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Report on the evaluation for nuclear structure and decay data

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1. Introduction

Nuclear structure and decay data evaluations were performed in the frame of the Subtask 4.2.2 of the second Work Package of the SANDA project. This activity has important inter-connections with other international projects and collaborations: first of all, it is directly linked with the activity od the Nuclear Structure and Decay Data (NSDD) Network that develops and maintains the most comprehensive and complete nuclear structure database available worldwide: the Evaluated Nuclear Structure and Decay Data File (ENSDF) [1]. NSDD is coordinated by the International Atomic Energy Agency (IAEA) and its activity takes place in several datacentres distributed in North America (most of them), Europe and Asia. The three datacentres based in Europe are in ATOMKI – Hungary, IFIN-HH – Romania and Sofia University – Bulgaria. All these datacentres were involved in the activities performed within the Task 4.4.2 of the SANDA project.

A significant synergy exists between some the activities described below and an ongoing project coordinated by IAEA aiming towards the evaluation of the decay proprieties of several isotopes used in monitoring applications. This activity is of importance at the European and global level, and it is particularly significant for the activity of the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO) [2].

The nuclear structure and decay data evaluations that took place within the SANDA project had a double purpose: to serve the needs of the ENSDF database (i.e. to evaluate nuclei for which significant experimental information exists that is not included in the current version of ENSDF) and to serve the needs for applications that are of importance at the European level (medical applications or the monitoring applications mentioned above).

The nuclear structure and decay evaluation activities described in this report will produce results integrated in the ENSDF database that is an open access resource. This integration implies a review process that is currently ongoing.

The nuclear structure and decay evaluation is performed for each nucleus separately. However, for practical reasons very often it is preferred that a full mass chain (i.e. all nuclei with the same mass number A) is evaluated at once. Indeed, as the beta decay occurs along the isotopes having the same mass number, structure and decay information in one isotope plays an important role in the evaluation of the daughter nucleus. The evaluation activity described in this report addressed several mass chains but also some specific nuclei that were considered of particular importance for certain applications.

The evaluation of the nuclear structure of a nucleus is based predominantly on experimental information (this is a major difference compared to the nuclear reaction data where experiment and theory are merged to generate the resulting evaluation). Various experiments reported in literature are divided on the type of decay or reaction that was studied. The full available information is then compiled generating one dataset for each type of experiment reported in literature. Finally, these datasets are fully evaluated and a so-called “Adopted levels and gammas” dataset is generated for each nucleus containing the most complete and reliable information regarding the nuclear structure of that particular isotope. The “Adopted levels and gammas” datasets from ENSDF are the major source of information for all other databases employed in reaction calculations, astrophysics and applications.

This report will further detail the nuclear structure and decay evaluations performed in each data centre in the frame of the SANDA project. Some of these activities were jointly performed by the datacentres, some were performed under the supervision of IAEA and some were performed in collaboration with other datacentres from outside Europe. Details are given below. Finally, the Annex of the report displays the resulting evaluation of a particular case exemplifying the complexity of a nuclear structure and decay data evaluation.

2. Nuclear structure and decay data evaluation at the IFIN-HH Data centre

The first activity reported by the IFIN-HH data centre is a new evaluation of the A=86 isotopes: ^{86}Ga, ^{86}Ge, ^{86}As, ^{86}Se, ^{86}Br, ^{86}Kr, ^{86}Rb, ^{86}Sr, ^{86}Y, ^{86}Zr, ^{86}Nb, ^{86}Mo, ^{86}Tc, and ^{86}Ru. (14 nuclei). The evaluation was completed and submitted for review in collaboration with the McMaster Data Centre (Canada). Out of the whole mass chain, of particular importance is the update on the evaluation of ^{86}Sr. Indeed, the β decay of ^{86}Y to ^{86}Sr is of significance for an emerging medical application: the use of Y as a theranostic pair, i.e. a combination of a therapeutic isotope (in this case ^{90}Y) with an imaging isotope (^{86}Y). Moreover, an important amount of nuclear structure information on the decay of ^{86}Y to ^{86}Sr became recently available [3] and had to be incorporated into the evaluated file becoming available for applications.

The full A=101 mass chain was evaluated in collaboration with the ATOMKI Data Centre. We emphasize however that only part of this extended activity was part of the

SANDA project. As the full evaluation of A=101 isotopes required an effort spent over many years, the mass chain had to be reviewed several times by the evaluators of the two data centres and only the last review before submission to ENSDF took place and was partially supported by the SANDA project. The evaluation was submitted to ENSDF and a detailed review was received. The post-review will also require an extended effort. However, this new evaluation will be finalised by the two cooperating data centres and will be incorporated in ENSDF.

Two isotopes were evaluated by the IFIN-HH Data Centre as part of the IAEA project dedicated to the update of the decay information of the isotopes used for monitoring applications within CTBTO [2]: ^{133}I and ^{140}La (as this activity was supported by SANDA, no financial support was requested from IAEA). Although the mentioned project is currently ongoing (completion foreseen in 2024), the two isotopes under the responsibility of IFIN-HH were completed (i.e evaluated, reviewed and finalised). We mention that the particular type of structure and decay review performed within this project was slightly different and significantly more extended than the usual ENSDF evaluations: Although in this case only decay datasets were produced, the evaluation employed all type of experimental information available (i.e. including a significant quantity of information from reaction-based experiments). In order to exemplify this type of activity we further shortly describe the evaluation of the ^{133}I decay into ^{133}Xe:

General information: Q_β = 1786 keV. 14 levels are known within the Q_β range, the highest at 1590 keV. 39 γ transitions are known between these levels. The ground state of ^{133}Xe has the spin and parity J^π=3/2$^+$ and the half-life $T_{1/2}$=5.2 d and the first excited level is an isomer with J^π=11/2$^-$ and $T_{1/2}$=2.2 d. The ground state of the parent nucleus ^{133}I has J^π=7/2$^+$ and $T_{1/2}$=20.83 h.

The evaluation covered about 40 experimental papers from 1950 to 2020 and identified 4 articles where γ transitions were reported with sufficient details and exceptional precision. The γ energies and intensities were based on these four experimental investigations. The level energies were deduced using a χ^2 procedure on the available γ energies.

The half lives of the ground state and the isomeric state in ^{133}Xe were re-evaluated resulting in very small changes compared to the previous values. The multipolarities of the γ transitions were mostly deduced from angular distributions obtained in a β decay experiment [4]. Spins and parities of excited levels were analysed one by one and mostly deduced based on the γ multipolarities. Finally, the normalization of the decay scheme was performed assuming no direct feeding of the ground state and a feeding of 2.833(23)% to the isomeric state as reported in ref. [5].

The evaluation of the decay of ^{133}I into ^{133}Xe was completed employing several specific codes usually used: BRICC (calculation of conversion coefficients), LOGFT (calculation of beta feedings, beta average energies and log*ft* values), RULER (calculation of reduced transition probabilities) and the control codes checking the consistency and the correct format of the files.

3. Nuclear structure and decay data evaluation at the Sofia University Data centre

Within SANDA, the Sofia Uni Data centre has evaluated nuclear structure and decay data on ^{117}Sn and the A=107 mass chain as per the SANDA project plan. Furthermore, in addition to the SANDA plan, nuclear data evaluations were performed for ^{144}Pr. Also, data evaluations were performed as part of the review process for the Nuclear Data Sheets and for the CTBTO project nuclear data library.

The interest in ^{117}Sn 11/2^{-} metastable state has risen in the last two decades due to enhanced prospects for production and use in nuclear medicine, both as diagnostic and therapeutic tools. Therefore the properties of the isomeric state and its decay modes had to be analysed in the light of new experimental data. To meet the needs new evaluations were performed as part of the SANDA project. This work evaluates data from 136 literature sources on β- and ε– decay, transfer and pick up reactions, Coulomb excitation, neutron capture and nuclear resonance fluorescence experiments. Decay and reactions data are organized in individual data sets and used as a basis for the adopted gammas and levels. The new evaluation contains detailed justification of transition multipolarities and level spin and parity assignments. The half-life of the isomeric 11/2^{-} state is determined from the experimental data of the last two decades.

Being part of the NSDD network, Sofia uni Data Centre also contributes to the effort of maintaining the Evaluated Nuclear Structure and decay Data File (ENSDF) up to date by providing nuclear data evaluations on the A=106, 107, 108, 111, 112 nuclei. As part of the SANDA project we have evaluated the A=107 mass chain, comprising 16 nuclei – ^{107}Sr, ^{107}Y, ^{107}Zr, ^{107}Nb, ^{107}Mo, ^{107}Tc, ^{107}Ru, ^{107}Rh, ^{107}Pd, ^{107}Ag, ^{107}Cd, ^{107}In, ^{107}Sb, ^{107}Sn, ^{107}Sb, ^{107}Te. The evaluation builds on the previous evaluation published in 2008 by adding data from more than 40 new literature sources. The work was done in line with the NSDD policies, following the network guidelines.

Nuclear data evaluations were performed for the ^{144}Pr nucleus for the IAEA Nuclear Data Section led effort to develop a data library for the CTBTO needs. The data evaluation approach in this task is somewhat different to the NSDD policies, where only selected data sets can be used for the reaction and decay data sets. In this case the statistical analysis had to include all available data. As an example, the new evaluation is given in the Appendices.

4. Nuclear structure and decay data evaluation at the ATOMKI Data centre

As a part of the SANDA project, ATOMKI data centre has evaluated the A=103 mass chain, as well as the ^{47}Sc and the ^{187}Re nuclides. Several of these nuclides have significant importance in medical or other applications. For example ^{103}Ru, ^{103}Pd, ^{103}Ag are exploited for the diagnosis and treatment of cancer, ^{47}Sc in targeted radionuclide therapy and single-photon emission computer tomography. The ^{187}Re isotope is used in geology and cosmology. Thus, the precise knowledge of their structure data is important for the society.

Besides these, the evaluation work carried out on the A=101 mass chain in collaboration with the IFIN-HH Data Centre has also been partly supported by the project, as it is discussed in section 2. These nuclei have also significant importance in applications.

Within the A=103 mass chain, the new experimental results of 15 nuclides, the ^{103}Rb, ^{103}Sr, ^{103}Y, ^{103}Zr, ^{103}Nb, ^{103}Mo, ^{103}Tc, ^{103}Ru, ^{103}Rh, ^{103}Pd, ^{103}Ag, ^{103}Cd, In^{103}, ^{103}Sn, ^{103}Sb has been critically evaluated for the ENSDF data base and to publish in the Nuclear Data Sheets. The last previous evaluations for these nuclei have been done in 2009, since that time a large amount of new experimental data on their structure has been accumulated and published in about 60 papers. Similarly, the latest evaluations for the ^{47}Sc and the ^{187}Re nuclides have been published in 2007 and in 2009, respectively. Since then, about 20 new papers reporting new nuclear structure data on them have appeared. These new data have been compiled, critically evaluated and implemented in the ENSDF files using the state of the art evaluation and checking codes. The previously evaluated data of these nuclei have also been checked. Based on all of the evaluated reaction and decay data adopted values of data have been suggested and implemented in the ENSDF data files.

To illustrate the work, in ^{103}Rh for example 3 decay data sets and 11 reaction data sets have been evaluated. Only in one reaction of them, in the ^{96}Zr(^{11}B,4nγ) one, 4 new bands, more than 40 new excited levels with more that 80 new transitions have been evaluated and implemented. Besides these, the previously known data have been checked, and more precise energy and intensity data have been implemented for more than 120 gamma transitions based on communication with the authors of the experimental papers reporting those data. The PDF file of the ^{103}Rh evaluation can be found in the annex as an example.

References:

[1] https://www.iaea.org/resources/databases/evaluated-nuclear-structure-data-file

[2] https://www.ctbto.org/

[3] A.C. Gula *et al.*, Phys. Rev. C102, 034316 (2020)

[4] B.K.S.Koene, H.Ligthart, H.Postma, Nucl.Phys. A235, 267 (1974)

[5] R.A.Meyer, F.F.Momyer, J.H.Landrum, E.A.Henry, R.P.Yaffe, W.B.Walters, Phys. Rev. C14, 1152 (1976)

Annex – Example of a new evaluation performed within the SANDA project:

Adopted Levels, Gammas

Q(β^-)=−574.7 *24*; S(n)=9320 *7*; S(p)=6214.2 *23*; Q(α)=−3128.8 *25* 2021Wa16

^{103}Rh Levels

Adopted B(E2) values are taken from Coul. ex.
The band interpretation is from ^{96}Zr($^{11}\beta$,4nγ) and from ^{100}Mo(^{6}Li,3nγ), (^{7}Li,4nγ).

Cross Reference (XREF) Flags

A	^{103}Ru β^- decay (39.247 d)	F	^{100}Mo(^{6}Li,3nγ), (^{7}Li,4nγ)	K	^{103}Rh(p,p′γ)
B	^{103}Rh IT decay (56.114 min)	G	^{102}Ru(p,p),(p,n) IAR	L	^{103}Rh(d,d′)
C	^{103}Pd ε decay (17.049 d)	H	^{102}Ru(^{3}He,d)	M	Coulomb excitation
D	^{94}Zr(^{12}C,p2nγ)	I	^{103}Rh(n,n′γ)	N	^{103}Rh(γ,γ′)
E	^{96}Zr(^{11}B,4nγ),^{11}B(^{96}Zr,4nγ)	J	^{103}Rh(p,p′)		

E(level)[†]	J$^\pi$[‡]	T$_{1/2}$	XREF	Comments
0.0[#]	1/2$^-$	stable	ABCDEF HIJKLMN	μ=−0.08829 *3* (1955So10,2019StZV) <r^2>$^{1/2}$=4.4945 fm *23* (2013An02). J=1/2 (optical spectroscopy) (1976Fu06). π: − from μ (exp vs theory).
39.751[a] *6*	7/2$^+$	56.114 min *9*	ABC EF HIJK	%IT=100 μ=4.50 *5* (1995Se20,2019StZV) T$_{1/2}$: weighted av: 56.12 min *1* (1973Gu06), 56.114 min *20* (1981Va11); others: 1944Fl01, 1945Wi03, 1947Fl03, 1950Me26, 1957Jo19, 1967VuZZ, 1969KoZW, 1972Pa10, 1974Sa15, 1978La21. J$^\pi$: E3+M4 transition to g.s.
93.039[&] *8*	9/2$^+$	1.11 ns *3*	A C EF HIJ	μ=+4.9 *8* (1973Ba52,2020StZV) T$_{1/2}$: From ^{103}Rh β^- decay.Weighted av: 1.06 ns *5* (1973Ba52), 1.13 ns *3* (1972Ja01) and 1.13 ns *7* (1972Ja01). J$^\pi$: from M1 decay to 7/2$^+$; and μ (exp vs calc) (1973Ba52).
294.967[@] *8*	3/2$^-$	6.61 ps *18*	A C EF HIJK M	Q=−0.3 *2* (1976Ge19,2021StZZ); μ=+0.81 *8* (1989La14,2020StZV) T$_{1/2}$: From B(E2) in Coul. ex. Q: other: −0.32 *20* (1989Ra17). μ: other: +0.69 *12* (1988Be45). J$^\pi$: M1+E2 γ decay to 1/2$^-$ in band.
357.401[#] *16*	5/2$^-$	73 ps *2*	A CDEF HIJKLM	Q=−0.4 *2* (1976Ge19,2021StZZ); μ=+1.08 *8* (1989La14,2020StZV) T$_{1/2}$: From B(E2) in Coul. ex. Q: Other −0.41 *18* (1989Ra17). μ: others: +1.08 *8*, +0.93 *20* (1989Ra17,1988Be45). J$^\pi$: E2 γ to 1/2$^-$, M1 γ to 3/2$^-$ in band.
536.842 *8*	5/2$^+$	39 ps *12*	A C IJ	T$_{1/2}$: from centroid-shift analysis of (225β)(497γ)(t) calibrated with ^{60}Co,^{198}Au sources (1968Ra06); others: 1953En06, 1969Be81, 1970Be10. J$^\pi$: E1 γ to 3/2$^-$, E2 γ to 9/2$^+$.
607.412 *14*	(5/2$^+$,7/2,9/2)		A I	J$^\pi$: γ′s to 7/2$^+$ and 9/2$^+$.
650.086 *13*	5/2$^+$	≤0.1 ns	A HIJK	XREF: J(650)K(650). T$_{1/2}$: via $\beta\gamma$(t) (1970Be10). J$^\pi$: log *ft*=5.94 from 3/2$^+$, M1+E2 γ to 7/2$^+$, E2 γ to 9/2$^+$.
651.731 *24*	3/2$^+$		A IJK	XREF: J(650)K(650). J$^\pi$: M1(+E2) γ to 5/2$^+$, γ to 7/2$^+$ and γ to1/2$^-$.
657.28[a] *18*	11/2$^+$		EF I	J$^\pi$: M1+E2 γ to 9/2$^+$, Q γ to 7/2$^+$ in band; 564γ excit in

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Adopted Levels, Gammas (continued)

^{103}Rh Levels (continued)

E(level)[†]	J^{π}[‡]	$T_{1/2}$	XREF	Comments
				^{100}Mo(^{6}Li,3nγ).
781.15 *21*	(9/2$^+$)		I	J^{π}: γ to 7/2$^+$ and 9/2$^+$ levels and (n,n′γ) cross sections (exp vs theory).
803.10 *18*	1/2$^-$	0.120 ps *19*	HIJ MN	XREF: J(798). $T_{1/2}$: from ^{103}Rh(γ,γ′) if J=1/2 and adopted branching (1981Ca10). J^{π}: L=1 in (^{3}He,d), J=1/2 from γ(θ) in 1988Ta23.
821.09[&] *16*	13/2$^+$	3.0 ps *13*	EF	J^{π}: E2 γ to 9/2$^+$, D γ to 11/2$^+$ in band. $T_{1/2}$: From recoil-distance method in ^{11}B(^{96}Zr,4nγ) (2008Su18).
837 *3*	1/2$^-$,3/2$^-$		H	L=1 in (^{3}He,d).
847.72[@] *11*	7/2$^-$	1.9 ps *2*	EF IJ M	μ=+2.0 *6* (1989La14,2020StZV) XREF: J(843). J^{π}: Q γ to 3/2$^-$ and D γ to 5/2$^-$ in band. $T_{1/2}$: from 1972SiZO (DSA method). Other: 1.7 ps (1972SiZO) via (B(E2); 3/2$^-$ to 7/2$^-$)=0.29, I(553γ) branching=22%.
880.85 *19*	5/2$^-$	2.2 ps *3*	HIJKLM	B(E2)↑=0.0131 *10* XREF: J(877). B(E2)↑: Others: 0.0117 *15* (1972SiZO), 0.0133 (1969Bl04). $T_{1/2}$: via B(E2)=0.0131 (1972Sa03) and Iγ(880)-branching=9%. J^{π}: E2 γ to 1/2$^-$, M1+E2 γ to 3/2$^-$ and to 5/2$^-$.
902.99[c] *17*	11/2$^+$		E	J^{π}: Q γ to 7/2$^+$ and D γ to 9/2$^+$ in high-spin reaction.
920.11[#] *11*	9/2$^-$	5.6 ps *3*	DEF IJ M	μ=+2.8 *5* (1989La14,2020StZV) XREF: J(915). B(E2)(From (9/2$^-$ to 5/2$^-$)=0.178 *9*. $T_{1/2}$: From B(E2)(9/2$^-$ to 5/2$^-$) in Coul. ex. J^{π}: E2 γ to 5/2$^-$ and D γ to 7/2$^-$ in band.
1078.32 *20*	5/2$^+$,7/2		I	J^{π}: γ′s to 9/2$^+$, 5/2$^+$ and to 5/2$^-$.
1106.87 *13*	5/2$^-$		IJ M	B(E2)↑=0.0031 *4* XREF: J(1102). J^{π}: γ(θ) and excit in Coul. ex.
1135.8 *4*	(1/2,3/2,5/2$^-$)		I	J^{π}: γ′s to 1/2$^-$ and 3/2$^-$.
1160 *3*			H	
1252.1 *3*	(5/2,7/2)		IJ L	XREF: J(1247)L(1260). J^{π}: γ to 5/2$^+$ and to 7/2$^+$.
1256.5 *3*	1/2$^+$		HIJ L	XREF: J(1247)L(1260). J^{π}: L=0 in (^{3}He,d).
1277.14 *11*	3/2$^-$	0.53 ps *36*	IJK MN	XREF: J(1270)K(1275). $T_{1/2}$: From B(E2)=0.0132 *12* in Coul. ex. Other: 0.60 ps 10 from ^{103}Rh(γ,γ′) (1981Ca10). J^{π}: M1+E2 γ to 1/2$^-$.
1294.00 *23*	1/2$^-$,3/2,5/2$^-$		I	J^{π}: γ′s to 1/2$^-$ and 5/2$^-$.
1327.0 *5*			I	
1344.4 *4*	7/2$^+$,9/2$^+$		I	J^{π}: γ′s to 5/2$^+$ and 11/2$^+$.
1348.94[b] *18*	13/2$^+$		E	J^{π}: γ to 9/2$^+$, D γ to 11/2$^+$ in band.
1403.5 *6*			IJ	XREF: J(1400).
1411.10 *15*	3/2$^-$,5/2$^-$		IJ	XREF: J(1400). J^{π}: γ′s to 1/2$^-$ and 7/2$^-$.
1412 *3*	3/2$^+$,5/2$^+$		H	J^{π}: L=2 in (^{3}He,d).
1420.8 *10*			K	
1428.7 *6*			I	
1438.4 *4*	3/2$^+$,5/2$^+$		HIJ	J^{π}: from L=2 in (^{3}He,d).
1443.63 *23*	1/2$^-$,3/2,5/2$^-$		IJ	XREF: J(1438). J^{π}: γ to 1/2$^-$ and to 5/2$^-$.

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Adopted Levels, Gammas (continued)

^{103}Rh Levels (continued)

E(level)[†]	Jπ[‡]	$T_{1/2}$	XREF	Comments
1458 3	1/2+		H	Jπ: L=0 in (³He,d).
1466.4 4	(3/2,5/2)		I	Jπ: γ to 3/2− and to 5/2−.
1470			L	
1480.1 7	7/2+,9/2+		HI	Jπ: L=4 in (³He,d).
1482.35 14	3/2,5/2−		IJ	XREF: J(1483). Jπ: γ to 1/2−, 5/2− and 5/2+.
1491.6 4	1/2−,3/2−		HIJ	XREF: J(1483). Jπ: L=1 in (³He,d).
1515.6 7			I	
1524.15[a] 19	15/2+		EF	Jπ: E2 γ to 11/2+ and M1+E2 γ to 13/2+ in band.
1530.8 4	3/2+,5/2+		HI	Jπ: L=2 in (³He,d).
1579.9 4	3/2+,5/2+		HI	Jπ: L=2 in (³He,d).
1586.56[@] 18	11/2−		E	Jπ: γ to 7/2− and to 9/2− in band.
1599.7 6	1/2+		HI	XREF: H(1604). Jπ: L=0 in (³He,d).
1605.0 5			IJ	XREF: J(1598).
1611.2 8			I	
1614 1			N	
1626 1			N	
1637.20[#] 18	13/2−		DEF	Jπ: E2 to 9/2− in band.
1650? 10			H J L	
1665 10	5/2−,7/2−		H	Jπ: L=3 in (³He,d).
1685.2 4			HI	
1706.1 5	1/2−,3/2−		HI	Jπ: L=1 in (³He,d).
1707.3 4			IJ	
1716.54[&] 19	17/2+	0.54 ps 12	EF	Jπ: fE2 γ to 13/2+ and γ to 15/2+ in band. $T_{1/2}$: From recoil-distance method in ¹¹B(⁹⁶Zr,4nγ) (2008Su18).
1731.5 5			I	
1774 10			J L	
1778.0 8	3/2+,5/2+		HI L N	Jπ: L=2 in (³He,d).
1812 1	1/2−,3/2−		H N	Jπ: from L=1 in (³He,d).
1842.2 8			IJ	
1851.14[c] 20	15/2+		E	Jπ: Band member.
1861 1	3/2+,5/2+		H N	Jπ: from L=2 in (³He,d).
1901 10			J	
1923 1	3/2+,5/2+		H N	Jπ: from L=2 in (³He,d).
1943 1			N	
1968.2 8			I	
1969.8 10			I N	
1986 10	3/2+,5/2+		H J L	XREF: L(1990). Jπ: L=2 in (³He,d).
1997 1			N	
1999.3 6	1/2−,3/2,5/2−		I	Jπ: γ to1/2− and to 5/2−.
2001 1			N	
2008.7 5	1/2,3/2,5/2−		I	Jπ: γ to 1/2− and to 3/2−.
2034.23[h] 18	13/2−		E	Jπ: Band member.
2035.0 5	1/2+		H N	Jπ: from L=0 in (³He,d).
2040.9 10			K	
2049 1			N	
2058.8 9			I	
2059 1			N	
2071 1			N	
2075 1			N	
2089 1	3/2+,5/2+		H L N	Jπ: from L=2 in (³He,d).

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Adopted Levels, Gammas (continued)

^{103}Rh Levels (continued)

E(level)[†]	J^{π}[‡]	$T_{1/2}$	XREF	Comments
2103.5 *13*			IJ	
2128 *1*	$3/2^+,5/2^+$		H N	J^{π}: from L=2 in (^{3}He,d).
2136.4 *11*			I N	
2155 *1*	$3/2^+,5/2^+$		H N	J^{π}: from L=2 in (^{3}He,d).
2163 *1*			N	
2177 *10*	$3/2^+,5/2^+$		H	J^{π}: from L=2 in (^{3}He,d).
2196 *1*	$3/2^+,5/2^+$		H N	J^{π}: from L=2 in (^{3}He,d).
2220.11[i] *17*	$15/2^-$		EF	J^{π}: D γ to $13/2^-$; band member.
2228.5[l] *3*	$13/2^-$		E	J^{π}: Band member.
2234.7 *6*	$1/2^+$		HI	J^{π}: from L=0 in (^{3}He,d).
2290			L	
2306 *1*	$3/2^+,5/2^+$		H N	J^{π}: from L=2 in (^{3}He,d).
2319 *1*	$3/2^+,5/2^+$		H N	J^{π}: from L=2 in (^{3}He,d).
2337 *10*	$1/2^+$		H	J^{π}: from L=0 in (^{3}He,d).
2344.48[h] *18*	$17/2^-$		DEF	J^{π}: E2 γ to $13/2^-$, D γ to $15/2^+$.
2352 *1*			N	
2362 *1*	$3/2^+,5/2^+$		H N	J^{π}: from L=2 in (^{3}He,d).
2366.57[m] *18*	$15/2^-$		E	
2395.40[@] *23*	$15/2^-$		E	
2399 *10*	$1/2^+$		H	J^{π}: from L=0 in (^{3}He,d).
2417.52[#] *21*	$17/2^-$		EF	J^{π}: E2 transition to $13/2^-$ state in band.
2418 *10*	$3/2^+,5/2^+$		H	J^{π}: from L=2 in (^{3}He,d).
2418.39[b] *20*	$17/2^+$		E	
2434 *1*			L N	XREF: L(2430).
2444.65[o] *23*	$15/2^-$		E	
2446 *10*	$3/2^+,5/2^+$		H	J^{π}: from L=2 in (^{3}He,d).
2468 *1*	$1/2^+$		H N	J^{π}: from L=0 in (^{3}He,d).
2478 *1*			N	
2495 *10*	$1/2^+$		H	J^{π}: from L=0 in (^{3}He,d).
2516 *1*	$3/2^+,5/2^+$		H N	J^{π}: from L=2 in (^{3}He,d).
2520.93[l] *18*	$17/2^-$		EF	J^{π}: D γ to ($15/2^-$) and Q γ to $13/2^-$; band member.
2524.75[a] *25*	$19/2^+$		EF	J^{π}: (M1+E2) transition to $17/2^+$; band member.
2527 *10*	$3/2^+,5/2^+$		H	J^{π}: from L=2 in (^{3}He,d).
2539.72[i] *19*	$19/2^-$		DEF	J^{π}: M1 γ to $17/2^-$ in band.
2544 *1*	$3/2^+,5/2^+$		H N	J^{π}: from L=2 in (^{3}He,d).
2585 *1*			N	
2594 *1*			N	
2604 *1*	$3/2^+,5/2^+$		H N	J^{π}: from L=2 in (^{3}He,d).
2619 *10*	$3/2^+,5/2^+$		H L	J^{π}: from L=2 in (^{3}He,d).
2644.14[n] *23*	$17/2^-$		E	
2645 *1*	$3/2^+,5/2^+$		H N	J^{π}: from L=2 in (^{3}He,d).
2666 *1*			N	
2680 *1*			N	
2695 *1*	$3/2^+,5/2^+$		H N	J^{π}: from L=2 in (^{3}He,d).
2698 *1*			N	
2700.46[m] *18*	$19/2^-$		EF	J^{π}: Band member.
2706 *1*	$1/2^+$		H N	J^{π}: from L=0 in (^{3}He,d).
2720 *10*	$3/2^+,5/2^+$		H	J^{π}: from L=2 in (^{3}He,d).
2738.53[&] *24*	$21/2^+$	0.50 ps *9*	EF	J^{π}: E2 γ to $17/2^+$ and D γ to $19/2^+$ in band. $T_{1/2}$: From recoil-distance method in ^{11}B(^{96}Zr,4nγ) (2008Su18).
2745.66[k] *22*	$19/2^-$		E	

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{103}Rh Levels (continued)

E(level)[†]	J^{π}[‡]	$T_{1/2}$	XREF	Comments
2746.4 *3*			N	
2752.62[h] *21*	21/2−		DEF	J^{π}: M1 γ to 19/2− in band.
2762 *1*	3/2+,5/2+		H N	J^{π}: from L=2 in (^{3}He,d).
2801 *1*	3/2+,5/2+		H N	J^{π}: from L=2 in (^{3}He,d).
2824 *10*	3/2+,5/2+		H	J^{π}: from L=2 in (^{3}He,d).
2854 *1*	3/2+,5/2+		H N	J^{π}: from L=2 in (^{3}He,d).
2866 *1*			N	
2872.52[o] *21*	19/2−		E	J^{π}: Band member.
2882.4[c] *3*	19/2+		E	J^{π}: Band member.
2886 *10*	3/2+,5/2+		H	J^{π}: from L=2 in (^{3}He,d).
2911 *1*	3/2+,5/2+		H N	J^{π}: from L=2 in (^{3}He,d).
2916.71[l] *20*	21/2−		EF	J^{π}: Band member.
2917.2 *3*			N	
2923 *1*	3/2+,5/2+		H N	J^{π}: from L=2 in (^{3}He,d).
2935.29[j] *22*	21/2−		EF	J^{π}: Band member.
2944 *1*			N	
2956 *1*			N	
2960 *1*			N	
2966 *1*			N	
2991 *1*			N	
3013.30[i] *22*	23/2−		DEF	J^{π}: M1 γ to 21/2− in band.
3028 *1*			N	
3056 *1*			N	
3082 *1*			N	
3091.63[n] *21*	21/2−		E	J^{π}: Q γ to 17/2− and D γ to 19/2− in band.
3108 *1*			N	
3114 *1*			N	
3138 *1*			N	
3153 *1*			N	
3165 *1*			N	
3201 *1*			N	
3213.3[#] *5*	(21/2−)		F	
3217.5[d] *3*	21/2+		F	J^{π}: Band member. Interpreted in ^{100}Mo(^{6}Li,3nγ), (^{7}Li,4nγ) as member of a band based on the 21/2+ state with ΔI=1.
3223 *1*			N	
3228.41[m] *22*	23/2−		EF	J^{π}: Band member.
3242 *1*			N	
3274.71[k] *23*	23/2−		EF	J^{π}: Band member.
3278.1[a] *3*	21/2+		E	J^{π}: Band member.
3288 *1*			N	
3296 *1*			N	
3315 *1*			N	
3329.06[h] *23*	25/2−		DEF	J^{π}: Band member.
3331 *1*			N	
3339 *1*			N	
3345 *1*			N	
3358 *1*			N	
3397.5[e] *3*	23/2+	0.69 ps *19*	EF	J^{π}: Band member. $T_{1/2}$: From recoil-distance method in ^{11}B(^{96}Zr,4nγ) (2008Su18).
3401 *1*			N	
3411 *1*			N	
3417.39[o] *21*	23/2−		E	J^{π}: Band member.

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Adopted Levels, Gammas (continued)

^{103}Rh Levels (continued)

E(level)[†]	Jπ[‡]	$T_{1/2}$	XREF	Comments
3435 *1*			N	
3440 *1*			N	
3449 *1*			N	
3462 *1*			N	
3487.6[b] *4*	(21/2+)		E	Jπ: Probable band member.
3521 *1*			N	
3531 *1*			N	
3535 *1*			N	
3557 *1*			N	
3573 *1*			N	
3589 *1*			N	
3600 *1*			N	
3613 *1*			N	
3616.60[j] *22*	25/2−		EF	Jπ: Band member.
3617 *1*			N	
3631.7[d] *3*	25/2+	0.66 ps *12*	EF	Jπ: Band member. $T_{1/2}$: From recoil-distance method in $^{11}B(^{96}Zr,4n\gamma)$ (2008Su18).
3652 *1*			N	
3660 *1*			N	
3669.68[l] *23*	25/2−		EF	Jπ: Band member.
3691 *1*			N	
3708 *1*			N	
3728 *1*			N	
3770.5[i] *3*	27/2−		EF	Jπ: Band member.
3773 *1*			N	
3779.87[n] *24*	25/2−		E	Jπ: Band member.
3790 *1*			N	
3798 *1*			N	
3820 *1*			N	
3831 *1*			N	
3868.3[&] *4*	(25/2+)		EF	Jπ: Probable band member.
3890 *1*			N	
3904 *1*			N	
3916 *1*			N	
3936 *1*			N	
3940.1[e] *3*	27/2+	0.69 ps *7*	EF	Jπ: Band member. $T_{1/2}$: From recoil-distance method in $^{11}B(^{96}Zr,4n\gamma)$ (2008Su18).
3944 *1*			N	
3977 *1*			N	
4038.2[#] *7*	(25/2−)		F	
4081.29[k] *24*	27/2−		E	Jπ: Band member.
4107.31[m] *25*	27/2−		E	Jπ: Band member.
4197.0[h] *3*	29/2−		E	Jπ: Band member.
4212.54[o] *24*	27/2−		E	Jπ: Band member.
4322.1[d] *3*	29/2+	0.50 ps *16*	EF	Jπ: Band member. $T_{1/2}$: From recoil-distance method in $^{11}B(^{96}Zr,4n\gamma)$ (2008Su18).
4338.4 *6*	(29/2−)		F	Jπ: D γ to 27/2−.
4486.0[g] *3*	27/2+		E	Jπ: Band member.
4560.5[j] *3*	29/2−		E	Jπ: Band member.
4607.0[l] *3*	29/2−		E	Jπ: Band member.
4661.6[n] *3*	29/2−		E	Jπ: Band member.
4706.3[e] *4*	31/2+		EF	Jπ: Band member.
4765.3[i] *4*	31/2−		E	Jπ: Band member.

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Adopted Levels, Gammas (continued)

^{103}Rh Levels (continued)

E(level)[†]	J^{π}[‡]	XREF	Comments
4830.3[f] 3	$29/2^+$	E	J^{π}: Band member.
5050.1[&] 6	$(29/2^+)$	F	J^{π}: Probable band member.
5061.6[o] 4	$31/2^-$	E	J^{π}: Band member.
5061.9[m] 3	$31/2^-$	E	J^{π}: Band member.
5092.4[k] 3	$31/2^-$	E	J^{π}: Band member.
5197.6[d] 4	$33/2^+$	EF	J^{π}: Band member.
5207.1[g] 4	$31/2^+$	E	J^{π}: Band member.
5299.3[h] 4	$33/2^-$	E	J^{π}: Band member.
5578.0[l] 3	$33/2^-$	E	J^{π}: Band member.
5657.2[f] 4	$33/2^+$	E	J^{π}: Band member.
5664.2[e] 5	$35/2^+$	EF	J^{π}: Band member.
5686.8[j] 4	$33/2^-$	E	J^{π}: Band member.
5925.8[i] 5	$35/2^-$	E	J^{π}: Band member.
6103.0[g] 5	$35/2^+$	E	J^{π}: Band member.
6144.2[m] 4	$35/2^-$	E	J^{π}: Band member.
6205.6[d] 5	$37/2^+$	EF	J^{π}: Band member.
6569.3[f] 5	$37/2^+$	E	J^{π}: Band member.
6588.7[h] 5	$37/2^-$	E	J^{π}: Band member.
6748.9[e] 6	$39/2^+$	E	J^{π}: Band member.
7114.5[g] 6	$39/2^+$	E	J^{π}: Band member.
7188.7[i] 6	$39/2^-$	E	J^{π}: Band member.
7360.2[d] 6	$41/2^+$	E	J^{π}: Band member.
7995.3[e] 7	$43/2^+$	E	J^{π}: Band member.

† From a least-squares fit to adopted Eγ data for levels with γ-ray decay.

‡ Unless noted otherwise, based on band structure in the different (HI,xnγ) reactions. In these bands at least one band member has solid spin-parity assignment based on strng arguments.

\# Band(A): Band 1: $\pi p_{1/2}$, α=+1/2.

@ Band(a): Band 1: $\pi p_{1/2}$, α=−1/2.

& Band(B): Band 2: $\pi g_{9/2}$, α=+1/2.

a Band(b): Band 2: $\pi g_{9/2}$, α=−1/2.

b Band(C): Band 3: $\pi g_{9/2}+\gamma$ vib, α=+1/2.

c Band(c): Band 3: $\pi g_{9/2}+\gamma$ vib, α=−1/2.

d Band(D): Band 4: $\pi g_{9/2}\nu h^2_{11/2}$, α=+1/2.

e Band(d): Band 4: $\pi g_{9/2}\nu h^2_{11/2}$, α=−1/2.

f Band(E): Band 5: $\pi g_{9/2}\nu h^2_{11/2}$ chiral partner, α=+1/2.

g Band(e): Band 5: $\pi g_{9/2}\nu h^2_{11/2}$ chiral partner, α=−1/2.

h Band(F): Band 6: $\pi g_{9/2}\nu(h_{11/2}g_{7/2})$ yrast, α=+1/2.

i Band(f): Band 6: $\pi g_{9/2}\nu(h_{11/2}g_{7/2})$ yrast, α=−1/2.

j Band(G): Band 7: $\pi g_{9/2}\nu(h_{11/2}g_{7/2})$ yrast chiral partner, α=+1/2.

k Band(g): Band 7: $\pi g_{9/2}\nu(h_{11/2}g_{7/2})$ yrast chiral partner, α=−1/2.

l Band(H): Band 8: $\pi g_{9/2}\nu(h_{11/2}g_{7/2})$ excited, α=+1/2.

m Band(h): Band 8: $\pi g_{9/2}\nu(h_{11/2}g_{7/2})$ excited, α=−1/2.

n Band(I): Band 9: $\pi g_{9/2}\nu(h_{11/2}g_{7/2})$ excited chiral partner, α=+1/2.

o Band(i): Band 9: $\pi g_{9/2}\nu(h_{11/2}g_{7/2})$ excited chiral partner, α=−1/2.

Adopted Levels, Gammas (continued)

$\gamma(^{103}Rh)$

α(K)exp, α(L)exp from ^{103}Ru β^- or ^{103}Pd EC decay.

E_i(level)	J^π_i	E_γ†	I_γ†	E_f	J^π_f	Mult.#	δ#	α@	Comments
39.751	7/2$^+$	39.753 *6*	100	0.0	1/2$^-$	E3+M4	0.023 *5*	1433 *25*	α(K)exp=141.1 *23* B(E3)(W.u.)=0.00254 *5*; B(M4)(W.u.)=9.E+3 *4* α(K)exp: 141.1 *23* (2018Ni14). α(exp): 1428 *13* (2018Ni14). Mult.,δ: from electron conversion coefficients (2018Ni14).
93.039	9/2$^+$	53.288 *7*	100	39.751	7/2$^+$	M1		2.077 *29*	α(K)exp=1.51 *15* B(M1)(W.u.)=0.0426 *13* Mult.: from electron conversion coefficients in ^{103}Ru β^- decay.
294.967	3/2$^-$	294.964 *10*	100	0.0	1/2$^-$	M1+E2	−0.17 *1*	0.01911 *27*	α(K)exp=0.0158 *20* B(E2)(W.u.)=37 *5*; B(M1)(W.u.)=0.124 *4* E_γ: From 2008KrZX. δ: from 1977Kr13, 295$\gamma(\theta)$ in Coul. ex. Others: −0.18 *1* (1955Mc51), −0.17 *1* (1958Mc02), −0.189 *10* (1970RoZS), −0.15 *1* (1972Sa03).
357.401	5/2$^-$	62.41 *3*	4.56 *7*	294.967	3/2$^-$	M1		1.314 *18*	B(M1)(W.u.)=0.0504 *16*
		317.72 *4*	0.065 *6*	39.751	7/2$^+$	[E1]		0.00563 *8*	B(E1)(W.u.)=7.6×10^{-8} *8*
		357.387 *21*	100.0 *7*	0.0	1/2$^-$	E2		0.01588 *22*	α(K)exp=0.020 *12* B(E2)(W.u.)=41.3 *12* E_γ: From 2008KrZX. Mult.: based on α(K)exp in ^{103}Ru β^- decay.
536.842	5/2$^+$	241.875 *10*	0.0157 *3*	294.967	3/2$^-$	E1		0.01179 *17*	α(K)exp=0.012 *3* B(E1)(W.u.)=9.E−8 *3* E_γ: From 2008KrZX. Mult.: based on α(K)exp in ^{103}Ru β^- decay.
		443.80 *2*	0.373 *4*	93.039	9/2$^+$	E2		0.00807 *11*	α(K)exp=0.0067 *9* B(E2)(W.u.)=0.11 *4* Mult.: based on α(K)exp in ^{103}Ru β^- decay.
		497.084 *9*	100.0 *8*	39.751	7/2$^+$	M1+E2	−0.368 *11*	0.00524 *7*	α(K)exp=0.0046 *4* B(E2)(W.u.)=2.0 *7*; B(M1)(W.u.)=0.0040 *13* δ: from low temperature nuclear orientation and $\gamma(\theta)$ in ^{103}Ru β^- decay.
607.412	(5/2$^+$,7/2,9/2)	514.365 *12*	100.0 *15*	93.039	9/2$^+$				
		567.70 *4*	33.8 *15*	39.751	7/2$^+$				

$\gamma(^{103}Rh)$ (continued)

E_i(level)	J_i^{π}	E_γ[†]	I_γ[†]	E_f	J_f^{π}	Mult.[#]	δ[#]	α[@]	Comments
650.086	5/2+	42.63 *4*	0.093 *10*	607.412	(5/2+,7/2,9/2)				
		113.19 *4*	0.057 *5*	536.842	5/2+				
		292.7 *2*	0.10 *3*	357.401	5/2−				
		557.057 *15*	15.02 *15*	93.039	9/2+	E2		0.00415 *6*	α(K)exp=0.0033 *5* B(E2)(W.u.) > 0.48 Mult.: based on α(K)exp in ^{103}Ru β^- decay.
		610.334 *19*	100.0 *10*	39.751	7/2+	M1+E2	0.09 *14*	0.00318 *4*	α(K)exp=0.0025 *3* B(M1)(W.u.) > 0.00081 δ: from low temperature nuclear orientation and γ(θ) in ^{103}Ru β^- decay.
651.731	3/2+	114.870 *25*	7.9 *3*	536.842	5/2+	M1(+E2)		0.53 *29*	α(K)exp=0.27 *8* Mult.: from α(K)exp. No δ given.
		612.10 *6*	100 *5*	39.751	7/2+			0.00319 *4*	
		651.69 *15*	0.21 *3*	0.0	1/2−				
657.28	11/2+	564.2 *3*	100 *20*	93.039	9/2+	M1+E2	+0.15 *2*	0.00383 *5*	Mult.: from 564γ(θ) and linear pol.
		617.6 *5*	14 *3*	39.751	7/2+	Q			
781.15	(9/2+)	688.2 *3*	100	93.039	9/2+				
		741.3 *3*	64	39.751	7/2+				
803.10	1/2−	445.8 *4*	7.6	357.401	5/2−				
		508 *1*	44	294.967	3/2−				
		803.2 *3*	100	0.0	1/2−				
821.09	13/2+	163.6 *3*	6.0 *12*	657.28	11/2+	D			
		728.2 *3*	100 *10*	93.039	9/2+	E2		2.02×10^{-3} *3*	B(E2)(W.u.)=30 *14*
847.72	7/2−	490.32 *21*	100[‡] *9*	357.401	5/2−	D			
		552.72 *18*	31[‡] *8*	294.967	3/2−	Q		0.00424 *6*	B(E2)(W.u.)=48 *12*
880.85	5/2−	523.5 *3*	100[‡] *6*	357.401	5/2−	M1+E2	−0.25 *3*	0.00459 *6*	B(E2)(W.u.)=6.6 *18*; B(M1)(W.u.)=0.033 *5* δ: from γ(θ) in Coul. ex.
		585.9 *3*	77[‡] *4*	294.967	3/2−	M1+E2	−0.27 *2*	0.00350 *5*	B(E2)(W.u.)=3.4 *7*; B(M1)(W.u.)=0.018 *3* δ: from γ(θ) in Coul. ex.
		880.7 *4*	24[‡] *3*	0.0	1/2−	E2		1.27×10^{-3} *2*	B(E2)(W.u.)=2.0 *4* Mult.: from A_2 coef 880 γ(θ) in Coul. ex.
902.99	11/2+	809.9 *3*	40	93.039	9/2+	D			Mult.: From DCO ratio.
		863.2 *3*	100	39.751	7/2+	Q			Mult.: From DCO ratio.
920.11	9/2−	72.8 *3*	8 *2*	847.72	7/2−	D			
		562.68 *12*	100 *10*	357.401	5/2−	E2		0.00403 *6*	B(E2)(W.u.)=58 *4*
1078.32	5/2+,7/2	428.5 *4*	100[‡]	650.086	5/2+				
		541.6 *4*	48[‡]	536.842	5/2+				
		720.3 *4*	43[‡]	357.401	5/2−				
		985.5 *4*	36[‡]	93.039	9/2+				
1106.87	5/2−	500.6 *4*	28	607.412	(5/2+,7/2,9/2)				E_γ: if energy is correct no final level within 1.3 keV.

$^{103}_{45}Rh_{58}$-9

Adopted Levels, Gammas (continued)

$\gamma(^{103}Rh)$ (continued)

E_i(level)	J^{π}_i	E_{γ}†	I_{γ}†	E_f	J^{π}_f	Mult.#	δ#	α@	Comments
1106.87	5/2⁻	749.35 *19*	100‡	357.401	5/2⁻	D+Q	−0.8 *+17−6*		δ: from 1977Kr13.
		811.75 *19*	67‡	294.967	3/2⁻				
1135.8	(1/2,3/2,5/2⁻)	840.3 *5*	100	294.967	3/2⁻				
		1136.3 *5*	11	0.0	1/2⁻				
1252.1	(5/2,7/2)	601.9 *4*	49‡	650.086	5/2⁺				
		1212.5 *4*	100‡	39.751	7/2⁺				
1256.5	1/2⁺	604.7 *4*	100‡	651.731	3/2⁺				
		961.6 *4*	19‡	294.967	3/2⁻				
1277.14	3/2⁻	474.0 *5*		803.10	1/2⁻	D+Q	0.53 *+37−21*		δ: From Coul. ex.
		919.82 *24*	10	357.401	5/2⁻				
		982.38 *24*	18	294.967	3/2⁻				
		1277.04 *14*	100‡	0.0	1/2⁻	M1+E2	−0.6 *3*	6.16×10^{-4} *13*	B(E2)(W.u.)=2.3 *23*; B(M1)(W.u.)=0.011 *9* δ: from 1277$\gamma(\theta)$ in Coul. ex.
1294.00	1/2⁻,3/2,5/2⁻	936.5 *4*	40‡	357.401	5/2⁻				
		999.2 *4*	100‡	294.967	3/2⁻				
		1293.9 *4*	82‡	0.0	1/2⁻				
1327.0		1287.2 *5*	100	39.751	7/2⁺				
1344.4	7/2⁺,9/2⁺	686.8 *6*	49	657.28	11/2⁺				
		807.9 *6*	100	536.842	5/2⁺				
1348.94	13/2⁺	445.9 *3*	25	902.99	11/2⁺	D			Mult.: From DCO ratio.
		527.8 *4*	12.5	821.09	13/2⁺				
		691.7 *3*	100	657.28	11/2⁺	D			Mult.: From DCO ratio.
		1255.6 *5*	12.5	93.039	9/2⁺				
1403.5		1046.1 *6*	100 *15*	357.401	5/2⁻				
1411.10	3/2⁻,5/2⁻	563.0 *3*	66	847.72	7/2⁻				
		760.6 *3*	32	650.086	5/2⁺				
		1116.6 *3*	30	294.967	3/2⁻				
		1411.4 *3*	100	0.0	1/2⁻				
1420.8		540		880.85	5/2⁻				
1428.7		1071.3 *6*	100	357.401	5/2⁻				
1438.4	3/2⁺,5/2⁺	786.9 *5*	54‡	651.731	3/2⁺				
		1398.5 *5*	100‡	39.751	7/2⁺				
1443.63	1/2⁻,3/2,5/2⁻	1086.1 *4*	41‡	357.401	5/2⁻				
		1148.5 *4*	100‡ *15*	294.967	3/2⁻				
		1443.9 *4*	16	0.0	1/2⁻				
1466.4	(3/2,5/2)	1108.7 *5*	100	357.401	5/2⁻				
		1171.8 *5*	21	294.967	3/2⁻				
1480.1	7/2⁺,9/2⁺	1440.3 *7*	100	39.751	7/2⁺				
1482.35	3/2,5/2⁻	679.4 *3*	59‡	803.10	1/2⁻				

γ(^{103}Rh) (continued)

E$_i$(level)	J$^\pi_i$	E$_\gamma$†	I$_\gamma$†	E$_f$	J$^\pi_f$	Mult.#	δ#	α@	Comments
1482.35	3/2,5/2⁻	945.2 *3*	33‡	536.842	5/2⁺				
		1124.7 *3*	100‡	357.401	5/2⁻				
		1187.5 *3*	31‡	294.967	3/2⁻				
		1482.6 *3*	33‡	0.0	1/2⁻				
1491.6	1/2⁻,3/2⁻	1134.0 *5*	33‡	357.401	5/2⁻				
		1196.9 *5*	100‡	294.967	3/2⁻				
1515.6		1158.2 *7*	100	357.401	5/2⁻				
1524.15	15/2⁺	703.6 *5*	100 *21*	821.09	13/2⁺	M1+E2	+0.10 *2*	2.28×10^{-3} *3*	
		867.3 *5*	54 *11*	657.28	11/2⁺	E2		1.31×10^{-3} *2*	
1530.8	3/2⁺,5/2⁺	993.6 *5*	100‡	536.842	5/2⁺				
		1491.3 *5*	67‡	39.751	7/2⁺				
1579.9	3/2⁺,5/2⁺	928.5 *5*	43‡	651.731	3/2⁺				
		1539.9 *5*	100‡	39.751	7/2⁺				
1586.56	11/2⁻	666.5 *3*	100	920.11	9/2⁻				
		738.7 *3*	50	847.72	7/2⁻				
1599.7	1/2⁺	949.6 *6*	100	650.086	5/2⁺				
1605.0		1247.5 *7*	82	357.401	5/2⁻				
		1310.1 *7*	100‡	294.967	3/2⁻				
1611.2		763.5 *8*	100	847.72	7/2⁻				
1637.20	13/2⁻	717.2 *4*	100	920.11	9/2⁻	E2		2.10×10^{-3} *3*	
1685.2		1328.0 *5*	100‡ *15*	357.401	5/2⁻				
		1390.1 *5*	79‡ *14*	294.967	3/2⁻				
1706.1	1/2⁻,3/2⁻	1348.7 *5*	100‡	357.401	5/2⁻				
		1705.7 *5*	56‡	0.0	1/2⁻				
1707.3		1614.3 *5*	100	93.039	9/2⁺				
1716.54	17/2⁺	192.3 *3*	6.9 *13*	1524.15	15/2⁺				
		895.5 *3*	100 *11*	821.09	13/2⁺	E2		1.22×10^{-3} *2*	B(E2)(W.u.)=59 *14*
1731.5		1080.9 *7*	96‡	650.086	5/2⁺				
		1692.2 *7*	100	39.751	7/2⁺				
1778.0	3/2⁺,5/2⁺	1126.3 *8*	100	651.731	3/2⁺				
1842.2		1547.2 *8*	100	294.967	3/2⁻				
1851.14	15/2⁺	327.4 *6*	16.7	1524.15	15/2⁺				
		502.0 *3*	100	1348.94	13/2⁺	D			Mult.: From DCO ratio.
		948.1 *3*	100	902.99	11/2⁺	Q			Mult.: From DCO ratio.
		1030.2 *3*	50	821.09	13/2⁺				
1968.2		1968.2 *8*	100	0.0	1/2⁻				
1969.8		1674.8 *10*	100	294.967	3/2⁻				
1999.3	1/2⁻,3/2,5/2⁻	1641.1 *8*	100	357.401	5/2⁻				
		2000.0 *8*	79	0.0	1/2⁻				

$^{103}_{45}Rh_{58}$-11

γ(^{103}Rh) (continued)

E$_i$(level)	J$_i^\pi$	E$_\gamma$†	I$_\gamma$†	E$_f$	J$_f^\pi$	Mult.#	α@	Comments
2008.7	1/2,3/2,5/2$^-$	1713.1 7	100	294.967	3/2$^-$			
		2009.2 7	47	0.0	1/2$^-$			
2034.23	13/2$^-$	396.6 3	40	1637.20	13/2$^-$			
		1114.2 3	80	920.11	9/2$^-$			
		1212.7 3	100	821.09	13/2$^+$			
2040.9		1160		880.85	5/2$^-$			
2058.8		1408.7 9	100	650.086	5/2$^+$			
2103.5		2103.5 13	100	0.0	1/2$^-$			
2136.4		1779.0 11	100	357.401	5/2$^-$			
2220.11	15/2$^-$	185.7 2	33	2034.23	13/2$^-$			
		582.9 4	100	1637.20	13/2$^-$	D		
		695.6 4	17	1524.15	15/2$^+$			
		1399.1 4	94	821.09	13/2$^+$			
2228.5	13/2$^-$	591.2 4	100	1637.20	13/2$^-$			
		642.3 4	100	1586.56	11/2$^-$			
2234.7	1/2$^+$	1582.9 9	67	651.731	3/2$^+$			
		1697.8 9	100	536.842	5/2$^+$			
2344.48	17/2$^-$	124.26 17	46 5	2220.11	15/2$^-$	D		
		309.6 5	2	2034.23	13/2$^-$			
		707.6 3	100	1637.20	13/2$^-$	E2	2.18×10^{-3} 3	
		820.4 4	15 3	1524.15	15/2$^+$	D		
2366.57	15/2$^-$	138.2 3	33	2228.5	13/2$^-$			
		146.4 3	33	2220.11	15/2$^-$			
		332.2 3	67	2034.23	13/2$^-$			
		729.3 4	33	1637.20	13/2$^-$			
		779.9 4	67	1586.56	11/2$^-$			
		1545.4 3	100	821.09	13/2$^+$			
2395.40	15/2$^-$	758.0 3	100	1637.20	13/2$^-$			
		808.8 3	100	1586.56	11/2$^-$			
2417.52	17/2$^-$	197.3 3	6	2220.11	15/2$^-$			
		780.4 3	100	1637.20	13/2$^-$	E2	1.70×10^{-3} 2	
2418.39	17/2$^+$	567.2 5	33	1851.14	15/2$^+$	D		Mult.: From DCO ratio.
		701.8 4	33	1716.54	17/2$^+$			
		894.7 3	100	1524.15	15/2$^+$			
		1069.5 3	67	1348.94	13/2$^+$			
2444.65	15/2$^-$	807.6 3	100	1637.20	13/2$^-$			
		857.9 3	100	1586.56	11/2$^-$			
2520.93	17/2$^-$	125.3 3	8	2395.40	15/2$^-$			
		154.0 3	42	2366.57	15/2$^-$			
		300.85 21	42	2220.11	15/2$^-$	D		
		804.3 3	17	1716.54	17/2$^+$			
		883.9 3	100	1637.20	13/2$^-$	Q		
		996.7 3	17	1524.15	15/2$^+$			

$^{103}_{45}$Rh$_{58}$-12

$\gamma(^{103}$Rh) (continued)

E_i(level)	J_i^π	E_γ†	I_γ†	E_f	J_f^π	Mult.#	δ#	α@	Comments
2524.75	19/2+	808.0 *5*	100 *19*	1716.54	17/2+	(M1+E2)	+0.06 *2*	1.67×10^{-3} *2*	
		1000.7 *3*	51 *10*	1524.15	15/2+				
2539.72	19/2−	122.2 *3*	10.4 *21*	2417.52	17/2−	D			
		195.22 *15*	100 *10*	2344.48	17/2−	M1		0.0550 *8*	
		319.5 *3*	2.6 *6*	2220.11	15/2−				
		822.9 *4*	4.4	1716.54	17/2+				
2644.14	17/2−	199.5 *4*	50	2444.65	15/2−				
		226.3 *5*	50	2417.52	17/2−				
		1007.0 *3*	100	1637.20	13/2−	Q			Mult.: From DCO ratio.
2700.46	19/2−	179.33 *17*	100	2520.93	17/2−	D			
		282.7 *3*	10	2418.39	17/2+				
		334.0 *3*	5	2366.57	15/2−				
		355.9 *3*	40	2344.48	17/2−				
		983.7 *3*	20	1716.54	17/2+				
2738.53	21/2+	213.9 *3*	14 *3*	2524.75	19/2+	D			
		1022.15 *23*	100 *11*	1716.54	17/2+	E2		8.98×10^{-4} *13*	B(E2)(W.u.)=31 *6*
2745.66	19/2−	101.5 *4*	33	2644.14	17/2−				
		205.7 *3*	100	2539.72	19/2−				
		401.1 *3*	67	2344.48	17/2−				
2752.62	21/2−	212.90 *13*	100 *10*	2539.72	19/2−	M1		0.0438 *6*	
		407.4 *7*	1.3 *3*	2344.48	17/2−				
2872.52	19/2−	228.3 *4*	50	2644.14	17/2−				
		427.8 *4*	50	2444.65	15/2−				
		454.9 *3*	100	2417.52	17/2−				
		1156.1 *3*	50	1716.54	17/2+				
2882.4	19/2+	463.7 *4*	33	2418.39	17/2+				
		1031.3 *4*	100	1851.14	15/2+				
		1166.1 *4*	33	1716.54	17/2+				
2916.71	21/2−	170.9 *3*	27	2745.66	19/2−				
		216.29 *17*	100	2700.46	19/2−	D			
		395.9 *3*	7	2520.93	17/2−				
2935.29	21/2−	189.5 *4*	10	2745.66	19/2−				
		234.5 *4*	100	2700.46	19/2−				
		395.6 *3*	30	2539.72	19/2−	D			Mult.: From DCO ratio.
3013.30	23/2−	260.66 *15*	100 *10*	2752.62	21/2−	M1		0.0258 *4*	
		473.4 *3*	16 *3*	2539.72	19/2−				
3091.63	21/2−	219.0 *3*	100	2872.52	19/2−				
		391.0 *3*	100	2700.46	19/2−	D			
		447.5 *4*	50	2644.14	17/2−				
		674.3 *3*	50	2417.52	17/2−	Q			
		747.3 *3*	50	2344.48	17/2−				
3213.3	(21/2−)	795.8 *5*	100	2417.52	17/2−				
3217.5	21/2+	479.8 *3*	21	2738.53	21/2+	D			

$^{103}_{45}$Rh$_{58}$-13

γ(^{103}Rh) (continued)

E_i(level)	J^π_i	E_γ†	I_γ†	E_f	J^π_f	Mult.#	α@	Comments
3217.5	21/2$^+$	692.6 *3*	100	2524.75	19/2$^+$	D		
3228.41	23/2$^-$	311.6 *2*	100	2916.71	21/2$^-$	D		
		482.6 *4*	11	2745.66	19/2$^-$			
		528.1 *3*	11	2700.46	19/2$^-$			
3274.71	23/2$^-$	339.2 *3*	100	2935.29	21/2$^-$	D		
		357.9 *4*	29	2916.71	21/2$^-$			
		574.2 *3*	14	2700.46	19/2$^-$	Q		Mult.: From DCO ratio.
3278.1	21/2$^+$	539.4 *3*	100	2738.53	21/2$^+$			
		753.2 *4*	50	2524.75	19/2$^+$			
3329.06	25/2$^-$	315.72 *15*	100	3013.30	23/2$^-$	M1	0.01582 *22*	
		576.5 *3*	9	2752.62	21/2$^-$			
3397.5	23/2$^+$	119.1 *4*	5	3278.1	21/2$^+$			
		180.5 *3*	100 *11*	3217.5	21/2$^+$	D		
		658.8 *3*	59 *11*	2738.53	21/2$^+$	D		
		872.9 *3*	38 *7*	2524.75	19/2$^+$	Q		
3417.39	23/2$^-$	325.7 *3*	100	3091.63	21/2$^-$			
		481.9 *3*	33	2935.29	21/2$^-$			
		500.7 *3*	33	2916.71	21/2$^-$			
		544.9 *3*	33	2872.52	19/2$^-$			
		664.6 *4*	33	2752.62	21/2$^-$			
3487.6	(21/2$^+$)	605.2 *3*	100	2882.4	19/2$^+$			
3616.60	25/2$^-$	341.7 *3*	100	3274.71	23/2$^-$	D		
		387.9 *3*	17	3228.41	23/2$^-$			
		681.5 *3*	17	2935.29	21/2$^-$			
		700.2 *3*	17	2916.71	21/2$^-$	Q		Mult.: From DCO ratio.
3631.7	25/2$^+$	234.6 *4*	100 *10*	3397.5	23/2$^+$	D		
		353.5 *9*	7	3278.1	21/2$^+$			
		618.1 *4*	7	3013.30	23/2$^-$			
		893.1 *3*	48 *10*	2738.53	21/2$^+$	Q		
3669.68	25/2$^-$	252.0 *3*	25	3417.39	23/2$^-$			
		441.1 *4*	100	3228.41	23/2$^-$	D		
		753.0 *4*	25	2916.71	21/2$^-$			
3770.5	27/2$^-$	441.4 *4*	100 *18*	3329.06	25/2$^-$	D		
		757.3 *3*	26 *5*	3013.30	23/2$^-$			
3779.87	25/2$^-$	362.3 *3*	100	3417.39	23/2$^-$			
		504.8 *3*	50	3274.71	23/2$^-$			
		688.4 *3*	50	3091.63	21/2$^-$			
3868.3	(25/2$^+$)	1129.5 *6*	100	2738.53	21/2$^+$	Q		
3940.1	27/2$^+$	308.49 *24*	100	3631.7	25/2$^+$	D		
		543.1 *4*	5	3397.5	23/2$^+$			
		610.8 *4*	5	3329.06	25/2$^-$			
4038.2	(25/2$^-$)	824.9 *5*	100	3213.3	(21/2$^-$)	Q		
4081.29	27/2$^-$	410.9 *4*	25	3669.68	25/2$^-$			

$^{103}_{45}Rh_{58}$-14

$\gamma(^{103}Rh)$ (continued)

E_i(level)	J^π_i	E_γ†	I_γ†	E_f	J^π_f	Mult.#	Comments
4081.29	27/2⁻	464.5 *3*	100	3616.60	25/2⁻		
		752.3 *3*	25	3329.06	25/2⁻		
		806.8 *3*	25	3274.71	23/2⁻		
4107.31	27/2⁻	437.6 *3*	100	3669.68	25/2⁻		
		490.5 *3*	50	3616.60	25/2⁻		
		879.1 *3*	50	3228.41	23/2⁻		
4197.0	29/2⁻	426.4 *3*	100	3770.5	27/2⁻		
		868.0 *4*	33	3329.06	25/2⁻		
4212.54	27/2⁻	432.4 *3*	100	3779.87	25/2⁻		
		542.8 *2*	100	3669.68	25/2⁻		
		596.2 *3*	100	3616.60	25/2⁻		
		795.3 *3*	100	3417.39	23/2⁻		
4322.1	29/2⁺	382.12 *24*	100	3940.1	27/2⁺	D	
		691.0 *6*	18	3631.7	25/2⁺		
4338.4	(29/2⁻)	567.9 *5*	100	3770.5	27/2⁻	D	
4486.0	27/2⁺	617.5 *4*	100	3868.3	(25/2⁺)		
		853.9 *5*	100	3631.7	25/2⁺		
		1088.4 *5*	100	3397.5	23/2⁺	Q	Mult.: From DCO ratio.
4560.5	29/2⁻	479.1 *3*	100	4081.29	27/2⁻		
		944.1 *3*	100	3616.60	25/2⁻		
4607.0	29/2⁻	499.5 *3*	100	4107.31	27/2⁻		
		525.5 *5*	100	4081.29	27/2⁻		
		937.5 *3*	100	3669.68	25/2⁻		
4661.6	29/2⁻	449.0 *4*	100	4212.54	27/2⁻		
		554.4 *4*	100	4107.31	27/2⁻		
		881.6 *3*	100	3779.87	25/2⁻		
4706.3	31/2⁺	384.3 *6*	100 *21*	4322.1	29/2⁺	D	
		766.4 *6*	22 *4*	3940.1	27/2⁺		
4765.3	31/2⁻	568.2 *3*	100	4197.0	29/2⁻		
		994.9 *4*	33	3770.5	27/2⁻		
4830.3	29/2⁺	344.4 *5*	100	4486.0	27/2⁺	D	Mult.: From DCO ratio.
		889.9 *5*	100	3940.1	27/2⁺		
		962.1 *4*	100	3868.3	(25/2⁺)	Q	Mult.: From DCO ratio.
		1198.5 *5*	100	3631.7	25/2⁺		
5050.1	(29/2⁺)	1181.8 *5*	100	3868.3	(25/2⁺)		
5061.6	31/2⁻	399.9 *4*	100	4661.6	29/2⁻		
		849.1 *4*	100	4212.54	27/2⁻		
5061.9	31/2⁻	454.7 *3*	100	4607.0	29/2⁻		
		954.7 *3*	100	4107.31	27/2⁻		
5092.4	31/2⁻	430.8 *5*	100	4661.6	29/2⁻		
		531.9 *3*	100	4560.5	29/2⁻		
		895.5 *3*	100	4197.0	29/2⁻		
		1011.0 *4*	100	4081.29	27/2⁻		

Adopted Levels, Gammas (continued)

$\gamma(^{103}Rh)$ (continued)

E_i(level)	J^π_i	E_γ†	I_γ†	E_f	J^π_f	Mult.#	Comments
5197.6	33/2+	491.0 *3*	100 *23*	4706.3	31/2+	D	
		876.1 *5*	11.5 *23*	4322.1	29/2+		
5207.1	31/2+	376.8 *3*	100	4830.3	29/2+	D	
		720.9 *3*	100	4486.0	27/2+		
		885.2 *5*	100	4322.1	29/2+		
5299.3	33/2−	534.0 *3*	100	4765.3	31/2−		
		1102.4 *4*	100	4197.0	29/2−		
5578.0	33/2−	516.0 *3*	100	5061.9	31/2−		
		971.2 *3*	100	4607.0	29/2−		
5657.2	33/2+	450.2 *4*	100	5207.1	31/2+	D	Mult.: From DCO ratio.
		826.5 *4*	100	4830.3	29/2+		
		951.7 *5*	100	4706.3	31/2+		
5664.2	35/2+	466.5 *3*	100 *21*	5197.6	33/2+	D	
		957.9 *3*	29 *6*	4706.3	31/2+		
5686.8	33/2−	594.2 *4*	100	5092.4	31/2−		
		1126.4 *4*	100	4560.5	29/2−		
5925.8	35/2−	626.3 *4*	100	5299.3	33/2−		
		1160.5 *5*	100	4765.3	31/2−		
6103.0	35/2+	445.3 *6*	100	5657.2	33/2+	D	Mult.: From DCO ratio.
		895.5 *4*	100	5207.1	31/2+		
6144.2	35/2−	566.2 *3*	100	5578.0	33/2−		
		1082.2 *3*	100	5061.9	31/2−		
6205.6	37/2+	541.2 *5*	100	5664.2	35/2+	D	
		1007.9 *5*	100	5197.6	33/2+		
6569.3	37/2+	465.7 *4*	100	6103.0	35/2+		
		912.7 *4*	100	5657.2	33/2+		
6588.7	37/2−	662.8 *4*	100	5925.8	35/2−		
		1289.5 *5*	100	5299.3	33/2−		
6748.9	39/2+	543.2 *5*	100	6205.6	37/2+		
		1085.0 *5*	100	5664.2	35/2+		
7114.5	39/2+	545.3 *5*	100	6569.3	37/2+		
		1011.5 *5*	100	6103.0	35/2+		
7188.7	39/2−	600.1 *5*	100	6588.7	37/2−		
		1262.7 *6*	100	5925.8	35/2−		
7360.2	41/2+	611.4 *5*	100	6748.9	39/2+		
		1154.4 *6*	100	6205.6	37/2+		
7995.3	43/2+	634.9 *6*	100	7360.2	41/2+		
		1246.5 *6*	100	6748.9	39/2+		

† Weighted averages of all available data with comparable precision.
‡ Relative photon branching for this level from (n,n′γ).

Adopted Levels, Gammas (continued)

$\gamma(^{103}Rh)$ (continued)

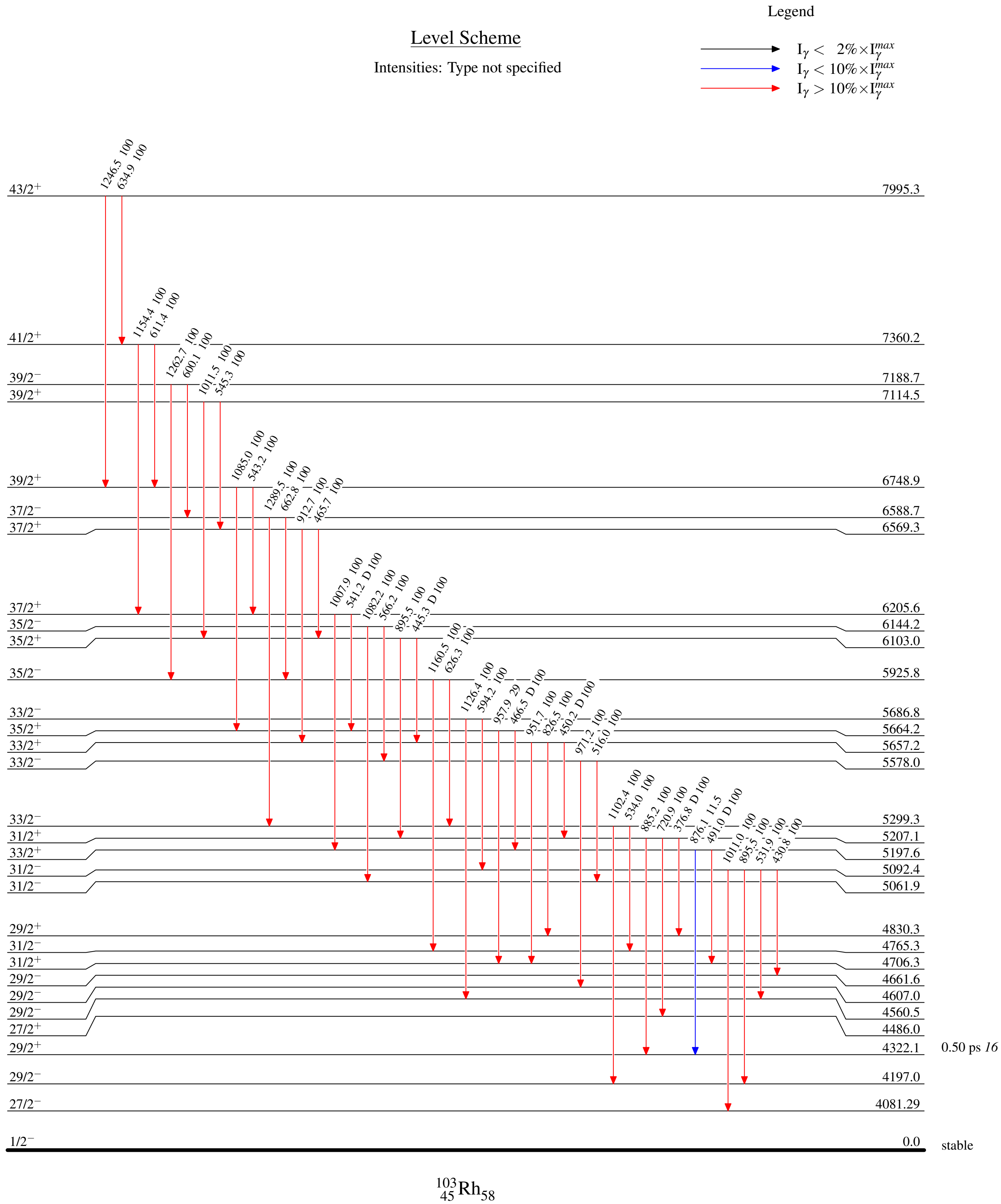
From $\gamma(\theta)$ and linear polarization measurements in $^{100}Mo(^{7}Li,4n)$, unless noted otherwise.

@ 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.

Adopted Levels, Gammas

Level Scheme

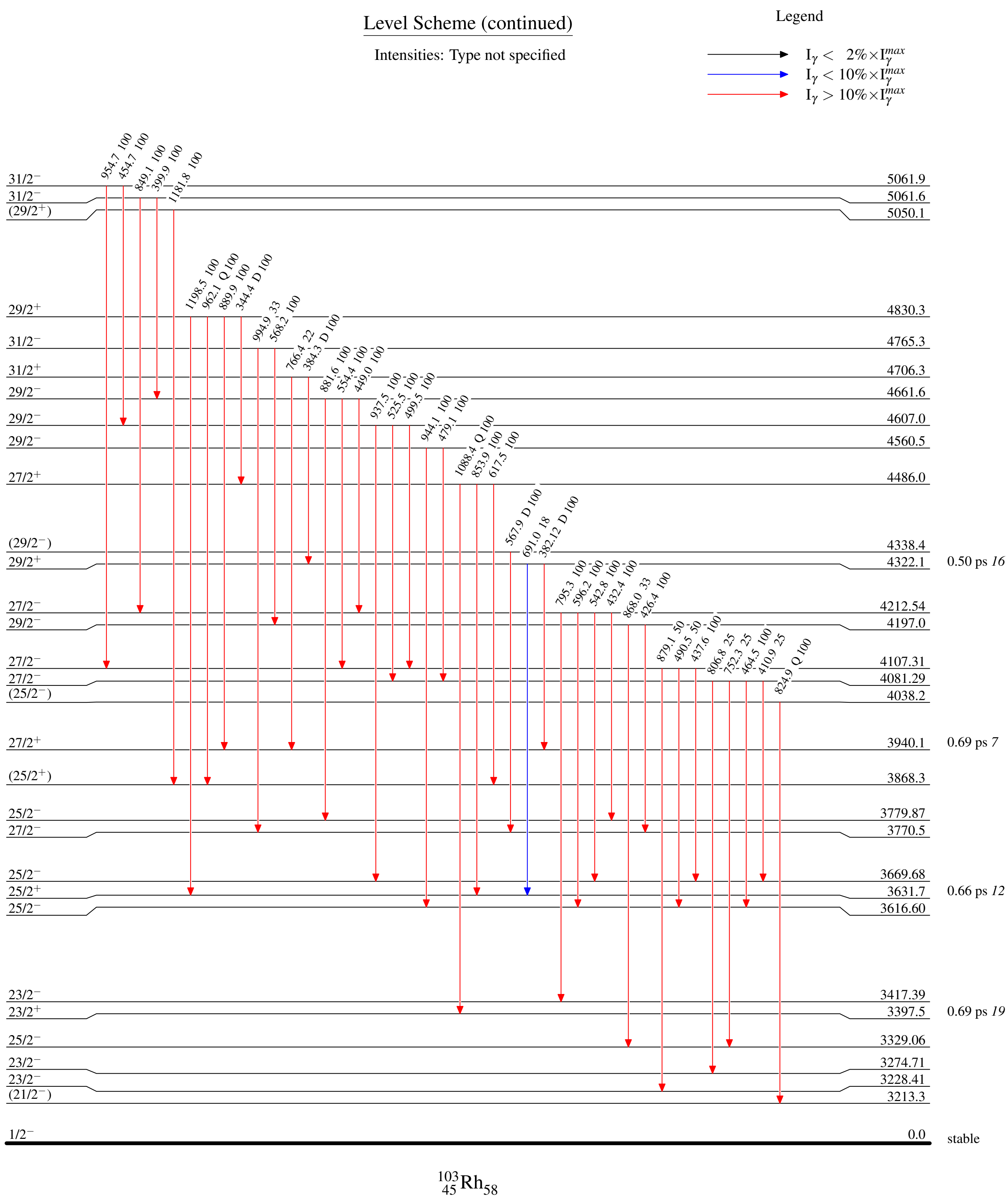
Intensities: Type not specified



Adopted Levels, Gammas

Level Scheme (continued)

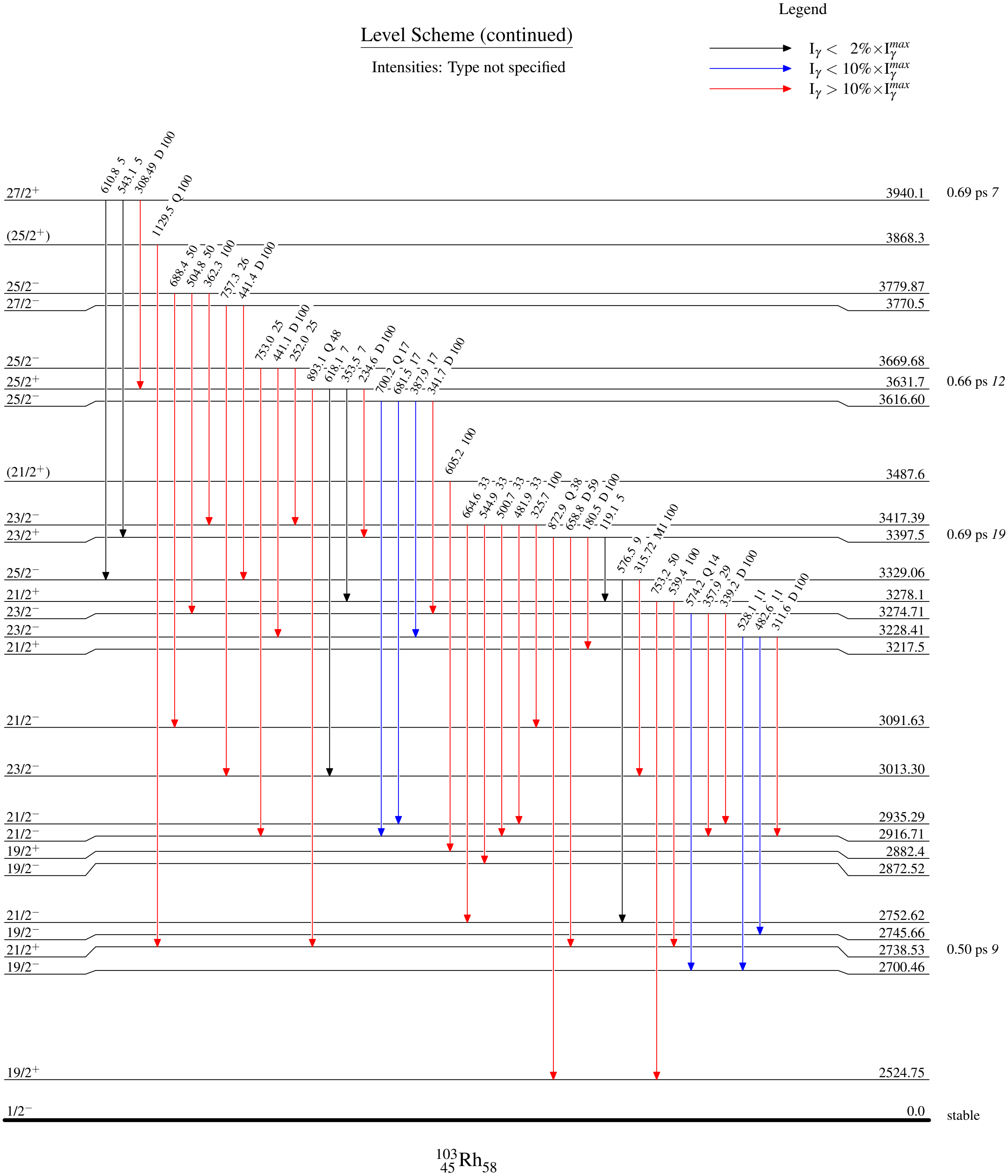
Intensities: Type not specified



Adopted Levels, Gammas

Level Scheme (continued)

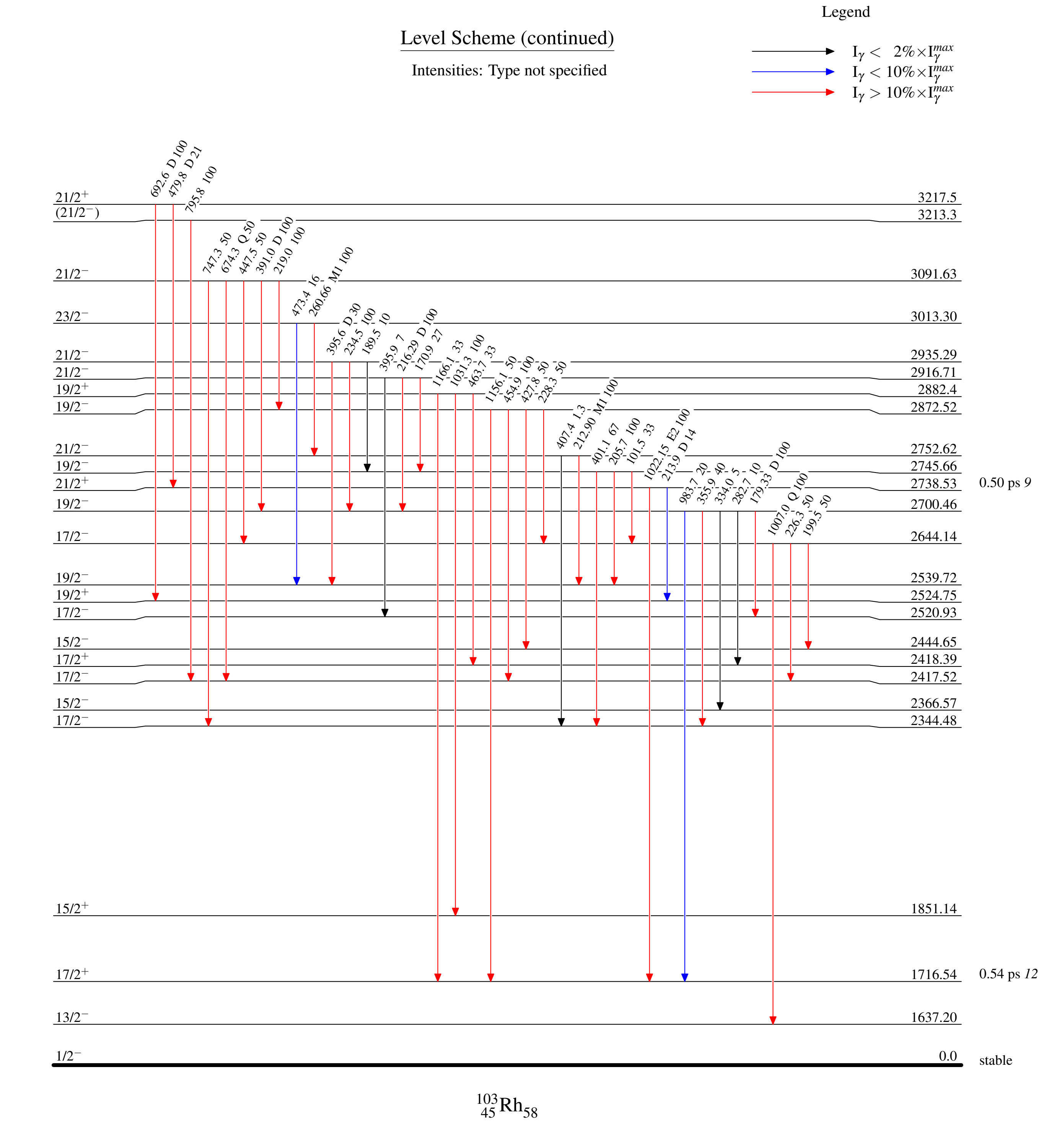
Intensities: Type not specified



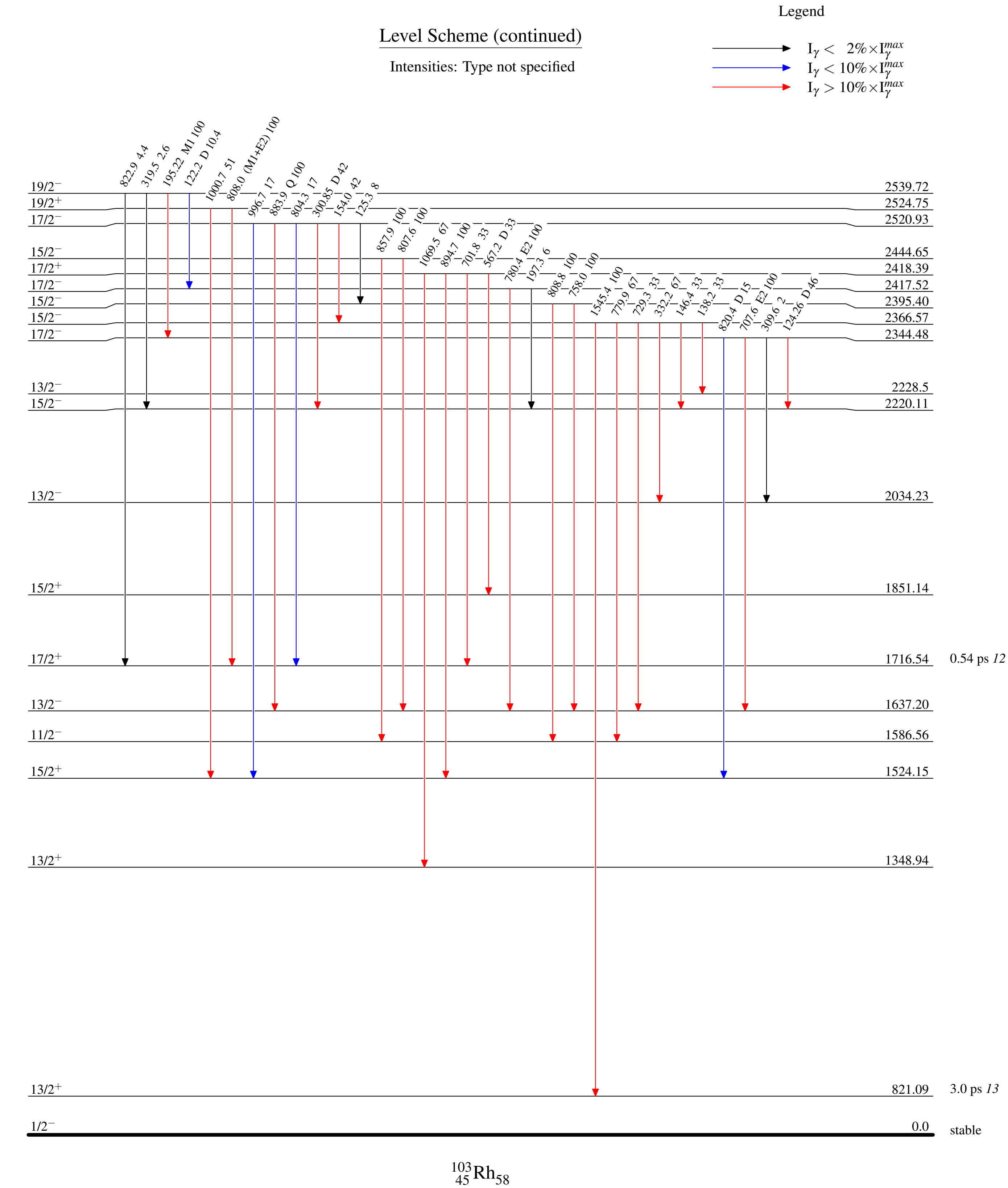
Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Type not specified



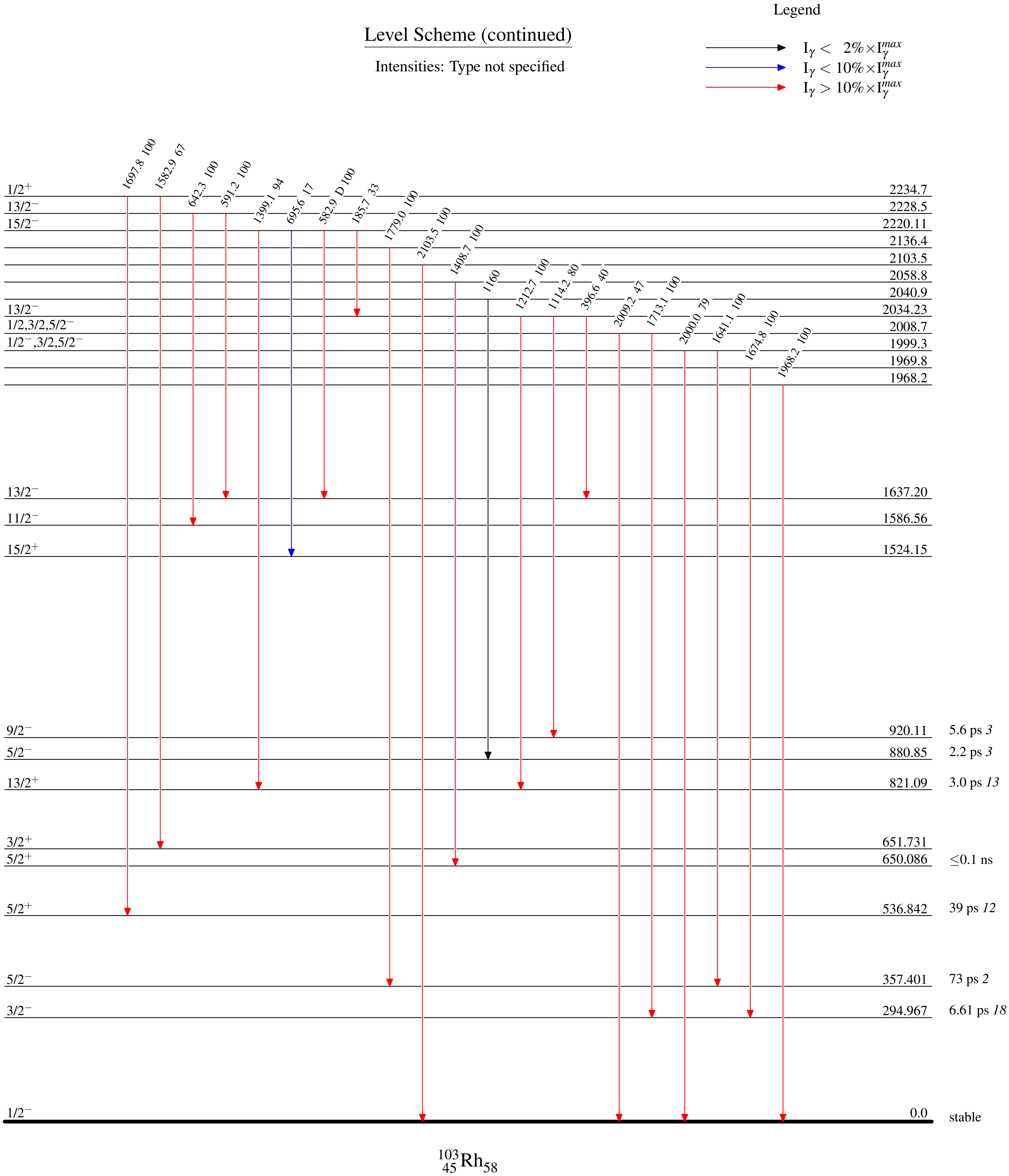
Adopted Levels, Gammas



Adopted Levels, Gammas

Level Scheme (continued)

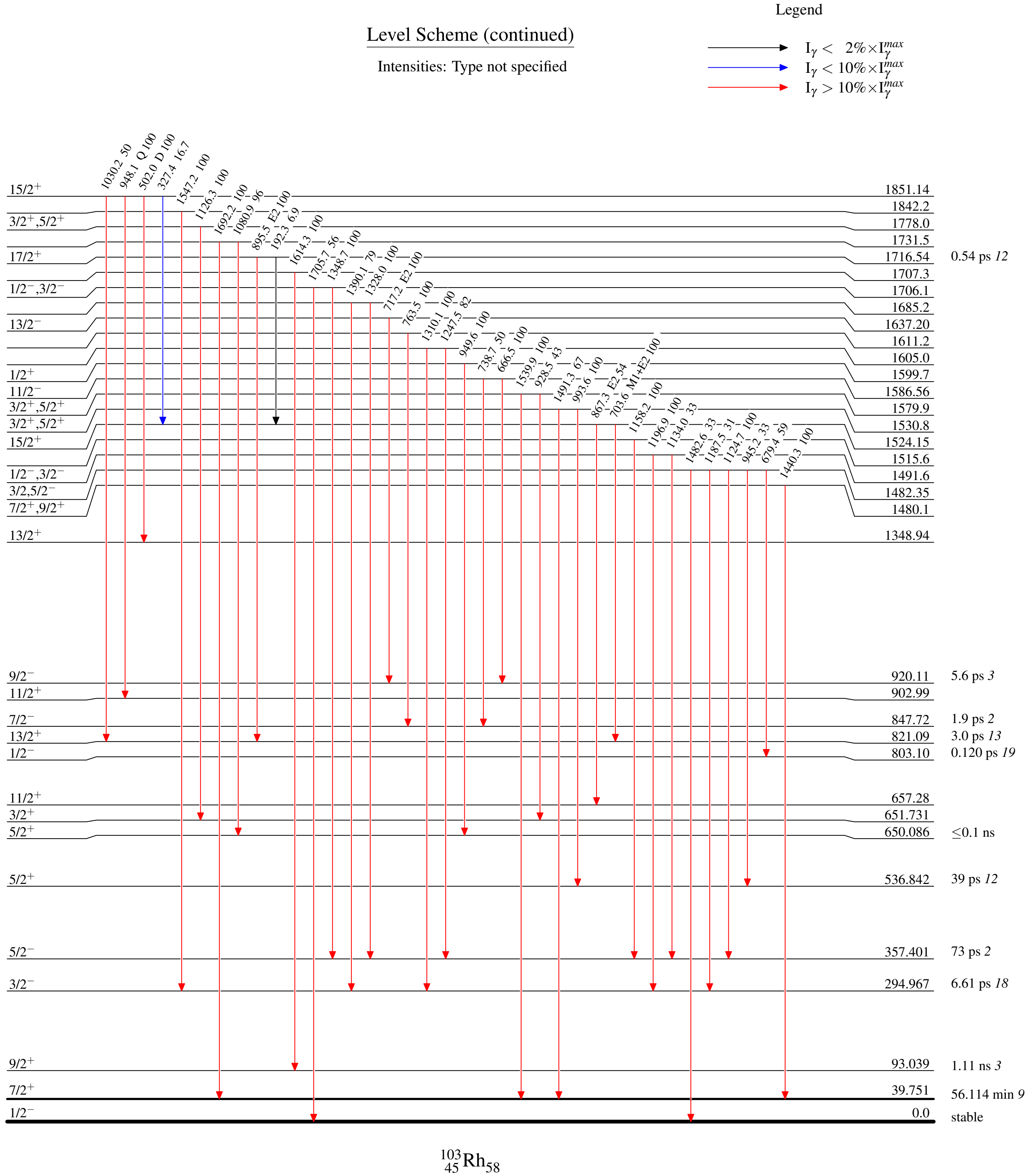
Intensities: Type not specified



Adopted Levels, Gammas

Level Scheme (continued)

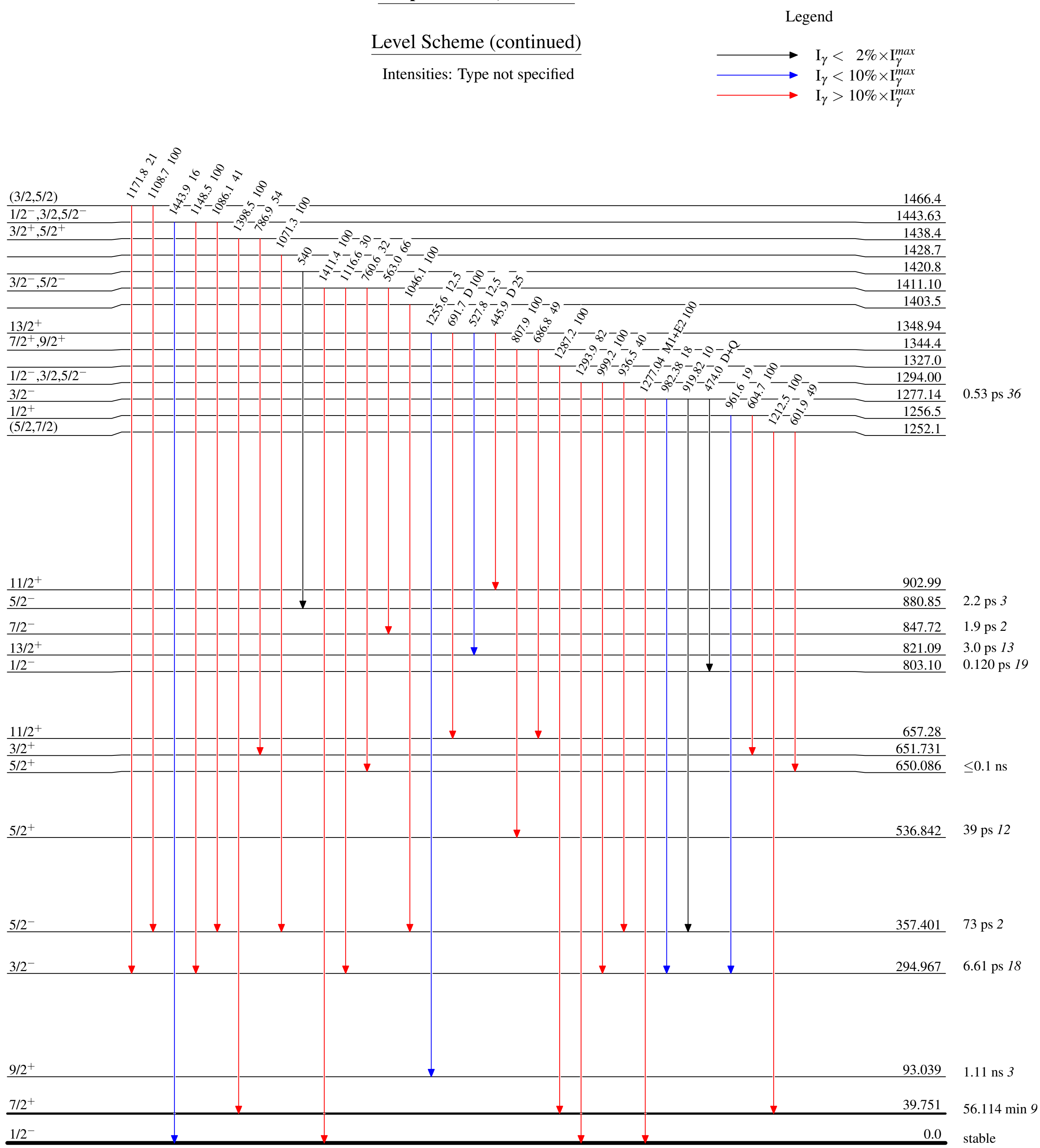
Intensities: Type not specified



Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Type not specified

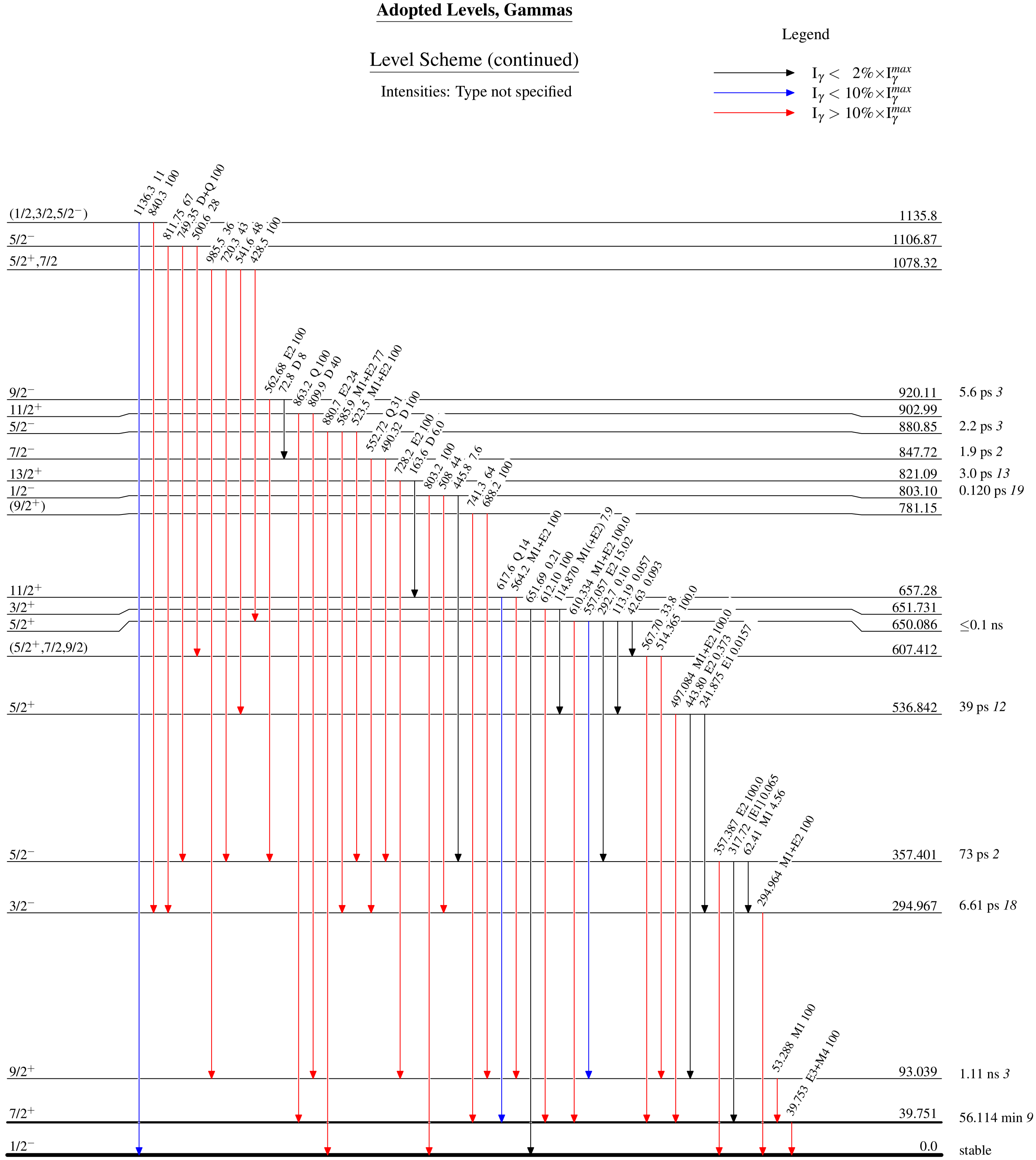


$^{103}_{45}Rh_{58}$

Adopted Levels, Gammas

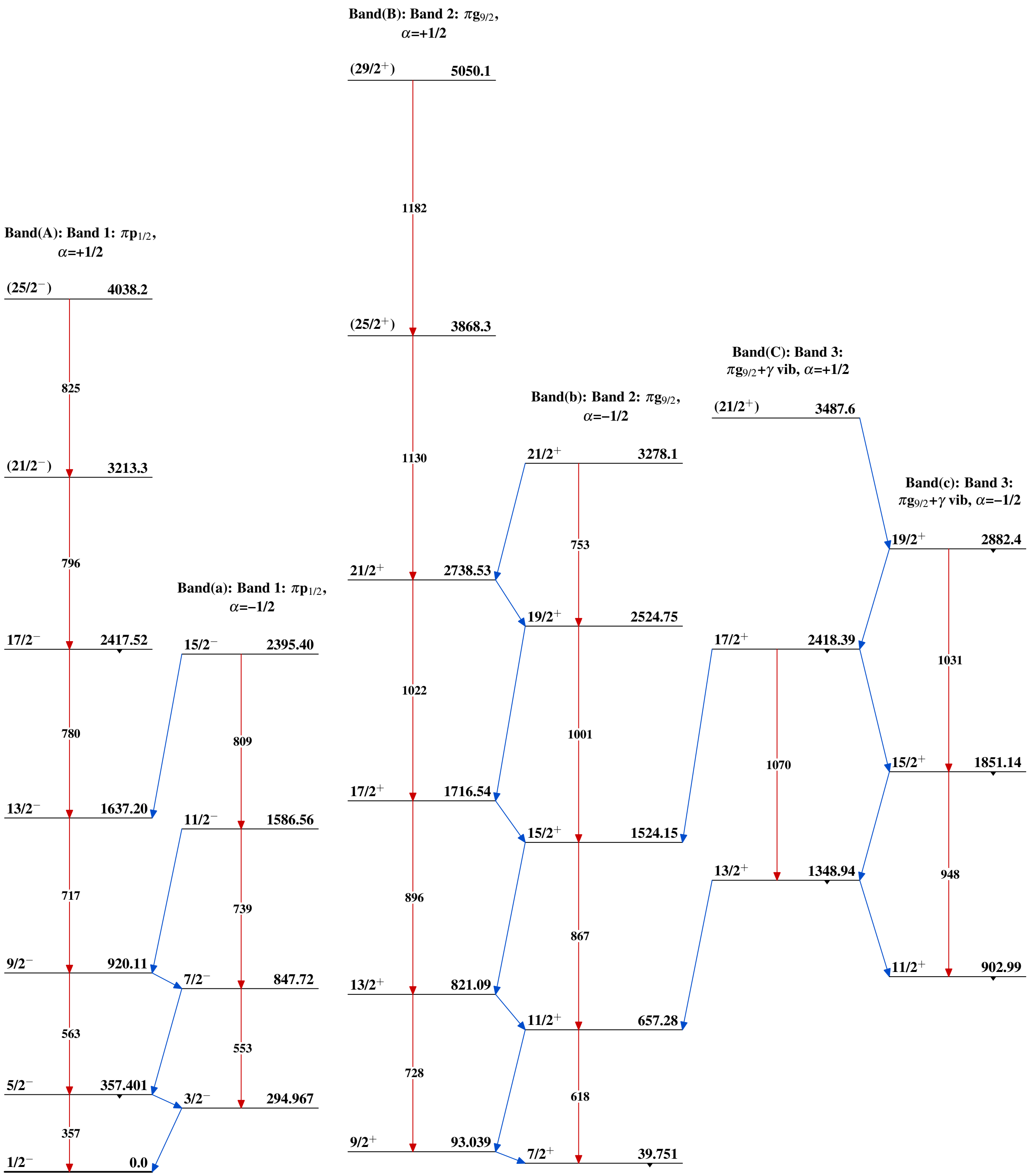
Level Scheme (continued)

Intensities: Type not specified



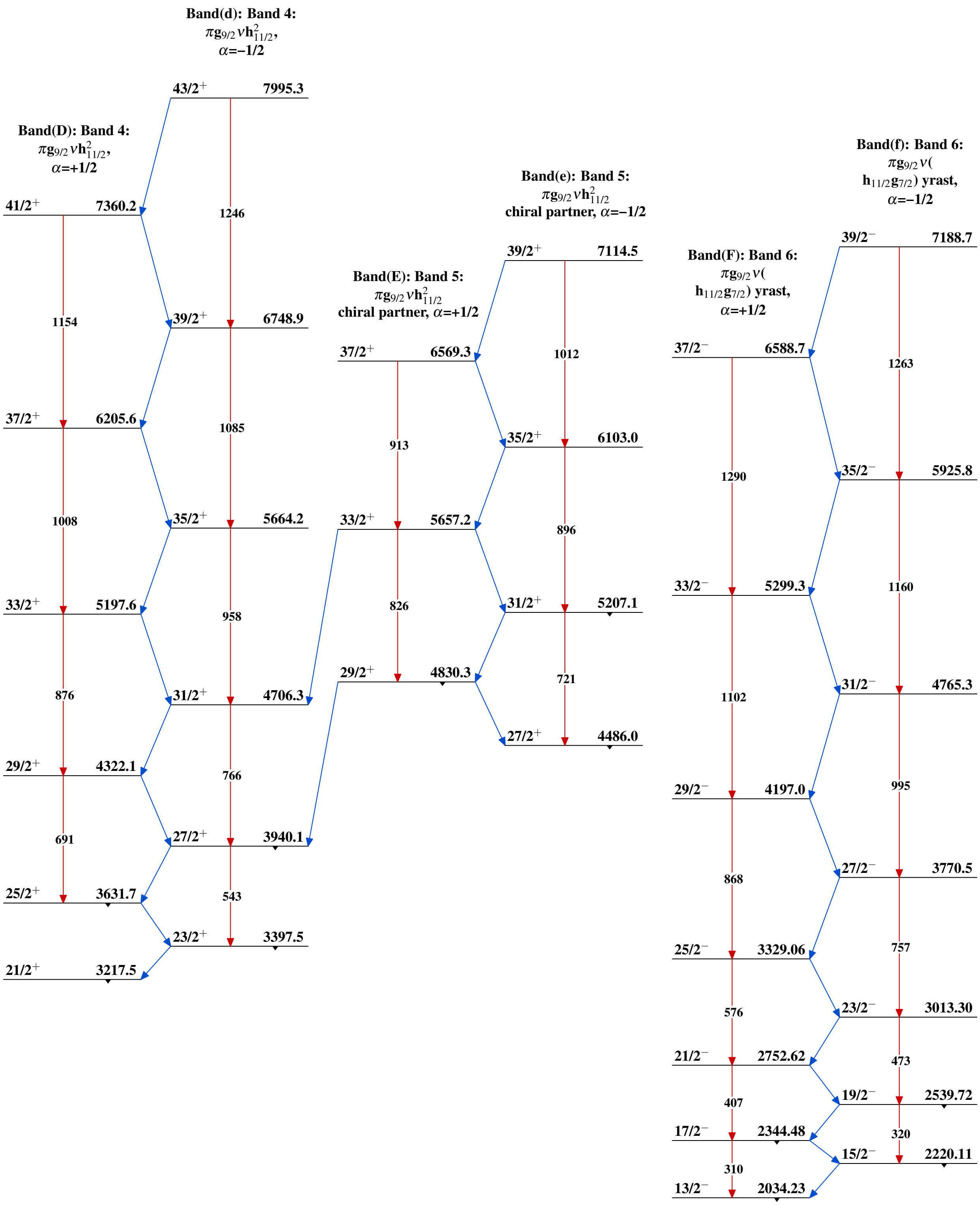
$^{103}_{45}Rh_{58}$

Adopted Levels, Gammas



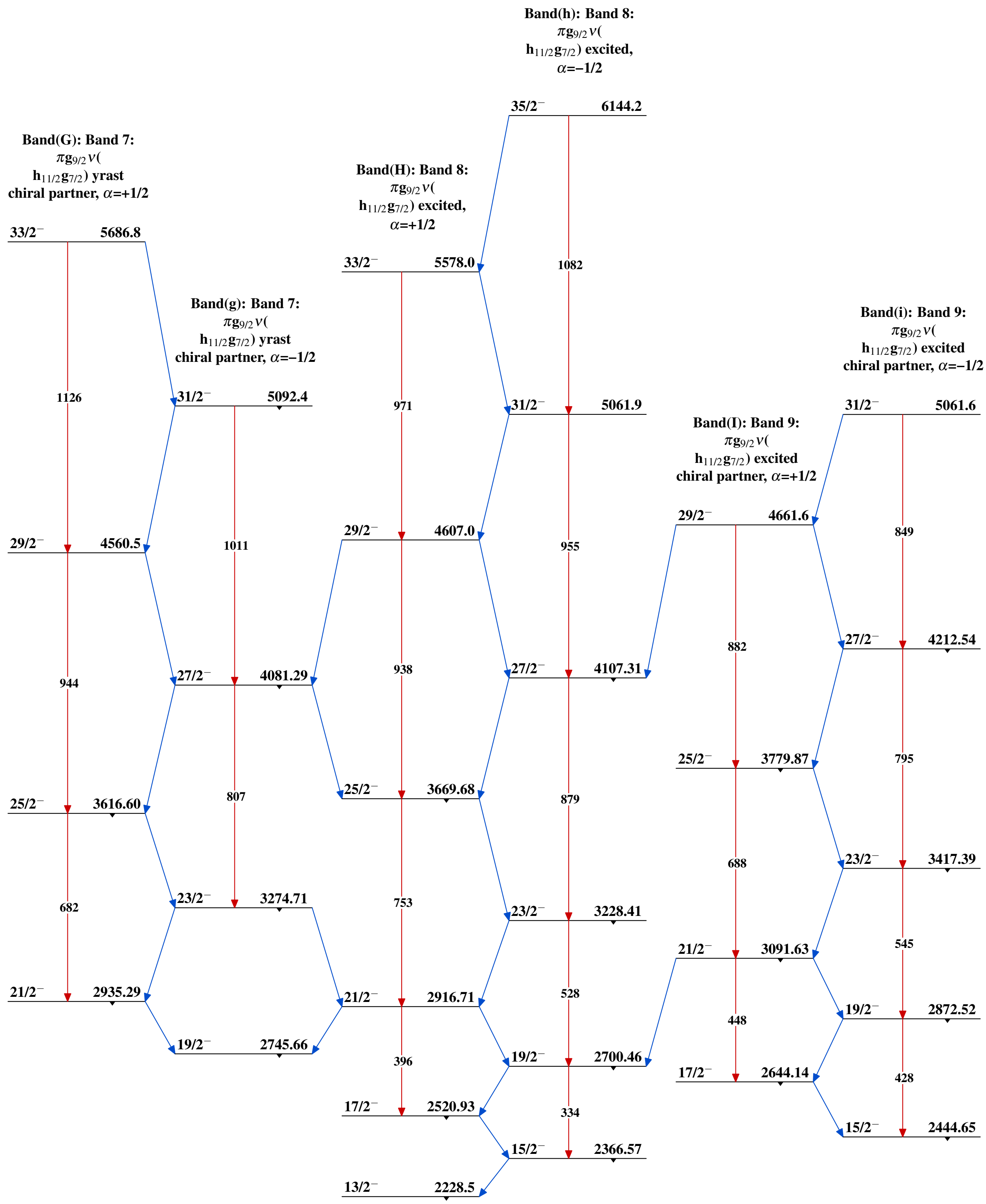
$^{103}_{45}Rh_{58}$

Adopted Levels, Gammas (continued)



$^{103}_{45}Rh_{58}$

Adopted Levels, Gammas (continued)



$^{103}_{45}Rh_{58}$

^{103}Ru β^- decay (39.247 d) 2010Kr05,1970Pe04,1976Ma37

Parent: ^{103}Ru: E=0.0; J$^\pi$=3/2$^+$; $T_{1/2}$=39.247 d *3*; Q(β^-)=764.5 *23*; %β^- decay=100

2010Kr05: ^{103}Ru activity from Ru(n,γ). Measured Eγ,Iγ. Deduced: ^{103}Rh levels, log *ft*.

1970Pe04: ^{103}Ru activity from commercial source and ^{102}Ru(n,γ). Measured: Eβ, Iβ, ce(K), ce(L), Eγ, Iγ. Deduced: ^{103}Rh levels, log *ft*, J$^\pi$, α(K)exp, K:L1:L2:L3, δ(E2/M1). Enriched isotope, double-focusing β spectrometer, Ge(Li) detector.

1976Ma37: ^{103}Ru activity from ^{102}Ru(n,γ). Measured: Eγ, Iγ, Xγ-coin. Deduced: ^{103}Rh levels, log *ft*, J$^\pi$, α, δ(E2/M1), B(E2), B(M1). Enriched targets, Ge(Li) and Si(Li) detectors, anti-Compton spectrometer.

1988Ch44: ^{103}Ru activity from commercial source. Measured: Eγ, Iγ, Iγ(K x ray).

1982Oh04: ^{103}Ru activity from ^{102}Ru(n,γ). Measured: Eβ, Iβ, Ice. Deduced: ^{103}Rh levels, log *ft*, J$^\pi$.

Others: 1950Me26, 1952Co16, 1952Ko27, 1952Kn12, 1954De35, 1955Dr43, 1955Sa16, 1956Sh19, 1958Ro07, 1962Na12, 1964Ka23, 1965Mu09, 1966Po05, 1968Ru08, 1968Mu11, 1968Ma08, 1969Zo02, 1969Ra18, 1969Su08, 1970Ma58, 1970Su05, 1970NiZV, 1971Av03, 1972De67, 1974HeYW, 1976Ba36, 1977Ra02.

^{103}Rh Levels

Level scheme is from 2010Kr05. Same as in 1976Ma37.

E(level)‡	J$^\pi$†	$T_{1/2}$	Comments
0.0	1/2$^-$	stable	
39.754 *8*	7/2$^+$	56.114 min *9*	$T_{1/2}$: from Adopted Levels.
93.038 *10*	9/2$^+$	1.11 ns *3*	$T_{1/2}$: weighted average: 1.06 ns *5* (1973Ba52) via (557γ)(53γ)(t), 1.13 ns *3* (1972Ja01) via (553γ+444γ)(53γ)(t), 1.13 ns *7* (1972Ja01) via (70-150β)(ce(K) 53γ)(t). $T_{1/2}$: others: 1958Fl40, 1969Zo02, 1970Be10, 1978BeYS.
294.969 *8*	3/2$^-$	6.61 ps *18*	
357.392 *17*	5/2$^-$	73 ps *2*	
536.847 *9*	5/2$^+$	39 ps *12*	$T_{1/2}$: from (225β)(497γ)(t) (1968Ra06). Others: 1953En06, 1969Be81, 1970Be10.
607.414 *14*	(5/2$^+$,7/2,9/2)		
650.089 *11*	5/2$^+$	≤0.1 ns	$T_{1/2}$: via $\beta\gamma$(t) (1970Be10). Other: <0.4 ns (1969Zo02).
651.735 *24*	3/2$^+$		

† From Adopted Levels.
‡ From a least-squares fit to Eγ data.

β^- radiations

E(decay)	E(level)	Iβ^-†‡	Log *ft*	Comments
(112.8 *23*)	651.735	0.118 *6*	7.66 *4*	
114 *5*	650.089	6.47 *7*	5.94 *3*	E(decay): weighted average: 112 *6* (1965Mu09), 117 *7* (1970Pe04). Iβ^-: other: 5.3 *16* (1970Pe04).
(157.1 *23*)	607.414	0.0031 *6*	9.69 *9*	
223 *5*	536.847	91.8 *12*	5.728 *16*	E(decay): weighted average of 225 *5* (1970Pe04) and 223 *8* (1982Oh04). Other: 214 *12* (1965Mu09). Iβ^-: others: 91 *2* (1970Pe04), 89 (1965Mu09).
(407.1 *23*)	357.392	0.0041 *18*	10.90 *19*	
(469.5 *23*)	294.969	0.279 *4*	9.281 *10*	
(671.5 *23*)	93.038	0.17 *4*	10.04 *11*	
769 *4*	0.0	0.87 *5*	9.53 *3*	E(decay): from 1982Oh04. Others: 716 *40* (1965Mu09), 725 *15* (1970Pe04). Iβ^-: From Iβ(769β)/Iβ(223β)=0.0094 (1982Oh04) and the present decay scheme. Others: 3 (1965Mu09), 3.5 *2* (1970Pe04), 2.3 calc from absolute Iγ (1975DeYF).

Continued on next page (footnotes at end of table)

^{103}Ru β^- decay (39.247 d) 2010Kr05,1970Pe04,1976Ma37 (continued)

β^- radiations (continued)

† Calculated from absolute transition intensities if not noted.
‡ Absolute intensity per 100 decays.

$\gamma(^{103}Rh)$

Iγ normalization: Based on absolute intensity determination for 497γ. Weighted average: Iγ(497γ)=90.1% *5* (1975DeYF), Iγ(497γ)=90.9% *7* (1981Di01), Iγ(497γ)=91.3% *4* (1982Oh04), Iγ(497γ)=91.08% *76* (1981Mi10).

Unless noted otherwise, α(K)exp=ce(K)(1970Pe04)/Iγ(present) normalized to α(K)(497γ)=0.0046(4) (M1+E2 theory).

E_γ †	I_γ †#	E_i(level)	J_i^π	E_f	J_f^π	Mult.‡	δ	α @	Comments
39.760 *10*	0.0756 *11*	39.754	7/2$^+$	0.0	1/2$^-$	E3+M4	0.023 *5*	1431 *25*	α(K)exp=141.1 *23* (2018Ni14) B(E3)(W.u.)=0.00254 *5*; B(M4)(W.u.)=9.E+3 *4* I_γ: from I(γ+ce) and α. Others: 0.073 *6* (1969Zo02), 0.072 *8* (1970NiZV), 0.060 *6* (1974HeYW). E_γ: weighted average: 39.755 *12* (1969Ra18), 39.762 *16* (1970Pe04). α(tot)exp=1428 *13* (2018Ni14).
42.63 *4*	0.0057 *6*	650.089	5/2$^+$	607.414	(5/2$^+$,7/2,9/2)				I_γ: From 1988Ch44. E_γ: From 1976Ma37.
53.286 *10*	0.487 *11*	93.038	9/2$^+$	39.754	7/2$^+$	M1		2.077 *29*	α(K)exp=1.51 *15* B(M1)(W.u.)=0.0426 *13* I_γ: From 1988Ch44. 0.50 *12* in 2010Kr05.
62.41 *3*	4.8×10^{-4} *4*	357.392	5/2$^-$	294.969	3/2$^-$	M1		1.314 *18*	I_γ: obtained from I(62γ)/I(357γ)=0.0471 *21* in ^{103}Pd decay.
113.191 *36*	0.0035 *3*	650.089	5/2$^+$	536.847	5/2$^+$				
114.870 *25*	0.0091 *3*	651.735	3/2$^+$	536.847	5/2$^+$	M1(+E2)		0.53 *29*	α(K)exp=0.27 *8*
241.875 *10*	0.0157 *3*	536.847	5/2$^+$	294.969	3/2$^-$	E1		0.01179 *17*	α(K)exp=0.012 *3* B(E1)(W.u.)=9.E−8 *3*
292.7 *2*	0.0063 *19*	650.089	5/2$^+$	357.392	5/2$^-$				I_γ: From 1988Ch44. E_γ: From 1976Ma37.
294.964 *10*	0.317 *3*	294.969	3/2$^-$	0.0	1/2$^-$	M1+E2	−0.17 *1*	0.01911 *27*	α(K)exp=0.0158 *20*
317.72 *5*	6.5×10^{-6} *4*	357.392	5/2$^-$	39.754	7/2$^+$				I_γ: obtained from I(317γ)/I(357γ)=0.00068 *4* in ^{103}Pd decay. E_γ: From 1976Ma37.
357.382 *23*	0.0095 *4*	357.392	5/2$^-$	0.0	1/2$^-$	E2		0.01588 *22*	α(K)exp=0.020 *12* Mult.: α(K)exp consistent with E2 as mult.
443.810 *10*	0.373 *4*	536.847	5/2$^+$	93.038	9/2$^+$	E2		0.00807 *11*	α(K)exp=0.0067 *9* B(E2)(W.u.)=0.11 *4*
497.085 *10*	100.0 *10*	536.847	5/2$^+$	39.754	7/2$^+$	M1+E2	−0.368 *11*	0.00524 *7*	α(K)exp=0.0046 *4* B(E2)(W.u.)=2.0 *7*; B(M1)(W.u.)=0.0040 *13* δ: from 1983Kr01.

γ(^{103}Rh) (continued)

E_γ[†]	I_γ[†#]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[‡]	δ	α[@]	Comments
514.365 *12*	0.0068 *1*	607.414	(5/2$^+$,7/2,9/2)	93.038	9/2$^+$				
557.057 *10*	0.924 *9*	650.089	5/2$^+$	93.038	9/2$^+$	E2		0.00415 *6*	α(K)exp=0.0033 *5* B(E2)(W.u.) > 0.48
567.693 *29*	0.0023 *1*	607.414	(5/2$^+$,7/2,9/2)	39.754	7/2$^+$				
610.333 *10*	6.15 *6*	650.089	5/2$^+$	39.754	7/2$^+$	M1(+E2)	0.09 *14*	0.00318 *4*	α(K)exp=0.0025 *3* B(M1)(W.u.) > 0.00081? δ: or δ: >+11, <−6 (1983Kr01).
612.094 *60*	0.115 *6*	651.735	3/2$^+$	39.754	7/2$^+$			0.00319 *4*	α(K)exp=0.008 *5*
651.69 *15*	0.00024 *3*	651.735	3/2$^+$	0.0	1/2$^-$				

† From 2010Kr05 if not noted.

‡ From α(K)exp.

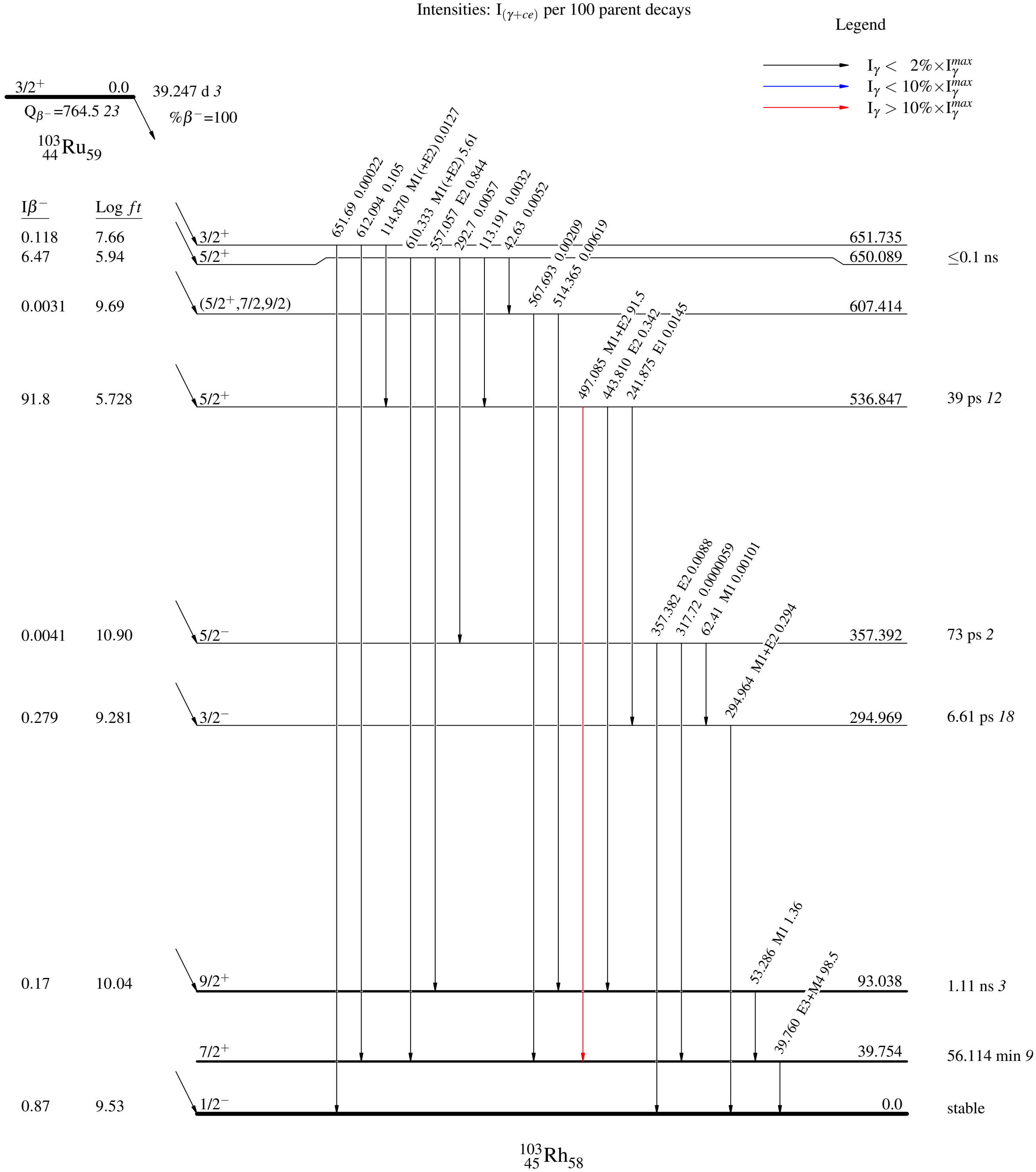
\# For absolute intensity per 100 decays, multiply by 0.910 *7*.

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

^{103}Ru β^- decay (39.247 d) 2010Kr05,1970Pe04,1976Ma37

Decay Scheme

Intensities: $I_{(\gamma+ce)}$ per 100 parent decays



^{103}Rh IT decay (56.114 min)

Parent: ^{103}Rh: E=39.751 *6*; J^π=7/2$^+$; $T_{1/2}$=56.114 min *9*; %IT decay=100

2018Ri01 Source produced by neutron activation of natural Rh at the reactor ISIS of CEA Saclay followed by chemistry. Measured Eγ, Iγ, x-rays using an n-type HPGe detector.

1981Va11: radioactivity ^{57}Co, ^{103}Ru, ^{103m}Rh, ^{103}Pd, ^{109}Cd; measured $T_{1/2}$ Photon counting method, NaI(Tl), Si(Li) detectors.

1969Ra18: ^{103}Ru [from 102Ru(n,γ)]; measured Eγ, Iγ, γγ-coin. ^{103}Rh deduced levels. Enriched target, curved-crystal, Ge(Li) spectrometers.

1975Cz03: radioactivity ^{103m}Rh; measured I(ce), Iγ; deduced α.

1981Va22: radioactivity ^{103m}Rh; measured K x-ray emission probability. Calibrated Si(Li) detectors.

^{103}Rh Levels

E(level)	J^π†	$T_{1/2}$	Comments
0.0	1/2$^-$	stable	
39.755 *6*	7/2$^+$	56.114 min *20*	$T_{1/2}$: from γ(t) (1981Va11). $T_{1/2}$: see also 1944Fl01, 1945Wi03, 1947Fl03, 1950Me26, 1957Jo19, 1967VuZZ, 1969KoZW, 1972Pa10, 1973Gu06, 1974Sa15, 1978La21. %IT=100.

† From Adopted Levels.

γ(^{103}Rh)

Iγ normalization: Absolute intensity is given from I(K x ray) measurements.

Eγ†	Iγ‡@	E_i(level)	J^π_i	E_f	J^π_f	Mult.#	δ#	α&	Comments
39.755 *12*	0.065 *4*	39.755	7/2$^+$	0.0	1/2$^-$	E3+M4	0.023 *5*	1432 *25*	α(K)exp=141.1 *23* Others: 1975Cz03,1972Pa10, 1970NiZV, 1969Le17. α: 1428 *13* (2018Ni14); 1531 *30* (1975Cz03); 1430 *89* (1979VaZE). L1:L2:L3=2.83 *6*:70.2 *14*:100 (1975Ma32), 0.92 *21*:71.0 *15*:100 (1972Br02), 1.63 *25*:69.5 *6*:100 (1970Pe04), 1.45 *45*:68.2 *11*:100 (1969Gr13), 1.26 *5*:69.7 *5*:100 (1968DiZZ). K/(L+M+N+O)=0.0914 *43* (1975Cz03), 0.0986 *50* (1967Br04). With the given mixing ratio the absolute intensity of the 39.755 γ does not yield 100% but only 93%. This discrepancy may suggest a somewhat larger mixing ratio. α(K)exp: from 2018Ni14.

† From 1969Ra18.

‡ From I(K x ray)/100 ^{103}Rh IT decays=6.76 *5* (1975Cz03), 6.97 *28* (1974Sa15), 7.03 *44* (1973In07), 7.00 *35* (1967Br04), 8.43 *13* (1981Va22), 8.25 *17* (2018Ri01) with K fluorescence yield of 0.814 *41* (2017Ri10).

\# From 2018Ni14.

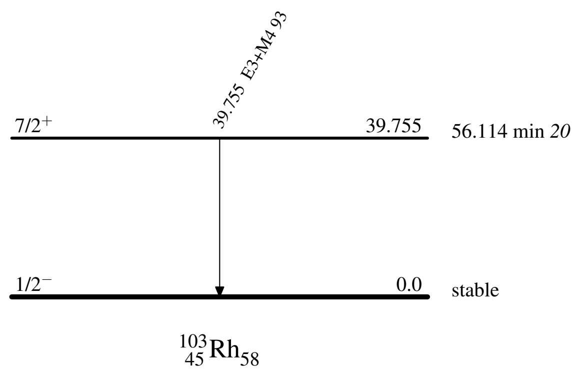
@ Absolute intensity per 100 decays.

& 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.

^{103}Rh IT decay (56.114 min)

Decay Scheme

Intensities: $I_{(\gamma+ce)}$ per 100 parent decays
%IT=100



^{103}Pd ε decay (17.049 d) 2021Ri01,1976Ma37

Parent: ^{103}Pd: E=0.0; J^π=5/2$^+$; $T_{1/2}$=17.049 d *16*; Q(ε)=574.7 *24*; %ε decay=100

2021Ri01: the ^{103}Pd sources were palladium chloride in dilute ammonium hydroxide solution standardize by liquid scintillation counting with the TDCR counter at Laboratoire National Henri Becquerel (LNHB). X rays were detected with a silicon drift detector (SDD) and γ rays were detected with HPGe detectors. Measured Eγ, Iγ, E(X ray), I(X ray), γ(t). Deduced absolute γ-ray emission probabilities, parent $T_{1/2}$.

1976Ma37: ^{103}Pd activity from ^{102}Pd(n,γ). Enriched target. Measured: Eγ, Iγ, Xγ-coin. Deduced: ^{103}Rh levels, log *ft*, J^π, α, δ, B(E2), B(M1).

1969Gr13: ^{103}Pd activity from ^{102}Pd(n,γ), ^{103}Rh(p,n), ^{103}Rh(d,2n). Measured: $T_{1/2}$, Eγ, Iγ, Ice, I-Auger. Deduced: ^{103}Rh levels, log *ft*, J^π, α. Natural and enriched targets.

1969Zo02: ^{103}Pd activity from ^{102}Rh(d,2n). Enriched target. Measured: Eγ, 7Iγ, $\gamma\gamma(\theta)$, Ice, α. Deduced: ^{103}Rh levels, J^π.

Others: 1954Ri09, 1955Sa16, 1955Av11, 1970NiZV, 1974HeYW.

Relative intensities of L-shell X rays

Line	Level	Energy(keV)	I(X ray)
Ll	L3-M1	2.370	2.67 *14*
Lh	L2-M1	2.513	1.73 *9*
L$\alpha_{1,2}$	L3-M4,5	2.695	100 *5*
Lβ_1	L2-M4	2.891	48.5 *24*
Lβ_4	L1-M2	2.891	8.23 *41*
Lβ_3	L1-M3	2.915	
Lβ_6	L3-N1	2.934	
L$\beta_{2,15}$	L3-N4,5	3.012	8.00 *40*
L$\beta_{9,10}$	L1-M4,5	3.101	4.94 *25*
Lγ_1	L2-N4	3.154	0.841 *43*
L$\gamma_{2,3}$	L1-N2,3	3.373	0.848 *44*

total absolute %I(L X ray)=8.61 *43*

Absolute emission probabilities of K-shell X rays

Line	Energy(keV)	%I(X ray)
Kα_2	20.07	19.59 *21*
Kα_1	20.22	39.48 *42*
Kβ_1	22.81	10.27 *11*
Kβ_2	23.20	1.781 *19*

total absolute %I(K X ray)=71.1 *6*

^{103}Rh Levels

E(level)‡	J^π†	$T_{1/2}$
0.0	1/2$^-$	stable
39.748 *8*	7/2$^+$	56.114 min *9*
93.038 *13*	9/2$^+$	1.11 ns *3*
295.00 *4*	3/2$^-$	6.61 ps *18*
357.43 *3*	5/2$^-$	73 ps *2*
536.836 *20*	5/2$^+$	39 ps *12*

† From Adopted Levels.

‡ Calculated from the given gamma energies using a least-squares procedure.

^{103}Pd ε decay (17.049 d) 2021Ri01,1976Ma37 (continued)

ε radiations

E(decay)	E(level)	Iε†	Log *ft*	Comments
(37.9 *24*)	536.836	0.00443 *7*	7.33 *11*	
(217.3 *24*)	357.43	0.02788 *18*	8.576 *11*	
(279.7 *24*)	295.00	6.0×10^{-4} *8*	10.48 *6*	
(535.0 *24*)	39.748	95.5 *45*	5.876 *21*	I($\varepsilon+\beta^+$): 92.8 *19* from the absolute γ intensity by 2021Ri01 using ICC=1434. However, as it is pointed out in the IT DECAY (56.114 M) dataset, either the ICC value or the experimentally determined absolute γ intensity is too low.
(574.7‡ *24*)	0.0	<0.1	>9.0^{1u}	I($\varepsilon+\beta^+$): Assumed value.

† Absolute intensity per 100 decays.

‡ Existence of this branch is questionable.

γ(^{103}Rh)

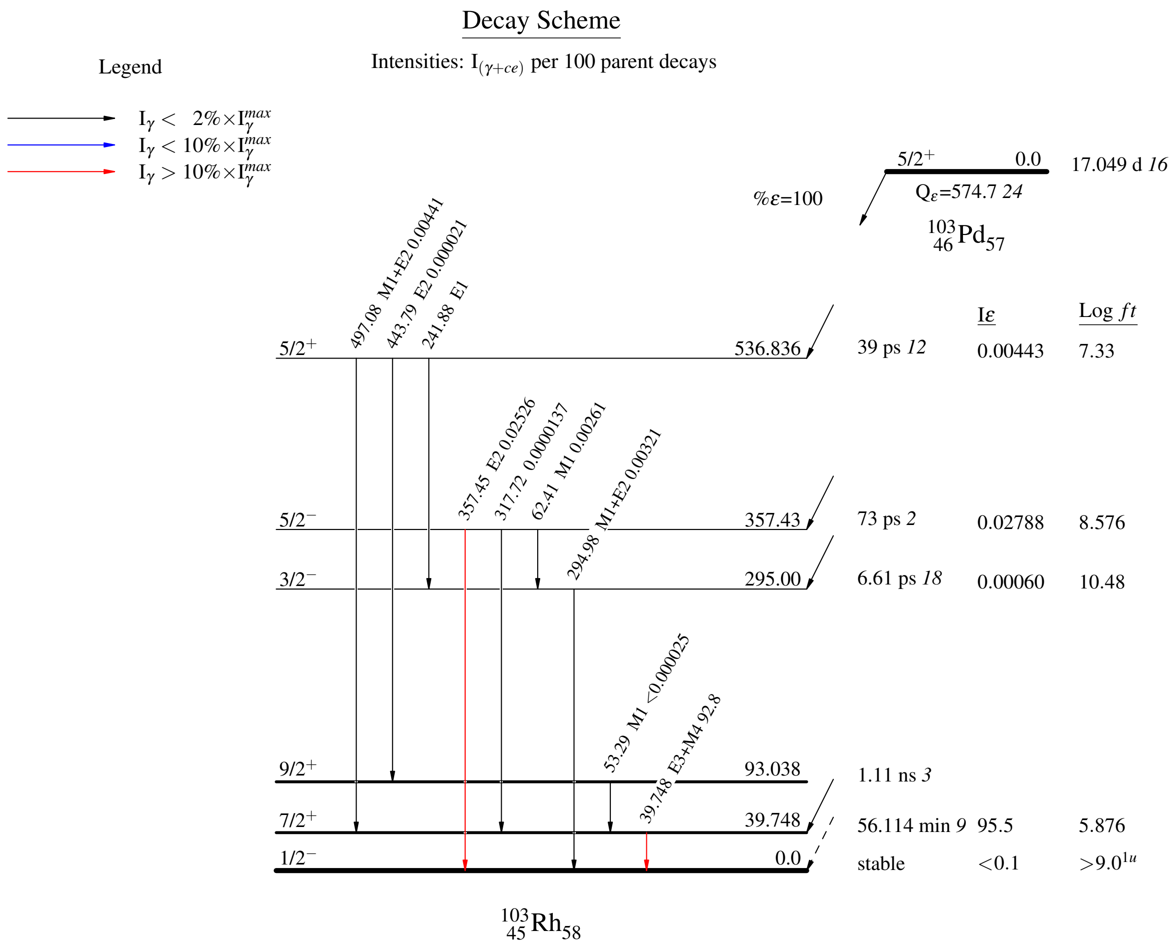
Iγ normalization: Absolute intensities are given from 2021RI01.
α(K)exp=ce(K)(1969Gr13)/Iγ(1976Ma37) normalized to α(K)exp(295γ)=0.0186 from ^{103}Ru β^- decay.

E_γ †	I_γ ‡@	E_i(level)	J_i^π	E_f	J_f^π	Mult.#	δ	α&	Comments
39.748 *8*	0.0647 *7*	39.748	7/2+	0.0	1/2−	E3+M4	0.023 *5*	1434 *25*	E_γ: from 1969Gr13. Mult.,δ: from 2018Ni14.
53.29 *1*	<8×10^{-6}	93.038	9/2+	39.748	7/2+	M1		2.076 *29*	
62.41 *3*	0.001128 *16*	357.43	5/2−	295.00	3/2−	M1		1.314 *18*	α(L)exp=0.15 *3* E_γ: others: 62.30 *12* (1969Gr13), 62.5 *1* (1974HeYW). Mult.: from α(L)exp and L1/(L2+L3).
241.88 *5*		536.836	5/2+	295.00	3/2−	E1		0.01179 *17*	
294.98 *15*	0.00315 *7*	295.00	3/2−	0.0	1/2−	M1+E2	−0.17 *1*	0.01911 *27*	
317.72 *5*	1.37×10^{-5} *17*	357.43	5/2−	39.748	7/2+				
357.45 *8*	0.02486 *17*	357.43	5/2−	0.0	1/2−	E2		0.01587 *22*	α(K)exp=0.010 *2* E_γ: others: 356.98 *9* (1969Gr13), 357.5 *1* (1974HeYW). Mult.: From 1976Ma37.
443.79 *5*	2.1×10^{-5} *8*	536.836	5/2+	93.038	9/2+	E2		0.00807 *11*	
497.08 *2*	0.00439 *7*	536.836	5/2+	39.748	7/2+	M1+E2	−0.368 *11*	0.00524 *7*	

† From 1976Ma37, unless noted otherwise.
‡ From 2021RI01.
# From adopted gammas.
@ Absolute intensity per 100 decays.
& 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.

$^{103}_{45}Rh_{58}$-39

^{103}Pd ε decay (17.049 d) 2021Ri01,1976Ma37



^{94}Zr(^{12}C,p2nγ) 1974Gr07

E=44-56 MeV. Measured: Eγ, Iγ, γ(θ). Observed as impurity in ^{103}Pd spectrum obtained in ^{94}Zr(^{12}C,3nγ) reaction.
E: γγ indicate all observed γ-rays are members of the same cascade.

^{103}Rh Levels

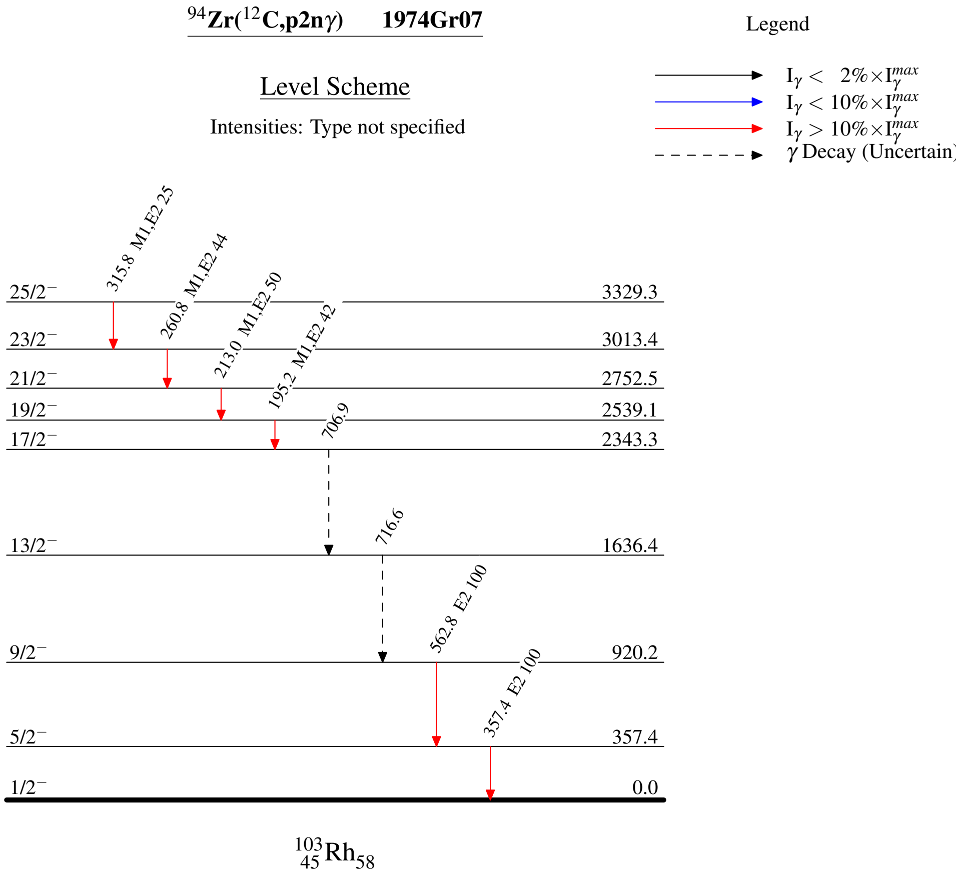
E(level)	J$^{\pi}$ †
0.0	1/2$^-$
357.4	5/2$^-$
920.2	9/2$^-$
1636.4	13/2$^-$
2343.3	17/2$^-$
2539.1	19/2$^-$
2752.5	21/2$^-$
3013.4	23/2$^-$
3329.3	25/2$^-$

† From Adopted Levels.

γ(^{103}Rh)

Eγ	Iγ	E$_i$(level)	J$^{\pi}_i$	E$_f$	J$^{\pi}_f$	Mult.#	Comments
195.2† *2*	42 *7*	2539.1	19/2$^-$	2343.3	17/2$^-$	M1,E2	A$_{22}$=−0.056 *39*, A$_{44}$=−0.003 *43*.
213.0† *2*	50 *6*	2752.5	21/2$^-$	2539.1	19/2$^-$	M1,E2	A$_{22}$=−0.235 *21*, A$_{44}$=0.045 *31*.
260.8† *3*	44 *5*	3013.4	23/2$^-$	2752.5	21/2$^-$	M1,E2	A$_{22}$=−0.117 *28*, A$_{44}$=−0.062 *34*.
315.8† *3*	25 *4*	3329.3	25/2$^-$	3013.4	23/2$^-$	M1,E2	A$_{22}$=−0.340 *172* , A$_{44}$=0.245 *155*.
357.4 *1*	100	357.4	5/2$^-$	0.0	1/2$^-$	E2	A$_{22}$=0.215 *27*, A$_{44}$=−0.093 *34*.
562.8 *1*	100 *19*	920.2	9/2$^-$	357.4	5/2$^-$	E2	A$_{22}$=0.354 *29*, A$_{44}$=−0.137 *38*.
706.9‡@		2343.3	17/2$^-$	1636.4	13/2$^-$		
(716.6‡)		1636.4	13/2$^-$	920.2	9/2$^-$		Probably obscured by the very intense 717.7-keV γ transition in ^{103}Pd.

† Unplaced γ transitions in 1974GR07, placed in the level scheme by the evaluator based on Adopted Levels.
‡ Not observed in 1974GR07, inserted by evaluator based on Adopted Levels to complete the cascade.
# From A$_2$, A$_4$ coefficient of γ(θ); Q assumed E2, D, Q assumed M1,E2.
@ Placement of transition in the level scheme is uncertain.



$^{94}Zr(^{12}C,p2n\gamma)$ 1974Gr07
Level Scheme
Intensities: Type not specified
Legend
$I_\gamma < 2\% \times I_\gamma^{max}$
$I_\gamma < 10\% \times I_\gamma^{max}$
$I_\gamma > 10\% \times I_\gamma^{max}$
γ Decay (Uncertain)
25/2⁻ 3329.3
23/2⁻ 3013.4
21/2⁻ 2752.5
19/2⁻ 2539.1
17/2⁻ 2343.3
13/2⁻ 1636.4
9/2⁻ 920.2
5/2⁻ 357.4
1/2⁻ 0.0
315.8 M1,E2 25
260.8 M1,E2 44
213.0 M1,E2 50
195.2 M1,E2 42
706.9
716.6
562.8 E2 100
357.4 E2 100
$^{103}_{45}Rh_{58}$

$^{96}Zr(^{11}B,4n\gamma),^{11}B(^{96}Zr,4n\gamma)$ **2014Ku15,2006Ti01,2008Su18**

2014KU15,2006TI01: $^{96}Zr(^{11}B,4n\gamma)$ E=40 MeV. Measured: Eγ, Iγ, γγ, γγ(θ)(DCO) using Gammasphere array at LBNL cyclotron facility. Deduced high-spin levels, bands, J, π, configurations, B(M1)/B(E2) ratios, chiral doublet bands.

2008SU18: $^{11}B(^{96}Zr,4n\gamma)$ E=330 MeV. Measured lifetimes by recoil-distance Doppler-shift (RDDS) method using Gammasphere array at Argonne facility.

^{103}Rh Levels

The level scheme is a combination of the level schemes of 2014KU15 and 2006TI01.

E(level)[†]	Jπ[‡]	$T_{1/2}$[#]	Comments
0.0[@]	1/2−		
39.753[b] 6	7/2+	56.114 min 9	%IT=100 $T_{1/2}$: from Adopted Levels of ^{103}Rh in ENSDF database.
93.041[a] 9	9/2+		
294.80[&] 21	3/2−		
357.24[@] 16	5/2−		
656.99[b] 13	11/2+		
820.86[a] 13	13/2+	3.0 ps 13	
847.22[&] 21	7/2−		
902.90[d] 17	11/2+		
919.59[@] 18	9/2−		
1348.76[c] 17	13/2+		
1523.61[b] 16	15/2+		
1586.03[&] 20	11/2−		
1636.68[@] 17	13/2−		
1716.08[a] 16	17/2+	0.54 ps 12	
1850.94[d] 19	15/2+		
2033.73[i] 18	13/2−		
2219.53[j] 17	15/2−		
2228.0[m] 3	13/2−		
2343.82[i] 18	17/2−		
2366.05[n] 18	15/2−		
2394.84[&] 23	15/2−		
2416.94[@] 20	17/2−		
2418.23[c] 21	17/2+		
2444.11[p] 23	15/2−		
2520.30[m] 18	17/2−		
2524.01[b] 22	19/2+		
2539.10[j] 20	19/2−		
2643.57[o] 23	17/2−		
2699.78[n] 18	19/2−		
2737.95[a] 22	21/2+	0.50 ps 9	
2745.03[l] 22	19/2−		
2751.96[i] 22	21/2−		
2871.95[p] 21	19/2−		
2882.1[d] 3	19/2+		
2916.03[m] 20	21/2−		
2934.73[k] 21	21/2−		
3012.59[j] 24	23/2−		

Continued on next page (footnotes at end of table)

^{96}Zr(^{11}B,4nγ),^{11}B(^{96}Zr,4nγ) 2014Ku15,2006Ti01,2008Su18 (continued)

^{103}Rh Levels (continued)

E(level)[†]	J^{π}[‡]	$T_{1/2}$[#]	E(level)[†]	J^{π}[‡]	$T_{1/2}$[#]	E(level)[†]	J^{π}[‡]
3091.00[o] *20*	21/2⁻		4106.64[n] *25*	27/2⁻		5298.7[i] *4*	33/2⁻
3227.78[n] *22*	23/2⁻		4196.4[i] *3*	29/2⁻		5577.4[m] *3*	33/2⁻
3274.00[l] *22*	23/2⁻		4211.86[p] *23*	27/2⁻		5656.2[g] *4*	33/2⁺
3277.4[e] *3*	21/2⁺		4321.2[e] *4*	29/2⁺	0.50 ps *16*	5662.7[f] *5*	35/2⁺
3328.32[i] *24*	25/2⁻		4485.1[h] *3*	27/2⁺		5686.1[k] *4*	33/2⁻
3396.6[f] *3*	23/2⁺	0.69 ps *19*	4559.8[k] *3*	29/2⁻		5925.2[j] *5*	35/2⁻
3416.75[p] *21*	23/2⁻		4606.3[m] *3*	29/2⁻		6102.1[h] *5*	35/2⁺
3487.3[c] *4*	21/2⁺		4660.9[o] *3*	29/2⁻		6143.5[n] *4*	35/2⁻
3615.94[k] *22*	25/2⁻		4705.0[f] *4*	31/2⁺		6204.2[e] *5*	37/2⁺
3630.9[e] *3*	25/2⁺	0.66 ps *12*	4764.7[j] *4*	31/2⁻		6568.4[g] *5*	37/2⁺
3668.98[m] *23*	25/2⁻		4829.5[g] *3*	29/2⁺		6588.0[i] *5*	37/2⁻
3770.0[j] *3*	27/2⁻		5060.9[p] *4*	31/2⁻		6747.4[f] *6*	39/2⁺
3779.21[o] *23*	25/2⁻		5061.3[n] *3*	31/2⁻		7113.6[h] *6*	39/2⁺
3867.6[a] *4*	25/2⁺		5091.8[l] *3*	31/2⁻		7188.0[j] *6*	39/2⁻
3939.4[f] *3*	27/2⁺	0.69 ps *7*	5196.3[e] *4*	33/2⁺		7358.8[e] *6*	41/2⁺
4080.60[l] *24*	27/2⁻		5206.3[h] *4*	31/2⁺		7993.8[f] *7*	43/2⁺

† From least-squares fit to Eγ data.
‡ From $\gamma\gamma(\theta)$(DCO), band structures, and previous assignments for low-lying levels.
# From recoil-distance method in inverse kinematics (2008Su18).
@ Band(A): Band 1: $\pi p_{1/2}$, α=+1/2.
& Band(a): Band 1: $\pi p_{1/2}$, α=−1/2.
a Band(B): Band 2: $\pi g_{9/2}$, α=+1/2.
b Band(b): Band 2: $\pi g_{9/2}$, α=−1/2.
c Band(C): Band 3: $\pi g_{9/2}+\gamma$ vib, α=+1/2.
d Band(c): Band 3: $\pi g_{9/2}+\gamma$ vib, α=−1/2.
e Band(D): Band 4: $\pi g_{9/2}\nu h^2_{11/2}$, α=+1/2.
f Band(d): Band 4: $\pi g_{9/2}\nu h^2_{11/2}$, α=−1/2.
g Band(E): Band 5: $\pi g_{9/2}\nu h^2_{11/2}$ chiral partner, α=+1/2.
h Band(e): Band 5: $\pi g_{9/2}\nu h^2_{11/2}$) chiral partner, α=−1/2.
i Band(F): Band 6: $\pi g_{9/2}\nu(h_{11/2}g_{7/2})$ yrast, α=+1/2.
j Band(f): Band 6: $\pi g_{9/2}\nu(h_{11/2}g_{7/2})$ yrast, α=−1/2.
k Band(G): Band 7: $\pi g_{9/2}\nu(h_{11/2}g_{7/2})$ yrast chiral partner, α=+1/2.
l Band(g): Band 7: $\pi g_{9/2}\nu(h_{11/2}g_{7/2})$ yrast chiral partner, α=−1/2.
m Band(H): Band 8: $\pi g_{9/2}\nu(h_{11/2}g_{7/2})$ excited, α=+1/2.
n Band(h): Band 8: $\pi g_{9/2}\nu(h_{11/2}g_{7/2})$ excited, α=−1/2.
o Band(I): Band 9: $\pi g_{9/2}\nu(h_{11/2}g_{7/2})$ excited chiral partner, α=+1/2.
p Band(i): Band 9: $\pi g_{9/2}\nu(h_{11/2}g_{7/2})$ excited chiral partner, α=−1/2.

^{96}Zr(^{11}B,4nγ),^{11}B(^{96}Zr,4nγ) 2014Ku15,2006Ti01,2008Su18 (continued)

γ(^{103}Rh)

E_γ†	I_γ†	E_i(level)	J^π_i	E_f	J^π_f	Mult.‡	Comments
(39.753 *6*)		39.753	7/2$^+$	0.0	1/2$^-$	E3+M4	E_γ,Mult.: from Adopted dataset.
53.288 *7*	14	93.041	9/2$^+$	39.753	7/2$^+$		E_γ: from Adopted dataset.
62.3 *4*	3	357.24	5/2$^-$	294.80	3/2$^-$		
72.4 *5*	4	919.59	9/2$^-$	847.22	7/2$^-$		
101.5 *4*	1	2745.03	19/2$^-$	2643.57	17/2$^-$		
119.1 *4*	1	3396.6	23/2$^+$	3277.4	21/2$^+$		
122.1 *4*	5	2539.10	19/2$^-$	2416.94	17/2$^-$		
124.2 *2*	18	2343.82	17/2$^-$	2219.53	15/2$^-$		
125.3 *3*	1	2520.30	17/2$^-$	2394.84	15/2$^-$		
138.2 *3*	1	2366.05	15/2$^-$	2228.0	13/2$^-$		
146.4 *3*	1	2366.05	15/2$^-$	2219.53	15/2$^-$		
154.0 *3*	5	2520.30	17/2$^-$	2366.05	15/2$^-$		
163.7 *3*	9	820.86	13/2$^+$	656.99	11/2$^+$		
170.9 *3*	4	2916.03	21/2$^-$	2745.03	19/2$^-$		
179.3 *2*	20	2699.78	19/2$^-$	2520.30	17/2$^-$		
185.7 *2*	4	2219.53	15/2$^-$	2033.73	13/2$^-$		
189.5 *4*	1	2934.73	21/2$^-$	2745.03	19/2$^-$		
192.4 *3*	4	1716.08	17/2$^+$	1523.61	15/2$^+$		
195.1 *3*	45	2539.10	19/2$^-$	2343.82	17/2$^-$		
197.3 *3*	1	2416.94	17/2$^-$	2219.53	15/2$^-$		
199.5 *4*	1	2643.57	17/2$^-$	2444.11	15/2$^-$		
205.7 *3*	3	2745.03	19/2$^-$	2539.10	19/2$^-$		
212.8 *2*	42	2751.96	21/2$^-$	2539.10	19/2$^-$		
213.8 *3*	1	2737.95	21/2$^+$	2524.01	19/2$^+$		
216.2 *2*	15	2916.03	21/2$^-$	2699.78	19/2$^-$		
219.0 *3*	2	3091.00	21/2$^-$	2871.95	19/2$^-$		
226.3 *5*	1	2643.57	17/2$^-$	2416.94	17/2$^-$		
228.3 *4*	1	2871.95	19/2$^-$	2643.57	17/2$^-$		
234.2 *3*	15	3630.9	25/2$^+$	3396.6	23/2$^+$		
234.9 *3*	10	2934.73	21/2$^-$	2699.78	19/2$^-$		
252.0 *3*	1	3668.98	25/2$^-$	3416.75	23/2$^-$		
260.5 *2*	34	3012.59	23/2$^-$	2751.96	21/2$^-$		
282.7 *3*	2	2699.78	19/2$^-$	2416.94	17/2$^-$		
294.7 *3*	7	294.80	3/2$^-$	0.0	1/2$^-$		
300.7 *3*	5	2520.30	17/2$^-$	2219.53	15/2$^-$		
308.3 *4*	20	3939.4	27/2$^+$	3630.9	25/2$^+$		E_γ: 382 in table I of 2008Su18 is a misprint, it should be 308 according to e-mail reply from the first author on Oct 1, 2008.
309.6 *5*	1	2343.82	17/2$^-$	2033.73	13/2$^-$		
311.6 *2*	9	3227.78	23/2$^-$	2916.03	21/2$^-$		
315.6 *2*	23	3328.32	25/2$^-$	3012.59	23/2$^-$		
319.4 *4*	1	2539.10	19/2$^-$	2219.53	15/2$^-$		
325.7 *3*	3	3416.75	23/2$^-$	3091.00	21/2$^-$		
327.4 *6*	1	1850.94	15/2$^+$	1523.61	15/2$^+$		
332.2 *3*	2	2366.05	15/2$^-$	2033.73	13/2$^-$		
334.0 *3*	1	2699.78	19/2$^-$	2366.05	15/2$^-$		
339.1 *2*	7	3274.00	23/2$^-$	2934.73	21/2$^-$		
341.7 *3*	6	3615.94	25/2$^-$	3274.00	23/2$^-$		
344.4 *5*	1	4829.5	29/2$^+$	4485.1	27/2$^+$	D	DCO=0.65 *11*
353.5 *9*	1	3630.9	25/2$^+$	3277.4	21/2$^+$		
355.9 *3*	8	2699.78	19/2$^-$	2343.82	17/2$^-$		
357.1 *2*	98	357.24	5/2$^-$	0.0	1/2$^-$		
357.9 *4*	2	3274.00	23/2$^-$	2916.03	21/2$^-$		
362.3 *3*	2	3779.21	25/2$^-$	3416.75	23/2$^-$		
376.8 *3*	1	5206.3	31/2$^+$	4829.5	29/2$^+$	D	DCO=0.53 *9*

Continued on next page (footnotes at end of table)

^{96}Zr(^{11}B,4nγ),^{11}B(^{96}Zr,4nγ) 2014Ku15,2006Ti01,2008Su18 (continued)

γ(^{103}Rh) (continued)

Eγ†	Iγ†	Ei(level)	J_i^π	Ef	J_f^π	Mult.‡	Comments
381.8 *4*	11	4321.2	29/2+	3939.4	27/2+		
383.6 *5*	7	4705.0	31/2+	4321.2	29/2+		
387.9 *3*	1	3615.94	25/2−	3227.78	23/2−		
391.0 *3*	2	3091.00	21/2−	2699.78	19/2−	D	DCO=0.54 *13*
395.6 *3*	3	2934.73	21/2−	2539.10	19/2−	D	DCO=0.55 *2*
395.9 *3*	1	2916.03	21/2−	2520.30	17/2−		
396.6 *3*	2	2033.73	13/2−	1636.68	13/2−		
399.9 *4*	1	5060.9	31/2−	4660.9	29/2−		
401.1 *3*	2	2745.03	19/2−	2343.82	17/2−		
407.9 *4*	1	2751.96	21/2−	2343.82	17/2−		
410.9 *4*	1	4080.60	27/2−	3668.98	25/2−		
426.4 *3*	6	4196.4	29/2−	3770.0	27/2−		
427.8 *4*	1	2871.95	19/2−	2444.11	15/2−		
430.8 *5*	1	5091.8	31/2−	4660.9	29/2−		
432.4 *3*	1	4211.86	27/2−	3779.21	25/2−		
437.6 *3*	2	4106.64	27/2−	3668.98	25/2−		
440.9 *3*	4	3668.98	25/2−	3227.78	23/2−		
441.6 *3*	11	3770.0	27/2−	3328.32	25/2−		
445.3 *6*	1	6102.1	35/2+	5656.2	33/2+	D	DCO=0.97 *11* DCO is from dipole gate.
445.9 *3*	2	1348.76	13/2+	902.90	11/2+	D	DCO=1.12 *7* DCO is from dipole gate.
447.5 *4*	1	3091.00	21/2−	2643.57	17/2−		
449.0 *4*	1	4660.9	29/2−	4211.86	27/2−		
450.2 *4*	1	5656.2	33/2+	5206.3	31/2+	D	DCO=1.01 *12* DCO is from dipole gate.
454.7 *3*	1	5061.3	31/2−	4606.3	29/2−		
454.9 *3*	2	2871.95	19/2−	2416.94	17/2−		
463.7 *4*	1	2882.1	19/2+	2418.23	17/2+		
464.5 *3*	4	4080.60	27/2−	3615.94	25/2−		
465.7 *4*	1	6568.4	37/2+	6102.1	35/2+		
466.3 *4*	2	5662.7	35/2+	5196.3	33/2+		
473.5 *4*	2	3012.59	23/2−	2539.10	19/2−		
479.1 *3*	1	4559.8	29/2−	4080.60	27/2−		
481.9 *3*	1	3416.75	23/2−	2934.73	21/2−		
482.6 *4*	1	3227.78	23/2−	2745.03	19/2−		
489.9 *3*	3	847.22	7/2−	357.24	5/2−		
490.5 *3*	1	4106.64	27/2−	3615.94	25/2−		
491.1 *3*	4	5196.3	33/2+	4705.0	31/2+		
499.5 *3*	1	4606.3	29/2−	4106.64	27/2−		
500.7 *3*	1	3416.75	23/2−	2916.03	21/2−		
502.0 *3*	6	1850.94	15/2+	1348.76	13/2+	D	DCO=0.91 *5* DCO is from dipole gate.
504.8 *3*	1	3779.21	25/2−	3274.00	23/2−		
516.0 *3*	1	5577.4	33/2−	5061.3	31/2−		
525.5 *5*	1	4606.3	29/2−	4080.60	27/2−		
527.8 *4*	1	1348.76	13/2+	820.86	13/2+		
528.1 *3*	1	3227.78	23/2−	2699.78	19/2−		
531.9 *3*	1	5091.8	31/2−	4559.8	29/2−		
534.0 *3*	1	5298.7	33/2−	4764.7	31/2−		
539.4 *3*	2	3277.4	21/2+	2737.95	21/2+		
541.2 *5*	1	6204.2	37/2+	5662.7	35/2+		
542.8 *2*	1	4211.86	27/2−	3668.98	25/2−		
543.1 *4*	1	3939.4	27/2+	3396.6	23/2+		
543.2 *5*	1	6747.4	39/2+	6204.2	37/2+		
544.9 *3*	1	3416.75	23/2−	2871.95	19/2−		

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$^{96}Zr(^{11}B,4n\gamma),^{11}B(^{96}Zr,4n\gamma)$ 2014Ku15,2006Ti01,2008Su18 (continued)

$\gamma(^{103}Rh)$ (continued)

E_γ†	I_γ†	E_i(level)	J^π_i	E_f	J^π_f	Mult.‡	Comments
545.3 *5*	1	7113.6	39/2+	6568.4	37/2+		
552.4 *3*	1	847.22	7/2−	294.80	3/2−		
554.4 *4*	1	4660.9	29/2−	4106.64	27/2−		
562.2 *2*	98	919.59	9/2−	357.24	5/2−		
563.9 *2*	26	656.99	11/2+	93.041	9/2+		
566.2 *3*	1	6143.5	35/2−	5577.4	33/2−		
567.2 *5*	1	2418.23	17/2+	1850.94	15/2+	D	DCO=1.11 *18* DCO is from dipole gate.
568.2 *3*	3	4764.7	31/2−	4196.4	29/2−		
574.2 *3*	1	3274.00	23/2−	2699.78	19/2−	Q	DCO=0.89 *18*
576.5 *3*	2	3328.32	25/2−	2751.96	21/2−		
582.6 *3*	5	2219.53	15/2−	1636.68	13/2−		
591.2 *4*	1	2228.0	13/2−	1636.68	13/2−		
594.2 *4*	1	5686.1	33/2−	5091.8	31/2−		
596.2 *3*	1	4211.86	27/2−	3615.94	25/2−		
600.1 *5*	1	7188.0	39/2−	6588.0	37/2−		
605.2 *3*	5	3487.3	21/2+	2882.1	19/2+		
610.8 *4*	1	3939.4	27/2+	3328.32	25/2−		
611.4 *5*	1	7358.8	41/2+	6747.4	39/2+		
617.3 *3*	3	656.99	11/2+	39.753	7/2+		
617.5 *4*	1	4485.1	27/2+	3867.6	25/2+		
618.1 *4*	1	3630.9	25/2+	3012.59	23/2−		
626.3 *4*	1	5925.2	35/2−	5298.7	33/2−		
634.9 *6*	1	7993.8	43/2+	7358.8	41/2+		
642.3 *4*	1	2228.0	13/2−	1586.03	11/2−		
658.6 *3*	12	3396.6	23/2+	2737.95	21/2+		
662.8 *4*	1	6588.0	37/2−	5925.2	35/2−		
664.6 *4*	1	3416.75	23/2−	2751.96	21/2−		
666.5 *3*	4	1586.03	11/2−	919.59	9/2−		
674.3 *3*	1	3091.00	21/2−	2416.94	17/2−	Q	DCO=0.93 *11*
681.5 *3*	1	3615.94	25/2−	2934.73	21/2−		
688.4 *3*	1	3779.21	25/2−	3091.00	21/2−		
691.0 *6*	2	4321.2	29/2+	3630.9	25/2+		
691.7 *3*	8	1348.76	13/2+	656.99	11/2+	D	DCO=1.11 *6* DCO is from dipole gate.
695.6 *4*	2	2219.53	15/2−	1523.61	15/2+		
700.2 *3*	1	3615.94	25/2−	2916.03	21/2−	Q	DCO=0.88 *19*
701.8 *4*	1	2418.23	17/2+	1716.08	17/2+		
702.6 *3*	22	1523.61	15/2+	820.86	13/2+		
707.2 *3*	51	2343.82	17/2−	1636.68	13/2−		
716.9 *2*	100	1636.68	13/2−	919.59	9/2−		
720.9 *3*	1	5206.3	31/2+	4485.1	27/2+		
728.0 *2*	85	820.86	13/2+	93.041	9/2+		
729.3 *4*	1	2366.05	15/2−	1636.68	13/2−		
738.7 *3*	2	1586.03	11/2−	847.22	7/2−		
747.3 *3*	1	3091.00	21/2−	2343.82	17/2−		
752.3 *3*	1	4080.60	27/2−	3328.32	25/2−		
753.0 *4*	1	3668.98	25/2−	2916.03	21/2−		
753.2 *4*	1	3277.4	21/2+	2524.01	19/2+		
757.5 *3*	2	3770.0	27/2−	3012.59	23/2−		
758.0 *3*	2	2394.84	15/2−	1636.68	13/2−		
765.9 *4*	2	4705.0	31/2+	3939.4	27/2+		
779.9 *4*	2	2366.05	15/2−	1586.03	11/2−		
780.2 *3*	17	2416.94	17/2−	1636.68	13/2−		
795.3 *3*	1	4211.86	27/2−	3416.75	23/2−		
804.3 *3*	2	2520.30	17/2−	1716.08	17/2+		

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^{96}Zr(^{11}B,4nγ),^{11}B(^{96}Zr,4nγ) 2014Ku15,2006Ti01,2008Su18 (continued)

γ(^{103}Rh) (continued)

$E_γ$†	$I_γ$†	E_i(level)	$J_i^π$	E_f	$J_f^π$	Mult.‡	Comments
806.8 3	1	4080.60	27/2⁻	3274.00	23/2⁻		
807.6 3	1	2444.11	15/2⁻	1636.68	13/2⁻		
807.7 3	9	2524.01	19/2⁺	1716.08	17/2⁺		
808.8 3	2	2394.84	15/2⁻	1586.03	11/2⁻		
809.9 3	2	902.90	11/2⁺	93.041	9/2⁺	D	DCO=0.95 12 DCO is from dipole gate.
820.2 3	5	2343.82	17/2⁻	1523.61	15/2⁺		
822.9 4	2	2539.10	19/2⁻	1716.08	17/2⁺		
826.5 4	1	5656.2	33/2⁺	4829.5	29/2⁺		
849.1 4	1	5060.9	31/2⁻	4211.86	27/2⁻		
853.9 5	1	4485.1	27/2⁺	3630.9	25/2⁺		
857.9 3	1	2444.11	15/2⁻	1586.03	11/2⁻		
863.2 3	5	902.90	11/2⁺	39.753	7/2⁺	Q	DCO=1.46 14 DCO is from dipole gate.
866.7 2	14	1523.61	15/2⁺	656.99	11/2⁺		
868.0 4	2	4196.4	29/2⁻	3328.32	25/2⁻		
872.8 3	5	3396.6	23/2⁺	2524.01	19/2⁺		
875.5 6	1	5196.3	33/2⁺	4321.2	29/2⁺		
879.1 3	1	4106.64	27/2⁻	3227.78	23/2⁻		
881.6 3	1	4660.9	29/2⁻	3779.21	25/2⁻		
883.8 3	12	2520.30	17/2⁻	1636.68	13/2⁻		
885.2 5	1	5206.3	31/2⁺	4321.2	29/2⁺		
889.9 5	1	4829.5	29/2⁺	3939.4	27/2⁺		
893.3 4	14	3630.9	25/2⁺	2737.95	21/2⁺		
894.7 3	3	2418.23	17/2⁺	1523.61	15/2⁺		
895.3 2	61	1716.08	17/2⁺	820.86	13/2⁺		
895.5 3	1	5091.8	31/2⁻	4196.4	29/2⁻		
895.5 4	1	6102.1	35/2⁺	5206.3	31/2⁺		
912.7 4	1	6568.4	37/2⁺	5656.2	33/2⁺		
937.5 3	1	4606.3	29/2⁻	3668.98	25/2⁻		
944.1 3	1	4559.8	29/2⁻	3615.94	25/2⁻		
948.1 3	6	1850.94	15/2⁺	902.90	11/2⁺	Q	DCO=0.96 8
951.7 5	1	5656.2	33/2⁺	4705.0	31/2⁺		
954.7 3	1	5061.3	31/2⁻	4106.64	27/2⁻		
957.7 4	1	5662.7	35/2⁺	4705.0	31/2⁺		
962.1 4	1	4829.5	29/2⁺	3867.6	25/2⁺	Q	DCO=0.95 12
971.2 3	1	5577.4	33/2⁻	4606.3	29/2⁻		
983.7 3	4	2699.78	19/2⁻	1716.08	17/2⁺		
994.9 4	1	4764.7	31/2⁻	3770.0	27/2⁻		
996.7 3	2	2520.30	17/2⁻	1523.61	15/2⁺		
1000.6 3	7	2524.01	19/2⁺	1523.61	15/2⁺		
1007.0 3	2	2643.57	17/2⁻	1636.68	13/2⁻	Q	DCO=1.07 4
1007.9 5	1	6204.2	37/2⁺	5196.3	33/2⁺		
1011.0 4	1	5091.8	31/2⁻	4080.60	27/2⁻		
1011.5 5	1	7113.6	39/2⁺	6102.1	35/2⁺		
1022.0 2	37	2737.95	21/2⁺	1716.08	17/2⁺		
1030.2 3	3	1850.94	15/2⁺	820.86	13/2⁺		
1031.3 4	3	2882.1	19/2⁺	1850.94	15/2⁺		
1069#		3487.3	21/2⁺	2418.23	17/2⁺		Based on communication with authors of 2006Ti01, this transition is rejected.
1069.5 3	2	2418.23	17/2⁺	1348.76	13/2⁺		
1082.2 3	1	6143.5	35/2⁻	5061.3	31/2⁻		
1085.0 5	1	6747.4	39/2⁺	5662.7	35/2⁺		
1088.4 5	1	4485.1	27/2⁺	3396.6	23/2⁺	Q	DCO=1.49 26 DCO is from dipole gate.

Continued on next page (footnotes at end of table)

^{96}Zr(^{11}B,4nγ),^{11}B(^{96}Zr,4nγ) 2014Ku15,2006Ti01,2008Su18 (continued)

γ(^{103}Rh) (continued)

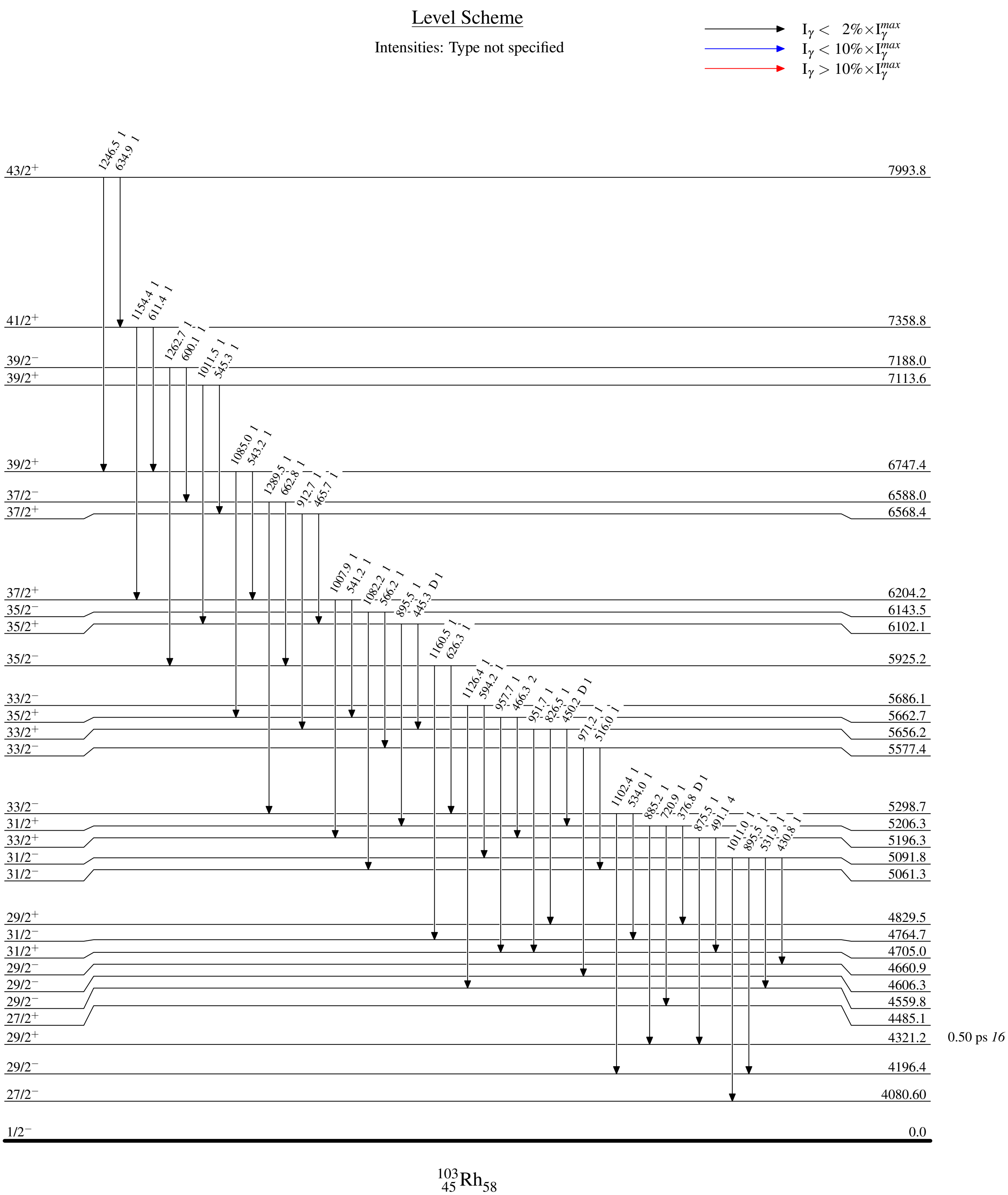
E_γ †	I_γ †	E_i(level)	J_i^π	E_f	J_f^π
1102.4 *4*	1	5298.7	33/2−	4196.4	29/2−
1114.2 *3*	4	2033.73	13/2−	919.59	9/2−
1126.4 *4*	1	5686.1	33/2−	4559.8	29/2−
1129.3 *2*	3	3867.6	25/2+	2737.95	21/2+
1154.4 *6*	1	7358.8	41/2+	6204.2	37/2+
1156.1 *3*	1	2871.95	19/2−	1716.08	17/2+
1160.5 *5*	1	5925.2	35/2−	4764.7	31/2−
1166.1 *4*	1	2882.1	19/2+	1716.08	17/2+
1198.5 *5*	1	4829.5	29/2+	3630.9	25/2+
1212.7 *3*	5	2033.73	13/2−	820.86	13/2+
1246.5 *6*	1	7993.8	43/2+	6747.4	39/2+
1255.6 *5*	1	1348.76	13/2+	93.041	9/2+
1262.7 *6*	1	7188.0	39/2−	5925.2	35/2−
1289.5 *5*	1	6588.0	37/2−	5298.7	33/2−
1398.7 *4*	12	2219.53	15/2−	820.86	13/2+
1545.4 *3*	3	2366.05	15/2−	820.86	13/2+

† From private communication with the authors of 2014KU15 and 2006TI01. Intensities are estimated values with large possible uncertainties.

‡ From DCO ratios gated on ΔJ=2, quadrupole transitions if not noted. Expected DCO ratios from quadrupole gates are ≈1.0 for ΔJ=2, quadrupole and ≈0.5 for ΔJ=1, dipole transitions.

Placement of transition in the level scheme is uncertain.

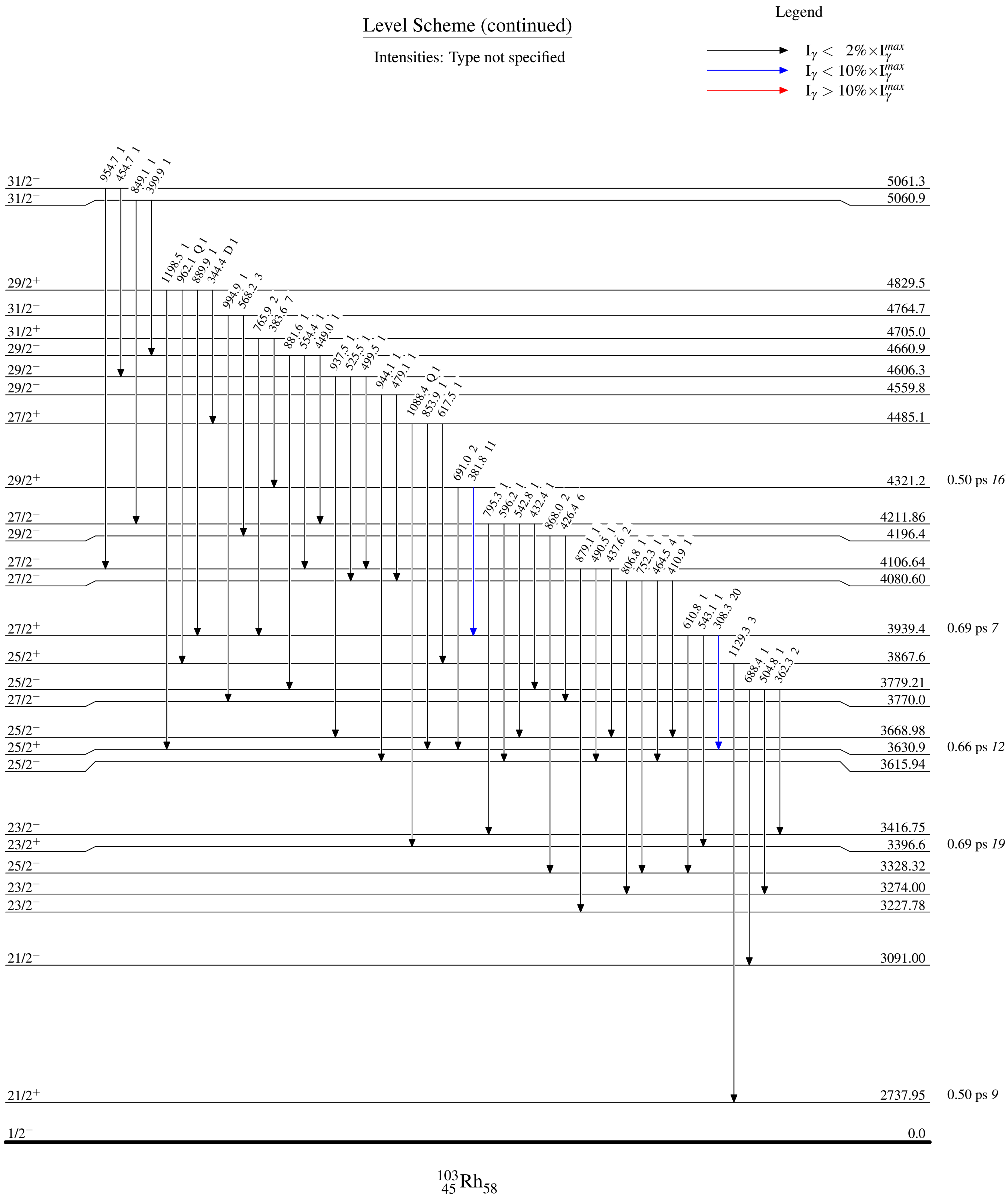
$^{96}Zr(^{11}B,4n\gamma),^{11}B(^{96}Zr,4n\gamma)$ 2014Ku15,2006Ti01,2008Su18



^{96}Zr(^{11}B,4nγ),^{11}B(^{96}Zr,4nγ) 2014Ku15,2006Ti01,2008Su18

Level Scheme (continued)

Intensities: Type not specified



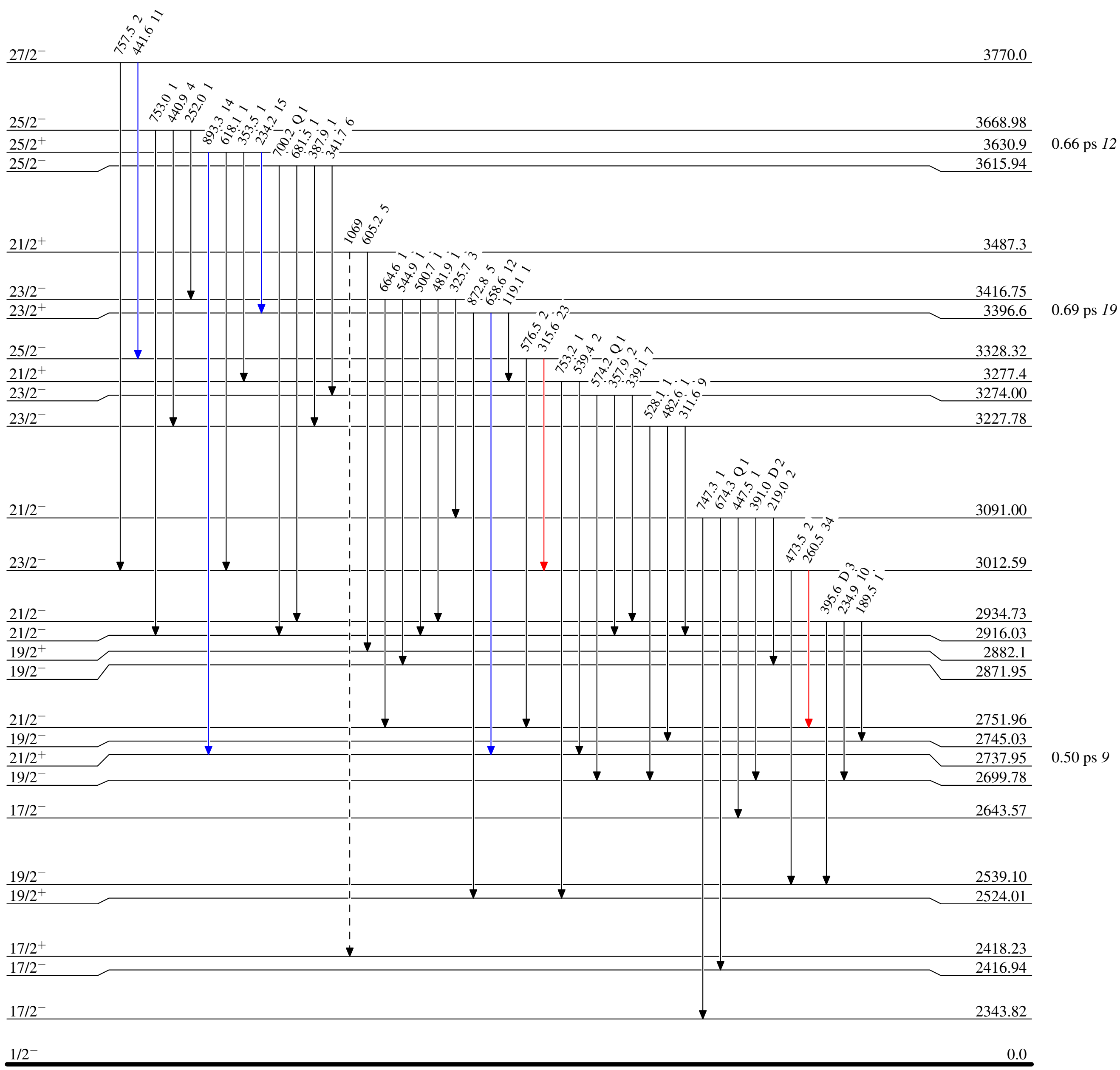
^{96}Zr(^{11}B,4nγ),^{11}B(^{96}Zr,4nγ) 2014Ku15,2006Ti01,2008Su18

Level Scheme (continued)

Intensities: Type not specified

Legend

- $I_\gamma < 2\% \times I_\gamma^{max}$
- $I_\gamma < 10\% \times I_\gamma^{max}$
- $I_\gamma > 10\% \times I_\gamma^{max}$
- γ Decay (Uncertain)

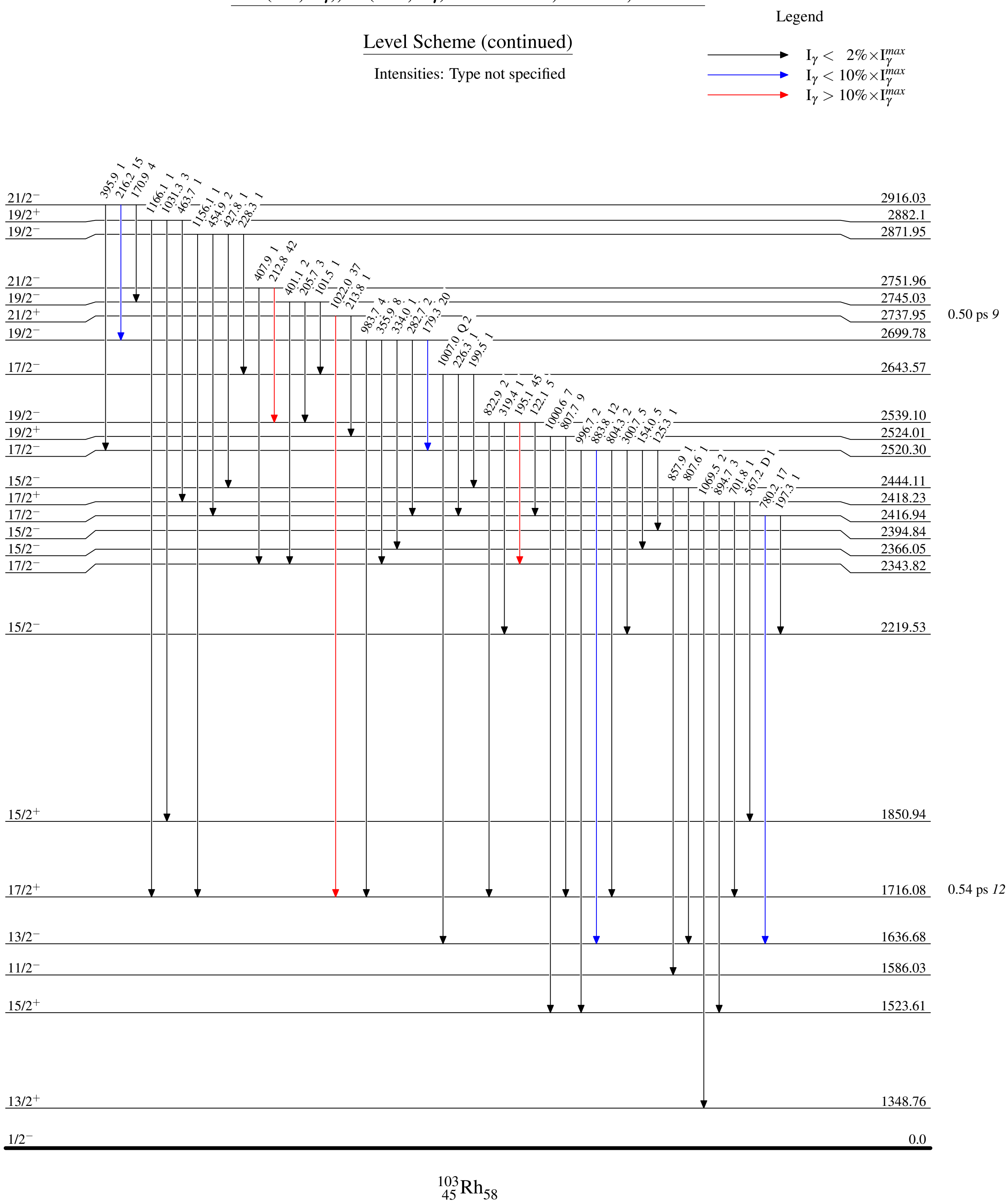


$^{103}_{45}Rh_{58}$

$^{96}Zr(^{11}B,4n\gamma),^{11}B(^{96}Zr,4n\gamma)$ 2014Ku15,2006Ti01,2008Su18

Level Scheme (continued)

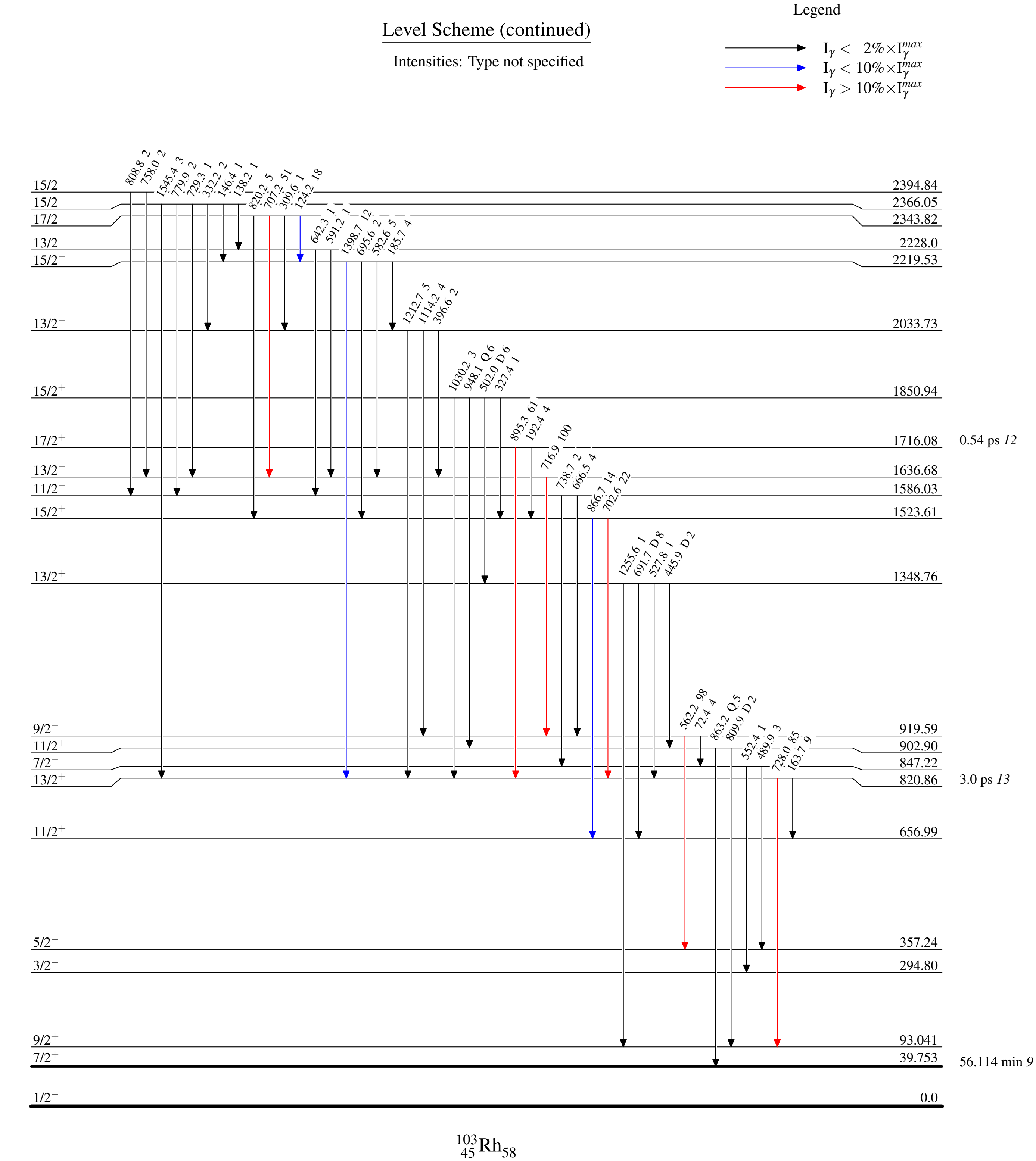
Intensities: Type not specified



$^{96}Zr(^{11}B,4n\gamma),^{11}B(^{96}Zr,4n\gamma)$ 2014Ku15,2006Ti01,2008Su18

Level Scheme (continued)

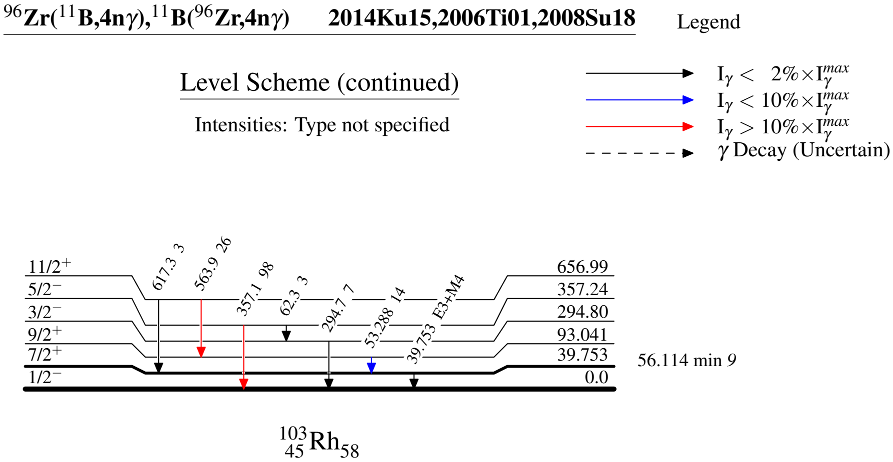
Intensities: Type not specified



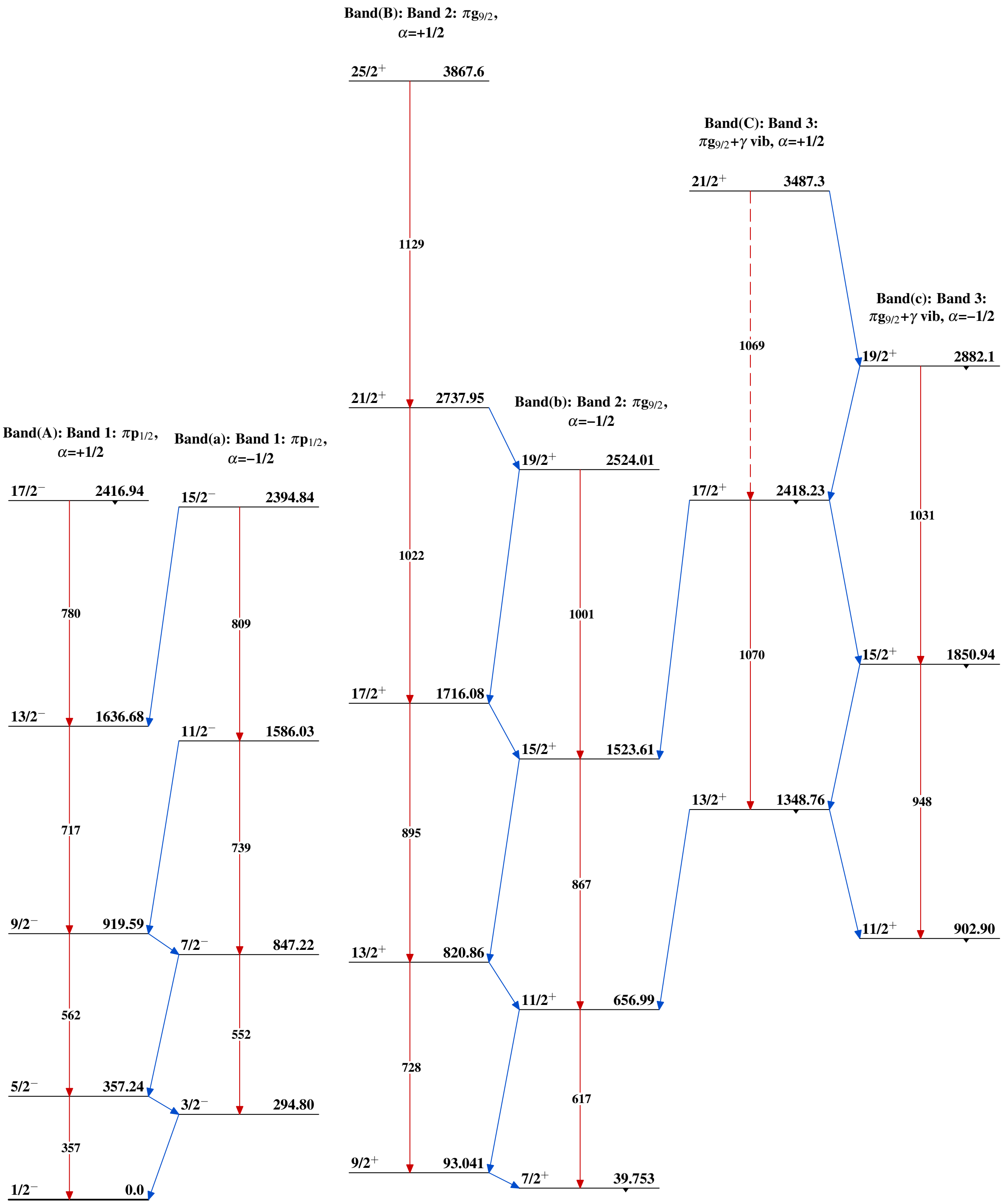
^{96}Zr(^{11}B,4nγ),^{11}B(^{96}Zr,4nγ) 2014Ku15,2006Ti01,2008Su18

Level Scheme (continued)

Intensities: Type not specified

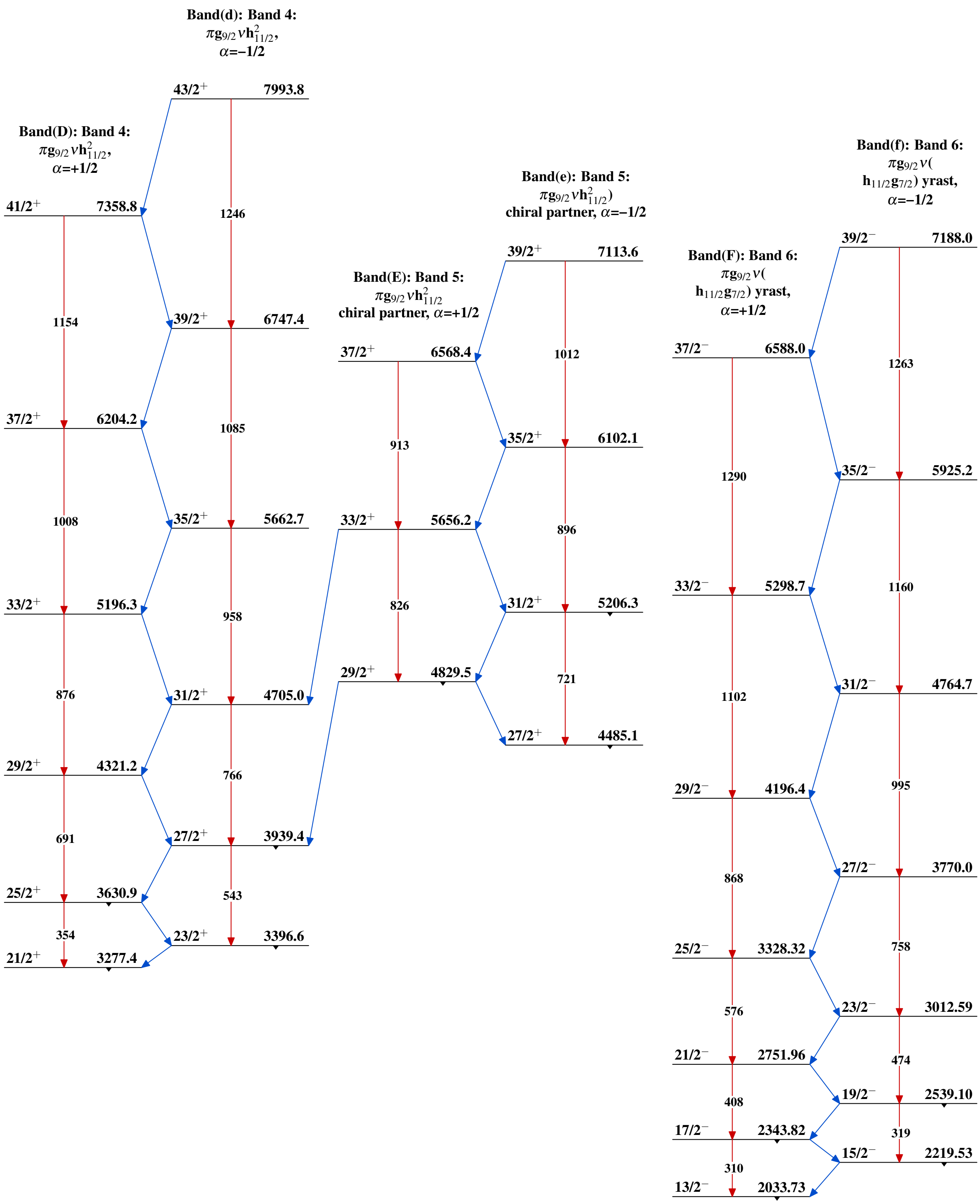


$^{96}Zr(^{11}B,4n\gamma),^{11}B(^{96}Zr,4n\gamma)$ 2014Ku15,2006Ti01,2008Su18



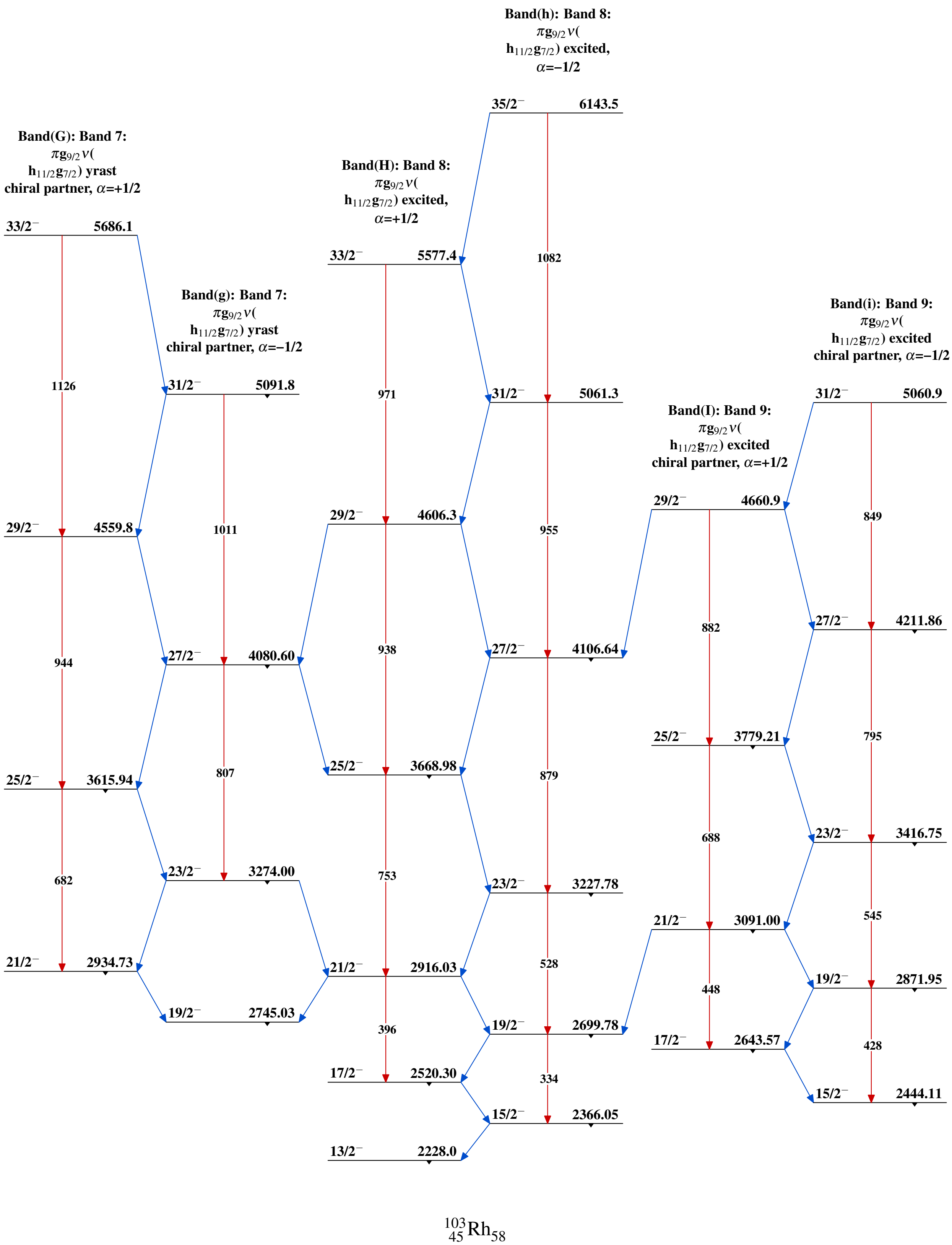
$^{103}_{45}Rh_{58}$

$^{96}Zr(^{11}B,4n\gamma),^{11}B(^{96}Zr,4n\gamma)$ 2014Ku15,2006Ti01,2008Su18 (continued)



$^{103}_{45}Rh_{58}$

^{96}Zr(^{11}B,4nγ),^{11}B(^{96}Zr,4nγ) 2014Ku15,2006Ti01,2008Su18 (continued)



^{100}Mo(^{6}Li,3nγ), (^{7}Li,4nγ) 1988De04,1984Ch06

1983Ka31: E(^{6}Li)=22-34 MeV. Enriched targets. Measured: Eγ, γγ, γ(θ). Deduced: ^{103}Rh levels, J^{π}, mult, δ.
1984Ch06: E(^{7}Li)=28 MeV. Enriched targets. Measured: Eγ, Iγ, γγ(t),γ(θ), γ pol. Deduced: ^{103}Rh levels, J^{π}, mult, δ.
1986Ha09: E(^{6}Li)=49 MeV. Measured: Eγ, γγ, γ coin with energetic ejectiles, deduced: change in the signature splitting.
1988De04: E(^{6}Li)=49 MeV. Measured: Eγ, γγ, γ coin with energetic ejectiles, γ(θ).

^{103}Rh Levels

E(level)[†]	J^{π}[‡]	Comments
0.0[@]	1/2⁻	
40.0[b] 7	7/2⁺	
93.3[a] 7	9/2⁺	
295.0[&] 4	3/2⁻	
357.5[@] 3	5/2⁻	
658.1[b] 7	11/2⁺	
821.8[a] 7	13/2⁺	
847.7[&] 4	7/2⁻	J^{π}: 1983Ka31 give 3/2⁻ based on γ excitation in ^{100}Mo(^{6}Li,3nγ) in disagreement with Coul. ex. results of 1972Sa03 and 1969Bl04; however, 1988De04 point out that the 73γ from 9/2⁻ rules out 3/2⁻.
887.8?[#] 6		
920.5[@] 4	9/2⁻	
1525.4[b] 7	15/2⁺	
1638.3[@] 5	13/2⁻	
1717.6[a] 7	17/2⁺	
2221.8[f] 5	15/2⁻	
2346.1[e] 5	17/2⁻	
2419.1[@] 6	17/2⁻	
2523.1[g] 6	17/2⁻	
2526.3[b] 7	19/2⁺	
2541.2[f] 6	19/2⁻	
2703.1[h] 6	19/2⁻	
2740.2[a] 7	21/2⁺	
2753.7[e] 6	21/2⁻	
2919.6[g] 6	21/2⁻	
2937.2[i] 6	21/2	
3014.5[f] 6	23/2⁻	
3214.9[@] 8	21/2⁻	
3219.1[c] 8	21/2⁺	
3231.4[h] 8	23/2⁻	
3277.1[i] 8	23/2	
3330.5[e] 7	25/2⁻	
3399.3[d] 7	23/2⁺	
3618.9[i] 10	(25/2)	
3634.0[c] 8	25/2⁺	
3673.2[g] 10	(25/2)	
3771.3[f] 7	27/2⁻	
3871.2[a] 9	25/2⁺	
3942.6[d] 8	27/2⁺	
4039.8[@] 9	(25/2⁻)	
4324.8[c] 9	29/2⁺	
4339.2[e] 9	(29/2⁻)	

Continued on next page (footnotes at end of table)

^{100}Mo(^{6}Li,3nγ), (^{7}Li,4nγ) 1988De04,1984Ch06 (continued)

^{103}Rh Levels (continued)

E(level)[†]	J^{π}[‡]
4709.9[d] *9*	31/2^{+}
5053.0[a] *10*	29/2^{+}
5201.1[c] *9*	33/2^{+}
5668.0[d] *10*	35/2^{+}
6213.4[c] *11*	(37/2^{+})

[†] From least-squares fit to Eγ data.
[‡] As given by 1988De04 based on $\gamma(\theta)$ and observed band structure.
[#] Observed only by 1983Ka31.
[@] Band(A): Band 1, α=+1/2.
[&] Band(a): Band 1, α=−1/2.
[a] Band(B): Band 2, α=+1/2.
[b] Band(b): Band 2, α=−1/2.
[c] Band(C): Band 3, α=+1/2.
[d] Band(c): Band 3, α=−1/2.
[e] Band(D): Band 4, α=+1/2.
[f] Band(d): Band 4, α=−1/2.
[g] Band(E): Band 5, α=+1/2.
[h] Band(e): Band 5, α=−1/2.
[i] Band(F): Band 6.

γ(^{103}Rh)

E_γ[†]	I_γ[†]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[#]	α[&]	Comments
53.3[‡] *2*	51 *5*	93.3	9/2$^+$	40.0	7/2$^+$	M1	2.08 *4*	A_2=−0.12 *4*, A_4=+0.007 *5* (1984Ch06). Mult.,I_γ: from 1984Ch06. A_2=−0.22 *7* (1988De04).
62.4[‡] *5*	5.4 *18*	357.5	5/2$^-$	295.0	3/2$^-$	D		A_2=−0.3 *2* (1984Ch06).
73.5[‡] *5*	8.2 *16*	920.5	9/2$^-$	847.7	7/2$^-$	D		A_2=−0.03 *6* (1984Ch06). A_2=−0.33 *9*, A_4=−0.03 *2* (1988de04).
122.3 *5*	7.5 *15*	2541.2	19/2$^-$	2419.1	17/2$^-$	D		A_2=−0.27 *4*, A_4=+0.09 *6* (1984Ch06). A_2=−0.28 *10*, A_4=0.01 *1* (1988de04).
124.4 *3*	19.5 *20*	2346.1	17/2$^-$	2221.8	15/2$^-$	D		A_2=−0.25 *3*, A_4=+0.02 *5* (1984Ch06). A_2=−0.10 *4* (1988de04).
163.5[‡] *5*	6.0 *12*	821.8	13/2$^+$	658.1	11/2$^+$	D		A_2=−0.175 *3*, A_4=0.003 *45* (1983Ka31). A_2=−0.10 *3*, A_4=+0.03 *5* (1984Ch06). A_2=−0.16 *6* (1988de04).
179.4 *3*	28 *3*	2703.1	19/2$^-$	2523.1	17/2$^-$	D		A_2=+0.05 *5* (1984Ch06). A_2=−0.25 *8*, A_4=−0.01 *1* (1988de04).
180.5[‡] *3*	27 *3*	3399.3	23/2$^+$	3219.1	21/2$^+$	D		A_2=+0.05 *5* (1984Ch06). A_2=−0.19 *5*, A_4=−0.02 *1* (1988de04).
191.9 *5*	5.2 *10*	1717.6	17/2$^+$	1525.4	15/2$^+$			
195.4 *3*	71.8 *72*	2541.2	19/2$^-$	2346.1	17/2$^-$	M1	0.0549 *8*	A_2=−0.146 *15*, A_4=0.018 *17* (1983Ka31). A_2=−0.16 *5*, A_4=0.06 *8* (1984Ch06). A_2=−0.28 *7*, A_4=−0.06 *4* (1988de04).
212.9 *3*	78 *8*	2753.7	21/2$^-$	2541.2	19/2$^-$	M1	0.0438 *6*	A_2=−0.169 *14*, A_4=0.004 *15* (1983Ka31). A_2=−0.26 *5*, A_4=−0.03 *8* (1984Ch06). A_2=−0.26 *6*, A_4=0.01 *1* (1988de04).
214.0 *5*	5.2 *10*	2740.2	21/2$^+$	2526.3	19/2$^+$	D		A_2=−0.26 *5*, A_4=−0.03 *8* (1984Ch06).
216.5[‡] *3*	22.8 *23*	2919.6	21/2$^-$	2703.1	19/2$^-$	D		A_2=−0.16 *3*, A_4=+0.03 *5* (1984Ch06). A_2=−0.23 *8* (1988de04).
234.1 *3*	21.5 *22*	2937.2	21/2	2703.1	19/2$^-$			A_2=+0.20 *5*, A_4=−0.20 *8* Pol= −0.55 *15* (1984Ch06) given for unresolved doublet.
235.0 *3*	31 *3*	3634.0	25/2$^+$	3399.3	23/2$^+$	D		A_2=−0.06 *4* (1988de04).
260.9[‡] *3*	49 *5*	3014.5	23/2$^-$	2753.7	21/2$^-$	M1	0.0258 *4*	A_2=−0.124 *50*, A_4=−0.044 *58* (1983Ka31). A_2=0.0 *1* (1984Ch06). A_2=−0.25 *8*, A_4=0.07 *5* (1988de04).
294.9 *5*	18.7 *37*	295.0	3/2$^-$	0.0	1/2$^-$	D		A_2=−0.186 *16*, A_4=0.011 *18* (1983Ka31). A_2=+0.10 *6*, A_4=+0.01 *5* Pol= +0.06 *5* (1984Ch06) given for unresolved doublet. A_2=−0.33 *7* (1988De04).
301.0[‡] *3*	23.9 *24*	2523.1	17/2$^-$	2221.8	15/2$^-$	D		A_2=−0.3 *1* (1984Ch06).
308.6[‡] *3*	30 *3*	3942.6	27/2$^+$	3634.0	25/2$^+$	D		A_2=−0.32 *4* (1988de04).
311.8 *5*	6.7 *13*	3231.4	23/2$^-$	2919.6	21/2$^-$	D		A_2=−0.12 *8* (1984Ch06). A_2=−0.32 *6*, A_4=−0.03 *1* (1988de04).
315.9 *3*	35 *4*	3330.5	25/2$^-$	3014.5	23/2$^-$	M1	0.01580 *22*	A_2=−0.161 *68*, A_4=0.041 *74* (1983Ka31).

γ(^{103}Rh) (continued)

E_γ[†]	I_γ[†]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	δ[@]	α[&]	Comments
									A_2=−0.05 *7* (1984Ch06). A_2=−0.16 *3*, A_4=0.10 *5* (1988de04).
319.7 *5*	1.9 *4*	2541.2	19/2$^-$	2221.8	15/2$^-$				
339.9‡ *5*	10.4 *20*	3277.1	23/2	2937.2	21/2	D			A_2=−0.13 *6* (1988de04).
341.8 *5*	10.3	3618.9	(25/2)	3277.1	23/2	D			A_2=−0.29 *7* (1988de04).
357.5[a] *3*	142[a] *14*	357.5	5/2$^-$	0.0	1/2$^-$	Q			A_2=+0.09 *5*, A_4=−0.07 *5* Pol= +0.10 *4* (1984Ch06) given for unresolved doublet. A_2=0.27 *3*, A_4=−0.08 *6* (1988de04).
357.6[a] *3*	142[a] *14*	2703.1	19/2$^-$	2346.1	17/2$^-$				A_2=+0.09 *5*, A_4=−0.07 *5* Pol= +0.10 *4* (1984Ch06) given for unresolved doublet.
382.3 *3*	22.1 *22*	4324.8	29/2$^+$	3942.6	27/2$^+$	D			A_2=−0.17 *6* (1988de04).
384.9‡ *5*	19 *4*	4709.9	31/2$^+$	4324.8	29/2$^+$	D			A_2=−0.24 *3* (1988de04).
x396.5‡ *5*	5.3 *10*								
406.5 *5*	1.0 *2*	2753.7	21/2$^-$	2346.1	17/2$^-$				
x427.5‡ *5*	17 *3*								
440.7‡ *5*	17 *3*	3771.3	27/2$^-$	3330.5	25/2$^-$	D			A_2=0.0 *1* (1984Ch06). A_2=−0.33 *7* (1988de04).
441.8‡ *5*	16 *3*	3673.2	(25/2)	3231.4	23/2$^-$	D			A_2=0.0 *1* (1984Ch06). A_2=−0.13 *1* (1988de04).
x447.5‡ *5*	8.3 *17*								
x455.6‡ *5*	6.5 *13*								
466.8‡ *5*	6.3 *13*	5668.0	35/2$^+$	5201.1	33/2$^+$	D			A_2=−0.48 *7*, A_4=−0.03 *2* (1988de04).
473.2 *5*	7.8 *15*	3014.5	23/2$^-$	2541.2	19/2$^-$				
479.8 *5*	3.6 *7*	3219.1	21/2$^+$	2740.2	21/2$^+$	D			
490.8[a] *5*	13[a] *3*	847.7	7/2$^-$	357.5	5/2$^-$	D			A_2=−0.219 *41*, A_4=0.035 *46* (1983Ka31). E_γ: not given by 1984Ch06 although clearly observed by 1983Ka31, 1988De04 and in (n,n′γ). A_2=−0.29 *7*, A_4=−0.01 *1* (1988de04).
490.8[a] *5*	13[a] *3*	5201.1	33/2$^+$	4709.9	31/2$^+$	D			A_2=−0.29 *7*, A_4=0.01 *1* (1988de04).
530.3 *5*	4.8 *3*	887.8?		357.5	5/2$^-$				A_2=0.095 *81*, A_4=−0.012 *59* (1983Ka31).
545.4 *5*	14 *3*	6213.4	(37/2$^+$)	5668.0	35/2$^+$	D			A_2=−0.29 *7*, A_4=0.03 *1* (1988de04).
552.7 *5*	9.5 *19*	847.7	7/2$^-$	295.0	3/2$^-$	Q			A_2=0.101 *82*, A_4=−0.082 *97* (1983Ka31). A_2=0.0 *1* (1984Ch06) given for unresolved doublet. A_2=0.10 *5*, A_4=−0.31 *6* (1988de04).
562.8 *3*	104 *10*	920.5	9/2$^-$	357.5	5/2$^-$	E2		0.00403 *6*	A_2=+0.34 *6*, A_4=−0.10 *7* Pol= +0.5 *1* (1984Ch06). A_2=0.212 *15*, A_4=−0.083 *19* (1983Ka31). A_2=0.25 *3*, A_4=−0.20 *9* (1988de04).
564.5 *3*	46 *9*	658.1	11/2$^+$	93.3	9/2$^+$	M1+E2	+0.15 *2*	0.00382 *5*	A_2=0.223 *15*, A_4=−0.024 *24* (1983Ka31). A_2=+0.41 *6*, A_4=+0.09 *5* Pol= −0.6 *1* (1984Ch06). A_2=−0.07 *4* (1988de04).
567.9‡ *5*	8.8 *18*	4339.2	(29/2$^-$)	3771.3	27/2$^-$	D			A_2=−0.07 *6*, A_4=0.02 *1* (1988de04).

^{100}Mo(^{6}Li,3nγ), (^{7}Li,4nγ) 1988De04,1984Ch06 (continued)

γ(^{103}Rh) (continued)

Eγ†	Iγ†	Ei(level)	J^{π}_{i}	E_f	J^{π}_{f}	Mult.#	δ@	α&	Comments
583.6 *5*	10.9 *22*	2221.8	15/2−	1638.3	13/2−	D			A_2=−0.11 *4* (1988de04).
618.5‡ *5*	6.5 *13*	658.1	11/2+	40.0	7/2+	Q			A_2=0.160 *38*, A_4=−0.027 *46* (1983Ka31).
659.2‡ *5*	16 *3*	3399.3	23/2+	2740.2	21/2+	D			A_2=−0.23 *6*, A_4=0.09 *6* (1988de04).
692.6 *5*	18 *4*	3219.1	21/2+	2526.3	19/2+	D			
703.6 *5*	19 *4*	1525.4	15/2+	821.8	13/2+	M1+E2	+0.10 *2*	2.28×10^{-3} *3*	A_2=0.139 *28*, A_4=0.011 *34* (1983Ka31). A_2=+0.26 *7*, A_4=0.01 *8* Pol= −0.5 *2* (1984Ch06).
707.9 *3*	42	2346.1	17/2−	1638.3	13/2−	E2		2.17×10^{-3} *3*	A_2=0.250 *22*, A_4=−0.096 *28* (1983Ka31). A_2=+0.45 *10*, A_4=−0.13 *12* Pol= +0.56 *12* (1984Ch06). A_2=0.31 *5*, A_4=−0.02 *1* (1988de04).
717.8 *3*	77 *16*	1638.3	13/2−	920.5	9/2−	E2		2.10×10^{-3} *3*	A_2=+0.24 *6*, A_4=−0.14 *9* Pol= +0.47 *8* (1984Ch06). A_2=0.240 *7*, A_4=−0.098 *96* (1983Ka31). A_2=0.36 *5*, A_4=−0.01 *1* (1988de04).
728.6 *3*	100 *10*	821.8	13/2+	93.3	9/2+	E2		2.02×10^{-3} *3*	A_2=0.225 *17*, A_4=−0.087 *22* (1983Ka31). A_2=+0.25 *5*, A_4=−0.11 *8* Pol= +0.46 *8* (1984Ch06). A_2=0.29 *7*, A_4=−0.06 *5* (1988de04).
756.8 *5*	4.5 *9*	3771.3	27/2−	3014.5	23/2−				
767.1 *5*	4.2 *8*	4709.9	31/2+	3942.6	27/2+				
780.9‡ *5*	18‡ *4*	2419.1	17/2−	1638.3	13/2−	E2		1.70×10^{-3} *2*	A_2=0.245 *37*, A_4=−0.087 *48* (1983Ka31). A_2=+0.45 *12*, A_4=−0.10 *15* (1984Ch06). 1983Ka31: excit suggests possible doublet. A_2=0.25 *6*, A_4=−0.13 *10* (1988de04).
795.8 *5*	1.3 *3*	3214.9	21/2−	2419.1	17/2−				
808.9 *5*	16 *3*	2526.3	19/2+	1717.6	17/2+	(M1+E2)	+0.06 *2*	1.66×10^{-3} *2*	A_2=+0.0 *1* (1984Ch06). A_2=−0.16 *4* (1988de04).
821.0 *5*	6.2 *12*	2346.1	17/2−	1525.4	15/2+	D			A_2=−0.27 *1* (1988de04).
824.9 *5*	10.5 *21*	4039.8	(25/2−)	3214.9	21/2−	Q			A_2=0.27 *5* (1988de04).
867.3 *5*	10.3 *20*	1525.4	15/2+	658.1	11/2+	E2		1.31×10^{-3} *2*	A_2=0.272 *37*, A_4=−0.123 *49* (1983Ka31). A_2=0.20 *12* (1984Ch06). A_2=0.26 *8* (1988de04).
873.2 *5*	10.3 *20*	3399.3	23/2+	2526.3	19/2+	Q			A_2=0.14 *6* (1988de04).
876.5 *5*	1.5 *3*	5201.1	33/2+	4324.8	29/2+				
884.2 *5*	6.4 *13*	2523.1	17/2−	1638.3	13/2−	Q			A_2=+0.4 *2* (1984Ch06). A_2=0.29 *8*, A_4=−0.16 *9* (1988de04).
892.9 *5*	15 *3*	3634.0	25/2+	2740.2	21/2+	Q			A_2=0.13 *2* (1988de04).
895.9 *3*	75 *8*	1717.6	17/2+	821.8	13/2+	E2		1.22×10^{-3} *2*	A_2=0.228 *30*, A_4=−0.094 *35* (1983Ka31). A_2=+0.18 *6*, A_4=−0.07 *10* Pol= +0.51 *10* (1984Ch06). A_2=0.11 *1*, A_4=−0.10 *8* (1988de04).
x900.2‡ *5*	13‡ *3*								
x914.1‡ *5*	7.6‡ *15*								
958.3 *5*	1.8 *4*	5668.0	35/2+	4709.9	31/2+				
1000.8 *5*	8.2 *16*	2526.3	19/2+	1525.4	15/2+				A_2=+0.3 *1* (1984Ch06).
1022.5 *3*	36 *4*	2740.2	21/2+	1717.6	17/2+	E2		8.98×10^{-4} *13*	A_2=0.312 or ±0.060, A_4=−0.144 or ±0.077 (1983Ka31).

γ(^{103}Rh) (continued)

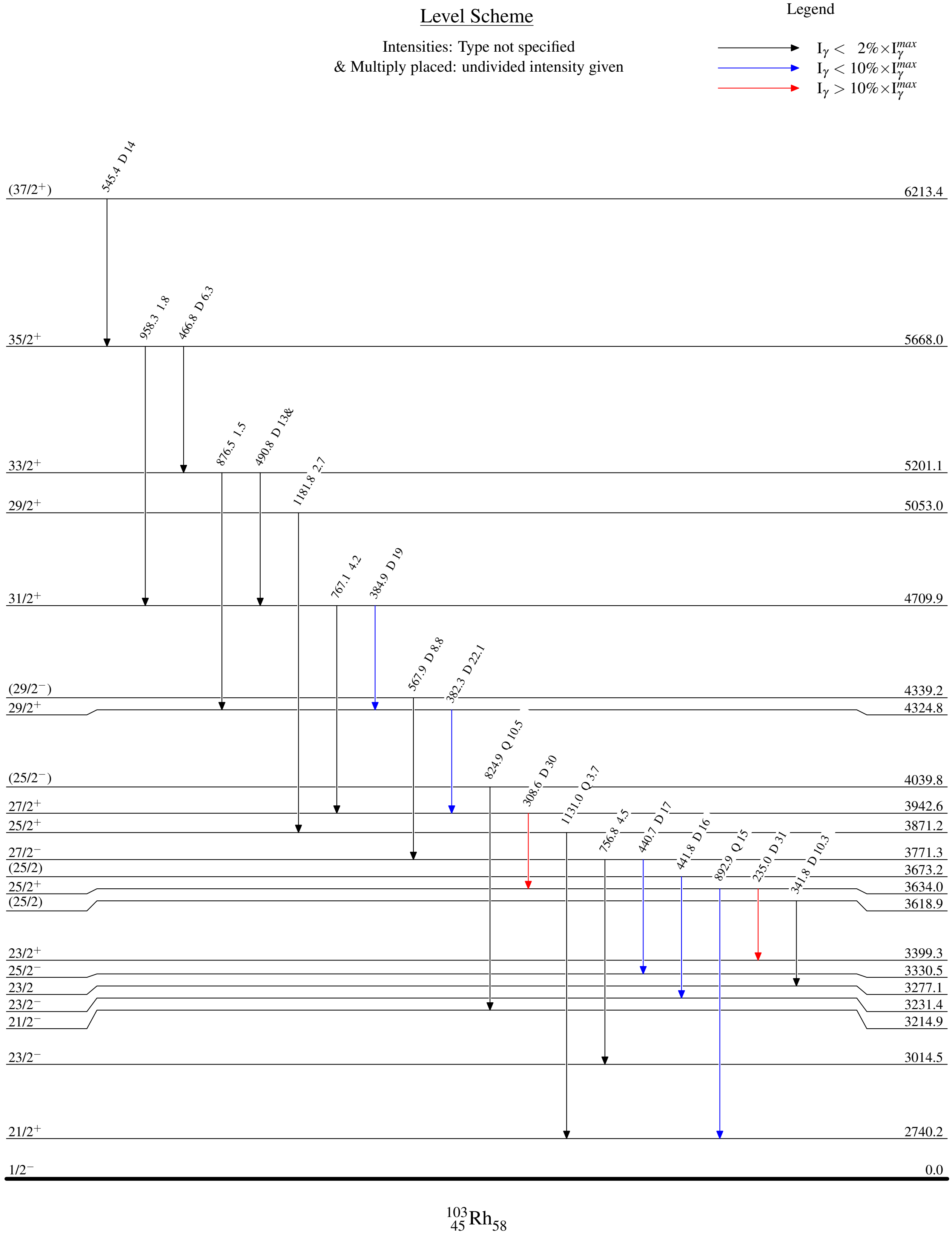
E_γ †	I_γ †	E_i(level)	J_i^π	E_f	J_f^π	Mult.#	Comments
							A_2=+0.27 *9*, A_4=−0.06 *12* Pol= +0.2 *2* (1984Ch06). A_2=0.17 *2*, A_4=−0.19 *12* (1988de04).
1131.0 *5*	3.7 *8*	3871.2	25/2$^+$	2740.2	21/2$^+$	Q	A_2=0.10 *8* (1988de04).
1181.8 *5*	2.7 *5*	5053.0	29/2$^+$	3871.2	25/2$^+$		
1399.6 *5*	10.2 *20*	2221.8	15/2$^-$	821.8	13/2$^+$		

† From 1988De04, unless noted otherwise.
‡ Contaminated by ^{102}Rh. Iγ not corrected.
# Based on A_2, A_4 coefficient from $\gamma(\theta)$ (1988De04,1984Ch06,1983Ka31) and linear pol (1987Ch06).
@ From 1984Ch06.
& 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 undivided intensity.
[x] γ ray not placed in level scheme.

^{100}Mo(^{6}Li,3nγ), (^{7}Li,4nγ) 1988De04,1984Ch06

Level Scheme

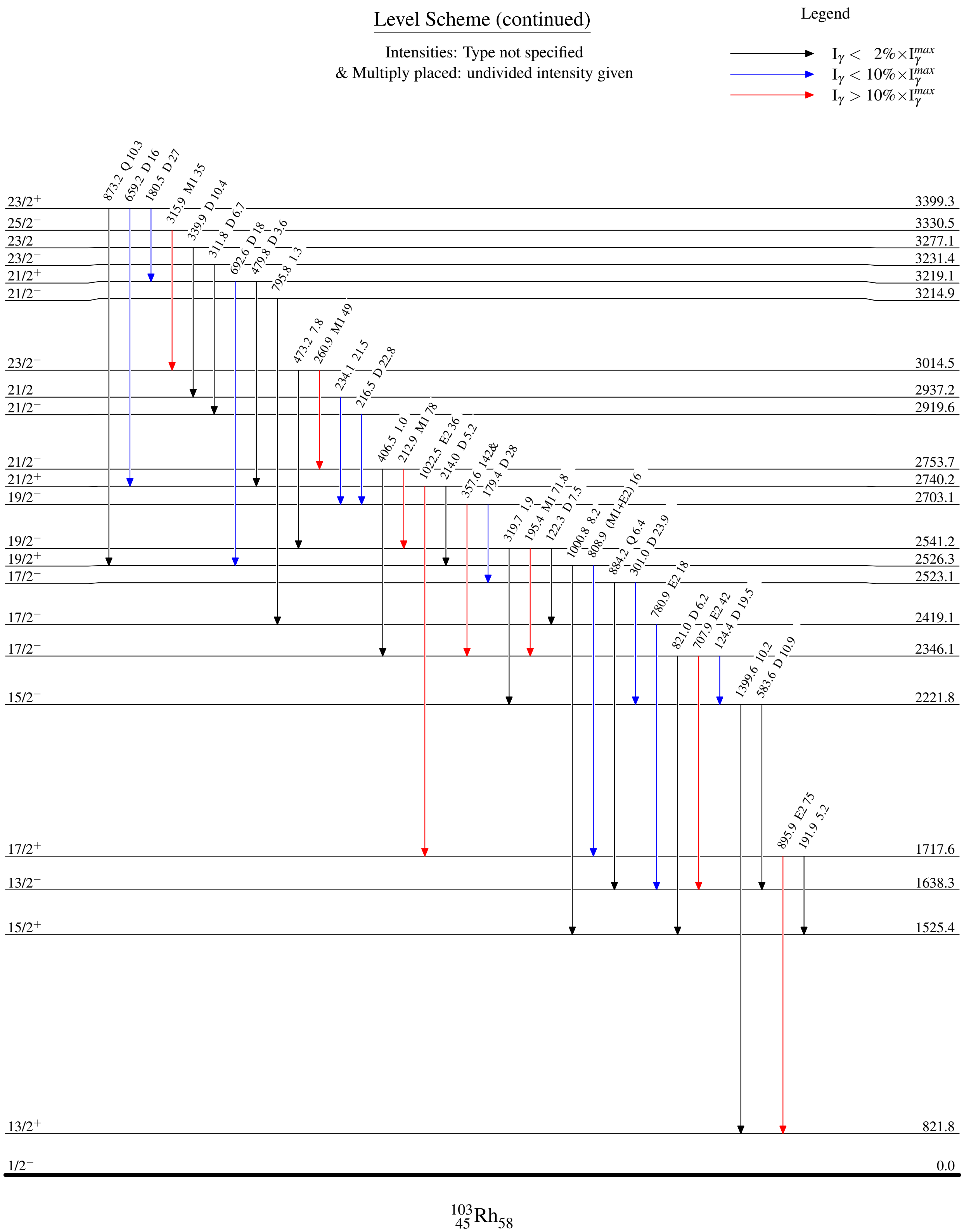
Intensities: Type not specified
& Multiply placed: undivided intensity given



^{100}Mo(^{6}Li,3nγ), (^{7}Li,4nγ) 1988De04,1984Ch06

Level Scheme (continued)

Intensities: Type not specified
& Multiply placed: undivided intensity given

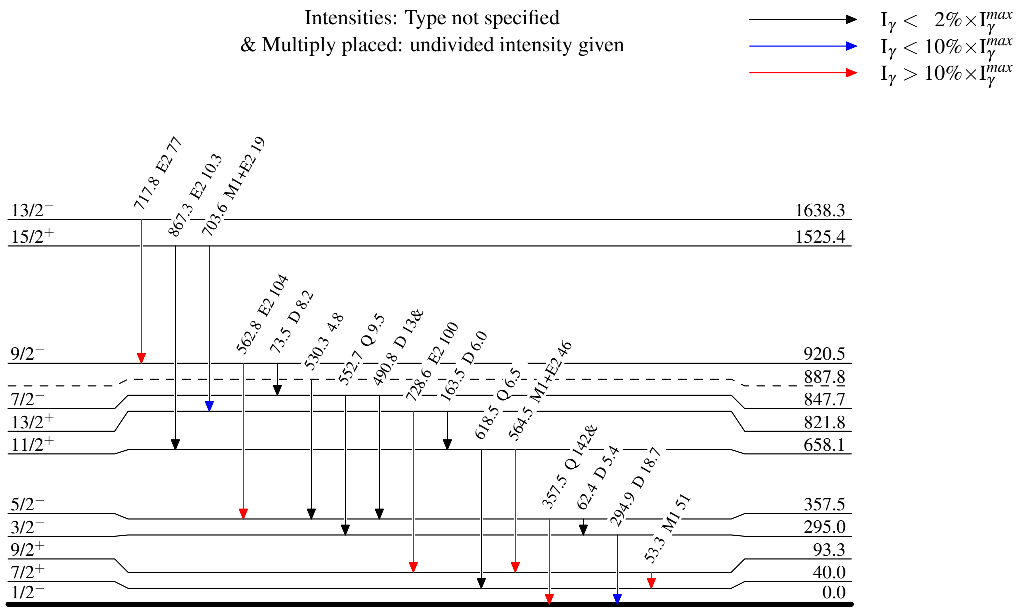


$^{100}Mo(^{6}Li,3n\gamma)$, $(^{7}Li,4n\gamma)$ 1988De04,1984Ch06

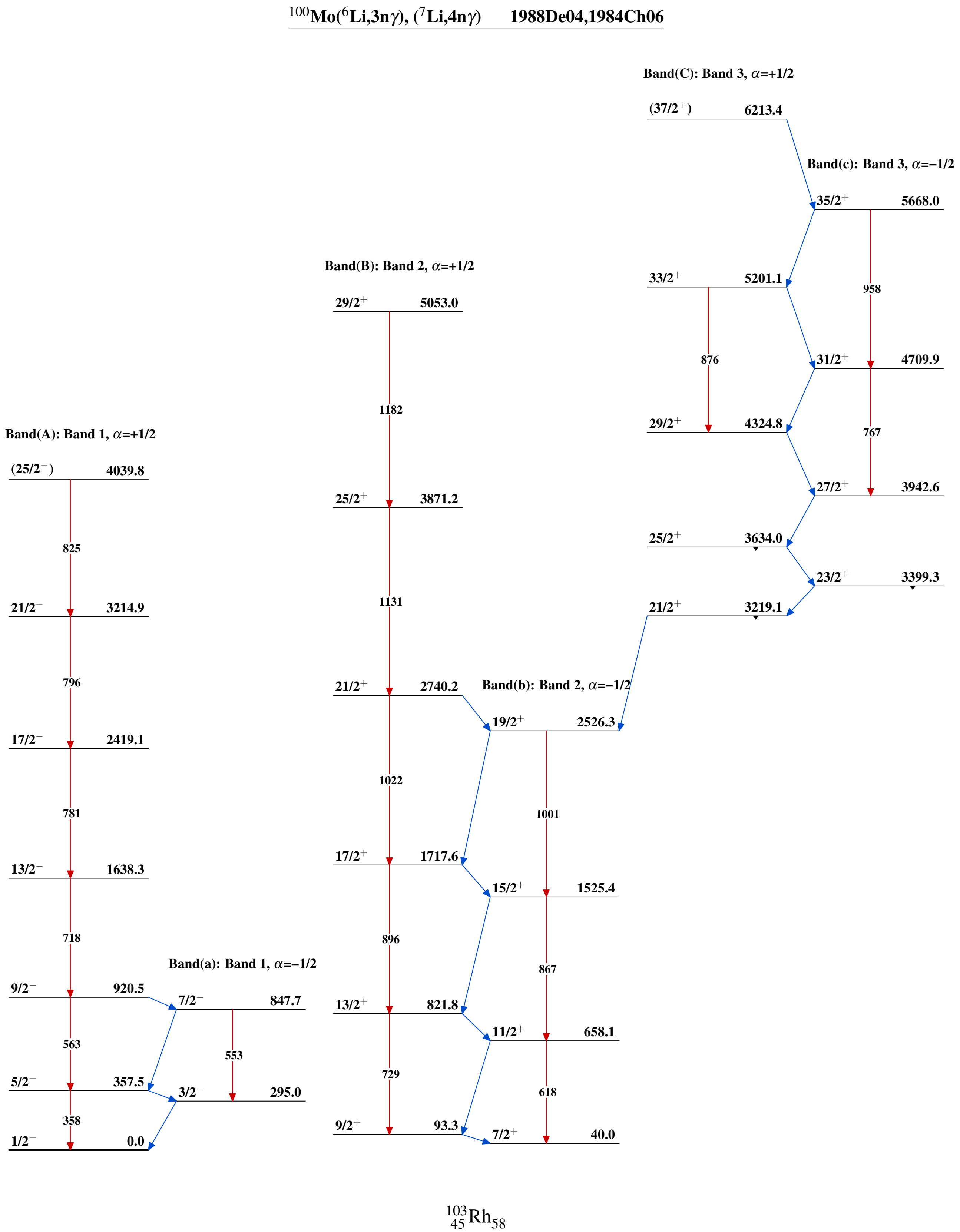
Level Scheme (continued)

Intensities: Type not specified
& Multiply placed: undivided intensity given

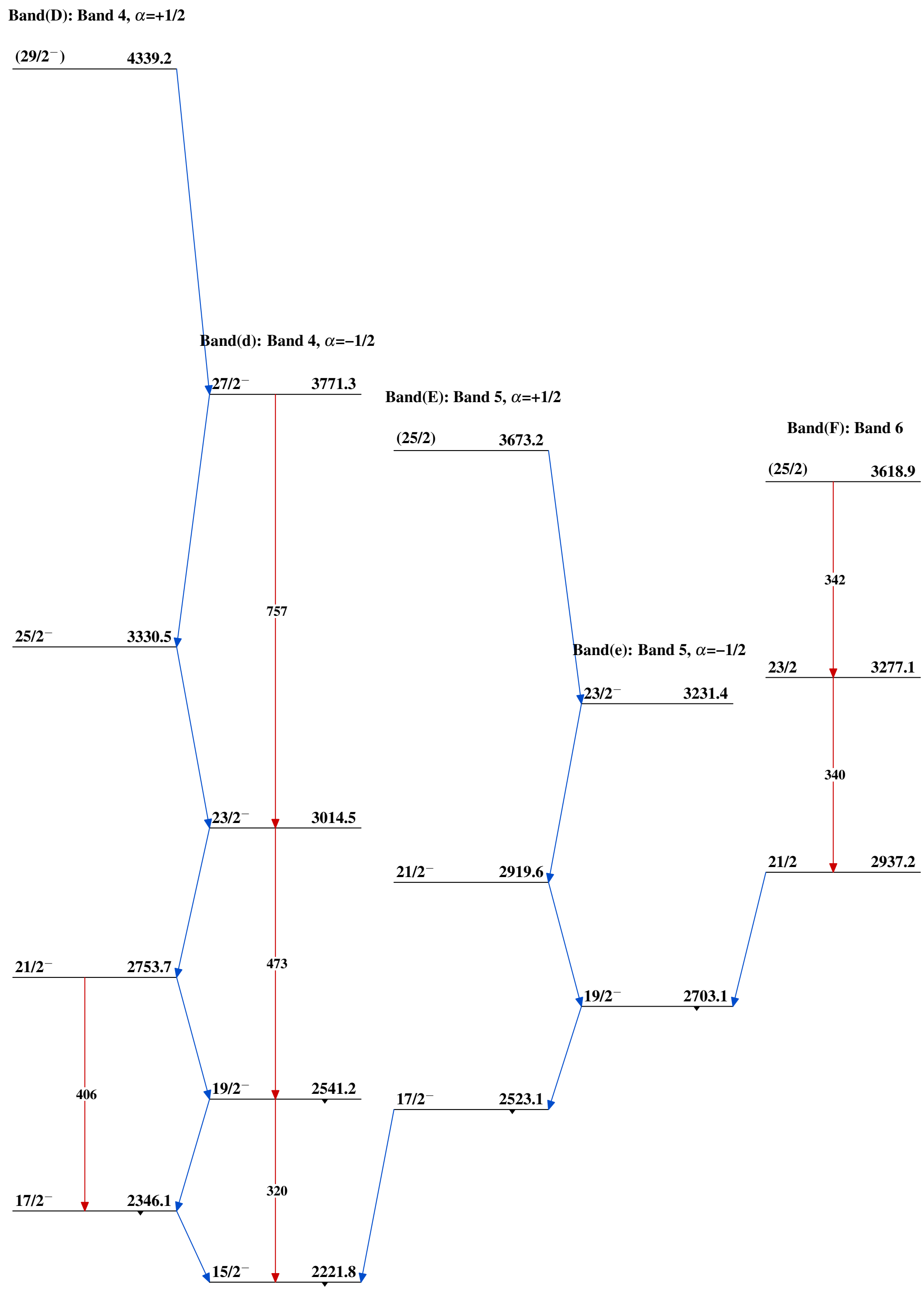
Legend



$^{103}_{45}Rh_{58}$


^{100}Mo(^{6}Li,3nγ), (^{7}Li,4nγ) 1988De04,1984Ch06
Band(C): Band 3, α=+1/2
(37/2+) 6213.4
Band(c): Band 3, α=−1/2
35/2+ 5668.0
33/2+ 5201.1
958
Band(B): Band 2, α=+1/2
29/2+ 5053.0
876
31/2+ 4709.9
1182
29/2+ 4324.8
767
Band(A): Band 1, α=+1/2
(25/2−) 4039.8
25/2+ 3871.2
27/2+ 3942.6
825
25/2+ 3634.0
23/2+ 3399.3
21/2− 3214.9
21/2+ 3219.1
1131
796
21/2+ 2740.2
Band(b): Band 2, α=−1/2
17/2− 2419.1
19/2+ 2526.3
1022
781
1001
17/2+ 1717.6
13/2− 1638.3
15/2+ 1525.4
718
896
Band(a): Band 1, α=−1/2
867
9/2− 920.5
7/2− 847.7
13/2+ 821.8
563
553
11/2+ 658.1
729
5/2− 357.5
618
3/2− 295.0
358
9/2+ 93.3
1/2− 0.0
7/2+ 40.0
$^{103}_{45}Rh_{58}$

^{100}Mo(^{6}Li,3nγ), (^{7}Li,4nγ) 1988De04,1984Ch06 (continued)



$^{103}_{45}Rh_{58}$

^{102}Ru(p,p),(p,n) IAR **1969Fr18**

IAS studied via (p,n) and proton elastic scattering excit; E(p)=6.1-7.0 MeV; semi, pc.
Coulomb displacement energy=12551 *16* (1969Fr18) if Q(d,p)=4008 *6*.

^{103}Rh Levels

E(level)†	Comments
12532 *10*	Analog of ^{103}Ru g.s., J=5/2^{+}. Γ(p)=4 keV *1*, Γ=35 keV *7*.
12681 *10*	Analog of ^{103}Ru 174 keV L=0 (d,p) excitation (1971Fo01) Γ(p)=24 keV *5*, Γ=60 keV *12*.
12938 *10*	Analog of ^{103}Ru 405 keV L=2 (d,p) excitation (1971Fo01) Γ(p)=1.5 keV *3*, Γ=30 keV *6*.

† From S(p)=6214.2 *23* (2021Wa16) + res E(p)(c.m.).

^{102}Ru(^{3}He,d) 2017Fr08

2017Fr08: E=36 MeV ^{3}He beam was produced from the MP tandem accelerator at the Maier-Leibnitz Laboratorium of the Ludwig-Maximilians Universitat and Technische Universitat Munchen. Target was 99.38% isotopically enriched ^{102}Ru with a nominal thickness of 100 μg/cm^2 on a thin carbon foil. Reaction products were momentum analyzed with a Q3D magnetic spectrometer (FWHM≈8 keV) Measured $\sigma(\theta)$. Deduced levels, L-transfers, spectroscopic strengths, neutron occupancies from DWBA analysis. Comparisons with theoretical calculations.

^{103}Rh Levels

2017Fr08 list only statistical uncertainties for cross sections and the evaluator has added a 5% systematic uncertainty stated in 2017Fr08 in quadrature, as given under comments.

E(level)†	J$^{\pi}$†	L‡	S‡	Comments
0	1/2$^-$	1	0.76 *4*	σ(mb/sr)=1.79 *9* (at 6°), 1.27 *6* (at 10°), 0.434 *22* (at 14°), 0.611 *31* (at 18°), 0.470 *24* (at 22°).
34 *3*	7/2$^+$	4	0.176 *9*	0.0150 *13* (at 14°), 0.0220 *15* (at 18°), 0.0160 *13* (at 22°).
92 *3*	9/2$^+$	4	3.63 *18*	σ(mb/sr)=0.121 *6* (at 6°), 0.265 *14* (at 10°), 0.499 *25* (at 14°), 0.669 *34* (at 18°), 0.475 *24* (at 22°).
295 *3*	3/2$^-$	1	0.325 *16*	σ(mb/sr)=0.84 *4* (at 6°), 0.630 *32* (at 10°), 0.210 *11* (at 14°), 0.274 *14* (at 18°), 0.232 *12* (at 22°).
357 *3*	5/2$^-$	3	0.133 *7*	σ(mb/sr)=0.0090 *21* (at 6°), 0.0300 *18* (at 10°), 0.0387 *21* (at 14°), 0.0367 *21* (at 18°), 0.0199 *12* (at 22°).
649 *3*	5/2$^+$	2		σ(mb/sr)=0.595 *30* (at 6°), 0.83 *4* (at 10°), 0.519 *26* (at 14°), 0.245 *13* (at 18°), 0.299 *15* (at 22°).
803 *3*	1/2$^-$	1	0.310 *16*	σ(mb/sr)=0.79 *4* (at 6°), 0.586 *30* (at 10°), 0.206 *11* (at 14°), 0.264 *13* (at 18°), 0.224 *11* (at 22°).
837 *3*	1/2$^-$	1	0.0120 *6*	σ(mb/sr)=0.0300 *18* (at 6°), 0.0250 *16* (at 10°), 0.0150 *13* (at 14°), 0.0170 *13* (at 18°), 0.0140 *12* (at 22°).
879 *3*	5/2$^-$	3	0.308 *16*	σ(mb/sr)=0.0440 *24* (at 6°), 0.073 *4* (at 10°), 0.097 *5* (at 14°), 0.079 *4* (at 18°), 0.0410 *23* (at 22°).
1160 *3*				σ(mb/sr)=0.004 *1* (at 6°), 0.0060 *11* (at 10°), 0.003 *1* (at 14°), 0.003 *1* (at 18°), 0.002 *1* (at 22°).
1256 *3*	1/2$^+$	0		σ(mb/sr)=1.73 *9* (at 6°), 1.51 *8* (at 10°), 1.43 *7* (at 14°), 0.643 *33* (at 18°), 0.632 *32* (at 22°).
1412 *3*	3/2$^+$,5/2$^+$	2		σ(mb/sr)=0.597 *30* (at 6°), 0.72 *4* (at 10°), 0.424 *21* (at 14°), 0.225 *12* (at 18°), 0.247 *13* (at 22°).
1438 *3*	3/2$^+$,5/2$^+$	2		σ(mb/sr)=0.441 *23* (at 6°), 0.561 *29* (at 10°), 0.343 *17* (at 14°), 0.185 *10* (at 18°), 0.194 *10* (at 22°).
1458 *3*	1/2$^+$	0		σ(mb/sr)=0.092 *5* (at 6°), 0.079 *5* (at 10°), 0.083 *5* (at 14°), 0.0390 *22* (at 18°), 0.0400 *28* (at 22°).
1480 *3*	7/2$^+$,9/2$^+$	4	0.357 *18*	σ(mb/sr)=0.0220 *15* (at 6°), 0.0230 *23* (at 10°), 0.0570 *35* (at 14°), 0.081 *5* (at 18°), 0.0560 *35* (at 22°).
1493 *3*	1/2$^-$,3/2$^-$	1	0.0170 *9*	σ(mb/sr)=0.0460 *25* (at 6°), 0.0370 *27* (at 10°), 0.0160 *22* (at 14°), 0.0190 *22* (at 18°), 0.0150 *21* (at 22°).
1532 *10*	3/2$^+$,5/2$^+$	2		σ(mb/sr)=0.213 *11* (at 6°), 0.255 *13* (at 10°), 0.151 *8* (at 14°), 0.081 *4* (at 18°), 0.084 *4* (at 22°).
1582 *10*	3/2$^+$,5/2$^+$	2		σ(mb/sr)=0.398 *20* (at 6°), 0.511 *26* (at 10°), 0.300 *25* (at 14°), 0.162 *8* (at 18°), 0.181 *9* (at 22°).
1604 *10*	1/2$^+$	0		σ(mb/sr)=0.125 *7* (at 6°), 0.078 *4* (at 10°), 0.081 *4* (at 14°), 0.0490 *27* (at 18°), 0.0380 *22* (at 22°).
1647 *10*				σ(mb/sr)=0.0090 *21* (at 6°), 0.0150 *21* (at 10°), 0.0260 *24* (at 14°), 0.0200 *22* (at 18°), 0.0200 *14* (at 22°).
1665 *10*	5/2$^-$	3	0.463 *23*	σ(mb/sr)=0.07 *2* (at 6°), 0.125 *8* (at 10°), 0.177 *9* (at 14°), 0.167 *9* (at 18°), 0.103 *6* (at 22°).
1685 *10*				σ(mb/sr)=0.007 *2* (at 6°), 0.0090 *11* (at 10°), 0.0160 *13* (at 14°), 0.0130 *31* (at 18°), 0.0090 *21* (at 22°).
1705 *10*	1/2$^-$,3/2$^-$	1	0.0130 *7*	σ(mb/sr)=0.0360 *21* (at 6°), 0.0300 *18* (at 10°), 0.0100 *11* (at 14°), 0.0170 *13* (at 18°),

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^{102}Ru(^{3}He,d) 2017Fr08 (continued)

^{103}Rh Levels (continued)

E(level)†	J$^{\pi}$†	L‡	Comments
			0.0140 *12* (at 22°).
1782 *10*	3/2+,5/2+	2	σ(mb/sr)=0.056 *3* (at 6°), 0.071 *4* (at 10°), 0.0610 *32* (at 14°), 0.0540 *29* (at 18°), 0.0530 *28* (at 22°).
1809 *10*	1/2−,3/2−	1	σ(mb/sr)=0.0120 *12* (at 6°), 0.0070 *11* (at 10°), 0.0100 *11* (at 14°), 0.0080 *11* (at 18°), 0.005 *1* (at 22°).
1853 *10*	3/2+,5/2+	2	σ(mb/sr)=0.087 *5* (at 6°), 0.127 *7* (at 10°), 0.086 *5* (at 14°), 0.0370 *21* (at 18°), 0.0420 *23* (at 22°).
1927 *10*	3/2+,5/2+	2	σ(mb/sr)=0.0270 *24* (at 6°), 0.0360 *21* (at 10°), 0.0224 *14* (at 14°), 0.0122 *10* (at 18°), 0.0148 *11* (at 22°).
1981 *10*	3/2+,5/2+	2	σ(mb/sr)=0.142 *7* (at 6°), 0.175 *9* (at 10°), 0.118 *6* (at 14°), 0.0600 *32* (at 18°), 0.0650 *34* (at 22°).
2029 *10*	1/2+	0	σ(mb/sr)=0.0250 *16* (at 6°), 0.0140 *12* (at 10°), 0.0318 *18* (at 14°), 0.0273 *16* (at 18°), 0.0273 *16* (at 22°).
2086 *10*	3/2+,5/2+	2	σ(mb/sr)=0.177 *9* (at 6°), 0.227 *12* (at 10°), 0.146 *8* (at 14°), 0.076 *4* (at 18°), 0.085 *4* (at 22°).
2119 *10*	3/2+,5/2+	2	σ(mb/sr)=0.0420 *29* (at 6°), 0.0570 *35* (at 10°), 0.0380 *22* (at 14°), 0.0190 *14* (at 18°), 0.0190 *14* (at 22°).
2157 *10*	3/2+,5/2+	2	σ(mb/sr)=0.0550 *34* (at 6°), 0.066 *4* (at 10°), 0.0440 *24* (at 14°), 0.0330 *19* (at 18°), 0.0270 *17* (at 22°).
2177 *10*	3/2+,5/2+	2	σ(mb/sr)=0.0330 *26* (at 6°), 0.0370 *27* (at 10°), 0.0280 *17* (at 14°), 0.0120 *12* (at 18°), 0.0120 *12* (at 22°).
2190 *10*	3/2+,5/2+	2	σ(mb/sr)=0.0210 *23* (at 6°), 0.0240 *23* (at 10°), 0.0100 *11* (at 14°), 0.0066 *10* (at 18°), 0.006 *1* (at 22°).
2234 *10*	1/2+	0	σ(mb/sr)=0.459 *23* (at 6°), 0.396 *20* (at 10°), 0.414 *21* (at 14°), 0.184 *10* (at 18°), 0.169 *9* (at 22°).
2305 *10*	3/2+,5/2+	2	σ(mb/sr)=0.0350 *27* (at 6°), 0.0360 *35* (at 10°), 0.0330 *34* (at 14°), 0.0080 *11* (at 18°), 0.0110 *21* (at 22°).
2316 *10*	3/2+,5/2+	2	σ(mb/sr)=0.058 *4* (at 6°), 0.071 *5* (at 10°), 0.0410 *29* (at 14°), 0.0310 *34* (at 18°), 0.0330 *34* (at 22°).
2337 *10*	1/2+	0	σ(mb/sr)=0.066 *4* (at 6°), 0.065 *4* (at 10°), 0.0630 *33* (at 14°), 0.034 *2* (at 18°), 0.0320 *19* (at 22°).
2370 *10*	3/2+,5/2+	2	σ(mb/sr)=0.078 *5* (at 6°), 0.091 *6* (at 10°), 0.067 *4* (at 14°), 0.035 *2* (at 18°), 0.0390 *22* (at 22°).
2399 *10*	1/2+	0	σ(mb/sr)=0.0380 *28* (at 6°), 0.0320 *26* (at 10°), 0.034 *2* (at 14°), 0.0190 *14* (at 18°), 0.0151 *12* (at 22°).
2418 *10*	3/2+,5/2+	2	σ(mb/sr)=0.107 *6* (at 6°), 0.137 *8* (at 10°), 0.103 *6* (at 14°), 0.056 *3* (at 18°), 0.0590 *31* (at 22°).
2446 *10*	3/2+,5/2+	2	σ(mb/sr)=0.066 *4* (at 6°), 0.077 *4* (at 10°), 0.0580 *31* (at 14°), 0.0370 *21* (at 18°), 0.0400 *22* (at 22°).
2472 *10*	1/2+	0	σ(mb/sr)=0.0530 *33* (at 6°), 0.0350 *27* (at 10°), 0.070 *4* (at 14°), 0.0460 *25* (at 18°), 0.034 *2* (at 22°).
2495 *10*	1/2+	0	σ(mb/sr)=0.0250 *33* (at 6°), 0.0290 *25* (at 10°), 0.0260 *17* (at 14°), 0.0260 *17* (at 18°), 0.0190 *14* (at 22°).
2510 *10*	3/2+,5/2+	2	σ(mb/sr)=0.0340 *26* (at 6°), 0.045 *3* (at 10°), 0.0320 *19* (at 14°), 0.0200 *14* (at 18°), 0.0210 *15* (at 22°).
2527 *10*	3/2+,5/2+	2	σ(mb/sr)=0.084 *5* (at 6°), 0.100 *31* (at 10°), 0.0650 *34* (at 14°), 0.034 *2* (at 18°), 0.0370 *21* (at 22°).
2545 *10*	3/2+,5/2+	2	σ(mb/sr)=0.075 *4* (at 6°), 0.082 *5* (at 10°), 0.0610 *32* (at 14°), 0.0290 *18* (at 18°), 0.0320 *19* (at 22°).
2603 *10*	3/2+,5/2+	(2)	σ(mb/sr)=0.0240 *23* (at 6°), 0.0300 *25* (at 10°), 0.0190 *14* (at 14°), 0.0160 *22* (at 18°), 0.0135 *11* (at 22°).
2619 *10*	3/2+,5/2+	2	σ(mb/sr)=0.078 *4* (at 6°), 0.102 *6* (at 10°), 0.0580 *31* (at 14°), 0.0370 *27* (at 18°), 0.0390 *22* (at 22°).
2639 *10*	3/2+,5/2+	2	σ(mb/sr)=0.0520 *33* (at 6°), 0.0570 *35* (at 10°), 0.0400 *22* (at 14°), 0.0250 *16* (at 18°), 0.0150 *11* (at 22°).
2695 *10*	3/2+,5/2+	2	σ(mb/sr)=0.071 *5* (at 6°), 0.108 *7* (at 10°), 0.0630 *33* (at 14°), 0.044 *3* (at 18°), 0.0410 *29* (at 22°).
2708 *10*	1/2+	0	σ(mb/sr)=0.051 *6* (at 6°), 0.044 *5* (at 10°), 0.0540 *29* (at 14°), 0.0300 *25* (at 18°), 0.0210 *23* (at 22°).
2720 *10*	3/2+,5/2+	2	σ(mb/sr)=0.051 *5* (at 6°), 0.064 *5* (at 10°), 0.0420 *23* (at 14°), 0.0230 *23* (at 18°), 0.0290 *25* (at 22°).
2765 *10*	3/2+,5/2+	(2)	σ(mb/sr)=0.093 *5* (at 6°), 0.087 *5* (at 10°), 0.074 *4* (at 14°), 0.0390 *22* (at 18°), 0.0380 *22* (at 22°).
2801 *10*	3/2+,5/2+	2	σ(mb/sr)=0.224 *12* (at 6°), 0.266 *14* (at 10°), 0.174 *9* (at 14°), 0.088 *5* (at 18°), 0.093 *5* (at 22°).
2824 *10*	3/2+,5/2+	2	σ(mb/sr)=0.089 *5* (at 6°), 0.109 *6* (at 10°), 0.068 *4* (at 14°), 0.0350 *27* (at 18°), 0.034 *2* (at 22°).
2859 *10*	3/2+,5/2+	2	σ(mb/sr)=0.077 *6* (at 6°), 0.090 *11* (at 10°), 0.049 *8* (at 14°), 0.0240 *32* (at 18°), 0.0250 *33* (at 22°).

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^{102}Ru(^{3}He,d) 2017Fr08 (continued)

^{103}Rh Levels (continued)

E(level)†	Jπ†	L‡	Comments
2886 *10*	3/2+,5/2+	(2)	σ(mb/sr)=0.068 *5* (at 6°), 0.110 *8* (at 10°), 0.096 *6* (at 14°), 0.050 *4* (at 18°), 0.039 *5* (at 22°).
2907 *10*	3/2+,5/2+	(2)	σ(mb/sr)=0.055 *4* (at 6°), 0.083 *7* (at 10°), 0.064 *4* (at 14°), 0.050 *4* (at 18°), 0.053 *6* (at 22°).
2921 *10*	3/2+,5/2+	(2)	σ(mb/sr)=0.051 *4* (at 6°), 0.071 *5* (at 10°), 0.053 *4* (at 14°), 0.0360 *35* (at 18°), 0.025 *4* (at 22°).

† From 2017Fr08.
‡ From comparisons of measured σ(θ) with DWBA calculations (2017Fr08).

^{103}Rh(n,n′γ) 1991Ab03,1978Ba36

1991Ab03: E not given; measured σ(E, Eγ), Eγ, Iγ. ^{103}Rh deduced levels.
1978Ba36: ^{103}Rh(n,n), E=0.2-1.3 MeV; measured σ(E,τ). ^{103}Rh(n,n′), E=0.55-1.5 MeV; measured σ(E,En′). ^{103}Rh(n,n′γ), E=1.1-1.93 MeV; measured Eγ, Iγ, σ(E,Eγ). ^{103}Rh deduced levels, branching ratios, J, π, activation of isomeric state. Natural target, time of flight, Ge(Li) detector.
Other: 1994De20.

^{103}Rh Levels

E(level)‡	Jπ†	E(level)‡	Jπ†	E(level)‡	Jπ†
0.0	1/2−	1252.3 *4*	(5/2,7/2)	1600.1 *7*	1/2+
39.66 *25*	7/2+	1256.7 *4*	1/2+	1605.3 *6*	
92.9 *3*	9/2+	1277.86 *25*	3/2−	1611.9 *9*	
295.19 *15*	3/2−	1294.20 *25*	1/2−,3/2,5/2−	1685.5 *4*	
357.78 *16*	5/2−	1326.9 *6*		1706.5 *4*	
537.25 *23*	5/2+	1344.9 *5*	7/2+,9/2+	1706.6 *6*	1/2−,3/2−
607.5 *4*	(5/2+,7/2,9/2)	1403.9 *7*		1731.6 *6*	
650.51 *24*	5/2+	1411.43 *20*	3/2−,5/2−	1778.2 *9*	3/2+,5/2+
651.9 *3*	3/2+	1429.1 *7*		1842.4 *9*	
657.9 *5*	11/2+	1438.5 *5*	3/2+,5/2+	1968.2 *8*	
781.0 *4*	(9/2+)	1443.83 *25*	1/2−,3/2,5/2−	1970.0 *11*	
803.46 *23*	1/2−	1466.7 *4*	(3/2,5/2)	1999.5 *6*	1/2−,3/2,5/2−
848.39 *24*	7/2−	1480.0 *8*	7/2+,9/2+	2008.8 *5*	1/2,3/2,5/2−
881.36 *20*	5/2−	1482.62 *18*	3/2,5/2−	2059.2 *10*	
920.9 *4*	9/2−	1491.9 *4*	1/2−,3/2−	2103.5 *13*	
1078.6 *3*	5/2+,7/2	1516.0 *8*		2136.8 *12*	
1107.9 *3*	5/2−	1530.9 *4*	3/2+,5/2+	2234.9 *7*	1/2+
1135.9 *4*	(1/2,3/2,5/2−)	1580.0 *5*	3/2+,5/2+		

† From Adopted Levels.
‡ Calculated from the gamma energies using a least-squares procedure.

γ(^{103}Rh)

ΔIγ: Uncertainty not given by authors.

Eγ†	Iγ‡	E_i(level)	J^π_i	E_f	J^π_f
39.76	100	39.66	7/2+	0.0	1/2−
53.29	100	92.9	9/2+	39.66	7/2+
62.4 *4*	5	357.78	5/2−	295.19	3/2−
72.6 *5*	9	920.9	9/2−	848.39	7/2−
114.9 *4*	16	651.9	3/2+	537.25	5/2+
242.3 *4*	16	537.25	5/2+	295.19	3/2−
295.6 *4*	100	295.19	3/2−	0.0	1/2−
357.9 *4*	95	357.78	5/2−	0.0	1/2−
428.5 *4*	44	1078.6	5/2+,7/2	650.51	5/2+
445.8 *4*	5	803.46	1/2−	357.78	5/2−
490.8 *4*	86	848.39	7/2−	357.78	5/2−
497.6 *4*	84	537.25	5/2+	39.66	7/2+
500.6@ *4*	14	1107.9	5/2−	607.5	(5/2+,7/2,9/2)
508 *1*	29	803.46	1/2−	295.19	3/2−
514 *1*	70	607.5	(5/2+,7/2,9/2)	92.9	9/2+
523.8 *3*	50	881.36	5/2−	357.78	5/2−

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^{103}Rh(n,n′γ) 1991Ab03,1978Ba36 (continued)

γ(^{103}Rh) (continued)

E_γ [†]	I_γ [‡]	E_i(level)	J_i^π	E_f	J_f^π
541.6 4	21	1078.6	$5/2^+,7/2$	537.25	$5/2^+$
553.0 4	14	848.39	$7/2^-$	295.19	$3/2^-$
557.5 3	12	650.51	$5/2^+$	92.9	$9/2^+$
563.0 5	91	920.9	$9/2^-$	357.78	$5/2^-$
563.0 3	29	1411.43	$3/2^-,5/2^-$	848.39	$7/2^-$
564.9 4	100	657.9	$11/2^+$	92.9	$9/2^+$
568.2 4	30	607.5	$(5/2^+,7/2,9/2)$	39.66	$7/2^+$
586.2 3	44	881.36	$5/2^-$	295.19	$3/2^-$
601.9 4	33	1252.3	(5/2,7/2)	650.51	$5/2^+$
604.7 4	84	1256.7	$1/2^+$	651.9	$3/2^+$
610.9 3	88	650.51	$5/2^+$	39.66	$7/2^+$
612.4 4	84	651.9	$3/2^+$	39.66	$7/2^+$
679.4 3	23	1482.62	$3/2,5/2^-$	803.46	$1/2^-$
686.8 6	33	1344.9	$7/2^+,9/2^+$	657.9	$11/2^+$
688.2 3	61	781.0	$(9/2^+)$	92.9	$9/2^+$
720.3 4	19	1078.6	$5/2^+,7/2$	357.78	$5/2^-$
741.3 3	39	781.0	$(9/2^+)$	39.66	$7/2^+$
750.1 4	51	1107.9	$5/2^-$	357.78	$5/2^-$
760.6 3	14	1411.43	$3/2^-,5/2^-$	650.51	$5/2^+$
763.5 8	100	1611.9		848.39	$7/2^-$
786.9 5	35	1438.5	$3/2^+,5/2^+$	651.9	$3/2^+$
803.8 4	66	803.46	$1/2^-$	0.0	$1/2^-$
807.9 6	67	1344.9	$7/2^+,9/2^+$	537.25	$5/2^+$
812.5 4	34	1107.9	$5/2^-$	295.19	$3/2^-$
840.3 5	90	1135.9	$(1/2,3/2,5/2^-)$	295.19	$3/2^-$
881.1 3	7	881.36	$5/2^-$	0.0	$1/2^-$
920.3 4	8	1277.86	$3/2^-$	357.78	$5/2^-$
928.5 5	30	1580.0	$3/2^+,5/2^+$	651.9	$3/2^+$
936.5 4	18	1294.20	$1/2^-,3/2,5/2^-$	357.78	$5/2^-$
945.2 3	13	1482.62	$3/2,5/2^-$	537.25	$5/2^+$
949.6 6	100	1600.1	$1/2^+$	650.51	$5/2^+$
961.6 4	16	1256.7	$1/2^+$	295.19	$3/2^-$
982.7 4	14	1277.86	$3/2^-$	295.19	$3/2^-$
985.5 4	16	1078.6	$5/2^+,7/2$	92.9	$9/2^+$
993.6 5	60	1530.9	$3/2^+,5/2^+$	537.25	$5/2^+$
999.2 4	45	1294.20	$1/2^-,3/2,5/2^-$	295.19	$3/2^-$
1046.1 6	100	1403.9		357.78	$5/2^-$
1071.3 6	100	1429.1		357.78	$5/2^-$
1080.9 7	49	1731.6		650.51	$5/2^+$
1086.1 4	26	1443.83	$1/2^-,3/2,5/2^-$	357.78	$5/2^-$
1108.7 5	83	1466.7	(3/2,5/2)	357.78	$5/2^-$
1116.6 3	13	1411.43	$3/2^-,5/2^-$	295.19	$3/2^-$
1124.7 3	39	1482.62	$3/2,5/2^-$	357.78	$5/2^-$
1126.3 8	100	1778.2	$3/2^+,5/2^+$	651.9	$3/2^+$
1134.0 5	25	1491.9	$1/2^-,3/2^-$	357.78	$5/2^-$
1136.3 5	10	1135.9	$(1/2,3/2,5/2^-)$	0.0	$1/2^-$
1148.5 4	64	1443.83	$1/2^-,3/2,5/2^-$	295.19	$3/2^-$
1158.2 7	100	1516.0		357.78	$5/2^-$
1171.8 5	17	1466.7	(3/2,5/2)	295.19	$3/2^-$
1187.5 3	12	1482.62	$3/2,5/2^-$	295.19	$3/2^-$
1196.9 5	75	1491.9	$1/2^-,3/2^-$	295.19	$3/2^-$
1212.5 4	67	1252.3	(5/2,7/2)	39.66	$7/2^+$
1247.5 7	45	1605.3		357.78	$5/2^-$
1277.6 4	78	1277.86	$3/2^-$	0.0	$1/2^-$
1287.2 5	100	1326.9		39.66	$7/2^+$
1293.9 4	37	1294.20	$1/2^-,3/2,5/2^-$	0.0	$1/2^-$

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^{103}Rh(n,n′γ) 1991Ab03,1978Ba36 (continued)

γ(^{103}Rh) (continued)

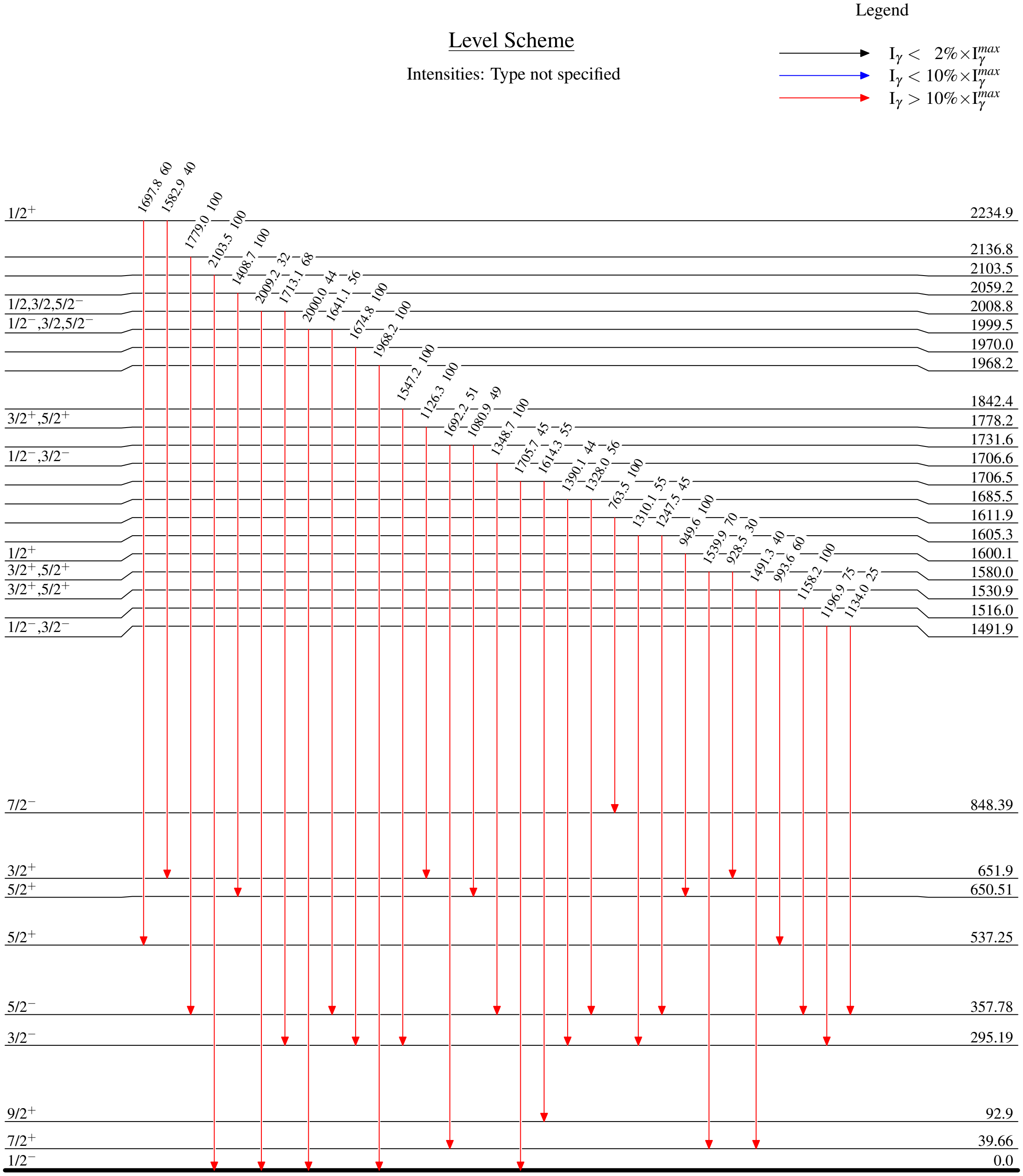
Eγ†	Iγ‡	Ei(level)	J^π_i	Ef	J^π_f	Eγ†	Iγ‡	Ei(level)	J^π_i	Ef	J^π_f
1310.1 *7*	55	1605.3		295.19	3/2⁻	1582.9 *9*	40	2234.9	1/2⁺	651.9	3/2⁺
1328.0 *5*	56	1685.5		357.78	5/2⁻	1614.3 *5*	55	1706.5		92.9	9/2⁺
1348.7 *5*	100	1706.6	1/2⁻,3/2⁻	357.78	5/2⁻	1641.1 *8*	56	1999.5	1/2⁻,3/2,5/2⁻	357.78	5/2⁻
1390.1 *5*	44	1685.5		295.19	3/2⁻	1674.8 *10*	100	1970.0		295.19	3/2⁻
1398.5 *5*	65	1438.5	3/2⁺,5/2⁺	39.66	7/2⁺	1692.2 *7*	51	1731.6		39.66	7/2⁺
1408.7 *9*	100	2059.2		650.51	5/2⁺	1697.8 *9*	60	2234.9	1/2⁺	537.25	5/2⁺
1411.4 *3*	44	1411.43	3/2⁻,5/2⁻	0.0	1/2⁻	1705.7 *5*	45	1706.5		0.0	1/2⁻
1440.3 *7*	100	1480.0	7/2⁺,9/2⁺	39.66	7/2⁺	1713.1 *7*	68	2008.8	1/2,3/2,5/2⁻	295.19	3/2⁻
1443.9 *4*	10	1443.83	1/2⁻,3/2,5/2⁻	0.0	1/2⁻	1779.0 *11*	100	2136.8		357.78	5/2⁻
1482.6 *3*	13	1482.62	3/2,5/2⁻	0.0	1/2⁻	1968.2 *8*	100	1968.2		0.0	1/2⁻
1491.3 *5*	40	1530.9	3/2⁺,5/2⁺	39.66	7/2⁺	2000.0 *8*	44	1999.5	1/2⁻,3/2,5/2⁻	0.0	1/2⁻
1539.9 *5*	70	1580.0	3/2⁺,5/2⁺	39.66	7/2⁺	2009.2 *7*	32	2008.8	1/2,3/2,5/2⁻	0.0	1/2⁻
1547.2 *8*	100	1842.4		295.19	3/2⁻	2103.5 *13*	100	2103.5		0.0	1/2⁻

† From 1991Ab03, ΔE taken from ΔE(levels) given by 1991Ab03. Other: 1978Ba36.
‡ % photon branchings from each level (1991Ab03).
# Uncertainty not given by authors.
@ If energy is correct no final level within 1.3 keV.

^{103}Rh(n,n′γ) 1991Ab03,1978Ba36

Level Scheme

Intensities: Type not specified

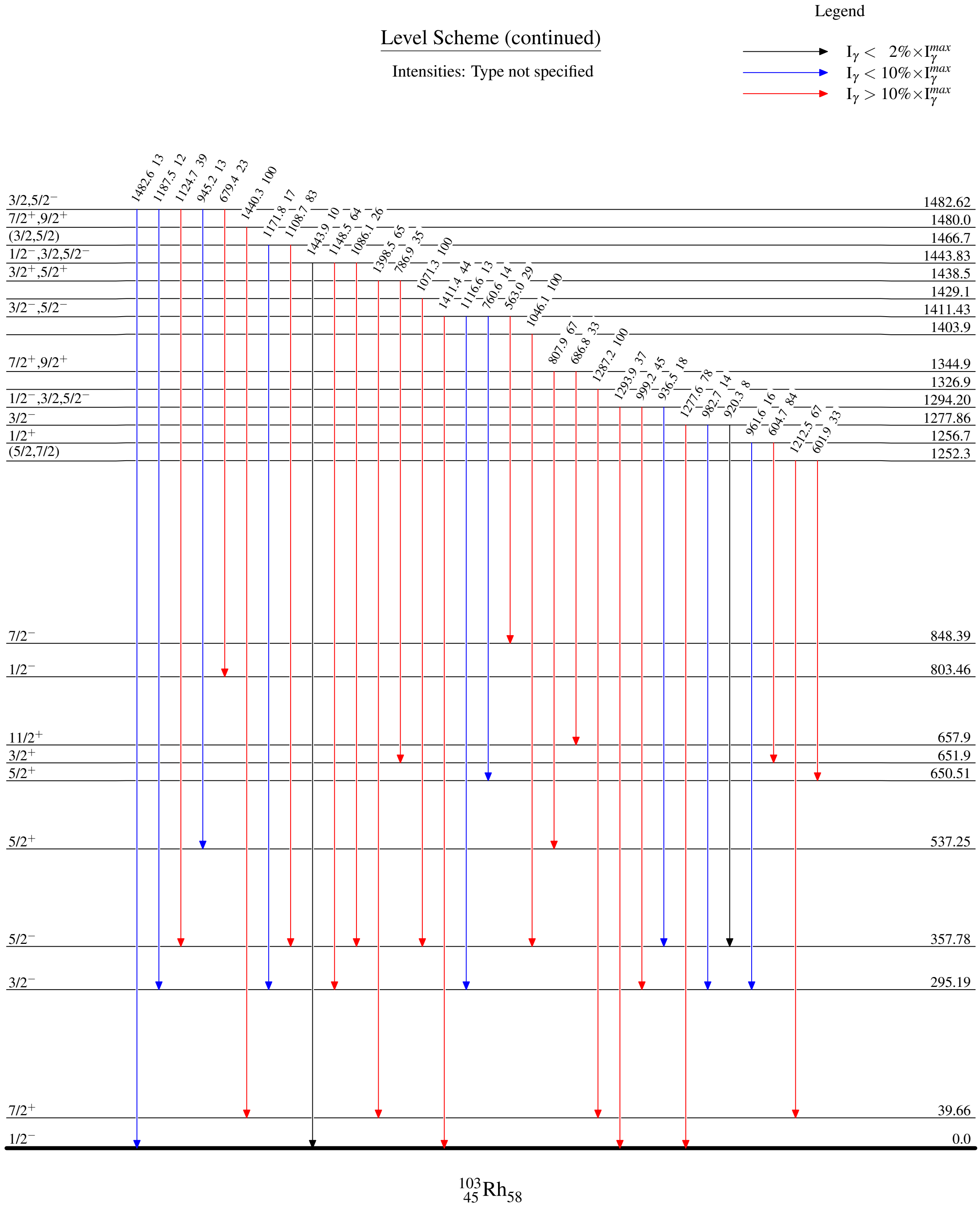


$^{103}_{45}Rh_{58}$

^{103}Rh(n,n′γ) 1991Ab03,1978Ba36

Level Scheme (continued)

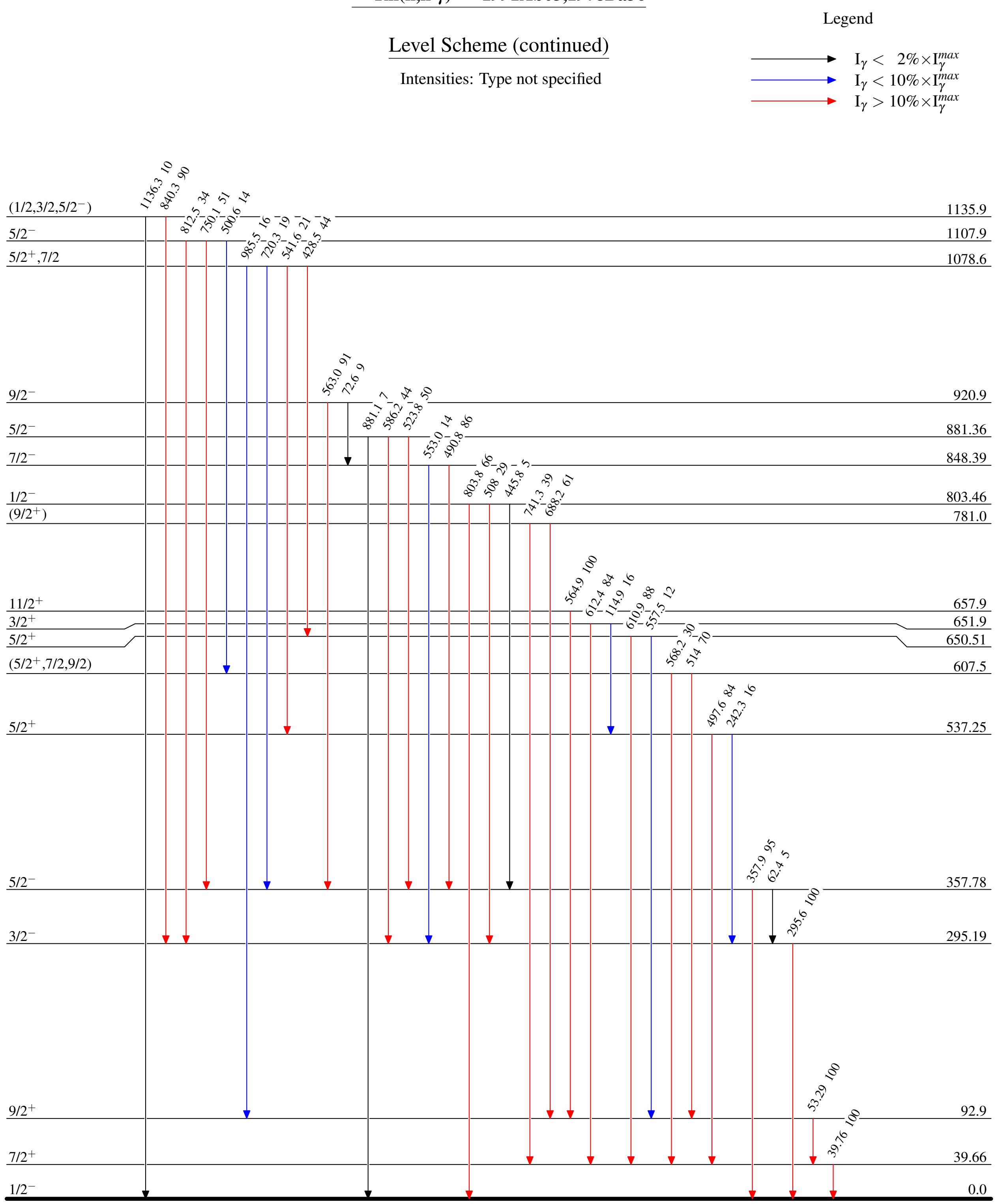
Intensities: Type not specified



^{103}Rh(n,n′γ) 1991Ab03,1978Ba36

Level Scheme (continued)

Intensities: Type not specified



$^{103}_{45}Rh_{58}$

^{103}Rh(p,p′) 1969Bl04

E=10, 11.75 MeV. Measured: σ(E(p),E(p)′,θ), θ=100°, 120° and 140° at E=10 MeV and θ=130° at E=11.75 MeV. Deduced: ^{103}Rh levels. Natural targets. Magnetic spectrograph.
Others: 1957Co56, 1958Co73.

^{103}Rh Levels

ΔE: Uncertainty≤10 keV.

E(level)	E(level)	E(level)	E(level)
0.0 *10*	798 *10*	1400 *10*	1842 *10*
40 *10*	843 *10*	1438 *10*	1901 *10*
93 *10*	877‡ *10*	1483 *10*	1986 *10*
295‡ *10*	915 *10*	1598 *10*	2105 *10*
356‡ *10*	1102 *10*	1650? *10*	
536 *10*	1247 *10*	1705 *10*	
650 *10*	1270 *10*	1774 *10*	

† Uncertainty≤10 keV.
‡ Absolute (p,p′) cross sections extracted for those levels.

^{103}**Rh(p,p′γ)** **1967ThZZ**

E(p)=3.5, 4, 4.5 MeV; semi. γ spectra via inelastic p scattering;

^{103}Rh Levels

E(level)[†]
0.0
40
297
360
650
880
1275
1420?
2040?

[†] No ΔE given by the authors.

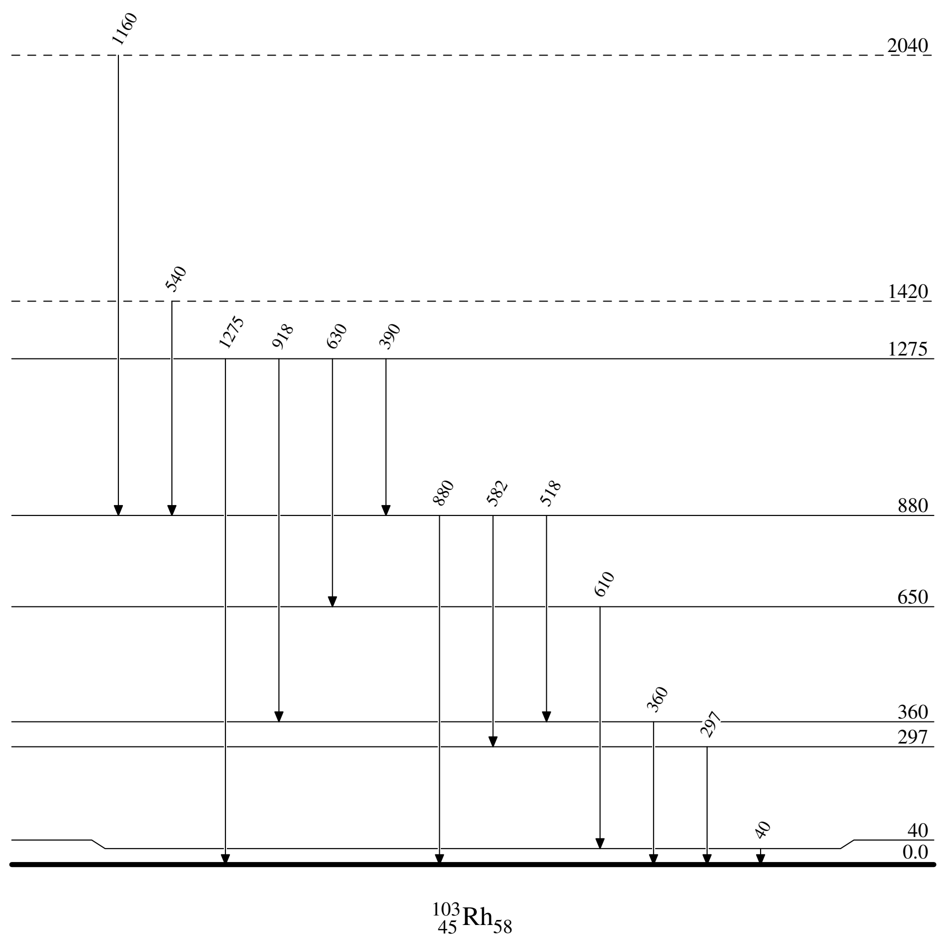
γ(^{103}Rh)

E_γ	E_i(level)	E_f	E_γ	E_i(level)	E_f	E_γ	E_i(level)	E_f
40	40	0.0	540	1420?	880	918	1275	360
297	297	0.0	582	880	297	1160	2040?	880
360	360	0.0	610	650	40	1275	1275	0.0
390	1275	880	630	1275	650	[x]1320[†]		
518	880	360	880	880	0.0			

[†] Placement of transition in the level scheme is uncertain.
[x] γ ray not placed in level scheme.

^{103}Rh(p,p′γ) 1967ThZZ

Level Scheme



^{103}Rh(d,d′) 1962Jo05

E=15 MeV. Measured: relative intensity of scattered deuterons at θ=42°, 59°. Deduced: ^{103}Rh levels. Magnetic spectrograph, resolution≈40 keV.
Others: 1959Yn17, 1961Co07, 1966Du03.

^{103}Rh Levels

E(level)†	E(level)†	E(level)†	E(level)†
0.0	1260	1780	2290
350	1470	1990	2430
880	1670	2090	2620

† No ΔE given by the authors.

Coulomb excitation 1972Sa03,1969WaZU

^{103}Rh(p,p′γ): E=2.7,3.0 MeV (1958Mc02), E=2.5-4.5 MeV (1988Ta23).
^{103}Rh(α,α′γ): E=7-10 MeV (1972Sa03).
^{103}Rh(^{16}O,^{16}O′γ): E=36-45 MeV (1972Sa03), E=40 MeV (1970GrYS,1970GrYR,1971GrXO), E=34,40 MeV (1969Bl04).
^{103}Rh(^{35}Cl,^{35}Cl′γ): E=62-88 MeV (1969WaZU), E=100 MeV (1972SiZP,1972SiZO).
^{103}Rh(^{32}S,^{32}S′γ): E=70-80 MeV (1988Be45).
^{103}Rh(^{40}Ar,^{40}Ar′γ): E=129 MeV (1989Lo08,1990Na17).
Others: 1955Mc51, 1956Te26, 1962Va20, 1964Al27, 1964Ko12.

^{103}Rh Levels

E(level)[†]	Jπ[‡]	$T_{1/2}$	Comments
0.0	1/2⁻	stable	
294.90 *15*	3/2⁻	6.61 ps *18*	B(E2)↑=0.216 *6*; g=0.46 *8* (1988Be45) $T_{1/2}$: From B(E2)=0.216 *6*. B(E2)↑: weighted av: 0.228 *14* (1970GrYS), 0.245 *18* (1972Sa03). 0.22 *1* (1988Ta23), 0.209 *15* (1958Mc02,1969Bl04) 0.198 *11* (1970GrYR) and 0.213 *16* (1972SiZO). g: others: g=0.68 *17* (1971SpZT), 0.70 *21* (1973MiZC) if $T_{1/2}$=6.7 ps. Others: 1971BhZV, 1972Sz03, 1974HeYO.
357.31 *14*	5/2⁻	73 ps *2*	B(E2)↑=0.346 *9*; g=0.37 *8* (1988Be45) $T_{1/2}$: From B(E2). B(E2)↑: Weighted average of 0.358 *14* (1970GrYS), 0.326 *29* (1974Mi02) 0.343 *13* (1989Lo08), 0.334 *35* (1970GrYR). g: others: g=0.42 *6* (1974HeYO), 0.4 *1* *14* (1973MiZC), 0.44 *2* (1972Sz03), 0.39 *7* (1971BhZV), 0.47 *10* (1971SpZT); $T_{1/2}$=73 ps assumed.
803.09 *19*	1/2⁻		Jπ: J=1/2 from γ(θ) (1988Ta23).
847.7 *3*	7/2⁻	1.9 ps *2*	$T_{1/2}$: from 1972SiZO (DSA method). Other: 1.7 ps (1972SiZO) via B(E2) (3/2⁻ to 7/2⁻)=0.29, I(553γ)-branching=22%.
880.41 *19*	5/2⁻	2.9 ps *3*	B(E2)↑=0.0131 *10* $T_{1/2}$: via B(E2) (1972Sa03). Jπ: J=5/2 from γ(θ) (1972Sa03). B(E2)↑: others: 0.0117 *15* (1972SiZO), 0.0133 (1969Bl04), 0.0132 *16* (1988Ta23).
919.8 *3*	9/2⁻	5.6 ps *3*	$T_{1/2}$: From B(E2)(9/2⁻ to 5/2⁻). B(E2)(From (9/2⁻ to 5/2⁻)=0.178 *9* B(E2) is weighted average of 0.178 *15* (1989Lo08); 0.181 *15* (1972Sa03) 0.175 *2* (1972SiZO); Other: 0.144 *16* (1972SiZO).
1106.61 *15*	5/2⁻		B(E2)↑=0.0031 *4* Jπ: J=5/2 from γ(θ) (1988Ta23). B(E2)↑: From 1972Sa03 for adopted branching %Iγ(749γ)=52 *5*. Others: B(E2)=0.0032 *4* (1988Ta23), 0.8 (1971GrXO).
1277.02 *9*	3/2⁻	0.53 ps *36*	B(E2)↑=0.0132 *12* $T_{1/2}$: from B(E2)=0.0132 *12* (1972Sa03) and δ(1277γ)=−0.62 *30*. B(E2)↑: for adopted branching %Iγ (1277γ)=75.2 *23*. Other: B(E2)=0.040 *6* (1988Ta23).

† From least-squares fit to Eγ data.
‡ From Adopted Levels.

γ(^{103}Rh)

$E_γ$[†]	$I_γ$[‡]	E_i(level)	$J^π_i$	E_f	$J^π_f$	Mult.	δ[&]	α[a]	Comments
62.3	5.3 *5*	357.31	5/2⁻	294.90	3/2⁻	M1		1.321 *18*	B(M1)(W.u.)=0.058 *6* $E_γ$,$I_γ$: from 1970GrYS. δ: E2 admixture negligible from 62γ(θ) (1976Ge19).
295.1 *3*	100	294.90	3/2⁻	0.0	1/2⁻	M1+E2	−0.17 *1*	0.01909 *27*	B(E2)(W.u.)=37 *5*; B(M1)(W.u.)=0.124 *4*

Continued on next page (footnotes at end of table)

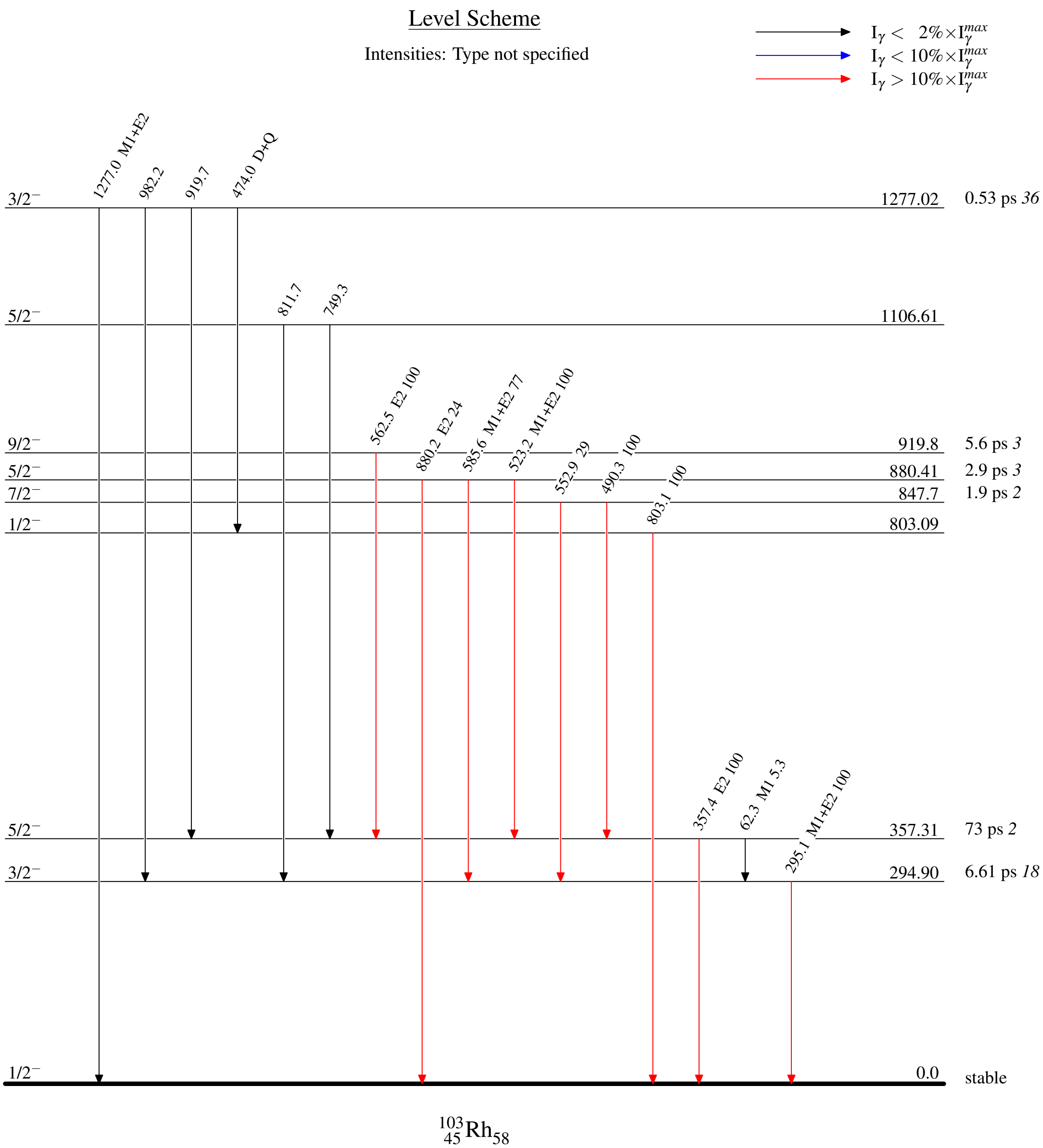
Coulomb excitation 1972Sa03,1969WaZU (continued)

$\gamma(^{103}Rh)$ (continued)

E_γ [†]	I_γ [‡]	E_i(level)	J^π_i	E_f	J^π_f	Mult.	δ [&]	α [a]	Comments
									δ: weighted average of −0.18 *1* (1955Mc51), −0.17 *1* (1958Mc02), −0.189 *10* (1970RoZS), −0.15 *1* (1972Sa03). Others: −0.58 +*12*−*8* (1988Ta23); see also 1955Mc51, 1970RoZS, 1972Sa03, 1978Ba36.
357.4 *3*	100	357.31	5/2⁻	0.0	1/2⁻	E2		0.01588 *23*	B(E2)(W.u.)=40.7 *12*
474.0 *5*		1277.02	3/2⁻	803.09	1/2⁻	D+Q	0.53 +*37*−*21*		δ: from 1988Ta23.
490.3 *3*	100[@] *10*	847.7	7/2⁻	357.31	5/2⁻				
523.2 *3*	100[#] *6*	880.41	5/2⁻	357.31	5/2⁻	M1+E2	−0.25 *3*	0.00460 *6*	B(E2)(W.u.)=5.1 *13*; B(M1)(W.u.)=0.025 *3* δ: from 1977Kr13. δ=−0.25 +*33*−*10* or −0.96 +*33*−*24* (1988Ta23).
552.9 *3*	29[@] *3*	847.7	7/2⁻	294.90	3/2⁻				
562.5 *3*	100	919.8	9/2⁻	357.31	5/2⁻	E2		0.00404 *6*	B(E2)(W.u.)=62 *4*
585.6 *3*	77[#] *4*	880.41	5/2⁻	294.90	3/2⁻	M1+E2	−0.27 *2*	0.00351 *5*	B(E2)(W.u.)=2.6 *5*; B(M1)(W.u.)=0.0134 *16* I_γ: others: 73 (1971GrXO), 103 *14* (1969WaZU). δ: from 1977Kr13. −0.14 *6* or +0.21 *8* (1988Ta23).
749.3 *1*		1106.61	5/2⁻	357.31	5/2⁻				
803.1 *2*	100	803.09	1/2⁻	0.0	1/2⁻				
811.7 *1*		1106.61	5/2⁻	294.90	3/2⁻				δ: −0.45 or +3.1 *4* (1988Ta23).
880.2 *3*	24[#]	880.41	5/2⁻	0.0	1/2⁻	E2		1.27×10^{-3} *2*	B(E2)(W.u.)=1.53 *17* I_γ: others: 20 (1971GrXO), 22 *3* (1969WaZU). Mult.: from A_2 coef 880$\gamma(\theta)$ (1972Sa03).
919.7 *2*		1277.02	3/2⁻	357.31	5/2⁻				
982.2 *3*		1277.02	3/2⁻	294.90	3/2⁻				
1277.0 *1*		1277.02	3/2⁻	0.0	1/2⁻	M1+E2	−0.62 *30*	6.15×10^{-4} *13*	δ: −0.62 *30* (1972Sa03) 1277$\gamma(\theta)$; sign from 1977Kr13.

† From 1969WaZU, unless otherwise noted.
‡ Relative photon branching from each level.
# From 1972Sa03.
@ From 1969WaZU.
& Based on $\gamma(\theta)$. From 1972Sa03, unless noted otherwise.
a Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on γ-ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

Coulomb excitation 1972Sa03,1969WaZU



^{103}Rh(γ,γ') 2001St03,1981Ca10

2001St03: ^{103}Rh(γ,γ'), Eγ=2.4, 4.1 MeV bremsstrahlung; measured Eγ, Iγ. ^{103}Rh transitions deduced energies, widths, B(M1), B(E1), levels, dipole strength distribution, population inversion. Possible application to γ-ray laser discussed.

1981Ca10: ^{103}Rh(γ,γ'), Eγ=0.5-1.65 MeV bremsstrahlung; measured $\gamma(\theta)$, self absorption, absolute γ-transition strength. ^{103}Rh levels deduced $T_{1/2}$. Nuclear resonance fluorescence technique.

All data are from 2001St03, unless noted otherwise. All widths are in meV.

^{103}Rh Levels

E(level)	J$^\pi$	$T_{1/2}$	Comments
0.0			
803.10 *18*	1/2$^-$	0.120 ps *19*	E(level): From Adopted Levels. $T_{1/2}$: From 1981Ca10, if J^π=1/2 is assumed.
1277.14 *11*	3/2$^-$	0.60 ps *10*	E(level): From Adopted Levels. $T_{1/2}$: From 1981Ca10, if J^π=3/2 is assumed. gΓ_0=1.30 *13*. Based on Γ_0/Γ = 0.75 from Table of Isotopes: R.B.Firestone and V.S. Shirley (Wiley, New York, 1996) Vol.1.
1614 *1*			gΓ_0=0.71 *13*.
1626 *1*			gΓ_0=0.57 *7*.
1778 *1*			gΓ_0=0.81 *15*.
1812 *1*			gΓ_0=0.63 *18*.
1861 *1*			gΓ_0=2.18 *21*.
1923 *1*			gΓ_0=1.98 *22*.
1943 *1*			gΓ_0=0.72 *16*.
1969 *1*			gΓ_0=9.83 *63*.
1997 *1*			gΓ_0=0.97 *19*.
2001 *1*			gΓ_0=0.77 *17*.
2034 *1*			gΓ_0=1.24 *19*.
2049 *1*			gΓ_0=0.56 *13*.
2059 *1*			gΓ_0=1.03 *20*.
2071 *1*			gΓ_0=0.86 *15*.
2075 *1*			gΓ_0=1.15 *16*.
2089 *1*			gΓ_0=0.66 *16*.
2128 *1*			gΓ_0=8.68 *60*.
2137 *1*			gΓ_0=0.99 *15*.
2155 *1*			gΓ_0=6.42 *48*.
2163 *1*			gΓ_0=0.69 *16*.
2196 *1*			gG$_0$=0.66 *18*.
2306 *1*			gΓ_0=0.95 *23*.
2319 *1*			gΓ_0=4.08 *41*.
2352 *1*			gΓ_0=1.57 *28*.
2362 *1*			gΓ_0=0.84 *18*.
2434 *1*			gΓ_0=1.35 *22*.
2468 *1*			gΓ_0=3.50 *44*.
2478 *1*			gΓ_0=0.63 *18*.
2516 *1*			gΓ_0=3.53 *47*.
2544 *1*			gΓ_0=0.89 *18*.
2585 *1*			gΓ_0=0.76 *18*.
2594 *1*			gΓ_0=17.28 *113*.
2604 *1*			gΓ_0=4.26 *43*.
2645 *1*			gΓ_0=1.17 *17*.
2666 *1*			gΓ_0=2.90 *37*.
2680 *1*			gΓ_0=30.46 *159*.
2695 *1*			gΓ_0=4.14 *41*.
2698 *1*			gΓ_0=1.30 *28*.
2706 *1*			gΓ_0=4.25 *42*.
2747 *1*			gΓ_0=10.84 *88*.
2762 *1*			gΓ_0=27.36 *210*.

Continued on next page (footnotes at end of table)

^{103}Rh(γ,γ′) 2001St03,1981Ca10 (continued)

^{103}Rh Levels (continued)

E(level)	Comments
2801 *1*	$g\Gamma_0$=9.08 *74*.
2854 *1*	$g\Gamma_0$=6.78 *64*.
2866 *1*	$g\Gamma_0$=1.32 *23*.
2911 *1*	$g\Gamma_0$=1.76 *27*.
2919 *1*	$g\Gamma_0$=1.07 *28*.
2923 *1*	$g\Gamma_0$=4.48 *57*.
2944 *1*	$g\Gamma_0$=2.04 *35*.
2956 *1*	$g\Gamma_0$=4.13 *40*.
2960 *1*	$g\Gamma_0$=1.75 *27*.
2966 *1*	$g\Gamma_0$=0.64 *13*.
2991 *1*	$g\Gamma_0$=0.89 *12*.
3028 *1*	$g\Gamma_0$=2.58 *33*.
3056 *1*	$g\Gamma_0$=1.61 *26*.
3082 *1*	$g\Gamma_0$=3.58 *67*.
3108 *1*	$g\Gamma_0$=1.38 *38*.
3114 *1*	$g\Gamma_0$=1.84 *28*.
3138 *1*	$g\Gamma_0$=2.37 *37*.
3153 *1*	$g\Gamma_0$=12.40 *88*.
3165 *1*	$g\Gamma_0$=1.45 *27*.
3201 *1*	$g\Gamma_0$=2.29 *54*.
3223 *1*	$g\Gamma_0$=4.89 *57*.
3242 *1*	$g\Gamma_0$=2.93 *56*.
3288 *1*	$g\Gamma_0$=2.34 *35*.
3296 *1*	$g\Gamma_0$=11.48 *87*.
3315 *1*	$g\Gamma_0$=3.90 *46*.
3331 *1*	$g\Gamma_0$=12.05 *86*.
3339 *1*	$g\Gamma_0$=3.88 *45*.
3345 *1*	$g\Gamma_0$=4.40 *65*.
3358 *1*	$g\Gamma_0$=1.57 *40*.
3401 *1*	$g\Gamma_0$=1.69 *36*.
3411 *1*	$g\Gamma_0$=1.78 *33*.
3435 *1*	$g\Gamma_0$=2.60 *47*.
3440 *1*	$g\Gamma_0$=5.40 *69*.
3449 *1*	$g\Gamma_0$=2.72 *61*.
3462 *1*	$g\Gamma_0$=4.52 *78*.
3521 *1*	$g\Gamma_0$=3.27 *61*.
3531 *1*	$g\Gamma_0$=4.48 *74*.
3535 *1*	$g\Gamma_0$=4.04 *73*.
3557 *1*	$g\Gamma_0$=2.12 *44*.
3573 *1*	$g\Gamma_0$=6.42 *17*.
3589 *1*	$g\Gamma_0$=11.93 *137*.
3600 *1*	$g\Gamma_0$=2.32 *46*.
3613 *1*	$g\Gamma_0$=5.55 *72*.
3617 *1*	$g\Gamma_0$=4.82 *83*.
3652 *1*	$g\Gamma_0$=6.65 *131*.
3660 *1*	$g\Gamma_0$=3.16 *57*.
3691 *1*	$g\Gamma_0$=5.08 *79*.
3708 *1*	$g\Gamma_0$=3.26 *99*.
3728 *1*	$g\Gamma_0$=4.88 *96*.
3773 *1*	$g\Gamma_0$=3.93 *73*.
3790 *1*	$g\Gamma_0$=3.18 *73*.
3798 *1*	$g\Gamma_0$=3.99 *71*.
3820 *1*	$g\Gamma_0$=28.12 *226*.
3831 *1*	$g\Gamma_0$=6.30 *95*.
3890 *1*	$g\Gamma_0$=7.33 *142*.
3904 *1*	$g\Gamma_0$=4.06 *95*.
3916 *1*	$g\Gamma_0$=6.82 *133*.

Continued on next page (footnotes at end of table)

^{103}**Rh**(γ,γ') **2001St03,1981Ca10 (continued)**

^{103}Rh Levels (continued)

E(level)	Comments
3936 *1*	gΓ_0=8.03 *32*.
3944 *1*	gΓ_0=3.80 *117*.
3977 *1*	gΓ_0=7.71 *136*.