

$^{171}\text{Ir}$   $\alpha$  decay (1.27 s)    2023Zh03,2013An10,2014Pe02

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh and Jun Chen	NDS 191,1 (2023)	22-Aug-2023

Parent:  $^{171}\text{Ir}$ : E=0+x;  $J^\pi=(11/2^-)$ ;  $T_{1/2}=1.27$  s 5;  $Q(\alpha)=5997$  12; % $\alpha$  decay=62 5

$^{171}\text{Ir}$ -E, $J^\pi$ : From  $^{171}\text{Ir}$  Adopted Levels in the ENSDF database (June 2018 update).

$^{171}\text{Ir}$ -T<sub>1/2</sub>: weighted average of 1.28 s 4 (2023Zh03), weighted average of values from decays of the two alpha lines), 1.14 s 5 (2014Pe02), 1.4 s 1 (2010An01), 1.15 s +13-11 (2002Ro17), 1.3 s 2 (1996Pa01), 1.6 s 2 (1992Sc16), 1.4 s 2 (1978Ca11), 1.6 s 1 (1978Sc26), 1.7 s 4 (1978Ca11); and 1.0 s 3 (1967Si02). Reduced  $\chi^2=2.8$  is somewhat higher than 1.9 at 95% confidence level.

$^{171}\text{Ir}$ -Q( $\alpha$ ): 5997 12 from systematics (2021Wa16).

$^{171}\text{Ir}$ -% $\alpha$  decay: % $\alpha$ =62 5 (2023Zh03). Other: 54 5 from  $^{171}\text{Ir}$  Adopted Levels in the ENSDF database (June 2018 update), where data are from 2010An01 and 1996Pa01.

2023Zh03:  $^{171m}\text{Ir}$  produced in  $^{92}\text{Mo}(^{83}\text{Kr},p3n)$ , E( $^{83}\text{Kr}$ )=383 MeV, followed by separation of fragments of interest using RITU in-flight separator at the University of Jyvaskyla cyclotron facility. The  $^{171m}\text{Ir}$  nuclei and decay radiations were detected using GREAT spectrometer and JUROGAM II array of 15 Eurogam Phase I and 24 Euroball clover Compton-suppressed HPGe detectors. Measured E $\alpha$ , I $\alpha$ , E $\gamma$ , I $\gamma$ ,  $\alpha\gamma$ -coin,  $\alpha$ -branching ratios, K-conversion coefficients for  $\gamma$  rays, half-life of  $^{171m}\text{Ir}$  decay. Deduced levels in  $^{167}\text{Re}$ , and  $\alpha$ -hindrance factors.

2014Pe02: measured E $\alpha$  and half-life of  $^{171}\text{Ir}$   $\alpha$  decay.

2013An10, 2010An01:  $^{171}\text{Ir}$  from  $\alpha$  decay chain of  $^{179}\text{Tl}$  produced in two reactions. First reaction E(p)=1.4 GeV at ISOLDE. Target=50 g/cm<sup>2</sup>  $^{238}\text{U}$ .  $^{179}\text{Tl}$  ionized to 1<sup>+</sup> charge by the Resonance Ionization Laser Ion Source (RILIS) and mass separated by the High Resolution (HRS) and General Purpose (GPS) Separators. Second reaction E( $^{40}\text{Ca}$ )=232 MeV provided by the UNILAC at GSI. Target≈350  $\mu\text{g}/\text{cm}^2$   $^{144}\text{Sm}$ . Separated by the velocity filter SHIP. Measured E $\gamma$ , I $\gamma$ , E $\alpha$ , I $\alpha$ , T<sub>1/2</sub>, yield using a single Miniball Ge cluster and a PSSD. Deduced  $J^\pi$ , and  $\alpha$  branching ratio.

2002Ro17: measured E $\alpha$  and half-life of  $^{171}\text{Ir}$   $\alpha$  decay.

1996Pa01: sources from heavy-ion fusion-evaporation reactions; recoil mass separator, double-sided Si strip detector (FWHM≤20 keV); measured E $\alpha$ , parent T<sub>1/2</sub> and % $\alpha$ .

1992Sc16: source from  $^{141}\text{Pr}(^{36}\text{Ar},xn)$ , E=175-204 MeV; measured  $\alpha$  excitation, E $\alpha$ , I $\alpha$ , E $\gamma$ , I $\gamma$ , I(K x ray),  $\alpha$ -(K x ray) coin,  $\alpha\gamma$  coin,  $\alpha(t)$ ; deduced  $\alpha$  branching; Si and Ge detectors. Only one activity of  $^{171}\text{Ir}$  reported decaying with half-life of 1.46 s.

1982De11: sources from  $^{63}\text{Cu}$  bombardments of Ag, Cd, In, Sn; measured E $\alpha$  (silicon surface-barrier detector); He-jet transport.

1978MaYF:  $^{171}\text{Ir}$  produced in  $^{58}\text{Ni},^{63}\text{Cu}(^{58}\text{Ni},X)$ , E=290 MeV followed by the measurement of  $\alpha$  decay at the UNILAC facility of GSI.

Others: 1978Ca11, 1978Sc26, 1967Si02.

 $^{167}\text{Re}$  Levels

E(level)	$J^\pi$	$T_{1/2}$	Comments
0.0+x	(9/2 <sup>-</sup> )	5.9 s 5	E(level), $J^\pi$ , $T_{1/2}$ : from the Adopted Levels. $J^\pi$ : tentative configuration=π9/2[514], analogous to $^{169}\text{Re}$ (1992Sc16).
92.1+x 2	(11/2 <sup>-</sup> )		

 $\alpha$  radiations

E $\alpha$	E(level)	I $\alpha$ <sup>†</sup>	HF <sup>†</sup>	Comments
5920 4	92.1+x	85.5 12	1.06 11	E $\alpha$ : weighted average of 5919 4 (2023Zh03); 5925 8 (2010An01); and 5920 4 recommended in 1991Ry01 (value based on measurements: 5925 3 in 1982De11, 5909 5 in 1967Si02, 5910 10 in 1978Ca11, and 5910 10 in 1978Sc26). Other: 5945 11 (1996Pa01, seems discrepant). I $\alpha$ : 53% 5 (2023Zh03). Relative I $\alpha$ =85.5 12 (evaluators), assuming I $\alpha(6011\alpha)+I\alpha(5920\alpha)=100$ . HF: other: 1.9 3 (2023Zh03). E $\alpha$ : from 2023Zh03. I $\alpha$ : 9% 1 (2023Zh03). Relative I $\alpha$ =14.5 12 (evaluators), assuming I $\alpha(6011\alpha)+I\alpha(5920\alpha)=100$ . HF: other: 15 2 (2023Zh03).
6011 5	0.0+x	14.5 12	14.7 20	

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 **$^{171}\text{Ir}$   $\alpha$  decay (1.27 s)    2023Zh03,2013An10,2014Pe02 (continued)**

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 $\alpha$  radiations (continued)

<sup>†</sup> The nuclear radius parameter  $r_0(^{167}\text{Re})=1.5595\ 50$  is deduced from interpolation (or unweighted average) of radius parameters of the adjacent even-even nuclides (2020Si16). In deducing  $\alpha$ -hindrance factors, energy of the ( $11/2^-$ ) isomer in  $^{171}\text{Ir}$  assumed as 100 keV for 0+x, and level energies in  $^{167}\text{Re}$  as 0.0 keV for 0.0+x, and 92.1 keV for 92.1+x.

<sup>‡</sup> For absolute intensity per 100 decays, multiply by 0.62 5.

<sup>171</sup>Ir  $\alpha$  decay (1.27 s)    2023Zh03,2013An10,2014Pe02 (continued)

$\gamma(^{167}\text{Re})$										
$E_\gamma$	$I_\gamma^\dagger$	$E_i(\text{level})$	$J_i^\pi$	$E_f$	$J_f^\pi$	Mult.	$\delta$	$a^\ddagger$	$I_{(\gamma+ce)}^\dagger$	Comments
92.1 2	11.42 24	92.1+x	(11/2 <sup>-</sup> )	0.0+x	(9/2 <sup>-</sup> )	M1+E2	0.28 15	6.49 12	85.5 12	$\alpha(K)=5.1\ 4; \alpha(L)=1.08\ 24; \alpha(M)=0.25\ 6; \alpha(N)=0.061\ 15$ $\alpha(O)=0.0098\ 20; \alpha(P)=0.00056\ 5$ $E_\gamma$ : from 2023Zh03. $I_{(\gamma+ce)}$ : from $I\alpha=85.5\ 12$ . $I_\gamma$ : from $I(\gamma+ce)$ and $\alpha$ . Mult.: from $\alpha(K)\exp=5.1\ 4$ (2023Zh03, from $I\gamma$ and $I(\text{Re K x-rays})$ ). Other: $\delta(E2/M1)<1.8$ from $\alpha(K)\exp=10\ 8$ (1992Sc16). $I(\text{K x ray, Re}):I(92\gamma)=95\ 15:9\ 5$ (1992Sc16).

<sup>†</sup> For absolute intensity per 100 decays, multiply by 0.62 5.

<sup>‡</sup> Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on  $\gamma$ -ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

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Legend

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