			History	
	Туре	Author	Citation	Literature Cutoff Date
	Full Evaluation	Coral M. Baglin	NDS 114,1293 (2013)	1-Sep-2013
7; S(n)=10107	7; S(p)=6835 7;	$Q(\alpha) = -5287 8$	2012Wa38	

 $Q(\beta^{-})=-6222$  7; S(n)=10107 7; S(p)=6835 7; Q( $\alpha$ )=-5287 8 20  $Q(\epsilon p)=-724$  6 (2012Wa38).

Other experiment:  $(p,\pi^-)$ , 1982Vi05.

Theory (partial list): Nuclear structure calculations: 1996Ru02, 1992Si15, 1976Gr07, 1976Se01 (shell model). 1973Ki04, 1984Ng01 (quasi-particle phonon coupling model).

<sup>91</sup>Mo Levels

See 1993Hi12 for spectroscopic strength functions for  $p_{1/2}$ ,  $p_{3/2}$ ,  $f_{5/2}$ ,  $f_{7/2}$  and  $g_{9/2}$  hole states in <sup>91</sup>Mo.

## Cross Reference (XREF) Flags

		A B C D E	<sup>90</sup> Zr( $\alpha$ ,3n $\gamma$ ), <sup>91</sup> Mo IT dec <sup>91</sup> Tc ε decay <sup>91</sup> Tc ε decay <sup>92</sup> Mo(p,d),(d	b), ${}^{92}Mo(\alpha, \alpha' n\gamma) = F = {}^{92}Mo(pol p,d)$ (cay (64.6 s) = G = {}^{66}Zn({}^{28}Si,2pn\gamma) (ay (3.14 min) = H = {}^{63}Cu({}^{31}P,n2p\gamma) (3.3 min) = ${}^{92}Mo(p,pn)$ :radius,Mom (d,t),({}^{3}He,\alpha) = {}^{92}Mo(p,pn)
E(level)	$J^{\pi \dagger}$	T <sub>1/2</sub> ‡	XREF	Comments
0	9/2+	15.49 min <i>I</i>	ABCDEFGHI	$%ε+%β^+=100$ μ=-0.932 3 (2009Ch09) μ: from hyperfine structure in laser spectroscopy (2011StZZ from 2009Ch09). Δ <r<sup>2&gt;(<sup>91</sup>Mo,<sup>92</sup>Mo)=+0.021 fm<sup>2</sup> 1 (2009Ch09); uncertainty is statistical only. Isotope shift(<sup>91</sup>Mo,<sup>92</sup>Mo)=-171 MHz 5 (2009Ch09); total uncertainty is given; statistical uncertainty is 2. J<sup>π</sup>: J(pol p,d)=9/2; L(pol p,d)=4. T<sub>1/2</sub>: from 1965Eb01. Other measurements: 16.6 min 8 (1976De37), 15.6 min 4 (1976Bo19), 15.7 min 2 (1965Cr10), 15.2 min 3 (1961Ra06), 15.7 min 3 (1955Ax02), 15.5 min 2 (1953Ka11), 15.5 min 5 (1949Du10). Additional information 1.</r<sup>
653.01 9	1/2-	64.6 s <i>6</i>	BCDEF	$%ε+%β^+=50.0 \ 16; %IT=50.0 \ 16$ %ε+%β <sup>+</sup> , %IT: from <sup>91</sup> Mo ε decay (64.6 s). J <sup>π</sup> : J(pol p,d)=1/2; L(pol p,d)=1. T <sub>1/2</sub> : weighted average of 63.5 s 10 (1990KaZW), 65.1 s 12 (1976De37), 68 s 2 (1965Cr10), 64 s 1 (1957Pr44), 66 s 3 (1955Ax02), 65.5 s 20 (1953Ka11).
1156.10 13	3/2-		CDEF	$J^{\pi}$ : J(pol p,d)=3/2; L(pol p,d)=1.
1362.01 8	5/2+		CDEF	$J^{n}$ : L(n)=2; J=5/2 from (pol p,d).
1414.11 <sup>&amp;</sup> <i>13</i>	13/2 <sup>(+)</sup>		ACEG	$J^{\pi}$ : stretched Q 1414 $\gamma$ to 9/2 <sup>+</sup> g.s.; 13/2 <sup>+</sup> supported by shell-model calculations.
1531.90 24	$5/2^{-}$		C EF	$J^{\pi}$ : J(pol p,d)=5/2; L(n)=3.
1564.92 9			С	J <sup><math>\pi</math></sup> : $\gamma$ to 9/2 <sup>+</sup> g.s. favors J <sup><math>\pi</math></sup> =5/2 <sup>+</sup> ,7/2,9/2,11/2,13/2 <sup>+</sup> .
1605.32 7			CE	$J^{\pi}$ : $\gamma$ to $9/2^+$ g.s. favors $J^{\pi} = 5/2^+, 7/2, 9/2, 11/2, 13/2^+$ .

# <sup>91</sup>Mo Levels (continued)

E(level)	$J^{\pi}$	T <sub>1/2</sub> ‡	XREF	Comments				
1639.95 8	$(7/2, 9/2^+)$		СЕ	$J^{\pi}$ : 1640y to 9/2 <sup>+</sup> g.s.; 278y to 5/2 <sup>+</sup> 1362; log <i>ft</i> =6.5 from (9/2) <sup>+</sup> .				
1844 5	5/2-,7/2-		E	$J^{\pi}$ : L(p,d)=3.				
1902.49 7	9/2+		C EF	$J^{\pi}$ : J(pol p,d)=9/2; L(p,d)=4.				
2067.91 <sup>&amp;</sup> 24	$17/2^{(+)}$		A GH	$J^{\pi}$ : stretched E2 654 $\gamma$ to 13/2 <sup>(+)</sup> 1414 from ( <sup>31</sup> P,n2p $\gamma$ ) and ( $\alpha$ 3n $\gamma$ ).				
2083.66 14	3/2-		DEF	$J^{\pi}$ : J(pol p,d)=3/2; L(n)=1.				
2233 69 9	9/2+		C EF	$I^{\pi}$ : I(nol p d)=9/2: I (n)=4				
2233.09 9 2243 <sup>#</sup>	//=		F					
22+3 2267 1 & 1	21/2(+)	17 no. 1						
2207.4 4	21/2	47 115 1	A GN	$\mu$ -+0.89 δ $\mu$ : From time-differential perturbed angular distribution. Unweighted average of +8.81 8 (1983Ra08) and +8.97 9 (1978Ha52) (the data listed in 2011StZZ and 1989Ra17). J <sup>π</sup> : stretched E2 200γ to 17/2 <sup>(+)</sup> 2068; measured g factor consistent (via additivity rule) with the configuration ( $\nu$ $g_{9/2}$ ) <sup>-1</sup> $\otimes$ (( $\pi$ $g_{9/2}$ ) <sup>2</sup> (6 <sup>+</sup> or 8 <sup>+</sup> )) coupled to give a $J^{\pi}$ =21/2 <sup>+</sup> state (1983Ra08).				
2279.6 4	$(17/2^{-})$	38 ns 4	Α	$\mu = +4.51 6$				
				μ: From time-differential perturbed angular distribution (2011StZZ and 1989Ra17, from 1983Ra08). Relative to <sup>90</sup> Mo 2875 level. J <sup>π</sup> : 212γ to 17/2 <sup>(+)</sup> 2068 in (α,3nγ); measured g factor supports (via additivity rule) the configuration ((ν g <sub>9/2</sub> ) <sup>-1</sup> ⊗( <sup>92</sup> Mo, 5 <sup>-</sup> level))17/2 <sup>-</sup> (1983Ra08).				
2302 <sup>@</sup>	$(1/2^{-}\&9/2^{+})$		EF	XREF: E(2300)F(2304).				
				$J^{\pi}$ : J(pol p,d)=(1/2&9/2); L(pol p,d)=(1&4).				
				E(level): for doublet.				
2345 4	$(7/2^+, 9/2^+)$		E	J <sup><math>\pi</math></sup> : L( <sup>3</sup> He, $\alpha$ )=4 for $\sigma(\theta)$ with little structure.				
2450.99 9	9/2+		C EF	$J^{\pi}$ : J(pol p,d)=9/2; L(n)=4.				
2492.16 17	2/2+ 5/2+		CE	J <sup>*</sup> : 2492 $\gamma$ to 9/2 <sup>+</sup> g.s. so J=(5/2 to 13/2).				
2337 4	5/2 ,5/2		EF	$I_{\pi}^{\pi}$ , $I_{(n)}^{-2}$				
2566 4	7/2+.9/2+		Е	$J^{\pi}: L(n)=4.$				
2624 6			Е					
2663 6			E					
2690.44 11	$(3/2)^{-}$		DE	$J^{\pi}$ : log ft=5.6 from (1/2) <sup>-</sup> ; 1328 $\gamma$ to (5/2) <sup>+</sup> 1362.				
2716 4	$5/2^{-}$		EF	$J^{\pi}$ : J(pol p,d)=5/2; L(n)=3.				
2/10.44 /	$(1/2,9/2)^{+}$		C F	$J^{n}$ : log $ft=5.3$ from $(9/2)^{-1}$ ; 1354 $\gamma$ to $(5/2)^{-1}$ 1362.				
2781 12.8	$(7/2^+, 9/2^+)$ $(7/2^+, 9/2^+, 11/2^+)$		C E	J. $L(n) = (4)$ . $I^{\pi} \cdot \log f_{t} = 5.6 \text{ from } (9/2)^{+}$				
2818 4	9/2 <sup>+</sup>		EF	$J^{\pi}$ : J(pol p.d)=9/2: L(n)=4.				
2851 6	9/2-,11/2-		Е	$J^{\pi}$ : L(n)=5.				
2867 6	9/2-,11/2-		E	$J^{\pi}$ : L(p,d)=5.				
2883 4	1/2-,3/2-		E	$J^{\pi}$ : L(n)=1.				
2887.50 12	$(9/2^+, 11/2^+)$		C	J <sup>*</sup> : log $ft=5.8$ from $(9/2)^+$ ; weak 1/31 $\gamma$ to 3/2 <sup>-</sup> 1156; 2808 $\gamma$ to $9/2^+$ g.s.				
2901	3/2-		F	$J^{\pi}$ : J(pol p,d)=3/2; L(n)=1.				
2914 5	$(5/2^{-},7/2^{-})$		E	$J^{\pi}$ : L(n)=(3).				
2940.1 4	$(23/2^+)$	0.08 ps	A GH	$J^{\pi}$ : M1 673 $\gamma$ to 21/2 <sup>(+)</sup> 2267 in (HI,xn $\gamma$ ) in ( <sup>31</sup> P,n2p $\gamma$ ).				
2941 5	$(5/2^{-}, 7/2^{-})$		E	$J^{n}$ : L(n)=(3).				
2904 0 2084 6			ድ ድድ	<b>XPEE:</b> $f(2007)$				
3010.5	$(5/2^{-},7/2^{-})$		EF	$I^{\pi}: L(n)=(3).$				
3031 6	$(1/2^{-}, 3/2^{-})$		E	$J^{\pi}$ : L <sup>(3</sup> He, $\alpha$ )=(1).				
3085 6	×1 )-1 - /		EF					

Continued on next page (footnotes at end of table)

# <sup>91</sup>Mo Levels (continued)

E(level)	$J^{\pi \dagger}$	$T_{1/2}$	X	REF	Comments
3126 6	$(1/2^{-}, 3/2^{-})$			E	$J^{\pi}$ : L( <sup>3</sup> He, $\alpha$ )=(1) for doublet at 3120 20.
3162 6				E	
3191 6	3/2-			EF	$J^{\pi}$ : J(pol p,d)=3/2; L(n)=1.
3230 6	$(5/2^-, 7/2^-)$			E	$J^{n}$ : L( <sup>3</sup> He, $\alpha$ )=(3).
3328 6	(9/2 <sup>+</sup> )			EF	$J^{\pi}$ : L(n)=4, J=9/2 for 3330 level in (pol p,d); inconsistent with L(n)=(2) in
3351 6	(5/2 <sup>-</sup> ,7/2 <sup>-</sup> )			E	$J^{\pi}$ : L(p,d)=(3).
3413 6	$(5/2^{-},7/2^{-})$			E	$I^{\pi}: L(n,d) = (3)$
3447 6	7/2-			EF	$J^{\pi}$ : L(n)=3, J=7/2 for 3456 level in (pol p,d); confirmed in ( <sup>3</sup> He, $\alpha$ ). However L (n d)=(2)
3472 6 3524 6	$(1/2^-, 3/2^-)$			E	$J^{\pi}$ : L( <sup>3</sup> He, $\alpha$ )=(1).
3515 6 × 1	$(25/2^{+})$	0.11  pc	٨	CU	$I^{\pi}$ : A I = 1 d(+0) 605a to (23/2 <sup>+</sup> ) 2040 in ( <sup>28</sup> Si 2nna)
3585 6	$(7/2^{-})$	0.11 ps	A	EF	$J^{\pi}$ : L(pol p,d)=(3), J=(7/2) for 3591 level; supported by L( <sup>3</sup> He,d). L(p,d)=(4) is probably arranged to incomplete $\sigma(0)$
3631.6	$(1/2^{-} 3/2^{-})$			E	$L(p,q)=(4)$ is probably entineous due to incomplete $\delta(\theta)$ . $I^{\pi} \cdot L(q)=(1)$
3645 6	$5/2^+$			EF	$J^{\pi}$ : J(pol p,d)=5/2; L(n)=2.
3696 6				E	
3729 6				E	
3759 6				EF	
3809.7 4	(25/2+)	17 ps 3	A	GH	$J^{\pi}$ : D(+Q) 870 $\gamma$ to (23/2 <sup>+</sup> ) 2940, (M1) 264 $\gamma$ to (25/2 <sup>+</sup> ) 3545 in;
					(F,112py), absence of $\gamma$ to $3 < 25/2$ . Type: from RDM in $({}^{28}Si 2pnz)$ . Other: $>20$ ns from $(\alpha 3nz)$
3836 6	$(7/2^{-})$			EF	XREF: F(3823). $\mathbb{I}^{\pi}$ . [(no) n d)=7/2. L(n)=3 for 3823 state which may conceivably be a
					3806+3836 doublet.
3930 6	$(9/2^+)$			EF	$J^{\pi}$ : L(p,d)=(4); J(pol p,d)=(7/2&9/2) for L=(3&4) 3956-keV doublet.
3956 6	$(7/2^{-})$			EF	$J^{\pi}$ : L(p,d)=(3); J(pol p,d)=(7/2&9/2) for L=(3&4) 3956-keV doublet.
4022 6	$(1/2^-, 3/2^-)$			E	$J^{\pi}$ : L(p,d)=(1). However, L( <sup>3</sup> He, $\alpha$ )=(3) for level at 4020 20.
4060 20	$(5/2^{-},7/2^{-})$			E	$J^{\pi}$ : L( <sup>3</sup> He, $\alpha$ )=(3) for doublet which presumably includes the 4069 level.
4069 6	9/21			EF F	$J^{*}$ : $J(pol p,d)=9/2$ ; $L(n)=4$ in (pol p,d).
4116 7				E	
4133 6	5/2-,7/2-			EF	$J^{\pi}$ : L(p,d)=3.
4157 <sup>#</sup> 7	(9/2 <sup>+</sup> )			EF	$J^{\pi}$ : L=(3 and 4), J=(7/2 and 9/2) in (pol p,d) for 4151-keV doublet which may include L=3 4133 level.
4186 7				E	.,
4228 7				E	
4258 7				E	
4276 7	(9/2+)			EF	$J^{n}$ : L(n)=4, J=9/2 for 4283 level in (pol p,d). L(p,d)=3 assigned by 1976Ka08, but $\sigma(\theta)$ does not appear to rule out L=4.
4301 6	$(5/2^{-},7/2^{-})$			E	$J^{\pi}$ : L( <sup>3</sup> He, $\alpha$ )=(3).
4341.9 5	$(27/2^{+})$	0.20 ps	A	GH	$J^{n}$ : $\Delta J=1 d+Q 532\gamma$ to $(25/2^{+}) 3811$ in $(^{28}S1,2pn\gamma)$ . Other $T_{1/2}$ : <1.4 ps from RDM in $(^{28}S1,2pn\gamma)$ .
4349 7				E	
4385 7	(5/2 <sup>-</sup> &7/2 <sup>-</sup> )			EF	$J^{\pi}$ : L(n)=(3&3), J=(5/2&7/2) for 4383 doublet in (pol p,d). It is unclear whether this doublet is comprised of two levels near 4385 or of the
1108 7				F	4408+4385 levels. See comment on 1385 level
4432 7	$(5/2^{-} 7/2^{-})$			F	$I^{\pi}$ , $I({}^{3}\text{He}\alpha) = 3$ for a 4450 20 level presumably the same level as this one
4445.1 <sup><i>a</i></sup> 4	$(5/2^{+},7/2^{-})$ $25/2^{(+)}$			GH	$J^{\pi}$ : stretched Q 2178 $\gamma$ to 21/2 <sup>(+)</sup> 2267; 1504 $\gamma$ to 23/2 <sup>+</sup> 2940.

Continued on next page (footnotes at end of table)

# <sup>91</sup>Mo Levels (continued)

E(level)	$J^{\pi}$	T <sub>1/2</sub> ‡	2	XREF	Comments
4456.5 11	(27/2)			Н	$J^{\pi}$ : 647 $\gamma$ to (25/2 <sup>+</sup> ) 3810 in ( <sup>31</sup> P.n2p $\gamma$ ).
4481	5/2-			F	$J^{\pi}$ : J(pol p,d)=5/2, L(n)=3.
4522 7				E	$J^{\pi}$ : L( <sup>3</sup> He, $\alpha$ )=3 for a 4500 20 level; this may correspond to the 4481
4560 7				F	and/or 4522 levels adopted here.
4577 7				F	$I^{\pi}$ : I ( <sup>3</sup> He $\alpha$ )=3 for a 4600 20 doublet
4603 7				F	$I^{\pi}$ : $I({}^{3}\text{He}\alpha)=3$ for a 4600 20 doublet
4643 7	$3/2^{-}$			EF	XREF: F(4664).
	- 1				$J^{\pi}$ : J(pol p,d)=3/2, L(n)=1.
4683 7	$(7/2^+, 9/2^+)$			Е	J <sup><math>\pi</math></sup> : L(n)=4 favored over L(n)=3 in ( <sup>3</sup> He, $\alpha$ ).
4707 7				E	
4768 7				E	- 2
4780 7	$(1/2^{-}, 3/2^{-})$			E	$J^{\pi}$ : L( <sup>3</sup> He, $\alpha$ )=1 favored over L=3 for 4790 20 peak.
4796?	7/2-			F	$J^{\mu}$ , E(level): J(pol p,d)=7/2, L(n)=3. However, it is possible that the 4796 peak in (pol p,d) corresponds to the 4780 or 4780+4815 levels in (p,d).
4815 7				E	
4841 7				E	- 2
4869 7				E	$L({}^{3}He, \alpha) = 1$ for 4869+4899 doublet.
4899 7				EF	XREF: $F(4917)$ .
4050 (0 4	(07/0+)			CII	$L({}^{(4)}He,\alpha)=1$ for 4869+4899 doublet.
4952.6 <sup>4</sup> 4	$(21/2^{+})$			GH	J <sup>*</sup> : stretched Q 2012 $\gamma$ to (23/2 <sup>+</sup> ); D+Q 508 $\gamma$ to 25/2 <sup>(+)</sup> 4445 in ( <sup>28</sup> Si,2pn $\gamma$ ).
4958.8 <i>5</i>	$(29/2^+)$	0.12 ps	Α	GH	$J^{\pi}$ : $\Delta J=1 d(+Q) 617\gamma$ to $(27/2^+) 4342$ in $({}^{28}Si,2pn\gamma)$ .
					Other $T_{1/2}$ : <1.4 ps from RDM in ( <sup>28</sup> Si,2pn $\gamma$ ).
$5.03 \times 10^3 2$	$(1/2^-, 3/2^-)$			EF	XREF: F(5056).
					$J^{\pi}$ : L( <sup>3</sup> He, $\alpha$ )=(1).
$5.13 \times 10^{3#} 2$				EF	XREF: F(5177).
					J <sup><math>\pi</math></sup> : L( <sup>3</sup> He, $\alpha$ )=(1) for doublet.
$5.19 \times 10^3 2$	$(1/2^-, 3/2^-)$			Е	$J^{\pi}$ : L( <sup>3</sup> He, $\alpha$ )=(1).
$5.23 \times 10^3 2$	$(5/2^-, 7/2^-)$			E	$J^{\pi}$ : L( <sup>3</sup> He, $\alpha$ )=(3).
5243.3 6	$(31/2^+)$	0.40 ps	Α	G	J <sup>π</sup> : M1, $\Delta$ J=1 285γ to (29/2 <sup>+</sup> ) 4959 in ( <sup>28</sup> Si,p2nγ).
5295	7/2-			F	$J^{\pi}$ : J=7/2, L(n)=3 from (pol p,d).
					E(level): may be the same level as that seen in ( <sup>3</sup> He, $\alpha$ ) at 5230 20.
5299.0? 6	(31/2)			GH	$J^{\pi}$ : $\Delta J=1 d+Q 340\gamma$ to $(29/2^+) 4959$ in $({}^{31}P,n2p\gamma)$ .
$5.34 \times 10^{3} 2$	1/2-,3/2-			E	$J^{n}$ : L( <sup>3</sup> He, $\alpha$ )=1.
$5.42 \times 10^{3} 2$	7/2-			EF	XREF: $F(5394)$ .
5188 10 5	$(20/2^{+})$			СЧ	J <sup>*</sup> : J(pol p,d)=//2, L(f)=5. $I^{\pi}$ : stratched O 10/3a/ to (25/2 <sup>+</sup> ) 35/6; D I O 536a/ to (27/2 <sup>+</sup> ) 4053
5400.4 5	(23/2)			F	J. Since $Q = 1745$ y to $(25/2) = 5540$ , $D + Q = 550$ y to $(27/2) = 4955$ .
5516	$\frac{1}{2}, \frac{3}{2}$ $\frac{7}{2}^{-}$			F	$J^{\pi}$ : I(nol n d)=7/2, I.(n)=3
5690	$(7/2^{-})$			F	$J^{\pi}$ : J(pol p,d)=(7/2), L(n)=(3).
5796				F	
5817.8? 6				G	$J^{\pi}$ : 329 $\gamma$ to (29/2 <sup>+</sup> ) 5488 in ( <sup>28</sup> Si,2pn $\gamma$ ).
5.90×10 <sup>3#</sup> 2	-			EF	$J^{\pi}$ : L(n)=1 for 5900 20 doublet in ( <sup>3</sup> He, $\alpha$ ), but L(n)=3, J=7/2 in (pol p,d) for 5930 line which presumably may also be a doublet.
5929.3 12				Н	1 5 5
5963.8 12	(35/2)			Н	J <sup><math>\pi</math></sup> : E2 665 $\gamma$ to (31/2) 5299 in ( <sup>31</sup> P,n2p $\gamma$ ).
5.99×10 <sup>3</sup> 2	1/2-,3/2-			Е	$J^{\pi}$ : L( <sup>3</sup> He, $\alpha$ )=1.
6.06×10 <sup>3</sup> 2	7/2-			EF	XREF: F(6070).
					$J^{\pi}$ : J(pol p,d)=7/2, L(n)=3.
6106.6 8	$(29/2^+)$			Н	J <sup><math>\pi</math></sup> : D 1154 $\gamma$ to 27/2 <sup>+</sup> 4952; Q 1661 $\gamma$ to 25/2 <sup>+</sup> 4445 in ( <sup>31</sup> P,n2p $\gamma$ ).
6232.7 <sup>a</sup> 6	$(31/2^+)$			GH	$J^{\pi}$ : $\Delta J=1 d+Q 744\gamma$ to (29/2 <sup>+</sup> ) 5488 in ( <sup>28</sup> Si,2pn $\gamma$ ).

Continued on next page (footnotes at end of table)

#### <sup>91</sup>Mo Levels (continued)

E(level)	$J^{\pi \dagger}$	XREF	Comments
6327.8 15	(31/2)	Н	$J^{\pi}$ : Q 1871 $\gamma$ to (27/2) 4458 in ( <sup>31</sup> P,n2p $\gamma$ ).
6437.9 12	(33/2)	Н	$J^{\pi}$ : D 1139 $\gamma$ to (31/2 <sup>+</sup> ) 5300 in ( <sup>31</sup> P,n2p $\gamma$ ).
6444.8 15	· · · ·	Н	
6469.2 <sup>a</sup> 6	$(33/2^+)$	GH	J <sup><math>\pi</math></sup> : $\Delta$ J=1 M1(+E2) 236 $\gamma$ to (31/2 <sup>+</sup> ) 6233 in ( <sup>31</sup> P,n2p $\gamma$ ).
6658.6 8	$(31/2^+)$	Н	$J^{\pi}$ : Q 1706 $\gamma$ to (27/2 <sup>+</sup> ) 4952 in ( <sup>31</sup> P,n2p $\gamma$ ).
6813.1? <i>12</i>		Н	
6959.4? 12		Н	
$6.99 \times 10^3 3$	9/2+	EF	XREF: F(7026).
2			$J^{\pi}$ : J(pol p,d)=9/2, L(n)=4. <sup>91</sup> Nb(g.s.) IAS.
$7.12 \times 10^3 \ 3$	$1/2^{-}$	EF	XREF: F(7158).
			$J^{\pi}$ : J(pol p,d)=1/2, L(n)=1. <sup>91</sup> Nb(105) IAS.
7262.8 9	$(33/2^+)$	Н	$J^{\pi}$ : Q 1775 $\gamma$ to (29/2 <sup>+</sup> ) 5488 in ( <sup>31</sup> P,n2p $\gamma$ ).
7321.2 12	$(35/2^+)$	Н	$J^{\pi}$ : E2 2078 $\gamma$ to (31/2 <sup>+</sup> ) 5244 in ( <sup>31</sup> P,n2p $\gamma$ ).
7336.5 11	$(33/2^+)$	Н	$J^{\pi}$ : Q 1848 $\gamma$ to 29/2 <sup>+</sup> 5488 in ( <sup>31</sup> P,n2p $\gamma$ ).
7469.4 14	$(35/2^+)$	Н	$J^{\pi}$ : D+Q 207 $\gamma$ to (33/2 <sup>+</sup> ) 7263 in ( <sup>31</sup> P,n2p $\gamma$ ).
7805.7 12	(33/2)	Н	$J^{\pi}$ : D 2562 $\gamma$ to (31/2 <sup>+</sup> ) 5244 in ( <sup>31</sup> P,n2p $\gamma$ ).
8001.6 16	$(39/2^+)$	Н	$J^{\pi}$ : Q 2038 $\gamma$ to (35/2 <sup>+</sup> ) 5965 in ( <sup>31</sup> P,n2p $\gamma$ ).
8112.5 17	$(37/2^+)$	Н	$J^{\pi}$ : (M1) 643 $\gamma$ to (35/2 <sup>+</sup> ) 7469 in ( <sup>31</sup> P,n2p $\gamma$ ).
8153.6 <i>16</i>	$(39/2^+)$	Н	$J^{\pi}$ : Q 2190 $\gamma$ to (35/2 <sup>+</sup> ) 5965 in ( <sup>31</sup> P,n2p $\gamma$ ).
$8.17 \times 10^{3}$	$(5/2^{-})$	E	$J^{\pi}$ : L( <sup>3</sup> He, $\alpha$ )=(3,4); probable analog of 5/2 <sup>-91</sup> Nb(1187) level.
8173.7 15		Н	
8278.7 12	$(37/2^+)$	Н	$J^{\pi}$ : (E2) 1810 $\gamma$ to (37/2 <sup>+</sup> ) 6469 in ( <sup>31</sup> P,n2p $\gamma$ ); J=37/2 supported by shell-model calculations (2004Ra12).
8.34×10 <sup>3</sup> 3	3/2-	EF	XREF: F(8433).
			$J^{\pi}$ : J(pol p,d)=3/2, L(n)=1. <sup>91</sup> Nb(1313) IAS.
8578.3? 20		Н	$J^{\pi}$ : possible 466 $\gamma$ to (37/2 <sup>+</sup> ) 8112 in ( <sup>31</sup> P,n2p $\gamma$ ).
8626.6 12	$(37/2^+)$	Н	$J^{\pi}$ : Q 2157 $\gamma$ to (33/2 <sup>+</sup> ) 6469 in ( <sup>31</sup> P,n2p $\gamma$ ).
8.66×10 <sup>3</sup> 3	3/2-	EF	XREF: F(8742).
			$J^{\pi}$ : J(pol p,d)=3/2, L(n)=1. <sup>91</sup> Nb(1613) IAS.
8708.2 19		Н	$J^{\pi}$ : 707 $\gamma$ to (39/2 <sup>+</sup> ) 8002 in ( <sup>31</sup> P,n2p $\gamma$ ).
8749.4 20	$(39/2^+)$	Н	$J^{\pi}$ : M1 637 $\gamma$ to (37/2 <sup>+</sup> ) 8112 in ( <sup>31</sup> P,n2p $\gamma$ ).
$8.87 \times 10^3 \ 3$	5/2-	EF	XREF: F(8938).
			$J^{\pi}$ : J(pol p,d)=5/2, L(n)=3. <sup>91</sup> Nb(1845) IAS.
9282.2 15	$(39/2^+)$	Н	$J^{\pi}$ : (Q) 1961 $\gamma$ to (35/2 <sup>+</sup> ) 7322 in ( <sup>31</sup> P,n2p $\gamma$ ).
$10.15 \times 10^{3}$		E	
$10.40 \times 10^{3}$		Е	
10749.4? 16		Н	$J^{\pi}$ : 2471 $\gamma$ to (37/2 <sup>+</sup> ) 8279 in ( <sup>31</sup> P,n2p $\gamma$ ).
$12.42 \times 10^3$		Е	

<sup>†</sup> Due to the large number of unplaced  $\gamma$ 's in  $\varepsilon$  decay (3.14 min),  $J^{\pi}$  arguments based on log *ft* for weakly fed levels should be treated with caution.

<sup>±</sup> From Doppler-shift attenuation or time-differential perturbed angular distribution observed in  $(\alpha, 3n\gamma)$ , if not indicated otherwise.

<sup>#</sup> Doublet.

<sup>@</sup> Triplet.

& Band(A):  $\pi$ =+, seniority=3 states (1993Si14).

<sup>*a*</sup> Band(B):  $\pi$ =+, seniority=5 states (1993Si14). The 25/2<sup>+</sup> state configuration includes a significant seniority=3 component.

					Adop	ted Level	s, Gammas	(continued)
							γ( <sup>91</sup> Mo)	
E <sub>i</sub> (level)	$\mathbf{J}_i^\pi$	$E_{\gamma}^{\dagger}$	$I_{\gamma}^{\dagger}$	$E_f$	$\mathbf{J}_f^{\pi}$	Mult. <sup>‡</sup>	$\alpha^{\boldsymbol{b}}$	Comments
653.01	1/2-	652.9 1	100	0	9/2+	M4	0.0374	B(M4)(W.u.)=8.8 3 Mult.: from $\alpha(\exp)=0.052$ 14 as deduced in IT decay. Calculated hindrance =4.48 25 (2012Se10).
1156.10 1362.01	3/2 <sup>-</sup> 5/2 <sup>+</sup>	502.9 2 205.6 4 1362.0 1	100 1.1 <i>4</i> 100 <i>4</i>	653.01 1156.10 0	1/2 <sup>-</sup> 3/2 <sup>-</sup> 9/2 <sup>+</sup>	[E1]	0.01572	
1414.11	13/2 <sup>(+)</sup>	1414.10 13	100	0	9/2+	(E2)		$E_{\gamma}$ : weighted average from <sup>91</sup> Tc ε decay, ( <sup>28</sup> Si,2pnγ), (α,3nγ). Mult.: Q from $\gamma(\theta)$ , $\Delta \pi$ =no from level scheme.
1531.90 1564.92 1605.32	5/2-	375.8 2 1564.9 <i>1</i> 1605.2 <i>1</i>	100 100 100	1156.10 0 0	3/2 <sup>-</sup> 9/2 <sup>+</sup> 9/2 <sup>+</sup>			$E_{\gamma}$ : weighted average from $\varepsilon$ decay and $(\alpha, 3n\gamma)$ .
1639.95	(7/2,9/2 <sup>+</sup> )	277.9 2 1639.9 <i>1</i>	6.7 7 100 <i>3</i>	1362.01 0	5/2 <sup>+</sup> 9/2 <sup>+</sup>			
1902.49	9/2+	297.1 2 337.5 2 1902.3 1	3.9 <i>4</i> 19 <i>3</i> 100 <i>3</i>	1605.32 1564.92 0	9/2+			
2067.91	17/2 <sup>(+)</sup>	653.8 <sup>@</sup> 2	100	1414.11	13/2(+)	E2		Mult.: Q from $\gamma(\theta)$ ; not M2 from RUL, assuming $T_{1/2} < 10$ ns based on prompt coincidence component in 654 $\gamma$ in ( $\alpha$ ,3n $\gamma$ ).
2083.66	3/2-	927.6 <sup>&amp;</sup> 1 1430.4 <sup>&amp;</sup> 2	100 <sup>&amp;</sup> 6	1156.10	$3/2^{-}$			
2233.69	9/2+	628.4 <i>3</i> 668.8 <i>10</i> 2233.8 <i>1</i>	56 <i>11</i> 24 <i>12</i> 100 <i>4</i>	1605.32 1564.92 0	9/2 <sup>+</sup>			
2267.4	21/2 <sup>(+)</sup>	199.5 <sup>@</sup> 2	100	2067.91	17/2 <sup>(+)</sup>	E2	0.1000	B(E2)(W.u.)=1.42 4 Mult.: Q from $\gamma(\theta)$ ; not M2 from RUL.
2279.6	(17/2 <sup>-</sup> )	211.7 <sup>@</sup> 2	100	2067.91	17/2 <sup>(+)</sup>	[E1]	0.01447	B(E1)(W.u.)=9.1×10 <sup>-7</sup> 10 Mult.: not M2 or higher from RUL. $\gamma(\theta)$ in $(\alpha, 3n\gamma)$ consistent with Q $(\Delta J=2)$ or D+Q $(\Delta J=1)$ or D(+Q) $(\Delta J=0)$ ; the level scheme implies the latter.
2450.99	9/2+	217.8 2 548.7 3 811.0 5 844.9 3 1088.9 4 2450.9 1 251.8 2	1.04 <i>12</i> 12.2 7 37.1 23 8.8 9 4.25 27 100 3	2233.69 1902.49 1639.95 1605.32 1362.01 0	9/2 <sup>+</sup> 9/2 <sup>+</sup> (7/2,9/2 <sup>+</sup> ) 5/2 <sup>+</sup> 9/2 <sup>+</sup>			
2492.16	(2 (2) -	851.8 3 2492.3 2	100 13 71 3	0	(7/2,9/2 <sup>+</sup> ) 9/2 <sup>+</sup>			
2690.44	(3/2)-	606.7 <sup>&amp;</sup> 3 1328.4 <sup>&amp;</sup> 2	$58^{\infty} 4$ $100^{\&} 4$	2083.66 1362.01	3/2 <sup>-</sup> 5/2 <sup>+</sup>			

From ENSDF

<sup>91</sup><sub>42</sub>Mo<sub>49</sub>-6

L

# $\gamma(^{91}Mo)$ (continued)

E <sub>i</sub> (level)	${ m J}^{\pi}_i$	$E_{\gamma}^{\dagger}$	$I_{\gamma}^{\dagger}$	$\mathrm{E}_{f}$	$\mathrm{J}_f^\pi$	Mult.‡	α <b>b</b>	Comments
2690.44	(3/2)-	1534.4 <sup>&amp;</sup> 2	98 <sup>&amp;</sup> 4	1156.10	3/2-			
2716.44	(7/2,9/2)+	483.2 6 813.9 5 1076.5 2 1111.1 <i>I</i> 1354.4 2 2716.4 <i>I</i>	34.2 25 55 10 29.6 20 100 4 22.9 10 58.8 20	033.01 2233.69 1902.49 1639.95 1605.32 1362.01 0	$\frac{1}{2}$ 9/2 <sup>+</sup> 9/2 <sup>+</sup> (7/2,9/2 <sup>+</sup> ) 5/2 <sup>+</sup> 9/2 <sup>+</sup>			
2781.12	(7/2 <sup>+</sup> ,9/2 <sup>+</sup> ,11/2 <sup>+</sup> )	878.4 <i>1</i> 2781.3 <i>1</i>	34.3 25 100 4	1902.49 0	9/2 <sup>+</sup> 9/2 <sup>+</sup>			
2887.50	(9/2+,11/2+)	985.0 <i>4</i> 1322.6 2 1731.0 2 2887.8 2	15.8 <i>10</i> 49.9 <i>23</i> 9.9 9 100 <i>3</i>	1902.49 1564.92 1156.10 0	9/2 <sup>+</sup> 3/2 <sup>-</sup> 9/2 <sup>+</sup>			
2940.1	(23/2 <sup>+</sup> )	672.6 <sup>@</sup> 2	100	2267.4	21/2 <sup>(+)</sup>	M1		B(M1)(W.u.)=0.90 Mult.: from $({}^{31}P,n2p\gamma)$ .
3545.6	(25/2+)	605.5 <sup>@</sup> 2	100	2940.1	(23/2+)	D(+Q)		B(M1)(W.u.) $\approx$ 0.90 Other E $\gamma$ : 604.7 in ( <sup>31</sup> P,n2p $\gamma$ ). Mult.: D(+Q) ( $\Delta$ J=1) from $\gamma(\theta)$ in ( $\alpha$ ,3n $\gamma$ ).
3809.7	(25/2 <sup>+</sup> )	264.2 <sup>@</sup> 2	12.2 7	3545.6	(25/2+)	(M1)	0.0186	<ul> <li>B(E1)(W.u.)=0.0076 15</li> <li>E<sub>γ</sub>: 265.1 3 in (<sup>28</sup>Si,2pnγ), 265.0 in (<sup>31</sup>P,n2pγ).</li> <li>I<sub>γ</sub>: weighted average of 12.0 8 from (<sup>28</sup>Si,2pnγ) and 12.8 13 from (α,3nγ). Other: 20.0 7 from (<sup>31</sup>P,n2pγ).</li> <li>Mult.: Q (ΔJ=2) or D (ΔJ=0) from anisotropy and γ(θ) in (<sup>28</sup>Si,2pnγ); magnetic D from (<sup>31</sup>P,n2pγ); ΔJ=0 favored by level scheme.</li> </ul>
		869.6 <sup>@</sup> 2	100 <i>3</i>	2940.1	$(23/2^+)$	D(+Q)		I <sub><math>\gamma</math></sub> : weighted average from ( <sup>28</sup> Si,2pn $\gamma$ ) and ( $\alpha$ ,3n $\gamma$ ).
4341.9 4445.1	(27/2 <sup>+</sup> ) 25/2 <sup>(+)</sup>	532.2 <sup>@</sup> 2 1504.2 <sup>a</sup>	100 5.3 <sup>a</sup> 4	3809.7 2940.1	(25/2 <sup>+</sup> ) (23/2 <sup>+</sup> )	D+Q		B(M1)(W.u.)=0.7
1156 5	(07/0)	$2177.8^{\#}$ 3	100 <sup>#</sup> 10	2267.4	$21/2^{(+)}$	Q		Other E $\gamma$ : 2176.8 from ( <sup>31</sup> P,n2p $\gamma$ ).
4450.5	(27/2)	$507.6^{\#}$	$100^{\circ\circ}$	3809.7	$(25/2^{+})$			
4932.0	(27/2)	$1406.6^{a}$	$9.9^{a} 6$	3545.6	$(25/2^+)$	D+Q D		Mult.: from $({}^{31}P,n2p\gamma)$ .
4958.8	(29/2 <sup>+</sup> )	616.9 <sup>@</sup> 2	42" 5 100	2940.1 4341.9	$(23/2^+)$ $(27/2^+)$	Q D(+Q)		Other E $\gamma$ (I $\gamma$ ): 2011.4 (24.4 23) from ( <sup>31</sup> P,n2p $\gamma$ ). Mult.: D+Q from ( <sup>28</sup> Si,2pn $\gamma$ ), D from ( <sup>31</sup> P,n2p $\gamma$ ). B(E1)(W.u.) exceeds RUL if pure E1.
5243.3	(31/2 <sup>+</sup> )	284.5 <sup>@</sup> 2	100	4958.8	(29/2 <sup>+</sup> )	M1	0.01542	B(M1)(W.u.)=2.35

7

	Adopted Levels, Gammas (continued)									
$\gamma$ <sup>(91</sup> Mo) (continued)										
E <sub>i</sub> (level)	$\mathbf{J}_i^{\pi}$	$E_{\gamma}^{\dagger}$	$I_{\gamma}^{\dagger}$	$\mathbf{E}_{f}$	$\mathbf{J}_{f}^{\pi}$	Mult. <sup>‡</sup>	α <b>b</b>	Comments		
								Mult.: D, $\Delta J=1$ from ( <sup>31</sup> P,n2p $\gamma$ ); polarization favors M1; B(E1)(W.u.) exceeds RUL if E1.		
5299.0?	(31/2)	340.2 <sup>#</sup> 3	100#	4958.8	$(29/2^+)$	D+Q				
5488.4	$(29/2^+)$	535.8 <sup>#</sup> 3	100 <sup>#</sup> 3	4952.6	$(27/2^+)$	D+Q		Other I $\gamma$ : 139 7 from ( <sup>31</sup> P,n2p $\gamma$ ).		
		1942.8 <sup>#</sup> 3	72 <sup>#</sup> 5	3545.6	$(25/2^+)$	0				
5817.8?		329.4 <sup>#c</sup> 3	100 <sup>#</sup>	5488.4	$(29/2^+)$					
5929.3		686.0 <sup>a</sup>	100 <sup><i>a</i></sup>	5243.3	$(31/2^+)$					
5963.8	(35/2)	664.8 <mark>a</mark>	100 <i>a</i>	5299.0?	(31/2)	E2		Mult.: from $({}^{31}P,n2p\gamma)$ .		
6106.6	$(29/2^+)$	1154.1 <sup>a</sup>	45 <sup>a</sup> 3	4952.6	$(27/2^+)$	D		Mult.: from $({}^{31}P,n2p\gamma)$ .		
		1661.3 <sup>a</sup>	100 <sup>a</sup> 10	4445.1	$25/2^{(+)}$	Q		Mult.: from $(^{31}P,n2p\gamma)$ .		
6232.7	$(31/2^+)$	744.3 <sup>#</sup> 3	100 <sup>#</sup>	5488.4	$(29/2^+)$	D+Q				
6327.8	(31/2)	1871.3	100 9	4456.5	(27/2)	Q		Mult.: from $({}^{31}P,n2p\gamma)$ .		
6437.9	(33/2)	1138.9	100 6	5299.0?	(31/2)	D		Mult.: from $({}^{31}P,n2p\gamma)$ .		
6444.8		515.5 <sup>a</sup>	$100^{a} 6$	5929.3						
6469.2	$(33/2^+)$	236.4 <sup>#</sup> 3	100# 4	6232.7	$(31/2^+)$	M1(+E2)	0.0248	Mult.: M1 from $({}^{31}P,n2p\gamma)$ ; D+Q from $({}^{28}Si,2pn\gamma)$ .		
		981.5 <sup>a</sup>	56.0 <sup>a</sup> 26	5488.4	$(29/2^+)$	Q		Mult.: from $(^{31}P,n2p\gamma)$ .		
6658.6	$(31/2^+)$	551.7 <sup>4</sup>	100 <sup><i>u</i></sup> 5	6106.6	$(29/2^+)$	_		21		
(012.19		1705.8 <sup>d</sup>	$60.00^{4}$ 6	4952.6	$(27/2^+)$	Q		Mult.: from $({}^{31}P,n2p\gamma)$ .		
6050 42		1569.8 <sup>ac</sup>	100 <sup>a</sup>	5243.3 4058.8	$(31/2^{+})$ $(20/2^{+})$					
7262.8	$(33/2^+)$	$603.9^{a}$	$28^{a}$ 14	4958.8 6658.6	(29/2) $(31/2^+)$					
7202.0	(33/2)	1774 8 <sup>a</sup>	$100^{a}$ 11	5488.4	$(31/2^{+})$ $(29/2^{+})$	0		Mult : from $({}^{31}Pn2ny)$		
7321.2	$(35/2^+)$	2077.8 <sup><i>a</i></sup>	$100^{a} 8$	5243.3	$(31/2^+)$	E2		Mult.: from $(^{31}\text{P},n2p\gamma)$ .		
7336.5	$(33/2^+)$	1848.1 <sup><i>a</i></sup>	100 <sup><i>a</i></sup>	5488.4	$(29/2^+)$	0		Mult.: from $({}^{31}P.n2p\gamma)$ .		
7469.4	$(35/2^+)$	206.6 <sup>a</sup>	100 <sup><i>a</i></sup> 5	7262.8	$(33/2^+)$	D+Q		Mult.: from $({}^{31}P,n2p\gamma)$ .		
7805.7	(33/2)	2562.3 <sup>a</sup>	100 <sup><i>a</i></sup> 10	5243.3	$(31/2^+)$	D		Mult.: from $({}^{31}P,n2p\gamma)$ .		
8001.6	$(39/2^+)$	2037.7 <sup>a</sup>	100 <sup><i>a</i></sup> 10	5963.8	(35/2)	Q		Mult.: from $({}^{31}P,n2p\gamma)$ .		
8112.5	$(37/2^+)$	643.1 <sup>a</sup>	100 <sup><i>a</i></sup> 6	7469.4	$(35/2^+)$	(M1)		Mult.: from $({}^{31}P,n2p\gamma)$ .		
8153.6	$(39/2^+)$	2189.7 <sup>a</sup>	100 <sup><i>a</i></sup>	5963.8	(35/2)	Q		Mult.: from $(^{31}P,n2p\gamma)$ .		
8173.7		2244.3 <sup>a</sup>	100 <sup><i>a</i></sup>	5929.3				21		
8278.7	$(37/2^+)$	1809.5 <sup><i>a</i></sup>	100 <sup><i>a</i></sup>	6469.2	$(33/2^+)$	(E2)		Mult.: from $({}^{31}P,n2p\gamma)$ .		
8578.3?	(07/0+)	465.8 <sup>ac</sup>	1004	8112.5	$(37/2^+)$	0				
8626.6	$(37/2^{+})$	$2157.4^{\circ}$	100 <sup>a</sup>	6469.2	$(33/2^{+})$	Q		Mult.: from $({}^{3}P,n2p\gamma)$ .		
8/08.2	$(20/2^{+})$	$700.0^{\circ}$	100 <sup></sup> 100 <sup>a</sup>	8001.0 8112.5	$(39/2^{+})$	M1		Mult from $({}^{31}\mathbf{D}\mathbf{n}2\mathbf{n})$		
0149.4	(39/2) $(30/2^+)$	1061 0 <sup>4</sup>	100 100 <i>a</i>	0112.J 7321.2	(31/2) $(35/2^+)$	$(\mathbf{O})$		Mult : from $({}^{31}\text{Pn}2\text{m})$		
10749.4?	(37/2)	2470.7 <sup><i>ac</i></sup>	100 <sup>a</sup>	8278.7	$(35/2^+)$ $(37/2^+)$			Mun 110111 ( 1,112µ <i>y</i> ).		

From ENSDF

L

# $\gamma$ (<sup>91</sup>Mo) (continued)

<sup>†</sup> From <sup>91</sup>Tc  $\varepsilon$  decay (3.14 min), except as noted. <sup>‡</sup> From  $\gamma(\theta)$  in (<sup>28</sup>Si,2pn $\gamma$ ), if not noted otherwise.

# From  $\gamma(\theta)$  in (~3i,2piry), it not not # From  $({}^{28}\text{Si},2pn\gamma)$ . @ From  ${}^{90}\text{Zr}(\alpha,3n\gamma)$ ,  ${}^{92}\text{Mo}(\alpha,\alpha'n\gamma)$ . & From  ${}^{91}\text{Tc} \varepsilon$  decay (3.3 min). a From  ${}^{63}\text{Cu}({}^{31}\text{P},n2p\gamma)$ .

<sup>b</sup> Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on  $\gamma$ -ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

<sup>c</sup> Placement of transition in the level scheme is uncertain.



<sup>91</sup><sub>42</sub>Mo<sub>49</sub>

#### Level Scheme (continued)

Intensities: Relative photon branching from each level



Level Scheme (continued)

Intensities: Relative photon branching from each level



 $^{91}_{42} {\rm Mo}_{49}$ 



