		History		
	Туре	Author	Citation	Literature Cutoff Date
	Full Evaluation	T. D. Johnson and W. D. Kulp(a)	NDS 129,1 (2015)	27-Jul-2015
$Q(\beta^{-})=282.2 \ 11; \ S(n)$ $Q(\beta^{-}n)=-8145.9 \ 11$	h)=9922.10 20; S(p) $Q(\varepsilon p)=-16255 3.$	$P = 8621.10 \ l; \ Q(\alpha) = -8009 \ 4 201$	2Wa38	

Some recent nuclear structure theory, calculations: 2010Ro31, 2010Sh23 2006Fl02.

## 87Rb Levels

Since  ${}^{87}$ Rb has a closed neutron shell with N=50, the low-lying levels will have configurations based on the odd protons; these states include  $p_{3/2}$ ,  $f_{5/2}$ , and  $g_{9/2}$ .

#### Cross Reference (XREF) Flags

		A B C D	Coulomb excitation ${}^{86}$ Kr(p,p') IAR ${}^{86}$ Kr( ${}^{3}$ He,d) ${}^{87}$ Kr $\beta^{-}$ decay	E F G H	$^{87}$ Rb(n,n'γ) $^{87}$ Rb(p,p') $^{88}$ Sr(d, <sup>3</sup> He) $^{87}$ Sr ε decay (2.815 h)	I J K L	${}^{192}Os({}^{82}Se,X\gamma)$ ${}^{176}Yb({}^{23}Na,X\gamma)$ ${}^{87}Rb(\gamma,\gamma')$ ${}^{12}C({}^{86}Kr,X\gamma)$
$E(level)^{\dagger\ddagger}$	$J^{\pi}$	T <sub>1/2</sub>	XREF			C	omments
0.0 <sup>b</sup>	3/2-	4.97×10 <sup>10</sup> y	A CDE GHIJKL		<sup>-</sup> =100 +0.132 <i>I</i> ; μ=+2.75131 <i>12</i> from atomic beam magnet pectroscopy (1976Fu06), c heasurement (1981Th04), z or Taken from most recent ounting in a photomultipli recision is 4.967×10 <sup>10</sup> y 3 ers: 4.72 <i>4</i> (1966Mc12), 4 1977De22), 5.560 25 [E, A 5 (1965Br25), 4.60 6 (196 1964Ko11), 5.80 <i>12</i> (1962 1961Eg01), 5.53 <i>10</i> (1961 Dychinnikova, Geochemica 1959F140), 5.07 <i>20</i> (1957I 2 <i>3</i> (1954Ma31), 4.3 <i>3</i> (1 1952Le24), and 6.15 <i>30</i> (1 x10 <sup>10</sup> y. There are several fany of these values have 990Ho28. In the previous tree recent measurements etermined the amount of <sup>8</sup> 974Ne14 (absolute counting rrors which were shown to 976Ne10) were avoided to n internal uncertainty of 0 ncertainty of 0.06. This una te two most precise values epends greatly on which v xample, note that the four <i>0</i> to 5.82 <i>10</i> . Others: in th 982Mi14 state that, if thei	tic res confirm $\pi$ from $\pi$ mease er-tub 32. (188 8 (198 8) (198 8) (198 8) (198 8) (198 8) (198 8) (198 8) (198 8) (199 8)	sonance (1962Pe14), optical ned by hyperfine-structure n L=1 in ( <sup>3</sup> He,d). surement using $4\pi\beta$ liquid scintillation se spectrometer (2003Ko66). Full (1974Ne14,1972Ne19), and 4.89 <i>4</i> a, Radioisotopes 30 (1981) 647], 5.21 CY, as cited in 1990Ho28), 4.77 <i>10</i> b, 5.25 <i>10</i> (1961Mc07), 5.82 <i>10</i> b, 4.72 <i>8</i> (1960Ra01), 5.02 <i>20</i> [G. V. 259) 393, as cited in 1990Ho28], 4.7 <i>1</i> 4.6 5 (1956Fr12), 5.0 <i>2</i> (1956Al31), e60), 6.2 <i>2</i> (1954F118), 5.9 <i>3</i> au30) where all numbers are in units of r measurements reported before 1950. taken from citations in 1961Be41 or ation, the evaluator averaged only the 66Mc12 and 1977De22, who roduced in the <sup>87</sup> Rb β <sup>-</sup> decay, and of proportional counter), where systematic nherent in the older measurements (see rge extent. This weighted average has a reduced- $\chi^2$ of 4.9, and an external inty was increased to 0.09 to include s clear that the adopted half-life are included in the average. For rs from 1961 and 1962 range from 5.25 cess of analyzing some meteorite data, b- <sup>87</sup> Sr data are to agree with their

# <sup>87</sup>Rb Levels (continued)

E(level) <sup>†‡</sup>	$\mathrm{J}^{\pi}$	T <sub>1/2</sub>	XREF	Comments
				<ul> <li>U-Th-Pb data, the <sup>87</sup>Rb decay constant would need to be 1.402 8 x10<sup>-11</sup> y<sup>-1</sup>, which corresponds to a half-life of 4.94 <i>3</i> x10<sup>10</sup> years. Determination of the half-life is, for some techniques, dependent on the β spectrum shape factor function, discussion of which may be found in 2007Gr05 and 2007Gr06.</li> <li>μ: from 2011StZZ evaluation and based on data of 1993Du08; others: +2.751818 2, and +2.751235 <i>3</i> cited in 1989Ra17 evaluation.</li> <li>Q: from 2011StZZ evaluation, where the measured values are given as +0.132 <i>1</i> (1973Fe05), +0.127 <i>1</i> (1971St12) +0.134 <i>1</i>, +0.128 <i>1</i> (1999Ke12). Other: +0.13 <i>2</i> (1981Th04).</li> <li>δ<r<sup>2&gt;(<sup>85,87</sup>Rb)=0.03 6 fm<sup>2</sup> and δ<r<sup>2&gt;(<sup>87,89</sup>Rb)=0.28 6 fm<sup>2</sup> (1999GaZU). Plot in 1981Jo01 gives similar values.</r<sup></r<sup></li> <li>Octupole mom(mag): -0.58 b v<sub>n</sub> <i>39</i> from combining measured hyperfine intervals with atomic structure calculations, 2009Ge02.</li> </ul>
402.588 <sup>b</sup> 12	5/2-	0.08 ns +9-5	A CDEFG IJK	L $J^{\pi}$ : L=3 in ( <sup>3</sup> He,d), M1+E2 $\gamma$ to 3/2 <sup>-</sup> .
845.44 4	1/2-	101 fs +9-11	CDEFG K	L $J^{\pi}$ : a comparison of $T_{1/2}$ measured by DSAM in ${}^{12}C(86Kr,x\gamma)$ with $g\Gamma^2_{\gamma 0}/\Gamma$ measured in $(n,n'\gamma)$ gives J=1/2. T <sub>1/2</sub> : DSAM (2013St05). Other: 95 fs +14-11 from $\Gamma$ in
1340 36 10			DE	$(\gamma,\gamma').$
1389.78 8	3/2-	0.19 ps +5-3	DEF K	$J^{\pi}$ : L=2 in (p,p') from 3/2 <sup>-</sup> , comparison of $\gamma$ excitation functions in (n,n' $\gamma$ ) with Hauser-Feshbach calculations gives 3/2 <sup>-</sup> .
1463.00 15	1/2-	0.21 ps +12-6	C EF K	$I_{1/2}$ : Calculated from $(\gamma, \gamma')$ level width. $J^{\pi}$ : $\gamma$ excitation in $(n, n' \gamma)$ . $T_{1/2}$ : Calculated from $(\gamma, \gamma')$ level width
1577.9 <sup>b</sup> 3	9/2+	6 ns 1	C EFG IJ	L XREF: G(1578). $J^{\pi}$ : L=4 in ( <sup>3</sup> He,d), comparison with model calculation supports an assignment of $g_{9/2}$ (1975Me02). $T_{1/2}$ : from $(\alpha, \alpha')$ using a pulsed beam technique
1578.05 5	1/2-,3/2-		D G IJK	(1995)Xa16). XREF: G(1578).
1740.57 5	3/2-		DEF K	$J^{\pi}$ : L=1 in (d, He). $J^{\pi}$ : L=2 in (p,p') from 3/2 <sup>-</sup> , comparison of $\gamma$ excitation functions in (n,n' $\gamma$ ) with Hauser-Feshbach calculations gives 3/2 <sup>-</sup> .
1893 <i>10</i> 1950.0 <i>3</i>	(1/2,3/2) <sup>-</sup> (1/2)		C E	$J^{\pi}$ : L=1 in ( <sup>3</sup> He,d). $J^{\pi}$ : Comparison of $\gamma$ excitation functions with
2014 <i>I</i> 2284 <i>I</i> 2378.36 <i>17</i>	$(1/2,3/2,5/2)^{-}$ $(1/2,3/2,5/2)^{-}$ $(1/2^{-},3/2,5/2)$		FK FK DK	$J^{\pi}$ : L=2 in (p,p') from 3/2 <sup>-</sup> and direct excitation in ( $\gamma\gamma'$ ). $J^{\pi}$ : L=2 in (p,p') from 3/2 <sup>-</sup> and direct excitation in ( $\gamma\gamma'$ ). $J^{\pi}$ : From ( $\gamma\gamma'$ ). The 1/2 <sup>+</sup> can be ruled out since the the 1975 $\gamma$ transition to the 403 keV 5/2 <sup>-</sup> level would then have mult=M2 with the $q\Gamma^2/T$ when leading to
2379 8	(*)		F	B(M2)(W.u.)=830 exceeding RUL. $J^{\pi}$ : L=(5) in (p,p') from 3/2 <sup>-</sup> , this level is probably not identical with the 2379 level observed in $\beta^{-}$ decay because of $\gamma$ to 3/2 <sup>-</sup> from the latter level.

Continued on next page (footnotes at end of table)

# <sup>87</sup>Rb Levels (continued)

E(level) <sup>†‡</sup>	$J^{\pi}$	T <sub>1/2</sub>	XREF		Comments
2398 <sup>@</sup> 1 2414.43 6	1/2 <sup>-</sup> ,3/2 <sup>-</sup> (3/2 <sup>-</sup> )		C F D G	K	$J^{\pi}$ : L=1 in ( <sup>3</sup> He,d). XREF: G(2420).
2415 <sup>#</sup> 8 2530 2554.82 7	(7/2,9/2) <sup>+</sup> 1/2 <sup>-</sup> ,3/2 <sup>-</sup> 3/2 <sup>+</sup> ,5/2 <sup>+</sup>		F G CD F	K	$J^{\pi}$ : log <i>ft</i> =6.8, log <i>f</i> <sup>4<i>u</i></sup> <i>t</i> =7.6 from 5/2 <sup>+</sup> L=(1) in (d, <sup>3</sup> He). $J^{\pi}$ : L=3 in (p,p') from 3/2 <sup>-</sup> . $J^{\pi}$ : L=1 in (d, <sup>3</sup> He). XREF: C(2548).
2731 <sup>@</sup> 4 2811.2 2 2960.62 7 2974 <sup>@</sup> 4	$7/2^+,9/2^+$ $3/2^+,5/2^+$ $(3/2,5/2)^+$ $7/2^+,9/2^+$		C F CD F D F C F	K	$J^{\pi}: L=2 \text{ in } ({}^{3}\text{He,d}) \text{ leads to } 3/2^{+}, 5/2^{+}.$ $J^{\pi}: L=4 \text{ in } ({}^{3}\text{He,d}).$ $J^{\pi}: L=2 \text{ in } ({}^{3}\text{He,d}).$ $J^{\pi}: L=3 \text{ in } (p,p') \text{ from } 3/2^{-}, \gamma \text{ to } 3/2^{-}.$ $J^{\pi}: L=4 \text{ in } ({}^{3}\text{He,d}).$
3001.2 <sup>0</sup> 4	$(11/2)^+$ $(1/2, 3/2, 5/2)^+$		F	I] K	XREF: F(3002). $J^{\pi}$ : based on systematics of surrounding levels in <sup>87</sup> Rb. J and L=5 in (p,p') from 3/2 <sup>-</sup> . $J^{\pi}$ : from ( $\gamma\gamma\gamma'$ ).
3043 <i>I</i> 3055.15 24	(1/2,3/2,5/2) (1/2,3/2,5/2) $3/2,5/2,7/2^-$		DF	K	J from $(\gamma \gamma')$ . XREF: F(3058). J <sup><math>\pi</math></sup> : log <i>ft</i> =7.6, log/ <sup>1</sup> <sup><i>u</i></sup> <i>t</i> =8.0 from 5/2 <sup>+</sup> , $\gamma$ to 3/2 <sup>-</sup> .
3060 1	1/2+	24.4 fs +24-21	CF	K	XREF: F(3058). E(level): only from ( <sup>3</sup> He,d) and (g,g'). $J^{\pi}$ : L=0 in ( <sup>3</sup> He,d). There is Calculated by evaluator from ( $\chi(\chi')$ level width
3098.5 11	$(13/2)^+$		F	J	$T_{1/2}^{-1}$ character by contractor from (7,7) fixed within XREF: F(3099). $T^{\pi}$ : L = 5 in (n p <sup>2</sup> ) from $3/2^{-1}$ and $\gamma$ from $(17/2^{+})$
3308.49 <i>12</i> 3338.1 <sup>@</sup> 7	3/2 <sup>+</sup> ,5/2 <sup>+</sup> 1/2 <sup>-</sup> ,3/2 <sup>-</sup>		CD F C F	K K	$J^{\pi}$ : L=2 in ( <sup>3</sup> He,d). XREF: C(3335).
3356 8 3409.1 <sup>b</sup> 3	(13/2 <sup>+</sup> )		F F	IJ	$J^{\pi}$ : L=1 in ( <sup>3</sup> He,d). XREF: F(3411). $I^{\pi}$ : Based on one $\alpha(\theta)$ data in (82Se var) and hand
3411 8 3436 8			F F		placement.
3480 8 3534 8 3586 8 3618 8	(7/2,9/2) <sup>+</sup> - +		F F F		$J^{\pi}$ : L=3+(5) in (p,p') from 3/2 <sup>-</sup> . $J^{\pi}$ : L=4 in (p,p') from 3/2 <sup>-</sup> . $I^{\pi}$ : L=5 in (p,p') from 3/2 <sup>-</sup> .
3644.1 <sup>b</sup> 3	(15/2 <sup>+</sup> )		F	IJ	<b>Solution</b> Size $T_{1}$ : <b>XREF:</b> F(3647). <b>J</b> <sup><math>\pi</math></sup> : Based on one $\gamma(\theta)$ data in (82Se,x $\gamma$ ) and band placement.
3685 <sup>#</sup> 8 3692 7	$(7/2,9/2)^+$ $1/2^-,3/2^-\&(5/2)^-$		C F C		$J^{\pi}$ : L=3+(5) in (p,p') from 3/2 <sup>-</sup> . $J^{\pi}$ : L=1+(4) in ( <sup>3</sup> He,d) and possible doublet with 3702 in
3702 1	(1/2,3/2,5/2) <sup>-</sup>		F	K	(p,p) with L=4. XREF: F(3707). $J^{\pi}$ : L=4 in (p,p') from 3/2 <sup>-</sup> and ( $\gamma,\gamma'$ ) and possible doublet with L=1+(4) in ( <sup>3</sup> He,d).
3744 8 3767 <sup>@</sup> 1	1/2-,3/2-		F C F	K	XREF: C(3764). $I^{\pi}$ : I = 1 in ( <sup>3</sup> He d)
3824 8 3837 <i>1</i>	- 1/2 <sup>+</sup>	3.9 fs +4-3	F C	K	$J^{\pi}$ : L=2 in (p,p') from 3/2 <sup>-</sup> . $J^{\pi}$ : L=0 in ( <sup>3</sup> He,d) and ( $\gamma,\gamma'$ ). $T_{1/2}$ : Calculated by evaluator from ( $\gamma,\gamma'$ ) level width.

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# <sup>87</sup>Rb Levels (continued)

E(level) <sup>†‡</sup>	J <sup>π</sup> XREI		Comments			
3910 8	+	F	$J^{\pi}$ : L=5 in (p,p') from $3/2^{-}$ .			
3958 8	-	F	$J^{\pi}$ : L=4 in (p,p') from $3/2^{-}$ .			
3974 <sup>@</sup> 4	$3/2^+, 5/2^+$	C F	$J^{\pi}$ : L=2 in ( <sup>3</sup> He,d).			
4014 <sup>#</sup> 8	-1 )-1	F				
4029.8	-	F	$J^{\pi}$ : L=4 in (p,p') from $3/2^{-1}$			
4057 8		F				
4068 8		F				
4090.0 11		f J	XREF: f(4094).			
4106 8	-	F	$J^{\pi}$ : L=4 in (p,p') from 3/2 <sup>-</sup> .			
4146 5	$3/2^+, 5/2^+$	С	$J^{\pi}$ : L=2 in ( <sup>3</sup> He,d).			
4150.6 <sup>b</sup> 3	$(17/2^+)$	IJ	$J^{\pi}$ : Based on one $\gamma(\theta)$ data in (82Se,x $\gamma$ ) and band placement.			
4153 8	-	F	$J^{\pi}$ : L=2 in (p,p') from 3/2 <sup>-</sup> .			
4209 8	-	F	$J^{\pi}$ : L=4 in (p,p') from 3/2 <sup>-</sup> .			
4266 5	u	C				
4314.1 15		J				
4379 5	3/2+,5/2+	C	$J^{n}$ : L=2 in ( <sup>3</sup> He,d).			
4492 5	3/2+,5/2+	C	$J^{n}$ : L=2 in ( <sup>3</sup> He,d).			
4681.5	1/2 ,3/2	C	$J^{n}$ : L=1 in ( <sup>3</sup> He,d).			
4854.7 <sup>0</sup> 4	$(19/2^+)$	IJ	$J^{\pi}$ : Based on one $\gamma(\theta)$ data in (82Se,g $\theta$ ) and band placement.			
4862 5	$(1/2^+)\&(3/2^+,5/2^+)$	C	$J^{n}$ : L=(0+2) in ( <sup>3</sup> He,d).			
4941 5	1/2+	C	$J^{n}$ : L=0 in ( <sup>3</sup> He,d).			
5026.4 <sup>0</sup> 4	$(21/2^+)$	IJ	$J^{\pi}$ : Based on one $\gamma(\theta)$ data in (82Se,g $\theta$ ) and band placement.			
5118 9	$3/2^+, 5/2^+$	C	$J^{\pi}$ : L=2 in ( <sup>3</sup> He,d).			
5196 5	1/2+	C	$J^{\pi}$ : L=0 in ( <sup>3</sup> He,d).			
5233 5	$3/2^+, 5/2^+$	C	$J^{\pi}$ : L=2 in ( <sup>3</sup> He,d).			
5316 5	$3/2^+, 5/2^+$	C	$J^{\pi}$ : L=2 in ( <sup>3</sup> He,d).			
5347 5	$3/2^+, 5/2^+$	C	$J^{\pi}$ : L=2 in ( <sup>3</sup> He,d).			
5480.8 <sup>0</sup> 5	$(23/2^+)$	IJ	$J^{\pi}$ : Based on one $\gamma(\theta)$ data in (82Se, X $\gamma$ ) and band placement.			
5491 5	$3/2^+, 5/2^+$	С	$J^{\pi}$ : L=2 in ( <sup>3</sup> He,d).			
5542 5	$(1/2^+)\&(3/2^+,5/2^+)$	С	$J^{\pi}$ : L=(0+2) in ( <sup>3</sup> He,d).			
5634 7	$1/2^{+}$	С	$J^{\pi}$ : L=0 in ( <sup>3</sup> He,d).			
5750 5	1/2+	C	$J^{\pi}$ : L=0 in ( <sup>3</sup> He,d).			
5790.0 11		J				
5802 5	$(1/2^+)\&(3/2^+,5/2^+)$	C	$J^{n}$ : L=(0+2) in ( <sup>3</sup> He,d).			
5845 5	3/2+,5/2+	C	$J^{\pi}$ : L=2 in ( <sup>3</sup> He,d).			
5884 5	3/2+,5/2+	C	$J^{n}$ : L=2 in ( <sup>3</sup> He,d).			
5978 5	3/2+,5/2+	C	$J^{\pi}$ : L=2 in ( <sup>3</sup> He,d).			
6018 5	1/2+	C	$J^{n}$ : L=0 in ( <sup>3</sup> He,d).			
6089 5	3/2+,5/2+	C	$J^{n}$ : L=2 in ( <sup>3</sup> He,d).			
6176 5	1/2+	C	$J^{n}$ : L=0 in ( <sup>3</sup> He,d).			
6206 5	3/2+,5/2+	C	$J^{n}$ : L=2 in ( <sup>3</sup> He,d).			
6307 5	3/2+,5/2+	C	$J^{n}$ : L=2 in ( <sup>3</sup> He,d).			
6345.9 11	$(1/2+) \otimes (2/2+5/2+)$	J				
03/3 J 6469 5	$(1/2^{+}) \propto (3/2^{+}, 3/2^{+})$		$J^{(1)}$ : L=(0+2) III ("He,d). III: L=0 in ( <sup>3</sup> He,d).			
0408 J	$1/2^{+}$ $2/2^{+} 5/2^{+}$		$J^{*}: L=0 \text{ in } ({}^{\circ}\text{He}, d).$			
UJ12 J	5/2 <sup>+</sup> ,5/2 <sup>+</sup>		J. $L=2$ in (Fite, d). $\pi$ , $L=0$ in ( <sup>3</sup> He d)			
0348 3	1/2	C	J : L=0 m (He,d).			
0303.50 0	2/0+ 5/0+	LT				
0018 3	$3/2^+, 3/2^+$	C	$J^{n}: L=2$ in ( <sup>3</sup> He,d).			
6652 5	3/2',5/2'	C	$J^{n}$ : L=2 in ( <sup>3</sup> He,d).			

#### <sup>87</sup>Rb Levels (continued)

E(level) <sup>†‡</sup>	$\mathbf{J}^{\pi}$	T <sub>1/2</sub>	XREF		Comments
6744 10	3/2+,5/2+		С		$J^{\pi}$ : L=2 in ( <sup>3</sup> He,d).
6791 9	$(1/2^+)\&(3/2^+,5/2^+)$		С		$J^{\pi}$ : L=(0+2) in ( <sup>3</sup> He,d).
6821.3 <sup>b</sup> 6				IJ	
6838 <i>5</i>	1/2+		С		$J^{\pi}$ : L=0 in ( <sup>3</sup> He,d).
6989 <i>5</i>	1/2+		С		$J^{\pi}$ : L=0 in ( <sup>3</sup> He,d).
7242.1 9				J	
13969	5/2+&	36.0 keV	В		J <sup><math>\pi</math></sup> : isobaric analog to the 5/2 <sup>+</sup> ground state in <sup>87</sup> Kr.
14491	$1/2^{+}$	77.0 keV	В		$J^{\pi}$ : L=0 in (p,p') IAR.
15447	3/2+,5/2+&	49.6 keV	В		$J^{\pi}$ : L=2 in (p,p') IAR.
15855	3/2 <sup>+</sup> ,5/2 <sup>+</sup> <b>&amp;</b>	30.0 keV	В		$J^{\pi}$ : L=2 in (p,p') IAR.
15969	3/2 <sup>+</sup> ,5/2 <sup>+</sup> <b>&amp;</b>	36.0 keV	В		$J^{\pi}$ : L=2 in (p,p') IAR.
16041	1/2+&	60.0 keV	В		$J^{\pi}$ : L=0 in (p,p') IAR.
16084	3/2 <sup>+</sup> ,5/2 <sup>+</sup> <b>&amp;</b>	62.0 keV	В		$J^{\pi}$ : L=2 in (p,p') IAR.
16241	9/2 <sup>-</sup> ,11/2 <sup>-&amp;</sup>	45.0 keV	В		$J^{\pi}$ : L=5 in (p,p') IAR.
16513	7/2+ <sup>&amp;</sup>	30.0 keV	В		J <sup><math>\pi</math></sup> : isobaric analog to the 2519 level in <sup>87</sup> Kr (J <sup><math>\pi</math></sup> =7/2 <sup>+</sup> ).
16763	3/2 <sup>+</sup> ,5/2 <sup>+</sup> <b>&amp;</b>	65.0 keV	В		$J^{\pi}$ : L=2 in (p,p') IAR.
16884	3/2+,5/2+&	65.0 keV	В		$J^{\pi}$ : L=2 in (p,p') IAR.
16995	5/2 <sup>-</sup> ,7/2 <sup>-&amp;</sup>	35.0 keV	В		$J^{\pi}$ : L=3 in (p,p') IAR.
17194	$1/2^{+}$	70.0 keV	В		$J^{\pi}$ : L=0 in (p,p') IAR.
17514	3/2 <sup>+</sup> ,5/2 <sup>+</sup> <b>&amp;</b>	38.0 keV	В		$J^{\pi}$ : L=2 in (p,p') IAR.

 $^\dagger$  From least-squares fit to  $\gamma$  energies.  $^\ddagger$  Questionable level at 1999 keV from (n,n' $\gamma$ ) has been omitted.

<sup>#</sup> From <sup>87</sup>Rb(p,p').

<sup>(a)</sup> Weighted average from (<sup>3</sup>He,d) and <sup>87</sup>Rb(p,p'). <sup>&</sup> The assignment of isobaric analogs in <sup>87</sup>Kr is confirmed by the agreement of spectroscopic factors in <sup>86</sup>Kr(p,p') and <sup>86</sup>Kr(d,p).

<sup>*a*</sup>  $J^{\pi} = (1/2^{-}, 3/2^{-})$  and  $3/2^{+}, 5/2^{+}$  from L=(1)+2 in (<sup>3</sup>He,d).

<sup>b</sup> Band(A): Yrast sequence.

					Adop	oted Levels	, Gammas (conti	inued)			
$\gamma$ <sup>(87</sup> Rb)											
E <sub>i</sub> (level)	${f J}^\pi_i$	$E_{\gamma}^{\dagger\ddagger}$	$I_{\gamma}$ #	$\mathbf{E}_{f}$	$\mathbf{J}_f^{\pi}$	Mult.	δ	$\alpha^{e}$	Comments		
402.588	5/2-	402.588 12	100	0.0	3/2-	M1+E2	-0.24 +9-12	0.00411 6	B(M1)(W.u.)=0.0042 +61-23; B(E2)(W.u.)=1.63 15 $\alpha$ (K)=0.00364 16; $\alpha$ (L)=0.000398 19; $\alpha$ (M)=6.6×10 <sup>-5</sup> 3 $\alpha$ (N)=7.4×10 <sup>-6</sup> 4; $\alpha$ (O)=3.20×10 <sup>-7</sup> 13		
845.44	1/2-	845.43 4	100	0.0	3/2-	M1		7.30×10 <sup>-4</sup>	Mult., $\delta$ : from Coulomb excitation. $\alpha(K)=0.000648 \ 9; \ \alpha(L)=6.93\times10^{-5} \ 10;$ $\alpha(M)=1.143\times10^{-5} \ 16$ $\alpha(N)=1.300\times10^{-6} \ 19; \ \alpha(O)=5.68\times10^{-8} \ 8$ B(M1)(W.u.)=0.36 4; B(E2)(W.u.)>300 Mult.: Dominant M1 character interpreted as proton spin flip from 2p <sub>1/2</sub> to 2p <sub>3/2</sub> . B(E2)(W.u.): Limit from RUL, which leads to		
349.36		946.69 13	100	402.588	$5/2^{-}$				$\delta < 1.1.$		
1389.78	3/2-	987.2 <sup>@</sup> 2 1389.77_8	24 <sup>@</sup> 100	402.588 0.0	5/2 <sup>-</sup> 3/2 <sup>-</sup>						
1463.00	1/2-	$1060.4^{\textcircled{0}}{2}$ $1463.0^{\textcircled{0}}{2}$	15 <sup>@</sup> 100 <sup>@</sup>	402.588 0.0	5/2 <sup>-</sup> 3/2 <sup>-</sup>	[E2]		4.68×10 <sup>-4</sup> 7	B(E2)(W.u.)=11 + 4 - 3		
1577.9	9/2+	1175.3 <sup>@</sup> 3	100 <sup>@d</sup>	402.588	5/2-	M2		8.04×10 <sup>-4</sup>	B(M2)(W.u.)=0.103 18 $\alpha$ (K)=0.000712 10; $\alpha$ (L)=7.71×10 <sup>-5</sup> 11; $\alpha$ (M)=1.272×10 <sup>-5</sup> 18 $\alpha$ (N)=1.447×10 <sup>-6</sup> 21; $\alpha$ (O)=6.31×10 <sup>-8</sup> 9; $\alpha$ (IPF)=6.66×10 <sup>-7</sup> 11 Mult.: Deduced from half-life (1995Ka18).		
		1578.0 5	14 <sup><i>d</i></sup> 1	0.0	3/2-	[E3]		4.08×10 <sup>-4</sup>	B(E3)(W.u.)=2.3 5 $\alpha$ (K)=0.000319 5; $\alpha$ (L)=3.45×10 <sup>-5</sup> 5; $\alpha$ (M)=5.69×10 <sup>-6</sup> 8 $\alpha$ (N)=6.45×10 <sup>-7</sup> 9; $\alpha$ (O)=2.78×10 <sup>-8</sup> 4; $\alpha$ (IPF)=4.89×10 <sup>-5</sup> 7		
1578.05	1/2-,3/2-	1175.40 <sup>&amp;</sup> 8	100 3	402.588	$5/2^{-}$						
1740.57	3/2-	894.2 <sup>@</sup> 8 1337.99 7 1740.54 7	$2^{@b}$ 31.1 17 100 2	845.44 402.588 0.0	3/2 1/2 <sup>-</sup> 5/2 <sup>-</sup> 3/2 <sup>-</sup>						
1950.0 2014 2284	(1/2) $(1/2,3/2,5/2)^{-}$ $(1/2,3/2,5/2)^{-}$	1547.4 <sup>@</sup> 3 2014 1881 2284	100 <sup>@</sup> 100 49 9 100 9	402.588 0.0 402.588 0.0	5/2 <sup>-</sup> 3/2 <sup>-</sup> 5/2 <sup>-</sup> 3/2 <sup>-</sup>						

From ENSDF

 $^{87}_{37}$ Rb $_{50}$ -6

L

## $\gamma(^{87}\text{Rb})$ (continued)

$E_i$ (level)	$\mathbf{J}_i^{\pi}$	$E_{\gamma}^{\dagger\ddagger}$	$I_{\gamma}^{\#}$	$\mathbf{E}_{f}$	$\mathrm{J}_f^\pi$	Mult.	$\alpha^{e}$	Comments
2378.36	$(1/2^{-}, 3/2, 5/2)$	1975 <i>1</i>	43 9	402.588	5/2-			Only observed in $(\gamma \gamma')$ from 2002Ka25.
		2378.5 <sup>&amp;</sup> 3	100 9	0.0	3/2-			• • • • • • • • • • • • • • • • • • • •
2398	1/2-,3/2-	1553 <i>1</i>	8 2	845.44	1/2-			Only observed in $(\gamma \gamma')$ from 2002Ka25.
		1995 <i>1</i>	11 1	402.588	5/2-			Only observed in $(\gamma \gamma')$ from 2002Ka25.
0414 40	(2/2-)	2398 1	100 2	0.0	3/2			Only observed in $(\gamma \gamma')$ from 2002Ka25.
2414.43	(3/2)	$6/3.83 \approx 8$	65.6 1/	1/40.5/	3/2			
		836.37 0	26.77	15/8.05	1/2 ,3/2			
		2011.88 <sup>cc</sup> 10	100 4	402.588	5/2-			
2554.82	3/2+,5/2+	814.25 6	1.776	1740.57	3/2-			
		976.5 <sup>cc</sup> 3	0.61 4	1578.05	1/2-,3/2-			
		2554.8 <sup>°</sup> 2	100 5	0.0	3/2-			
2811.2	3/2+,5/2+	1461.3 <sup>a</sup> 6	15.4 <i>16</i>	1349.36				
		2408.5 <sup>°</sup> 2	71 6	402.588	5/2-			
		2811.4 <sup>°</sup> 2	100 5	0.0	3/2-			
2960.62	$(3/2, 5/2)^+$	582.3 <sup>x</sup> 2	0.9 3	2378.36	$(1/2^{-}, 3/2, 5/2)$			
		1382.55 <sup><i>x</i></sup> 6	7.3 3	1578.05	1/2-,3/2-			
		1611.18 <sup>&amp;</sup> 14	2.7 4	1349.36				
		2558.1 <sup>&amp;</sup> 2	100 5	402.588	5/2-			
		2961.2 <sup>&amp;</sup> 8	1.8 5	0.0	3/2-			
3001.2	$(11/2)^+$ $(1/2)^2/2)^+$	1423.3 <sup>4</sup> 4	100 20	1577.9	9/2+			
3043	(1/2, 3/2, 5/2) (1/2, 3/2, 5/2)	3043	100	0.0	$\frac{3}{2}$			
3055 15	(1/2,3/2,3/2) $3/2 5/2 7/2^{-}$	2652 5 <sup>&amp;</sup> 4	28.5	402 588	5/2 <sup>-</sup>			
5055.15	5/2,5/2,7/2	3055 1 & 3	100 6	0.0	3/2-			
3060	$1/2^{+}$	3060	100 0	0.0	3/2-	[E1]	$1.29 \times 10^{-3} 2$	B(E2)(W.u.)=0.00049 5
3098.5	$(13/2)^+$	1520.0 5	100	1577.9	9/2+			
3308.49	3/2+,5/2+	894.02 <sup>&amp;</sup> 13	10.1 7	2414.43	$(3/2^{-})$			
		3308.5 <mark>&amp;</mark> 2	100 6	0.0	3/2-			
3338.1	1/2-,3/2-	1760 1	100 21	1578.05	1/2-,3/2-			$I_{\gamma}$ : From $(\gamma \gamma')$ .
2400.1	(12/0+)	3338 1	52 21	0.0	$3/2^{-}$			$I_{\gamma}$ : From $(\gamma \gamma')$ .
3409.1	$(13/2^{\circ})$	408.0 3 1831 1 7	$11.1^{\circ} 22$ $100^{\circ} 21$	5001.2 1577 9	$(11/2)^{-}$ 9/2 <sup>+</sup>			
3644.1	$(15/2^+)$	235.0 1	$100^{\circ} 21$ $100^{\circ} 20$	3409.1	$(13/2^+)$	D+O		
3702	$(1/2, 3/2, 5/2)^{-}$	2312 1	83	1389.78	3/2-			$E_{\gamma}$ : Only in $(\gamma \gamma')$ .
a= <=		3702 1	100 3	0.0	3/2-			$E_{\gamma}$ : Only in $(\gamma \gamma')$ .
3767	$1/2^{-}, 3/2^{-}$	3767 1	100	0.0	3/2-			$E_{\gamma}$ : Only in $(\gamma \gamma')$ .

7

#### $\gamma(^{87}\text{Rb})$ (continued)

$E_i$ (level)	$\mathbf{J}_i^{\pi}$	$E_{\gamma}^{\dagger\ddagger}$	$I_{\gamma}^{\#}$	$E_f$	$\mathbf{J}_{f}^{\pi}$	Mult.	$\alpha^{e}$	Comments
3837	1/2+	3837	100	0.0 3	/2-	[E1]	1.64×10 <sup>-3</sup> 3	B(E1)(W.u.)=0.00156 +12-6 E <sub><math>\gamma</math></sub> : Only in ( $\gamma\gamma'$ ).
4090.0		1088.8 10	100 32	3001.2 (	$11/2)^{+}$			$E_{\gamma}$ : Only in <sup>176</sup> Yb( <sup>23</sup> Na,x $\gamma$ ) deep inelastic.
4150.6	$(17/2^+)$	506.5 <sup>a</sup> 1	100 <sup>d</sup> 10	3644.1 (	$15/2^+)$	D(+Q)		
		1052.1 10	8 <sup>d</sup> 2	3098.5 (	$(13/2)^{+}$			E only in ${}^{176}$ Yb( ${}^{23}$ Na,X $\gamma$ ) deep inelastic.
4314.1		224.1 10	<100	4090.0				
4854.7	$(19/2^+)$	704.1 <sup>a</sup> 2	100 <sup>C</sup> 19	4150.6 (	$17/2^+)$	(D+Q)		
		1210.8 <sup>a</sup> 4	27 <sup>°</sup> 4	3644.1 (	$15/2^+$ )			
5026.4	$(21/2^+)$	171.7 <sup>a</sup> 1	100 <b>d</b> 27	4854.7 (	19/2+)	(D+Q)		
		875.9 <sup>a</sup> 4	32 <b>d</b> 9	4150.6 (	$17/2^{+})$			
5480.8	$(23/2^+)$	454.4 <sup>a</sup> 3	100 <sup>d</sup> 15	5026.4 (2	$21/2^+$ )	(D+Q)		
5790.0		935.3 10	100 32	4854.7 (	$19/2^{+}$ )			
6345.9		865.1 10	100 20	5480.8 (2	$23/2^+)$			
6565.5		1084.6 <sup>a</sup> 4	100 <sup>d</sup> 34	5480.8 (2	23/2+)			
		1539.2 10	50 <i>33</i>	5026.4 (2	$21/2^+$ )			E Seen only in ${}^{176}$ Yb( ${}^{23}$ Na,X $\gamma$ ).
6821.3		255.8 5	100 <sup>C</sup> 20	6565.5				
		1340.5 5	100 <sup>C</sup> 20	5480.8 (2	23/2+)			
7242.1		420.8 6	100 40	6821.3				

 $\infty$ 

<sup>†</sup> Weighted average from  $\beta^-$  decay and  $(n,n'\gamma)$ , unless indicated otherwise.

 $\frac{1}{2}\gamma$  rays which are reported in only one decay mode, such as  $(n,n'\gamma)$  or  $\beta$ - decay, and are reported as questionable are omitted.

<sup>#</sup> From  $\beta^-$  decay, unless indicated otherwise.

<sup>@</sup> From only  $(n,n'\gamma)$ .

<sup>&</sup> From  $\beta^-$  decay.

<sup>*a*</sup> Weighted average from 2005Fo05 and 2004Zh27.

<sup>b</sup> Note that a transition with  $E_{\gamma}=894.02$  13 and  $I_{\gamma}(894)/I_{\gamma}(1740)=0.0221$  15 is seen in  $\beta^-$  decay, but is placed from the 3308 level. Note that energy of the  $\beta^-$  does not fit the 1740 level. Also the 3308 level is not populated in  $(n,n'\gamma)$ , so the transition can not be placed from that level.

<sup>c</sup> From <sup>192</sup>Os(<sup>82</sup>Se,xG) deep inelastic.

<sup>*d*</sup> From  ${}^{176}$ Yb( ${}^{23}$ Na,xG) deep inelastic.

<sup>e</sup> Additional information 1.







<sup>87</sup><sub>37</sub>Rb<sub>50</sub>



<sup>87</sup><sub>37</sub>Rb<sub>50</sub>