

(HI,xnγ) 1998Mo22,1993Ja04,1979Sh03

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	Jean Blachot	NDS 111, 1471 (2010)	1-May-2009

1998Mo22: ¹⁰³Rh(¹⁶O, α 2n) E=80 MeV. Measured E γ , I γ , $\gamma\gamma$, $\gamma\gamma(\theta)$ (DCO) using Spectrometer, 6 Compton-suppressed HPGe detectors.

1993Ja04,1995Ja15: ⁹⁴Mo(²³Na,2p2n) E=117 MeV. Preliminary data in **1993Ra08**.

Measured E γ , I γ , $\gamma\gamma$ coin, $\gamma(\theta)$, DCO, 20 Compton-suppressed HPGe, spherical shell of 71 BGO.

1990Ko42: ¹⁰⁴Pd(¹²C,p2n γ) E=63 MeV.

Measured E γ , I γ , $\gamma\gamma$ coin, $\gamma(\theta)$, $\gamma(t)$.

1989Bu27: ¹¹²Sn(α ,pn γ) E=40-50 MeV.

Measured E γ , I γ , $\gamma\gamma$ coin, $\gamma(\theta)$, excit.

1979Sh03: ¹¹⁰Cd(⁶Li,3n γ) E=24-34 MeV.

Measured E γ , I γ , $\gamma\gamma$ coin, $\gamma(\theta)$, excit.

Other: **1975Ga11**.

Using DSAM, **1993Ja04** extracted an average quadrupole moment for the rotational sequence, consistent with a prolate deformation:

$$\beta_2 \approx 0.32.$$

¹¹³Sb Levels

E(level) [†]	J π [‡]	T _{1/2}	E(level) [†]	J π [‡]	E(level) [†]	J π [‡]
0	5/2 ⁺		3914.7 ^{& 5}	21/2 ⁺	6093.5 ^{@ 8}	35/2 ⁻
814.6 ³	7/2 ⁺		4167.1 ^{a 5}	25/2	6153.7 ^{b 6}	33/2 ⁺
1257.1 ⁵	9/2 ⁺		4345.7 ^{c 6}	(23/2 ⁻)	6197.1 ^{c 7}	(33/2 ⁻)
1348.0 ^{@ 5}	11/2 ⁻		4363.4 ^{& 5}	23/2 ⁺	6334.2 ^{& 11}	33/2 ⁺
1461.1 ^{& 3}	9/2 ⁺		4459.5 ^{@ 7}	27/2 ⁻	6424.4 ^{a 7}	
1910.4 ^{& 4}	11/2 ⁺		4506.8 ⁶	(25/2 ⁻)	6546.0 ^{b 6}	35/2 ⁺
2218.4 ^{& 5}	13/2 ⁺		4525.5 ⁵		6626.6 ^{c 7}	(35/2 ⁻)
2308.0 ⁵	(13/2 ⁺)		4536.2 ⁶		6682.0 ^{& 12}	35/2 ⁺
2395.5 ⁵			4644.0 ^{c 6}	(25/2 ⁻)	6976.9 ^{b 6}	37/2 ⁺
2505.3 ⁵	(15/2 ⁺)		4745.2 ^{b 5}	25/2 ⁺	6977.6 ^{& 13}	37/2 ⁺
2626.3 ^{a 5}	15/2 ⁻		4784.2 ^{a 6}	27/2	7012.5 ^{@ 9}	39/2 ⁻
2659.9 ^{& 5}	15/2 ⁺		5015.6 ^{c 6}	(27/2 ⁻)	7077.0 ^{c 7}	(37/2 ⁻)
2815.6 ^{@ 5}	15/2 ⁻		5041.1 ^{b 6}	27/2 ⁺	7545.7 ^{c 7}	(39/2 ⁻)
3010.2 ¹¹			5166.4 ⁶	29/2	7998.2 ^{@ 9}	43/2 ⁻
3044.8 ^{a 5}	19/2 ⁻	3.7 [#] ns 3	5177.7 ^{& 8}	27/2 ⁺	8026.4 ^{c 8}	(41/2 ⁻)
3084.5 ^{& 5}	17/2 ⁺		5238.8 ^{@ 8}	31/2 ⁻	9059.5 ^{@ 10}	47/2 ⁻
3173.9 ⁵	21/2 ⁽⁻⁾		5389.0 ^{b 6}	29/2 ⁺	10215.2 ^{@ 10}	51/2 ⁻
3213.0 ^{@ 5}	19/2 ⁻		5392.3 ^{c 7}	(29/2 ⁻)	11466.4 ^{@ 11}	55/2 ⁻
3345.3 ⁶	(21/2)		5569.3 ^{& 9}	29/2 ⁺	12800.7 ^{@ 11}	59/2 ⁻
3346.8 ⁶			5612.4 ⁶	(29/2 ⁻)	14213.7 ^{@ 15}	63/2 ⁻
3400.2 ¹²			5716.7 ^{a 7}	29/2	15717.7 ^{@ 18}	67/2 ⁻
3473.4 ^{& 5}	19/2 ⁺		5762.9 ^{b 6}	31/2 ⁺	17352.7 ^{@ 21}	71/2 ⁻
3553.2 ^{a 5}	23/2		5782.9 ^{c 7}	(31/2 ⁻)	19143.7 ^{@ 23}	75/2 ⁻
3777.7 ^{@ 6}	23/2 ⁻		5960.1 ^{& 10}	31/2 ⁺	21103.8 ^{@ 25}	79/2 ⁻
3826.7 ⁶			6052.9 ⁷			

[†] From least-squares fit to γ energies.

[‡] From **1993Ja04**. Based on levels being members of rotational band and Nilsson model consideration.

[#] From **1990Ko42**.

(HI,xnγ) 1998Mo22,1993Ja04,1979Sh03 (continued)

¹¹³Sb Levels (continued)

@ Band(A): suggested (1993Ja04) As members of a rotational band with the 1348-keV level as bandhead. Proton h11/2 orbital? 1/2 [550] Nilsson configuration.

& Band(B): suggested As members of a rotational band with the 1461-keV level as bandhead. Nilsson orbital [404]9/2⁺.

a Band(C): Band based on 15/2⁻, only given in 1998Mo22.

b Band(D): Band 3 based on 25/2⁺, only given in 1998Mo22.

c Band(E): Band 4 based on 25/2⁻, only given in 1998Mo22.

<u>γ(¹¹³Sb)</u>								
<u>E_γ[†]</u>	<u>I_γ[‡]</u>	<u>E_i(level)</u>	<u>J_i^π</u>	<u>E_f</u>	<u>J_f^π</u>	<u>Mult.[@]</u>	<u>δ[#]</u>	<u>Comments</u>
90.9 2	172 18	1348.0	11/2 ⁻	1257.1	9/2 ⁺	E1		
129.1 2	122 13	3173.9	21/2 ⁽⁻⁾	3044.8	19/2 ⁻	D+Q	-0.10 4	
171.5 3		3345.3	(21/2)	3173.9	21/2 ⁽⁻⁾			Mult.: DCO=1.10 25.
173.0 3		3346.8		3173.9	21/2 ⁽⁻⁾			
197.1 3	18 2	2505.3	(15/2 ⁺)	2308.0	(13/2 ⁺)	D+Q	+0.09 6	
209.0 3		4745.2	25/2 ⁺	4536.2				
219.7 3		4745.2	25/2 ⁺	4525.5				
230.8 3		2626.3	15/2 ⁻	2395.5				E _γ : From 1998Mo22.
277.5 3		4784.2	27/2	4506.8	(25/2 ⁻)			
287.2 3	38 4	2505.3	(15/2 ⁺)	2218.4	13/2 ⁺	D+Q	+0.08 9	
295.8 3		5041.1	27/2 ⁺	4745.2	25/2 ⁺			
296		6977.6	37/2 ⁺	6682.0	35/2 ⁺	D		
298.3 3	7 1	4644.0	(25/2 ⁻)	4345.7	(23/2 ⁻)	D		Mult.: DCO=0.65 16.
306.7		2218.4	13/2 ⁺	1910.4	11/2 ⁺	D+Q	+0.16 6	E _γ : E _γ =306.7 (1979Sh03) E _γ =308.7 (1998Mo22).
339.5 3		4506.8	(25/2 ⁻)	4167.1	25/2			
340.3 3		4167.1	25/2	3826.7				
347.6 3		5389.0	29/2 ⁺	5041.1	27/2 ⁺			
348		6682.0	35/2 ⁺	6334.2	33/2 ⁺	D		
358.4 3		4525.5		4167.1	25/2			
369.1 3		4536.2		4167.1	25/2			
371.6 3		5015.6	(27/2 ⁻)	4644.0	(25/2 ⁻)			
373.8 3		5762.9	31/2 ⁺	5389.0	29/2 ⁺			
374		6334.2	33/2 ⁺	5960.1	31/2 ⁺	D		
376.7 3		5392.3	(29/2 ⁻)	5015.6	(27/2 ⁻)			
379.2 3		3553.2	23/2	3173.9	21/2 ⁽⁻⁾	D+Q	-0.25 5	Mult.: DCO=0.31 24.
381.7 3		4745.2	25/2 ⁺	4363.4	23/2 ⁺			
389.0 3		3473.4	19/2 ⁺	3084.5	17/2 ⁺			
390.0 3		3400.2		3010.2				
390.6 3		5782.9	(31/2 ⁻)	5392.3	(29/2 ⁻)			
390.8 3		6153.7	33/2 ⁺	5762.9	31/2 ⁺			
391		5960.1	31/2 ⁺	5569.3	29/2 ⁺	D		
392		5569.3	29/2 ⁺	5177.7	27/2 ⁺	D		
392.3 3		6546.0	35/2 ⁺	6153.7	33/2 ⁺			
397.4 3	34 5	2308.0	(13/2 ⁺)	1910.4	11/2 ⁺	D+Q	+0.24 5	
397.4 3		3213.0	19/2 ⁻	2815.6	15/2 ⁻	(E2)		
414.2 3		6197.1	(33/2 ⁻)	5782.9	(31/2 ⁻)			
418.5 3	163 16	3044.8	19/2 ⁻	2626.3	15/2 ⁻	Q		
425.6 3	23 3	3084.5	17/2 ⁺	2659.9	15/2 ⁺	D+Q	+0.07 8	
429.5 3		6626.6	(35/2 ⁻)	6197.1	(33/2 ⁻)			
430.9 3		6976.9	37/2 ⁺	6546.0	35/2 ⁺			
432		5177.7	27/2 ⁺	4745.2	25/2 ⁺	D		
441.3 3		3914.7	21/2 ⁺	3473.4	19/2 ⁺			
441.5 10	43 4	2659.9	15/2 ⁺	2218.4	13/2 ⁺	D+Q	+0.09 5	

Continued on next page (footnotes at end of table)

(HI,xny) 1998Mo22,1993Ja04,1979Sh03 (continued) $\gamma(^{113}\text{Sb})$ (continued)

E_γ^\dagger	I_γ^\ddagger	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. @	$\delta^\#$	Comments
443.0	10	1257.1	9/2 ⁺	814.6	7/2 ⁺	D+Q	-0.02	9
448.7	3	4363.4	23/2 ⁺	3914.7	21/2 ⁺			
449.3	3	1910.4	11/2 ⁺	1461.1	9/2 ⁺	D+Q	+0.24	6
450.4	3	7077.0	(37/2 ⁻)	6626.6	(35/2 ⁻)			
468.7	3	7545.7	(39/2 ⁻)	7077.0	(37/2 ⁻)			
480.7	3	8026.4	(41/2 ⁻)	7545.7	(39/2 ⁻)			
504.9	10	3010.2		2505.3	(15/2 ⁺)			
564.7	3	3777.7	23/2 ⁻	3213.0	19/2 ⁻	(E2)		
586.7	3	3213.0	19/2 ⁻	2626.3	15/2 ⁻			
613.9	3	4167.1	25/2	3553.2	23/2	D		Mult.: DCO=0.67 17.
617.1	3	4784.2	27/2	4167.1	25/2	D		Mult.: DCO=0.32 28.
643		6977.6	37/2 ⁺	6334.2	33/2 ⁺	Q		
644.0	3	5389.0	29/2 ⁺	4745.2	25/2 ⁺			
646.6	3	1461.1	9/2 ⁺	814.6	7/2 ⁺	D+Q	+0.03	8
652.7	3	3826.7		3173.9	21/2 ⁽⁻⁾			
669.9	3	5015.6	(27/2 ⁻)	4345.7	(23/2 ⁻)			
681.8	3	4459.5	27/2 ⁻	3777.7	23/2 ⁻	(E2)		
707.7	3	6424.4		5716.7	29/2			
722.0	3	5762.9	31/2 ⁺	5041.1	27/2 ⁺			
722		6682.0	35/2 ⁺	5960.1	31/2 ⁺	Q		
748.3	3	5392.3	(29/2 ⁻)	4644.0	(25/2 ⁻)			
749.5	3	2659.9	15/2 ⁺	1910.4	11/2 ⁺	Q		E_γ : $E_\gamma=748.2$ (1979Sh03).
756.1		2218.4	13/2 ⁺	1461.1	9/2 ⁺	Q		E_γ : $E_\gamma=756.1$ (1979Sh03) $E_\gamma=757.3$ (1998Mo22).
764.6	3	6153.7	33/2 ⁺	5389.0	29/2 ⁺			
765		6334.2	33/2 ⁺	5569.3	29/2 ⁺	Q		
767.3	3	5782.9	(31/2 ⁻)	5015.6	(27/2 ⁻)			
779.3	3	5238.8	31/2 ⁻	4459.5	27/2 ⁻	(E2)		
782		5960.1	31/2 ⁺	5177.7	27/2 ⁺	Q		
783.1	3	6546.0	35/2 ⁺	5762.9	31/2 ⁺			
804.8	3	6197.1	(33/2 ⁻)	5392.3	(29/2 ⁻)			
813.8	3	3473.4	19/2 ⁺	2659.9	15/2 ⁺			
814.8	3	814.6	7/2 ⁺	0	5/2 ⁺	D+Q	-0.22	12
815		5177.7	27/2 ⁺	4363.4	23/2 ⁺	Q		
823.2	3	6976.9	37/2 ⁺	6153.7	33/2 ⁺			
824		5569.3	29/2 ⁺	4745.2	25/2 ⁺	Q		
830.3	3	3914.7	21/2 ⁺	3084.5	17/2 ⁺			
830.4	3	4745.2	25/2 ⁺	3914.7	21/2 ⁺			
843.7	3	6626.6	(35/2 ⁻)	5782.9	(31/2 ⁻)			
854.7	3	6093.5	35/2 ⁻	5238.8	31/2 ⁻	(E2)		
865.7	3	3084.5	17/2 ⁺	2218.4	13/2 ⁺			
879.9	3	7077.0	(37/2 ⁻)	6197.1	(33/2 ⁻)			
886.5	3	6052.9		5166.4	29/2			
890.0	3	4363.4	23/2 ⁺	3473.4	19/2 ⁺			
919.0	3	7012.5	39/2 ⁻	6093.5	35/2 ⁻	(E2)		
919.1	3	7545.7	(39/2 ⁻)	6626.6	(35/2 ⁻)			
932.5	3	5716.7	29/2	4784.2	27/2			
949.4	3	8026.4	(41/2 ⁻)	7077.0	(37/2 ⁻)			
972.3	3	4525.5		3553.2	23/2			
985.6	3	7998.2	43/2 ⁻	7012.5	39/2 ⁻	(E2)		
998.9	3	4345.7	(23/2 ⁻)	3346.8				
999.3	3	5166.4	29/2	4167.1	25/2	Q		Mult.: DCO=1.21 37.
1000.4	3	4345.7	(23/2 ⁻)	3345.3	(21/2)	D		Mult.: DCO=0.92 42.
1047.2	5	2395.5		1348.0	11/2 ⁻			
1061.3	3	9059.5	47/2 ⁻	7998.2	43/2 ⁻	(E2)		
1105.6	3	5612.4	(29/2 ⁻)	4506.8	(25/2 ⁻)			

Continued on next page (footnotes at end of table)

(HI,xn γ) 1998Mo22,1993Ja04,1979Sh03 (continued) $\gamma(^{113}\text{Sb})$ (continued)

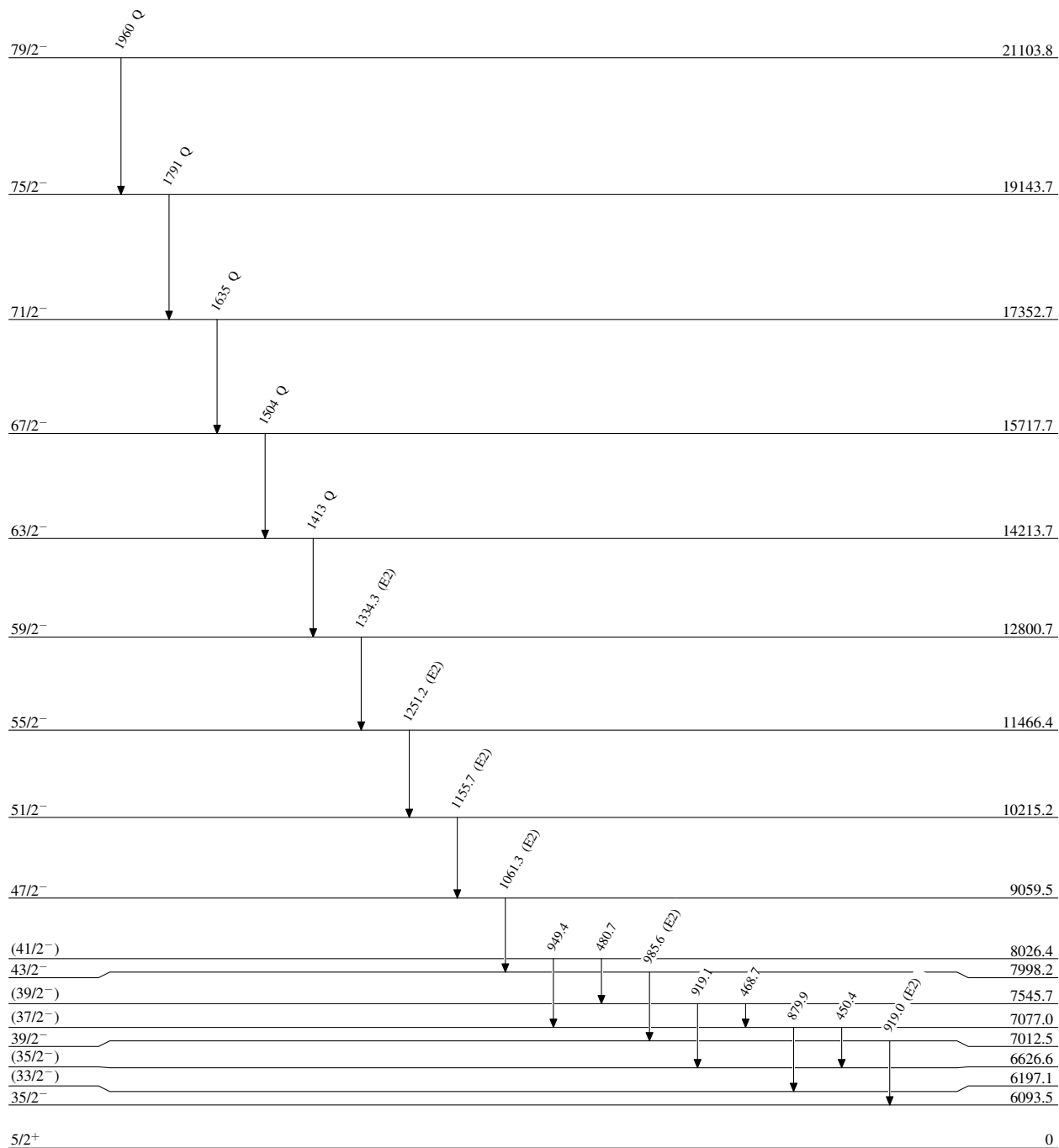
E_γ [†]	I_γ [‡]	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. [@]	Comments
1155.7 3		10215.2	51/2 ⁻	9059.5	47/2 ⁻	(E2)	
1161.7 3		4506.8	(25/2 ⁻)	3345.3	(21/2)	Q	Mult.: DCO=1.50 20.
1251.2 3		11466.4	55/2 ⁻	10215.2	51/2 ⁻	(E2)	
1257.1 10		1257.1	9/2 ⁺	0	5/2 ⁺		
1278.9 6	165 17	2626.3	15/2 ⁻	1348.0	11/2 ⁻	Q	
1334.3 3		12800.7	59/2 ⁻	11466.4	55/2 ⁻	(E2)	
1347.9 7	35 4	1348.0	11/2 ⁻	0	5/2 ⁺	E3	Mult.: from large A_2 in $\gamma(\theta)$.
1413		14213.7	63/2 ⁻	12800.7	59/2 ⁻	Q	
1460.8 5	117 12	1461.1	9/2 ⁺	0	5/2 ⁺	E2	
1467.6 3		2815.6	15/2 ⁻	1348.0	11/2 ⁻	(E2)	
1504		15717.7	67/2 ⁻	14213.7	63/2 ⁻	Q	
1635		17352.7	71/2 ⁻	15717.7	67/2 ⁻	Q	
1791		19143.7	75/2 ⁻	17352.7	71/2 ⁻	Q	
1960		21103.8	79/2 ⁻	19143.7	75/2 ⁻	Q	

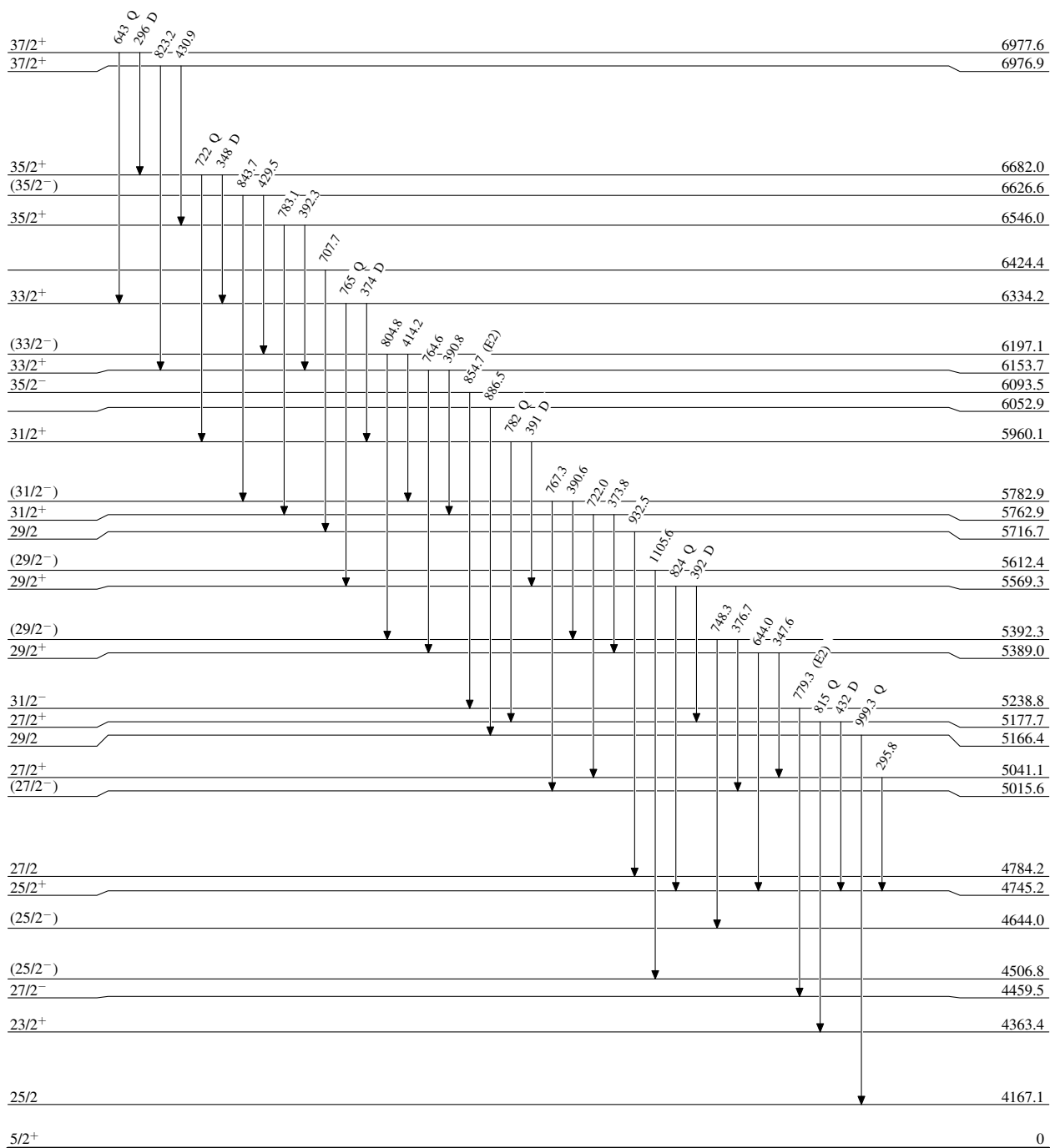
[†] From 1979Sh03 and 1998Mo22.

[‡] Relative intensity normalized to the $I_\gamma(449)=100$ (1979Sh03).

Or J^π 's shown and for an assumed Gaussian distribution with $\sigma=2.2$ 3 for the population of magnetic substates (1979Sh03).

@ From $\gamma(\theta)$ (1979Sh03).

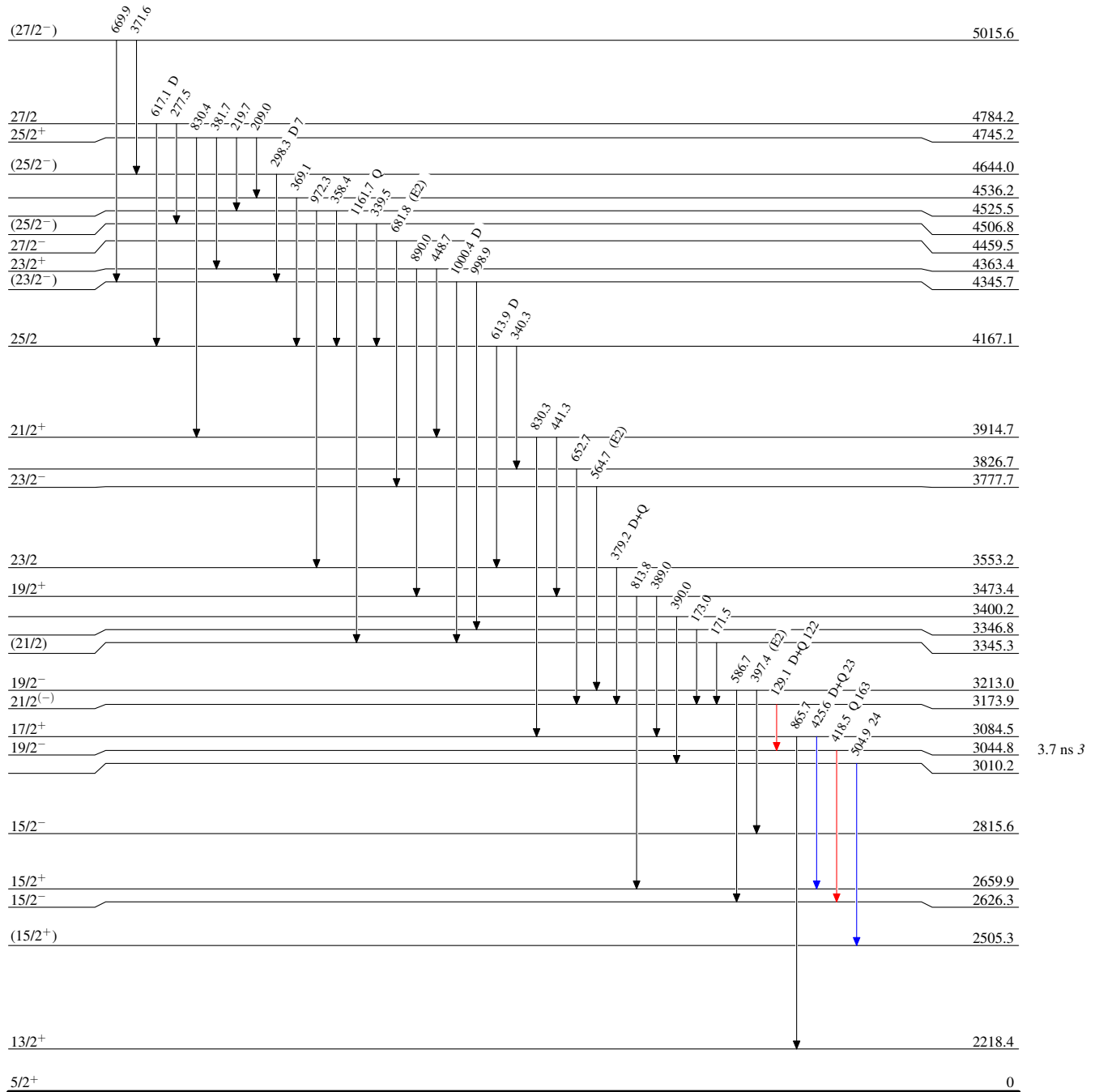
(HI,xn γ) 1998Mo22,1993Ja04,1979Sh03Level SchemeIntensities: Relative I_{γ}  $^{113}_{51}\text{Sb}_{62}$

(HI,xn γ) 1998Mo22,1993Ja04,1979Sh03Level Scheme (continued)Intensities: Relative I $_{\gamma}$  $^{113}_{51}\text{Sb}_{62}$

(HI,xn γ) 1998Mo22,1993Ja04,1979Sh03**Level Scheme (continued)**Intensities: Relative I_{γ}

Legend

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

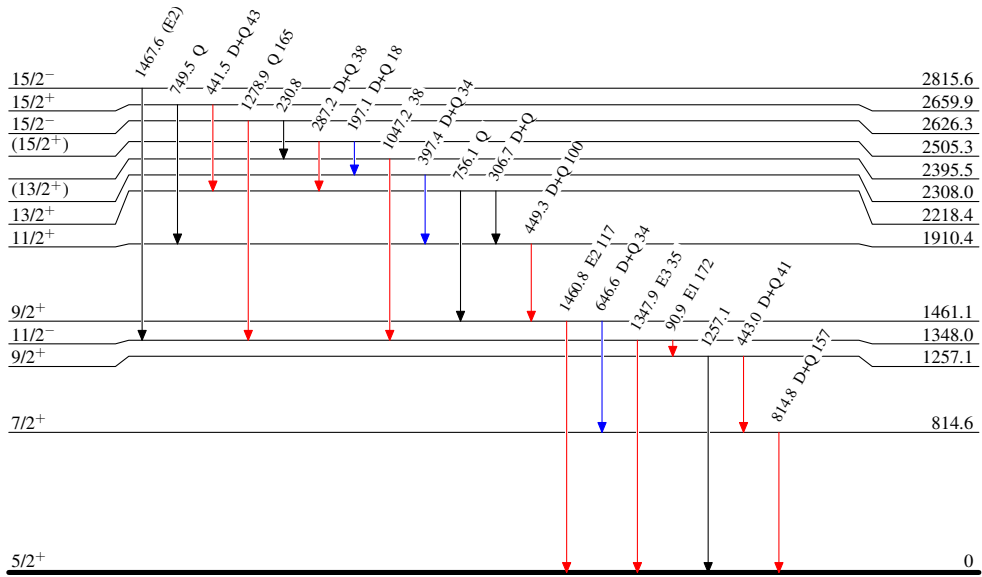


3.7 ns 3

(HI,xn γ) 1998Mo22,1993Ja04,1979Sh03**Level Scheme (continued)**Intensities: Relative I_γ

Legend

- \blackrightarrow $I_\gamma < 2\% \times I_\gamma^{\max}$
- \bluearrow $I_\gamma < 10\% \times I_\gamma^{\max}$
- \redarrow $I_\gamma > 10\% \times I_\gamma^{\max}$

 $^{113}_{51}\text{Sb}_{62}$

(HI,xn γ) 1998Mo22,1993Ja04,1979Sh03

Band(A): Suggested
(1993Ja04) As members of
a rotational band with
the 1348-keV level as
bandhead

79/2 ⁻	21103.8
1960	
75/2 ⁻	19143.7
1791	
71/2 ⁻	17352.7
1635	
67/2 ⁻	15717.7
1504	
63/2 ⁻	14213.7
1413	
59/2 ⁻	12800.7
1334	
55/2 ⁻	11466.4
1251	
51/2 ⁻	10215.2
1156	
47/2 ⁻	9059.5
1061	
43/2 ⁻	7998.2
986	
39/2 ⁻	7012.5
919	
35/2 ⁻	6093.5
855	
31/2 ⁻	5238.8
779	
27/2 ⁻	4459.5
682	
23/2 ⁻	3777.7
565	
19/2 ⁻	3213.0
397	
15/2 ⁻	2815.6
1468	
11/2 ⁻	1348.0

Band(B): Suggested As members of a
rotational band with the 1461-keV
level as bandhead

37/2 ⁺	6977.6
35/2 ⁺	6682.0
33/2 ⁺	6334.2
31/2 ⁺	5960.1
29/2 ⁺	5569.3
27/2 ⁺	5177.7
815	
23/2 ⁺	4363.4
449	
21/2 ⁺	3914.7
441	
19/2 ⁺	3473.4
830	
17/2 ⁺	3084.5
814	
15/2 ⁺	2659.9
426	
13/2 ⁺	2218.4
866	
11/2 ⁺	1910.4
750	
9/2 ⁺	1461.1
307	
756	
449	

Band(C): Band based on
15/2⁻, only given in
1998Mo22

6424.4	
29/2 ⁻	5716.7
708	
932	
27/2 ⁻	4784.2
617	
25/2 ⁻	4167.1
614	
23/2 ⁻	3553.2
19/2 ⁻	3044.8
418	
15/2 ⁻	2626.3

Band(D): Band 3 based on 25/2⁺,
only given in 1998Mo22

37/2 ⁺	6976.9
35/2 ⁺	6546.0
33/2 ⁺	6153.7
31/2 ⁺	5762.9
29/2 ⁺	5389.0
27/2 ⁺	5041.1
25/2 ⁺	4745.2
431	
823	
783	
392	
391	
765	
722	
374	
296	

Band(E): Band 4 based on 25/2⁻,
only given in 1998Mo22

(41/2 ⁻)	8026.4
(39/2 ⁻)	7545.7
(37/2 ⁻)	7077.0
(35/2 ⁻)	6626.6
(33/2 ⁻)	6197.1
(31/2 ⁻)	5782.9
(29/2 ⁻)	5392.3
(27/2 ⁻)	5015.6
(25/2 ⁻)	4644.0
(23/2 ⁻)	4345.7
481	
949	
469	
880	
450	
844	
430	
805	
414	
391	
767	
377	
748	
372	
298	