^{232}Th(^{6}Li,Fγ)   **2010Re01**

	Type	Author	History Citation	Literature Cutoff Date
	Full Evaluation	Jun Chen	NDS 174, 1 (2021)	15-Apr-2021

2010Re01: E=45 MeV ^{6}Li beam was produced from the 88-Inch Cyclotron of the LBNL. Target was isotopically pure, 889 μg/cm^2 ^{232}Th. Fission fragments and emitted particles were detected in the Silicon Telescope Array for Reaction Studies (STARS), consisting of a series of double-sided, annular Si detectors covering a range of $21° - 52°$ with respect to the incident beam. γ-rays were detected with the Livermore Berkeley Array consisting of six clover HPGe detectors and one LEPS detector. Measured Eγ, $\gamma\gamma$-coin, (particle)-γ correlations, particle-γ(t). Deduced evidence for a new isomer and its half-life.

2010Re01 take level scheme below the 2079+x isomer from 2004Sc42 in ^{123}In IT decay, with γ transitions (except 32γ) confirmed in their measurement.

^{123}In Levels

E(level)	J$^{\pi\dagger}$	T$_{1/2}$	Comments
0	9/2$^+$		
1027	11/2$^+$		
1166	13/2$^+$		
2047	(13/2$^-$)		
2079	(17/2$^-$)	1.4 μs 2	T$_{1/2}$: from 2004Sc42 in ^{123}In IT decay.
2079+x	(21/2$^-$)	$\geq$100 μs	E(level): this isomer is proposed by 2010Re01 based on their observation of delayed γ transitions seen in the decay of the 1.4$-\mu$s isomer in 2004Sc42, which however less likely originates from the relatively short-lived 1.4$-\mu$s isomer due to the particle-γ correlation time from 5 to 175 μs in their setup, but is likely from a longer-lived isomer above the 1.4$-\mu$s isomer to further delay the decays as observed. J$^\pi$,T$_{1/2}$: from 2010Re01, with the half-life limit suggested from intensity in time spectra. This isomer is suggested to arise from $\nu(h_{11/2}\otimes d_{3/2})7^-$ and $\nu(h_{11/2}\otimes s_{1/2})5^-$ neutron core excitation coupling with the valence proton (2010Re01).

† Proposed in 2010Re01, based on systematics of neighboring nuclei and theoretical predictions.

$\gamma(^{123}$In)

E$_\gamma$	E$_i$(level)	J$_i^\pi$	E$_f$	J$_f^\pi$	Comments
x†	2079+x	(21/2$^-$)	2079	(17/2$^-$)	E$_\gamma$: it is stated in 2010Re01 that by assuming a single transition between the two isomeric states, it is not possible to assign this transition in their experiment and mass separation or isomer decay tagging would be needed to determine the origin with confidence.
32	2079	(17/2$^-$)	2047	(13/2$^-$)	E$_\gamma$: not seen in 2010Re01, taken from 2004Sc42.
881	2047	(13/2$^-$)	1166	13/2$^+$	
1020	2047	(13/2$^-$)	1027	11/2$^+$	
1027	1027	11/2$^+$	0	9/2$^+$	
1166	1166	13/2$^+$	0	9/2$^+$	

† Placement of transition in the level scheme is uncertain.

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Legend

<u>Level Scheme</u>

- - - - - - ► γ Decay (Uncertain)

$^{123}_{49}$In$_{74}$