(HI,xnγ) 1997Ru03

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	J. K. Tuli, E. Browne	NDS 157, 260 (2019)	1-Mar-2019

1997Ru03: ^{58}Ni(^{28}Si,2p2n), E=130 MeV. Gammasphere, 57 Compton-suppressed Ge array, 4π, 95 scin charged-particle detector array Microball, measured γγ, γγγ, DCO, $T_{1/2}$ (RDM).
1997Pa07: ^{58}Ni(^{27}Al,p2nγ), E=92 MeV, γγ, $T_{1/2}$ (RDM), observed g.s. band up to 14^+.
1993Mi07,1993Mi11: ^{58}Ni(^{28}Si,2p2nγ), E=128 MeV, γγ, Iγ.
1993Ch41: ^{58}Ni(^{28}Si,2p2n), E=120, 125 MeV. Measured $T_{1/2}$ (RDM).
1982Li17: mass separated products from Sr(He,X). Measured Eγ, x-rays.
1982De36: products from ^{54}Fe(^{32}S,X). Time-of-flight mass separator. Measured Eβ, Eγ.

^{82}Zr Levels

E(level)	Jπ†#	$T_{1/2}$‡	Comments
0.0&	0^+		
407.00& *10*	2^+	22 ps *9*	$T_{1/2}$: from 1997Pa07 RDM. Other: 28 ps *3* (1993Ch41) RDM.
1040.84& *14*	4^+	3.3 ps *7*	$T_{1/2}$: from 1997Pa07 RDM. Other: 5.5 ps *14* (1993Ch41) RDM.
1060.87? *22*			
1449.14@ *21*	$(3)^+$		
1887.87& *24*	6^+	0.5 ps *2*	$T_{1/2}$: from 1997Ru03 and 1997Pa07 RDM.
2057.3 *6*			
2175.40@ *24*	$(5)^+$		
2691.6?a *8*	(4^-)		
2791.6b *3*	$5^{(-)}$		
2856.99c *23*	5^-		
2908.6& *4*	8^+	0.22 ps *6*	
3068.4@ *4*	$(7)^+$		
3128.2d *3*	6^-		
3287.3a *7*	(6^-)		
3480.8b *4*	$7^{(-)}$		
3506.8c *4*	7^-		
3946.7d *4*	8^-		
4022.6a *8*	(8^-)		
4036.9& *5*	10^+	0.16 ps *4*	
4086.4@ *6*	$(9)^+$		
4347.7b *5*	$9^{(-)}$		
4444.1c *8*	(9^-)		
4908.4d *6*	10^-		
4973.2a *9*	(10^-)		
5195.4@ *12*	$(11)^+$		
5213.4& *7*	12^+	0.13 ps *4*	
5361.4b *8*	$11^{(-)}$		
5550.1c *22*	(11^-)		
5989.2d *8*	12^-		
6100.2a *14*	(12^-)		
6406.4@ *16*	(13^+)		
6490.7& *7*	14^+	<0.27 ps	$T_{1/2}$: effective $T_{1/2}$ not corrected for feeding.
6535.9b *11*	$13^{(-)}$		
7041.7d *9*	14^-		

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(HI,xnγ) 1997Ru03 (continued)

^{82}Zr Levels (continued)

E(level)	Jπ†#	E(level)	Jπ†#	E(level)	Jπ†#	E(level)	Jπ†#
7345.2[a] *17*	(14⁻)	7992.5 *12*	(16⁺)	9234.9? *25*	(17⁻)	12365?[d] *3*	(22⁻)
7680.4 *19*	(15)⁺	8113.7[d] *14*	16⁻	9338.7[d] *17*	(18⁻)	14013[&] *3*	(24⁺)
7687.9[b] *15*	(15⁻)	9046.9?[b] *18*	(17⁻)	9452.8 *12*	(18⁺)	16120?[&] *4*	(26⁺)
7750.4 *19*	(15⁺)	9070? *3*	(17)⁺	10490.7[&] *17*	(20⁺)		
7859.7[&] *8*	16⁺	9111.7[&] *13*	18⁺	10752.7[d] *20*	(20⁻)		
7907.9? *23*	(15⁻)	9183? *3*	(17)⁺	12126.7[&] *19*	(22⁺)		

† π=− Band C and Band D are signature partners; Band E and Band F are signature partners.
‡ From Doppler-shift analysis (1997Ru03), unless given otherwise.
# From 1997Ru03 based on multipolarities determined by DCO ratios and band membership.
@ Band(A): π=+, α=1, side band.
& Band(B): π=+, α=0, g.s. band.
[a] Band(C): π=−, α=0.
[b] Band(D): π=−, α=1.
[c] Band(E): π=−, α=1.
[d] Band(F): π=−, α=0.

γ(^{82}Zr)

DCO ratios are determined with gates set at stretch E2 transitions; various gates were A(278γ), B(278γ+504γ), C(278γ+712γ) D(278γ+712γ+895γ), E(504γ+712γ+895γ).

Eγ	Iγ	Ei(level)	J_i^π	Ef	J_f^π	Mult.‡	α#	Comments
219 *1*	1 *1*	3287.3	(6⁻)	3068.4	(7)⁺			
271.1 *2*	7 *1*	3128.2	6⁻	2856.99	5⁻	D		DCO(gate B)=0.53 5.
336.6 *3*	1 *1*	3128.2	6⁻	2791.6	5⁽⁻⁾			
377.5 *6*	3 *1*	3506.8	7⁻	3128.2	6⁻	D+Q		DCO(gate B)=0.43 7.
387.7 *6*	3 *1*	1449.14	(3)⁺	1060.87?				
407.0 *1*	120 *4*	407.00	2⁺	0.0	0⁺	E2	0.00791	α(K)=0.00692 *10*; α(L)=0.000825 *12*; α(M)=0.0001432 *20* α(N)=2.00×10⁻⁵ *3*; α(O)=1.282×10⁻⁶ *18* DCO(gate B)=1.03 4.
408.3 *3*	1.0 *5*	1449.14	(3)⁺	1040.84	4⁺			Eγ: complex calculated from E(level).
439.2 *7*	2 *1*	3946.7	8⁻	3506.8	7⁻			
464 *1*	1 *1*	4908.4	10⁻	4444.1	(9⁻)			
596 *1*	1 *1*	3287.3	(6⁻)	2691.6?	(4⁻)			
633.9 *1*	100 *3*	1040.84	4⁺	407.00	2⁺	E2	0.00212	α(K)=0.00186 *3*; α(L)=0.000213 *3*; α(M)=3.70×10⁻⁵ *6* α(N)=5.21×10⁻⁶ *8*; α(O)=3.52×10⁻⁷ *5* DCO(gate A) =1.01 3.
650.1 *4*	3 *1*	3506.8	7⁻	2856.99	5⁻			
653.8 *2*	4 *1*	1060.87?		407.00	2⁺			
689 *1*	3 *1*	3480.8	7⁽⁻⁾	2791.6	5⁽⁻⁾			
726.0 *2*	10 *1*	2175.40	(5)⁺	1449.14	(3)⁺	(E2)	1.47×10⁻³	α(K)=0.001296 *19*; α(L)=0.0001468 *21*; α(M)=2.55×10⁻⁵ *4* α(N)=3.59×10⁻⁶ *5*; α(O)=2.46×10⁻⁷ *4* DCO(gate A)=0.95 12.
735.3 *4*	5 *1*	4022.6	(8⁻)	3287.3	(6⁻)	E2	1.42×10⁻³	α(K)=0.001254 *18*; α(L)=0.0001419 *20*;

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(HI,xnγ) 1997Ru03 (continued)

γ(^{82}Zr) (continued)

E_γ	I_γ	E_i(level)	J_i^π	E_f	J_f^π	Mult.‡	α#	Comments
								α(M)=2.46×10^{-5} *4* α(N)=3.48×10^{-6} *5*; α(O)=2.38×10^{-7} *4* DCO(gate C)=0.92 17.
800& *1*	1 *1*	2856.99	5$^-$	2057.3				
818.7 *3*	8 *1*	3946.7	8$^-$	3128.2	6$^-$	E2	1.08×10^{-3}	α(K)=0.000955 *14*; α(L)=0.0001073 *15*; α(M)=1.86×10^{-5} *3* α(N)=2.63×10^{-6} *4*; α(O)=1.81×10^{-7} *3* DCO(gate B)=1.07 9.
847.0 *2*	76 *2*	1887.87	6$^+$	1040.84	4$^+$	E2	9.96×10^{-4}	α(K)=0.000878 *13*; α(L)=9.85×10^{-5} *14*; α(M)=1.708×10^{-5} *24* α(N)=2.42×10^{-6} *4*; α(O)=1.669×10^{-7} *24* DCO(gate C)=1.07 3.
866.9 *3*	9 *1*	4347.7	9$^{(-)}$	3480.8	7$^{(-)}$	E2	9.41×10^{-4}	α(K)=0.000830 *12*; α(L)=9.29×10^{-5} *13*; α(M)=1.612×10^{-5} *23* α(N)=2.28×10^{-6} *4*; α(O)=1.578×10^{-7} *23* DCO(gate C)=1.07 12.
893.1 *3*	14 *1*	3068.4	(7)$^+$	2175.40	(5)$^+$	E2	8.76×10^{-4}	α(K)=0.000772 *11*; α(L)=8.63×10^{-5} *13*; α(M)=1.497×10^{-5} *21* α(N)=2.12×10^{-6} *3*; α(O)=1.469×10^{-7} *21* DCO(gate C)=0.93 7.
937 *1*	3 *1*	4444.1	(9$^-$)	3506.8	7$^-$			
950.6 *4*	4 *1*	4973.2	(10$^-$)	4022.6	(8$^-$)			
961.7 *4*	8 *1*	4908.4	10$^-$	3946.7	8$^-$	E2	7.35×10^{-4}	α(K)=0.000648 *9*; α(L)=7.22×10^{-5} *11*; α(M)=1.251×10^{-5} *18* α(N)=1.773×10^{-6} *25*; α(O)=1.234×10^{-7} *18* DCO(gate B)=1.07 10.
1013.7 *6*	11 *1*	5361.4	11$^{(-)}$	4347.7	9$^{(-)}$	E2	6.50×10^{-4}	α(K)=0.000574 *8*; α(L)=6.38×10^{-5} *9*; α(M)=1.105×10^{-5} *16* α(N)=1.566×10^{-6} *22*; α(O)=1.094×10^{-7} *16* DCO(gate C)=1.00 14.
1017† *1*	3 *1*	2057.3		1040.84	4$^+$			
1017.9 *4*	12 *2*	4086.4	(9)$^+$	3068.4	(7)$^+$			
1020.7 *3*	48 *3*	2908.6	8$^+$	1887.87	6$^+$	E2	6.40×10^{-4}	α(K)=0.000565 *8*; α(L)=6.27×10^{-5} *9*; α(M)=1.087×10^{-5} *16* α(N)=1.541×10^{-6} *22*; α(O)=1.077×10^{-7} *15* DCO(gate D)=1.15 6.
1041.7 *3*	7 *1*	1449.14	(3)$^+$	407.00	2$^+$	D+Q		DCO(gate A)=0.85 9.
1052.5 *5*	6 *1*	7041.7	14$^-$	5989.2	12$^-$	E2	5.97×10^{-4}	α(K)=0.000527 *8*; α(L)=5.84×10^{-5} *9*; α(M)=1.013×10^{-5} *15* α(N)=1.436×10^{-6} *21*; α(O)=1.005×10^{-7} *15* DCO(gate C)=0.99 20.
1071† *1*	2 *1*	3128.2	6$^-$	2057.3				
1072 *1*	5 *1*	8113.7	16$^-$	7041.7	14$^-$	E2	5.73×10^{-4}	α(K)=0.000506 *8*; α(L)=5.60×10^{-5} *8*; α(M)=9.71×10^{-6} *14* α(N)=1.377×10^{-6} *20*; α(O)=9.64×10^{-8} *14* DCO(gate C)=1.01 16.
1080.8 *5*	8 *1*	5989.2	12$^-$	4908.4	10$^-$	E2	5.63×10^{-4}	α(K)=0.000497 *7*; α(L)=5.50×10^{-5} *8*; α(M)=9.53×10^{-6} *14* α(N)=1.351×10^{-6} *19*; α(O)=9.47×10^{-8} *14* DCO(gate C)=1.21 19.
1106 *2*	2 *1*	5550.1	(11$^-$)	4444.1	(9$^-$)			
1109† *1*	10 *2*	5195.4	(11)$^+$	4086.4	(9)$^+$	E2	5.32×10^{-4}	α(K)=0.000469 *7*; α(L)=5.19×10^{-5} *8*;

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(HI,xnγ) 1997Ru03 (continued)

γ(^{82}Zr) (continued)

E_γ	I_γ	E_i(level)	J_i^π	E_f	J_f^π	Mult.‡	α#	Comments
								α(M)=8.99×10^{-6} *13* α(N)=1.275×10^{-6} *18*; α(O)=8.94×10^{-8} *13*; α(IPF)=8.6×10^{-7} *3* DCO(gate C)=0.94 13.
1127 *1*	3 *1*	6100.2	(12$^-$)	4973.2	(10$^-$)			
1128.3 *3*	39 *2*	4036.9	10$^+$	2908.6	8$^+$	E2	5.13×10^{-4}	α(K)=0.000451 *7*; α(L)=4.99×10^{-5} *7*; α(M)=8.65×10^{-6} *13* α(N)=1.227×10^{-6} *18*; α(O)=8.61×10^{-8} *12*; α(IPF)=1.53×10^{-6} *3* DCO(gate D)=1.03 4.
1135.2 *3*	5 *1*	2175.40	(5)$^+$	1040.84	4$^+$			
1152 *1*	3 *1*	7687.9	(15$^-$)	6535.9	13$^{(-)}$			
1174.4 *7*	10 *1*	6535.9	13$^{(-)}$	5361.4	11$^{(-)}$			
1176.5 *4*	31 *2*	5213.4	12$^+$	4036.9	10$^+$	E2	4.72×10^{-4}	α(K)=0.000412 *6*; α(L)=4.55×10^{-5} *7*; α(M)=7.88×10^{-6} *11* α(N)=1.118×10^{-6} *16*; α(O)=7.86×10^{-8} *11*; α(IPF)=5.02×10^{-6} *9* DCO(gate D)=1.03 4.
1180† *1*	3 *1*	3068.4	(7)$^+$	1887.87	6$^+$			E_γ: calculated from E(level).
1211 *1*	7 *1*	6406.4	(13$^+$)	5195.4	(11)$^+$			
1225 *1*	4 *1*	9338.7	(18$^-$)	8113.7	16$^-$			
1245 *1*	2 *1*	7345.2	(14$^-$)	6100.2	(12$^-$)			
1252 *1*	7 *1*	9111.7	18$^+$	7859.7	16$^+$	E2	4.25×10^{-4}	α(K)=0.000361 *5*; α(L)=3.97×10^{-5} *6*; α(M)=6.88×10^{-6} *10* α(N)=9.77×10^{-7} *14*; α(O)=6.89×10^{-8} *10*; α(IPF)=1.67×10^{-5} *3* DCO(gate D)=1.10 16.
1274 *1*	3 *1*	7680.4	(15)$^+$	6406.4	(13$^+$)			
1277.3 *3*	22 *1*	6490.7	14$^+$	5213.4	12$^+$	E2	4.13×10^{-4}	α(K)=0.000346 *5*; α(L)=3.80×10^{-5} *6*; α(M)=6.59×10^{-6} *10* α(N)=9.36×10^{-7} *14*; α(O)=6.60×10^{-8} *10*; α(IPF)=2.19×10^{-5} *4* DCO(gate D)=1.04 6.
1327& *1*	2 *1*	9234.9?	(17$^-$)	7907.9?	(15$^-$)			
1344 *1*	3 *1*	7750.4	(15$^+$)	6406.4	(13$^+$)			
1359& *1*	2 *1*	9046.9?	(17$^-$)	7687.9	(15$^-$)			
1368.9 *4*	15 *1*	7859.7	16$^+$	6490.7	14$^+$	E2	3.82×10^{-4}	α(K)=0.000299 *5*; α(L)=3.28×10^{-5} *5*; α(M)=5.69×10^{-6} *8* α(N)=8.08×10^{-7} *12*; α(O)=5.72×10^{-8} *8*; α(IPF)=4.32×10^{-5} *7* DCO(gate D)=1.02 13.
1372& *2*	3 *1*	7907.9?	(15$^-$)	6535.9	13$^{(-)}$			
1379 *1*	4 *1*	10490.7	(20$^+$)	9111.7	18$^+$			
1390& *2*	2 *1*	9070?	(17)$^+$	7680.4	(15)$^+$			
1399 *1*	6 *1*	3287.3	(6$^-$)	1887.87	6$^+$			
1414 *1*	3 *1*	10752.7	(20$^-$)	9338.7	(18$^-$)			
1433& *2*	2 *1*	9183?	(17)$^+$	7750.4	(15$^+$)			
1439 *1*	4 *1*	4347.7	9$^{(-)}$	2908.6	8$^+$			
1461 *2*	2 *1*	9452.8	(18$^+$)	7992.5	(16$^+$)			
1502 *1*	3 *1*	7992.5	(16$^+$)	6490.7	14$^+$			
1593.0@ *3*	8@ *1*	3480.8	7$^{(-)}$	1887.87	6$^+$	(E1)	4.44×10^{-4}	α(K)=0.0001121 *16*; α(L)=1.209×10^{-5} *17*;

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(HI,xnγ) 1997Ru03 (continued)

γ(^{82}Zr) (continued)

E_γ	I_γ	E_i(level)	J_i^π	E_f	J_f^π	Mult.‡	α#	Comments
								α(M)=2.09×10^{-6} *3* α(N)=2.98×10^{-7} *5*; α(O)=2.13×10^{-8} *3*; α(IPF)=0.000317 *5* DCO(gate C)=0.67 17.
1593@ *1*	3@ *1*	9452.8	(18$^+$)	7859.7	16$^+$			
1612& *2*	2 *1*	12365?	(22$^-$)	10752.7	(20$^-$)			
1619& *2*	1 *1*	3506.8	7$^-$	1887.87	6$^+$			
1636 *1*	3 *1*	12126.7	(22$^+$)	10490.7	(20$^+$)			
1651& *1*	1 *1*	2691.6?	(4$^-$)	1040.84	4$^+$			
1750.7 *3*	4 *1*	2791.6	5$^{(-)}$	1040.84	4$^+$	(E1)	5.47×10^{-4}	α(K)=9.63×10^{-5} *14*; α(L)=1.037×10^{-5} *15*; α(M)=1.79×10^{-6} *3* α(N)=2.55×10^{-7} *4*; α(O)=1.83×10^{-8} *3*; α(IPF)=0.000439 *7* DCO(gate B)=0.46 11.
1816.1 *2*	9 *1*	2856.99	5$^-$	1040.84	4$^+$	(E1)	5.90×10^{-4}	α(K)=9.09×10^{-5} *13*; α(L)=9.79×10^{-6} *14*; α(M)=1.693×10^{-6} *24* α(N)=2.41×10^{-7} *4*; α(O)=1.726×10^{-8} *25*; α(IPF)=0.000487 *7* DCO(gate B)=0.47 7.
1886 *2*	2 *1*	14013	(24$^+$)	12126.7	(22$^+$)			
2107& *3*	1 *1*	16120?	(26$^+$)	14013	(24$^+$)			

† Complex.

‡ The expected DCO ratios are 1.0 for a stretched Q transition and ≠0.5-0.6 for stretched d. Q are taken as E2′s as mostly M2 are unlikely on basis of RUL. D are taken as E1 by level-scheme placement.

Additional information 1.

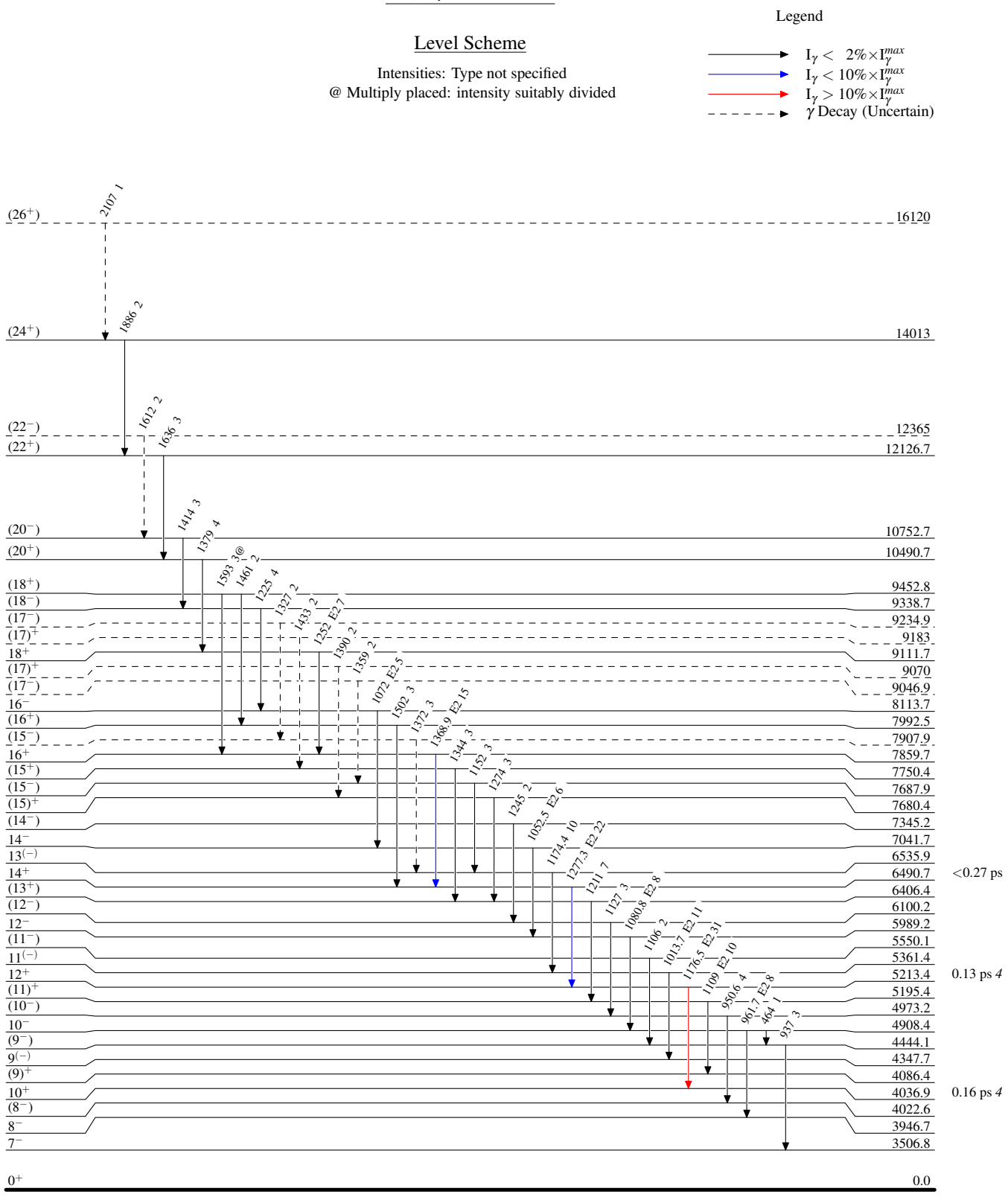
@ Multiply placed with intensity suitably divided.

& Placement of transition in the level scheme is uncertain.

(HI,xnγ) 1997Ru03

Level Scheme

Intensities: Type not specified
@ Multiply placed: intensity suitably divided



$^{82}_{40}Zr_{42}$

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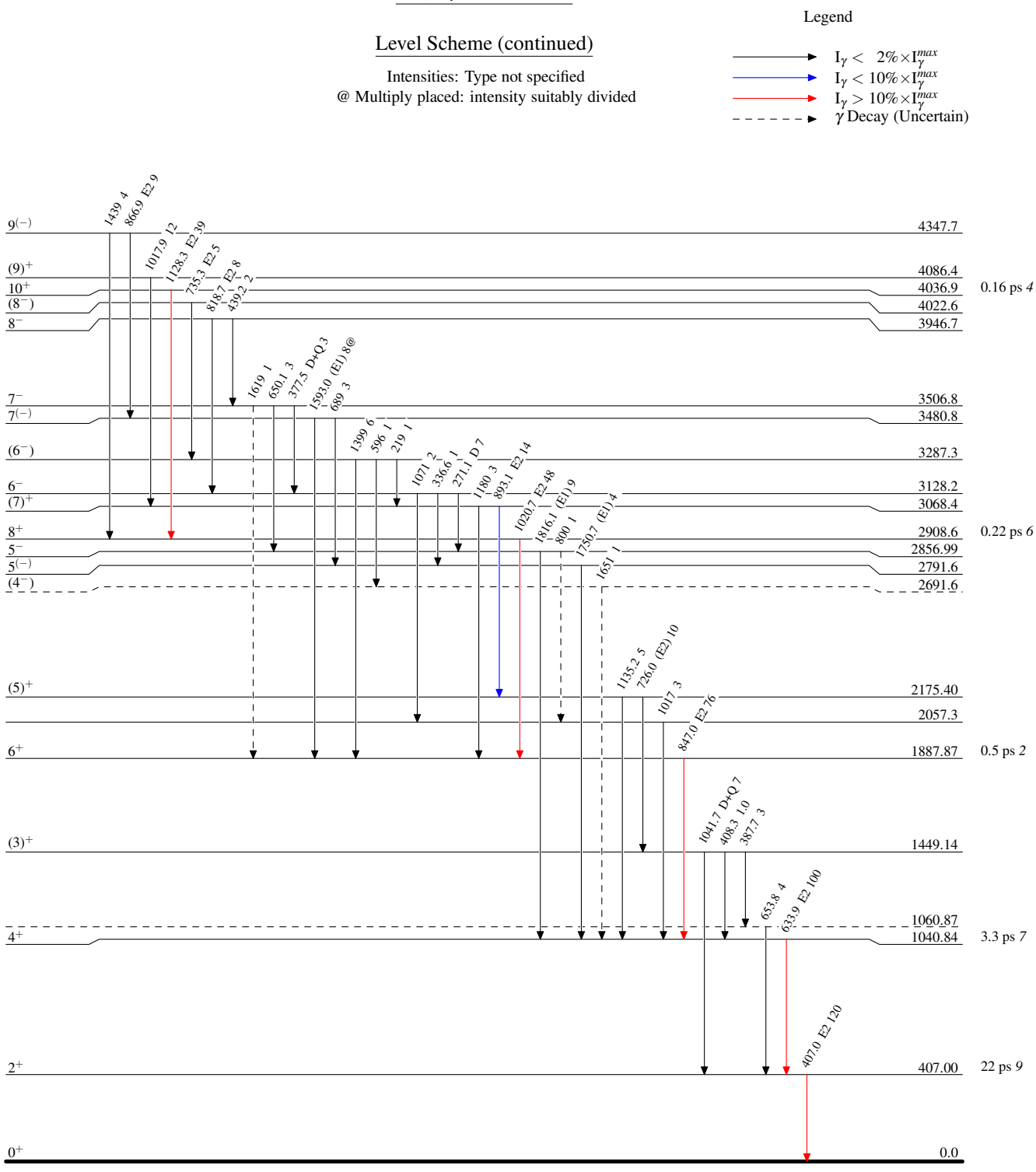
Level Scheme (continued)

Intensities: Type not specified
@ Multiply placed: intensity suitably divided



$^{82}_{40}Zr_{42}$

(HI,xnγ) 1997Ru03