Adopted Levels, Gammas

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	E. Browne, J. K. Tuli	NDS 145, 25 (2017)	1-Jul-2017

Q(β^-)=3635 *12*; S(n)=6882 *13*; S(p)=8338 *15*; Q(α)=−3551 *14* 2017Wa10

^{99}Nb Levels

Additional information 1.

Cross Reference (XREF) Flags

- A ^{99}Zr β^- decay
- B ^{99}Nb IT decay (2.5 min)
- C ^{100}Mo(d,^{3}He)
- D ^{100}Mo(pol t,α)

E(level)[†]	J$^\pi$	T$_{1/2}$[‡]	XREF	Comments
0.0	9/2$^+$	15.0 s *2*	ABCD	%β^-=100 μ=+5.97 *3* Q=0.42 *14* J$^\pi$: from L and analyzing power in (pol t,α). T$_{1/2}$: from 1972Tr08. Others: 14.3 s *6* (1970Ei02), 10 s *2* (1963Tr01). μ: Collinear Laser Spectroscopy (2009Ch25). Isotope shift $\Delta<r^2>$=+1.028 fm^2 *12* (2009Ch25). Q: Collinear Laser Spectroscopy (2009Ch25).
365.27 *8*	1/2$^-$	2.5 min *2*	ABCD	%β^->96.2; %IT<3.8 %IT: A very weak γ has been observed in ^{99}Zr β^- decay. %IT deduced if B(M4)(W.u.)<30 (RUL). J$^\pi$: from L and analyzing power in (pol t,α). T$_{1/2}$: Weighted average of 2.6 min *2* (1971Ha07), 2.6 min *2* (1971Ca18), 2.3 min *3* (1963Tr01), 2.4 min *3* (1960Or02).
387.38 *7*	(7/2$^+$)	12 ps *5*	A	J$^\pi$: γ387 to 9/2$^+$, γ628 from (3/2$^+$). T$_{1/2}$: Other: 17 ps *4* from $\gamma\gamma$ and $\beta\gamma$ in β^- decay (1990OhZY).
469.139 *13*	(5/2)$^+$	0.175 ns *5*	A D	J$^\pi$: from L and the analyzing power in (pol t,α) and γ546 M1+(E2) from level (3/2)$^+$ at 1015.27 keV. T$_{1/2}$: from $\beta\gamma$(t) in ^{99}Zr decay (1990OhZY). Other: 0.21 ns *6* (1982Ba36), 0.18 ns *9* (1997Lh01). T$_{1/2}$: Other: 173 ps *4* from $\gamma\gamma$ and $\beta\gamma$ in β^- decay (1990OhZY).
544.23 *8*	3/2$^-$	51 ps *13*	A CD	XREF: C(562). J$^\pi$: from L and analyzing power in (pol t,α). T$_{1/2}$: Other: 56 ps *10* from $\gamma\gamma$ and $\beta\gamma$ in β^- decay (1990OhZY), 60 ps *20* (1989Lh01), 0.26 ns *17* (1997Lh01).
630.70 *22*	5/2$^-$		A D	J$^\pi$: from L and analyzing power in (pol t,α).
765.05 *18*	3/2$^+$		A D	J$^\pi$: from L and analyzing power in (pol t,α).
816.73 *14*	5/2$^+$		A CD	J$^\pi$: from L and analyzing power in (pol t,α).
930.91 *9*	(3/2$^+$)	<10 ps	A D	T$_{1/2}$: from 1990OhZY. Other value: 40 ps *13* (1997Lh01). J$^\pi$: γ462 M1+E2 to (5/2)$^+$, 28.4γ (M1) from (1/2$^+$).
959.31 *8*	(1/2$^+$,3/2$^+$)	<10 ps	A	T$_{1/2}$: from 1990OhZY. Other: 30 ps *13* (1997Lh01). J$^\pi$: log *ft*=4.5 from (1/2$^+$).
970 *10*	1/2$^-$,3/2$^-$		CD	XREF: D(983). J$^\pi$: L(d,^{3}He)=1.
1015.27 *4*	(3/2)$^+$	<12 ps	A D	J$^\pi$: log *ft*=4.16 from (1/2$^+$). T$_{1/2}$: Others: <5 ps (1990OhZY), 30 ps *13* (1997Lh01).
1044.33 *20*			A	

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Adopted Levels, Gammas (continued)

^{99}Nb Levels (continued)

E(level)[†]	J^π	$T_{1/2}$[‡]	XREF	Comments
1264 *9*	$3/2^-$		CD	XREF: C(1271)D(1253). J^π: from L and analyzing power in (pol t,α).
1305 *12*			D	
1408 *9*	$5/2^-$,$7/2^-$		CD	J^π: L(d,^{3}He)=3; ($7/2^+$) from L and analyzing power in (pol t,α).
1543 *12*			D	
1579 *8*	$5/2^-$,$7/2^-$		CD	XREF: C(1573). J^π: L(d,^{3}He)=3.
1703 *15*			D	
1759 *13*	$(3/2)^-$		CD	XREF: C(1746)D(1771). J^π: L(d,^{3}He)=1; ($3/2^-$) from L and analyzing power in (pol t,α).
1831 *20*			D	
1921 *20*			D	
1974.5 *4*		<5 ns	A CD	XREF: C(1967)D(1982). $T_{1/2}$: Other value: 70 ps *23* (1997Lh01).
2336.3 *3*			A	

[†] Level energies with ΔE<1 keV have been deduced from a least-squares fit to adopted gammas; the others are from (pol t,α) or weighted averages of (pol t,α) and (d,^{3}He).

[‡] From $\gamma\gamma$(t) by 2013RuZX using induced-fission on ^{235}U, except where noted otherwise.

Adopted Levels, Gammas (continued)

γ(^{99}Nb)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[‡]	δ[‡@]	α[#]	Comments
365.27	1/2$^-$	365.1	100	0.0	9/2$^+$	[M4]		0.372	α(K)=0.311 *5*; α(L)=0.0505 *7*; α(M)=0.00916 *13* α(N)=0.001307 *19*; α(O)=6.26×10^{-5} *9*
387.38	(7/2$^+$)	387.42 *10*	100	0.0	9/2$^+$	[M1]		0.00649	α(K)=0.00571 *8*; α(L)=0.000646 *9*; α(M)=0.0001138 *16* α(N)=1.667×10^{-5} *24*; α(O)=9.68×10^{-7} *14* B(M1)(W.u.)=0.031 *13*
469.139	(5/2)$^+$	81.8 *1*	5.5 *8*	387.38	(7/2$^+$)	[M1+E2]		1.4 *10*	α(K)=1.13 *78*; α(L)=0.22 *19*; α(M)=0.040 *33* α(N)=0.0054 *44*; α(O)=1.58×10^{-4} *99*
		469.137 *13*	100 *8*	0.0	9/2$^+$	E2		0.00540	α(K)=0.00473 *7*; α(L)=0.000563 *8*; α(M)=9.92×10^{-5} *14* α(N)=1.433×10^{-5} *20*; α(O)=7.65×10^{-7} *11* B(E2)(W.u.)=4.6 *6* ΔIγ=8 estimated by evaluators.
544.23	3/2$^-$	74.3 *4*	0.20 *11*	469.139	(5/2)$^+$	[E1]		0.284 *6*	α(K)=0.249 *6*; α(L)=0.0290 *7*; α(M)=0.00505 *11* α(N)=0.000720 *16*; α(O)=3.59×10^{-5} *8* B(E1)(W.u.)=2.8×10^{-5} *18*
		178.984 *12*	100 *16*	365.27	1/2$^-$	[M1+E2]		0.093 *48*	α(K)=0.080 *40*; α(L)=0.0109 *62*; α(M)=0.0019 *11* α(N)=2.7×10^{-4} *15*; α(O)=1.25×10^{-5} *55*
630.70	5/2$^-$	86.7 *3*	100	544.23	3/2$^-$	[M1+E2]		1.14 *81*	α(K)=0.93 *64*; α(L)=0.18 *15*; α(M)=0.032 *26* α(N)=0.0043 *34*; α(O)=1.31×10^{-4} *81*
765.05	3/2$^+$	220.9 *2*	100	544.23	3/2$^-$	[E1]		0.01210	α(K)=0.01066 *16*; α(L)=0.001196 *17*; α(M)=0.000210 *3* α(N)=3.04×10^{-5} *5*; α(O)=1.682×10^{-6} *24*
816.73	5/2$^+$	347.5 *3*	21 *3*	469.139	(5/2)$^+$	[M1+E2]		0.011 *3*	α(K)=0.0098 *24*; α(L)=0.00118 *33*; α(M)=2.07×10^{-4} *59* α(N)=3.00×10^{-5} *82*; α(O)=1.6×10^{-6} *4*
		429.3 *3*	100 *21*	387.38	(7/2$^+$)	[M1+E2]		0.0061 *11*	α(K)=0.0053 *9*; α(L)=0.00062 *13*; α(M)=0.000110 *22* α(N)=1.6×10^{-5} *3*; α(O)=8.8×10^{-7} *13*
		816.7 *3*	32 *11*	0.0	9/2$^+$	[E2]		1.17×10^{-3}	α(K)=0.001028 *15*; α(L)=0.0001168 *17*; α(M)=2.06×10^{-5} *3* α(N)=3.00×10^{-6} *5*; α(O)=1.695×10^{-7} *24*
930.91	(3/2$^+$)	114.2 *2*	1.6 *4*	816.73	5/2$^+$				
		165.6[&] *3*	0.05 *5*	765.05	3/2$^+$				
		386.5 *3*	0.55 *15*	544.23	3/2$^-$				
		461.8 *2*	100 *5*	469.139	(5/2)$^+$	M1+E2	>1	0.0053 *4*	α(K)=0.0047 *4*; α(L)=0.00055 *5*; α(M)=9.7×10^{-5} *8* α(N)=1.40×10^{-5} *11*; α(O)=7.6×10^{-7} *5* B(E2)(W.u.)>45 Mult.,δ: δ large from γγ(θ) and hence E1+M2 excluded. Additional information 2.
		543.6 *4*	6.3 *9*	387.38	(7/2$^+$)				

$^{99}_{41}Nb_{58}$-3

Adopted Levels, Gammas (continued)

γ(^{99}Nb) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[‡]	δ[‡@]	α[#]	Comments
959.31	(1/2$^+$,3/2$^+$)	28.4 *1*	0.79 *23*	930.91	(3/2$^+$)	(M1)		8.50 *15*	α(K)=7.43 *13*; α(L)=0.892 *16*; α(M)=0.158 *3* α(N)=0.0229 *4*; α(O)=0.001276 *23* B(M1)(W.u.)>0.59 Mult.: From γ-ray intensity balance at 930.88 level α(28.4γ)≤5.9, and a comparison with theoretical α(E2)=1084 and α(M1)=8.50. Additional information 3.
		415.093 *13*	17.2 *15*	544.23	3/2$^-$				
		490.2 *3*	2.0 *4*	469.139	(5/2)$^+$				
		593.994 *18*	100 *3*	365.27	1/2$^-$				
1015.27	(3/2)$^+$	55.9 *1*	4.4 *8*	959.31	(1/2$^+$,3/2$^+$)	[M1]		1.177	α(K)=1.029 *16*; α(L)=0.1224 *19*; α(M)=0.0216 *4* α(N)=0.00315 *5*; α(O)=0.000177 *3* B(M1)(W.u.)>0.38 Additional information 4.
		84.4 *2*	0.18 *4*	930.91	(3/2$^+$)				
		198.0 *5*	0.068 *23*	816.73	5/2$^+$				
		250.4 *3*	0.046 *12*	765.05	3/2$^+$				
		384.8 *3*	0.068 *23*	630.70	5/2$^-$				
		471.1 *3*	0.14 *5*	544.23	3/2$^-$				
		546.13 *3*	100.0 *23*	469.139	(5/2)$^+$	M1+(E2)	<−0.4	0.00290 *6*	α(K)=0.00255 *5*; α(L)=0.000287 *7*; α(M)=5.06×10^{-5} *12* α(N)=7.41×10^{-6} *16*; α(O)=4.30×10^{-7} *8* B(M1)(W.u.)>0.0081 Additional information 5.
		627.9 *9*	4.2 *6*	387.38	(7/2$^+$)				
		650.0 *2*	4.7 *10*	365.27	1/2$^-$				Eγ: placed by the evaluators.
1044.33		113.4 *4*	3.8 *13*	930.91	(3/2$^+$)				
		499.9 *3*	3.8 *13*	544.23	3/2$^-$				
		575.4 *3*	100 *25*	469.139	(5/2)$^+$				
1974.5		960.0 *8*	100 *20*	1015.27	(3/2)$^+$				Eγ: from measurement at JOSEF (1979Se01).
		1043.4 *4*	30 *7*	930.91	(3/2$^+$)				
2336.3		1321.0 *3*	100	1015.27	(3/2)$^+$				

[†] From ^{99}Zr β$^-$ decay.
[‡] From γγ(θ) in ^{99}Zr β$^-$ decay.
[#] Additional information 6.
[@] If No value given it was assumed δ=1.00 for E2/M1, δ=1.00 for E3/M2 and δ=0.10 for the other multipolarities.
[&] Placement of transition in the level scheme is uncertain.

$^{99}_{41}Nb_{58}$-4

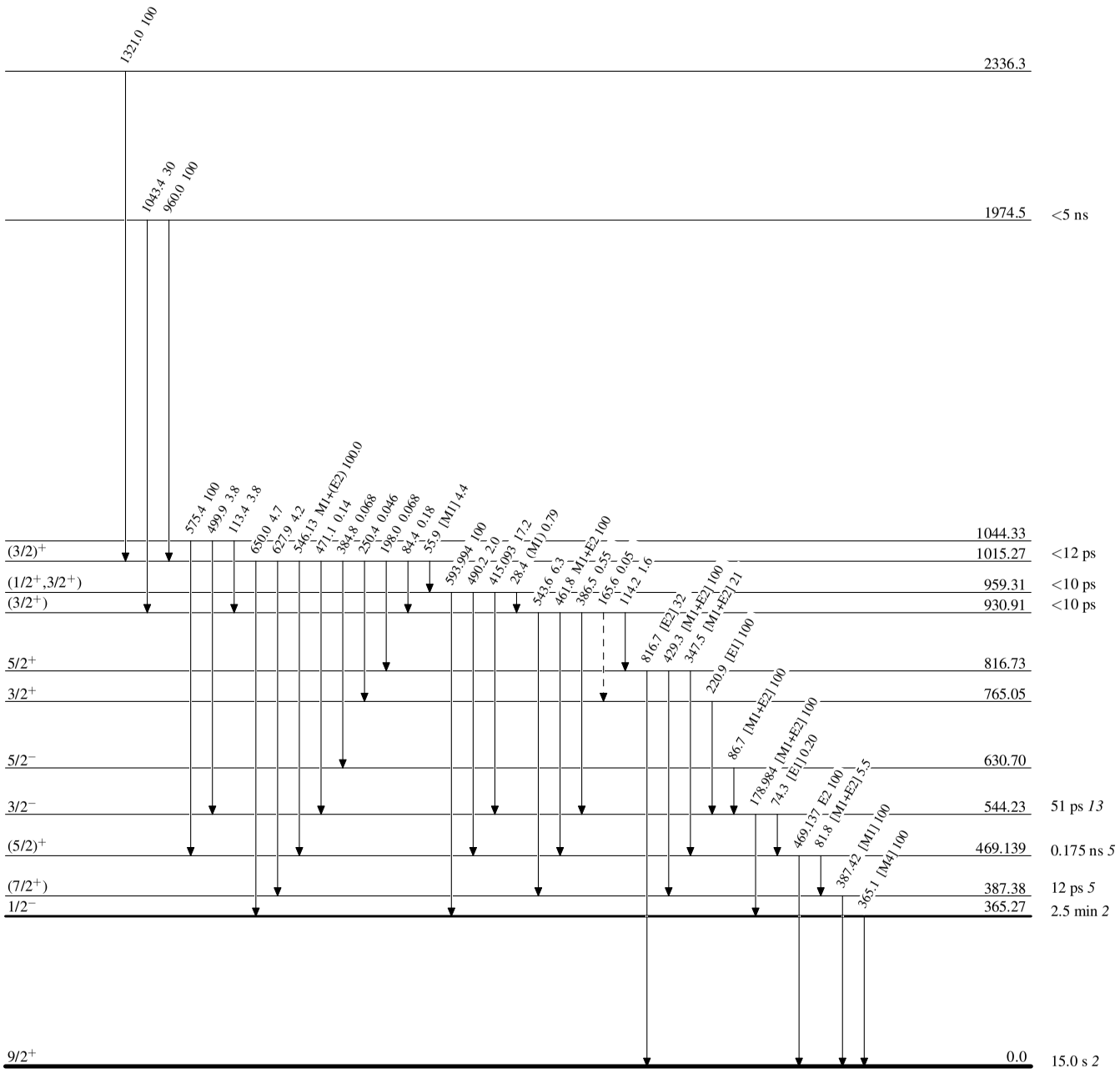
Adopted Levels, Gammas

Legend

Level Scheme

Intensities: Relative photon branching from each level

- - - - - - ► γ Decay (Uncertain)



$^{99}_{41}Nb_{58}$