^{57}Fe(γ,γ): Mossbauer

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	M. R. Bhat	NDS 85, 415 (1998)	24-Sep-1998

Includes ^{57}Co ε decay Mossbauer experiments.

The following groups, using polarized iron foils, obtained the Mossbauer absorption σ_0 at room temperature and deduced $\alpha(14.4\gamma)$, assuming J_f=3/2 and J_i=1/2: 1965Ha34 (enriched foils); 1965Ki03 (natural foil); 1965Nu01 (natural foil); and 1970Jo30 (natural foils).

Additional information 1.

Others: the 14.4γ arising from ^{57}Co ε decay has been used extensively in Mossbauer spectroscopy. See 1989Ra17 for measurements related to the determination of μ's and Q's and 1970Ra51 and recent references for other measurements. 1989Sm04 compared the $T_{1/2}$ of the 14.4-keV level excited by γ rays with the $T_{1/2}$ for spontaneous decay. 1985Da10 measured isomer shift for ^{57}Fe.

^{57}Fe Levels

See 1972Ru04 (Mossbauer,$\gamma\gamma$(t)) for chemical effects in $T_{1/2}$(14.4 state).

E(level)†	Jπ†	Comments
0.0	1/2−	Q=+0.21 *3* (1969Ch08,1969Ch03) Q: ^{57}Co-doped Mg oxide. Measured Q splitting.
14.413‡ *3*	3/2−	Q=+0.283 *35* (1968Ar08) Q: ^{57}Co in Pd source, α-Fe oxide absorber. Measured Mossbauer-effect Q interactions.
136.4745 *12*	5/2−	g=−0.39 *4* (1967He04) g: ^{57}Co source, ^{57}Fe scatterer. Measured 6.4 K x ray and observed partially resolved 136-keV hfs. The sign of the g-factor is discrepant with the adopted for μ and with g=+ 0.366 *18* from inelastic scattering.

† From Adopted Levels, except as noted.

‡ From 14.413γ.

$\gamma(^{57}Fe)$

Time reversal invariance and parity nonconservation studies: 1977Ch30,1976Ch14: measured linear polarization of the 122γ and deduced the relative phase of E2,M1 (^{57}Co in Fe source; Compton polarimeter). Results are consistent with time reversal invariance. 1980Da12: analyzed atomic processes which have to be considered in the analysis of time reversal and Mossbauer absorption experiments. 1987In03: measured the asymmetry of photon emission by polarized ^{57}Fe nuclei for the 14.4 keV transition. Deduced the ratio of reduced matrix element of an E1 transition due to a possible spatial parity violation to the reduced matrix element of the regular M1 transition to be 2.9×10^{-4} *6*. 1989Be10, 1993Be24: reanalysis of the time reversal experiment of 1977Ch30 in terms of nucleon-nucleon potential models. 1993Su17: estimate of circular polarization of the 14.4 keV Mossbauer transition and comparison with experimental data. 1996Re07: experimental limits on the interference of M1 and E2 multipoles in the γ transitions in ^{57}Fe are used to set limit on the strength of time-reversal-violating parity conserving interaction.

E_i(level)	J_i^π	E_γ†	E_f	J_f^π	α[a]	Comments
14.413	3/2−	14.413# *3*	0.0	1/2−	8.18@ *11*	M23/M1=0.08173 *51*; N1/M1=0.0381 *25* M23/M1,N1/M1: from 1979Sa32 (^{57}Fe in Au; iron-free spectrometer). See also 1976Sh30, 1973Sh01, and 1972Fu08; these measurements show chemical effects on the outer-shell ratios and spectral shapes.

Continued on next page (footnotes at end of table)

^{57}Fe(γ,γ): Mossbauer (continued)

γ(^{57}Fe) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†‡]	E_f	J_f^π	Mult.	δ	Comments
136.4745	5/2⁻	122.0614[&] *4*	100 *10*	14.413	3/2⁻	M1+E2	−0.15 *4*	Mult.,δ: from γγ(θ,h) (1963De04, NaI). δ=−2.580 *24* less likely since it would give too large an E2 transition probability.
		136.4743[&] *5*	12.0 *12*	0.0	1/2⁻	E2		Mult.: from adopted gammas; assumed by 1977Ch30.

† From adopted gammas, except as noted.
‡ Relative photon branching from each level. 1977Ch30 assumed Iγ(122γ)=89% and Iγ(136γ)=11% from 1967Le24.
# From 1978Co12. Center of resonance curve. Monochromatic synchrotron radiation (≈ 3 eV width; cryst); ce detected by channeltron.
@ From adopted gammas; 8.21 *15* from the evaluation of 1984HaZS based on σ_0.
& Not separated in polarimeter of 1977Ch30.
a 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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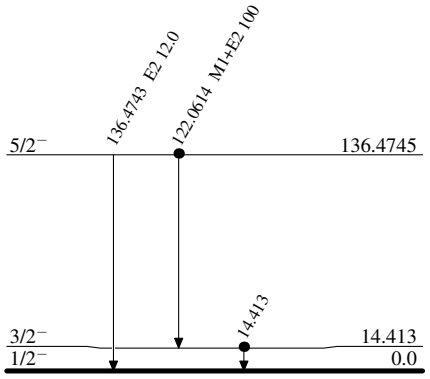
Legend

Level Scheme

Intensities: Relative photon branching from each level



● Coincidence

$^{57}_{26}Fe_{31}$