^{106}Pd(^{86}Kr,3nγ) 2015Ho14

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	T. D. Johnson, Balraj Singh	NDS 142, 1 (2017)	15-Apr-2017

2015Ho14: E(^{86}Kr)=355 MeV from K130 cyclotron facility at Jyvaskyla. Measured Eγ, Iγ, γγ, recoil-isomer-tagged prompt γγ and prompt- delayed and delayed-delayed γγ spectra, and angular intensity ratios using JUROGAM-II array of 39 Compton-suppressed HPGe detectors. Recoiling nuclei were transported through the RITU separator, followed by detection of events using GREAT spectrometer consisting of a multiwire proportional counter (MWPC), two double-sided silicon strip detectors (DSSDs), three Clover Ge detectors, and a planar Ge detector; the Ge detector system of the GREAT spectrometer was used to detect γ rays from isomer decay as well as those from β^- decay of implanted nuclei. Recoil-isomer tagging and recoil-gated γ detection techniques were used. Deduced a dipole band above the 31/2$^-$, 22–μs isomer, conversion coefficients, multipolarities, configuration, and alignments. Comparison with structure of neighboring nuclei.

^{189}Pb Levels

E(level)†	J$^\pi$‡	T$_{1/2}$	Comments
40 *4*	13/2$^+$	50 s *3*	%ε+%β$^+$≈100; %α≤0.40 Additional information 1. Half-life and decay modes are from ^{189}Pb Adopted Levels.
677.5 *8*	13/2$^+$		
858.9 *7*	17/2$^+$		
950.7 *7*	15/2$^+$		
1181.9 *7*	17/2$^+$		
1327.2 *10*	21/2$^+$		
1340.3 *9*	19/2$^+$		
1607.6 *9*	21/2$^+$		
1813.1 *11*	23/2$^+$		
1865.5 *11*	25/2$^+$		J$^\pi$: negative parity in level-scheme Figure 5 of 2015Ho14 seems a misprint.
2137.8 *10*	25/2$^+$		
2280.2 *13*	27/2$^+$		
2474.5# *12*	31/2$^-$	22.2 μs *+69−14*	%IT=100 T$_{1/2}$: from Adopted Levels.
2654.3? *12*	(33/2$^+$)		J$^\pi$: (33/2) in Adopted Levels.
2680.9# *12*	33/2$^-$		
3069.7# *12*	35/2$^{(-)}$		
3229.0? *16*	(33/2$^-$)		
3488.4?# *13*	37/2$^{(-)}$		
3923.4?# *13*	(39/2$^-$)		
4336.6?# *13*	(41/2$^-$)		
4671.7?# *15*	(43/2$^-$)		

† From least-squares fit by evaluators to Eγ values, assuming 1 keV uncertainty when not listed, and fixing the energy of the 13/2$^+$ isomer at 40 keV. Energies listed in 2015Ho14 are relative to zero for the 13/2$^+$ isomer.

‡ Assignments are from 2015Ho14, based on those in 2009Dr03 for levels up to the 31/2$^-$ isomer at 2474.5 keV.

\# Band(A): Magnetic-rotational (shears) dipole band. In comparison to structure of neighboring nuclides, this band is proposed as based on $\pi[s^{-2}_{1/2}h_{9/2}i_{13/2}]_{11-}\otimes \nu i^{-1}_{13/2}$ configuration.

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γ(^{189}Pb)

R(θ)=angular intensity ratio obtained from recoil-tagged $\gamma\gamma$ matrix. Based on presently measured R(θ) for four transitions of known multipolarity in ^{189}Tl, 2015Ho14 establish average R(θ)=0.54 *4* for stretched dipole, and 1.07 *3* for stretched quadrupole transition.

Relative K x ray and Gamma-ray intensities

E(x ray) or Eγ	I(x ray) or Iγ
75.0, $K_{\alpha1}$	4356 *81*
84.9, $K_{\beta1}$	1277 *50*
206.4	4120 *100*
413.2	1367 *56*
418.7	4564 *83*
435.0	1804 *72*

E_γ[†]	I_γ[‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	α[b]	Comments
142		2280.2	27/2$^+$	2137.8	25/2$^+$			
179.8[c] *3*	16.6 *4*	2654.3?	(33/2$^+$)	2474.5	31/2$^-$	D		R(θ)=0.49 *6*.
194		2474.5	31/2$^-$	2280.2	27/2$^+$	M2[@]		
206.4 *1*	99.9 *16*	2680.9	33/2$^-$	2474.5	31/2$^-$	M1	1.199	α(K)exp=1.11 *4* (2015Ho14) α(K)=0.979 *14*; α(L)=0.1683 *24*; α(M)=0.0394 *6* α(N)=0.01002 *14*; α(O)=0.00200 *3*; α(P)=0.000214 *3* Mult.: from α(K)exp deduced from K-x ray and γ intensities obtained from recoil-isomer tagged $\gamma\gamma$ matrix with a gate on the 389-keV transition. In this procedure, theoretical x-ray intensities from the internal conversion of the 419-, 435-, and 413-keV γ-rays was subtracted from the total x-ray intensity, with the assumption of M1 for 413, 419 and 435 γ rays. If E1 is assumed for all these three γ rays, then α(K)exp=1.35 *4* (2015Ho14) for 206.4γ, inconsistent with either the E1 or M1 for this transition. R(θ)=0.56 *5*.
231		1181.9	17/2$^+$	950.7	15/2$^+$			
267		1607.6	21/2$^+$	1340.3	19/2$^+$			
272		2137.8	25/2$^+$	1865.5	25/2$^+$			
280		1607.6	21/2$^+$	1327.2	21/2$^+$			
324		1181.9	17/2$^+$	858.9	17/2$^+$			
325		2137.8	25/2$^+$	1813.1	23/2$^+$			
335.1[c] *6*	18.3 *9*	4671.7?	(43/2$^-$)	4336.6?	(41/2$^-$)	(M1)[a]	0.316	α(K)=0.258 *4*; α(L)=0.0440 *7*; α(M)=0.01029 *16* α(N)=0.00261 *4*; α(O)=0.000521 *8*; α(P)=5.58×10^{-5} *9* Due to poor statistics, firm coincidence evidence of the placement of the 335.1-keV γ ray from recoil-isomer-tagged prompt $\gamma\gamma$ spectra is lacking. Present placement is based on systematic arguments. R(θ)=0.38 *13*.
337		2474.5	31/2$^-$	2137.8	25/2$^+$	E3[@]		
388.8 *2*	100.0 *17*	3069.7	35/2$^{(-)}$	2680.9	33/2$^-$	(M1)[a]	0.211	α(K)=0.1729 *25*; α(L)=0.0293 *5*; α(M)=0.00686

Continued on next page (footnotes at end of table)

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γ(^{189}Pb) (continued)

E_γ[†]	I_γ[‡]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[#]	α[b]	Comments
								10 α(N)=0.001744 *25*; α(O)=0.000348 *5*; α(P)=3.72×10^{-5} *6* R(θ)=0.49 *6*.
390		1340.3	19/2$^+$	950.7	15/2$^+$			
413.2 *3*	16.7 *7*	4336.6?	(41/2$^-$)	3923.4?	(39/2$^-$)	(M1)[&]	0.179	α(K)=0.1469 *21*; α(L)=0.0249 *4*; α(M)=0.00582 *9* α(N)=0.001479 *21*; α(O)=0.000295 *5*; α(P)=3.16×10^{-5} *5* R(θ)=0.69 *24*.
418.7 *3*	39.6 *10*	3488.4?	37/2$^{(-)}$	3069.7	35/2$^{(-)}$	(M1)[&]	0.1731	α(K)=0.1418 *20*; α(L)=0.0240 *4*; α(M)=0.00561 *8* α(N)=0.001427 *21*; α(O)=0.000284 *4*; α(P)=3.05×10^{-5} *5* R(θ)=0.44 *10*.
426		1607.6	21/2$^+$	1181.9	17/2$^+$			
435.0 *3*	24.7 *8*	3923.4?	(39/2$^-$)	3488.4?	37/2$^{(-)}$	(M1)[&]	0.1563	α(K)=0.1280 *18*; α(L)=0.0217 *3*; α(M)=0.00506 *8* α(N)=0.001287 *19*; α(O)=0.000257 *4*; α(P)=2.75×10^{-5} *4* R(θ)=0.62 *17*.
468		1327.2	21/2$^+$	858.9	17/2$^+$			
473		1813.1	23/2$^+$	1340.3	19/2$^+$			
481		1340.3	19/2$^+$	858.9	17/2$^+$			
504		1181.9	17/2$^+$	677.5	13/2$^+$			
530		2137.8	25/2$^+$	1607.6	21/2$^+$			
538		1865.5	25/2$^+$	1327.2	21/2$^+$			
609		2474.5	31/2$^-$	1865.5	25/2$^+$	(E3)[@]		
637		677.5	13/2$^+$	40	13/2$^+$			
754.5[c] *10*	19.8 *9*	3229.0?	(33/2$^-$)	2474.5	31/2$^-$	D		R(θ)=0.36 *20*.
811		2137.8	25/2$^+$	1327.2	21/2$^+$			
819		858.9	17/2$^+$	40	13/2$^+$			
911		950.7	15/2$^+$	40	13/2$^+$			
1142		1181.9	17/2$^+$	40	13/2$^+$			

† For γ rays from levels up to 2474.5 keV, 2015Ho14 quote values from 2009Dr03. For higher levels, values are from Table I of 2015Ho14.

‡ Intensities listed here are from Table I of 2015Ho14 divided by a factor of 10.

Stretched dipole from R(θ), except when noted otherwise.

@ From Adopted Gammas.

& From stretched dipole, and analysis of K-conversion coefficient for 206.4γ. See comment for 206.4γ from 2681 level. Also possible transition in a magnetic-dipole rotational band.

a From stretched dipole from R(θ), and transition intensity balance arguments. Also possible transition in a magnetic-dipole rotational band.

b Theoretical values from BrIcc code with “Frozen Orbitals” approximation.

c Placement of transition in the level scheme is uncertain.

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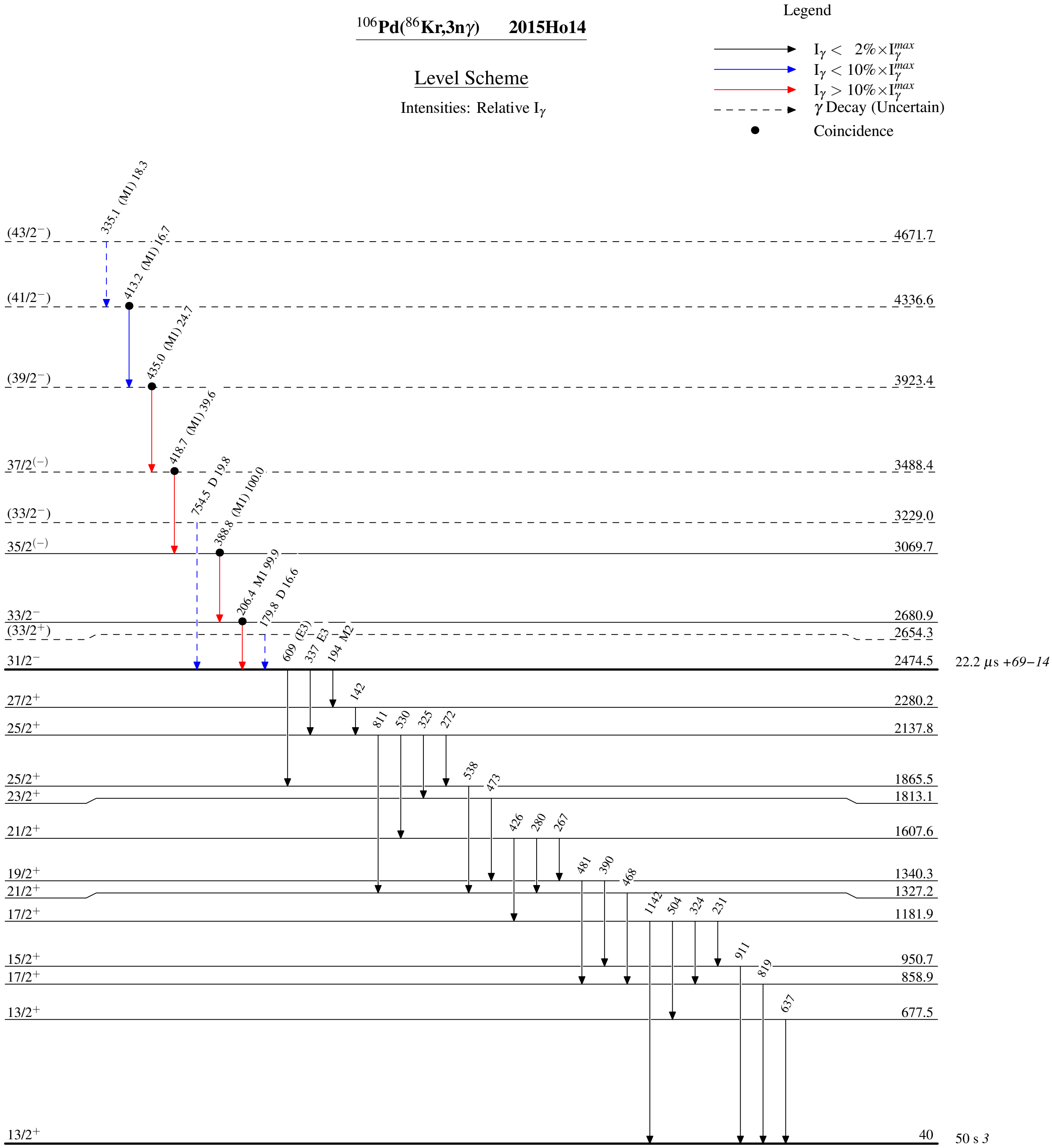
Level Scheme

Intensities: Relative I_γ



$^{189}_{82}Pb_{107}$

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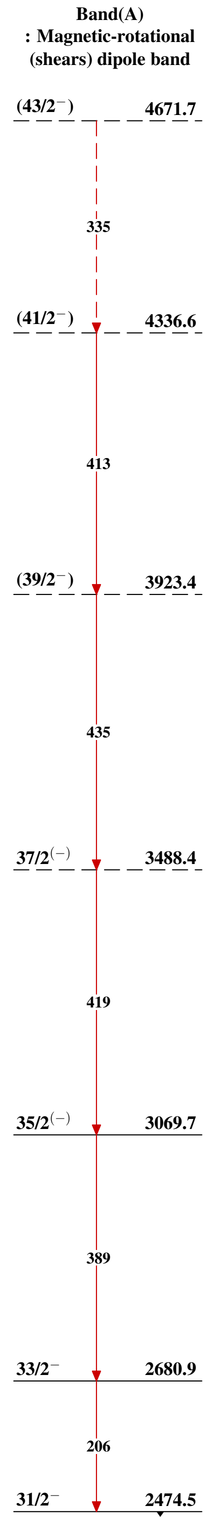

$^{189}_{82}Pb_{107}$