	(6 ⁺)	D	J ^π : 605.2 γ D ($\Delta J=0$) from (6 ⁺), assumed to be (M1) in 2014Ku04 .
1007.39 18	1 ⁺	A	J ^π : $\log ft=4.4$ from 0 ⁺ in ^{98}Pd ϵ decay.
1111.91 22	1 ⁺	A	J ^π : $\log ft=5.0$ from 0 ⁺ in ^{98}Pd ϵ decay.
1262.26 18	1 ⁺	A	J ^π : $\log ft=4.4$ from 0 ⁺ in ^{98}Pd ϵ decay.
1290.1 10	(7 ⁺)	D	J ^π : 889.6 γ to (5 ⁺), 333.3 γ from (9 ⁺).
1592.5 ^b 10	(7 ⁻)	D	J ^π : 676.4 γ to (6 ⁻), assumed to be (M1) in 2014Ku04 , 302 γ to (7 ⁺).
1611.0 ^{&} 10	(6 ⁺)	D	J ^π : 1554.6 γ D ($\Delta J=1$) to (5 ⁺), 629.4 γ Q from (8 ⁺).
1623.5 [@] 10	(9 ⁺)	BCDE G	J ^π : 725.6 γ E2 to (7 ⁺).
1653.2 10	(7 ⁺)	D	J ^π : 737.0 γ to (6 ⁻) assumed to be (E1) and 587.1 γ from (8 ⁺) assumed to be (M1) in 2014Ku04 .
1879.2 10	(8 ⁻)	D	J ^π : 632.6 γ from (9 ⁺) assumed to be (E1) in 2014Ku04 , 962.8 γ to (6 ⁻).
1930.2 11		D	
1982.1 ^a 10	(7 ⁺)	D	J ^π : 407.6 γ M1 ($\Delta J=1$) from (8 ⁺), 825.1 γ Q from (9 ⁺).
2137.5 13		D	
2173.7 ^b 13		D	

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Adopted Levels, Gammas (continued) ^{98}Rh Levels (continued)

E(level) [†]	J ^π #	XREF	Comments
2240.3 ^{&} 10	(8 ⁺)	D	J ^π : 258.3γ and 1342.2γ D (ΔJ=1) to (7 ⁺), 616.8γ to (9 ⁺).
2389.7 ^a 10	(8 ⁺)	D	J ^π : 1491.9γ D (ΔJ=1) to (7 ⁺), 764.1γ Q from (10 ⁺).
2483.5 ^c 10	(10 ⁺)	D	J ^π : 860.2γ D (ΔJ=1) to (9 ⁺), 1090.6γ E2 from (12 ⁺).
2511.9 ^{&} 10	(9 ⁺)	D	J ^π : 866.2γ Q from (11 ⁺), 1614.1γ to (7 ⁺).
2617.5 [@] 10	(11 ⁺)	BCDE G	J ^π : 994.0γ E2 to (9 ⁺).
2618.7 ^b 14		D	
2807.4 ^a 10	(9 ⁺)	D	J ^π : 346.1γ D (ΔJ=1) from (10 ⁺), 1909.3γ to (7 ⁺), 755.4γ from (11 ⁺).
3018.3 ^{&} 10	(10 ⁺)	D	J ^π : 750.9γ (Q) from (12 ⁺), 778.0γ (Q) to (8 ⁺).
3030.6 ^c 10	(11 ⁺)	BCD	J ^π : 1407.0γ E2 to (9 ⁺).
3153.6 ^a 10	(10 ⁺)	D	J ^π : 409.1γ D (ΔJ=1) from (11 ⁺), 1530.4γ to (9 ⁺).
3266.7 ^b 16		D	
3378.0 ^{&} 10	(11 ⁺)	D	J ^π : 391.4γ from (12 ⁺), 359.6γ to (10 ⁺).
3562.7 ^a 10	(11 ⁺)	CD	J ^π : 206.5γ M1 (ΔJ=1) from (12 ⁺), 544.4γ D (ΔJ=1) to (10 ⁺).
3574.2 ^c 10	(12 ⁺)	D	J ^π : 543.6γ M1 (ΔJ=1) to (11 ⁺).
3597.2 [@] 10	(13 ⁺)	BCDE G	J ^π : 979.7γ E2 to (11 ⁺).
3769.3 ^{&} 10	(12 ⁺)	D	J ^π : 462.7γ E1 (ΔJ=1) from (13 ⁻), 1151.7γ D (ΔJ=1) to (11 ⁺).
3862.1 ^c 10	(13 ⁺)	BCDE G	J ^π : 831.5γ E2 to (11 ⁺), 264.8γ (M1) to (13 ⁺).
4232.0 ^d 10	(13 ⁻)	D	J ^π : 792.0γ E2 from (15 ⁻).
4406.1 11	(14 ⁺)	D	J ^π : 544.0γ D (ΔJ=1) to (13 ⁺).
4411.0 ^c 10	(14 ⁺)	D	J ^π : 548.9γ and 813.9γ M1 (ΔJ=1) to (13 ⁺).
4447.0 [‡] 11	(14 ⁻)	D	J ^π : 577.1γ D (ΔJ=1) from (15 ⁻), 215.1γ to (13 ⁻).
5024.0 ^d 11	(15 ⁻)	D	J ^π : 1379.7γ E2 from (17 ⁻).
5091.0 [@] 11	(15 ⁺)	D	J ^π : 456.2γ M1 (ΔJ=1) from (16 ⁺), 1493.7γ Q to (13 ⁺).
5380.0 ^c 11	(15 ⁺)	D	J ^π : 969.1γ D (ΔJ=1) to (14 ⁺).
5547.2 ^c 10	(16 ⁺)	CD	J ^π : 1136.2γ E2 to (14 ⁺).
5552.2 [‡] 11	(16 ⁻)	D	J ^π : 851.6γ M1 (ΔJ=1) from (17 ⁻), 528.3γ D (ΔJ=1) to (15 ⁻).
5611.4 11	(16 ⁺)	D	J ^π : 1200.3γ to (14 ⁺), 792.3γ from (17 ⁻).
5939.0 [@] 13		D	
6403.7 ^d 11	(17 ⁻)	CD	J ^π : 856.6γ E1 (ΔJ=1) to (16 ⁺).
6747? 1		D	from the placement of 1136γ to 5611 level (by evaluators).
6909.2 ^c 11	(17 ⁺)	BCD	J ^π : 1361.9γ D (ΔJ=1) to (16 ⁺), 506.1γ to (17 ⁻).
7337.3 ^d 11	(19 ⁻)	D	J ^π : 933.6γ E2 to (17 ⁻).
7345.7 12		D	
7552.4 [‡] 12	(20 ⁻)	D	J ^π : 215.2γ to (19 ⁻), assumed to be M1 in 2014Ku04.
7558.4 13	(19 ⁺)	B D	J ^π : 649.2γ Q to (17 ⁺). 2014Ku04 propose J ^π =(18 ⁺) by assuming (M1) for 649.2γ.
7611.7 12		D	
8341.4 13		BCD	
8654.5 15		D	
8685.1 ^d 12	(21 ⁻)	D	J ^π : 1347γ Q to (19 ⁻).
8899.9 13		D	
10171.3 ^d 13	(23 ⁻)	D	J ^π : 1486.2γ to (21 ⁻), assumed to be (E2) in 2014Ku04.

[†] From a least-squares fit to γ-ray energies. Low-spin (J<3) levels are from ^{98}Pd ε decay and high-spin (J≥3) levels are from $^{75}\text{As}(^{28}\text{Si}, 2\text{p}3\text{n}\gamma)$.

[‡] Probably related to band based on 13⁻.

Assignments for high-spin states (J>5) are based on multiplicities and ΔJ values from γγ(DCO) and γγ(pol) in

$^{75}\text{As}(^{28}\text{Si}, 2\text{p}3\text{n}\gamma)$, where 2014Ku04 state that J^π assignments are tentative since the low-lying levels are not assigned definite J^π

Adopted Levels, Gammas (continued) ^{98}Rh Levels (continued)

values, and that all assignments are relative, assigned on the basis of multipolarity assignments from their DCO and POL data, and assuming that spins ascend with excitation energies as well as preference for transitions which do not involve parity change.

@ Seq.(A): Decoupled structure based on (5^+). Possible configuration= $\pi p_{1/2} \otimes \nu h_{11/2}$.

& Seq.(B): $\Delta J=1$ γ cascade based on (6^+).

^a Seq.(C): $\Delta J=1$ γ cascade based on (7^+). Possible configuration= $\pi f_{5/2} \otimes \nu h_{11/2}$.

^b Seq.(D): γ cascade based on 956 level.

^c Seq.(E): $\Delta J=1$, γ cascade based on (10^+). Possible configuration= $\pi(p_{1/2}/f_{5/2}) \otimes \pi g_{9/2}^2 \otimes \nu h_{11/2}$.

^d Seq.(F): γ cascade based on (13^-). Possible configuration= $\pi p_{1/2} \otimes \nu h_{11/2}^2 \otimes \nu d_{5/2}$.

 $\gamma(^{98}\text{Rh})$

$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\dagger$	E_f	J_f^π	Mult. #	$\alpha^\&$	Comments
106.75	(3) ⁺	106.8 2	100	0.0	(2) ⁺	M1	0.285	E_γ : weighted average of 106.8 2 from ^{98}Pd ε decay (17.7 min), 106.8 7 from ($^{28}\text{Si}, 2p3n\gamma$), 106.8 3 from ($\alpha, pn\gamma$), 106.8 2 from (p,n γ).
112.01	1 ⁺	112.4 2	100	0.0	(2) ⁺	M1	0.247	E_γ : weighted average of 112.2 2 from ^{98}Pd ε decay (17.7 min), 112.5 3 from ($\alpha, pn\gamma$), 112.4 2 from (p,n γ).
174.45	(2) ⁺	62.5 ^b 5 67.7 2	100 5	112.01 1 ⁺ 106.75 (3) ⁺	(M1) [@]		1.040	E_γ : only from 1972Ga21 in ^{98}Pd ε decay. E_γ : weighted average of 67.7 2 from ^{98}Pd ε decay (17.7 min), 67.7 3 from ($\alpha, pn\gamma$), 67.7 2 from (p,n γ).
		174.5 2	84 4	0.0	(2) ⁺	(M1) [@]	0.074	I_γ : from ^{98}Pd ε decay. E_γ : weighted average of 174.5 2 from ^{98}Pd ε decay (17.7 min), 174.4 3 from ($\alpha, pn\gamma$), 174.6 3 from (p,n γ). I_γ : from ^{98}Pd ε decay. Other: $I_\gamma(174)/I_\gamma(67.7)=100$ 15/65 12 in (p,n γ).
194.0?		145.6 ^{†b} 7	100	48.5				
214.10		214.1 2	100	0.0	(2) ⁺			E_γ : from (p,n γ).
271.9?		223.4 ^{†b} 5	100	48.5				
283.6?		227.3 ^b 3	94 9	56.3	(5) ⁺	D		$E_\gamma, I_\gamma, \text{Mult.}$: from $^{75}\text{As}(^{28}\text{Si}, 2p3n\gamma)$.
		235.1 3	100 9	48.5		Q		$E_\gamma, I_\gamma, \text{Mult.}$: from $^{75}\text{As}(^{28}\text{Si}, 2p3n\gamma)$.
291.27		184.4 4	14 5	106.75	(3) ⁺			E_γ, I_γ : from (p,n γ).
		291.3 2	100 12	0.0	(2) ⁺			E_γ, I_γ : from (p,n γ).
400.5	(5) ⁺	117.0 5	100 14	283.6?		Q		
		206.5 ^{a†b} 7	12.1 ^a 17	194.0?				
		344.2 5	80 8	56.3	(5) ⁺			
410.9	(5) ⁺	138.9 ^{†b} 5	112 16	271.9?				
		304.1 5	100 12	106.75	(3) ⁺			
		362.6 7	47 8	48.5				
836.67	1 ⁺	661.9 3	100 5	174.45	(2) ⁺	(M1,E2)	0.00261 5	
		725.6 4	20 2	112.01	1 ⁺			
		837.6 7	1.3 2	0.0	(2) ⁺			
897.9	(7) ⁺	497.4 5	1.38 17	400.5	(5) ⁺			
		841.5 3	100 5	56.3	(5) ⁺	E2	0.0014	E_γ : weighted average of 841.6 3 in ($^{28}\text{Si}, 2p3n\gamma$), 841.6 4 in ($^{36}\text{S}, 3n\gamma$) and 841.3 3 in ($\alpha, pn\gamma$). Placement of this γ to the 56, (5^+) level is from 2014Ku04; it was previously placed

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Adopted Levels, Gammas (continued)

$\gamma(^{98}\text{Rh})$ (continued)								
$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\dagger$	E_f	J_f^π	Mult. [#]	$\alpha^\&$	Comments
								to (2 ⁺) ground state. See also comments for 898 and 56 levels.
916.1	(6 ⁻)	515.6 3	100	400.5	(5 ⁺)	D		
956.2		555.8 5	100	400.5	(5 ⁺)			
1005.8	(6 ⁺)	594.9 3	100 8	410.9	(5 ⁺)	D		
		605.5 7	2.2 5	400.5	(5 ⁺)			
1007.39	1 ⁺	832.8	100 11	174.45	(2 ⁺)			
		895.4	48 6	112.01	1 ⁺			
		1007.5	41 4	0.0	(2) ⁺			
1111.91	1 ⁺	999.9	66 13	112.01	1 ⁺			
		1111.9	100 20	0.0	(2) ⁺			
1262.26	1 ⁺	1087.7	100 13	174.45	(2 ⁺)			
		1150.1	50 13	112.01	1 ⁺			
		1262.5	21 4	0.0	(2) ⁺			
1290.1	(7 ⁺)	334.2 7	12.6 23	956.2				
		374.1 5	43 4	916.1	(6 ⁻)			
		889.6 3	100 10	400.5	(5 ⁺)			E_γ : other: 889.7 4 (Mult=Q) placed from a 8400 level in (³⁶ S,3n γ).
1592.5	(7 ⁻)	302.4 3	100 9	1290.1	(7 ⁺)			
		636.2 7	15.6 21	956.2				
		676.4 7	16.2 24	916.1	(6 ⁻)			
1611.0	(6 ⁺)	605.2 3	100 8	1005.8	(6 ⁺)	D		
		1554.6 3	43 4	56.3	(5 ⁺)	D		
1623.5	(9 ⁺)	333.3 5	1.37 23	1290.1	(7 ⁺)			
		725.9 3	100 5	897.9	(7 ⁺)	E2	0.00204	E_γ : weighted average of 725.6 3 in (²⁸ Si,2p3n γ), 726.5 4 in (³⁶ S,3n γ) and 725.8 3 in (α ,pn γ).
1653.2	(7 ⁺)	737.0 5	100	916.1	(6 ⁻)			
1879.2	(8 ⁻)	589.3 5	64 9	1290.1	(7 ⁺)			
		962.8 5	100 14	916.1	(6 ⁻)			
1930.2		1014.0 5	100	916.1	(6 ⁻)			
1982.1	(7 ⁺)	329.0 7	8.8 15	1653.2	(7 ⁺)			
		371.0 5	10.2 15	1611.0	(6 ⁺)			
		1066.0 3	100 7	916.1	(6 ⁻)	D		
		1084.4 3	49 4	897.9	(7 ⁺)			
2137.5		545.0 7	100	1592.5	(7 ⁻)			
2173.7		581.2 7	100	1592.5	(7 ⁻)			
2240.3	(8 ⁺)	258.3 5	19.3 21	1982.1	(7 ⁺)	D		
		587.1 7	0.90 21	1653.2	(7 ⁺)			
		616.8 5	26.2 21	1623.5	(9 ⁺)			
		629.4 3	100 7	1611.0	(6 ⁺)	Q		
		950.1 7	1.10 21	1290.1	(7 ⁺)			
		1342.2 5	24 3	897.9	(7 ⁺)	D		
2389.7	(8 ⁺)	407.6 3	100 8	1982.1	(7 ⁺)	M1	0.0084	
		1491.9 5	38 4	897.9	(7 ⁺)	D		
2483.5	(10 ⁺)	860.2 5	100	1623.5	(9 ⁺)	D		
2511.9	(9 ⁺)	271.6 3	100 8	2240.3	(8 ⁺)			
		529.8 5	40 4	1982.1	(7 ⁺)			
		632.6 7	9.2 11	1879.2	(8 ⁻)			
		888.4 5	18.8 21	1623.5	(9 ⁺)			E_γ : other: 889.7 4 (Mult=Q) placed from a 8400 level in (³⁶ S,3n γ).
		1614.1 7	10.7 17	897.9	(7 ⁺)			
2617.5	(11 ⁺)	134.0 7	1.23 16	2483.5	(10 ⁺)			
		994.2 3	100 5	1623.5	(9 ⁺)	E2		E_γ : weighted average of 994.0 3 in (²⁸ Si,2p3n γ) and 994.3 3 in (α ,pn γ). Other: 995.1 4 in (³⁶ S,3n γ).

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Adopted Levels, Gammas (continued)

$\gamma(^{98}\text{Rh})$ (continued)								
$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\dagger$	E_f	J_f^π	Mult. [#]	α ^{&}	Comments
2618.7		445.0 7	100	2173.7				
2807.4	(9 ⁺)	295.5 7	23 3	2511.9 (9 ⁺)				
		417.8 5	70 8	2389.7 (8 ⁺)		D		
		825.1 5	100 15	1982.1 (7 ⁺)		Q		
		1183.7 5	30 4	1623.5 (9 ⁺)				
		1909.3 7	3.9 9	897.9 (7 ⁺)				
3018.3	(10 ⁺)	210.9 7	3.0 4	2807.4 (9 ⁺)				
		506.5 5	26.3 26	2511.9 (9 ⁺)				
		778.0 3	100 9	2240.3 (8 ⁺)		(Q)		
		1394.9 7	9.1 15	1623.5 (9 ⁺)				
3030.6	(11 ⁺)	413.2 4	39 4	2617.5 (11 ⁺)				E_γ : weighted average of 413.0 5 in ($^{28}\text{Si}, 2\text{p}3\text{n}\gamma$) and 413.4 4 in ($^{36}\text{S}, 3\text{n}\gamma$). I_γ : others: 29 6 in ($^{32}\text{S}, 3\text{p}\text{n}\gamma$) and 46 5 in ($^{36}\text{S}, 3\text{n}\gamma$).
		547.2 5	17.3 20	2483.5 (10 ⁺)				
		1407.0 3	100 7	1623.5 (9 ⁺)		E2		
3153.6	(10 ⁺)	346.1 5	100 8	2807.4 (9 ⁺)		D		E_γ : other: 1409.4 4 in ($^{36}\text{S}, 3\text{n}\gamma$).
		641.7 5	83 7	2511.9 (9 ⁺)				
		764.1 5	44 7	2389.7 (8 ⁺)		Q		
		1530.4 7	18 3	1623.5 (9 ⁺)				
3266.7		648.0 7	100	2618.7				
3378.0	(11 ⁺)	359.6 7	8.9 15	3018.3 (10 ⁺)				
		866.2 5	100 12	2511.9 (9 ⁺)		Q		
3562.7	(11 ⁺)	184.6 7	19.2 21	3378.0 (11 ⁺)				
		409.1 5	100 11	3153.6 (10 ⁺)		D		E_γ : other: 409.2 4 placed from a 2356 level in ($^{36}\text{S}, 3\text{n}\gamma$).
		544.4 5	92 11	3018.3 (10 ⁺)		D		Mult.: from $\gamma\gamma(\text{DCO})$ in ($^{32}\text{S}, 3\text{p}\text{n}\gamma$).
		755.4 5	37 5	2807.4 (9 ⁺)				
		945.3 7	15.5 21	2617.5 (11 ⁺)				
		1079.2 5	29 4	2483.5 (10 ⁺)				
3574.2	(12 ⁺)	543.6 3	100 8	3030.6 (11 ⁺)		M1	0.0042	
		956.6 5	38 5	2617.5 (11 ⁺)		(D)		
		1090.6 5	33 5	2483.5 (10 ⁺)		E2		
3597.2	(13 ⁺)	979.9 3	100	2617.5 (11 ⁺)		E2		E_γ : weighted average of 979.7 3 in ($^{28}\text{Si}, 2\text{p}3\text{n}\gamma$), 980.4 4 in ($^{36}\text{S}, 3\text{n}\gamma$) and 979.9 3 in ($\alpha, \text{p}\text{n}\gamma$).
3769.3	(12 ⁺)	206.5 ^a 7	100 ^a 7	3562.7 (11 ⁺)		M1	0.0474	E_γ : other: 207.1 4 placed from a 2563 level in ($^{36}\text{S}, 3\text{n}\gamma$).
		391.4 5	11.6 16	3378.0 (11 ⁺)				
		615.8 5	43 4	3153.6 (10 ⁺)				
		738.6 5	23.3 25	3030.6 (11 ⁺)				
		750.9 3	63 6	3018.3 (10 ⁺)		(Q)		
		1151.7 3	69 5	2617.5 (11 ⁺)		D		E_γ : other: 1152 (Mult=Q) placed from a 6346 level in ($^{32}\text{S}, 3\text{p}\text{n}\gamma$), 1150.7 4 placed from a 8848 level in ($^{36}\text{S}, 3\text{n}\gamma$).
3862.1	(13 ⁺)	264.8 3	100 6	3597.2 (13 ⁺)		(M1)	0.0248	E_γ : others: 263.7 3 from ($\alpha, \text{p}\text{n}\gamma$), 265.2 4 from ($^{36}\text{S}, 3\text{n}\gamma$).
								I_γ : others: 100 5 in ($^{32}\text{S}, 3\text{p}\text{n}\gamma$), 100 in ($^{36}\text{S}, 3\text{n}\gamma$).
		287.9 5	25 3	3574.2 (12 ⁺)		D		I_γ : other: 23 5 in ($^{32}\text{S}, 3\text{p}\text{n}\gamma$).
		831.5 5	25.0 18	3030.6 (11 ⁺)		E2		I_γ : other: 59 5 in ($^{32}\text{S}, 3\text{p}\text{n}\gamma$), 78 in ($^{36}\text{S}, 3\text{n}\gamma$).
4232.0	(13 ⁻)	462.7 3	100	3769.3 (12 ⁺)		E1		E_γ : others: 463.4 4 (Mult=D) placed from a 3243 level in ($^{36}\text{S}, 3\text{n}\gamma$), 462 (Mult=D) placed from a 3022 level in ($^{32}\text{S}, 3\text{p}\text{n}\gamma$).
4406.1	(14 ⁺)	544.0 5	100	3862.1 (13 ⁺)		D		
4411.0	(14 ⁺)	549.1 3	100 6	3862.1 (13 ⁺)		M1	0.0041	E_γ : weighted average of 548.9 3 in ($^{28}\text{Si}, 2\text{p}3\text{n}\gamma$)

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

$\gamma(^{98}\text{Rh})$ (continued)							
$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\dagger$	E_f	J_f^π	Mult. #	$\alpha\&$
							Comments
							and 549.5 4 in ($^{36}\text{S}, 3n\gamma$).
4411.0	(14 ⁺)	813.9 3	59 4	3597.2 (13 ⁺)	M1	0.00164	I_γ : other: 100 8 in ($^{32}\text{S}, 3p\text{ny}$), 77 in ($^{36}\text{S}, 3n\gamma$).
							E_γ : other: 815.4 4 (Mult=Q) in ($^{36}\text{S}, 3n\gamma$).
4447.0	(14 ⁻)	836.6 7 215.1 5	5.6 10 100	3574.2 (12 ⁺) 4232.0 (13 ⁻)			I_γ : other: 40 4 in ($^{32}\text{S}, 3p\text{ny}$), 100 in ($^{36}\text{S}, 3n\gamma$).
							I_γ : other: 20 4 in ($^{32}\text{S}, 3p\text{ny}$).
5024.0	(15 ⁻)	577.1 5 792.0 3	20.7 21 100 6	4447.0 (14 ⁻) 4232.0 (13 ⁻)	D E2		E_γ : other: 216.3 4 with Mult=D placed from a 2780 level in ($^{36}\text{S}, 3n\gamma$).
5091.0	(15 ⁺)	680.0 5 685.0 7 1493.7 5	66 5 15.7 22 100 8	4411.0 (14 ⁺) 4406.1 (14 ⁺) 3597.2 (13 ⁺)	D Q		E_γ : other: 792 (Mult=Q) placed from a 3814 level in ($^{32}\text{S}, 3p\text{ny}$), 792.5 4 (Mult=D) placed from a 4036 level in ($^{36}\text{S}, 3n\gamma$).
5380.0	(15 ⁺)	969.1 5 973.8 7 1517.8 5	100 12 5.8 12 51 7	4411.0 (14 ⁺) 4406.1 (14 ⁺) 3862.1 (13 ⁺)	D		E_γ : other: 1495 1 (Mult=Q) placed from a 5496 level in ($^{36}\text{S}, 3n\gamma$).
5547.2	(16 ⁺)	167.3 5 456.2 3	16.6 14 41 4	5380.0 (15 ⁺) 5091.0 (15 ⁺)	D M1	0.0064	E_γ : other: 457.4 4 (Mult=Q) placed from a 4001 level in ($^{36}\text{S}, 3n\gamma$).
							I_γ : other: 39 3 in ($^{32}\text{S}, 3p\text{ny}$).
		1136.2 3	100 6	4411.0 (14 ⁺)	E2		E_γ : other: 1137.3 4 (Mult=Q) placed from a 5496 level in ($^{36}\text{S}, 3n\gamma$).
							I_γ : other: 100 7 in ($^{32}\text{S}, 3p\text{ny}$).
5552.2	(16 ⁻)	528.3 5 1105.1 7	100 8 25 4	5024.0 (15 ⁻) 4447.0 (14 ⁻)	D		
5611.4	(16 ⁺)	1200.3 5	100	4411.0 (14 ⁺)			
5939.0		848.0 7		5091.0 (15 ⁺)			
6403.7	(17 ⁻)	792.3 5 851.6 5 856.6 3	9.7 16 38 4 65 6	5611.4 (16 ⁺) 5552.2 (16 ⁻) 5547.2 (16 ⁺)	M1 E1	0.00148	E_γ : other: 857.1 4 placed from a 7717 level in ($^{36}\text{S}, 3n\gamma$).
							E_γ : other: 1380 (Mult=Q) placed from a 5194 level in ($^{32}\text{S}, 3p\text{ny}$), 1380.9 4 (Mult=D) placed from a 5417 level in ($^{36}\text{S}, 3n\gamma$).
6747?		1136 ^b 1	100	5611.4 (16 ⁺)			In Table I of 2014Ku04, this γ is listed as feeding a 16 ⁺ level, but not clear which of the two 16 ⁺ levels: 5547 or 5611. Here the evaluators have assumed it feeds 5611 level.
6909.2	(17 ⁺)	506.1 7	3.0 6	6403.7 (17 ⁻)			I_γ : other: 21 4 in ($^{32}\text{S}, 3p\text{ny}$).
							Mult.: D ($\Delta J=1$) from $\gamma\gamma(\text{DCO})$ in ($^{32}\text{S}, 3p\text{ny}$) is inconsistent with adopted spin-change ($\Delta J=0$).
		1361.9 3	100 8	5547.2 (16 ⁺)	D		E_γ : other: 1363.9 4 (Mult=Q) in ($^{36}\text{S}, 3n\gamma$).
							I_γ : other: 100 13 in ($^{32}\text{S}, 3p\text{ny}$).
		1529.0 ^b 7	3.4 8	5380.0 (15 ⁺)			Mult.: other: (Q) from $\gamma\gamma(\text{DCO})$ in ($^{32}\text{S}, 3p\text{ny}$).
							E_γ : other: 1528 placed from a 9811 level in ($^{32}\text{S}, 3p\text{ny}$).
7337.3	(19 ⁻)	933.6 3	100	6403.7 (17 ⁻)	E2		E_γ : other: 933 (Mult=Q) placed from a 6127 level in ($^{32}\text{S}, 3p\text{ny}$), 933.1 γ (Mult=D) placed from a 6350 level and 934.6 4 placed from a 8652 level in ($^{36}\text{S}, 3n\gamma$).

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

$\gamma(^{98}\text{Rh})$ (continued)							
$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\dagger$	E_f	J_f^π	Mult. [#]	Comments
7345.7		942.0 ^b 5	100	6403.7	(17 ⁻)		
7552.4	(20 ⁻)	215.2 5	100	7337.3	(19 ⁻)		
7558.4	(19 ⁺)	649.2 7	100	6909.2	(17 ⁺)	Q	E_γ : other: 650.7 4 in ($^{36}\text{S}, 3\text{n}\gamma$). Mult.: from $\gamma\gamma(\text{DCO})$ in ($^{36}\text{S}, 3\text{n}\gamma$).
7611.7		1208.0 5	100	6403.7	(17 ⁻)		E_γ : other: 1207.9 4 placed from a 6625 level in ($^{36}\text{S}, 3\text{n}\gamma$).
8341.4		1432.9 4	100	6909.2	(17 ⁺)	(Q)	E_γ : weighted average of 1432.2 7 in ($^{28}\text{Si}, 2\text{p}3\text{n}\gamma$) and 1433.1 4 in ($^{36}\text{S}, 3\text{n}\gamma$). Mult.: from $\gamma\gamma(\text{DCO})$ in ($^{32}\text{S}, 3\text{pn}\gamma$).
8654.5		1096.1 7	100	7558.4	(19 ⁺)		E_γ : other: 1096.0 4 placed from a 9496 level in ($^{36}\text{S}, 3\text{n}\gamma$).
8685.1	(21 ⁻)	1132.7 5	41 6	7552.4	(20 ⁻)		
		1347.7 5	100 11	7337.3	(19 ⁻)	Q	E_γ : other: 1347.4 4 placed from a 7697 level in ($^{36}\text{S}, 3\text{n}\gamma$), 1347 (Mult=(Q)) placed from a 7474 level in ($^{32}\text{S}, 3\text{pn}\gamma$).
8899.9		1288.2 5	100	7611.7			E_γ : other: 1287.6 placed from a 7912 level in ($^{36}\text{S}, 3\text{n}\gamma$).
10171.3	(23 ⁻)	1486.2 5	100	8685.1	(21 ⁻)		E_γ : other: 1486 placed from a 8960 level in ($^{32}\text{S}, 3\text{pn}\gamma$), 1487.5 4 placed from a 9185 level in ($^{36}\text{S}, 3\text{n}\gamma$).

[†] From ^{98}Pd ε decay for low spin (≤ 3) levels, and from $^{75}\text{As}(^{28}\text{Si}, 2\text{p}3\text{n}\gamma)$ for high-spin ($J > 4$) levels, unless otherwise noted.

Averages are taken if comparable values from different datasets are available. Note that most of values in ($^{36}\text{S}, 3\text{n}\gamma$) (1998Gh07) are systematically higher by 0.5-1.5 keV than those in ($^{28}\text{Si}, 2\text{p}3\text{n}\gamma$) (2014Ku04), ($\alpha, \text{n}\text{p}\gamma$) and ($\text{d}, 3\text{n}\gamma$) (1983Be63), and are not used in averaging if discrepant.

[‡] Ordering of the 139-223 and 206-146 γ cascades is not established in $^{75}\text{As}(^{28}\text{Si}, 2\text{p}3\text{n}\gamma)$ (2014Ku04).

[#] From ce data in ^{98}Pd ε decay for low-spin ($J \leq 3$) levels, and from $\gamma\gamma(\text{DCO})$ and $\gamma\gamma(\text{pol})$ in $^{75}\text{As}(^{28}\text{Si}, 2\text{p}3\text{n}\gamma)$ for high-spin ($J > 5$) levels.

@ E1 is not excluded from ce data (see ^{98}Pd ε decay).

& 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.

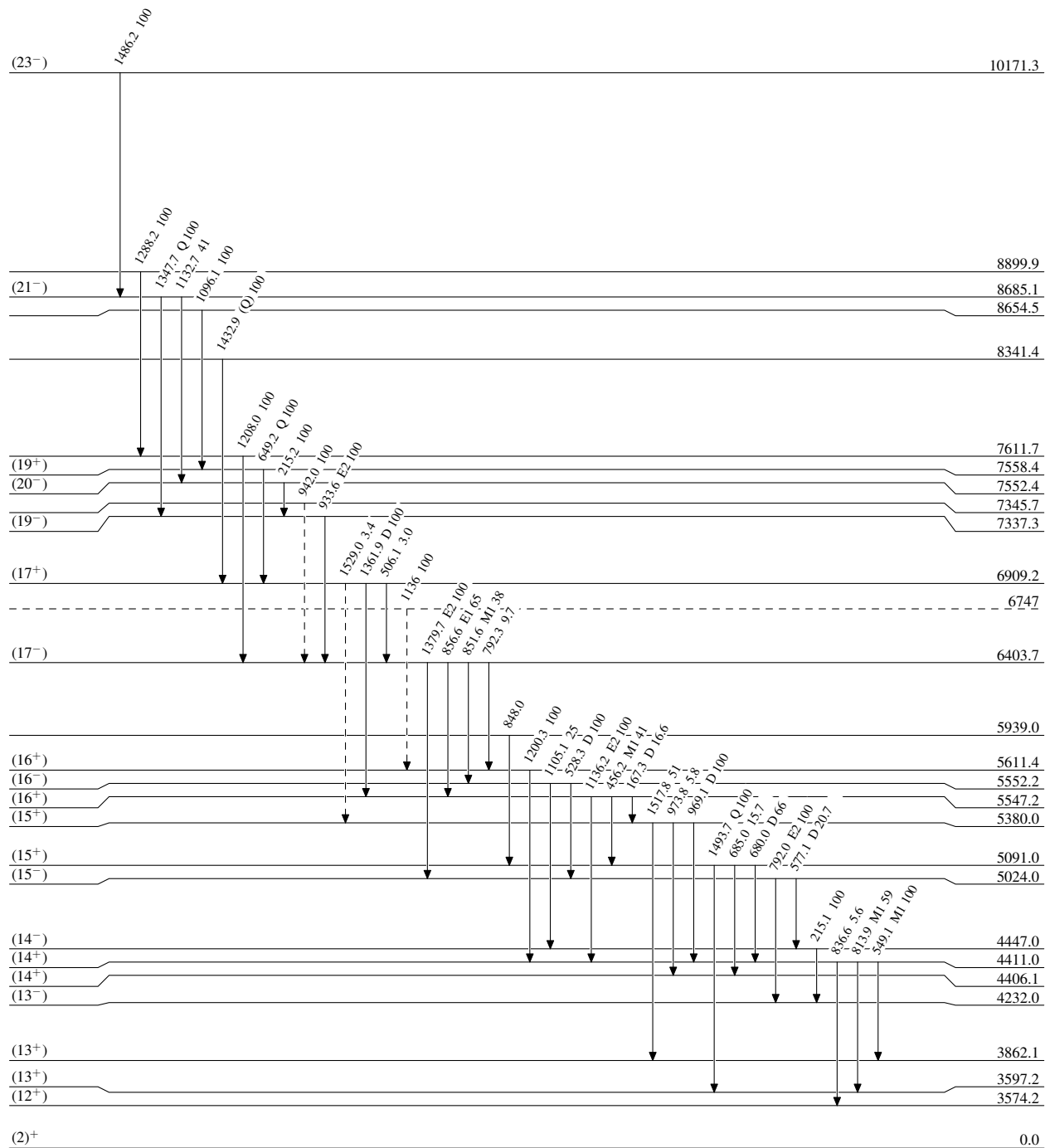
^b Placement of transition in the level scheme is uncertain.

Adopted Levels, Gammas

Legend

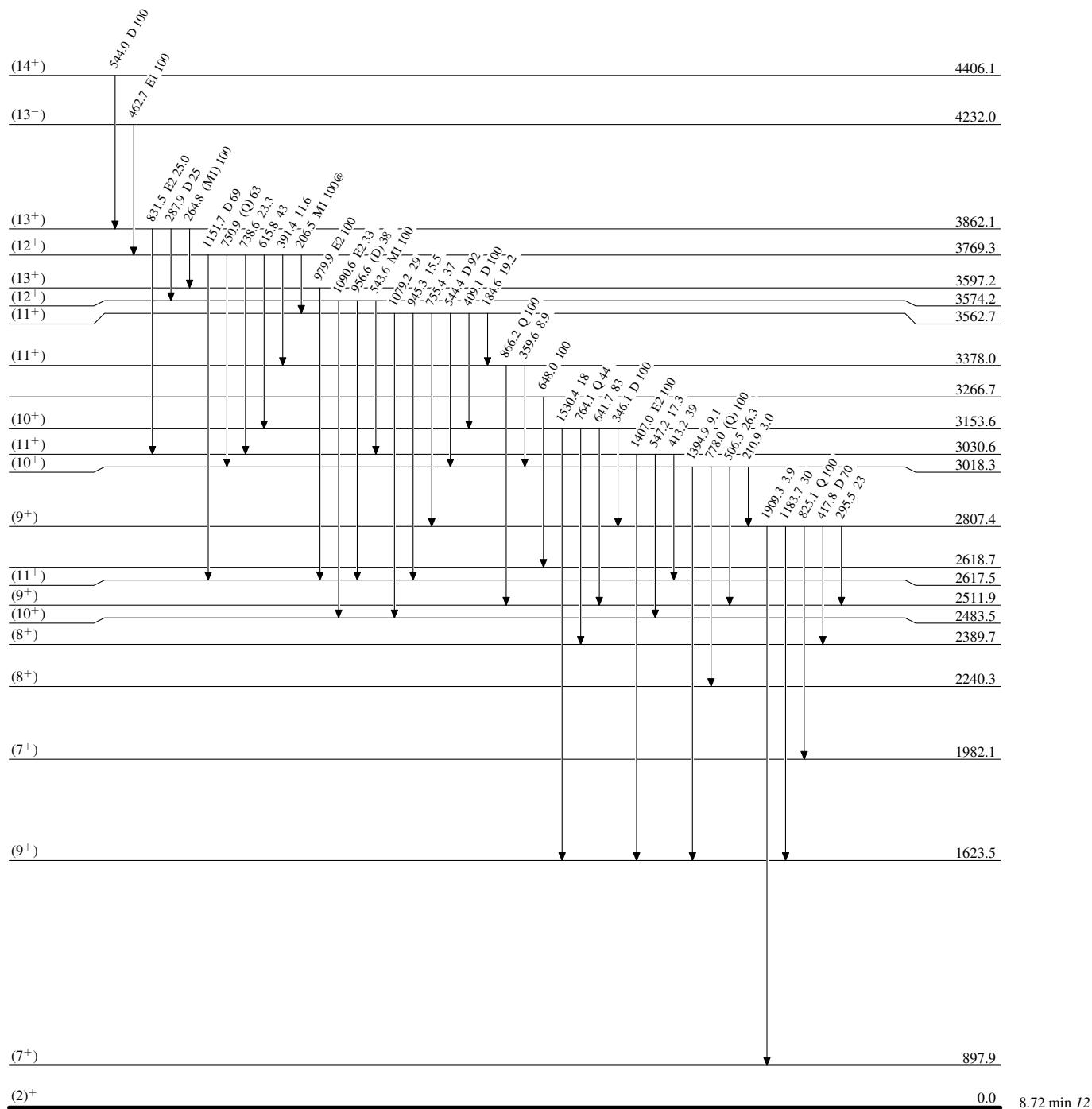
Level Scheme

Intensities: Relative photon branching from each level

-----► γ Decay (Uncertain)

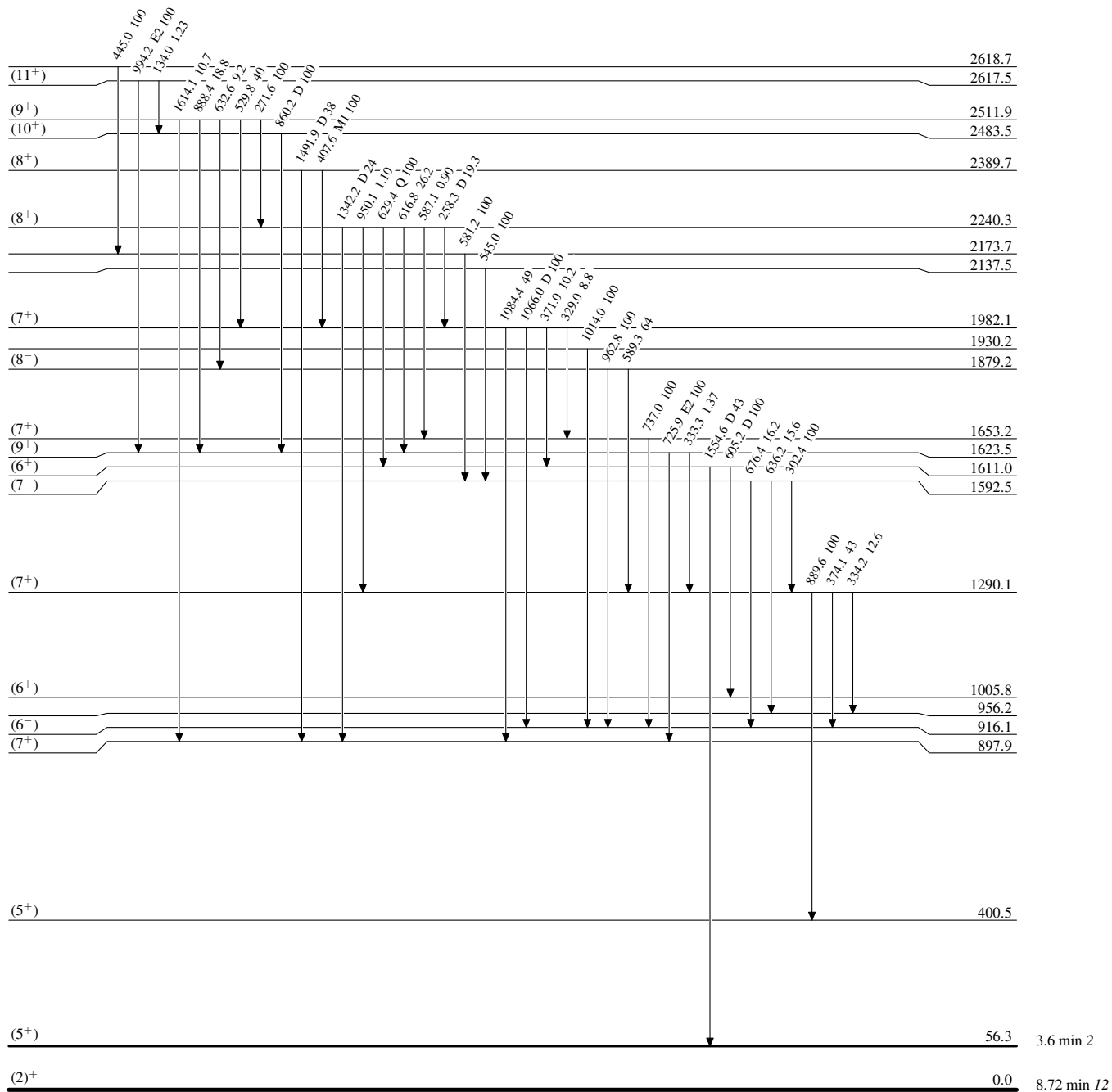
Adopted Levels, GammasLevel Scheme (continued)

Intensities: Relative photon branching from each level
 @ Multiply placed: intensity suitably divided



Adopted Levels, Gammas**Level Scheme (continued)**

Intensities: Relative photon branching from each level
@ Multiply placed: intensity suitably divided



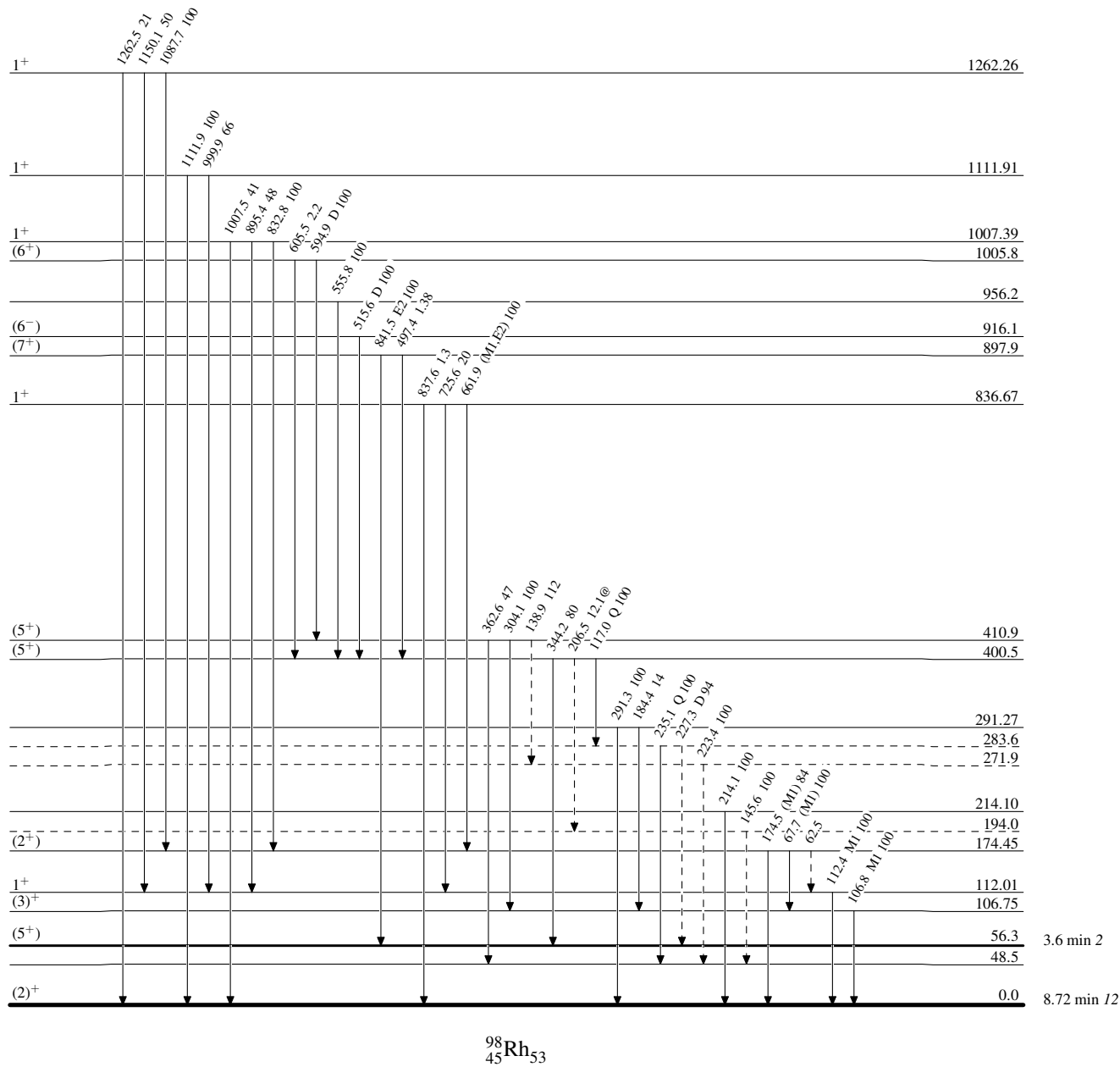
Adopted Levels, Gammas

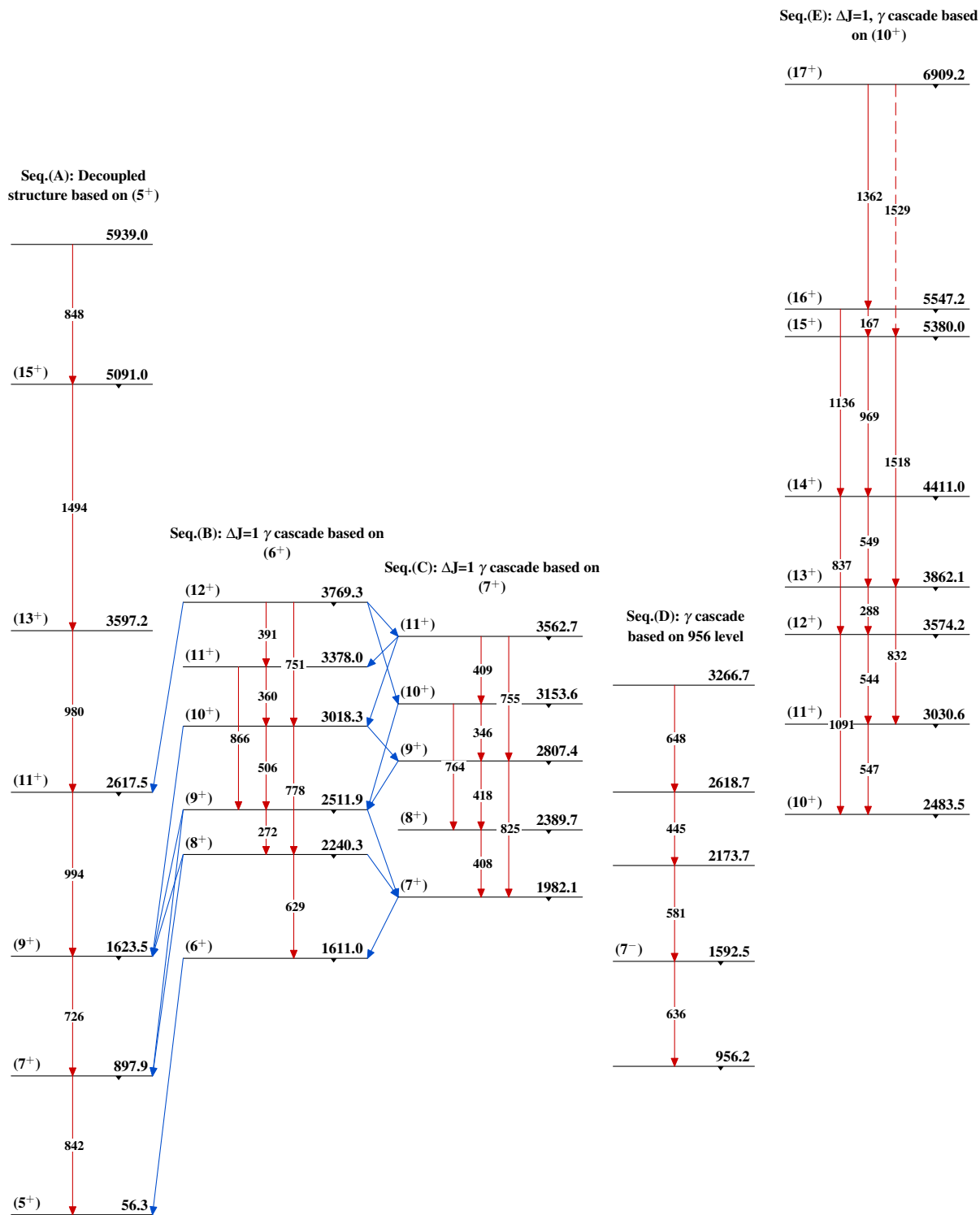
Legend

Level Scheme (continued)

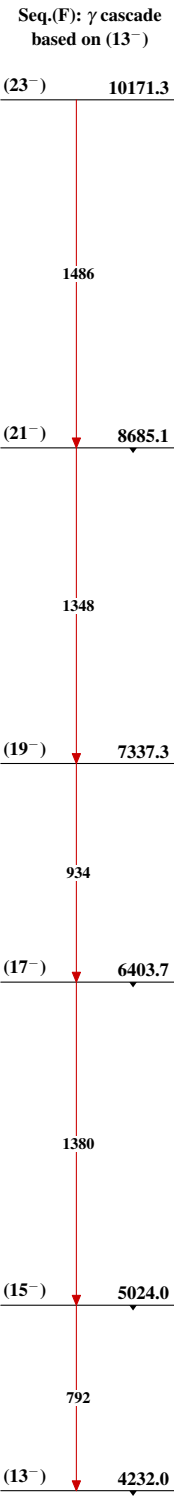
Intensities: Relative photon branching from each level

@ Multiply placed: intensity suitably divided

-----► γ Decay (Uncertain)


Adopted Levels, Gammas

Adopted Levels, Gammas (continued)



$^{98}_{45}\text{Rh}_{53}$