$^{68}Zn(^{12}C,p3n\gamma)$ 2022Xu06

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh, Jun Chen and Ameenah R. Farhan	NDS 194,3 (2024)	8-Jan-2024

Adapted from the XUNDL dataset compiled by B. Singh for 2022Xu06 on July 24, 2022; data table for Eγ, Iγ, and R(ADO) ratios received by e-mail reply of July 19, 2022 from the first author (W.Z. Xu) of 2022Xu06.

2022Xu06: E(^{12}C)=66 MeV delivered by the HI-13 Tandem Accelerator of the China Institute of Atomic Energy (CIAE). Measured Eγ, Iγ, γγ-coin, γγ(θ)(ADO), and level lifetimes by DSAM using one LEPS detector and nine Compton-suppressed HPGe detectors, two placed at 40°, three at 90°, and four at 140°, relative to the beam direction. The target was 1.50 mg/cm^2 thick evaporated onto a 14.56 mg/cm^2 lead backing. Deduced high-spin levels, J^π, bands, chirality. Comparison with triaxial particle rotor model (TPRM), and multidimensional-constrained covariant density function (MDC-CDFT) calculations.

^{76}Br Levels

E(level)[†]	Jπ[‡]	$T_{1/2}$[#]	Comments
0.0	1⁻		
45.48 *2*	2⁻		
102.59[@] *3*	4⁺	1.31 s *2*	%IT>99.4 Half-life and decay mode from ^{76}Br Adopted Levels.
245.0[&] *4*	5⁺		
301.7[c] *4*	4⁻		
357.0[@] *4*	6⁺		
467.3[d] *4*	5⁻		
594.9[&] *4*	7⁺		
687.6[c] *4*	6⁻		
688.4[@] *4*	8⁺		
988.2[d] *4*	7⁻		
1120.2[&] *5*	9⁺	0.707 ps *+35−28*	Measured mean lifetime τ=1.02 ps *+5−4*. $T_{1/2}$=0.71 ps *11* with a systemmatic uncertainty of 15% added in quadrature by the evaluators.
1254.5[a] *5*	8⁺		
1338.1[c] *4*	8⁻		
1511.3[@] *5*	10⁺	0.652 ps *35*	Measured mean lifetime τ=0.94 ps *5*. $T_{1/2}$=0.65 ps *10* with a systemmatic uncertainty of 15% added in quadrature by the evaluators.
1610.2[b] *5*	9⁺	0.395 ps *+49−42*	Measured mean lifetime τ=0.57 ps *+7−6*. $T_{1/2}$=0.40 ps *8* with a systemmatic uncertainty of 15% added in quadrature by the evaluators.
1747.6[d] *5*	9⁻	0.811 ps *+90−49*	Measured mean lifetime τ=1.17 ps *+13−7*. $T_{1/2}$=0.81 ps *+15−13* with a systemmatic uncertainty of 15% added in quadrature by the evaluators.
1992.7[&] *6*	11⁺	0.284 ps *14*	Measured mean lifetime τ=0.41 ps *2*. $T_{1/2}$=0.284 ps *44* with a systemmatic uncertainty of 15% added in quadrature by the evaluators.
2080.2[a] *5*	10⁺	0.319 ps *+49−42*	Measured mean lifetime τ=0.46 ps *+7−6*. $T_{1/2}$=0.32 ps *7* with a systemmatic uncertainty of 15% added in quadrature by the evaluators.
2217.4[c] *5*	10⁻	0.541 ps *+42−35*	Measured mean lifetime τ=0.78 ps *+6−5*. $T_{1/2}$=0.54 ps *9* with a systemmatic uncertainty of 15% added in quadrature by the evaluators.
2577.7[b] *5*	11⁺	0.194 ps *+62−49*	Measured mean lifetime τ=0.28 ps *+9−7*. $T_{1/2}$=0.19 ps *+7−6* with a systemmatic uncertainty of 15% added in quadrature by the evaluators.
2626.9[@] *6*	12⁺		
2688.6[d] *6*	11⁻	0.367 ps *28*	Measured mean lifetime τ=0.53 ps *4*. $T_{1/2}$=0.37 ps *6* with a systemmatic uncertainty of 15% added in quadrature by the evaluators.
3105.2[a] *6*	12⁺		
3107.7[&] *8*	13⁺	0.208 ps *28*	Measured mean lifetime τ=0.30 ps *4*. $T_{1/2}$=0.208 ps *43* with a systemmatic uncertainty of 15% added in quadrature by the evaluators.
3285.2[c] *7*	12⁻	0.256 ps *+49−42*	Measured mean lifetime τ=0.37 ps *+7−6*. $T_{1/2}$=0.256 ps *60* with a systemmatic

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^{68}Zn(^{12}C,p3nγ) 2022Xu06 (continued)

^{76}Br Levels (continued)

E(level)[†]	Jπ[‡]	$T_{1/2}$[#]	Comments
			uncertainty of 15% added in quadrature by the evaluators.
3641.6[b] *7*	(13⁺)		
3706.4[d] *8*	13⁻		
4001.5[@] *8*	14⁺	0.104 ps *14*	Measured mean lifetime τ=0.15 ps *2*. $T_{1/2}$=0.104 ps *21* with a systemmatic uncertainty of 15% added in quadrature by the evaluators.
4300.2[c] *9*	14⁻		
4363.7[a] *8*	(14⁺)		
4433.7[&] *9*	15⁺	0.097 ps *14*	Measured mean lifetime τ=0.14 ps *2*. $T_{1/2}$=0.097 ps *20* with a systemmatic uncertainty of 15% added in quadrature by the evaluators.
4852.4[d] *9*	15⁻		
5554.4[@] *10*	16⁺		
5930.4[&] *11*	17⁺		

[†] From a least-squares fit to Eγ data.
[‡] As proposed in 2022Xu06, based on band structures and multipolarities from ADO ratios, and previous assignments for low-lying levels.
[#] From Doppler-shift attenuation method (DSAM) (2022Xu06); with quoted uncertainties as statistical only. Authors mention that systematic uncertainties from the stopping powers, which could be up to 15% are not included.
[@] Band(A): $K^\pi=4^+,\alpha=0$. Configuration=$\pi g_{9/2}\otimes\nu g_{9/2}$.
[&] Band(a): $K^\pi=4^+,\alpha=1$. Configuration=$\pi g_{9/2}\otimes\nu g_{9/2}$.
[a] Band(B): Band based on $8^+,\alpha=0$. Configuration=$\pi g_{9/2}\otimes\nu g_{9/2}$. Possible chiral partner of $K^\pi=4^+$ band.
[b] Band(b): Band based on $8^+,\alpha=1$. Configuration=$\pi g_{9/2}\otimes\nu g_{9/2}$. Possible chiral partner of $K^\pi=4^+$ band.
[c] Band(C): $K^\pi=4^-,\alpha=0$. Configuration=$\nu g_{9/2}\otimes\pi(p_{3/2},f_{5/2})$, based on upbend at $\hbar\omega\approx0.5$ MeV, corresponding to the alignment of a pair of $g_{9/2}$ protons in this mass region (2022Xu06), thus Pauli blocking occupancy of valence proton by $g_{9/2}$ orbital.
[d] Band(c): $K^\pi=4^-,\alpha=1$. Configuration=$\nu g_{9/2}\otimes\pi(p_{3/2},f_{5/2})$. See additional comments in α=0 signature partner.

γ(^{76}Br)

R(ADO) values are for 90° and 40° (or 140°) geometry with gates on ΔJ=2, quadrupole transitions. Expected ratios are: ≈1.2 for stretched quadrupoles and ≈0.7 for stretched dipoles. R(ADO) ratios are from e-mail reply from the first author of 2022Xu06, July 19, 2022.

Eγ[†]	Iγ[†]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[‡]	Comments
45.48[#] *2*		45.48	2⁻	0.0	1⁻		
57.11[#] *2*		102.59	4⁺	45.48	2⁻		
93.4 *5*	20.6 *18*	688.4	8⁺	594.9	7⁺		
112.1 *5*	73.0 *52*	357.0	6⁺	245.0	5⁺		
142.4 *5*	100.0	245.0	5⁺	102.59	4⁺	D+Q	R(ADO)=0.98 *7*.
165.8 *5*	32.2 *26*	467.3	5⁻	301.7	4⁻	D	R(ADO)=0.85 *9*.
199.2 *5*	45.0 *26*	301.7	4⁻	102.59	4⁺	D	R(ADO)=1.22 *9*. Mult.: ΔJ=0 transition.
220.4 *5*	24.1 *24*	687.6	6⁻	467.3	5⁻	D	R(ADO)=0.66 *6*.
222.3 *5*	15.0 *11*	467.3	5⁻	245.0	5⁺	D	R(ADO)=1.28 *11*. Mult.: ΔJ=0 transition.
238.0 *5*	40.2 *28*	594.9	7⁺	357.0	6⁺	D	R(ADO)=0.76 *6*.
254.3 *5*	9.6 *7*	357.0	6⁺	102.59	4⁺	Q	R(ADO)=1.31 *11*.
300.5 *5*	15.5 *17*	988.2	7⁻	687.6	6⁻	D	R(ADO)=0.63 *6*.

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$^{68}Zn(^{12}C,p3n\gamma)$ 2022Xu06 (continued)

$\gamma(^{76}Br)$ (continued)

E_γ†	I_γ†	E_i(level)	J_i^π	E_f	J_f^π	Mult.‡	Comments
330.6 5	5.2 6	687.6	6⁻	357.0	6⁺	D	R(ADO)=1.26 15. Mult.: ΔJ=0 transition.
331.3 5	33.9 25	688.4	8⁺	357.0	6⁺	Q	R(ADO)=1.23 10.
349.8 5	8.7 7	1338.1	8⁻	988.2	7⁻	D	R(ADO)=0.68 7.
349.9 5	5.5 4	594.9	7⁺	245.0	5⁺	Q	R(ADO)=1.24 13.
355.9 5	6.6 7	1610.2	9⁺	1254.5	8⁺	D	R(ADO)=0.65 7.
364.8 5	5.1 6	467.3	5⁻	102.59	4⁺	D	R(ADO)=0.68 10.
385.7 5	11.9 13	687.6	6⁻	301.7	4⁻	Q	R(ADO)=1.24 10.
390.9 5	10.3 14	1511.3	10⁺	1120.2	9⁺	D	R(ADO)=0.69 6.
409.5 5	9.8 10	1747.6	9⁻	1338.1	8⁻	D	R(ADO)=0.59 7.
431.9 5	32.5 24	1120.2	9⁺	688.4	8⁺	D	R(ADO)=0.71 5.
442.5 5	4.7 5	687.6	6⁻	245.0	5⁺	D	R(ADO)=0.74 9.
469.5 5	4.7 6	2217.4	10⁻	1747.6	9⁻	D	R(ADO)=0.80 12.
470.1 5	4.3 5	2080.2	10⁺	1610.2	9⁺	D	R(ADO)=0.72 9.
471.2 5	5.3 8	2688.6	11⁻	2217.4	10⁻	D+Q	R(ADO)=0.96 14.
481.5 5	23.8 18	1992.7	11⁺	1511.3	10⁺	D	R(ADO)=0.62 5.
497.6 5	3.3 4	2577.7	11⁺	2080.2	10⁺	D	R(ADO)=0.90 10.
521.0 5	11.5 17	988.2	7⁻	467.3	5⁻	Q	R(ADO)=1.25 16.
525.3 5	2.5 6	1120.2	9⁺	594.9	7⁺	Q	R(ADO)=1.09 23.
527.5 5	2.3 6	3105.2	12⁺	2577.7	11⁺	D	R(ADO)=0.79 19.
536.4 5	1.4 4	3641.6	(13⁺)	3105.2	12⁺		
631.0 5	3.6 4	988.2	7⁻	357.0	6⁺	D	R(ADO)=0.64 8.
634.3 5	6.1 7	2626.9	12⁺	1992.7	11⁺	D	R(ADO)=0.84 9.
650.3 5	18.5 13	1338.1	8⁻	687.6	6⁻	Q	R(ADO)=1.28 10.
659.8 5	5.5 6	1254.5	8⁺	594.9	7⁺	D	R(ADO)=0.68 12.
743.3 5	3.9 5	1338.1	8⁻	594.9	7⁺	D	R(ADO)=0.68 10.
759.5 5	13.7 12	1747.6	9⁻	988.2	7⁻	Q	R(ADO)=1.26 16.
822.8 5	32.1 23	1511.3	10⁺	688.4	8⁺	Q	R(ADO)=1.26 9.
826.1 5	3.0 5	2080.2	10⁺	1254.5	8⁺		
872.5 5	9.7 17	1992.7	11⁺	1120.2	9⁺	Q	R(ADO)=1.27 24.
879.3 5	14.1 15	2217.4	10⁻	1338.1	8⁻	Q	R(ADO)=1.29 14.
897.7 5	4.8 5	1254.5	8⁺	357.0	6⁺	Q	R(ADO)=1.06 18.
921.9 5	4.8 5	1610.2	9⁺	688.4	8⁺	D	R(ADO)=0.62 8.
941.0 5	6.9 10	2688.6	11⁻	1747.6	9⁻	Q	R(ADO)=1.16 14.
959.8 5	8.4 7	2080.2	10⁺	1120.2	9⁺	D	R(ADO)=0.70 6.
967.6 5	2.5 4	2577.7	11⁺	1610.2	9⁺	Q	R(ADO)=1.24 24.
1015.0 5	5.7 6	1610.2	9⁺	594.9	7⁺	Q	R(ADO)=1.14 18.
1015.0 5	4.0 7	4300.2	14⁻	3285.2	12⁻		
1017.8 5	5.3 7	3706.4	13⁻	2688.6	11⁻		
1025.0 5	3.7 7	3105.2	12⁺	2080.2	10⁺	(Q)	R(ADO)=1.13 28.
1059.0 5	2.9 6	1747.6	9⁻	688.4	8⁺	D	B(E1)(W.u.)=3.9×10^{-5} 13 (2022Xu06) R(ADO)=0.76 14.
1063.8 5	3.1 7	3641.6	(13⁺)	2577.7	11⁺		
1066.3 5	3.2 6	2577.7	11⁺	1511.3	10⁺	D	R(ADO)=0.63 14.
1067.8 5	6.5 8	3285.2	12⁻	2217.4	10⁻	Q	R(ADO)=1.35 21.
1097.5 5	2.2 5	2217.4	10⁻	1120.2	9⁺	D	B(E1)(W.u.)=5.5×10^{-5} 18 (2022Xu06) R(ADO)=0.68 14.
1115.0 5	9.1 17	3107.7	13⁺	1992.7	11⁺	Q	R(ADO)=1.28 20.
1115.5 5	15.4 23	2626.9	12⁺	1511.3	10⁺	Q	R(ADO)=1.30 14.
1146.0 5	2.4 6	4852.4	15⁻	3706.4	13⁻		
1258.5 5	2.4 5	4363.7	(14⁺)	3105.2	12⁺		
1326.0 5	7.2 10	4433.7	15⁺	3107.7	13⁺	Q	R(ADO)=1.10 14.
1374.6 5	6.6 8	4001.5	14⁺	2626.9	12⁺	Q	R(ADO)=1.13 13.
1496.7 5	6.0 9	5930.4	17⁺	4433.7	15⁺	Q	R(ADO)=1.21 20.
1552.9 5	4.3 10	5554.4	16⁺	4001.5	14⁺	Q	R(ADO)=1.32 33.

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^{68}Zn(^{12}C,p3nγ) 2022Xu06 (continued)

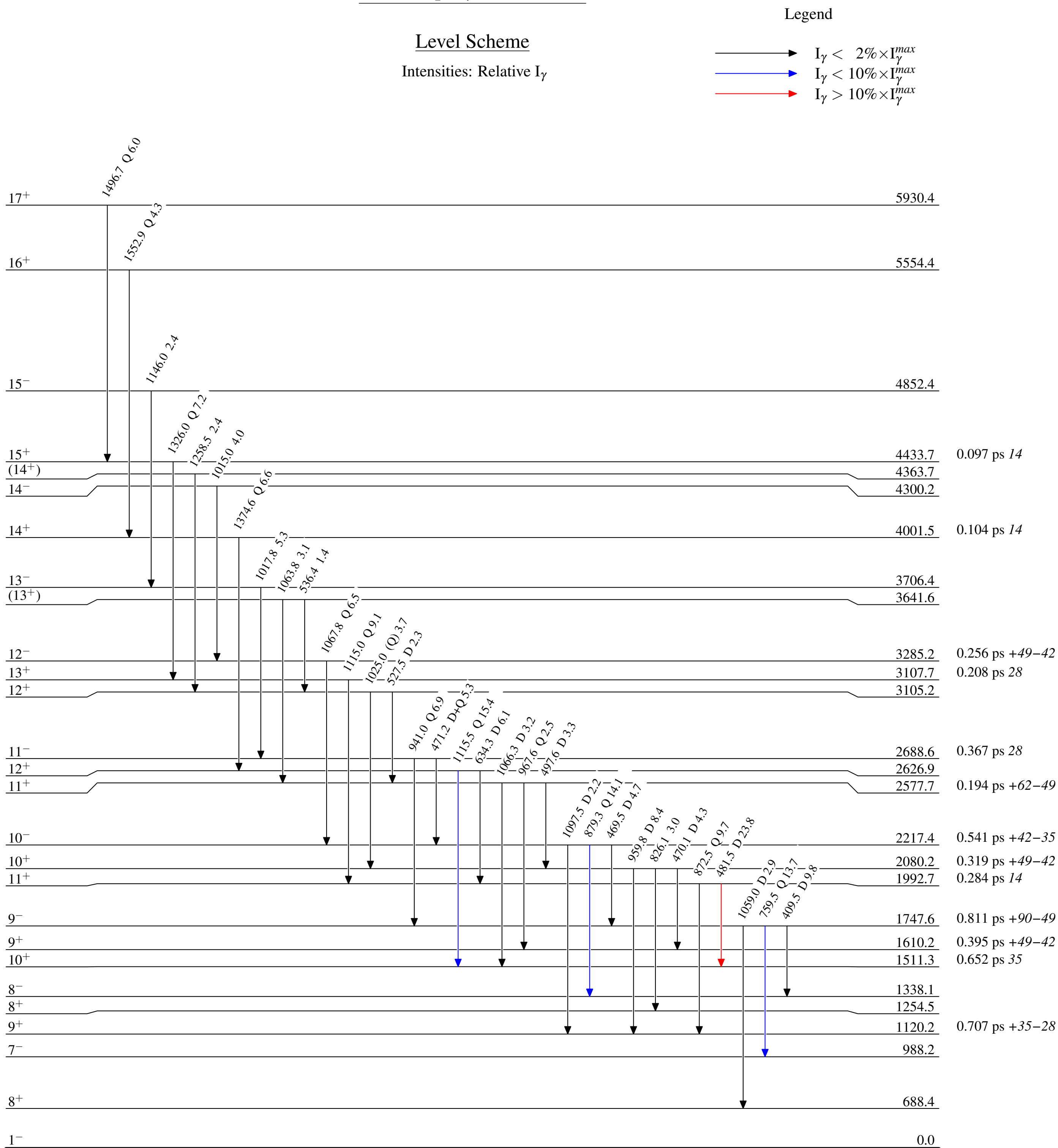
γ(^{76}Br) (continued)

† From e-mail reply from the first author of 2022Xu06 on July 19, 2022, unless otherwise noted.
‡ Deduced by the evaluators based on R(ADO) ratios in 2022Xu06 and the priv. comm., where mult=Q indicates stretched quadrupole (most likely E2) and mult=D indicates ΔJ=1 or 0, dipole.
# From Adopted Gammas.

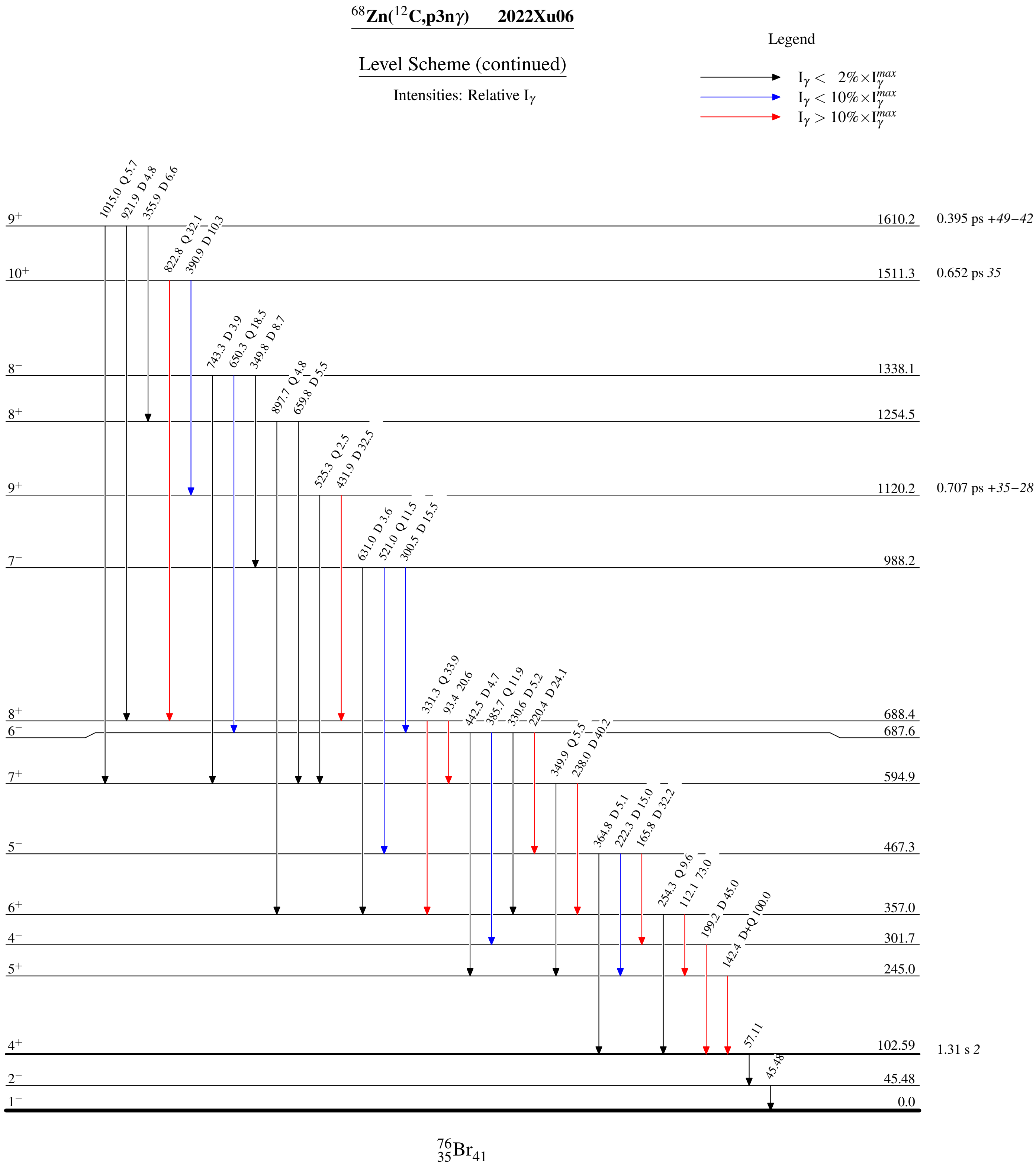
^{68}Zn(^{12}C,p3nγ) 2022Xu06

Level Scheme

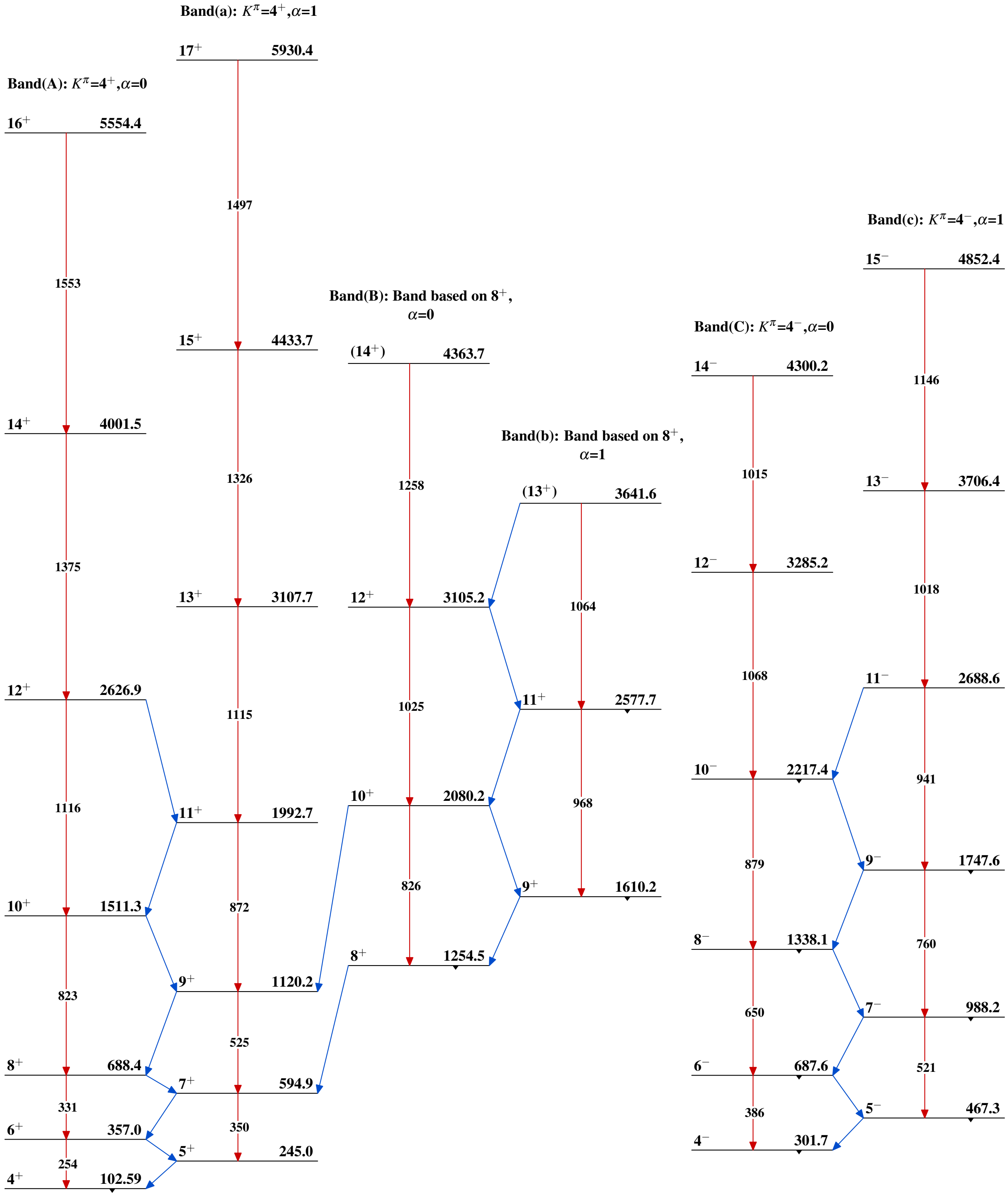
Intensities: Relative I_γ



$^{76}_{35}Br_{41}$


^{68}Zn(^{12}C,p3nγ) 2022Xu06
Level Scheme (continued)
Intensities: Relative Iγ
Legend
Iγ < 2%×Iγ^max
Iγ < 10%×Iγ^max
Iγ > 10%×Iγ^max
9+ 1610.2 0.395 ps +49−42
10+ 1511.3 0.652 ps 35
8− 1338.1
8+ 1254.5
9+ 1120.2 0.707 ps +35−28
7− 988.2
8+ 688.4
6− 687.6
7+ 594.9
5− 467.3
6+ 357.0
4− 301.7
5+ 245.0
4+ 102.59 1.31 s 2
2− 45.48
1− 0.0
1015.0 Q 5.7
921.9 D 4.8
355.9 D 6.6
822.8 Q 32.1
390.9 D 10.3
743.3 D 3.9
650.3 Q 18.5
349.8 D 8.7
897.7 Q 4.8
659.8 D 5.5
525.3 Q 2.5
431.9 D 32.5
631.0 D 3.6
521.0 Q 11.5
300.5 D 15.5
331.3 Q 33.9
93.4 20.6
442.5 D 4.7
385.7 Q 11.9
330.6 D 5.2
220.4 D 24.1
349.9 Q 5.5
238.0 D 40.2
364.8 D 5.1
222.3 D 15.0
165.8 D 32.2
254.3 Q 9.6
112.1 73.0
199.2 D 45.0
142.4 D+Q 100.0
57.11
45.48
$^{76}_{35}Br_{41}$

$^{68}Zn(^{12}C,p3n\gamma)$ 2022Xu06



$^{76}_{35}Br_{41}$