^{76}Co β^- decay (21.7 ms) 2015So23

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh, Jun Chen and Ameenah R. Farhan	NDS 194,3 (2024)	8-Jan-2024

Parent: ^{76}Co: E=0+x; J^π=(8$^-$); $T_{1/2}$=21.7 ms *+65−49*; Q(β^-)=16530 *syst*; %β^- decay=100

^{76}Co-E,J^π,$T_{1/2}$: From ^{76}Co Adopted Levels.

^{76}Co-Q(β^-): 16530 *580* (syst,2021Wa16).

^{76}Co-%β^- decay: Assumed 100% β^- decay of the 21.7-ms isomer of ^{76}Co.

2015So23: ^{76}Co isomer produced in ^{9}Be(^{238}U,F), E=345 MeV/nucleon reaction with the ^{238}U beam provided by the RIBF accelerator complex at RIKEN facility. Fission fragments were separated and analyzed by BigRIPS separator, transported to focal plane of ZeroDegree spectrometer. Particle identification was achieved by ΔE-tof-Bρ method. Silicon detector stack WAS3ABi was used for ion implantation and β detection. Gamma rays were detected using EURICA array of 12 HPGe cluster detectors arranged in three rings at 51°, 90° and 120° with respect to the beam direction. About 1000 ^{76}Co ions were implanted in the WAS3ABi Si detector stack. Measured Eγ, Iγ, $\gamma\gamma$-coin, $\beta\gamma$(t), half-lives of isomers in ^{76}Co and ^{76}Ni. Deduced levels, J, π, configurations. Monte-Carlo shell-model (MCSM) calculation for level structure of ^{76}Ni, and shell-model calculation with LNPS interaction for structure of ^{76}Co.

The log *ft* value deduced by evaluators is 4.6 *2*, if 100% β^- feeding is assumed to the 2418,(8$^+$) state in ^{76}Ni, and the energy of the (8$^-$) isomer in ^{76}Co is assumed to be close to the ground state of ^{76}Co. This log *ft* value, typical of allowed β transitions is inconsistent with expected first forbidden β transition for (8$^-$) to (8$^+$) transition, suggesting other pathways for the decay of the (8$^-$) isomer, either by β or isomeric transitions.

^{76}Ni Levels

E(level)†	J^π‡	$T_{1/2}$	Comments
0.0	0$^+$		
990.10 *25*	(2$^+$)		
1920.07 *35*	(4$^+$)		
2275.44 *43*	(6$^+$)		
2418.00 *50*	(8$^+$)	547.8 ns *33*	%IT=100 $T_{1/2}$: from γ(t) method, weighted average of values from the four transitions (2015So23). Previous (less precise) measurements: 636 ns *90* (2014Ra20), 409 ns *+58−50* (2012Ka36); 0.59 μs *+18−11* (2005Ma59); 0.24 μs *8* (2004Sa13). Weighted average of all the above values, except the seemingly discrepant result from 2004Sa13, is 547.4 ns *52*, in agreement with the result taken from 2015So23 only.

† Deduced from Eγ values.

‡ As given in Fig. 4 of 2015So23, based on Monte-Carlo shell-model calculations.

γ(^{76}Ni)

Eγ	Iγ†‡	E$_i$(level)	J_i^π	E$_f$	J_f^π	Mult.	α#	I$_{(\gamma+ce)}$‡	Comments
142.56 *25*	87.6 *24*	2418.00	(8$^+$)	2275.44	(6$^+$)	[E2]	0.1482	100.6 *28*	α(K)=0.1319 *21*; α(L)=0.01417 *23*; α(M)=0.00197 *3*; α(N)=7.34×10^{-5} *12*
355.37 *25*	97.7 *21*	2275.44	(6$^+$)	1920.07	(4$^+$)	[E2]	0.00513	98.2 *21*	α(K)=0.00460 *7*; α(L)=0.000463 *7*; α(M)=6.50×10^{-5} *10*; α(N)=2.67×10^{-6} *4*
929.97 *25*	100.1 *25*	1920.07	(4$^+$)	990.10	(2$^+$)	[E2]	2.88×10^{-4}	100.1 *25*	
990.10 *25*	101.7 *26*	990.10	(2$^+$)	0.0	0$^+$	[E2]	2.47×10^{-4}	101.7 *26*	

Continued on next page (footnotes at end of table)

^{76}Co β^- decay (21.7 ms) 2015So23 (continued)

$\gamma(^{76}Ni)$ (continued)

† Deduced from I(γ+ce) values listed by 2015So23 and total theoretical conversion coefficients from BrIcc code.
‡ 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.

^{76}Co β^- decay (21.7 ms) 2015So23

Decay Scheme

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