^{138}Eu ε decay 1986Re11,1992Si22

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	Jun Chen	NDS 146, 1 (2017)	30-Sep-2017

Parent: ^{138}Eu: E=0.0; J$^\pi$=(6$^-$); $T_{1/2}$=12.1 s *6*; Q(ε)=9750 *30*; %ε+%β^+ decay=100.0

^{138}Eu-J$^\pi$,$T_{1/2}$: From Adopted Levels of ^{138}Eu. The adopted half-life is from 1986Re11. Others: 12 s *1* from 1987Ke05 (also1986MlZX), 12 s *2* from 1982No15.

^{138}Eu-Q(ε): From 2017Wa10.

1986Re11 (also 1985Ch25, 1987Pl05): ^{138}Eu source was produced via the ^{35}Cl+^{106}Cd reaction with E=191 MeV ^{35}Cl beam from the SARA accelerator at Grenoble incident on 1-3 mg/cm^2 self-supporting enriched foils of ^{106}Cd. Reaction products were mass-separated and transported to a counting station. γ rays and X rays were detected with Ge detectors. Measured Eγ, Iγ, E(X ray), $\gamma\gamma$-coin, Xγ-coin. Deduced levels, J, π, band structures. Systematics of neighbouring nuclei.

1992Si22: ^{138}Eu source was produced via ^{48}Ti+^{98,96}Mo reaction with E=210-220 MeV ^{48}Ti beam. Reaction products were separated by the Daresbury isotope separator DOLIS and implanted into a polycrystalline iron foil thermally attached to the copper cold finger of the on-line dilution refrigerator. γ rays were detected with four large Ge detectors. Measured Eγ, γ-ray anisotropy vs temperature, time. Deduced levels, J, π, γ-ray multipolarities, parent $T_{1/2}$. Other: 1987Ke05, 1986MlZX, 1982No15.

From log *ft*≈5.2 to 6$^+$ and ≈5.5 to 8$^+$, derived from intensity imbalance by 1986Re11, J^π(^{138}Eu, g.s.) is suggested to be 7$^+$ which is in conflict with its μ measurement (1989SiZV). The decay scheme seems to be incomplete due to the large gap between Q-value and the highest level energy and, therefore, β feedings and deduced log *ft* are unreliable and not given.

^{138}Sm Levels

E(level)†	J$^\pi$‡	$T_{1/2}$‡	E(level)†	J$^\pi$‡	E(level)†	J$^\pi$‡
0.0#	0$^+$	3.1 min *2*	1576.9# *5*	6$^+$	2258.2 *5*	
346.71# *24*	2$^+$	40 ps *6*	1655.8 *3*	(4$^+$)	2352.0# *6*	8$^+$
745.59@ *24*	(2$^+$)		1732.6@ *4*	(5$^+$)	2500.7@ *5*	(7$^+$)
891.3# *3*	4$^+$		2097.1 *4*		2508.7 *6*	(7$^-$)
1084.0@ *3*	(3$^+$)		2105.0@ *5*	(6$^+$)	2560.4 *5*	
1398.7@ *3*	(4$^+$)		2237.7 *5*		2955.9 *6*	(8$^+$)

† From a least-squares fit to γ-ray energies.
‡ From Adopted Levels.
\# Band(A): g.s. band.
@ Band(B): γ-vibrational band.

γ(^{138}Sm)

E$_\gamma$‡	I$_\gamma$‡	E$_i$(level)	J$^\pi_i$	E$_f$	J$^\pi_f$	Mult.#	α†	Comments
338.0 *3*	140	1084.0	(3$^+$)	745.59	(2$^+$)	(M1+E2)	0.049 *10*	α(K)=0.041 *10*; α(L)=0.0067 *3*; α(M)=0.00145 *5* α(N)=0.000326 *12*; α(O)=4.7×10^{-5} *4*; α(P)=2.4×10^{-6} *8* Mult.: anisotropy=−0.14 *5* (1992Si22).
346.7 *3*	1000	346.71	2$^+$	0.0	0$^+$	E2	0.0362	α(K)=0.0287 *4*; α(L)=0.00584 *9*; α(M)=0.001294 *19* α(N)=0.000289 *5*; α(O)=4.02×10^{-5} *6*; α(P)=1.579×10^{-6} *23* Mult.: anisotropy=−0.28 *1* (1992Si22).
399.0 *3*	225	745.59	(2$^+$)	346.71	2$^+$	(M1+E2)	0.031 *8*	α(K)=0.026 *7*; α(L)=0.0041 *5*; α(M)=0.00088 *8* α(N)=0.000199 *19*; α(O)=2.9×10^{-5} *4*; α(P)=1.6×10^{-6} *5* Mult.: anisotropy=−0.01 *4* (1992Si22).
441.5 *3*	85	2097.1		1655.8	(4$^+$)			

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^{138}Eu ε decay 1986Re11,1992Si22 (continued)

γ(^{138}Sm) (continued)

E_γ[‡]	I_γ[‡]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[#]	α[†]	Comments
507.5 *3*	50	1398.7	(4$^+$)	891.3	4$^+$			
544.5 *3*	550	891.3	4$^+$	346.71	2$^+$	E2	0.01025	α(K)=0.00847 *12*; α(L)=0.001402 *20*; α(M)=0.000306 *5* α(N)=6.87×10^{-5} *10*; α(O)=9.88×10^{-6} *14*; α(P)=4.91×10^{-7} *7* Mult.: anisotropy=−0.45 *1* (1992Si22).
571.3 *3*	100	1655.8	(4$^+$)	1084.0	(3$^+$)	(M1+E2)	0.012 *4*	α(K)=0.010 *3*; α(L)=0.0015 *3*; α(M)=0.00032 *6* α(N)=7.3×10^{-5} *14*; α(O)=1.08×10^{-5} *22*; α(P)=6.3×10^{-7} *20* Mult.: anisotropy=−0.33 *7* (1992Si22).
602.4 *3*	35	2258.2		1655.8	(4$^+$)			
648.8 *3*	210	1732.6	(5$^+$)	1084.0	(3$^+$)	(E2)	0.00661	α(K)=0.00551 *8*; α(L)=0.000861 *13*; α(M)=0.000187 *3* α(N)=4.20×10^{-5} *6*; α(O)=6.11×10^{-6} *9*; α(P)=3.23×10^{-7} *5* Mult.: anisotropy=−0.40 *2* (1992Si22).
652.9 *3*	150	1398.7	(4$^+$)	745.59	(2$^+$)	(E2)	0.00651	α(K)=0.00543 *8*; α(L)=0.000847 *12*; α(M)=0.000184 *3* α(N)=4.13×10^{-5} *6*; α(O)=6.01×10^{-6} *9*; α(P)=3.18×10^{-7} *5* Mult.: anisotropy=−0.46 *3* (1992Si22).
685.6 *3*	410	1576.9	6$^+$	891.3	4$^+$	E2	0.00579	α(K)=0.00484 *7*; α(L)=0.000744 *11*; α(M)=0.0001611 *23* α(N)=3.63×10^{-5} *5*; α(O)=5.29×10^{-6} *8*; α(P)=2.85×10^{-7} *4* Mult.: anisotropy=−0.48 *1* (1992Si22).
698.2 *3*	50	2097.1		1398.7	(4$^+$)			
706.2 *3*	70	2105.0	(6$^+$)	1398.7	(4$^+$)	(E2)	0.00540	α(K)=0.00452 *7*; α(L)=0.000689 *10*; α(M)=0.0001491 *21* α(N)=3.36×10^{-5} *5*; α(O)=4.90×10^{-6} *7*; α(P)=2.66×10^{-7} *4* Mult.: anisotropy=−0.50 *5* (1992Si22).
737.2 *3*	190	1084.0	(3$^+$)	346.71	2$^+$	(M1+E2)	0.0065 *17*	α(K)=0.0056 *15*; α(L)=0.00078 *17*; α(M)=0.00017 *4* α(N)=3.8×10^{-5} *8*; α(O)=5.6×10^{-6} *13*; α(P)=3.4×10^{-7} *10* Mult.: anisotropy=−0.57 *2* (1992Si22).
745.6 *3*	110	745.59	(2$^+$)	0.0	0$^+$	(E2)	0.00475	α(K)=0.00399 *6*; α(L)=0.000600 *9*; α(M)=0.0001295 *19* α(N)=2.92×10^{-5} *4*; α(O)=4.28×10^{-6} *6*; α(P)=2.35×10^{-7} *4* Mult.: anisotropy=−0.38 *4* (1992Si22).
768.1 *3*	180	2500.7	(7$^+$)	1732.6	(5$^+$)			
775.1 *3*	125	2352.0	8$^+$	1576.9	6$^+$	E2	0.00435	α(K)=0.00366 *6*; α(L)=0.000544 *8*; α(M)=0.0001174 *17* α(N)=2.65×10^{-5} *4*; α(O)=3.88×10^{-6} *6*; α(P)=2.16×10^{-7} *3* Mult.: anisotropy=−0.39 *3* (1992Si22).
827.8 *3*	50	2560.4		1732.6	(5$^+$)			
838.9 *3*	60	2237.7		1398.7	(4$^+$)			
841.1 *3*	25	1732.6	(5$^+$)	891.3	4$^+$			
850.9 *3*	45	2955.9	(8$^+$)	2105.0	(6$^+$)	(E2)	0.00352	α(K)=0.00297 *5*; α(L)=0.000433 *6*; α(M)=9.33×10^{-5} *13* α(N)=2.10×10^{-5} *3*; α(O)=3.10×10^{-6} *5*;

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^{138}Eu ε decay 1986Re11,1992Si22 (continued)

$\gamma(^{138}Sm)$ (continued)

E_γ ‡	I_γ ‡	E_i(level)	J_i^π	E_f	J_f^π	Mult.#	α †	Comments
								α(P)=1.762×10^{-7} *25* Mult.: anisotropy=−0.53 *5* (1992Si22).
911.0 *3*	30	1655.8	(4$^+$)	745.59	(2$^+$)			
931.8 *3*	50	2508.7	(7$^-$)	1576.9	6$^+$	(E1)	1.18×10^{-3}	α(K)=0.001013 *15*; α(L)=0.0001306 *19*; α(M)=2.78×10^{-5} *4* α(N)=6.28×10^{-6} *9*; α(O)=9.39×10^{-7} *14*; α(P)=5.86×10^{-8} *9*

† Additional information 1.
‡ From 1986Re11, with mean ΔEγ=0.3 keV and ΔIγ=10%.
# From Adopted Gammas. The basis from this dataset for these assignments are γ-ray anisotropies from 1992Si22, given in comments.

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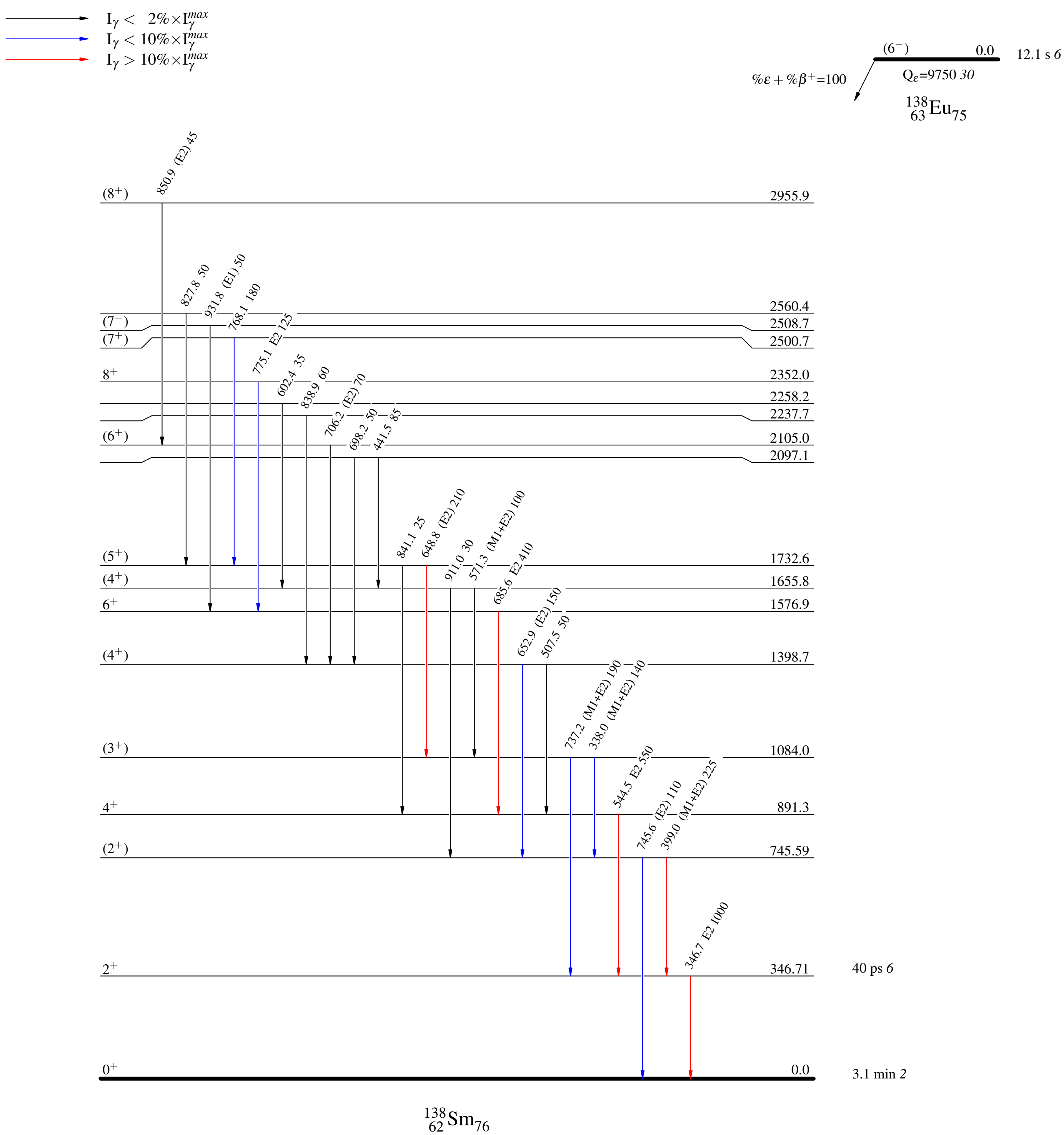
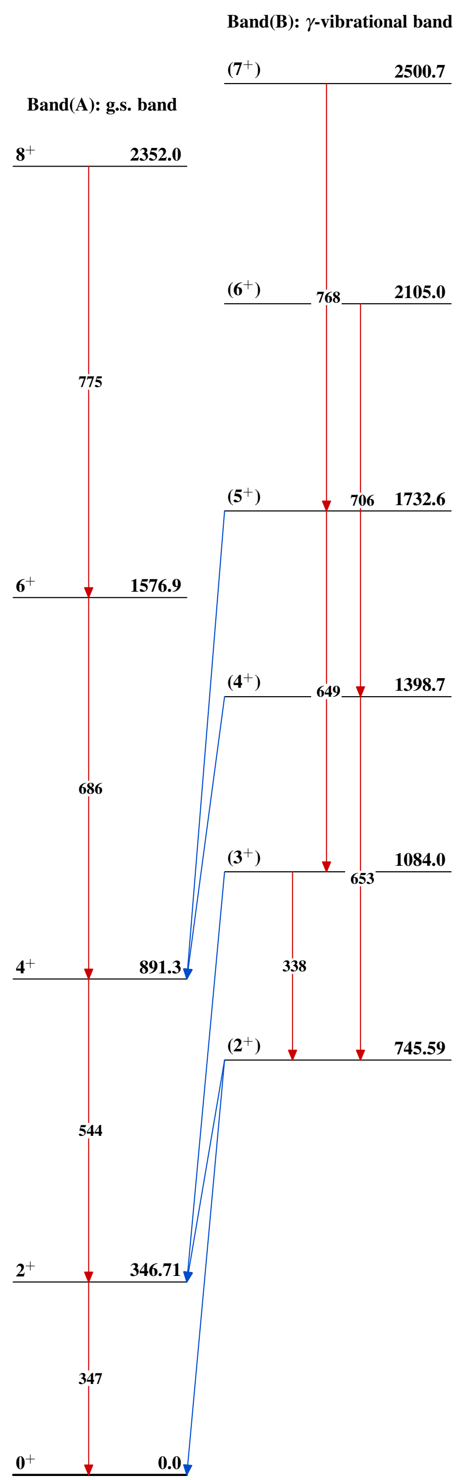
Decay Scheme

Intensities: Relative I_γ



^{138}Eu ε decay 1986Re11,1992Si22



$^{138}_{62}Sm_{76}$