^{91}Nb ε decay (60.86 d) 1993Hi09,1986Wa34,1955Ha23

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Coral M. Baglin	NDS 114, 1293 (2013)	1-Sep-2013

Parent: ^{91}Nb: E=104.60 *5*; $J^{\pi}=1/2^{-}$; $T_{1/2}$=60.86 d *22*; Q(ε)=1258 *3*; %ε+%$β^+$ decay=3.4 *5*

^{91}Nb-%ε+%$β^+$ decay: From α(105γ, ^{91}Nb)=167 (M4 theory), εK(theory) and I(105γ, ^{91}Nb):I$β^+$:I(1205γ):Iε(g.s.)=0.55 *3*:0.0024 *5*:1.92 *8*:1.3 *4* (1993Hi09) in ^{91}Nb(60.86 d) decay, it follows that %Iβ+(to ^{91}Zr g.s.)=0.0025 *5*, %(1205γ)=2.02 *8* and %(ε to ^{91}Zr g.s.)=1.4 *4*, so %(105(γ+ce), ^{91}Nb)=(100-3.4 *5*). 1993Hi09 have corrected their measured I$β^+$ for a 6% *2* contribution from 1205γ pair production. (1993Hi09 report slightly different branching because they assume α(105)=174.) Note that Iγ(105γ,^{91}Nb)/Iγ(1205)=0.286 *16* from 1993Hi09, cf. 0.233 *9* (1986Wa34), 0.164 (1955Ha23).

Others: 1969Be07, 1993Be08.

1993Hi09: radiochemically separated ^{91}Nb source; intrinsic Ge detectors; measured I(γ±), I(Zr K x ray), Iγ, I(Nb K x ray), K x ray-γ coin.

1986Wa34:Ge(Li). Measured Eγ, Iγ, ce.

1969Be07: Ge(Li), FWHM=3.1 keV at 934 keV. Measured Eγ.

1955Ha23: scin. Measured Eγ, Iγ, Xγ coin.

^{91}Zr Levels

E(level)†	J^{π}‡
0	$5/2^+$
1204.68 *8*	$1/2^+$

† From Eγ.

‡ From Adopted Levels.

ε,$β^+$ radiations

E(decay)	E(level)	I$β^+$ †	Iε†	Log *ft*	I(ε+$β^+$)†	Comments
(158 *3*)	1204.68		2.02 *8*	6.78 *3*	2.02 *8*	εK=0.8483 *6*; εL=0.1233 *5*; εM+=0.02838 *12* εK(exp)=0.765 *22* (1993Be08) from (K x ray)-γ coin; significantly different from theory (0.765 *22*) for allowed transitions.
(1363 *3*)	0	0.0013 *3*	1.4 *3*	9.60^{1u} *15*	1.4 *3*	av Eβ=169.8 *14*; εK=0.8672; εL=0.10764 *2*; εM+=0.024283 *4* I$β^+$: 0.0025% 5 from 1993Hi09; deduced from I(γ±) and I(K x ray, Zr) measured as a function of time for≈590 days in order to differentiate between contributions from ^{91}Nb(60.86 d) and ^{91}Nb(680 y) in source. The measured I$β^+$ implies Iε=2.7% 6 (cf. measured value of 1.4% 4) and log $f^{1u}t$=9.45 *9* based on first-forbidden unique theory. Iε: measured value=1.4% 4 (1993Hi09) (cf. 2.7% 6 expected based on theory and measured I$β^+$); log $f^{1u}t$=9.74 *13* based on measured value. Log *ft*: mean of values obtained based on measured I$β^+$ and Iε (9.45 *9* and 9.74 *13*, respectively).

† Absolute intensity per 100 decays.

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γ(^{91}Zr)

Iγ normalization: From α(105γ, ^{91}Nb)=167 (M4 theory), εK(theory) and I(105γ, ^{91}Nb):Iβ$^+$:I(1205γ):Iε(g.s.)=0.55 *3*:0.0024 *5*:1.92 *8*:1.3 *4* (1993Hi09) in ^{91}Nb(60.86 d) decay, it follows that %Iβ+(to ^{91}Zr g.s.)=0.0025 *5*, %(1205γ)=2.02 *8* and %(ε to ^{91}Zr g.s.)=1.4 *4*, so %(105(γ+ce), ^{91}Nb)=(100-3.4 *5*). 1993Hi09 have corrected their measured Iβ$^+$ for a 6% *2* contribution from 1205γ pair production. (1993Hi09 report slightly different branching because they assume α(105)=174.) Note that Iγ(105γ,^{91}Nb)/Iγ(1205)=0.286 *16* from 1993Hi09, cf. 0.233 *9* (1986Wa34), 0.164 (1955Ha23).

E_γ[†]	I_γ[#]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[‡]	α[@]	Comments
1204.67 *8*	2.02 *8*	1204.68	1/2$^+$	0	5/2$^+$	E2	0.000452 *7*	α=0.000452 *7*; α(K)=0.000392 *6*; α(L)=4.32×10^{-5} *6*; α(M)=7.48×10^{-6} *11*; α(N+..)=9.69×10^{-6} *14* α(N)=1.062×10^{-6} *15*; α(O)=7.47×10^{-8} *11*; α(IPF)=8.55×10^{-6} *12* E_γ: other datum: 1205.0 *7* (1969Be07). I_γ: from 1993Hi09.

† From 1986Wa34.
‡ From Adopted Gammas.
# Absolute intensity per 100 decays.
@ 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.

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Decay Scheme

Intensities: $I_{(\gamma+ce)}$ per 100 parent decays