Adopted Levels, Gammas

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	N. Nica	NDS 176, 1 (2021)	1-May-2021

S(n)=10150 *SY*; S(p)=−1267 *7*; Q(α)=6698 *4*　　2021Wa16

ΔS(n)=430 (syst,2021Wa16).

S(2p)=340 *360*, Q(εp)=10270 *300* (syst,2021Wa16).

Additional information 1.

Although the assignment of γ rays to ^{160}Re was made by their correlations with characteristic proton and alpha decay of the ^{160}Re ground state, the exact placement of those γ rays in the level scheme in not unambiguous.

^{160}Re Levels

Cross Reference (XREF) Flags

A	^{160}Re IT decay (2.8 μs)
B	^{164}Ir α decay (70 μs)
C	^{106}Cd(^{58}Ni,p3nγ)

E(level)[†]	J$^{\pi}$[‡]	T$_{1/2}$	XREF	Comments
0.0	(4$^-$)	612 μs *7*	AB	%p=89 *1*; %α=11 *1* %p,%α: from 2011Da12 assuming β decay branch is negligible. Other values: %p=91 *5*, %α=9 *5* (1996Pa01). J$^{\pi}$: tentatively proposed by 2011Da01 (IT decay) from the existence of an E2→E1→E2 γ cascade (where the last transition is assumed E2) from the expected 9$^+$ isomer in ^{160}Re. The final state in this cascade is assumed to be the ^{160}Re g.s. Previously (2$^-$) was assumed from proposed configuration, with antiparallel coupling of a d$_{3/2}$ proton orbital and an f$_{7/2}$ neutron orbital (1993Li34). configuration: possible πd$_{3/2}$⊗νf$_{7/2}$ or πd$_{3/2}$⊗νh$_{9/2}$ (2011Da01). From comparison of observed and calculated proton-decay half-lives, 2011Da12 deduce that the proton emission likely takes place from the d$_{3/2}$ orbital. T$_{1/2}$: weighted average of 614 μs *8*, p(t), and 597 μs *20*, α(t), both from 2011Da12. Others: 790 μs *160*, from 860 μs *+230−150*, p(t), and 380 μs *+38−13*, α(t), all from 1992Pa05.
50 *3*	(6$^-$)		AB	J$^{\pi}$: (E1) γ from (7$^+$).
88 *4*	(7$^+$)		AB	J$^{\pi}$: (E2) γ from (9$^+$).
184 *4*	(9$^+$)	2.8 μs *1*	AB	J$^{\pi}$: expected from systematics and theoretical arguments. Based on this assignment the lower J$^{\pi}$ values are assumed. T$_{1/2}$: from 38γ+96γ(t) in 2011Da01. configuration: possible πh$_{11/2}$⊗νf$_{7/2}$ or πh$_{11/2}$⊗νh$_{9/2}$.
184+x[#]	(10$^+$)		C	
1021.4+x[#] *3*	(12$^+$)		C	
1647.5+x[#] *6*	(14$^+$)		C	
1824.7+x[#] *6*	(16$^+$)		C	

[†] From Eγ data. Level ordering assumed based on systematics of odd-odd N=85 isotones is rather tentative.

[‡] Assigned by 2011Da01 for levels from the (9$^+$) isomer to g.s. based on syst and measured or assumed γ ray multipolarities; assigned by 2011Sa59 from systematics of N=85 isomers for levels of the γ sequence.

[#] Band(A): γ sequence based on (10$^+$). From ^{106}Cd(^{58}Ni,p3nγ) (2011Sa59); possible configuration=πh$_{11/2}$⊗νf$^2_{7/2}$⊗νh$_{9/2}$.

Adopted Levels, Gammas (continued)

$\gamma(^{160}$Re$)$

Unplaced γ's in ^{106}Cd(^{58}Ni,p3nγ) dataset.

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[‡]	α[#]	Comments
50	(6⁻)	50[@] *3*	100	0.0	(4⁻)	[E2]	90 *32*	α(L)=68 *25*; α(M)=17.4 *62* α(N)=4.1 *15*; α(O)=0.58 *21*; α(P)=5.2×10⁻⁴ *14* E_γ: weak γ observed in singles spectra but not confirmed by $\gamma\gamma$ coin (2011Da01, IT decay).
88	(7⁺)	38 *1*	100	50	(6⁻)	(E1)	1.02 *8*	α(L)=0.79 *6*; α(M)=0.184 *15* α(N)=0.043 *4*; α(O)=0.0062 *5*; α(P)=0.000223 *14* Mult.: from the prompt relationship between 38γ and 96γ and the intensity balance (2011Da01, IT decay).
184	(9⁺)	96 *1*	100	88	(7⁺)	(E2)	4.86 *23*	α(K)=0.891 *18*; α(L)=3.00 *16*; α(M)=0.76 *4* α(N)=0.181 *10*; α(O)=0.0258 *14*; α(P)=8.52×10⁻⁵ *25* B(E2)(W.u.)=0.082 *6* Mult.: α(K)exp=1.2 *4* deduced from Iγ(K x ray) and Iγ(96γ) (α(K)=0.891 *18* theory) (2011Da01, IT decay).
184+x	(10⁺)	x		184	(9⁺)			E_γ: based on Fig. 5 of 2011Sa59 in (^{58}Ni,p3nγ) dataset of the systematics of energy levels built upon 9/2⁻ and 10⁺ states in N=85 isotones one expects x<81 keV.
1021.4+x	(12⁺)	837.4 *3*	100	184+x	(10⁺)			Observation of x rays, 38-keV, and 96-keV transitions in coin with 837γ indicates that 837-keV transition populates isomeric state in ^{160}Re at 184 keV reported in 2011Da01 (^{160}Re IT decay dataset).
1647.5+x	(14⁺)	626.1 *5*	100	1021.4+x	(12⁺)			
1824.7+x	(16⁺)	177.2 *2*	100	1647.5+x	(14⁺)			

[†] From ^{160}Re IT decay for transitions from the (9⁺) isomer and the levels below (with $\Delta E\gamma$ was estimated by evaluator and assumed branchings), and from ^{106}Cd(^{58}Ni,p3nγ) for the other transitions.
[‡] From 2011Da01 (^{160}Re IT decay) unless otherwise stated.
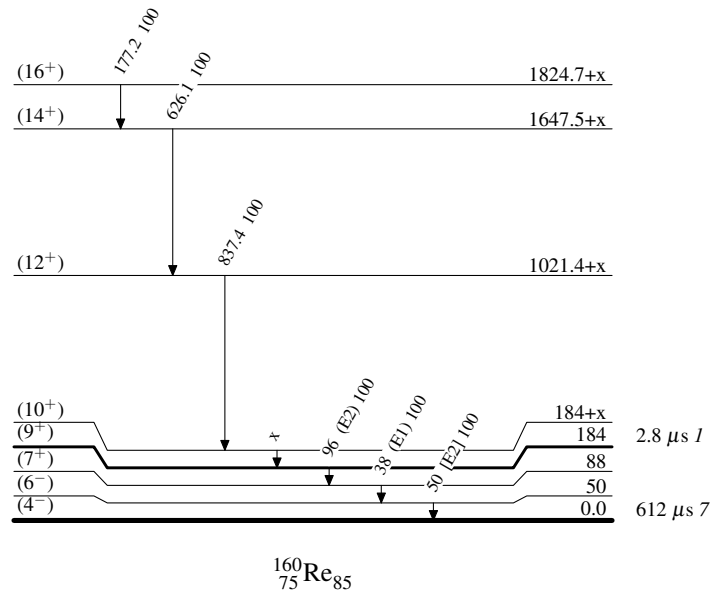[#] Additional information 2.
[@] Placement of transition in the level scheme is uncertain.
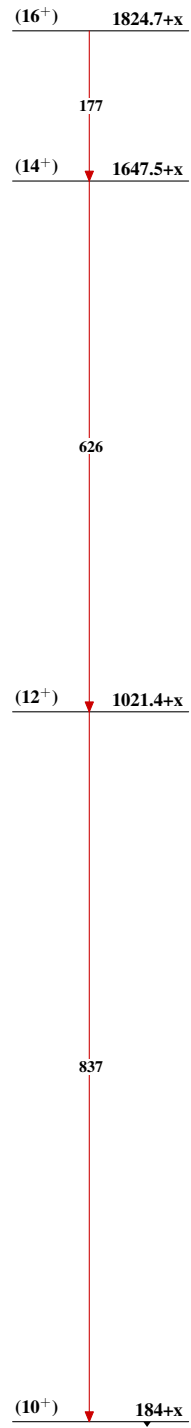
Adopted Levels, Gammas　　　Legend

Level Scheme

Intensities: Relative photon branching from each level

- - - - - - ▶ γ Decay (Uncertain)

$^{160}_{75}Re_{85}$

Adopted Levels, Gammas

Band(A): γ sequence based on (10$^+$)

(16$^+$)	1824.7+x

177

(14$^+$)	1647.5+x

626

(12$^+$)	1021.4+x

837

(10$^+$)	184+x

$^{160}_{75}$Re$_{85}$