Adopted Levels, Gammas

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Coral M. Baglin	NDS 113,2187 (2012)	15-Sep-2012

Q(β^-)=354.1 *25*; S(n)=7886 *4*; S(p)=5846.6 *18*; Q(α)=−4580 *3* 2012Wa38
Note: Current evaluation has used the following Q record 354 4 *7887* 3 *5846.6 18*−4581 3 2011AuZZ,2003Au03.
Q(β^-),S(p),Q(α): from 2011AuZZ; the values are 357 *4*, 5846.9 *18*, −4574 *3*, respectively, from 2003Au03.

Other Reactions:

^{91}Zr(^{7}Li,^{6}He): 1993Yo01: E(^{7}Li)=210 MeV, magnetic spectrograph, FWHM≈500 keV, 88.5% ^{91}Zr target; observed resonances at E=0.4 MeV (Γ=1 MeV), 3.5 MeV (Γ=0.9 MeV), 5.1 MeV (Γ=1.2 MeV), 6.4 MeV (Γ=1.3 MeV), 9.4 MeV (Γ=3.0 MeV) and 12.5 MeV (Γ=0.8 MeV); interpreted these resonances as single-particle states.

^{92}Mo(n,pγ), E(n)≤800 MeV: 2000Ga46.

99% ^{92}Mo target, pulsed beam; 15 coaxial HPGe detectors (for Eγ≤4 MeV) and 11 planar Ge detectors (for Eγ≤1 MeV), BGO suppression shields for all planar and 9 coaxial detectors; measured 150γ, 164γ, 357γ, 501γ excitation functions for E(n)≈3-250 MeV.

^{92}Nb Levels

The first six positive-parity levels are believed to be members of the configuration=((π 1g$_{9/2}$)(ν 2d$_{5/2}$)) multiplet. The positive parity of these states is determined by L=4 in (^{3}He,d) on 5/2$^+$ target. If 135 level has J^π=2$^+$ (which is very probable, given that ^{92}Nb (10 d) ε decays to 2$^+$ states in ^{92}Zr, but not to 0$^+$ or 4$^+$ states), then the spins of 3$^+$, 4$^+$, 5$^+$ states are determined uniquely from the multipolarities of γ transitions (1979Mi08). The negative-parity states (2$^-$ and 3$^-$) at 226 and 390 keV are presumed to be members of the configuration=((π 2p$_{1/2}$)(ν 2d$_{5/2}$)) doublet.

Owing to the high level density, the relationship between levels from different experiments is not always determined uniquely; the evaluator's best estimate is given here.

For theory see, e.g., 1975Gl07, 1975Mo01, 1976It01, 1978Ma10.

Cross Reference (XREF) Flags

A	^{88}Sr(^{7}Li,3nγ)	G	^{92}Zr(p,nγ), Y(α,xnγ)	M	^{94}Mo(d,α)
B	^{90}Zr(α,d)	H	^{92}Zr(^{3}He,p2nγ)	N	^{91}Zr(^{16}O,^{15}N)
C	^{91}Zr(p,n) IAR	I	^{92}Zr(^{3}He,t)	O	^{93}Nb(γ,n)
D	^{91}Zr(^{3}He,d)	J	^{93}Nb(p,d)	P	^{93}Nb(p,pn)
E	^{91}Zr(α,t)	K	^{93}Nb(d,t), (d,tγ)		
F	^{92}Zr(p,n)	L	^{93}Nb(^{3}He,α)		

E(level)†	J$^\pi$	T$_{1/2}$‡	XREF	Comments
0.0	7$^+$	3.47×10^7 y *24*	AB DEFGHIJKLM P	%ε+%β^+=100 μ=+5.136 *4* (2009Ch25); Q=−0.35 *3* (2009Ch25) %β^-: no β^- decay observed or expected. The only energetically possible transition is a seventh-forbidden branch to 0$^+$ ^{92}Mo(g.s.). Systematics for log *ft* values for such a transition have not been established, but log *ft* must significantly exceed 22.5, the lowest value known for a 4th forbidden decay; this would imply %Iβ<2×10^{-6}, so this decay mode can be ignored. μ,Q: from LASER spectroscopy using optical pumping in ion beam cooler buncher (2009Ch25). Δ<r^2>(^{91}Zr,^{92}Zr)=+0.127 fm^2 3 (2009Ch25). J$^\pi$: J=7 from LASER spectroscopy (2009Ch25); L=2 in (p,d), (d,t), (^{3}He,α) on 9/2$^+$ target. Supported by log *ft*=14.4 for ε decay to 4$^+$ which is high for ΔJ≤2 but typical for ΔJ=3, Δπ=no transitions (see 1998Si17); absence of IT decay from (2)$^+$ 135; J=7 favored in

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Adopted Levels, Gammas (continued)

^{92}Nb Levels (continued)

E(level)†	J$^{\pi}$	T$_{1/2}$‡	XREF	Comments
				(^{3}He,t). T$_{1/2}$: weighted average of: 3.6×10^7 y 3 (1978Ne04) [if σ=877 mb 42 for ^{93}Nb(n,2n)^{92}Nb(g.s.) at E(n)=14.8 MeV], 3.2×10^7 6 (1977Ma45), and 3.3×10^7 y 5 (1977Ma45) [if T$_{1/2}$(^{94}Nb)=2.03×10^4 y 16].
135.5 *4*	(2)$^+$	10.15 d *2*	AB DEFGHIJKLM O	%ε+%β^+=100 μ=(+)6.137 *4* %ε+%β^+: both IT decay (ΔJ=5) and β^- decay to (0$^+$ ^{92}Mo g.s.) are energetically possible but have not been observed. log *ft* values as low as 10.6 are known (1998Si17) for second-forbidden decays; this implies %β^-<0.005, compatible with an upper limit of 0.05% reported by 1951Pr20. μ: 2011StZZ from 1981Ha24, NMR on oriented nuclei; based on g factor=3.068 *2*, assuming J=2. Value is relative to ^{93}Nb. Calculation: 1998Jo17. J$^{\pi}$: L=2 in (p,d),(d,t) on 9/2$^+$; log *ft*=6.17 for ε decay to 2$^+$ level in ^{92}Zr but >10.0 to 4$^+$ level; D+Q 954γ from (1)$^+$ 1089. T$_{1/2}$: weighted average of 10.14 d *3* (1968Re04), 10.16 d *3* (1962Bu16) and 10.15 d *3* (1959We30). Other: 10.9 d *5* (1985He18).
225.8 *4*	(2)$^-$	5.9 μs *2*	AB DEFGHI M O	μ=−1.398 *14* μ: perturbed angular distribution (1974Le05); from measured g-factor assuming J=2; no Knight shift correction applied. J$^{\pi}$: π=− from L=1 in (α,t),(^{3}He,d); E1 90γ to (2)$^+$; ΔJ=1 164γ from (3)$^-$ 390. T$_{1/2}$: from 1978Ba18 (γ,n). Others: 5.9 μs *5* (1958Du80) (γ,n); 6 μs *1* (1969Iv02), 7.0 μs *11* (1968Iv02), 4.3 μs *5* (1971Co06), 5.0 μs *10* (1972Ku03), (p,nγ). The weighted average of all data is 5.72 μs *25*.
285.7 *4*	(3)$^+$	1.1 ns *+6−3*	AB DEFGHIJKLM	J$^{\pi}$: L=2 in (p,d),(d,t),(^{3}He,α) on 9/2$^+$; ΔJ=1 M1(+E2) 150γ to (2)$^+$ 136. T$_{1/2}$: from DSA measurement (1974BrXM) in (α,xnγ).
357.44 *16*	(5)$^+$	1.91 ns *4*	AB DE GHIJKLM	J$^{\pi}$: L=2 in (p,d) on 9/2$^+$; stretched E2 γ to 7$^+$ g.s. T$_{1/2}$: weighted average of 1.89 ns *6* (1971Co06) in (p,nγ) and 1.92 ns *5* (1988BeYU) in (α,xnγ).
389.8 *5*	(3)$^-$	≤10 ns	A DEFGH M	J$^{\pi}$: L(^{3}He,d)=1 for 5/2$^+$ target; ΔJ=1 E1+M2 254γ to (2)$^+$ 136. T$_{1/2}$: from (p,nγ).
480.28 *14*	(4)$^+$	0.62 ns *10*	Ab DEFGHIJKLM	XREF: b(490). J$^{\pi}$: ΔJ=1 M1 γ rays to (3)$^+$ and (5)$^+$; L(d,t)=2 for 9/2$^+$ target. T$_{1/2}$: from DSA measurement (1974BrXM) in (α,xnγ).
501.26 *18*	(6)$^+$	0.35 ns *5*	Ab DE GH JKL	XREF: b(490). J$^{\pi}$: J=2 to 7 from L(d,t)=2 on 9/2$^+$; ΔJ=1 501γ to (7)$^+$ g.s. T$_{1/2}$: from DSA measurement (1974BrXM) in (α,xnγ).
975.0 *5*	(1$^+$,2$^-$)	≤10 ns	FG	J$^{\pi}$: 749γ is polarized, so J≠0 (1979Ba54 in (p,nγ)); 703γ from (1)$^-$ 1678; (1$^+$,2$^-$) from σ(E) in (p,nγ). However, J=0 suggested in (p,n). T$_{1/2}$: from $\gamma\gamma$ coin in (p,nγ), (α,xnγ).
1089.4 *5*	(1)$^+$	≤10 ns	B DEFG I KLM	J$^{\pi}$: D(+Q) 864γ to (2)$^-$ 225; ΔJ=2 804γ to (3)$^+$ 286; L(^{3}He,d)=2 for 5/2$^+$ target. T$_{1/2}$: from $\gamma\gamma$ coin in (p,nγ), (α,xnγ).
1150.0 *5*	(1$^-$,2$^-$)		FG	J$^{\pi}$: J$^{\pi}$=(1$^-$,2,3) from D+Q 175γ to (1$^+$,2$^-$) 975 and 760γ to (3)$^-$ 390; σ(E) in (p,nγ) favors 1$^-$ but σ(E) in (p,n) favors 2$^-$.
1310.8 *7*	(2$^-$,3$^-$)	≤10 ns	A fGHI M	XREF: f(1322).

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Adopted Levels, Gammas (continued)

^{92}Nb Levels (continued)

E(level)[†]	J^π	$T_{1/2}$[‡]	XREF	Comments
				J^π: J=(1,2,3) from $\gamma(\theta)$ in (p,nγ), (α,xnγ); IAR enhancement for 1311+1324 doublet in (p,n) suggests $2^-,3^-$ for both states; $\sigma(\theta)$ in (^{3}He,t) resembles that for $(2)^-$ 226 state. $T_{1/2}$: from $\gamma\gamma$ coin in (p,nγ), (α,xnγ).
1323.8 *5*	$(2,3)^-$		D fG l	XREF: f(1322)l(1338). J^π: L=1 in (^{3}He,d) on $5/2^+$ target; IAR enhancement for 1311+1324 doublet in (p,n) suggests $2^-,3^-$ for both states. 1098γ to $(2)^-$ 225.
1345.5 *5*	(2^+)	≤10 ns	D FG Kl	XREF: l(1338). J^π: J=(2) from ΔJ=1 d 1060γ to $(3)^+$ 286 and (D) 1210γ to $(2)^+$ 136; L=(4) in (d,t) on $9/2^+$ target; IAR enhancement in (p,n) suggests $1^-,2^+$. However, $\gamma(\theta)$ in (α,xnγ) not consistent with that in (p,nγ). $T_{1/2}$: from $\gamma\gamma$ coin in (p,nγ), (α,xnγ).
1374 *10*	$^-$		D	J^π: 1^- to 4^- from L(^{3}He,d)=1 on $5/2^+$ target.
1374 *7*	$^+$		K	J^π: 2^+ to 7^+ from L(d,t)=2 on $9/2^+$ target.
1406.2 *5*	(5^+)[@]		efG ijklm	XREF: e(1400)f(1420)i(1410)j(1402)k(1407)l(1402)m(1409). J^π: J=(5) from σ(E) in (p,nγ); γ to $(3)^+$ 286.
1410.3 *6*	(5,6,7)[@]		efGHijklm	XREF: e(1400)f(1420)i(1410)j(1402)k(1407)l(1402)m(1409). J^π: D 909γ to $(6)^+$ 501.
1415.0 *3*	(3,4)[#@]	≤10 ns	defGHijklm	XREF: d(1416)e(1400)f(1420)i(1410)j(1402)k(1407)l(1402)m(1409). J^π: D 934γ to $(4)^+$ 480; J=5 eliminated in $\gamma(\theta)$, $\gamma\gamma(\theta)$ in (p,nγ), (α,xnγ). $T_{1/2}$: from $\gamma\gamma$ coin in (p,nγ).
1422.7 *5*	(4^-)[#]	≤10 ns	A d fGH m	XREF: d(1416)f(1420)m(1409). J^π: D+Q ΔJ=1 1033γ to $(3)^-$ 390; $\gamma\gamma(\theta)$ in (p,nγ) eliminates J=2; δ(1033γ) favors $\Delta\pi$=no. $T_{1/2}$: from $\gamma\gamma$ coin in (p,nγ).
1467.9 *5*	(4^+)		d G i	XREF: d(1474)i(1471). J^π: 1332γ to $(2)^+$ 136; $J^\pi=(4^+,5^+)$ from σ(E) in (p,nγ).
1472.8 *7*	(4^+)		A d GHi K	XREF: d(1474)i(1471)K(1479). J^π: L(d,t)=(0) for $9/2^+$ target; 1083γ to $(3)^-$ 390. E(level): differs from 1468 level because different γ rays deexcite it.
1481.3 *5*	(1^+)		d FG i	XREF: d(1474)i(1471). J^π: from σ(E) in (p,nγ) and IAR enhancement in (p,n).
1524?[&]			L	
1553.9 *5*	$(1^-,2,3)$	≤10 ns	D FG j m	XREF: F(1556)m(1556). J^π: (2,3) from $\gamma(\theta)$, $\gamma\gamma(\theta)$ in (p,nγ), (α,xnγ); J=(1) from σ(E) in (p,nγ); γ rays to $(3)^-$ and $(2)^-$. 1556 doublet in (p,n) has a (1^-) component. $T_{1/2}$: from $\gamma\gamma$ coin in (p,nγ).
1565.7 *11*	$(4)^+$		FG jK m	XREF: F(1556)m(1556). J^π: 1556 doublet in (p,n) probably has a J=4 component; L=2 in (d,t) for $9/2^+$ target; γ ray to $(3)^+$.
1607 *6*	$4^+,5^+$		D JKL	J^π: L=0 in (d,t), (p,d) for $9/2^+$ target.
1632.7 *11*	$4^+,5^+$		efG iJKlm	XREF: e(1630)f(1647)i(1643)l(1648)m(1646). J^π: L=0 in (d,t), (p,d) for $9/2^+$ target.
1642.0 *5*	$(2)^-$		DefG i m	XREF: D(1634)e(1630)f(1647)i(1643)m(1646). J^π: L=1 in (^{3}He,d) on $5/2^+$ target; γ rays to $(1)^+$ and $(3)^-$ and $(3)^+$. However, σ(E) in (p,nγ) suggests J=1.
1650.3 *3*	$(5)^+$		efGHi Klm	XREF: e(1630)f(1647)i(1643)l(1648)m(1646). J^π: L(d,t)=0 for $9/2^+$ target; J=(5,6) from σ(E) in (p,nγ).
1666.6 *5*	$(1)^-$		D FG l	XREF: D(1658)l(1676). J^π: L=1 in (^{3}He,d) on $5/2^+$; J=(1) from σ(E) in (p,nγ).
1678.1 *5*	$(1)^-$		D FG l	XREF: l(1676). J^π: L(^{3}He,d)=1 for $5/2^+$ target; J=(1) from σ(E) in (p,nγ).

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Adopted Levels, Gammas (continued)

^{92}Nb Levels (continued)

E(level)[†]	J^π	$T_{1/2}$[‡]	XREF	Comments
1717 *6*	$3^-,4^-$		D JK m	XREF: m(1718). J^π: L(^{3}He,d)=1 for 5/2$^+$ and L(d,t)=1 for 9/2$^+$ target.
1730 *10*	$^-$		b D m	XREF: b(1750)m(1718). E(level): differs from 1738.2 level in (p,nγ) only if the latter has π=+. J^π: 1$^-$ to 4$^-$ from L(^{3}He,d)=1 for 5/2$^+$ target.
1738.2 *5*	(3^+)		b FG	XREF: b(1750). E(level): from (p,nγ). Identical to 1730 level in (^{3}He,d) if π=−. J^π: (3$^+$) probable from IAR enhancement in (p,n); σ(E) in (p,nγ) favors J=0,3.
1768.03 *19*	$(4)^+$		b D fG IJKL	XREF: b(1750)f(1770). J^π: L=2 in (d,t), (p,d) on 9/2$^+$; γ to (3)$^+$; (4$^+$) from (^{3}He,t); σ(E) in (p,nγ) favors J=4.
1779 *10*	$^-$		b D f	XREF: b(1750)f(1770). J^π: 1$^-$ to 4$^-$ from L(^{3}He,d)=1 for 5/2$^+$ target.
1816 *10*			De j lm	XREF: e(1830)j(1828)l(1828)m(1811).
1831 *7*	$4^+,5^+$		e jKlm	XREF: e(1830)j(1828)l(1828)m(1811). J^π: L(d,t)=0 for 9/2$^+$ target.
1832 *10*	$^-$		De m	XREF: e(1830)m(1811). J^π: 1$^-$ to 4$^-$ from L(^{3}He,d)=1 for 5/2$^+$ target.
1851 *10*	$^-$		D m	XREF: m(1861). J^π: 1$^-$ to 4$^-$ from L(^{3}He,d)=1 for 5/2$^+$ target.
1875 *10*			D m	XREF: m(1861).
1907 *10*	$^-$		D K M	J^π: 1$^-$ to 4$^-$ from L(^{3}He,d)=1 for 5/2$^+$ target. Existence of level in (d,t) is not certain.
1932 *10*	$^-$		D	J^π: 1$^-$ to 4$^-$ from L(^{3}He,d)=1 for 5/2$^+$ target.
1945.3 *4*	$(7^-,8^+)$	≤6 ns	A H	J^π: γ ray to (6)$^+$ and possibly to 7$^+$ g.s.; 142γ from (9)$^-$ 2088 level.
1972 *10*	$\leq5^+$		D	J^π: L(^{3}He,d)=2 for 5/2$^+$ target.
2033 *7*	$^+$		b D KlM	XREF: b(2030)l(2039)M(2017). 2$^+$ to 7$^+$ from L(d,t)=2 for 9/2$^+$ target.
2056 *7*	$4^+,5^+$		b D Kl	XREF: b(2030)l(2039). J^π: L(d,t)=0 for 9/2$^+$ target.
2082 *6*	$^-$		D JK	J^π: 3$^-$ to 6$^-$ from L(d,t)=1 for 9/2$^+$ target.
2087.5 *4*	$(9)^-$	≤6 ns	A H	J^π: M2+E3 2087γ to 7$^+$ g.s.; weak 1586γ to (6)$^+$ but no γ to J<6 levels.
2128 *7*	$\leq5^+$		b D Klm	XREF: b(2150)l(2146)m(2132). J^π: L(^{3}He,d)=2 on 5/2$^+$ target.
2142 *10*	$\leq5^+$		b D J lm	XREF: b(2150)l(2146)m(2132). J^π: L(^{3}He,d)=2 on 5/2$^+$ target.
2147 *11*	$(^-)$		b jK m	XREF: b(2150)j(2142)m(2132). J^π: L(d,t)=1 on 9/2$^+$ for probable doublet. π=(+) for adjacent levels, so probably π=− for this level.
2162 *11*	$(^+)$		b Kl	XREF: b(2150)l(2146). J^π: L=(2+4) in (d,t) on 9/2$^+$ target.
2203.3 *4*	(11^-)	167 ns *4*	A H	μ=+9.7 *3* J^π: stretched E2 116γ to (9$^-$); absence of γ to J<9 in (^{7}Li,3nγ). $T_{1/2}$: from (^{7}Li,3nγ). μ: differential perturbed angular distribution (1989Ra17 from 1977Br12; TDPAD); from g-factor in (^{7}Li,3nγ), assuming J=11.
2213 *11*	$(^+)$		KL	J^π: L=(2+4) in (d,t), L=(4) in (^{3}He,α) on 9/2$^+$ target.
2235.7 *4*	(10^-)	≤6 ns	A H	J^π: stretched D γ to (9$^-$); (^{7}Li,3nγ) systematics disfavor transition to higher J; π=− favored based on competition between transitions from (11$^+$) 2998 to this level and to the (9$^+$) 2287 level (1977Br12).
2240 *10*	$\leq5^+$		D Lm	XREF: L(2243)m(2260). J^π: L=2 in (^{3}He,d) on 5/2$^+$ target.

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Adopted Levels, Gammas (continued)

^{92}Nb Levels (continued)

E(level)[†]	Jπ	$T_{1/2}$[‡]	XREF	Comments
2243 *8*	−		JK	XREF: K(2248). Jπ: L=1 in (p,d) on 9/2$^+$ so J=3 to 6.
2254 *8*	(3$^-$)		b I K m	XREF: b(2280)K(2255)m(2260). Jπ: L(^{3}He,t)=(3).
2271 *11*	−		b K m	XREF: b(2280)m(2260). Jπ: 3$^-$ to 6$^-$ from L(d,t)=1 on 9/2$^+$ target.
2287.1 *5*	(9$^+$)	≤6 ns	A H kl	XREF: k(2286)l(2293). Jπ: stretched Q 2287γ to 7$^+$ g.s.; J_f≤J_i expected in (^{7}Li,3nγ); absence of γ to J<7 levels or to (7$^-$) or (9)$^-$ levels. L(p,d)=(2+4) at E=2292 *12*; this level could account for L=4 component.
2292 *12*	($^+$)		b Jkl	XREF: b(2280)k(2286)l(2293). E(level),Jπ: L(p,d)=(2+4) on 9/2$^+$ target.
2294 *8*	−		b D K	XREF: b(2280)K(2300). Jπ: L(^{3}He,d)=1 on 5/2$^+$ so J=1 to 4. L(d,t)=(1) for 2294+2311 doublet.
2311 *12*			K	Jπ: L(d,t)=(1) for 2294+2311 doublet.
2335 *10*			D	
2362 *8*	+		D K	Jπ: L(^{3}He,d)=2 on 5/2$^+$ and L(d,t)=(2) on 9/2$^+$ so J=(2 to 5).
2391 *6*	−		D JK	Jπ: L=1 in (p,d) and (d,t) on 9/2$^+$ target so J=3 to 6.
2403[&]	($^+$)		Lm	XREF: m(2418). Jπ: L=(2+4) in (^{3}He,α) for 9/2$^+$ target.
2407 *12*	−		K m	XREF: m(2418). Jπ: L(d,t)=1 on 9/2$^+$ so J=3 to 6.
2433 *10*	≤5$^+$		D Lm	XREF: m(2418). Jπ: L(^{3}He,d)=2 on 5/2$^+$.
2463 *8*	(4,5)$^+$		b D K	XREF: b(2470). Jπ: L(^{3}He,d)=2 on 5/2$^+$; L(d,t)=(0) on 9/2$^+$.
2498 *11*			b E jK	XREF: b(2470)E(2490)j(2503). Jπ: L(d,t)=1 for 2498+2515 doublet; L(p,d)=(1+?) for probable doublet containing same levels.
2515 *13*			jK	XREF: j(2503). Jπ: L(d,t)=1 for 2498+2515 doublet; L(p,d)=(1+?) for probable doublet containing same levels.
2530 *10*	+		D L	Jπ: L(^{3}He,α)=4(+2) for 9/2$^+$ target.
2563 *8*	+		D K	Jπ: L(d,t)=4 on 9/2$^+$.
2580 *30*	(10$^-$)		B	Jπ: from σ(θ) in high energy (α,d) and reaction systematics. Proposed configuration=((ν $h_{11/2}$)(π $g_{9/2}$))10$^-$ (1988La18).
2594 *7*	($^+$)		D JKl	XREF: l(2603). Jπ: L(d,t)=(4) for 9/2$^+$ target.
2610 *8*	≤5$^+$		D Kl	XREF: l(2603). Jπ: L(^{3}He,d)=2 on 5/2$^+$ target.
2656 *8*	($^+$)		D K m	XREF: m(2679). Jπ: L(d,t)=(2).
2666 *12*	−		d J m	XREF: d(2670)m(2679). Jπ: L(p,d)=1 on 9/2$^+$ so J=3 to 6.
2680 *13*	+		d K m	XREF: d(2670)m(2679). Jπ: L(d,t)=4.
2700 *14*	($^+$)		K m	XREF: m(2679). Jπ: L(d,t)=(2+4).
2720 *14*	($^+$)		K	Jπ: L(d,t)=(2).
2739 *7*	+		D iJKl	XREF: i(2747)l(2750). Jπ: L=4 in (d,t) and (p,d). Microscopic DWBA for (^{3}He,t) implies (7$^+$,8$^+$) for level at 2747 *10*.
2756 *8*			D i Kl	XREF: i(2747)l(2750).

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Adopted Levels, Gammas (continued)

^{92}Nb Levels (continued)

E(level)†	J^{π}	$T_{1/2}$‡	XREF	Comments
				J^{π}: L=(3,2+4) in (d,t). (^{3}He,t) microscopic DWBA implies (7^{+},8^{+}) for level at 2747 *10*.
2785 *10*			b De m	XREF: b(2810)e(2800)m(2793).
2802 *8*	$(3)^{-}$		b e IJ m	XREF: b(2810)e(2800)m(2793).
				J^{π}: L(^{3}He,t)=3; L(p,d)=1 on $9/2^{+}$.
2811 *10*	$\leq 5^{+}$		b De m	XREF: b(2810)e(2800)m(2793).
				J^{π}: L(^{3}He,d)=2 on $5/2^{+}$.
2832 *10*			b D	XREF: b(2810).
2867 *10*	$(^{+})$		I M	XREF: M(2855).
				J^{π}: L(^{3}He,t)=(2).
2905 *9*			D K m	XREF: m(2920).
2926 *8*			De K m	XREF: e(2940)m(2920).
2948 *6*	$(6,5)^{+}$		De IJKl	XREF: e(2940)l(2958).
				L(p,d)=4; J from (^{3}He,t) microscopic DWBA.
2964 *8*			D Kl	XREF: l(2958).
2981 *10*			D m	XREF: m(2992).
2998.2 *5*	(11^{+})	$\leq$6 ns	A H	J^{π}: stretched (E2) 711γ to (9^{+}); stretched D γ to $(10)^{-}$.
3010 *10*			D j m	XREF: j(3015)m(2992).
				J^{π}: L(p,d)=4 for 3010 and/or 3020 level.
3020 *10*			D j	XREF: j(3015).
				J^{π}: L(p,d)=4 for 3010 and/or 3020 level.
3045 *6*	$(4,3)^{+}$		D IJ l	XREF: l(3063).
				J^{π}: from (^{3}He,t) microscopic DWBA; L(p,d)=4 on $9/2^{+}$ target.
3064 *10*			D l	XREF: l(3063).
3072 *10*			D l	XREF: l(3063).
3090 *10*	$\leq 5^{+}$		D m	XREF: m(3112).
				J^{π}: L(^{3}He,d)=2 for $5/2^{+}$ target.
3110 *12*	$^{-}$		J m	XREF: m(3112).
				J^{π}: L=1 in (p,d) on $9/2^{+}$, so J=3 to 6.
3119 *7*	(3^{+},4^{+})		D I lm	XREF: l(3127)m(3112).
				J^{π}: from (^{3}He,t) microscopic DWBA.
3134 *10*			D l	XREF: l(3127).
3142 *10*			D lm	XREF: l(3127)m(3158).
3160 *10*			D m	XREF: m(3158).
3185 *10*			D j	XREF: j(3196).
				J^{π}: L(p,d)=1 for 3200 and/or 3185 level.
3200 *10*			D j	XREF: j(3196).
				J^{π}: L(p,d)=1 for 3200 and/or 3185 level.
3228 *10*			D l	XREF: l(3225).
3242 *10*			D j lm	XREF: j(3251)l(3225)m(3253).
				J^{π}: L(p,d)=1 for 3260 and/or 3242 level.
3260 *10*			D j m	XREF: j(3251)m(3253).
				J^{π}: L(p,d)=1 for 3260 and/or 3242 level.
3280 *10*	$\leq 5^{+}$		D l	XREF: l(3291).
				J^{π}: L(^{3}He,d)=2 on $5/2^{+}$ target.
3294 *10*	$\leq 5^{+}$		D lm	XREF: l(3291)m(3304).
				J^{π}: L(^{3}He,d)=2 on $5/2^{+}$ target.
3316 *8*	$^{-}$		D J m	XREF: m(3304).
				J^{π}: L(p,d)=1 for $9/2^{+}$ target so J=3 to 6.
3325.9 *5*	(13^{+})	$\leq$6 ns	A H	J^{π}: stretched E2 γ to (11^{+}); (^{7}Li,3nγ) favors $J_{i}\geq J_{f}$.
3330 *10*	$\leq 5^{+}$		D	J^{π}: L(^{3}He,d)=2 on $5/2^{+}$ target.
3342 *12*	$^{-}$		e J	XREF: e(3360).
				J^{π}: L(p,d)=1 on $9/2^{+}$ target so J=3 to 6.
3345 *10*	$\leq 5^{+}$		De l	XREF: e(3360)l(3363).

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{92}Nb Levels (continued)

E(level)†	Jπ	$T_{1/2}$‡	XREF	Comments
				Jπ: L=2 in (^{3}He,d) on 5/2$^+$ target.
3372 *10*	≤5$^+$		De l	XREF: e(3360)l(3363). Jπ: L=2 in (^{3}He,d) on 5/2$^+$ target.
3385 *10*	≤5$^+$		D	Jπ: L=2 in (^{3}He,d) on 5/2$^+$ target.
3403 *8*	−		D J	Jπ: L(p,d)=1 on 9/2$^+$ target so J=3 to 6.
3445 *10*	≤5$^+$		D L	XREF: L(3427). Jπ: L=2 in (^{3}He,d) on 5/2$^+$ target.
3455 *8*	−		D J M	Jπ: L(p,d)=1 on 9/2$^+$ target so J=3 to 6.
3489 *12*	($^+$)		J m	Jπ: L(p,d)=(4+?).
3516 *8*	−		De J m	XREF: e(3530). Jπ: L(p,d)=1 on 9/2$^+$ target so J=3 to 6.
3530 *10*	≤5$^+$		Def L	XREF: e(3530)f(3530). Jπ: L=2 in (^{3}He,d) on 5/2$^+$ target.
3550 *10*			Def	XREF: e(3530)f(3530).
3560 *10*			D f	XREF: f(3530).
3580 *10*			D	
3590 *10*			D	
3619 *8*	≤5$^+$		D J l	XREF: l(3637). Jπ: L=2 in (^{3}He,d) on 5/2$^+$ target.
3650 *10*	≤5$^+$		De l	XREF: e(3660)l(3637). Jπ: L=2 in (^{3}He,d) on 5/2$^+$ target.
3665 *12*	−		e J	XREF: e(3660). Jπ: L(p,d)=1 on 9/2$^+$ target so J=3 to 6.
3672 *10*	≤5$^+$		De l	XREF: e(3660)l(3686). Jπ: L=2 in (^{3}He,d) on 5/2$^+$ target.
3696 *10*	≤5$^+$		b D l	XREF: b(3720)l(3686). Jπ: L=2 in (^{3}He,d) on 5/2$^+$ target.
3716 *12*	−		b J	XREF: b(3720). Jπ: L(p,d)=1 on 9/2$^+$ target so J=3 to 6.
3753&	+		b L	XREF: b(3720). Jπ: L=4 in (^{3}He,α).
3790 *10*			b D	XREF: b(3810).
3796.9 *11*	(12,13)	≤6 ns	A H	Jπ: γ to (13)$^+$; J=(12,13) suggested in (^{7}Li,3nγ) based on apparent non-yrast character of level (1977Br12).
3805 *8*	−		b D J	XREF: b(3810). Jπ: L(p,d)=1 on 9/2$^+$ target so J=3 to 6.
3837 *10*			b D L	XREF: b(3810)L(3828).
3875&			L	
3882&			L	
3920 *30*			B L	
4032&			L	
4079 *12*	−		J	Jπ: L(p,d)=1 for 9/2$^+$ target so J=3 to 6.
4135 *12*	+		J	Jπ: L(p,d)=4 for 9/2$^+$ target.
4172&			L	
4285&			L	
4355&			L	
4450 *30*			B	
4830 *30*			B E	E(level): from (α,d).
4.93×10^3 *10*			E	
5.21×10^3 *10*			E	
5620 *30*			B F	XREF: F(5680). E(level): from (α,d).

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{92}Nb Levels (continued)

E(level)†	J^π	$T_{1/2}$‡	XREF	Comments
6.0×10^3 *1*	(+)		B F	XREF: F(5920). J^π: L(p,n)=(0). E(level): from (α,d).
6280	(+)		F	J^π: L(p,n)=(0). E(level): from (p,n).
9008 *18*	(0+)		D F I	J^π: if isobaric analog of ^{92}Zr g.s.; L=(2) in (^{3}He,d); (^{3}He,t) microscopic DWBA favors 0+; L(p,n)=0.
9956 *10*	(2+)	33 keV *2*	CD F	J^π: possible isobaric analog of 934 state in ^{92}Zr; L=(2) in (^{3}He,d) on 5/2+ target. Γ corresponds to $T_{1/2}$=1.40 x 10^{-20} s 8.
10.47×10^3 *4*	(4+)		CD	J^π: possible isobaric analog of 1495 level in ^{92}Zr; L=(2) in (^{3}He,d) on 5/2+ target.
10.83×10^3 *4*	(2+)		D	J^π: possible isobaric analog of 1847 state in ^{92}Zr; L=(2) in (^{3}He,d) on 5/2+ target.
11.089×10^3	(2+)		C	J^π: possible isobaric analog of 2067 level in ^{92}Zr.
11.54×10^3 *30*	(5)−		J	J^π: possible isobaric analog of 2486 level in ^{92}Zr; L(p,d)=1 on 9/2+ target so J=3 to 6.
11.80×10^3 *30*	(4)−		J	J^π: possible isobaric analog of 2744 level in ^{92}Zr; L(p,d)=1 on 9/2+ target so J=3 to 6.

† From least squares fit to Eγ for levels deexcited by gammas, holding E(135 level) fixed at 135.5 *4*; average from cross-referenced particle reactions otherwise; note that ΔE=10 keV has been assumed for E(level) from (^{3}He,d) but ΔE may, in fact, be as low as 5 keV.

‡ Upper limit based on experimental timing resolution from (^{7}Li,3nγ), except as noted.

L=1 in (^{3}He,d) implying J^π=1− to 4− for either the 1415 level and/or the 1423 level.

@ L=0 in (p,d), (d,t), implying J^π=4+ or 5+ for one or more of the 1406, 1410 and 1415 levels.

& ΔE unstated by authors. ΔE≤20 keV assigned by evaluator; see source data set.

γ(^{92}Nb)

E_i(level)	J^π_i	E_γ[†]	I_γ[†]	E_f	J^π_f	Mult.	δ	α[&]	Comments
225.8	(2)$^-$	90.37 *9*	100	135.5	(2)$^+$	E1		0.1609	B(E1)(W.u.)=6.57×10^{-8} *23* E_γ: unweighted average of 90.50 *14* (p,nγ), 90.2 *2* (^{7}Li,3nγ) and 90.4 *2* (1978Ba18) (γ,n). Mult.: from α(K)exp, α(L+...)exp in (p,nγ).
285.7	(3)$^+$	150.13[#] *16*	100	135.5	(2)$^+$	M1(+E2)	+0.070 *14*	0.0751 *12*	B(M1)(W.u.)=0.0055 *+15−30*; B(E2)(W.u.)=1.2 *+6−9* Mult.: α(K)exp in (p,nγ); $\gamma(\theta)$ in (p,nγ), (α,xnγ). δ: from $\gamma(\theta)$ in (α,xnγ), (p,nγ).
357.44	(5)$^+$	357.43[#] *17*	100	0.0	7$^+$	E2		0.01277	B(E2)(W.u.)=2.03 *5* Mult.: from α(K)exp and $\gamma(\theta)$ in (p,nγ); $\gamma(\theta)$ in (α,xnγ). δ(Q,O)=−0.012 *21* from $\gamma(\theta)$, <0.0003 from RUL. α(K)exp, α(L+...)exp consistent with δ=0.
389.8	(3)$^-$	104.3 *4*	<1	285.7	(3)$^+$				
		164.00[#] *14*	100 *1*	225.8	(2)$^-$	M1+E2	+0.135 *23*	0.0609 *13*	B(M1)(W.u.)≥0.00044; B(E2)(W.u.)≥0.21 Mult.,δ: from α(K)exp, α(L+...)exp and $\gamma(\theta)$ in (p,nγ), and $\gamma(\theta)$ in (α,xnγ) and (^{3}He,p2nγ).
		254.09[#] *17*	3.1 *10*	135.5	(2)$^+$	E1+M2	+0.20 *7*	0.0114 *25*	B(E1)(W.u.)≥5.3×10^{-8}; B(M2)(W.u.)≥0.051 Mult.,δ: from α(K)exp, α(L+...)exp and $\gamma(\theta)$ in (p,nγ); $\gamma(\theta)$ in (α,xnγ).
480.28	(4)$^+$	122.8 *3*	31 *4*	357.44	(5)$^+$	M1(+E2)	−0.044 *25*	0.1288 *24*	B(M1)(W.u.)=0.0043 *9*; B(E2)(W.u.)=0.6 *+7−6* E_γ: unweighted average of 122.5 *2* in (^{7}Li,3nγ) and 123.07 *17* in (p,nγ). I_γ: weighted average of 32 *5* in (p,nγ) and 30 *5* in (d,tγ). Mult.,δ: from α(K)exp, α(L+...)exp, $\gamma(\theta)$ in (p,nγ); $\gamma(\theta)$ in (^{3}He,p2nγ), $\gamma\gamma(\theta)$ in (α,xnγ).
		194.53 *11*	100 *4*	285.7	(3)$^+$	M1		0.0372	B(M1)(W.u.)=0.0035 *6* I_γ: weighted average from (p,nγ) and (d,tγ). Mult.: from α(K)exp, α(L+...)exp, $\gamma(\theta)$ in (p,nγ); $\gamma(\theta)$ in (α,xnγ); $\gamma\gamma(\theta)$ in (α,xnγ). δ: +0.01 *2* from $\gamma(\theta)$, $\gamma\gamma(\theta)$ in (p,nγ), (α,xnγ).
501.26	(6)$^+$	501.28[#] *18*	100	0.0	7$^+$	(M1)			B(M1)(W.u.)=0.00050 *8* Mult.: D(+Q) from $\gamma(\theta)$ in (α,xnγ); adopted $\Delta\pi$=no. δ(D,Q)=−0.02 *+4−3* from $\gamma(\theta)$.
975.0	(1$^+$,2$^-$)	749.3 *2*	100	225.8	(2)$^-$				
1089.4	(1)$^+$	803.8 *2*	37 *4*	285.7	(3)$^+$	(E2)			B(E2)(W.u.)≥0.0014 Mult.: ΔJ=2 from $\gamma(\theta)$, $\gamma\gamma(\theta)$ in (p,nγ), (α,xnγ); adopted $\Delta\pi$=no.
		863.5 *2*	100 *4*	225.8	(2)$^-$	(E1(+M2))	−0.3 *3*		B(E1)(W.u.)≥2.1×10^{-8} Mult.,δ: D(+Q) from $\gamma(\theta)$ in (p,nγ), (α,xnγ); adopted $\Delta\pi$=yes.
		953.8 *2*	48 *4*	135.5	(2)$^+$	(M1+E2)			B(M1)(W.u.)≥2.5×10^{-7}; B(E2)(W.u.)≥0.00029 Mult.: D+Q from $\gamma(\theta)$ in (α,xnγ); adopted $\Delta\pi$=no.

From ENSDF

$^{92}_{41}$Nb$_{51}$-9

Adopted Levels, Gammas (continued)

$\gamma(^{92}$Nb) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.	δ	α[&]	Comments
1150.0	$(1^-,2^-)$	175.17 *18*	2.2 *11*	975.0	$(1^+,2^-)$	D+Q			Mult.: from $\gamma(\theta)$ in (p,nγ).
		760.13 *18*	5.4 *11*	389.8	$(3)^-$				
		924.08 *18*	100.0 *22*	225.8	$(2)^-$				
1310.8	$(2^-,3^-)$	921.0 *5*	100	389.8	$(3)^-$				
1323.8	$(2,3)^-$	933.8 *5*	5 *3*	389.8	$(3)^-$				
		1098.08 *18*	100 *3*	225.8	$(2)^-$				
1345.5	(2^+)	1059.88 *18*	41 *3*	285.7	$(3)^+$	D			Mult.: from $\gamma(\theta)$ in (α,xnγ).
		1210.0 *5*	100 *3*	135.5	$(2)^+$	(D)			Mult.: from $\gamma(\theta)$ in (p,nγ).
1406.2	(5^+)	1120.5 *2*	100	285.7	$(3)^+$				
1410.3	(5,6,7)	909.0 *5*	100	501.26	$(6)^+$	D			Mult.: from $\gamma(\theta)$ in (p,nγ) and (^{3}He,p2nγ).
1415.0	(3,4)	933.8 *5*	100 *20*	480.28	$(4)^+$	D			Mult.: from $\gamma(\theta)$ in (^{3}He,p2nγ).
		1129.55 *26*	100 *20*	285.7	$(3)^+$				
1422.7	(4^-)	1032.9 *3*	100	389.8	$(3)^-$	D+Q	+0.9 *+3−2*		Mult.,δ: from $\gamma(\theta)$, $\gamma\gamma(\theta)$ in (p,nγ).
1467.9	(4^+)	1332.4 *2*	100	135.5	$(2)^+$				
1472.8	(4^+)	1083.0 *5*	100	389.8	$(3)^-$				
1481.3	(1^+)	1255.6 *2*	20	225.8	$(2)^-$				
		1345.75 *24*	100	135.5	$(2)^+$				
1553.9	$(1^-,2,3)$	1164.13 *18*	100 *3*	389.8	$(3)^-$				
		1328.08 *18*	61 *3*	225.8	$(2)^-$				
1565.7	$(4)^+$	1280 *1*	100	285.7	$(3)^+$				
1632.7	$4^+,5^+$	1347 *1*	100	285.7	$(3)^+$				
1642.0	$(2)^-$	552.6 *2*	66	1089.4	$(1)^+$				
		1252.5 *2*	37	389.8	$(3)^-$				
		1356.1 *2*	100	285.7	$(3)^+$				
		1416.2 *2*	61	225.8	$(2)^-$				
1650.3	$(5)^+$	1149.0 *2*	100	501.26	$(6)^+$				
1666.6	$(1)^-$	1276.6 *2*	100	389.8	$(3)^-$				
		1441.0 *2*	47	225.8	$(2)^-$				
1678.1	$(1)^-$	702.9 *2*	8.7	975.0	$(1^+,2^-)$				
		1452.5 *2*	100	225.8	$(2)^-$				
1738.2	(3^+)	1512.4 *2*	100	225.8	$(2)^-$				
1768.03	$(4)^+$	1287.6 *2*	100	480.28	$(4)^+$				
		1482.5 *2*	54	285.7	$(3)^+$				
1945.3	$(7^-,8^+)$	1444.5[@] *10*	100[@]	501.26	$(6)^+$				
		1945[@a]	≤200[@]	0.0	7^+				
2087.5	$(9)^-$	142.2[@] *2*	3.1[@] *10*	1945.3	$(7^-,8^+)$	[E2]		0.323	B(E2)(W.u.)≥1.9 Mult.: D,E2 from RUL.
		1586.4[@] *10*	1.3[@] *4*	501.26	$(6)^+$	[E3]			B(E3)(W.u.)≥0.20

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$\gamma(^{92}Nb)$ (continued)

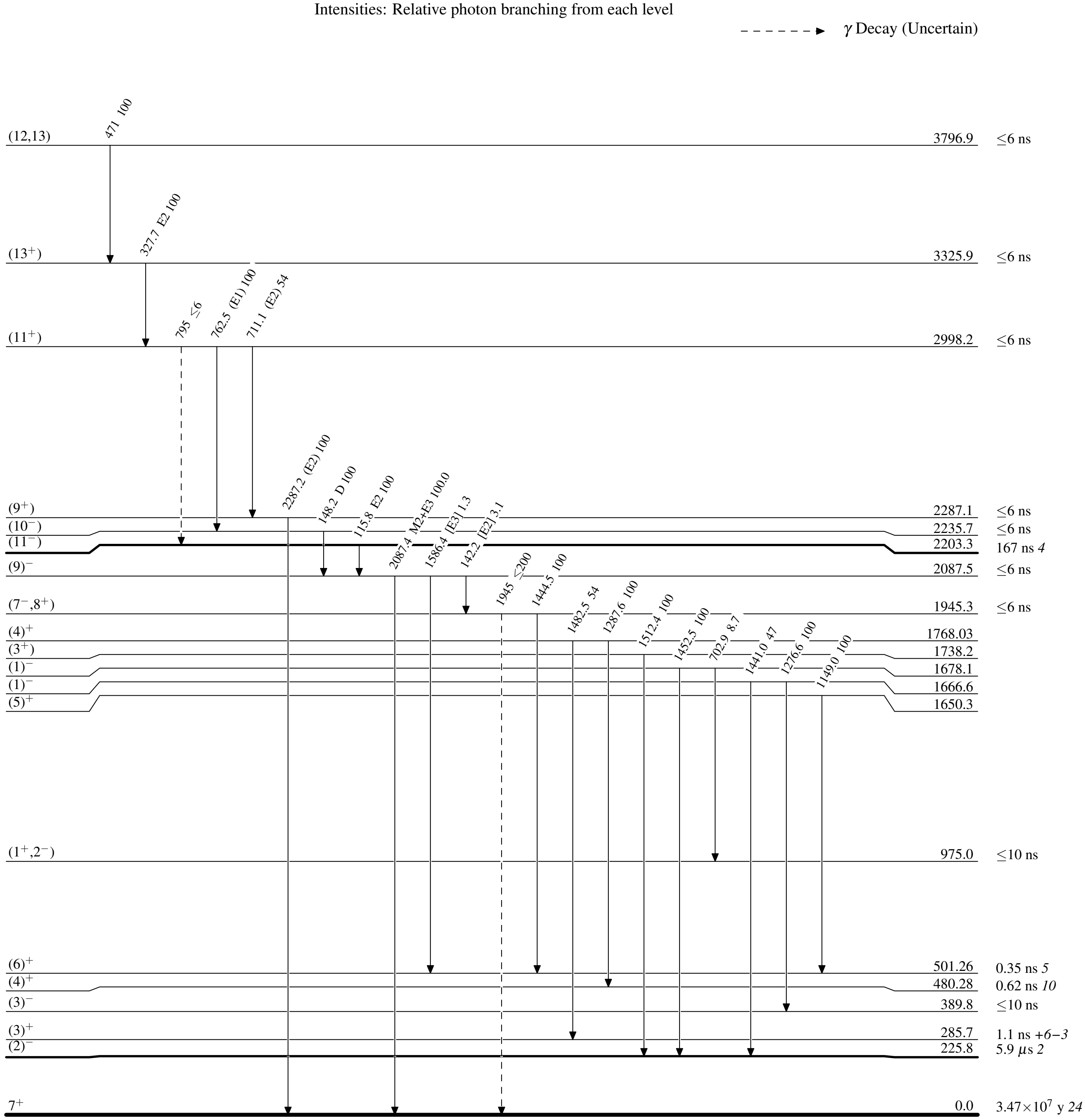
E_i(level)	J^π_i	E_γ[†]	I_γ[†]	E_f	J^π_f	Mult.	δ	α[&]	Comments
2087.5	(9)$^-$	2087.4[@] *4*	100.0[@] *11*	0.0	7$^+$	M2+E3	+11 *2*		B(M2)(W.u.)≥3.2×10^{-5}; B(E3)(W.u.)≥2.2 Mult.,δ: from $\gamma(\theta)$ for prompt γ in (^{7}Li,3nγ).
2203.3	(11$^-$)	115.8[@] *2*	100[@]	2087.5	(9)$^-$	E2		0.680	B(E2)(W.u.)=3.93 *11* Mult.: from $\gamma(\theta)$ in (^{7}Li,3nγ) and RUL.
2235.7	(10$^-$)	148.2[@] *2*	100[@]	2087.5	(9)$^-$	D			B(M1)(W.u.)≥8.7×10^{-4} if pure M1 transition. Mult.: from $\gamma(\theta)$ in (^{7}Li,3nγ).
2287.1	(9$^+$)	2287.2[@] *10*	100[@]	0.0	7$^+$	(E2)			B(E2)(W.u.)≥6.1×10^{-5} Mult.: member of stretched Q cascade to π=+ g.s. in (^{7}Li,3nγ).
2998.2	(11$^+$)	711.1 *2*	54[‡] *3*	2287.1	(9$^+$)	(E2)			B(E2)(W.u.)≥0.0072 E_γ: from (^{7}Li,3nγ). Mult.: Q from $\gamma(\theta)$ in (^{7}Li,3nγ); RUL favors E2 (since B(M2)(W.u.) gw 0.48).
		762.5 *2*	100[‡] *3*	2235.7	(10$^-$)	(E1)			B(E1)(W.u.)≥7.9×10^{-8} E_γ: from (^{7}Li,3nγ). Mult.: stretched D from $\gamma(\theta)$ in (^{7}Li,3nγ) and (^{3}He,p2nγ); $\Delta\pi$=(yes) from level scheme.
		795[@a]	≤6[@]	2203.3	(11$^-$)				
3325.9	(13$^+$)	327.7[@] *2*	100[@]	2998.2	(11$^+$)	E2		0.01702	B(E2)(W.u.)≥0.99 Mult.: Q from $\gamma(\theta)$ in (^{7}Li,3nγ), not M2 from RUL.
3796.9	(12,13)	471[@] *1*	100[@]	3325.9	(13$^+$)				Mult.: D,E2 from RUL.

† From ^{92}Zr(p,nγ), y(α,xnγ), except as noted.
‡ Branching from (^{7}Li,3nγ) (level scheme, fig. 1, 1977Br12). Note that I(711γ)/I(763γ)=0.54 *5* and 3.95 from (^{7}Li,3nγ) and (^{3}He,p2nγ), respectively. This may indicate that either the 763γ in (^{7}Li,3nγ) or the 711γ in (^{3}He,p2nγ) is complex.
# Weighted average from (p,nγ) and (^{7}Li,3nγ).
@ From (^{7}Li,3nγ).
& Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on γ-ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.
a Placement of transition in the level scheme is uncertain.

Adopted Levels, Gammas

Level Scheme

Intensities: Relative photon branching from each level

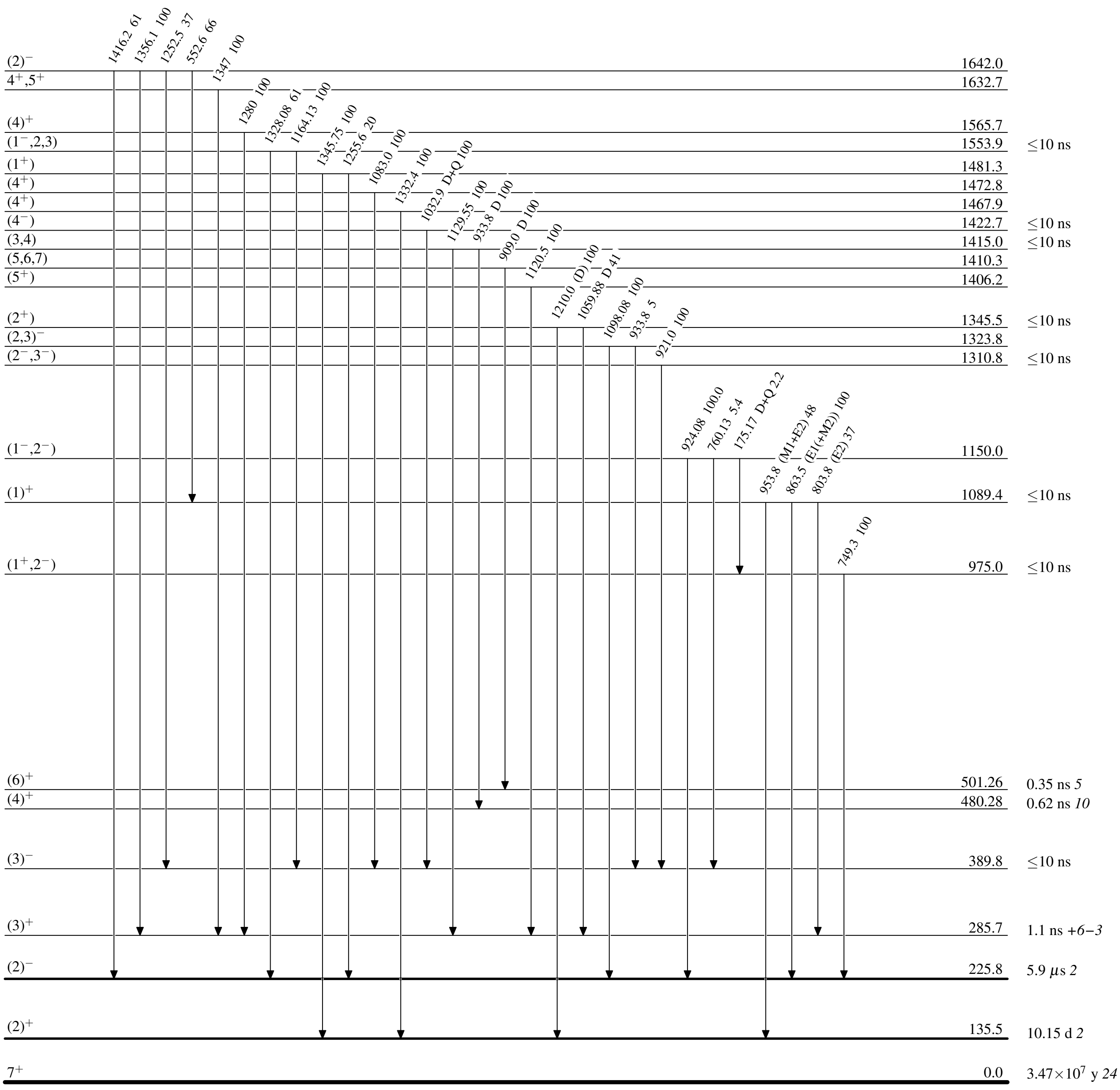


$^{92}_{41}Nb_{51}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level

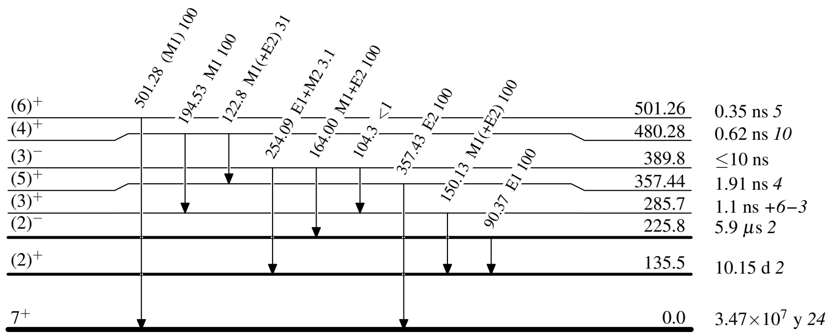


$^{92}_{41}Nb_{51}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level



$^{92}_{41}Nb_{51}$