

$^{103}\text{Rh}(\alpha, n\gamma)$ 1980Sa05

Type	Author	History	Citation	Literature Cutoff Date
Full Evaluation	D. De Frenne and A. Negret		NDS 109, 943 (2008)	1-May-2007

E=13.4, 16.7 MeV. Measured: γ singles, $\gamma\gamma$, $\gamma(\theta)$. Deduced: ^{106}Ag levels, J^π .

Others: 1975An07, 1978SaZK.

 ^{106}Ag Levels

E(level) [†]	J^π [‡]	$T_{1/2}$ [#]	Comments
0.0	1 ⁺	23.96 min 4	
89.66 7	6 ⁺	8.28 d 2	E(level): deduced from $E\gamma$'s originating from 4 ⁺ states, at 503 and 712 keV, in cascade to isomer and g.s. % ϵ =100; no evidence of IT decay (1975An07).
110.66 4	(2) ⁺		
205.95 4	(3) ⁺		
234.65 4	(1 ⁺ , 2 ⁺ , 3 ⁺)		J^π : $J^\pi=2^+$ suggested by 1980Sa05.
277.03 4	1 ⁻ , 2 ⁻		J^π : $J^\pi=2^-$ suggested by 1980Sa05.
328.83 7	5 ⁺		
332.62 8	7 ⁺		
364.43 4	(2, 3) ⁻		J^π : $J^\pi=3^-$ suggested by 1980Sa05.
389.16 5	3 ⁺		
416.62 6	(1) ⁻		
425.04 5	(2, 3) ⁻		J^π : $J^\pi=2^-$ suggested by 1980Sa05.
449.10 6	(4) ⁺		
468.84 23			J^π : $J^\pi=(2^+, 3^+, 4^+)$ suggested by 1980Sa05.
503.02 5	(3 ⁺ , 4, 5 ⁺)		J^π : $J^\pi=4^+$ suggested by 1980Sa05.
518.23 6	(3, 4) ⁻		J^π : $J^\pi=4^-$ suggested by 1980Sa05.
542.38 8	6		J^π : $J^\pi=6^+$ suggested by 1980Sa05.
556.80 7	(5) ⁺		
565.14 5	(2, 3) ⁻		J^π : $J^\pi=3^-$ suggested by 1980Sa05.
596.06 7	1 ⁻ , 2 ⁻ , 3 ⁻		J^π : $J^\pi=3^+$ suggested by 1980Sa05.
597.25 6	1 ⁻ , 2 ⁻ , 3 ⁻		J^π : $J^\pi=3^-$ suggested by 1980Sa05.
602.76 8	(2 ⁻ , 3 ⁻)		
625.68 10	7 ⁺		
661.30 8	1 ⁻		
676.28 7	5 ⁺		
698.20 6	1 ⁻ , 2 ⁻ , 3 ⁻		J^π : (3) ⁻ suggested by 1980Sa05.
712.14 8	4 ⁺		
730.43 13	(2 ⁺)		
741.58 9	(3 ⁺ , 4 ⁺)		
765.36 8	6 ⁻		E(level): levels at 765.14 keV and 765.62 keV considered as the same level by the evaluators.
769.67 16	1 ⁻ , 2 ⁻ , 3 ⁻		J^π : (1, 2) ⁻ suggested by 1980Sa05.
769.93 10	6		J^π : $J^\pi=(6^+)$ suggested by 1980Sa05.
773.49 12	(5) ⁺		
775.64 10	(4 ⁺ , 5 ⁺)		
797.45 12			
812.02 7	(3) ⁻		
816.47 9	(4) ⁺		
829.48 9	7 ⁻		
835.39 12	(2 ⁺ , 3 ⁺)		
861.57 9	(3 ⁻ , 4, 5 ⁻)		J^π : (3, 4) ⁻ suggested by 1980Sa05.
874.27 10	8 ⁻		
881.24 9	(6 ⁺)		
887.67 9	(5 ⁺)		
902.97 21	1 ⁻ , 2 ⁻ , 3 ⁻		J^π : (1, 2) ⁻ suggested by 1980Sa05 in $^{103}\text{Rh}(\alpha, n\gamma)$.

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$^{103}\text{Rh}(\alpha, n\gamma)$ **1980Sa05** (continued) ^{106}Ag Levels (continued)

E(level) [†]	J^π [‡]	Comments
912.50 11	(5,7) ⁻	
917.36 18	1 ⁻ , 2 ⁻ , 3 ⁻	
923.10 13	(2 ⁺ , 3 ⁺ , 4 ⁺)	
923.66 11	(1 ⁺ , 2 ⁺)	
927.2 1	(6 ⁺)	
933.17 10	(5 ⁻)	
936.45 10	0 ⁻ , 1 ⁻	
944.82 14	(2 ⁺ , 3 ⁺ , 4 ⁺)	
961.86 12	8 ⁺	J^π : $J^\pi=(7^+)$ suggested by 1980Sa05 .
979.21 13	8 ⁺	
1001.86 9	(2 ⁻ , 3 ⁻ , 4 ⁻)	
1003.41 11		
1003.95? 21		
1043.85 11	9 ⁻	
1063.18 11	(4 ⁺ , 5 ⁺)	
1086.86 11	(4 ⁻ , 5 ⁻)	
1106.33 10	(3 ⁻ , 4 ⁻)	
1123.55 12	(5 ⁻ , 6 ⁻)	
1133.85 16	(4 ⁺)	
1135.65 12	(2 ⁻ , 3 ⁻ , 4 ⁻)	
1145.06 11	(2 ⁻ , 3 ⁻ , 4 ⁻)	
1150.06 16	(2 ⁺ , 3 ⁺ , 4 ⁺)	
1166.8 3	(2 ⁻ , 3 ⁻ , 4 ⁻)	
1224.79 12	(6,7) ⁻	
1230.03 17	(2 ⁻ , 3 ⁻ , 4 ⁻)	
1288.95 16	(4 ⁺ , 5 ⁺)	
1303.37 11	(5 ⁻ , 6 ⁻ , 7 ⁻)	
1329.54 16	(3 ⁻ , 4 ⁻)	
1387.52 17	9 ⁺	J^π : (8) ⁺ suggested by 1980Sa05 in $^{103}\text{Rh}(\alpha, n\gamma)$.
1413.37 12	(5,6) ⁻	
1420.66 14	10 ⁻	

[†] For comparison of low-lying $\pi=+$ states (exp vs calc), see [1980Sa05](#). See [1980Sa05](#) for suggested Nilsson configuration.

[‡] From Adopted Levels. J^π suggestions from $^{103}\text{Rh}(\alpha, n\gamma)$ ([1980Sa05](#)) given as comment if different.

From Adopted Levels.

 $\gamma(^{106}\text{Ag})$

Placements are based on $\gamma\gamma$, and on consistency of photon branching ratios via $(\alpha, n\gamma)$ E=13.4, 16.7, MeV and $(\alpha, pn\gamma)$ E=35.6 MeV.

See [1980Sa05](#) for A_2, A_4 coef from $\gamma(\theta)$.

E_γ	I_γ [†]	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Comments
(28.70)		234.65	(1 ⁺ , 2 ⁺ , 3 ⁺)	205.95	(3) ⁺	E_γ : from level energy differences.
44.85 7	11.9 5	874.27	8 ⁻	829.48	7 ⁻	
53.77 7	3.9 4	556.80	(5 ⁺)	503.02	(3 ⁺ , 4, 5 ⁺)	
64.18 7	46.2 13	829.48	7 ⁻	765.36	6 ⁻	
87.40 6	51.0 14	364.43	(2,3) ⁻	277.03	1 ⁻ , 2 ⁻	
95.28 5	482 13	205.95	(3) ⁺	110.66	(2) ⁺	
107.71 5	39.3 12	556.80	(5 ⁺)	449.10	(4) ⁺	

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$^{103}\text{Rh}(\alpha, n\gamma)$ **1980Sa05 (continued)** $\gamma(^{106}\text{Ag})$ (continued)

E_γ	$I_\gamma^\dagger$	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Comments
110.66 5	1000	110.66	(2) ⁺	0.0	1 ⁺	
113.88 5	47.3 13	503.02	(3 ⁺ , 4, 5 ⁺)	389.16	3 ⁺	
116.09 6	10.2 4	712.14	4 ⁺	596.06	1 ⁻ , 2 ⁻ , 3 ⁻	
139.62 8	4.1 5	416.62	(1 ⁻)	277.03	1 ⁻ , 2 ⁻	
140.07 8	3.5 5	565.14	(2, 3) ⁻	425.04	(2, 3) ⁻	
147.14 7	15.3 6	912.50	(5, 7) ⁻	765.36	6 ⁻	
147.99 7	11.7 5	425.04	(2, 3) ⁻	277.03	1 ⁻ , 2 ⁻	
153.80 5	115 3	518.23	(3, 4) ⁻	364.43	(2, 3) ⁻	
154.51 5	101 3	389.16	3 ⁺	234.65	(1 ⁺ , 2 ⁺ , 3 ⁺)	
158.50 6	19.0 7	364.43	(2, 3) ⁻	205.95	(3) ⁺	
166.34 10	3.3 5	277.03	1 ⁻ , 2 ⁻	110.66	(2) ⁺	
169.58 5	47.5 14	1043.85	9 ⁻	874.27	8 ⁻	
173.26 8	6.8 6	676.28	5 ⁺	503.02	(3 ⁺ , 4, 5 ⁺)	
174.15 8	9.0 6	503.02	(3 ⁺ , 4, 5 ⁺)	328.83	5 ⁺	
^x 190.79 10	5.0 8					
200.72 6	14.7 8	565.14	(2, 3) ⁻	364.43	(2, 3) ⁻	
205.90 8	8.7 7	205.95	(3) ⁺	0.0	1 ⁺	
209.84 6	21.7 10	542.38	6	332.62	7 ⁺	
211.43 10	4.4 7	887.67	(5 ⁺)	676.28	5 ⁺	
213.47 6	16.3 8	542.38	6	328.83	5 ⁺	
219.10 6	14.4 8	425.04	(2, 3) ⁻	205.95	(3) ⁺	
227.19 5	48.8 16	676.28	5 ⁺	449.10	(4) ⁺	
234.66 5	57.3 17	234.65	(1 ⁺ , 2 ⁺ , 3 ⁺)	0.0	1 ⁺	
^x 239.36 [‡] 11	275 [‡] 7					I_γ : unresolved from 239.24 γ .
239.36 [‡] 5	275 [‡] 7	328.83	5 ⁺	89.66	6 ⁺	
^x 242.76 31						
242.94 9	≈330	332.62	7 ⁺	89.66	6 ⁺	
243.18 7	≈186	449.10	(4) ⁺	205.95	(3) ⁺	I_γ : $I_\gamma(242.76+242.94+243.18\gamma)=516$ 13.
253.77 5	246 7	364.43	(2, 3) ⁻	110.66	(2) ⁺	
262.89 22	4.2 6	468.84		205.95	(3) ⁺	
272.62 8	10.6 14	775.64	(4 ⁺ , 5 ⁺)	503.02	(3 ⁺ , 4, 5 ⁺)	
274.08 8	10.2 14	1135.65	(2 ⁻ , 3 ⁻ , 4 ⁻)	861.57	(3 ⁻ , 4, 5 ⁻)	
277.04 5	357 9	277.03	1 ⁻ , 2 ⁻	0.0	1 ⁺	
278.48 5	90 3	389.16	3 ⁺	110.66	(2) ⁺	
^x 279.27 10	8.9 9					
288.18 15	7.1 7	565.14	(2, 3) ⁻	277.03	1 ⁻ , 2 ⁻	
293.07 6	51 2	625.68	7 ⁺	332.62	7 ⁺	
297.06 6	35 2	503.02	(3 ⁺ , 4, 5 ⁺)	205.95	(3) ⁺	
305.94 7	19.6 9	416.62	(1 ⁻)	110.66	(2) ⁺	
312.29 7	20.9 10	518.23	(3, 4) ⁻	205.95	(3) ⁺	
314.38 6	52.4 21	425.04	(2, 3) ⁻	110.66	(2) ⁺	
320.20 6	39.2 15	597.25	1 ⁻ , 2 ⁻ , 3 ⁻	277.03	1 ⁻ , 2 ⁻	
324.39 10	12.0 8	773.49	(5 ⁺)	449.10	(4) ⁺	
325.73 7	35.5 15	602.76	(2 ⁻ , 3 ⁻)	277.03	1 ⁻ , 2 ⁻	
333.79 7	27.8 13	698.20	1 ⁻ , 2 ⁻ , 3 ⁻	364.43	(2, 3) ⁻	
^x 343.48 8	4.8 5					E_γ : deexcites 1764-keV, 11 ⁻ state in (α , p γ).
^x 347.59 10	13.0 13					
352.42 8	22.8 11	741.58	(3 ⁺ , 4 ⁺)	389.16	3 ⁺	
353.53 8	26.5 12	979.21	8 ⁺	625.68	7 ⁺	
359.12 8	25.0 21	565.14	(2, 3) ⁻	205.95	(3) ⁺	
361.40 7	42.2 17	596.06	1 ⁻ , 2 ⁻ , 3 ⁻	234.65	(1 ⁺ , 2 ⁺ , 3 ⁺)	
376.81 8	16.8 9	1420.66	10 ⁻	1043.85	9 ⁻	
383.28 10	8.8 7	712.14	4 ⁺	328.83	5 ⁺	
384.27 7	22.1 10	661.30	1 ⁻	277.03	1 ⁻ , 2 ⁻	
386.90 8	11.4 7	1063.18	(4 ⁺ , 5 ⁺)	676.28	5 ⁺	

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$^{103}\text{Rh}(\alpha, n\gamma)$ **1980Sa05 (continued)** $\gamma(^{106}\text{Ag})$ (continued)

E_γ	$I_\gamma^\dagger$	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Comments
391.20 <i>14</i>	5.9 7	597.25	$1^-, 2^-, 3^-$	205.95	$(3)^+$	
^x 394.20 <i>11</i>	6.3 7					
^x 407.53 <i>15</i>	3.7 7					
^x 412.38 8	9.2 7					
414.94 8	26.6 <i>12</i>	933.17	(5^-)	518.23	$(3,4)^-$	
418.01 <i>15</i>	6.0 7	1230.03	$(2^-, 3^-, 4^-)$	812.02	(3^-)	
421.14 7	16.1 9	698.20	$1^-, 2^-, 3^-$	277.03	$1^-, 2^-$	
427.23 9	8.2 7	816.47	(4^+)	389.16	3^+	
432.40 <i>16</i>	7.4 <i>16</i>	765.36	6^-	332.62	7^+	I_γ : from branching $I_\gamma(675.5\gamma)/I_\gamma(432.4\gamma)=34.7$ if fraction $I_\gamma(675\gamma)$ from 765 level) is the same in both 13.4- and 16.7-MeV data.
436.75 7	14.2 8	765.36	6^-	328.83	5^+	
438.55 7	16.8 9	887.67	(5^+)	449.10	$(4)^+$	
441.09 7	21.0 <i>10</i>	769.93	6	328.83	5^+	
447.55 7	30.2 <i>13</i>	812.02	(3^-)	364.43	$(2,3)^-$	
454.52 7	22.3 <i>11</i>	565.14	$(2,3)^-$	110.66	$(2)^+$	
459.43 8	10.7 6	1224.79	$(6,7)^-$	765.36	6^-	
467.12 8	12.0 8	556.80	(5^+)	89.66	6^+	
468.61 <i>10</i>	6.6 7	797.45		328.83	5^+	
^x 470.61 <i>10</i>	4.7 6					
485.43 <i>10</i>	15.6 9	596.06	$1^-, 2^-, 3^-$	110.66	$(2)^+$	
486.73 <i>11</i>	23.8 <i>11</i>	597.25	$1^-, 2^-, 3^-$	110.66	$(2)^+$	
487.76 <i>11</i>	15.1 9	816.47	(4^+)	328.83	5^+	
492.47 [#] <i>15</i>	$\approx 17^\#$	769.67	$1^-, 2^-, 3^-$	277.03	$1^-, 2^-$	I_γ : $I_\gamma(492.3+492.6\gamma)=26.6$ <i>12</i> .
492.47 [#] <i>17</i>	$\approx 10^\#$	917.36	$1^-, 2^-, 3^-$	425.04	$(2,3)^-$	
496.82 <i>16</i>	21 2	829.48	7^-	332.62	7^+	I_γ : from $I_\gamma(496\gamma)/I_\gamma(64\gamma)=0.46$ 4 in ($^{14}\text{N}, 4n\gamma$).
497.14 8	31 3	861.57	$(3^-, 4, 5^-)$	364.43	$(2,3)^-$	I_γ : doublet=52 2 minus $I_\gamma(496.8\gamma)=21$ 2.
524.48 <i>12</i>	10.4 8	730.43	(2^+)	205.95	$(3)^+$	
533.94 <i>12</i>	13.7 9	923.10	$(2^+, 3^+, 4^+)$	389.16	3^+	
534.86 [#] <i>CA</i>	$5^\#$ 4	741.58	$(3^+, 4^+)$	205.95	$(3)^+$	I_γ : doublet=27.7 <i>12</i> minus $I_\gamma(536.0\gamma)=22.7$.
534.86 [#] <i>12</i>	17.2 [#] <i>10</i>	812.02	(3^-)	277.03	$1^-, 2^-$	I_γ : from $I_\gamma(535\gamma)/I_\gamma(293\gamma)=0.45$ 7 in ($^{14}\text{N}, 4n\gamma$).
535.99 <i>12</i>	23 4	625.68	7^+	89.66	6^+	
538.01 7	15.9 8	1303.37	$(5^-, 6^-, 7^-)$	765.36	6^-	
541.58 7	18.4 9	874.27	8^-	332.62	7^+	
548.64 8	11.3 8	881.24	(6^+)	332.62	7^+	
552.39 7	15.7 9	881.24	(6^+)	328.83	5^+	
568.62 9	9.1 8	1086.86	$(4^-, 5^-)$	518.23	$(3,4)^-$	
588.09 8	19.8 <i>11</i>	1106.33	$(3^-, 4^-)$	518.23	$(3,4)^-$	
594.54 <i>15</i>	3.5 8	927.2	(6^+)	332.62	7^+	
598.37 7	15.4 8	927.2	(6^+)	328.83	5^+	
600.73 <i>11</i>	6.5 8	835.39	$(2^+, 3^+)$	234.65	$(1^+, 2^+, 3^+)$	
605.31 <i>10</i>	13.1 <i>10</i>	1123.55	$(5^-, 6^-)$	518.23	$(3,4)^-$	
625.94 <i>20</i>	6.6 8	902.97	$1^-, 2^-, 3^-$	277.03	$1^-, 2^-$	
629.24 8	20.5 <i>11</i>	961.86	8^+	332.62	7^+	
637.43 8	13.6 9	1001.86	$(2^-, 3^-, 4^-)$	364.43	$(2,3)^-$	
^x 641.12 8	13.8 9					
648.01 8	24.1 <i>12</i>	1413.37	$(5,6)^-$	765.36	6^-	
659.42 9	8.6 8	936.45	$0^-, 1^-$	277.03	$1^-, 2^-$	
675.11 [#] <i>20</i>	$\approx 16^\#$	1003.95?		328.83	5^+	I_γ : from coincidence data. I_γ : doublet=251 9 minus $I_\gamma(675.5\gamma)=235$. Considered doubtful by the evaluators. Observed only in $^{103}\text{Rh}(\alpha, n\gamma)$.
675.51 9	≈ 235	765.36	6^-	89.66	6^+	I_γ : from coincidence data.
689.00 <i>10</i>	7.3 7	923.66	$(1^+, 2^+)$	234.65	$(1^+, 2^+, 3^+)$	

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$^{103}\text{Rh}(\alpha, n\gamma)$ **1980Sa05 (continued)** $\gamma(^{106}\text{Ag})$ (continued)

E_γ	$I_\gamma^\dagger$	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Comments
706.36 [@] 20	4.0 9	1224.79	(6,7) ⁻	518.23	(3,4) ⁻	E_γ : placement only based on least-squares fit; other: 1980Sa05 .
738.87 13	10.4 9	944.82	(2 ⁺ , 3 ⁺ , 4 ⁺)	205.95	(3) ⁺	
739.87 13	10.2 9	829.48	7 ⁻	89.66	6 ⁺	
760.90 15	6.8 9	1150.06	(2 ⁺ , 3 ⁺ , 4 ⁺)	389.16	3 ⁺	
780.62 10	12.3 7	1145.06	(2 ⁻ , 3 ⁻ , 4 ⁻)	364.43	(2,3) ⁻	
797.46 10	14.2 10	1003.41		205.95	(3) ⁺	
802.39 28	3.8 10	1166.8	(2 ⁻ , 3 ⁻ , 4 ⁻)	364.43	(2,3) ⁻	
805.01 14	8.6 10	1133.85	(4 ⁺)	328.83	5 ⁺	
811.30 15	9.7 10	1329.54	(3 ⁻ , 4 ⁻)	518.23	(3,4) ⁻	
960.11 14	7.1 8	1288.95	(4 ⁺ , 5 ⁺)	328.83	5 ⁺	
1054.89 15	14.2 11	1387.52	9 ⁺	332.62	7 ⁺	

[†] Given for $E\alpha=16.7$ MeV and $\theta=55^\circ$.

[‡] Multiply placed with undivided intensity.

Multiply placed with intensity suitably divided.

@ Placement of transition in the level scheme is uncertain.

^x γ ray not placed in level scheme.

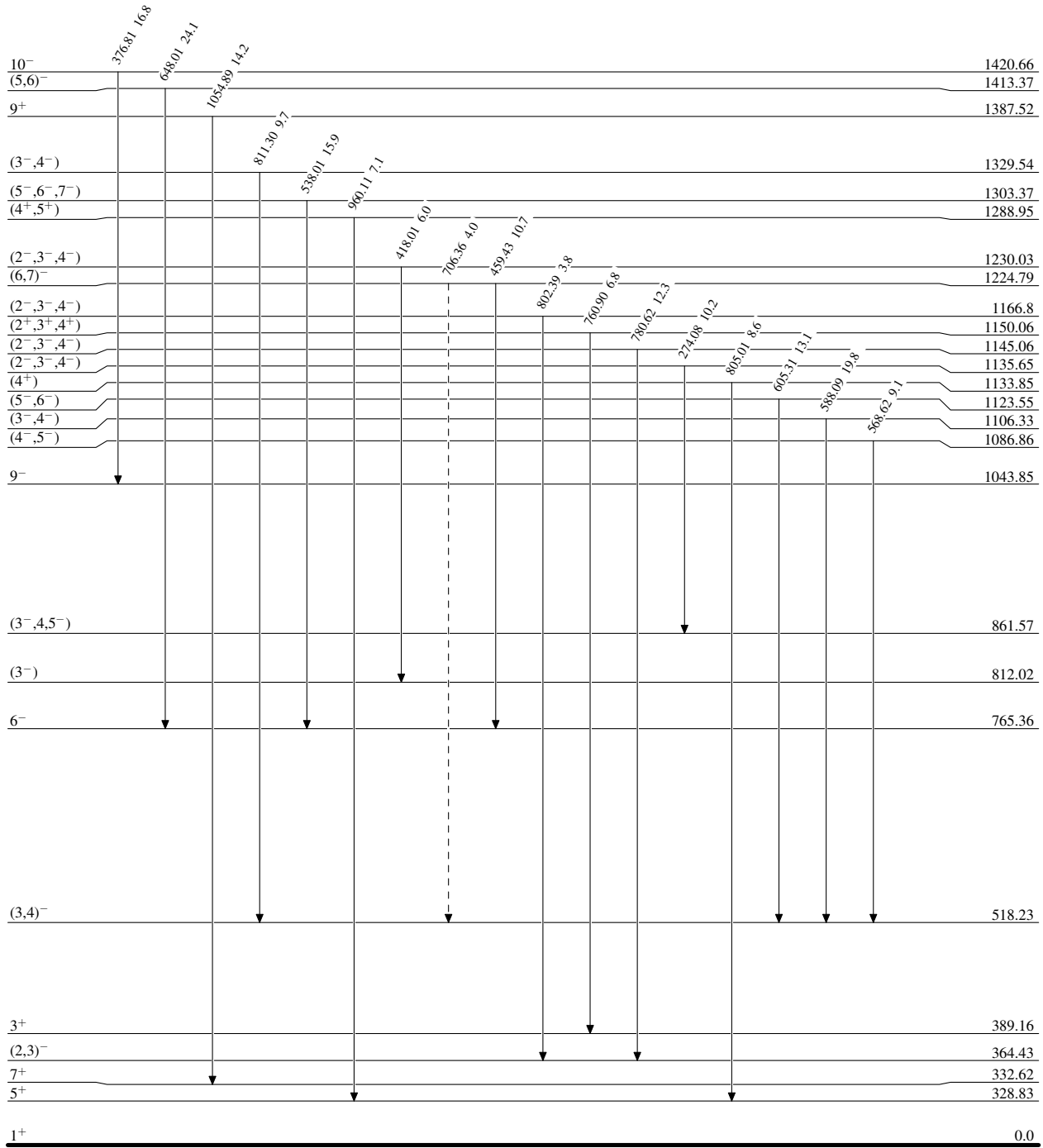
$^{103}\text{Rh}(\alpha, n\gamma)$ 1980Sa05

Legend

Level Scheme

Intensities: Type not specified

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

 $^{106}_{47}\text{Ag}_{59}$

23.96 min 4

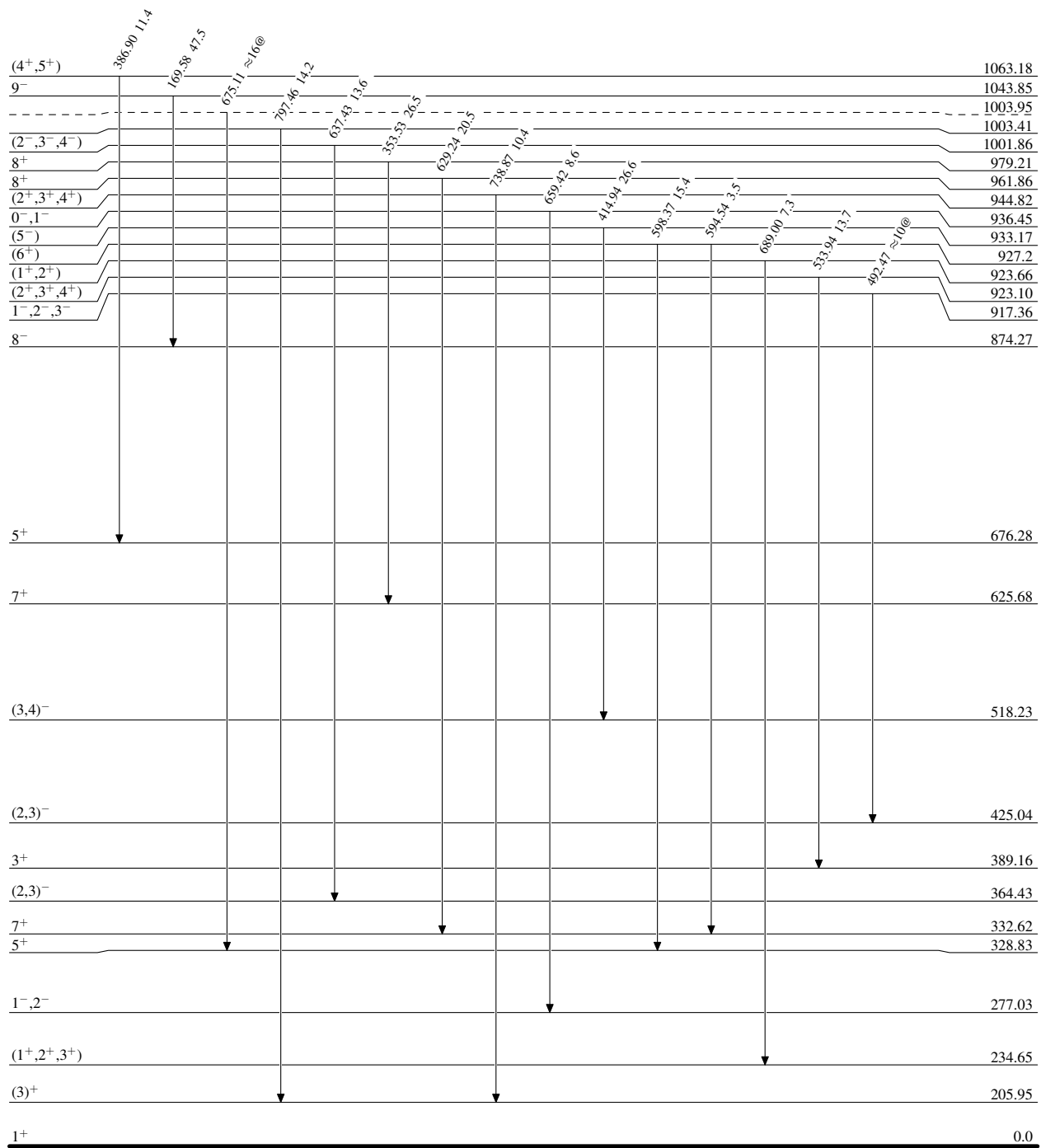
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Level Scheme (continued)

Intensities: Type not specified
 @ Multiply placed: intensity suitably divided

Legend

→ $I_\gamma < 2\% \times I_\gamma^{\max}$
 → $I_\gamma < 10\% \times I_\gamma^{\max}$
 → $I_\gamma > 10\% \times I_\gamma^{\max}$



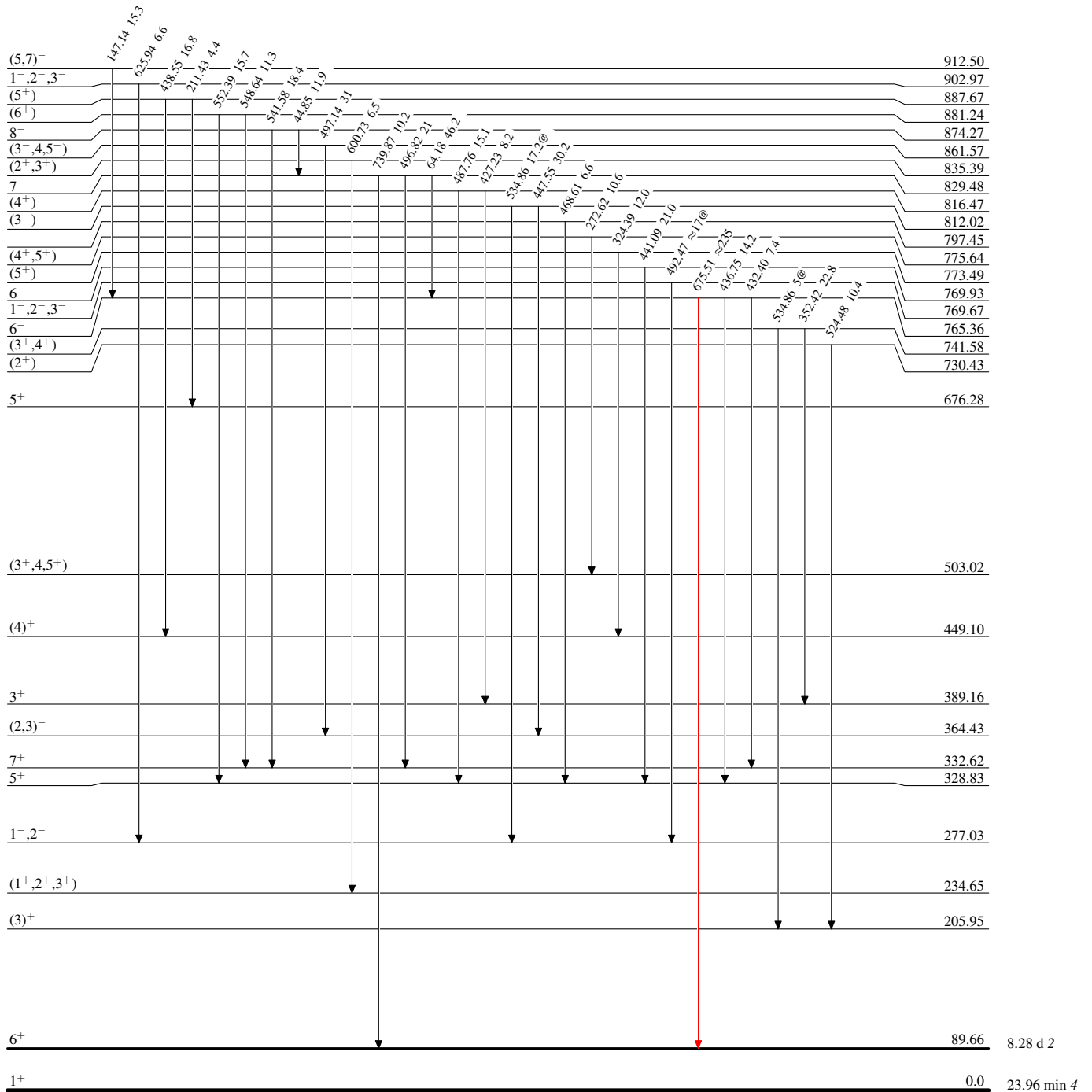
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Level Scheme (continued)

Intensities: Type not specified
 @ Multiply placed: intensity suitably divided

Legend

→ $I_\gamma < 2\% \times I_\gamma^{\max}$
 → $I_\gamma < 10\% \times I_\gamma^{\max}$
 → $I_\gamma > 10\% \times I_\gamma^{\max}$



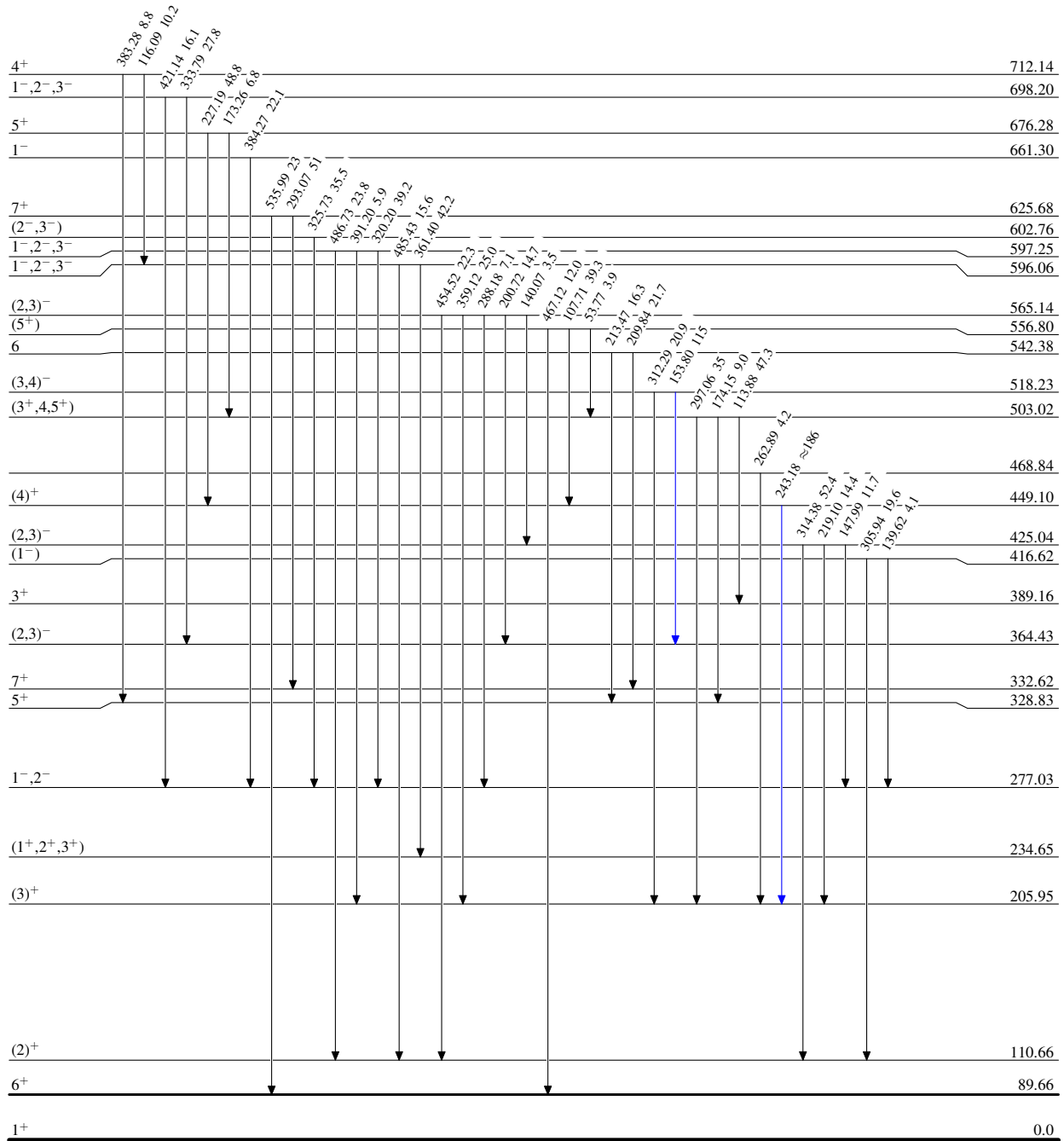
$^{103}\text{Rh}(\alpha, n\gamma)$ 1980Sa05

Level Scheme (continued)

Intensities: Type not specified
@ Multiply placed: intensity suitably divided

Legend

→ $I_\gamma < 2\% \times I_\gamma^{\max}$
→ $I_\gamma < 10\% \times I_\gamma^{\max}$
→ $I_\gamma > 10\% \times I_\gamma^{\max}$



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Level Scheme (continued)

Intensities: Type not specified
 & Multiply placed: undivided intensity given
 @ Multiply placed: intensity suitably divided

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)

