^{133}Cd β^-n decay (64 ms) 2016Ju02

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh	ENSDF	28-Feb-2018

Parent: ^{133}Cd: E=0; J^π=(7/2$^-$); $T_{1/2}$=64 ms *8*; Q(β^-n)=10420 *SY*; %β^-n decay≈100.0

^{133}Cd-J^π: From ^{133}Cd Adopted Levels in the ENSDF database (Oct 2010 update), based on systematics.

^{133}Cd-$T_{1/2}$: From 2015Lo04. Other: 57 ms *10* (2003ArZX,2005Kr20).

^{133}Cd-Q(β^-n): 10420 *300* (syst,2017Wa10).

^{133}Cd-%β^-n decay: 2016Ju02 assume %β^-n=100 for the decay of ^{133}Cd based on a statement by 2005Kr20. In evaluator′s opinion, 100% β^-n decay mentioned by 2005Kr20 seems a rather casual statement, lacking in solid experimental facts. Also note that theoretical calculations of %β^-n and %β^-2n by 2003Mo09 (and supplementary file) and 2016Ma12 (and supplementary file) are not in agreement with %β^-n=100% for ^{133}Cd decay. Theoretical values are: $T_{1/2}$=186 ms, %β^-n=21.1, %β^-2n=50.3 in 2003Mo09; and $T_{1/2}$=45 ms, %β^-n=18.5, %β^-2n=39.7 in 2016Ma12. In contrast to 100% assumption for %β^-n decay mode, both the theoretical calculations suggest dominance of delayed-two neutron decay of ^{133}Cd to ^{131}In in comparison to delayed-one neutron decay to ^{132}In.

2016Ju02: ^{132}Cd and ^{133}Cd isotopes were produced in ^{9}Be(^{238}U,X),E=345 MeV/nucleon reaction at RIBF-RIKEN, followed by separation of ions of interest using BigRIPS fragment separator and ZeroDegree spectrometer for the analysis of events in terms of atomic number (Z) and mass-to-charge (A/Q) ratio based on Bρ-ΔE-tof method. The BigRIPS separator was optimized for transmission of ^{136}Sn ions. The ^{132},^{133}Cd ions were implanted in the WAS3ABi detection system consisting of DSSSDs for β rays and ions. The gamma rays from radioactive isotopes were detected by 12 large-volume Ge cluster detectors from the EUROBALL spectrometer. Measured Eγ, Iγ, γ rays in coincidence with the decay events within a time window of 200 ms after the implantation of ^{133}Cd ions.

The decay scheme proposed by 2016Ju02 is considered as tentative by the evaluator since several assumptions are involved such as assignment of the observed γ rays to 100% β^-n decay mode of ^{133}Cd, the ordering of the γ rays in the proposed cascade based on pattern of levels calculated from shell model assuming $\pi g_{9/2}^{-1}\otimes\nu f_{7/2}$ multiplet, etc.

A decay scheme consisting of 602-357-227-103-86-50 γ cascade proceeding from (1$^-$) state to (7$^-$) ground state was also considered by 2016Ju02 (see dotted red line in authors′ Fig. 4a), but based on level energies calculated for the $\pi g_{9/2}^{-1}\otimes\nu f_{7/2}$ multiplet from shell model, this scenario was considered unlikely as it gives an energy of the (1$^-$) state about two times larger than the predicted energy by the shell model.

^{132}In Levels

E(level)[†]	J^π	$T_{1/2}$	Comments
0[‡]	(7$^-$)[‡]	200 ms *2*	J^π,$T_{1/2}$: from Adopted Levels.
25?[‡] *25*	(6$^-$)[‡]		
75?[‡] *25*	(5$^-$)[‡]		
161?[‡] *25*	(4$^-$)[‡]		
264?[‡] *25*	(3$^-$)[‡]		
491?[‡] *25*	(2$^-$)[‡]		
848?[‡] *25*	(1$^-$)[‡]		E(level): note that a level of energy ≈800 keV, J^π=(1$^-$) in ^{132}In was proposed from ^{132}Cd β^- decay study by 2000Ha55.

[†] From plot (solid line in red) in Fig. 4a and text of 2016Ju02, based on the assignment of 357-227-103-86-50−(25) γ cascade to a ΔJ=1 sequence of levels from J^π=(1$^-$) to (7$^-$) ground state forming members of $\pi g_{9/2}^{-1}\otimes\nu f_{7/2}$ multiplet from shell model calculations for four different 2-qp configurations for relevant valence protons and neutrons, as described by 2016Ju02 in their Fig. 4a (black solid lines) and text. Evaluator indicates all the excited levels as tentative since the assignment of γ rays to ^{132}In from the β^-n decay of ^{133}Cd and the ordering of the γ rays in the proposed cascade seems tenuous at the moment in the absence of observation of (^{133}Cd)γ correlated events and $\gamma\gamma$-coincidence relationships. Based on a statement by 2005Kr20, 2016Ju02 assume 100% β^-n decay of ^{133}Cd to ^{132}In, however, evaluator′s perusal of 2005Kr20 paper indicates that authors of 2005Kr20 do not seem to claim 100% β^-n decay branch of ^{133}Cd based on solid experimental facts.

[‡] Member of $\pi 0g_{9/2}^{-1}\otimes\nu 1f_{7/2}$ multiplet.

^{133}Cd β^-n decay (64 ms) 2016Ju02 (continued)

$\gamma(^{132}In)$

E_γ [†]	E_i(level)	J_i^π	E_f	J_f^π	Comments
(25 *25*)	25?	(6$^-$)	0	(7$^-$)	A gamma transition of 25 keV *25* is assumed by 2016Ju02 as a missed transition.
50[‡]	75?	(5$^-$)	25?	(6$^-$)	
86[‡]	161?	(4$^-$)	75?	(5$^-$)	
103[‡]	264?	(3$^-$)	161?	(4$^-$)	
227[‡]	491?	(2$^-$)	264?	(3$^-$)	
357[‡]	848?	(1$^-$)	491?	(2$^-$)	
[x]602					This γ ray is proposed by 2016Ju02 to deexcite a higher excitation, from $\pi p^{-1}_{1/2}\otimes\nu f_{7/2}$ or $\pi g^{-1}_{9/2}\otimes\nu p_{3/2}$ multiplet, based on shell-model calculations.

[†] From Fig. 3 and text in 2016Ju02. Assignment to ^{132}In and placements in the decay scheme are considered as tentative by the evaluator due to several assumptions involved in constructing the decay scheme, as explained above in general comments in the dataset.
[‡] Placement of transition in the level scheme is uncertain.
[x] γ ray not placed in level scheme.

^{133}Cd β^-n decay (64 ms) 2016Ju02

Decay Scheme