(HI,xnγ) 2000Di18,1990Mu14

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

Additional information 1.

Data set based on the XUNDL data set compiled by G. Reed and B. Singh (McMaster University).

Unless noted otherwise, the data are taken from 2000Di18. These are in essential agreement with those of 1990Mu14, but are more extensive.

2000Di18: Target=^{102}Pd(69%), ^{104}Pd(12%), ^{105}Pd(6%), ^{106}Pd(6%). Possible reactions include: ^{104}Pd(^{58}Ni,2pγ); ^{105}Pd(^{58}Ni,2pnγ); ^{106}Pd(^{58}Ni,2p2nγ). E(^{58}Ni)=270 MeV. Experiment carried out using the GAMMASPHERE array consisting of 101 Compton-suppressed Ge detectors, in conjunction with a Fragment Mass Analyzer. Assignment of γ's to ^{160}Hf is based on coincidences with the 389.40, $2^+\to0^+$, transition and on γ events coincident with the A=160 nuclides in the focal plane of the Fragment Mass Analyzer. Recoil products analyzed using a position-sensitive Parallel-Grid Avalanche Counter and implanted in a double-sided Si-strip detector. Decay relationships determined using recoil-decay tagging. Measured Eγ, Iγ, $\gamma(\theta)$, $\gamma\gamma$.

1990Mu14: ^{144}Sm(^{20}Ne,4n), E(^{20}Ne)=105 to 120 MeV, metallic foils enriched to 96.5% in ^{144}Sm. Between 6 and 12 Compton-suppressed Ge detectors in the OSIRIS array were used in the various studies; one also used an inner ball of 48 BGO detectors. Measured Eγ, Iγ, $\gamma\gamma$, and $\gamma\gamma(\theta)$ as DCO ratios from two experiments, DCO(60°,180°) and DCO(38°,90°) respectively. The typical values are ≈1 for stretched quadrupole transitions for both types of ratios, and DCO(60°,180°)>1 and DCO(38°,90°)<1 for stretched dipole transitions respectively.

^{160}Hf Levels

E(level)[†]	J$^\pi$[‡]	E(level)[†]	J$^\pi$[‡]	E(level)[†]	J$^\pi$[‡]	E(level)[†]	J$^\pi$[‡]
0.0[@]	0^+	2747.86 *23*	9^-[#]	4076.3[&] *6*	(14^+)	5415.4[&] *8*	(18^+)
389.40[@] *10*	2^+	2814.68[@] *22*	10^+	4107.8[b] *4*	(14^-)	5505.8[a] *4*	(19^-)
898.26[@] *15*	4^+	2964.33[b] *24*	10^-	4120.4[a] *3*	15^-	6087.0[b] *5*	(20^-)
1493.35[@] *18*	6^+	3026.12[a] *22*	11^-	4735.0[&] *8*	(16^+)	6283.9[a] *4*	(21^-)
2147.48[@] *20*	8^+	3474.8[&] *3*	12^+	4747.0[a] *3*	17^-	7000.3[a] *5*	(23^-)
2255.32[a] *22*	(7^-)	3502.8[b] *3*	(12^-)	4761.7[b] *5*	(16^-)	7747.5[a] *5*	(25^-)
2713.81[a] *22*	9^-[#]	3529.61[a] *24*	13^-	5351.4[b] *5*	(18^-)		

[†] From a least-squares fit to the listed Eγ values.

[‡] Values reported by 2000Di18 and 1990Mu14 based on γ multipolarities and theory considerations on band structures as well as systematics of even-Z Hf isotopes and N=88 isotones, especially ^{162}Hf whose bands structure is very similar. Some values can slightly differ from those in the Adopted Levels, Gammas dataset.

[#] According to 1990Mu14 the pair of 2714 and 2748, 9^- levels of ^{160}Hf is analogous to the 2489 and 2576, 9^- pair of 1988Hu05.

[@] Band(A): g.s. band.

[&] Band(B): aligned positive-parity band.

[a] Band(C): negative-parity band, signature=1.

[b] Band(D): negative-parity band, signature=0.

γ(^{160}Hf)

Given in table comments are the angular distribution coefficients A_2 from 2000Di18, as well as the DCO(60°,180°) and DCO(38°,90°) values from 1990Mu14.

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(HI,xnγ) 2000Di18,1990Mu14 (continued)

γ(^{160}Hf) (continued)

E_γ	I_γ	E_i(level)	J^π_i	E_f	J^π_f	Mult.[†]	Comments
211.48 *10*	9.9 *19*	3026.12	11^-	2814.68	10^+	(E1)[‡]	A_2=−0.40 *6*, DCO(60°,180°)=1.22 *12*, DCO(38°,90°)=0.63 *8*.
216.57 *13*	2.2 *6*	2964.33	10^-	2747.86	9^-	(M1)[#]	A_2=−0.97 *22*.
250.42 *13*	2.8 *7*	2964.33	10^-	2713.81	9^-	(M1)[#]	A_2=−0.32 *11*, DCO(60°,180°)=1.40 *26*, DCO(38°,90°)=0.78 *25*.
278.21 *12*	4.9 *11*	3026.12	11^-	2747.86	9^-	E2	A_2=+0.21 *17*, DCO(60°,180°)=0.92 *15*, DCO(38°,90°)=0.75 *17*.
312.30 *11*	11.1 *21*	3026.12	11^-	2713.81	9^-	E2	A_2=+0.26 *5*, DCO(60°,180°)=1.02 *12*, DCO(38°,90°)=0.88 *12*.
389.40 *10*	84 *11*	389.40	2^+	0.0	0^+	E2	A_2=+1.15 *3*, DCO(60°,180°)=1.02 *9*, DCO(38°,90°)=1.08 *9*.
458.47 *13*	6.6 *14*	2713.81	9^-	2255.32	(7^-)	(E2)	DCO(60°,180°)=0.89 *14*.
492.7 *3*	3.2 *8*	2747.86	9^-	2255.32	(7^-)		Mult.: assigned (E2) in 20008Di18 but no γ(θ) value.
503.49 *10*	32 *5*	3529.61	13^-	3026.12	11^-	E2	A_2=+0.21 *17*, DCO(60°,180°)=0.98 *9*, DCO(38°,90°)=0.95 *14*.
508.86 *10*	100	898.26	4^+	389.40	2^+	E2	DCO(60°,180°)=1.00 *7*, DCO(38°,90°)=1.00 *10*.
538.5 *2*	9.0 *17*	3502.8	(12^-)	2964.33	10^-	(E2)	DCO(60°,180°)=1.21 *31*, DCO(38°,90°)=0.75 *21*.
566.24 *12*	17 *3*	2713.81	9^-	2147.48	8^+	(E1)[‡]	A_2=−0.74 *22*, DCO(60°,180°)=1.32 *13*, DCO(38°,90°)=0.63 *10*.
589.7 *2*	<11	5351.4	(18^-)	4761.7	(16^-)	(E2)	DCO(60°,180°)=1.10 *33*, DCO(38°,90°)=0.98 *25*.
590.76 *12*	28 *5*	4120.4	15^-	3529.61	13^-	E2	A_2=+0.45 *9*, DCO(60°,180°)=1.04 *18*, DCO(38°,90°)=0.86 *11*.
595.09 *10*	81 *13*	1493.35	6^+	898.26	4^+	E2	A_2=+0.22 *5*, DCO(60°,180°)=1.01 *8*, DCO(38°,90°)=1.05 *10*.
600.6 *5*	18 *3*	2747.86	9^-	2147.48	8^+	(E1)[‡]	I_γ: sum of Iγ values for the 600.6 and 601.5 γ's. DCO(60°,180°)=1.31 *20*, DCO(38°,90°)=0.79 *24*.
601.5 *5*	18 *3*	4076.3	(14^+)	3474.8	12^+	(E2)	I_γ: sum of Iγ values for the 600.6 and 601.5 γ's. DCO(60°,180°)=1.14 *21*, DCO(38°,90°)=0.60 *21*.
605.0 *2*	14 *3*	4107.8	(14^-)	3502.8	(12^-)	(E2)	A_2=+0.10 *7*, DCO(60°,180°)=0.82 *14*, DCO(38°,90°)=0.57 *23*.
626.63 *11*	22 *4*	4747.0	17^-	4120.4	15^-	E2	A_2=+0.37 *15*, DCO(60°,180°)=0.89 *10*, DCO(38°,90°)=0.66 *10*.
653.9 *2*	<11	4761.7	(16^-)	4107.8	(14^-)		Mult.: assigned (E2) in 20008Di18 but no γ(θ) value.
654.13 *10*	72 *11*	2147.48	8^+	1493.35	6^+	E2	A_2=+0.29 *6*, DCO(60°,180°)=1.02 *9*, DCO(38°,90°)=0.86 *8*.
658.7 *5*	<11	4735.0	(16^+)	4076.3	(14^+)	(E2)	Mult.: assigned (E2) in 20008Di18 but no γ(θ) value.
660.12 *13*	17 *3*	3474.8	12^+	2814.68	10^+	E2	A_2=+0.22 *18*, DCO(60°,180°)=0.82 *15*, DCO(38°,90°)=0.95 *19*.
667.25 *11*	35 *6*	2814.68	10^+	2147.48	8^+	E2	A_2=+0.24 *7*, DCO(60°,180°)=0.96 *9*, DCO(38°,90°)=0.89 *11*.
680.4 *2*	7.4 *15*	5415.4	(18^+)	4735.0	(16^+)		Mult.: assigned (E2) in 20008Di18 but no γ(θ) value.
716.4 *2*	10.3 *20*	7000.3	(23^-)	6283.9	(21^-)	E2	A_2=+0.51 *13*.
735.58 *15*	8.8 *17*	6087.0	(20^-)	5351.4	(18^-)	E2	A_2=+0.24 *9*.
747.2 *2*	5.9 *13*	7747.5	(25^-)	7000.3	(23^-)		Mult.: assigned (E2) in 20008Di18 but no γ(θ) value.
758.8 *2*	18 *4*	5505.8	(19^-)	4747.0	17^-	(E2)	DCO(60°,180°)=0.83 *17*, DCO(38°,90°)=0.55 *10*.
762.0 *2*	9.9 *26*	2255.32	(7^-)	1493.35	6^+	(E1)[‡]	DCO(60°,180°)=1.29 *24*, DCO(38°,90°)=0.67 *16*.
778.10 *13*	10.2 *20*	6283.9	(21^-)	5505.8	(19^-)	E2	A_2=+0.41 *13*.

[†] Values as reported by 2000Di18 and 1990Mu14. Stretched quadrupole and dipole characters based on γ(θ) and DCO data were further adopted E2 and E1 or M1 when combined with intensity-balance considerations as well as band-structure arguments from theoretical calculations and systematics.

[‡] Pure stretched dipole γ from DCO ratio data assigned by 1990Mu14 as (E1) by connecting opposite parity bands, in analogy

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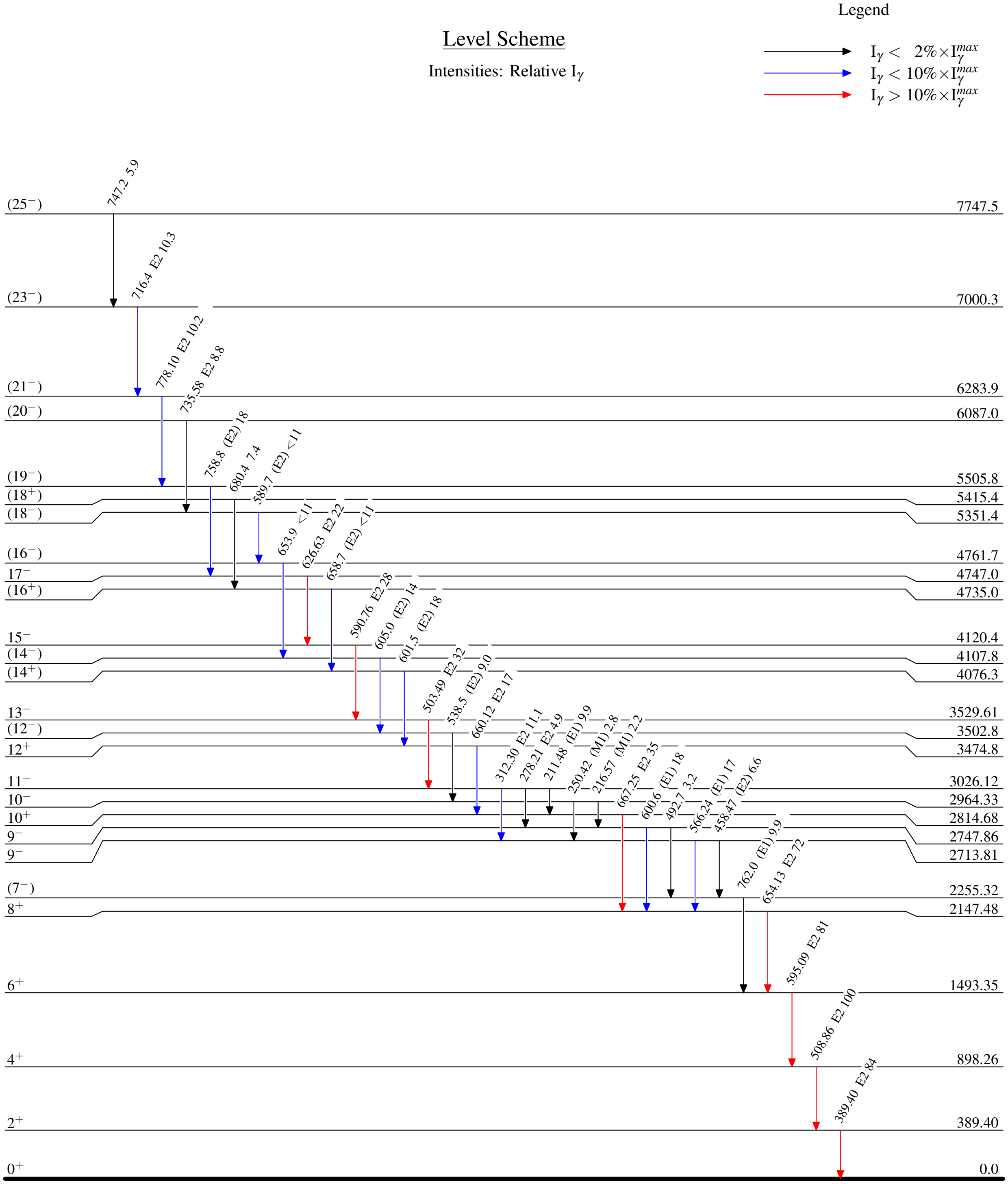
(HI,xnγ) 2000Di18,1990Mu14 (continued)

γ(^{160}Hf) (continued)

with ^{162}Hf band structure (1988Hu05).

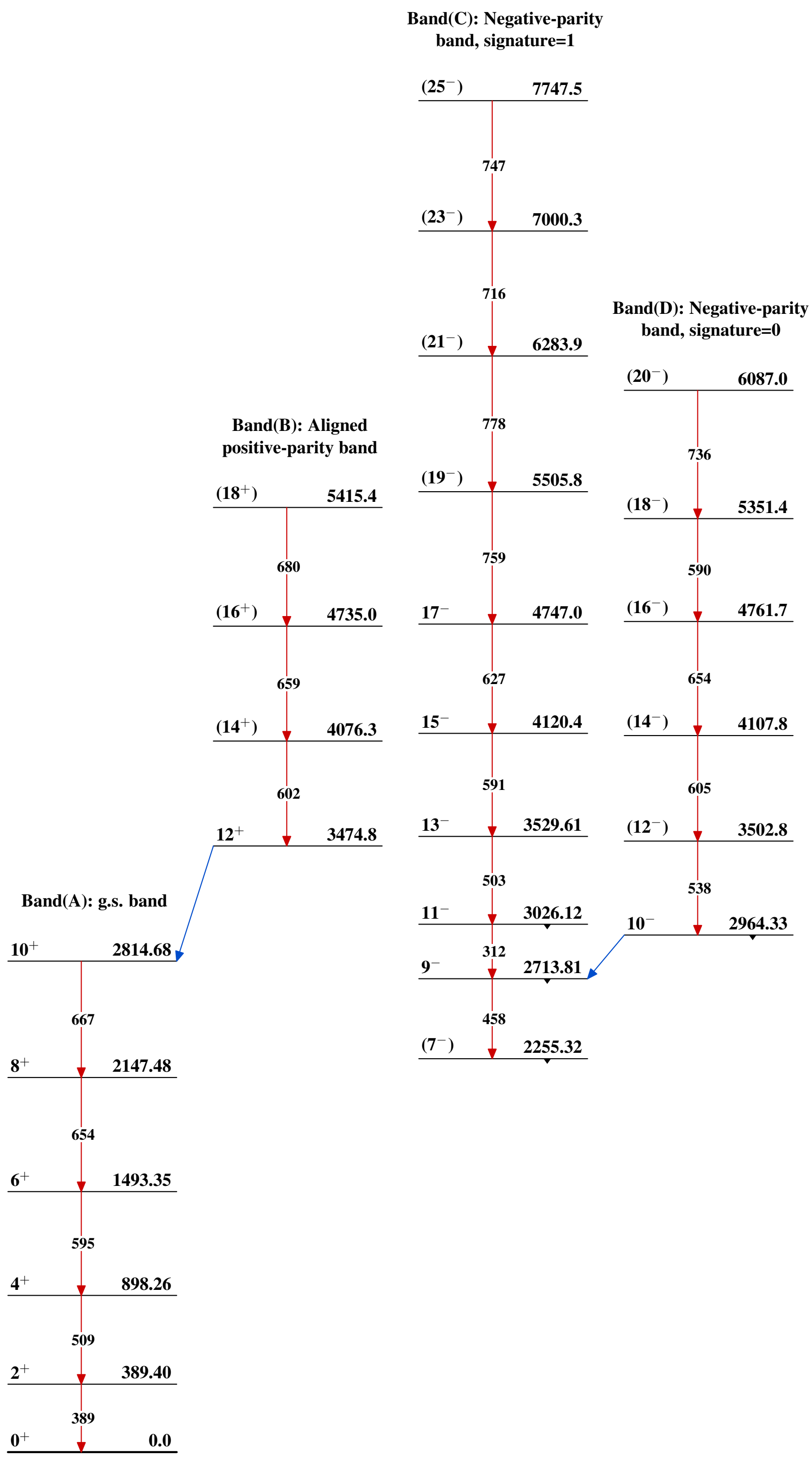
Pure stretched dipole γ from γ(θ) data assigned by 2000Di18 as (M1) by connecting same parity bands, in analogy with ^{162}Hf band structure (1988Hu05).

(HI,xnγ) 2000Di18,1990Mu14



$^{160}_{72}Hf_{88}$

(HI,xnγ) 2000Di18,1990Mu14



$^{160}_{72}Hf_{88}$