^{58}Ni(^{19}F,3pγ) 1990Co21

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh, Ameenah R. Farhan	NDS 107, 1923 (2006)	30-Apr-2006

Includes reactions: ^{12}C(^{64}Ni,2nγ); ^{48}Ti(^{32}S,α2pγ); ^{51}V(^{28}Si,p$\alpha\gamma$); ^{52}Cr(^{28}Si,α2pγ); ^{54}Fe(^{24}Mg,4pγ); ^{60}Ni(^{16}O,2pγ); ^{63}Cu(^{14}N,2pnγ); ^{64}Ni(^{12}C,2nγ); ^{64}Ni(^{16}O,α2nγ); ^{65}Cu(^{11}B,2nγ); ^{65}Cu(^{12}C,p2nγ); ^{72}Ge(α,2nγ); ^{73}Ge(α,3nγ).

1990Co21 (also 1987Gr26): ^{48}Ti(^{32}S,α2pγ) E=106 MeV, ^{58}Ni(^{19}F,3pγ) E=62 MeV. Measured γ, $\gamma\gamma$, $T_{1/2}$(DSA method), $\gamma\gamma(\theta)$(DCO). 1987Gr26: ^{52}Cr(^{28}Si,α2pγ) E=98 MeV, The g.s. band up to 22$^+$ reported with a cascade of 11 transitions. Above 16$^+$, however, there are differences in the transitions in the cascade as shown in 1987Gr26 and 1990Co21.

Other measurements:

1. 2001Pa53: ^{54}Fe(^{24}Mg,4pγ) E=104 MeV, measured $T_{1/2}$(DSA method). Lifetimes of 3 levels from 18$^+$ to 22$^+$.
2. 1999Lo17: ^{58}Ni(^{19}F,3pγ) E=70 MeV, measured $T_{1/2}$(DSA method). Lifetimes of 6 levels In g.s. band from 8$^+$ to 18$^+$.
3. 1999Mu21: ^{51}V(^{28}Si,p$\alpha\gamma$) E=115 MeV, measured $T_{1/2}$(DSA method). Lifetimes of 6 levels from 8$^-$ to 13$^-$.
4. 1998Do09: ^{65}Cu(^{12}C,p2nγ) E=50 MeV. Measured Eγ, Iγ, $\gamma\gamma$, and $\gamma\gamma(\theta)$(DCO) using PITT-FSU array with 9 Compton-suppressed Ge detectors. Results are given In a separate dataset: ^{65}Cu(^{12}C,p2nγ).
5. 1990MoZX: ^{12}C(^{64}Ni,2nγ) E=195 MeV, measured $\gamma(\theta$,H), g-factor.
6. 1989Ad01: ^{73}Ge(α,3nγ) E=40 MeV, ^{65}Cu(^{12}C,p2nγ) E=42 MeV. Measured γ,$T_{1/2}$(DSA and recoil-distance Doppler shift methods).
7. 1982An09: ^{60}Ni(^{16}O,2pγ) E=56 MeV, measured γ(t), $T_{1/2}$(Doppler-shift attenuation method).
8. 1979Pi05 (also 1977PiZR,1976Pi07): ^{60}Ni(^{16}O,2pγ) E=45 MeV; ^{64}Ni(^{12}C,2nγ) E=39 MeV; ^{65}Cu(^{11}B,2nγ) E=29 MeV. Measured γ, $\gamma(\theta)$, $\gamma\gamma(\theta)$. Lifetime results are included here whereas detailed data are given In a separate dataset: ^{64}Ni(^{12}C,2nγ),^{60}Ni(^{16}O,2pγ).
9. 1979An14: ^{64}Ni(^{16}O,α2nγ) E=80 MeV, measured Eγ-Eγ correlations for the continuum.
10. 1979Ki17: ^{60}Ni(^{16}O,2pγ) E=42, 45, 50, 55 MeV; ^{63}Cu(^{14}N,2pnγ) E=50 MeV; ^{65}Cu(^{12}C,p2nγ) E=48 MeV. Measured $T_{1/2}$(DSA and recoil-Doppler shift methods).
11. 1976Ha10: ^{64}Ni(^{16}O,α2nγ) E=42-81 MeV, measured γ, $\alpha\gamma$ coincidences, $T_{1/2}$(DSA method). Only g.s. band up to J=12 reported.
12. 1973Wy01, 1971WyZX, 1970Li11: ^{72}Ge(α,2nγ) E=27.5 MeV. γ, ce data on g.s. band up to J$^\pi$=8$^+$ reported.
13. 1970No03: ^{60}Ni(^{16}O,2pγ) E=42-57 MeV. γ, $\gamma\gamma$ data for g.s. band up to J=8.

^{74}Se Levels

E(level)[‡]	J$^\pi$[†]	$T_{1/2}$[#]	Comments
0.0[&]	0$^+$		
634.90[&] *16*	2$^+$	7.4 ps *6*	$T_{1/2}$: weighted average of 7.3 ps *6* (1979Ki17), 9.7 ps *28* (1989Ad01).
1268.81 *16*	2$^+$	4.0 ps *11*	$T_{1/2}$: from 1979Ki17.
1363.10[&] *19*	4$^+$	2.73 ps *20*	$T_{1/2}$: weighted average of 2.4 ps *6* (1979Ki17), 2.77 ps *21* (1989Ad01).
1884.02[c] *19*	3$^+$[@]	1.5 ps *6*	$T_{1/2}$: from 1979Ki17.
2107.60 *19*	4$^+$	1.9 ps *7*	$T_{1/2}$: from (1979Ki17).
2231.04[&] *22*	6$^+$	0.86 ps *17*	$T_{1/2}$: weighted average of 1.2 ps *6* (1979Ki17), 1.0 ps *3* (DSA method) (1979Ki17), 1.04 ps *21*, 0.97 ps *21* (1989Ad01), 0.53 ps *11* (DSA method) (1990Co21) and 1.66 ps *21* (DSA method)(1979Pi05).
2349.13[a] *19*	3$^-$	23 ps *3*	$T_{1/2}$: weighted average of 25 ps *4* (1979Ki17), 17 ps *7* (1989Ad01).
2661.53[c] *21*	5$^+$[@]	1.7 ps *6*	$T_{1/2}$: from 1979Ki17.
2830.92[b] *24*	(4$^-$)	10 ps *3*	$T_{1/2}$: from 1989Ad01.
2842.18[a] *20*	5$^-$	7.3 ps *8*	$T_{1/2}$: weighted average for 7.1 ps *8* (1979Ki17), 9.7 ps *28* (1989Ad01).
2986.3 *4*	(6$^+$)		J$^\pi$: From 1998Do09. In 1990Co21, J=(5,6$^+$).
3197.8[&] *5*	8$^+$	0.38 ps *4*	$T_{1/2}$: DSA method. Weighted average of 0.263 ps *35* (1999Lo17), 0.55 ps *7* (1979Pi05), 0.67 ps *7* (1976Ha10), 0.83 ps *21* (1979Ki17), 0.58 ps *14*, 0.49 ps *14* (1989Ad01) and 0.374 ps *21* (1990Co21).
3382.12[b] *22*	(6$^-$)	4.9 ps *17*	$T_{1/2}$: from (1989Ad01).
3515.6[a] *3*	7$^-$	3.5 ps *3*	$T_{1/2}$: weighted average of 3.6 ps *4* (1979Ki17), 3.2 ps *7* (1989Ad01) and 3.5 ps *14* (DSA

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^{58}Ni(^{19}F,3pγ) 1990Co21 (continued)

^{74}Se Levels (continued)

E(level)[‡]	J$^{\pi}$[†]	$T_{1/2}$[#]	Comments
			method, 1979Pi05).
3524.7[c] *3*	7+[@]	0.72 ps *24*	$T_{1/2}$: weighted average of 1.8 ps *10* (1979Ki17), 1.1 ps *3* (1989Ad01) and 0.49 ps *21* (DSA method, 1979Pi05).
4197.7[b] *3*	(8−)	1.4 ps *3*	$T_{1/2}$: from 1989Ad01. Other: 1.3 ps *+5−4* (DSA method 1999Mu21).
4255.2[&] *6*	10+	0.21 ps *4*	$T_{1/2}$: DSA method. Weighted average of 0.139 ps *14* (1999Lo17), 0.49 ps *14* (1979Ki17),0.47 ps *4* (1976Ha10), 0.37 ps *7* (1979Pi05), 0.22 ps *3*, 0.35 ps *6* (1989Ad01) and 0.243 ps *21* (1990Co21).
4402.7[a] *5*	9−	0.58 ps *6*	$T_{1/2}$: DSA method. Weighted average of 0.83 ps *56* (1979Ki17), 0.49 ps *14* (1979Pi05), 0.76 ps *14* (1989Ad01) and 0.55 ps *7* (1990Co21).
4449.2[c] *5*	9+[@]	0.57 ps *9*	$T_{1/2}$: weighted average of 1.8 ps *10* (1979Ki17), 1.1 ps *5* (DSA method, 1979Ki17), 0.42 ps *14* (DSA method 1979Pi05), 0.58 ps *10* and 0.9 ps *3* (1989Ad01).
5208.7[b] *5*	(10−)	0.9 ps *3*	$T_{1/2}$: from 1989Ad01. Other: 0.30 ps *+12−9* (DSA method 1999Mu21).
5441.8[&] *10*	12+	0.12 ps *3*	$T_{1/2}$: DSA method. Weighted average of 0.062 ps *21* (1999Lo17), 0.24 ps *7* (1979Ki17), 0.21 ps *10* (1979Pi05), 0.28 ps *4* (1976Ha10), 0.17 ps *3* (1989Ad01) and 0.111 ps *14* (1990Co21).
5490.5[a] *7*	11−	0.23 ps *2*	$T_{1/2}$: DSA method. Weighted average of 0.26 ps *7* (1999Mu21), 0.24 ps *7* (1979Ki17), 0.28 ps *4* (1979Pi05), 0.37 ps *7*, 0.28 ps *7* (1989Ad01) and 0.194 ps *21* (1990Co21).
5492.0[c] *6*	11+[@]		
6253.5[b] *7*	(12−)	<0.74 ps	$T_{1/2}$: DSA method (1999Mu21).
6681.5?[c] *9*	(13+)[@]		E(level): it is assumed that this level is the same As the 6686, 13+ In 1998Do09 deexciting by 1192.9γ.
6685.7[a] *10*	13−	0.22 ps *10*	$T_{1/2}$: weighted average of 0.44 ps *14* (DSA method 1979Ki17), 0.17 ps *7* (1989Ad01).
6733.6[&] *13*	14+	0.135 ps *14*	$T_{1/2}$: DSA method. Weighted average of 0.097 ps *21* (1999Lo17), 0.21 ps *6* (1979Ki17), 0.24 ps *10* (1979Pi05), 0.21 ps *4* (1976Ha10), 0.15 ps *6*, 0.21 ps *7* (1989Ad01) and 0.132 ps *14* (1990Co21).
7451.9[b] *10*	(14−)		
7976.8?[a] *14*	(15−)		
8114.1[&] *17*	16+	0.075 ps *15*	$T_{1/2}$: DSA method. Weighted average of 0.062 ps *14* (1999Lo17), 0.09 ps *5* (1979Ki17), 0.15 ps *4* and 0.10 ps *4* (1976Ha10).
9677.9[&] *22*	(18+)	0.076 ps *21*	$T_{1/2}$: from DSA method (2001Pa53). Other:≤0.13 ps (DSA method,1999Lo17).
11357[&] *3*	(20+)		

[†] From 1990Co21 based on $\gamma\gamma(\theta)$(DCO) data and band assignments, unless stated otherwise. The assignments are the same in 'Adopted Levels', except that some are given without parentheses there.

[‡] From least-squares fit to Eγ's. The 13118, (22+) and 14919, (24+) proposed by 1990Co21 are omitted here. The transitions are placed elsewhere by 1998Do09. See ^{65}Cu(^{12}C,p2nγ) dataset for details.

[#] Measurements by recoil-distance Doppler shift method, unless noted otherwise.

[@] From 1998Do09, in 1990Co21 it was proposed as one unit higher.

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

[a] Band(B): octupole band, α=1.

[b] Band(b): octupole band, α=0.

[c] Band(C): 3+ band.

^{58}Ni(^{19}F,3pγ) 1990Co21 (continued)

γ(^{74}Se)

R(DCO) for 4° and 90°.

E_γ	I_γ	E_i(level)	J_i^π	E_f	J_f^π	Mult.‡	Comments
493.0 *2*	5.1 *5*	2842.18	5⁻	2349.13	3⁻	E2	R(DCO)=1.11 *7*.
539.9 *2*	2.7 *3*	3382.12	(6⁻)	2842.18	5⁻	D	R(DCO)=0.34 *19*.
551.1 *2*	1.6 *3*	3382.12	(6⁻)	2830.92	(4⁻)	E2	R(DCO)=1.1 *3*.
611.6 *2*	2.6 *3*	2842.18	5⁻	2231.04	6⁺	D	R(DCO)=0.58 *20*.
615.3 *2*	18 *2*	1884.02	3⁺	1268.81	2⁺		R(DCO)=1.17 *9*.
634.6 *4*	100 *5*	1268.81	2⁺	634.90	2⁺		
634.8 *2*	210 *10*	634.90	2⁺	0.0	0⁺	E2	A_2=+0.29, A_4=−0.07 In (α,2nγ) (1970Li11). R(DCO)=1.14 *8*.
673.4 *3*	8.3 *6*	3515.6	7⁻	2842.18	5⁻	E2	R(DCO)=0.97 *12*.
682.2 *4*	0.9 *2*	4197.7	(8⁻)	3515.6	7⁻		
720.8 *2*	2.3 *3*	3382.12	(6⁻)	2661.53	5⁺	D	R(DCO)=0.68 *22*.
728.4 *2*	100 *5*	1363.10	4⁺	634.90	2⁺	E2	R(DCO)=1.12 *9*. α(K)exp=0.00096 *2* (1971WyZX). A_2=+0.32, A_4=−0.08 In (α,2nγ) (1970Li11).
734.6 *2*	6.5 *5*	2842.18	5⁻	2107.60	4⁺	D	R(DCO)=0.38 *13*.
777.7 *2*	4.5 *4*	2661.53	5⁺	1884.02	3⁺	E2	R(DCO)=0.93 *15*.
815.6 *2*	3.2 *4*	4197.7	(8⁻)	3382.12	(6⁻)	(E2)	R(DCO)=0.90 *21*.
838.9 *2*	17 *1*	2107.60	4⁺	1268.81	2⁺	E2	R(DCO)=1.14 *10*.
863.7 *3*	4.2 *4*	3524.7	7⁺	2661.53	5⁺	(E2)	R(DCO)=0.68 *16*.
868.2 *3*	30 *2*	2231.04	6⁺	1363.10	4⁺	E2	R(DCO)=1.02 *11*. α(K)exp=0.00061 *2* (1971WyZX). A_2=+0.33, A_4=−0.09 In (α,2nγ) (1970Li11).
878.7 *3*	1.7 *3*	2986.3	(6⁺)	2107.60	4⁺		R(DCO)=0.6 *3*.
887.1 *4*	5.6 *5*	4402.7	9⁻	3515.6	7⁻	(E2)	R(DCO)=0.89 *15*.
924.5 *4*	2.9 *3*	4449.2	9⁺	3524.7	7⁺	(E2)	R(DCO)=0.83 *18*.
966.8 *5*	18 *1*	3197.8	8⁺	2231.04	6⁺	E2	R(DCO)=1.17 *9*. α(K)exp=0.00050 *3* (1971WyZX). A_2=+0.34, A_4=−0.09 In (α,2nγ) (1970Li11).
986.4 *2*	2.2 *3*	2349.13	3⁻	1363.10	4⁺	D	R(DCO)=0.37 *23*.
1011.0 *4*	1.9 *3*	5208.7	(10⁻)	4197.7	(8⁻)	(E2)	R(DCO)=1.1 *3*.
1042.8 *5*	1.4 *2*	5492.0	11⁺	4449.2	9⁺		
1044.8 *5*	1.1 *2*	6253.5	(12⁻)	5208.7	(10⁻)	(E2)	R(DCO)=0.9 *3*.
1057.4 *6*	12 *1*	4255.2	10⁺	3197.8	8⁺	E2	R(DCO)=1.03 *14*.
1080.4 *2*	3.4 *4*	2349.13	3⁻	1268.81	2⁺	D	R(DCO)=0.56 *20*.
1087.8 *5*	4.4 *4*	5490.5	11⁻	4402.7	9⁻	E2	R(DCO)=1.20 *15*.
1151.0 *2*	1.7 *3*	3382.12	(6⁻)	2231.04	6⁺	(D)	Mult.: ΔJ=0, dipole transition. R(DCO)=1.2 *3*.
1186.6 *7*	8.3 *6*	5441.8	12⁺	4255.2	10⁺	E2	R(DCO)=1.08 *12*.
1189.5 *7*	1.4 *2*	6681.5?	(13⁺)	5492.0	11⁺		E_γ: possibly corresponds to 1192.9 *6* γ In 1998Do09.
1195.2 *7*	3.1 *4*	6685.7	13⁻	5490.5	11⁻	E2	R(DCO)=1.47 *22*.
1198.3 *7*	1.0 *2*	7451.9	(14⁻)	6253.5	(12⁻)		
1236.9# *5*	0.4 *2*	5492.0	11⁺	4255.2	10⁺		
1249.2 *2*	15 *1*	1884.02	3⁺	634.90	2⁺		R(DCO)=1.39 *11*.
1251.4 *4*	0.9 *2*	4449.2	9⁺	3197.8	8⁺		
1268.9 *2*	15 *1*	1268.81	2⁺	0.0	0⁺	E2	R(DCO)=1.09 *11*. Iγ(634γ)/Iγ(1269γ)=100 *5*/15 *1* (1990Co21) is in disagreement with values from 1979Pi05 and 1989Ad01.
1284.5 *3*	1.5 *2*	3515.6	7⁻	2231.04	6⁺		
1291.1# *9*	0.9 *2*	7976.8?	(15⁻)	6685.7	13⁻		
1291.8 *9*	5.6 *5*	6733.6	14⁺	5441.8	12⁺	E2	R(DCO)=1.79 *15*.
1293.0 *3*	1.7 *3*	3524.7	7⁺	2231.04	6⁺		

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^{58}Ni(^{19}F,3pγ) 1990Co21 (continued)

γ(^{74}Se) (continued)

E_γ	I_γ	E_i(level)	J_i^π	E_f	J_f^π	Mult.‡	Comments
1298.7 *2*	2.4 *3*	2661.53	5^+	1363.10	4^+		
1380.5 *11*	3.2 *4*	8114.1	16^+	6733.6	14^+	E2	R(DCO)=1.02 *21*.
1467.7 *2*	4.5 *4*	2830.92	(4^-)	1363.10	4^+	(D)	Mult.: ΔJ=0, dipole transition. R(DCO)=0.92 *15*.
1472.6 *2*	3.9 *4*	2107.60	4^+	634.90	2^+		
1478.6 *2*	2.8 *3*	2842.18	5^-	1363.10	4^+	D	R(DCO)=0.43 *18*.
1563.8 *13*	1.1 *2*	9677.9	(18^+)	8114.1	16^+		
1678.6 *15*	1.1 *2*	11357	(20^+)	9677.9	(18^+)		
1713.7 *2*	4.4 *4*	2349.13	3^-	634.90	2^+	D	R(DCO)=0.44 *15*.
^{x}1761.7† *17*	1.0 *2*						
^{x}1800.6† *19*	0.8 *2*						

† In 1998Do09, 1761.7 is placed from a 7206, (14^+) level and and 1800.6 from 8536, (16^+) level. The 22^+ to 20^+ transition in the g.s. band is 1842 in 1998Do09. See ^{65}Cu(^{12}C,p2nγ) dataset for details.

‡ DCO ratio of ≈1 indicates ΔJ=2, Q (most likely E2) transition and ≈0.5 ΔJ=1, dipole or D+Q transition. The E2 assignment is from DCO ratio and application of RUL when level lifetimes are known.

Placement of transition in the level scheme is uncertain.

^{x} γ ray not placed in level scheme.

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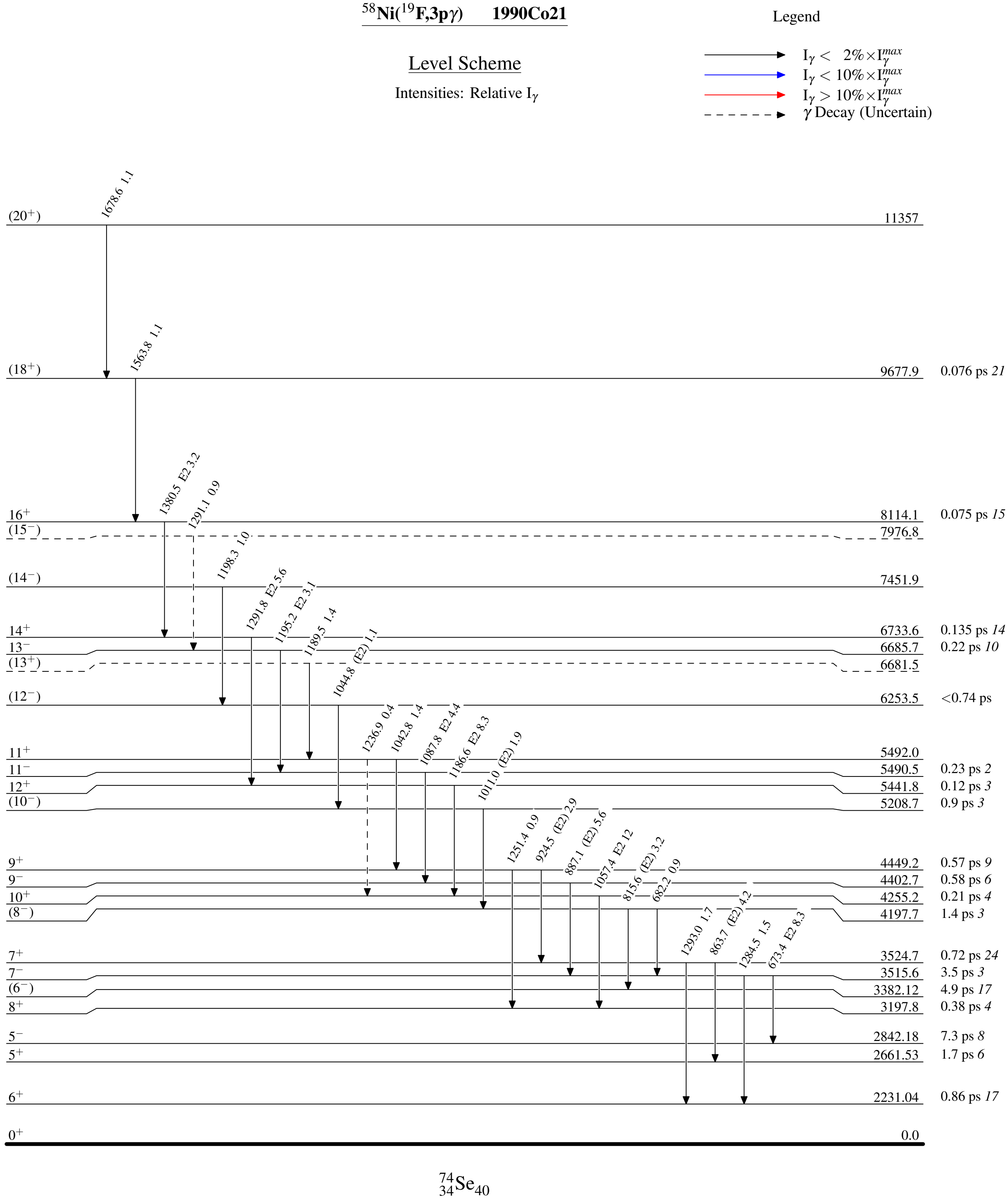
Level Scheme

Intensities: Relative I_γ



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Level Scheme (continued)

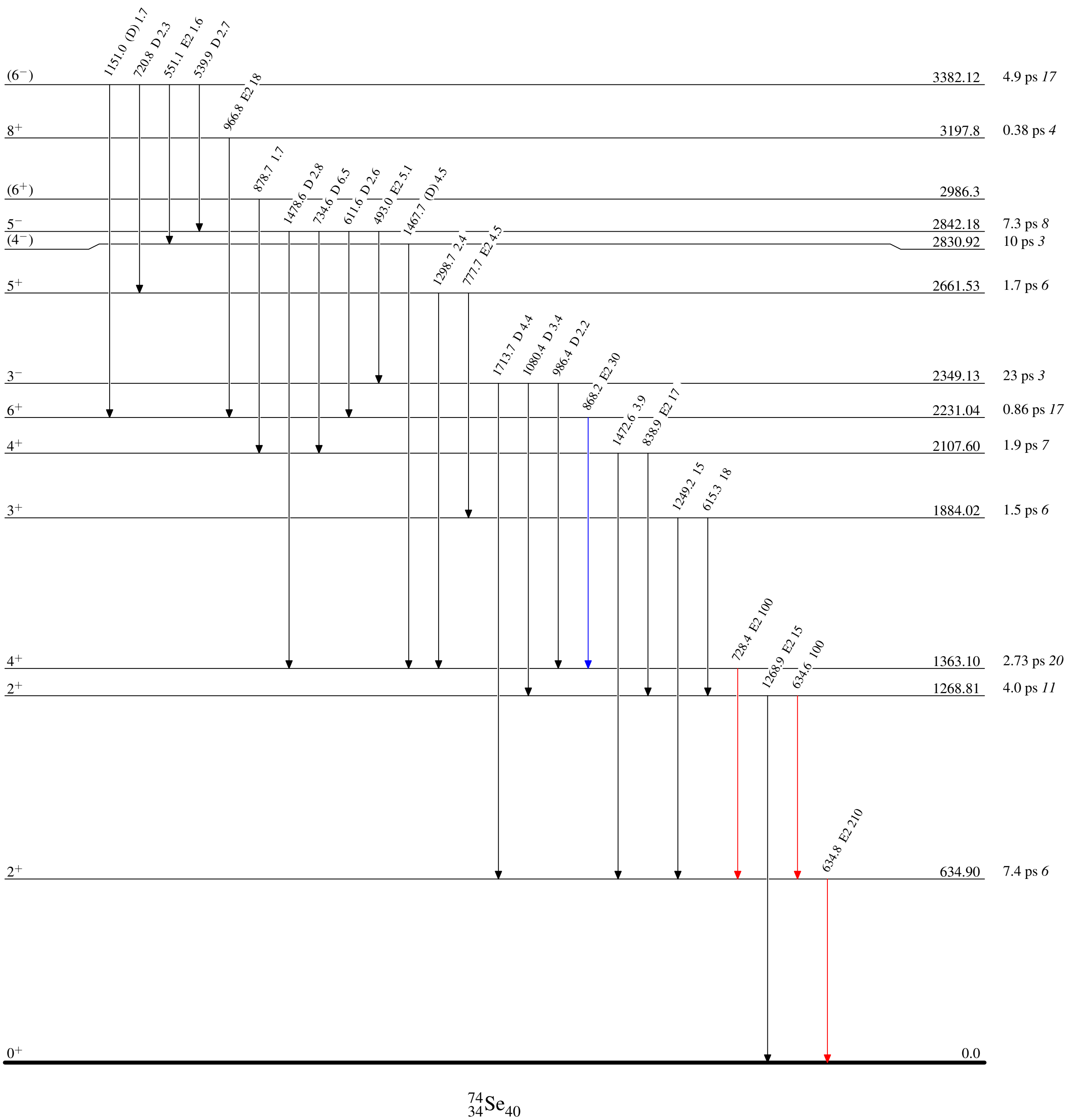
Intensities: Relative I_γ

Legend

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

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

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



$^{74}_{34}Se_{40}$

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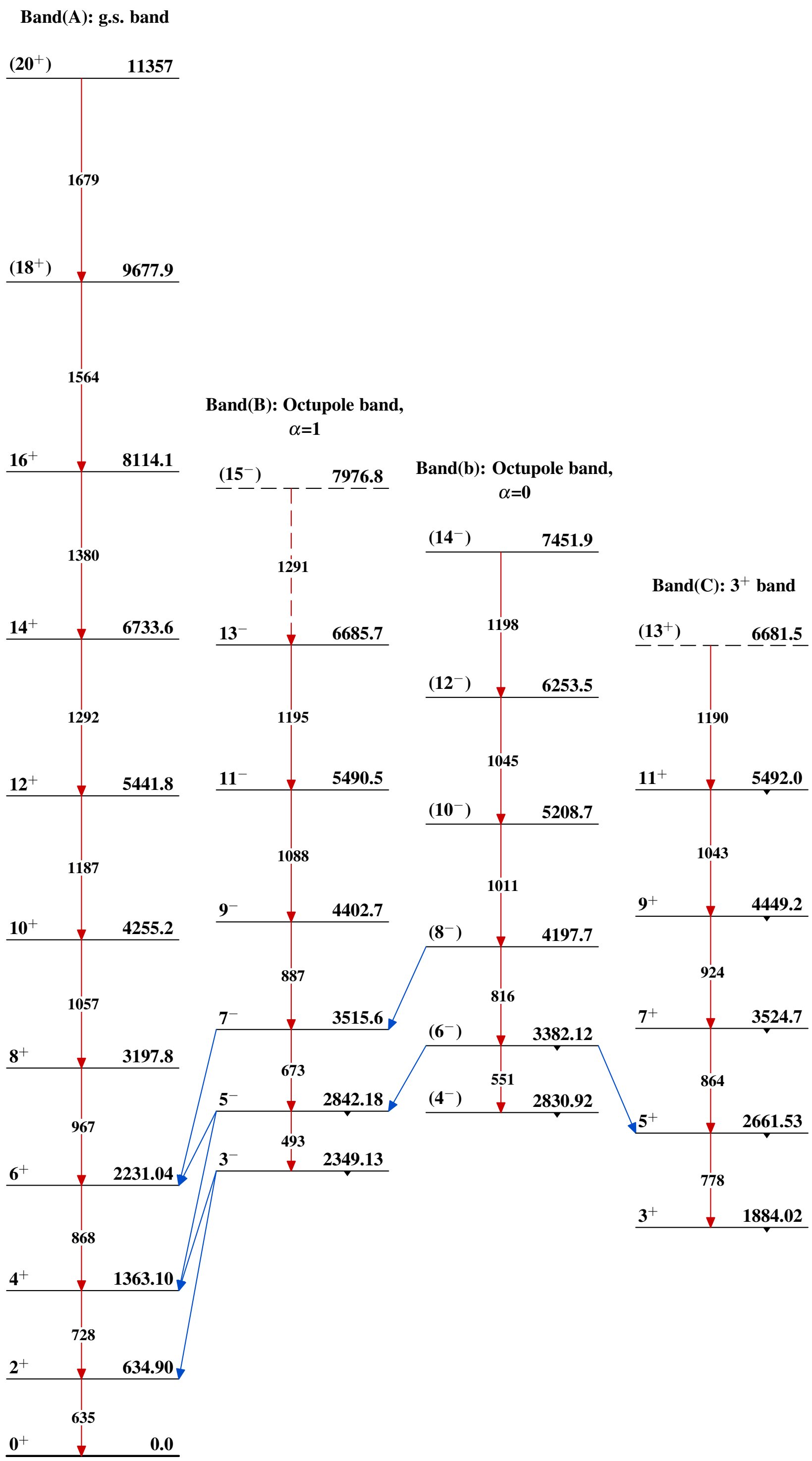

$^{74}_{34}Se_{40}$