^{48}Fe ε decay 2016Or03,2007Do17,1996Fa09

Type	Author	History Citation	Literature Cutoff Date
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Parent: ^{48}Fe: E=0.0; $J^\pi=0^+$; $T_{1/2}$=45.5 ms *8*; Q(ε)=11290 *90*; %ε+%$β^+$ decay=100.0

^{48}Fe-$T_{1/2}$: From Adopted Levels of ^{48}Fe. Adopted value is weighted average of 51 ms *3* (2016Or03), 45.3 ms *6* (2007Do17), and 44 ms *7* (1996Fa09) in this study.

^{48}Fe-Q(ε): From 2021Wa16.

^{48}Fe-%ε+%$β^+$ decay: %εp=15.3 *8* from Adopted Levels of ^{48}Fe, weighted average of 14.4 *7* (2016Or03) and 15.9 *6* (2007Do17). Other: >3.6 *11* for E(p)=959 keV *33* (1996Fa09). Total ε+$β^+$ feeding obtained in 2016Or03 is 87% *14*. 2016Or03 mention that missing ε+β feeding of 13% *14* could be due to either the unobserved feeding to the IAS (theoretical value is 49% *3* as compared to the experimental value of 35% *5*) or due to unobserved but expected states near 2288,1^+ and 2406,1^+ as reported by 2016Ga23 in the mirror nucleus ^{48}V in ^{48}Ti(^{3}He,t)^{48}V reaction.

2016Or03: ^{48}Fe source was produced via fragmentation of E=74.5 MeV/nucleon ^{58}Ni beam from the LISE3 facility of GANIL on a 200 μg natural Ni target. Fragments were selected by the LISE3 separator by energy loss, residual energy and time-of-flight, and implanted into a double-sided silicon strip detector (DSSSD). Time-of-flight of the selected ions was measured as the time-difference between the cyclotron radio frequency and the signal from a silicon ΔE detector placed upstream from the DSSSD. γ rays were detected by four EXOGAM Ge Clover detectors. Measured Eγ, Iγ, E(p), I(p), particle-γ-coin, implant-p time correlation. Deduced levels, J, π, parent $T_{1/2}$, β-decay branching ratios, B(GT) and B(F) values.

2007Do17: ^{48}Fe source was produced via fragmentation of 74.5 MeV/nucleon ^{58}Ni from SISSI-LISE3 facility of GANIL on a 250 mg/cm^2 natural Ni target. Fragment were selected by the ALPHA-LISE3 separator by energy loss, residual energy and time-of-flight using two micro-channel plate (MCP) detectors and Si detectors, and were implanted into double-sided silicon-strip detectors (DSSSD) and a thick Si(Li) detector for detecting implanted events, charged particles and β particles. γ rays were detected by four Ge detectors. Measured Eγ, Iγ, E(p), I(p), particle-γ-coin, implant-p time correlation. Deduced levels, J, π, parent $T_{1/2}$.

1996Fa09: ^{48}Fe source was produced via fragmentation of 650 MeV/nucleon ^{58}Ni beam from the SIS synchrotron on a 6019 mg/cm^2 Be target. Fragments were separated by the FRS separator by the magnetic rigidity, energy loss and time of flight, and implanted into the MUSIC detectors of two ionization chambers followed by an adjustable-energy degrader. Measured E(p), I(p), implant-p time correlation. Deduced parent $T_{1/2}$, proton-decay branching ratio.

All data are from 2016Or03, unless otherwise noted.

The decay scheme is considered as incomplete by the evaluator due to a large gap (≈6.5 MeV) between Q-value and the highest level reported in the decay scheme.

^{48}Mn Levels

E(level)‡	J^π†	Comments
0	4^+	T=1 T_z=−1.
313.3 *4*	(2^+)	
403.2 *8*	1^+	
3036.8 *9*	0^+	%p=14 *2* (2016Or03) T=2 E(level): IAS of ^{48}Fe g.s. E_p(c.m)=1018 *10*, %I_p=4.8 *3*. T_z=−1.
3204# *14*	1^+	%p=100 E_p(c.m)=1186 *10*, %I_p=1.0 *3*.
3495# *14*	1^+	%p=100 E_p(c.m)=1477 *10*, %I_p=1.8 *3*.
3619?#@ *14*	1^+	%p=100 E_p(c.m)=1601 *10*, %I_p=0.9 *3*.
3713# *14*	1^+	%p=100 E_p(c.m)=1695 *10*, %I_p=1.3 *2*.

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^{48}Fe ε decay 2016Or03,2007Do17,1996Fa09 (continued)

^{48}Mn Levels (continued)

E(level)‡	Jπ†	Comments
4299?#@ *14*	1^+	%p=100 E(level): 2281-keV proton peak, which gives a 4299-keV level in ^{48}Mn, may also be explained as entirely feeding the 98-keV level in ^{47}Cr, thus giving a level at 4399 keV in ^{48}Mn. E_p(c.m)=2281 *10*, %I_p=1.2 *3*.
4399# *14*	1^+	%p=100 E_p(c.m)=2381 *10*, %I_p=0.9 *4*.
4517# *14*	1^+	%p=100 E_p(c.m)=2499 *10*, %I_p=1.3 *5*.
4755# *14*	1^+	%p=100 E_p(c.m)=2737 *10*, %I_p=0.8 *1*.

† From Adopted Levels. For levels above 313-keV level, the adopted assignments are from 2016Or03 based on allowed β feedings.
‡ From Eγ data for levels with deexciting gammas and otherwise from proton energies in 2016Or03, where available.
# E_p(c.m.)+S(p)(^{48}Mn, where S(p)=2018 keV *10* deduced by 2016Or03 from IMME analysis of T=2 multiplet.
@ The 3619- and 4299-keV levels in ^{48}Mn implied from the 1601- and 2281-keV proton peaks (2016Or03), respectively feeding the g.s. of ^{47}Cr, may also be explained as both feeding only the 98-keV level in ^{47}Cr, thus giving levels at 3713 and 4399 keV, respectively in ^{48}Mn.

ε,β+ radiations

B(GT) and B(F) are transition strengths for allowed Gamow-Teller and Fermi β transitions, respectively (2016Or03).

E(decay)	E(level)	Iβ+ ‡	Iε‡	Log *ft*	I(ε+β+)†‡	Comments
(6.54×10^3 *9*)	4755	0.8 *1*	0.002	4.4 *1*	0.8 *1*	av Eβ=2564 *45*; εK=0.00182 *10*; εL=0.000191 *10*; εM+=3.33×10^{-5} *17* B(GT)=0.10 *2*.
(6.77×10^3 *9*)	4517	1.3 *5*	0.0023 *9*	4.3 *2*	1.3 *5*	av Eβ=2681 *45*; εK=0.00161 *8*; εL=0.000169 *9*; εM+=2.94×10^{-5} *15* B(GT)=0.16 *6*.
(6.89×10^3 *9*)	4399	0.9 *4*	0.002 *1*	4.5 *2*	0.9 *4*	av Eβ=2739 *45*; εK=0.00152 *8*; εL=0.000159 *8*; εM+=2.77×10^{-5} *14* B(GT)=0.10 *4*.
(6.99×10^{3}# *9*)	4299?	1.2 *3*	0.0019 *5*	4.4 *1*	1.2 *3*	av Eβ=2788 *45*; εK=0.00144 *7*; εL=0.000151 *7*; εM+=2.63×10^{-5} *13* B(GT)=0.13 *3*.
(7.58×10^3 *9*)	3713	1.3 *2*	0.0016 *3*	4.6 *1*	1.3 *2*	av Eβ=3075 *45*; εK=0.00109 *5*; εL=0.000115 *5*; εM+=2.00×10^{-5} *9* B(GT)=0.10 *2*.
(7.67×10^{3}# *9*)	3619?	0.9 *3*	0.001	4.7 *2*	0.9 *3*	av Eβ=3122 *45*; εK=0.00105 *5*; εL=0.000110 *5*; εM+=1.91×10^{-5} *8* B(GT)=0.06 *2*.
(7.80×10^3 *9*)	3495	1.8 *3*	0.0020 *3*	4.5 *1*	1.8 *3*	av Eβ=3183 *45*; εK=0.00099 *4*; εL=0.000104 *5*; εM+=1.81×10^{-5} *8* B(GT)=0.12 *2*.
(8.09×10^3 *9*)	3204	1.0 *3*		4.8 *2*	1.0 *3*	av Eβ=3326 *45* B(GT)=0.06 *2*.
(8.25×10^3 *9*)	3036.8	35 *5*	0.032 *5*	3.3 *1*	34.8 *50*	av Eβ=3408 *45*; εK=0.00082 *3*; εL=8.6×10^{-5} *4*;

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^{48}Fe ε decay 2016Or03,2007Do17,1996Fa09 (continued)

ε,β+ radiations (continued)

E(decay)	E(level)	Iβ+ ‡	Iε‡	Log *ft*	I(ε+β+)†‡	Comments
						εM+=1.49×10^{-5} *6* I(ε+β+): from measured %Iγ and %I$_p$ in 2016Or03. Theoretical calculation gives 49% *3* (2016Or03). B(F)=2.8 *4*.
(1.089×10^4 *9*)	403.2	42 *15*	0.015 *6*	3.9 *2*	42 *15*	av Eβ=4711 *45*; εK=0.000326 *9*; εL=3.41×10^{-5} *10*; εM+=5.95×10^{-6} *17* I(ε+β+): from γ-intensity balance, assuming (by the evaluator) that Iγ=74 *14* given in 2016Or03 for 90γ (as M1) has been corrected for conversion electrons. If not, the value of I(ε+β+) should be 45 *15*. B(GT)=0.47 *17*.

† From 2016Or03 based on measured absolute proton emission probabilities as given under comments, unless otherwise note.
‡ Absolute intensity per 100 decays.
# Existence of this branch is questionable.

γ(^{48}Mn)

Eγ	Iγ†	E$_i$(level)	J$_i^\pi$	E$_f$	J$_f^\pi$	Mult.	α‡	Comments
89.9 *6*	72 *14*	403.2	1$^+$	313.3	(2$^+$)	(M1)	0.040	Eγ: from 2007Do17. Other: 90 *1* (2016Or03). Iγ: from 2016Or03. Mult.: possible assignment deduced from γ-intensity balance at 313-keV level.
313.3 *4*	63 *6*	313.3	(2$^+$)	0	4$^+$			Eγ: from 2007Do17. Other: 313 *1* (2016Or03). Iγ: weighted average of 65 *13* (2016Or03) and 63 *6* (2007Do17).
2633.5 *5*	30 *5*	3036.8	0$^+$	403.2	1$^+$			Eγ,Iγ: from 2007Do17. This line was observed only partially due to some problems with the data acquisition system in 2016Or03.

† 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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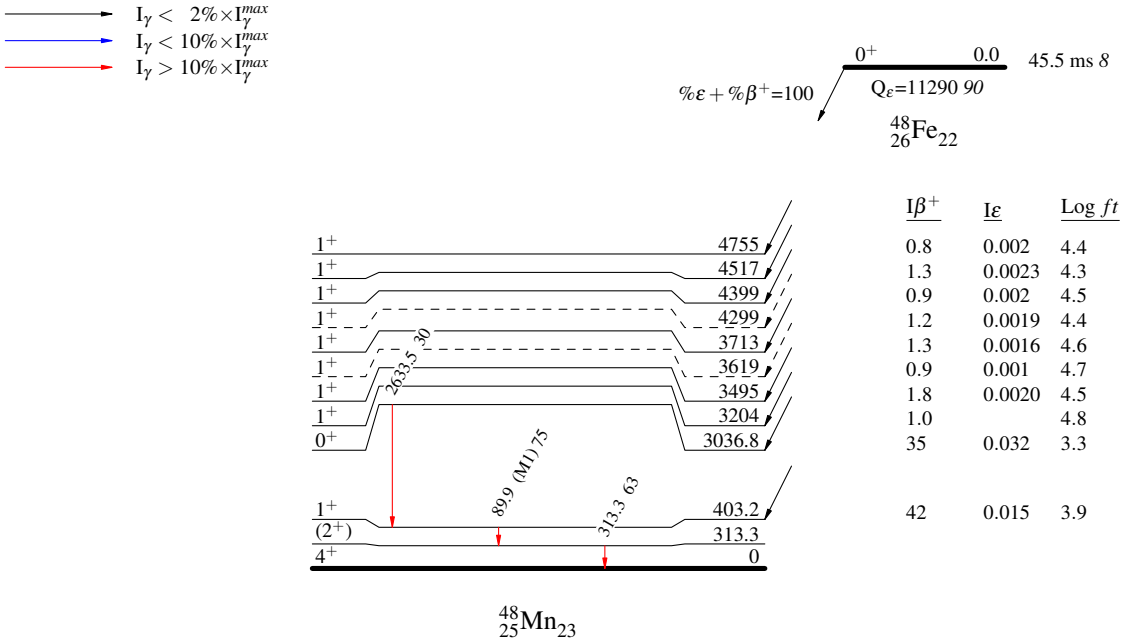
Decay Scheme

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



	Iβ+	Iε	Log *ft*
	0.8	0.002	4.4
	1.3	0.0023	4.3
	0.9	0.002	4.5
	1.2	0.0019	4.4
	1.3	0.0016	4.6
	0.9	0.001	4.7
	1.8	0.0020	4.5
	1.0		4.8
	35	0.032	3.3
	42	0.015	3.9