^{55}Cu ε decay (55.9 ms) 2013Tr09,2022TrZZ

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh	ENSDF	30-Apr-2022

Parent: ^{55}Cu: E=0; J$^{\pi}$=(3/2$^-$); $T_{1/2}$=55.9 ms *18*; Q(ε)=1370×10^1 *16*; %ε+%β^+ decay=100.0

^{55}Cu-J$^{\pi}$,$T_{1/2}$: From ^{55}Cu Adopted Levels.

^{55}Cu-Q(ε): From 2021Wa16.

2013Tr09, 2022TrZZ: ^{55}Cu produced in Be(^{58}Ni^{28+},p2n), E(^{58}Ni)=160 MeV/nucleon particle-transfer reaction, followed by separation using A1900 fragment separator and NSCL Radio Frequency Fragment separation at NSCL-MSU facility. Dominant fragments were ^{54}Ni and ^{55}Cu. The fragments were stopped in a planar Ge double-sided strip detectors (GeDSSD) surrounded by SeGA array of two rings of eight HPGe detectors each on either side. Measured Eγ, Iγ, (implants)β correlated events, $\beta\gamma$-coin, $\gamma\gamma$-coin, $\beta\gamma\gamma$-coin, half-life of ^{55}Cu g.s. decay. Deduced levels, J^{π}, IAS doublet, beta feedings, log *ft* values, isospin mixing, split isobaric analog state (IAS) in ^{55}Ni. Comparison with Shell model calculations using the code COSMO with GXPF1A interaction in the full *fp* shell.

S(p)(^{55}Ni)=4614.9 keV *7* (2021Wa16), thus no delayed protons can be emitted from the IAS doublet identified at 4579+4599. 2013Tr09 state that no protons were detected indicating that delayed proton branch is small. Note that 2007Do17 reported a delayed proton branch of 15.0% *43*, which may have belonged to another activity, as these authors obtained $T_{1/2}$=27 ms *8*, in disagreement with 57 ms *3* from 2013Tr09.

^{55}Ni Levels

E(level)[†]	J$^{\pi}$[‡]	Comments
0.0	7/2$^-$	T_z=−1/2.
2085.4 *4*	3/2$^-$	
2465.5 *4*	(3/2$^-$)	J$^{\pi}$: 3/2$^-$ in 2013Tr09.
2586.9 *5*	(5/2$^-$)	J$^{\pi}$: (3/2)$^-$ in 2013Tr09.
2802.0 *4*	(1/2$^-$)	J$^{\pi}$: (1/2)$^-$ in 2013Tr09.
3182.7 *4*	(5/2$^-$)	J$^{\pi}$: (5/2)$^-$ in 2013Tr09.
3214.1 *7*	(1/2$^-$)	J$^{\pi}$: (1/2)$^-$ in 2013Tr09.
3593.7 *6*	(5/2$^-$)	J$^{\pi}$: (5/2)$^-$ in 2013Tr09.
3808.3 *8*	(1/2$^-$,3/2$^-$)	J$^{\pi}$: (1/2,3/2)$^-$ in 2013Tr09.
4026.8 *6*	(1/2$^-$,3/2$^-$)	J$^{\pi}$: (1/2,3/2)$^-$ in 2013Tr09.
4579.4 *5*	(3/2$^-$)	J$^{\pi}$: 3/2$^-$ in 2013Tr09. E(level),J$^{\pi}$: proton-bound IAS of 3/2$^-$. ^{55}Cu g.s., and mirror state of 4721, 3/2$^-$ state in ^{55}Co.
4599.3 *4*	(3/2$^-$)	J$^{\pi}$: 3/2$^-$ in 2013Tr09. E(level),J$^{\pi}$: proton-bound IAS of 3/2$^-$. ^{55}Cu g.s., and mirror state of 4748, 3/2$^-$ state in ^{55}Co.
5075.5 *9*		

† From least-squares fit to Eγ data.

‡ From Adopted Levels, essentially based on proposed assignments by 2013Tr09 from shell-model calculations and comparison with level structure in mirror nucleus ^{55}Co. Evaluators place most assignments in parentheses for which strong arguments are lacking. The log *ft* values are not used here as there may be unobserved states above the 5076 level since the Q(ε) value is 13.7 MeV.

ε,β^+ radiations

E(decay)	E(level)	Iβ^+[†]	Iε[†]	Log *ft*	I($\varepsilon+\beta^+$)[†]	Comments
(8.62×10^3 *16*)	5075.5	4.0 *8*	0.0048 *10*	4.4 *1*	4.0 *8*	av Eβ=3590 *79*; εK=0.00108 *7*; εL=0.000116 *8*; εM+=1.96×10^{-5} *13* I($\varepsilon+\beta^+$): 4 *1* in 2013Tr09.
(9.10×10^3 *16*)	4599.3	47.3 *8*	0.048 *3*	3.49 *5*	47.3 *8*	av Eβ=3825 *79*; εK=0.00090 *6*; εL=9.7×10^{-5} *6*; εM+=1.64×10^{-5} *10* I($\varepsilon+\beta^+$): 48 *8* in 2013Tr09.

Continued on next page (footnotes at end of table)

^{55}Cu ε decay (55.9 ms) 2013Tr09,2022TrZZ (continued)

ϵ,β^+ radiations (continued)

E(decay)	E(level)	Iβ^+ †	Iε†	Log *ft*	I($\varepsilon+\beta^+$)†	Comments
(9.12×10^3 *16*)	4579.4	18.8 *7*	0.0189 *14*	3.89 *5*	18.8 *7*	av Eβ=3835 *79*; εK=0.00089 *6*; εL=9.6×10^{-5} *6*; εM+=1.63×10^{-5} *10* I($\varepsilon+\beta^+$): 19 *4* in 2013Tr09.
(9.67×10^3 *16*)	4026.8	4.3 *3*	0.0036 *3*	4.67 *5*	4.3 *3*	av Eβ=4108 *80*; εK=0.00073 *5*; εL=7.9×10^{-5} *5*; εM+=1.34×10^{-5} *8* I($\varepsilon+\beta^+$): 4.3 *5* in 2013Tr09.
(9.89×10^3‡ *16*)	3808.3	<0.6		>5.6	<0.6	av Eβ=4217 *80* I($\varepsilon+\beta^+$): 0.4 *1* in 2013Tr09. Evaluators obtain 0.1 *5*.
(1.011×10^4 *16*)	3593.7	0.5 *5*		5.7 *5*	0.5 *5*	av Eβ=4323 *80* I($\varepsilon+\beta^+$): 1.3 *2* in 2013Tr09.
(1.049×10^4 *16*)	3214.1	2.3 *5*	0.0015 *3*	5.1 *1*	2.3 *5*	av Eβ=4511 *80*; εK=0.00056 *3*; εL=6.1×10^{-5} *4*; εM+=1.03×10^{-5} *6* I($\varepsilon+\beta^+$): 2.3 *4* in 2013Tr09.
(1.052×10^4‡ *16*)	3182.7	<0.9		>5.5	<0.9	av Eβ=4526 *80* I($\varepsilon+\beta^+$): 1.4 *2* in 2013Tr09. Evaluators obtain 0.2 *7*.
(1.090×10^4 *16*)	2802.0	4.5 *7*	0.0025 *4*	4.9 *1*	4.5 *7*	av Eβ=4715 *80*; εK=0.000496 *25*; εL=5.4×10^{-5} *3*; εM+=9.0×10^{-6} *5* I($\varepsilon+\beta^+$): 4.6 *5* in 2013Tr09.
(1.111×10^4 *16*)	2586.9	1.6 *5*		5.4 *2*	1.6 *5*	av Eβ=4822 *80* I($\varepsilon+\beta^+$): 1.7 *2* in 2013Tr09.
(1.123×10^4 *16*)	2465.5	7.5 *12*	0.0038 *6*	4.8 *1*	7.5 *12*	av Eβ=4882 *80*; εK=0.000449 *22*; εL=4.85×10^{-5} *24*; εM+=8.2×10^{-6} *4* I($\varepsilon+\beta^+$): 16 *4* in 2013Tr09.
(1.161×10^4 *16*)	2085.4	6.6 *9*	0.0030 *4*	4.9 *1*	6.6 *9*	av Eβ=5071 *80*; εK=0.000403 *19*; εL=4.35×10^{-5} *20*; εM+=7.3×10^{-6} *4* I($\varepsilon+\beta^+$): 7 *2* in 2013Tr09.
(1.370×10^4‡ *16*)	0.0	2.2 *11*		5.8 *2*	2.2 *11*	av Eβ=6107 *80*

† Absolute intensity per 100 decays.

‡ Existence of this branch is questionable.

γ(^{55}Ni)

Iγ normalization: Absolute γ-ray intensities (per 100 decays of ^{55}Cu) are given in 2022TrZZ, obtained from total number of β-correlated implants and the counts and efficiency of the γ-ray counts. With S(p)(^{55}Ni)=4614.9 keV *7*, β-delayed proton decay mode of ^{55}Cu is possible but no protons were detected by 2013Tr09. Note that 2007Do17 reported a β^+-delayed proton branch of 15.0% *43*, which appears questionable as these authors obtained $T_{1/2}$=27 ms *8* for ^{55}Cu decay in contrast to 57 ms *3* by 2013Tr09 and 55.5 ms *18* by 2020Gi02.

E$_\gamma$†	I$_\gamma$†#	E$_i$(level)	J$^\pi_i$	E$_f$	J$^\pi_f$	Comments
336.7 *5*	7.7 *3*	2802.0	(1/2$^-$)	2465.5	(3/2$^-$)	
379.6 *10*	2.2 *2*	2465.5	(3/2$^-$)	2085.4	3/2$^-$	
716.5@ *5*	7.9@‡ *3*	2802.0	(1/2$^-$)	2085.4	3/2$^-$	Total Iγ=11.8 *3*.
716.5@ *5*	3.9@‡ *3*	3182.7	(5/2$^-$)	2465.5	(3/2$^-$)	
748.5 *10*	2.2 *2*	3214.1	(1/2$^-$)	2465.5	(3/2$^-$)	
771.0 *10*	2.0 *2*	4579.4	(3/2$^-$)	3808.3	(1/2$^-$,3/2$^-$)	
985.7 *10*	2.2 *2*	4579.4	(3/2$^-$)	3593.7	(5/2$^-$)	
1005.8 *10*	1.7 *1*	4599.3	(3/2$^-$)	3593.7	(5/2$^-$)	

Continued on next page (footnotes at end of table)

^{55}Cu ε decay (55.9 ms) 2013Tr09,2022TrZZ (continued)

γ(^{55}Ni) (continued)

E_γ[†]	I_γ[†#]	E_i(level)	J^π_i	E_f	J^π_f	Comments
1128.6[@] *10*	1.8[@‡] *3*	3214.1	(1/2⁻)	2085.4	3/2⁻	Total Iγ=3.2 *3*.
1128.6[@] *10*	1.4[@‡] *3*	3593.7	(5/2⁻)	2465.5	(3/2⁻)	
1267[&] *2*	0.6 *1*	5075.5		3808.3	(1/2⁻,3/2⁻)	
1342.6 *10*	2.5 *2*	3808.3	(1/2⁻,3/2⁻)	2465.5	(3/2⁻)	
1385.1 *10*	1.7 *2*	4599.3	(3/2⁻)	3214.1	(1/2⁻)	
1396.3 *5*	3.9 *3*	4579.4	(3/2⁻)	3182.7	(5/2⁻)	
1416.3 *5*	6.1 *3*	4599.3	(3/2⁻)	3182.7	(5/2⁻)	
1561.3 *5*	4.3 *3*	4026.8	(1/2⁻,3/2⁻)	2465.5	(3/2⁻)	
1777.8 *5*	6.8 *4*	4579.4	(3/2⁻)	2802.0	(1/2⁻)	
1797.0 *5*	4.3 *3*	4599.3	(3/2⁻)	2802.0	(1/2⁻)	
1992.5 *10*	3.9 *3*	4579.4	(3/2⁻)	2586.9	(5/2⁻)	
2085.6 *5*	23.2 *4*	2085.4	3/2⁻	0.0	7/2⁻	
2133.9 *5*	29.4 *5*	4599.3	(3/2⁻)	2465.5	(3/2⁻)	
2465.3 *5*	59.8 *7*	2465.5	(3/2⁻)	0.0	7/2⁻	
2514.3 *5*	4.1 *3*	4599.3	(3/2⁻)	2085.4	3/2⁻	
2586.9 *5*	5.5 *4*	2586.9	(5/2⁻)	0.0	7/2⁻	
2610 *1*	3.1 *3*	5075.5		2465.5	(3/2⁻)	
2990[&] *2*	0.9 *2*	5075.5		2085.4	3/2⁻	
3182.5 *5*	6.3 *4*	3182.7	(5/2⁻)	0.0	7/2⁻	
3593.5 *10*	3.0 *3*	3593.7	(5/2⁻)	0.0	7/2⁻	

[†] From 2022TrZZ. Uncertainties for intensities are statistical only.
[‡] Intensity split is based on γγ-coin data as state by 2022TrZZ.
[#] Absolute intensity per 100 decays.
[@] Multiply placed with intensity suitably divided.
[&] Placement of transition in the level scheme is uncertain.

^{55}Cu ε decay (55.9 ms) 2013Tr09,2022TrZZ

Decay Scheme

Intensities: I_γ per 100 parent decays

@ Multiply placed: intensity suitably divided

Legend

- $I_\gamma < 2\% \times I_\gamma^{max}$
- $I_\gamma < 10\% \times I_\gamma^{max}$
- $I_\gamma > 10\% \times I_\gamma^{max}$
- γ Decay (Uncertain)