^{173}Yb(^{19}F,4nγ) E=93 MeV 1992Ja01

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	F. G. Kondev, S. Juutinen, D. J. Hartley	NDS 150, 1 (2018)	1-Feb-2018

1992Ja01: ^{173}Yb(^{19}F,4nγ). E = 93 to 94 MeV beams of ^{19}F from McMaster Tandem Accelerator Laboratory. Enriched ^{173}Yb target of 2 mg/cm^2 with 8 mg/cm^2 lead backing was used. Five Ge, five NaI, and one BGO detectors were assembled into the array. An event trigger of Ge-Ge-NaI(or BGO), or Ge-Ge-Ge was required. A separate angular distribution experiment was also performed with the same array. Measured γ, $\gamma\gamma$, $\gamma\gamma$t, $\gamma(\theta)$.

Others: 1989PoZW, 1983NeZV (also 1982NeZU): ^{191}Ir(α,7nγ). γ, $\gamma\gamma$ data. First 7 levels proposed agree with the results from 1992Ja01.

^{188}Au Levels

E(level)[†]	J$^\pi$[‡]	Comments
0.0+x[#]	(11$^-$)	Additional information 1. J$^\pi$: From Adopted Levels.
314.26+x[#] *16*	(12$^-$)	
447.34+x[#] *16*	(13$^-$)	
803.66+x[#] *20*	(14$^-$)	
1170.02+x[#] *24*	(15$^-$)	
1535.4+x[#] *4*	(16$^-$)	
1691.6+x[&] *3*	(15$^+$)	
1911.8+x[&] *4*	(16$^+$)	
1957.6+x[&] *4*	(17$^+$)	
1964.8+x[#] *4*	(17$^-$)	
2216.9+x *5*	(18$^+$)	
2242.6+x[#] *4*	(18$^-$)	
2257.0+x[&] *5*	(18$^+$)	
2344.5+x[@] *4*	(18$^-$)	
2503.3+x[@] *4*	(19$^-$)	
2669.2+x[#] *5*	(19$^-$)	
2733.3+x[&] *5*	(19$^+$)	
2789.3+x[&] *5*	(20$^+$)	
2807.2+x[@] *5*	(20$^-$)	
2873.2+x[#] *5*	(20$^-$)	
3012.9+x[@] *5*	(21$^-$)	
3309.2+x[&] *5*	(21$^+$)	
3362.9+x[#] *7*	(21$^-$)	
3416.9+x[@] *6*	(22$^-$)	
3567.0+x[&] *5*	(22$^+$)	
3734.9+x *6*		
3807.9+x[@] *12*	(23$^-$)	
4126.7+x[&] *6*	(23$^+$)	
4215.8+x *7*		
4385.2+x[&] *6*	(24$^+$)	
5325.2+x? *12*	(26$^+$)	

[†] From a least-squares fit to Eγ.

[‡] From deduced transition multipolarities using $\gamma(\theta)$ data and the apparent band assignments in 1992Ja01.

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^{173}Yb(^{19}F,4nγ) E=93 MeV 1992Ja01 (continued)

^{188}Au Levels (continued)

Band(A): $\pi(h_{11/2})^{-1}\otimes\nu(i_{13/2})^{-1}$ (oblate).
@ Band(B): Possibly $\pi(h_{11/2})^{-1}\otimes\nu(i_{13/2})^{-3}$ (oblate).
& Band(C): Possibly $\pi h_{11/2}^{-1}\otimes\nu((i_{13/2})^{-2}(p_{3/2}$ or $f_{5/2})^{-1})$ (oblate).

$\gamma(^{188}Au)$

E_γ †	I_γ †	E_i(level)	J_i^π	E_f	J_f^π	Mult.‡	α#	Comments
133.1 *2*	11.8 *12*	447.34+x	(13$^-$)	314.26+x	(12$^-$)	M1+E2	3.20	α(K)=2.63 *4*; α(L)=0.441 *7*; α(M)=0.1022 *15* α(N)=0.0255 *4*; α(O)=0.00468 *7*; α(P)=0.000316 *5* Mult.: A_2=−0.30 *3*, A_4=+0.01 *14*.
158.8 *3*	4.4 *11*	2503.3+x	(19$^-$)	2344.5+x	(18$^-$)	M1+E2	1.94	α(K)=1.596 *24*; α(L)=0.266 *4*; α(M)=0.0618 *10* α(N)=0.01540 *23*; α(O)=0.00283 *5*; α(P)=0.000191 *3* Mult.: A_2=−0.41 *11*, A_4=+0.04 *12*.
204@ *1*	<3	2873.2+x	(20$^-$)	2669.2+x	(19$^-$)			I_γ: unresolved from 205.6γ.
205.6 *5*	10.6 *10*	3012.9+x	(21$^-$)	2807.2+x	(20$^-$)			I_γ: unresolved from 204γ. Mult.: A_2=−0.15 *3*, A_4=+0.03 *14* for 204+205.6.
220.2 *2*	29.5 *19*	1911.8+x	(16$^+$)	1691.6+x	(15$^+$)	M1+E2	0.777	α(K)=0.639 *9*; α(L)=0.1061 *15*; α(M)=0.0246 *4* α(N)=0.00613 *9*; α(O)=0.001128 *16*; α(P)=7.62×10^{-5} *11* Mult.: A_2=−0.15 *3*, A_4=+0.06 *14*.
257.9 *5*	4 *2*	3567.0+x	(22$^+$)	3309.2+x	(21$^+$)			I_γ: from $\gamma\gamma$. Unresolved from 258.4.
258.4 *5*	3 *1*	4385.2+x	(24$^+$)	4126.7+x	(23$^+$)			I_γ: unresolved from 257.9. Iγ from $\gamma\gamma$.
259.3 *2*	22.4 *21*	2216.9+x	(18$^+$)	1957.6+x	(17$^+$)	M1+E2	0.495	α(K)=0.407 *6*; α(L)=0.0674 *10*; α(M)=0.01562 *23* α(N)=0.00389 *6*; α(O)=0.000716 *11*; α(P)=4.84×10^{-5} *7* Mult.: A_2=+0.02 *2*, A_4=−0.04 *12*.
265.8 *5*	19 *2*	1957.6+x	(17$^+$)	1691.6+x	(15$^+$)	E2	0.1479 *23*	α(K)=0.0837 *13*; α(L)=0.0484 *8*; α(M)=0.01227 *20* α(N)=0.00303 *5*; α(O)=0.000502 *8*; α(P)=8.80×10^{-6} *13* I_γ: from $\gamma\gamma$. Mult.: For the unresolved structure, A_2=+0.22 *2*, A_4=−0.07 *12*.
277.8 *4*	3.6 *5*	2242.6+x	(18$^-$)	1964.8+x	(17$^-$)	M1+E2	0.410	α(K)=0.337 *5*; α(L)=0.0557 *9*; α(M)=0.01291 *19* α(N)=0.00322 *5*; α(O)=0.000592 *9*; α(P)=4.01×10^{-5} *6* Mult.: A_2=−0.38 *6*, A_4=+0.20 *18*.
299.4 *2*	27.1 *17*	2257.0+x	(18$^+$)	1957.6+x	(17$^+$)	M1+E2	0.334	α(K)=0.275 *4*; α(L)=0.0453 *7*; α(M)=0.01051 *15* α(N)=0.00262 *4*; α(O)=0.000482 *7*; α(P)=3.26×10^{-5} *5* Mult.: A_2=+0.06 *2*, A_4=0.00 *12*.
304.0 *2*	11.7 *11*	2807.2+x	(20$^-$)	2503.3+x	(19$^-$)	M1+E2	0.320	α(K)=0.264 *4*; α(L)=0.0435 *7*; α(M)=0.01007 *15* α(N)=0.00251 *4*; α(O)=0.000462 *7*; α(P)=3.13×10^{-5} *5* Mult.: A_2=−0.06 *4*, A_4=+0.06 *14*.

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^{173}Yb(^{19}F,4nγ) E=93 MeV 1992Ja01 (continued)

$\gamma(^{188}Au)$ (continued)

E_γ [†]	I_γ [†]	E_i(level)	J_i^π	E_f	J_f^π	Mult. [‡]	α [#]	Comments
314.3 *2*	55.2 *22*	314.26+x	(12$^-$)	0.0+x	(11$^-$)	M1+E2	0.293 *5*	α(K)=0.241 *4*; α(L)=0.0397 *6*; α(M)=0.00920 *13* α(N)=0.00229 *4*; α(O)=0.000421 *6*; α(P)=2.86×10^{-5} *4* Mult.: A$_2$=−0.05 *1*, A$_4$=+0.01 *11*.
356.3 *2*	76.8 *23*	803.66+x	(14$^-$)	447.34+x	(13$^-$)	M1+E2	0.208	α(K)=0.1717 *25*; α(L)=0.0282 *4*; α(M)=0.00653 *10* α(N)=0.001627 *23*; α(O)=0.000299 *5*; α(P)=2.03×10^{-5} *3* Mult.: A$_2$=−0.02 *1*, A$_4$=+0.03 *12*.
365.4 *5*	19 *3*	1535.4+x	(16$^-$)	1170.02+x	(15$^-$)			I$_\gamma$: from $\gamma\gamma$.
366.4 *5*	14 *2*	1170.02+x	(15$^-$)	803.66+x	(14$^-$)			I$_\gamma$: 365γ and 366γ are unresolved. Iγ from $\gamma\gamma$. For 365γ+366γ, A$_2$=−0.07 *7*, A$_4$=+0.07 *18*.
404.0 *3*	6 *2*	3416.9+x	(22$^-$)	3012.9+x	(21$^-$)			
422.3 *3*	7.3 *11*	1957.6+x	(17$^+$)	1535.4+x	(16$^-$)	E1	0.01234	α(K)=0.01024 *15*; α(L)=0.001619 *23*; α(M)=0.000373 *6* α(N)=9.22×10^{-5} *13*; α(O)=1.662×10^{-5} *24*; α(P)=1.004×10^{-6} *15* Mult.: A$_2$=−0.22 *6*, A$_4$=+0.20 *17*.
426.5 *4*	3.3 *7*	2669.2+x	(19$^-$)	2242.6+x	(18$^-$)	M1+E2	0.1288 *19*	α(K)=0.1062 *16*; α(L)=0.01736 *25*; α(M)=0.00402 *6* α(N)=0.001001 *15*; α(O)=0.000184 *3*; α(P)=1.252×10^{-5} *18* Mult.: A$_2$=−0.36 *11*, A$_4$=+0.11 *21*.
429.4 *4*	4.7 *7*	1964.8+x	(17$^-$)	1535.4+x	(16$^-$)	M1+E2	0.1265	α(K)=0.1043 *15*; α(L)=0.01705 *25*; α(M)=0.00395 *6* α(N)=0.000983 *14*; α(O)=0.000181 *3*; α(P)=1.229×10^{-5} *18* Mult.: A$_2$=−0.35 *7*, A$_4$=+0.12 *18*.
447.3 *2*	100	447.34+x	(13$^-$)	0.0+x	(11$^-$)	E2	0.0341	α(K)=0.0242 *4*; α(L)=0.00750 *11*; α(M)=0.00185 *3* α(N)=0.000457 *7*; α(O)=7.84×10^{-5} *11*; α(P)=2.66×10^{-6} *4* Mult.: A$_2$=+0.37 *1*, A$_4$=−0.07 *11*.
476.3 *2*	16.0 *15*	2733.3+x	(19$^+$)	2257.0+x	(18$^+$)	M1+E2	0.0961	α(K)=0.0793 *12*; α(L)=0.01292 *19*; α(M)=0.00299 *5* α(N)=0.000745 *11*; α(O)=0.0001371 *20*; α(P)=9.33×10^{-6} *13* Mult.: A$_2$=+0.18 *3*, A$_4$=+0.01 *14*.
480.9 *3*	5.9 *9*	4215.8+x		3734.9+x				Mult.: A$_2$=+0.46 *7*, A$_4$=−0.16 *19*.
489.4 *2*	12.7 *18*	803.66+x	(14$^-$)	314.26+x	(12$^-$)	E2	0.0272	α(K)=0.0198 *3*; α(L)=0.00565 *8*; α(M)=0.001381 *20* α(N)=0.000342 *5*; α(O)=5.91×10^{-5} *9*; α(P)=2.19×10^{-6} *3* Mult.: A$_2$=+0.37 *6*, A$_4$=−0.10 *14*.
509.5 *5*	5 *2*	3012.9+x	(21$^-$)	2503.3+x	(19$^-$)			I$_\gamma$: from $\gamma\gamma$.
519.9 *2*	12.4 *12*	3309.2+x	(21$^+$)	2789.3+x	(20$^+$)	M1+E2	0.0763	α(K)=0.0630 *9*; α(L)=0.01024 *15*; α(M)=0.00237 *4* α(N)=0.000590 *9*; α(O)=0.0001086 *16*; α(P)=7.39×10^{-6} *11* Mult.: A$_2$=−0.08 *4*, A$_4$=+0.03 *14*.
532.3 *2*	35.5 *22*	2789.3+x	(20$^+$)	2257.0+x	(18$^+$)	E2	0.0222	α(K)=0.01647 *23*; α(L)=0.00437 *7*; α(M)=0.001064 *15* α(N)=0.000264 *4*; α(O)=4.58×10^{-5} *7*;

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^{173}Yb(^{19}F,4nγ) E=93 MeV 1992Ja01 (continued)

$\gamma(^{188}Au)$ (continued)

E_γ [†]	I_γ [†]	E_i(level)	J_i^π	E_f	J_f^π	Mult. [‡]	α [#]	Comments
								α(P)=1.83×10^{-6} *3* Mult.: A_2=+0.35 *2*, A_4=−0.10 *12*.
538.4 *2*	11.8 *12*	2503.3+x	(19$^-$)	1964.8+x	(17$^-$)	E2	0.0216	α(K)=0.01607 *23*; α(L)=0.00423 *6*; α(M)=0.001028 *15* α(N)=0.000255 *4*; α(O)=4.43×10^{-5} *7*; α(P)=1.782×10^{-6} *25*
								Mult.: A_2=+0.29 *5*, A_4=+0.10 *15*.
559.6 *3*	5.1 *8*	4126.7+x	(23$^+$)	3567.0+x	(22$^+$)	M1+E2	0.0629	α(K)=0.0520 *8*; α(L)=0.00843 *12*; α(M)=0.00195 *3* α(N)=0.000485 *7*; α(O)=8.93×10^{-5} *13*; α(P)=6.09×10^{-6} *9*
								Mult.: A_2=−0.02 *13*, A_4=+0.12 *20*.
609.8 *4*	3.4 *7*	3416.9+x	(22$^-$)	2807.2+x	(20$^-$)	E2	0.01622	α(K)=0.01234 *18*; α(L)=0.00295 *5*; α(M)=0.000712 *10* α(N)=0.0001765 *25*; α(O)=3.09×10^{-5} *5*; α(P)=1.371×10^{-6} *20*
								Mult.: A_2=+0.37 *17*, A_4=+0.03 *25*.
630.6 *2*	17.6 *16*	2873.2+x	(20$^-$)	2242.6+x	(18$^-$)	E2	0.01504	α(K)=0.01151 *17*; α(L)=0.00269 *4*; α(M)=0.000647 *9* α(N)=0.0001605 *23*; α(O)=2.82×10^{-5} *4*; α(P)=1.279×10^{-6} *18*
								Mult.: A_2=+0.33 *2*, A_4=−0.01 *13*.
693.7 *5*	5 *2*	3362.9+x	(21$^-$)	2669.2+x	(19$^-$)			I_γ: from $\gamma\gamma$.
704.4 *4*	4.4 *9*	2669.2+x	(19$^-$)	1964.8+x	(17$^-$)	E2	0.01180	α(K)=0.00918 *13*; α(L)=0.00200 *3*; α(M)=0.000478 *7* α(N)=0.0001185 *17*; α(O)=2.10×10^{-5} *3*; α(P)=1.020×10^{-6} *15*
								Mult.: A_2=+0.76 *13*, A_4=+0.07 *15*.
707.2 *2*	18.3 *17*	2242.6+x	(18$^-$)	1535.4+x	(16$^-$)	E2	0.01170	α(K)=0.00911 *13*; α(L)=0.00198 *3*; α(M)=0.000473 *7* α(N)=0.0001172 *17*; α(O)=2.07×10^{-5} *3*; α(P)=1.012×10^{-6} *15*
								Mult.: A_2=+0.50 *3*, A_4=−0.04 *14*.
722.7 *2*	39.7 *24*	1170.02+x	(15$^-$)	447.34+x	(13$^-$)	E2	0.01117	α(K)=0.00872 *13*; α(L)=0.00187 *3*; α(M)=0.000446 *7* α(N)=0.0001107 *16*; α(O)=1.96×10^{-5} *3*; α(P)=9.68×10^{-7} *14*
								Mult.: A_2=+0.40 *2*, A_4=−0.10 *12*.
731.8 *5*	29 *3*	1535.4+x	(16$^-$)	803.66+x	(14$^-$)	E2	0.01087	α(K)=0.00851 *12*; α(L)=0.00181 *3*; α(M)=0.000432 *6* α(N)=0.0001071 *16*; α(O)=1.90×10^{-5} *3*; α(P)=9.44×10^{-7} *14*
								I_γ: from $\gamma\gamma$. Mult.: For the unresolved structure, A_2=+0.41 *6*, A_4=+0.08 *6*.
777.7 *2*	13.4 *13*	3567.0+x	(22$^+$)	2789.3+x	(20$^+$)	E2	0.00957	α(K)=0.00754 *11*; α(L)=0.001551 *22*; α(M)=0.000369 *6* α(N)=9.14×10^{-5} *13*; α(O)=1.626×10^{-5} *23*; α(P)=8.36×10^{-7} *12*
								Mult.: A_2=+0.34 *7*, A_4=−0.04 *15*.
794.9 *5*	21 *3*	1964.8+x	(17$^-$)	1170.02+x	(15$^-$)	E2	0.00914	α(K)=0.00722 *11*; α(L)=0.001468 *21*; α(M)=0.000349 *5* α(N)=8.65×10^{-5} *13*; α(O)=1.540×10^{-5} *22*; α(P)=8.00×10^{-7} *12*

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^{173}Yb(^{19}F,4nγ) E=93 MeV 1992Ja01 (continued)

$\gamma(^{188}Au)$ (continued)

E_γ[†]	I_γ[†]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[‡]	α[#]	Comments
								I_γ: unresolved doublet. Iγ from $\gamma\gamma$. Mult.: For the unresolved doublet, A_2=+0.40 *3*, A_4=−0.05 *13*.
795 *1*	2 *1*	3807.9+x	(23$^-$)	3012.9+x	(21$^-$)			I_γ: from $\gamma\gamma$, unresolved from main 794.9γ.
809.2 *3*	7.0 *11*	2344.5+x	(18$^-$)	1535.4+x	(16$^-$)	E2	0.00881	α(K)=0.00697 *10*; α(L)=0.001405 *20*; α(M)=0.000333 *5* α(N)=8.27×10^{-5} *12*; α(O)=1.473×10^{-5} *21*; α(P)=7.73×10^{-7} *11* Mult.: A_2=+0.30 *9*, A_4=+0.16 *19*.
818.2 *3*	9.1 *12*	4385.2+x	(24$^+$)	3567.0+x	(22$^+$)	E2	0.00861	α(K)=0.00682 *10*; α(L)=0.001367 *20*; α(M)=0.000324 *5* α(N)=8.04×10^{-5} *12*; α(O)=1.434×10^{-5} *21*; α(P)=7.56×10^{-7} *11* Mult.: A_2=+0.29 *4*, A_4=0.00 *14*.
861.7 *4*	4.9 *10*	3734.9+x		2873.2+x	(20$^-$)			A_2=+0.20 *11*, A_4=+0.04 *13*.
887.9 *2*	65 *3*	1691.6+x	(15$^+$)	803.66+x	(14$^-$)	E1	0.00275	α(K)=0.00230 *4*; α(L)=0.000344 *5*; α(M)=7.86×10^{-5} *11* α(N)=1.95×10^{-5} *3*; α(O)=3.56×10^{-6} *5*; α(P)=2.35×10^{-7} *4* Mult.: A_2=−0.21 *1*, A_4=+0.11 *11*. The absence of transition to the (13$^-$) level would argue against Mult.=M1.
940[@] *1*	<3	5325.2+x?	(26$^+$)	4385.2+x	(24$^+$)			

[†] From 1992Ja01. The authors quoted ΔEγ=0.2-0.5 keV, depending on Iγ. The uncertainty assigned here is as follows: 0.2 for Iγ>10, 0.3 for Iγ=5-10, 0.4 for Iγ<5 and 0.5 for unresolved structures and where Iγ is deduced (by 1992Ja01) from $\gamma\gamma$.
[‡] From $\gamma(\theta)$ data and the apparent band assignments in 1992Ja01.
[#] Additional information 2.
[@] Placement of transition in the level scheme is uncertain.

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Level Scheme

Intensities: Relative I_γ

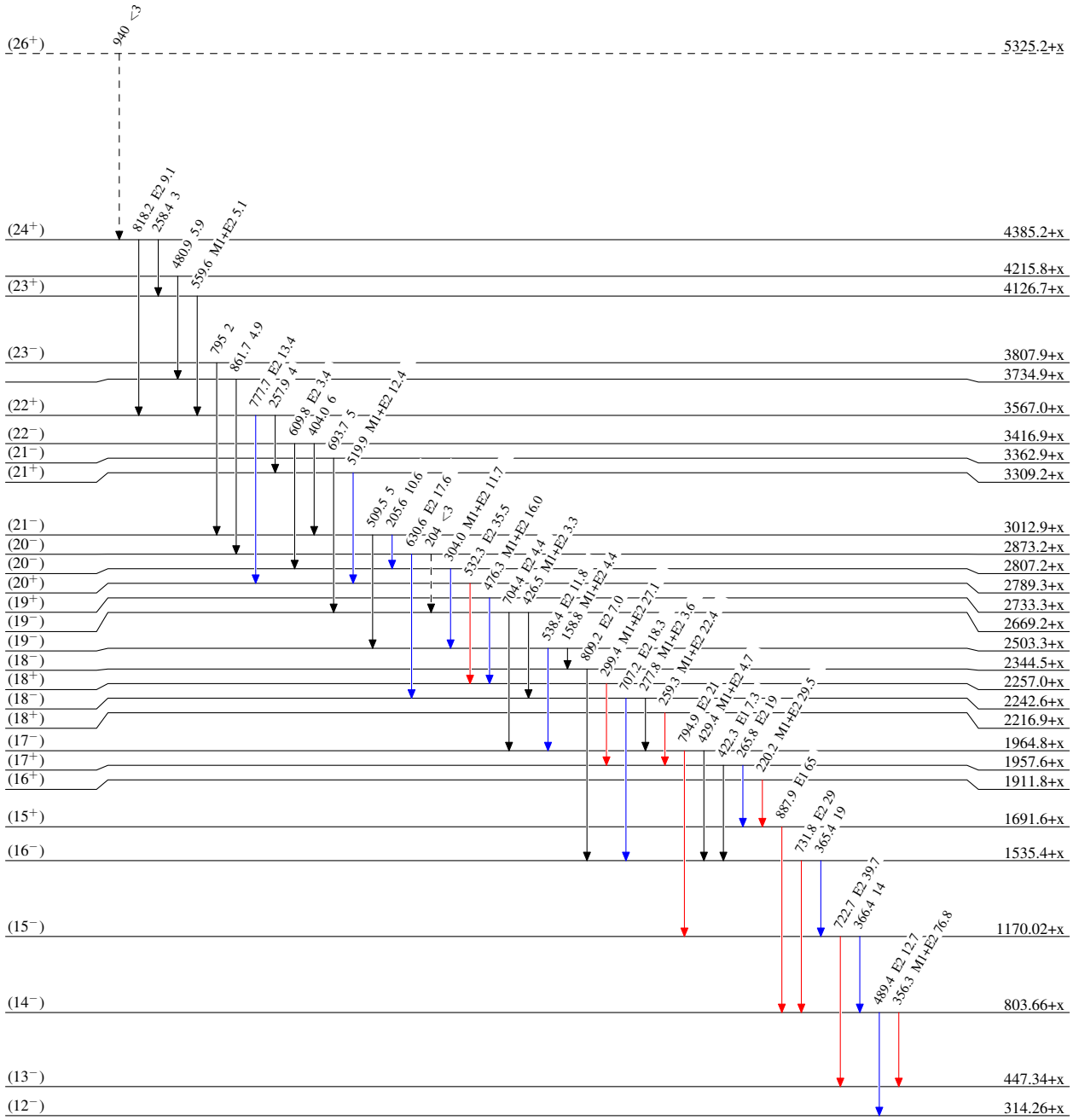
Legend

$I_\gamma < 2\% \times I_\gamma^{max}$

$I_\gamma < 10\% \times I_\gamma^{max}$

$I_\gamma > 10\% \times I_\gamma^{max}$

γ Decay (Uncertain)



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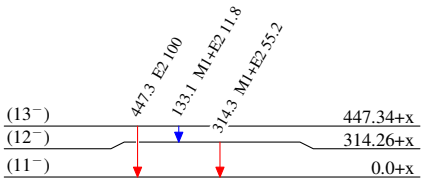
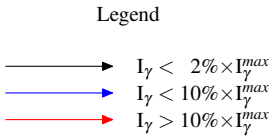
^{173}Yb(^{19}F,4nγ) E=93 MeV 1992Ja01

Level Scheme (continued)

Intensities: Relative I_γ



$^{188}_{79}Au_{109}$



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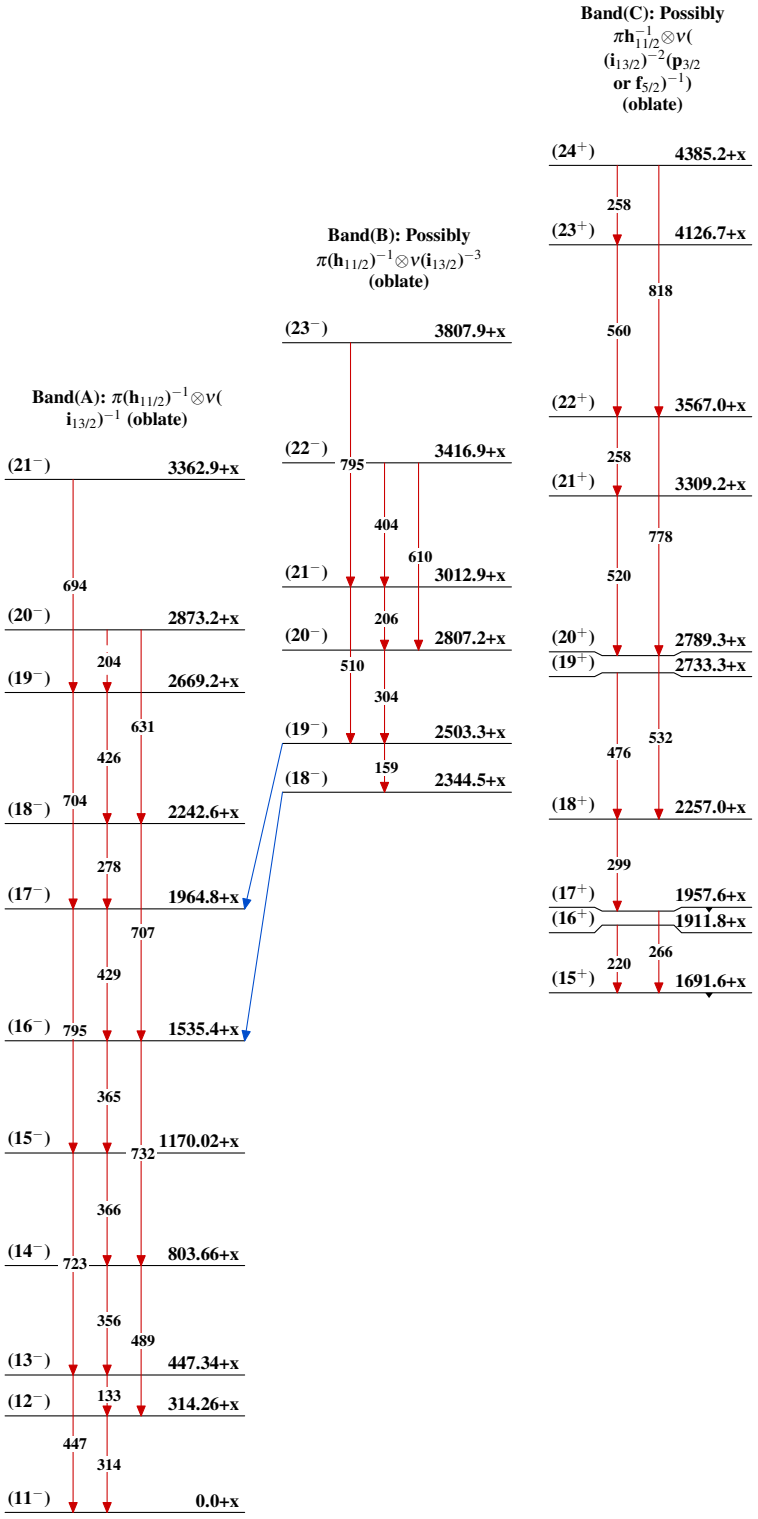

$^{188}_{79}Au_{109}$