^{28}Si(^{28}Si,α2pγ) 1998Ca26,1998Br34,2002Br41

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Jun Chen and Balraj Singh	NDS 157, 1 (2019)	15-Apr-2019

Includes reactions: ^{26}Mg(^{28}Si,2n2p); ^{9}Be(^{55}Ni,Xγ); ^{27}Al(^{28}Si,αpγ); and some other reactions in older studies.

1998Ca26: E(^{28}Si)=125 MeV beam from the Chalk River TASCC. Natural Si target. Measured Eγ, Iγ, $\gamma\gamma$, $\gamma\gamma(\theta)$(DCO), $\gamma\gamma(\theta)$(ADO) and lifetime by DSAM using 8π γ spectrometer with 20 detectors.

1998Br34, 2002Br41 (also 1998Br28,1998Le43,2001Le31,2001Lu14,2004Br42): E(^{28}Si)=115 MeV beam from the Tandem XTU accelerator of the Legnaro National Laboratory. Measured Eγ, Iγ, $\gamma\gamma$ and level lifetimes using GASP array with 40 Compton-suppressed large volume Ge detectors and a BGO multiplicity filter with 80 elements. Lifetimes were measured using DSAM. 2002Br41 update level scheme and J^π assignment given in other papers. Level scheme in 1998Br34 is taken mostly from 1997Le15 using ^{24}Mg(^{32}S,α2pγ) reaction (see separate dataset for this reaction). Note that the 2924, 3161, 3611 and 3629 levels in 1998Br34 were taken from other publications.

2005Wo01: ^{9}Be(^{55}Ni,Xγ), E=100 MeV/nucleon; GSI-RISING facility. Two γ rays at 783 (first 2^+ to g.s.) and 1098 (first 4^+ to 2^+) observed.

2017Ar09: ^{27}Al(^{28}Si,αpγ), E=86 MeV. Measured Eγ, $\gamma\gamma$-coin, lifetime of the first 2^+ state by recoil-distance Doppler-shift (RDDS) method using an array of 12 HPGe detectors and Cologne coincidence-plunger device. Target thickness=0.58 mg/cm^2. Recoiling nuclei out of the target were stopped in 9.6 mg/cm^2 thick gold foil. Data were recorded at seven target-to-stopper distances. Comparison of deduced B(E2) values with shell-model calculations using four different interactions.

Other (HI,xnγ) data from references below are mainly consistent (except as noted) with this dataset but contain less information.

1974BrXP: ^{47}Ti(α,nγ) and ^{48}Ti(α,2nγ). Measured ground-state band of levels from 0^+ to 12^+. No details given, but results are similar to those in ^{40}Ca(^{16}O,2p$\alpha\gamma$). 1974BrXP conclude that spectroscopic information from heavy-ion or α-induced reactions is equivalent.

Additional information 1.

1978Me19: ^{27}Al(^{28}Si,αpγ),E=65-81 MeV. Measured $\gamma\gamma$-coin and excitation functions; θ=±90°.

1979Da07: ^{48}Ti(^{16}O,^{12}C2nγ),E=120 MeV. Measured (^{12}C)γ coincidences; Ge(Li) (θ=−90°), Si telescope (θ=+15°). Observed γ rays from ground-state band members through 10^+ and from 4^+ and 5^+ levels.

1979Me03: ^{28}Si(^{28}Si,2p$\alpha\gamma$),E=65-90 MeV. Measured $\gamma\gamma$-coincidences and $\gamma(\theta)$ at 77 MeV; θ=±90°.

1980ToZV: ^{36}Ar(^{16}O,2pγ),E=42 MeV. Measured γ spectra $\gamma\gamma$-coincidences, and $\gamma\gamma$(t). Preliminary analysis seems to contradict level scheme of 1974Ku11.

1981Fr08: ^{46}Ti(^{13}C,n2$\alpha\gamma$),E=35-84 MeV. Measured γ spectra.

^{50}Cr Levels

E(level)[†]	J$^\pi$[‡]	T$_{1/2}$[#]	Comments
0.0[&]	0^+		
783.3[&] *3*	2^+	9.01 ps *28*	T$_{1/2}$: from 2017Ar09 by recoil-distance Doppler-shift method.
1881.4[&] *4*	4^+	1.47 ps *16*	T$_{1/2}$: from DSAM 2004Br42. Other: 1.7 ps *5* (DSAM in 1998Br34, same group as 2004Br42).
3163.9[&] *5*	6^+	0.69 ps *14*	
3324.5 *4*	4^+		J$^\pi$: from Adopted Levels.
3612.2 *12*	4^+		
3792.1[a] *6*	(4^-)		J$^\pi$: from 1998Br34 based on $\gamma(\theta)$, similarity to unnatural parity states in neighboring nuclides of ^{48}Cr and ^{46}Ti, and from theory, although angular distribution is also consistent with 5^+. 1998Ca26 quote 4^+ probably from a previous measurement (1968Mo07). 5^+ in Adopted Levels.
3825.6 *5*	6^+	<0.7 ps	J$^\pi$,T$_{1/2}$: from 2002Br41, J^π based on 662$\gamma(\theta)$ and lifetime measurement. (4^+,5,6^+) in Adopted Levels.
3875.3 *5*	5^+	0.62 ps *21*	J$^\pi$,T$_{1/2}$: from 2002Br41, J^π based on γ to 4^+ and lifetime measurement.
4367.2[a] *6*	(5^-)	1.39 ps *35*	J$^\pi$,T$_{1/2}$: from 2002Br41, belongs to 4^- band. T$_{1/2}$>0.7 ps from 1998Br34.
4744.9[&] *6*	8^+	0.28 ps *7*	
5213.3[a] *6*	(6^-)	0.42 ps *7*	J$^\pi$: from 2002Br41, belongs to 4^- band.
5998.0[a] *6*	(7^-)	<0.35 ps	J$^\pi$: from 2002Br41, belongs to 4^- band.

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^{28}Si(^{28}Si,α2pγ) 1998Ca26,1998Br34,2002Br41 (continued)

^{50}Cr Levels (continued)

E(level)[†]	J$^\pi$[‡]	T$_{1/2}$[#]	Comments
			T$_{1/2}$: 0.28 ps *7* is effective value, not corrected for side feeding.
6340.8[b] *6*	10$^+$	0.76 ps *14*	
6754.7[&] *6*	10$^+$	0.111 ps *21*	T$_{1/2}$: other: 0.11 ps +*9*−*7* (1998Ca26).
6950.7[b] *6*	11$^+$	0.49 ps *4*	T$_{1/2}$: other: 0.58 ps *10* (1998Ca26).
7612.9[b] *6*	12$^+$	0.111 ps *10*	T$_{1/2}$: other: 0.17 ps *2* (1998Ca26) seems in disagreement.
9327.8[&] *9*	(12$^+$)		
9642.8 *7*	13$^+$	0.05[@] ps *2*	J$^\pi$: from 1998Ca26 by ADO and DCO values. T$_{1/2}$: other: <0.07 ps (1998Br34).
9916.0 *7*	14$^+$	0.22 ps *4*	T$_{1/2}$: weighted average of 0.18 ps 3 (1998Br34) and 0.26 ps *3* (1998Ca26).
10801.0 *11*	13$^+$	<0.62[@] ps	J$^\pi$: from 1998Ca26 by ADO and DCO values.
11016.8 *10*	13$^+$	0.06[@] ps *1*	
12394.0 *11*	15$^{(+)}$		
12544.2 *12*	(14$^+$)		E(level): 12583 in level-scheme figure 1 of 1998Br34 seems a misprint.
13222.5 *7*	15$^+$	0.021[@] ps +*7*−*4*	T$_{1/2}$: other: <0.03 ps (1998Br34).
13496.0 *21*	(14$^+$)		J$^\pi$: seen only in 1998Ca26 but no information on how it was deduced.
13925.1 *12*	15$^+$	<0.076[@] ps	J$^\pi$: from 1998Ca26 by ADO and DCO values.
15038.9 *8*	16$^+$	<0.021 ps	
15815.6 *22*	17$^+$	<0.05[@] ps	J$^\pi$: from 1998Ca26 by ADO and DCO values. But 16$^+$ from Adopted Levels.
17961.9 *8*	18$^+$	<0.07 ps	T$_{1/2}$: 0.049 ps *21* is effective value, not corrected for side feeding.

[†] From least-squares fit to Eγ data.
[‡] From $\gamma(\theta)$, γ(DCO) and band assignments in this work, unless otherwise noted. Adopted assignments are given under comments if different.
[#] From DSAM with gate on transition above (GTA), gate on transition below (GTB) and narrow gate on transition below (NGTB) analyses (1998Br34), except as noted.
[@] From DSAM (1998Ca26).
[&] Band(A): g.s. band.
[a] Band(B): Band based on 4$^-$.
[b] Band(C): Band based on 10$^+$.

γ(^{50}Cr)

ADO=angular distribution asymmetry from oriented nuclei.
ADO and DCO values given under comments are from 1998Ca26. Expected ADO values are ≈0.8 for ΔJ=1 pure dipole transitions and ≈1.5 for ΔJ=2 pure quadrupole transitions (or ΔJ=0 dipole transitions). Expected DCO values are ≈1 for pure dipole transitions and ≈1.5 for pure quadrupole with gates on stretched dipole; ≈0.5 for pure dipole and ≈1 for stretched quadrupole with gates on stretched quadrupole transitions. All DCO values are with gates on stretched quadrupole.

E$_\gamma$[†]	I$_\gamma$[†]	E$_i$(level)	J$_i^\pi$	E$_f$	J$_f^\pi$	Mult.[#]	Comments
195.6 *3*	2.1 *2*	6950.7	11$^+$	6754.7	10$^+$		I$_\gamma$: Iγ(196):Iγ(610)=8:92 (1998Ca26).
272.9 *3*	3.1 *4*	9916.0	14$^+$	9642.8	13$^+$	D	I$_\gamma$: Iγ(273):Iγ(2303)=24:76 (1998Ca26). ADO=0.7 *2*.
413.6 *3*	0.32 *3*	6754.7	10$^+$	6340.8	10$^+$		I$_\gamma$: Iγ(414):Iγ(2010)=60:40 (1998Ca26).
468		3792.1	(4$^-$)	3324.5	4$^+$		A$_2$=+0.25 (1998Br34)
542		4367.2	(5$^-$)	3825.6	6$^+$		I$_\gamma$: Iγ(542):Iγ(575):Iγ(1042):Iγ(1203):Iγ(2485)=23:38:13:14:12 (1998Br34).

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^{28}Si(^{28}Si,α2pγ) 1998Ca26,1998Br34,2002Br41 (continued)

γ(^{50}Cr) (continued)

E_γ[†]	I_γ[†]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	Comments
551.0[‡] *3*		3875.3	5^+	3324.5	4^+		I_γ: Iγ(551):Iγ(711):Iγ(1994)=15:35:50 (2002Br41).
575.3 *3*	0.62 *6*	4367.2	(5^-)	3792.1	(4^-)		
610.1 *3*	69 *1*	6950.7	11^+	6340.8	10^+	D	DCO=0.56 *2* ADO=0.73 *1*.
661.5[‡] *3*		3825.6	6^+	3163.9	6^+		
662.2 *3*	69 *1*	7612.9	12^+	6950.7	11^+	D	DCO=0.53 *2* ADO=0.79 *1*.
711.1[‡] *3*		3875.3	5^+	3163.9	6^+		
755[‡]		4367.2	(5^-)	3612.2	4^+		
783.3 *3*	100	783.3	2^+	0.0	0^+		
784.6 *3*	0.15 *4*	5998.0	(7^-)	5213.3	(6^-)		
846.2 *3*	0.41 *4*	5213.3	(6^-)	4367.2	(5^-)		
858[@]		7612.9	12^+	6754.7	10^+		E_γ: from 1998Ca26 only.
1042		4367.2	(5^-)	3324.5	4^+		
1098.2 *3*	98 *1*	1881.4	4^+	783.3	2^+		
1203		4367.2	(5^-)	3163.9	6^+		
1272.2 *3*	1.9 *2*	7612.9	12^+	6340.8	10^+		
1282.1 *3*	93 *1*	3163.9	6^+	1881.4	4^+		
1388		5213.3	(6^-)	3825.6	6^+		
1421.1 *3*	0.33 *3*	5213.3	(6^-)	3792.1	(4^-)		
1443.3 *3*		3324.5	4^+	1881.4	4^+		E_γ: from figure 1 of 1998Br34, not given in authors' table 2.
1580.9 *3*	86 *1*	4744.9	8^+	3163.9	6^+		
1593		12394.0	$15^{(+)}$	10801.0	13^+		
1595.9 *3*	75 *1*	6340.8	10^+	4744.9	8^+		
1630.9 *3*	0.22 *4*	5998.0	(7^-)	4367.2	(5^-)		
1715		9327.8	(12^+)	7612.9	12^+		
1816.2 *3*	3.0 *6*	15038.9	16^+	13222.5	15^+		
1911		3792.1	(4^-)	1881.4	4^+		A_2=+0.25 (1998Br34) E_γ: from 2002Br41.
1944.4[‡] *3*		3825.6	6^+	1881.4	4^+		I_γ: Iγ(1944.4):Iγ(661.5)=13:87 (2002Br41).
1993.8[‡] *3*		3875.3	5^+	1881.4	4^+		
2009.8 *3*	2.1 *2*	6754.7	10^+	4744.9	8^+	E2	ADO=1.08 *18*.
2029.7 *3*	21 *2*	9642.8	13^+	7612.9	12^+	D	DCO=0.44 *6* I_γ: Iγ(2030):Iγ(2692)=88:12 (1998Ca26). ADO=1.22 *3*.
2206		13222.5	15^+	11016.8	13^+	E2	DCO=1.2 *2* Iγ(2206):Iγ(3306):Iγ(3580)=42:25:33 (1998Ca26).
2303.2 *3*	21 *2*	9916.0	14^+	7612.9	12^+	E2	DCO=1.25 *10* ADO=1.75 *5*.
2377[@]		9327.8	(12^+)	6950.7	11^+		E_γ: not seen in other studies.
2478		12394.0	$15^{(+)}$	9916.0	14^+		
2485		4367.2	(5^-)	1881.4	4^+		
2541.0[‡] *3*		3324.5	4^+	783.3	2^+		I_γ: Iγ(2541.0):Iγ(1443.3)=0.8:99.2 (2002Br41).
2573		9327.8	(12^+)	6754.7	10^+		
2593 *2*	9.2	15815.6	17^+	13222.5	15^+		DCO=1.0 *1* E_γ: from 1998Ca26. ADO=1.4 *2*.
2692.0 *3*	1.0 *2*	9642.8	13^+	6950.7	11^+	E2	ADO=1.79 *6*.
2923.0 *3*	1.6 *3*	17961.9	18^+	15038.9	16^+		
3188		10801.0	13^+	7612.9	12^+	D	DCO=0.55 *5* ADO=1.11 *5*.
3306.3 *3*	2.1 *5*	13222.5	15^+	9916.0	14^+		

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^{28}Si(^{28}Si,α2pγ) 1998Ca26,1998Br34,2002Br41 (continued)

γ(^{50}Cr) (continued)

E_γ[†]	I_γ[†]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	Comments
3404		11016.8	13^+	7612.9	12^+	D	ADO=0.76 *4*.
3580.3 *10*	2.2 *5*	13222.5	15^+	9642.8	13^+	E2	ADO=1.74 *12*.
3853 *2*		13496.0	(14^+)	9642.8	13^+		
4009		13925.1	15^+	9916.0	14^+		DCO=1.2 *4* ADO=0.97 *7*.
4931		12544.2	(14^+)	7612.9	12^+		
5123.4 *10*	9 *2*	15038.9	16^+	9916.0	14^+		

[†] From 1998Br34, except as noted.
[‡] From 2002Br41.
[#] From measured DCO and ADO ratios in 1998Ca26 and RUL.
[@] Placement of transition in the level scheme is uncertain.

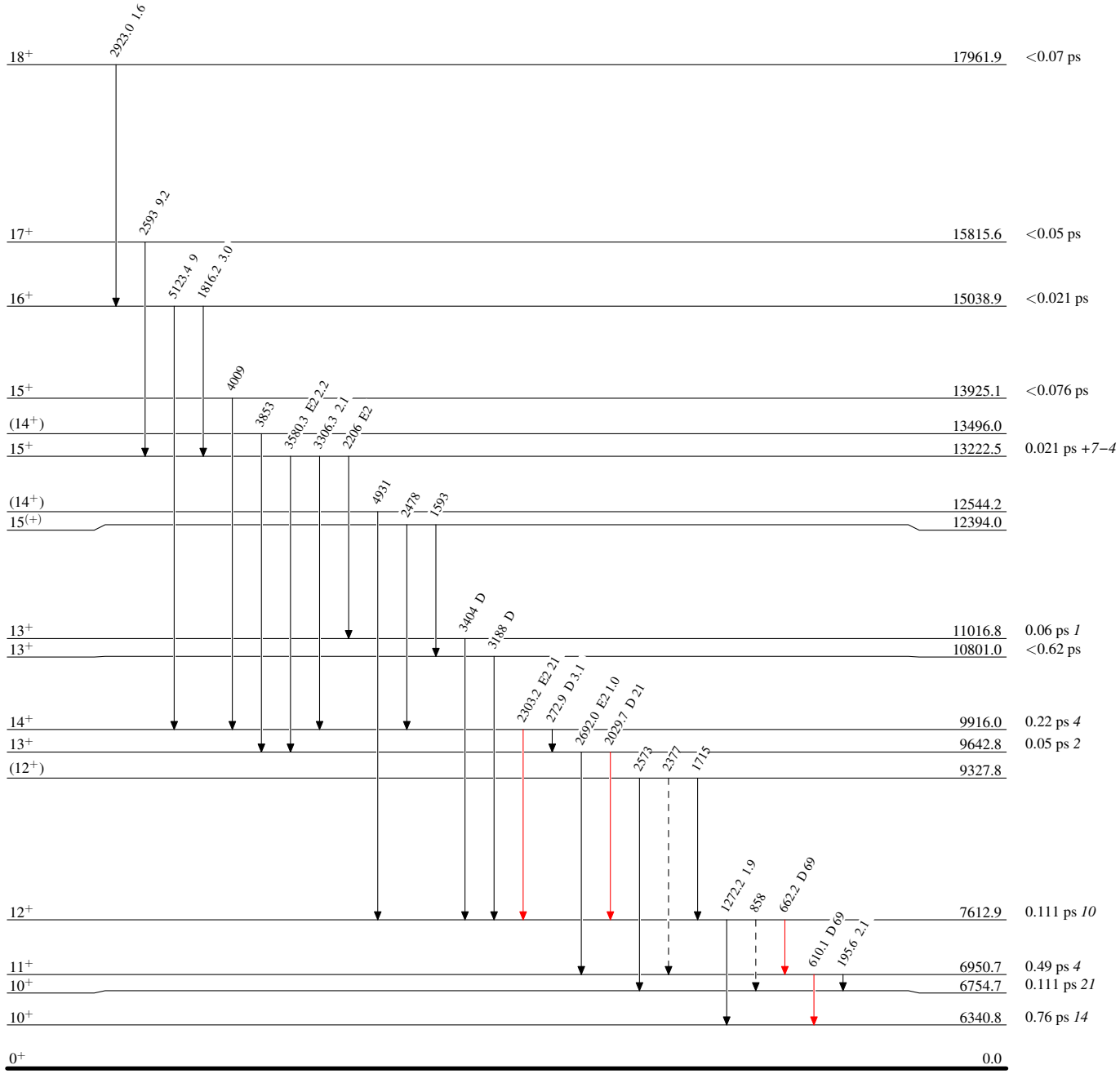
^{28}Si(^{28}Si,α2pγ) 1998Ca26,1998Br34,2002Br41

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)



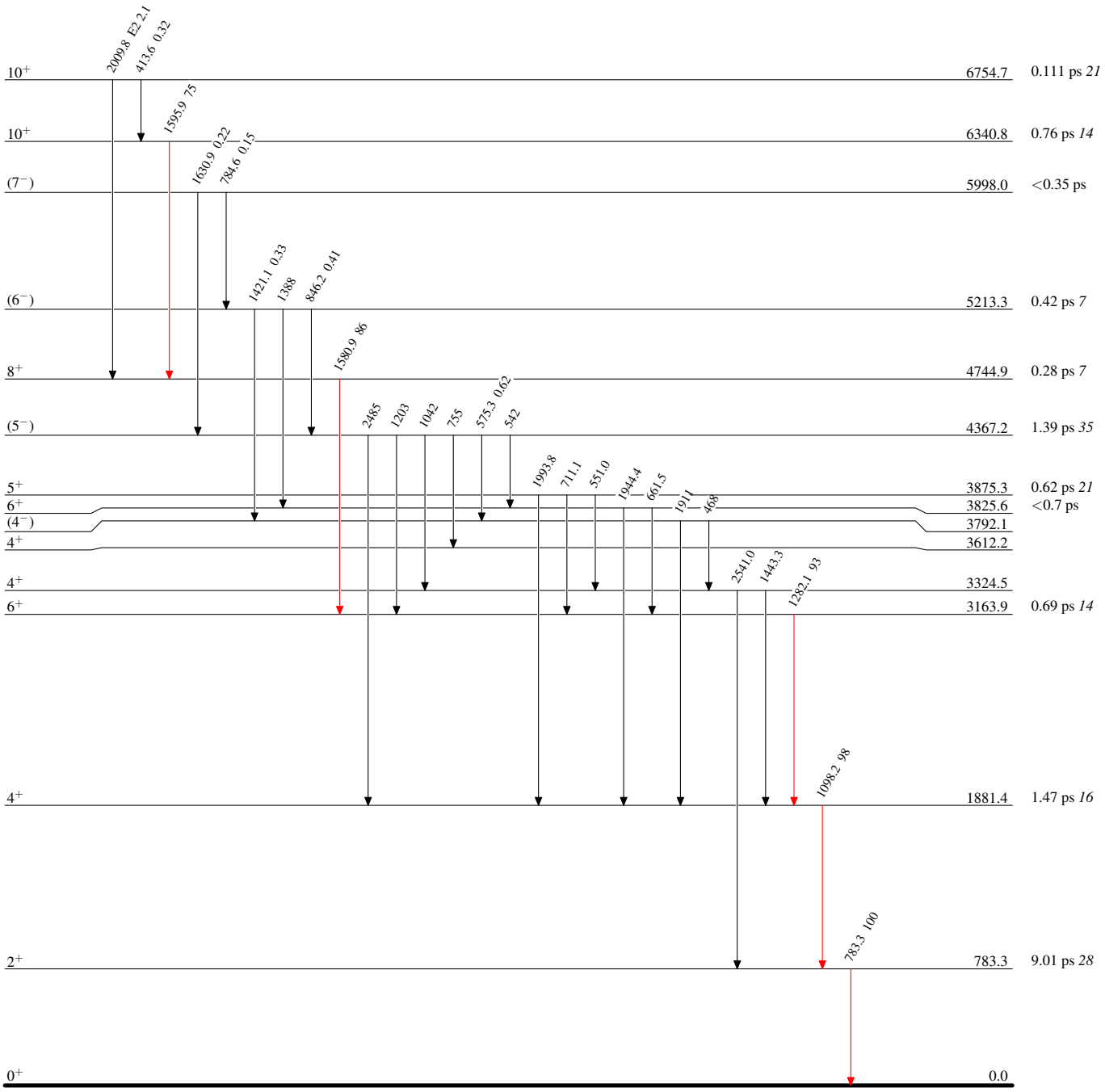
$^{50}_{24}Cr_{26}$

^{28}Si(^{28}Si,α2pγ) 1998Ca26,1998Br34,2002Br41

Level Scheme (continued)

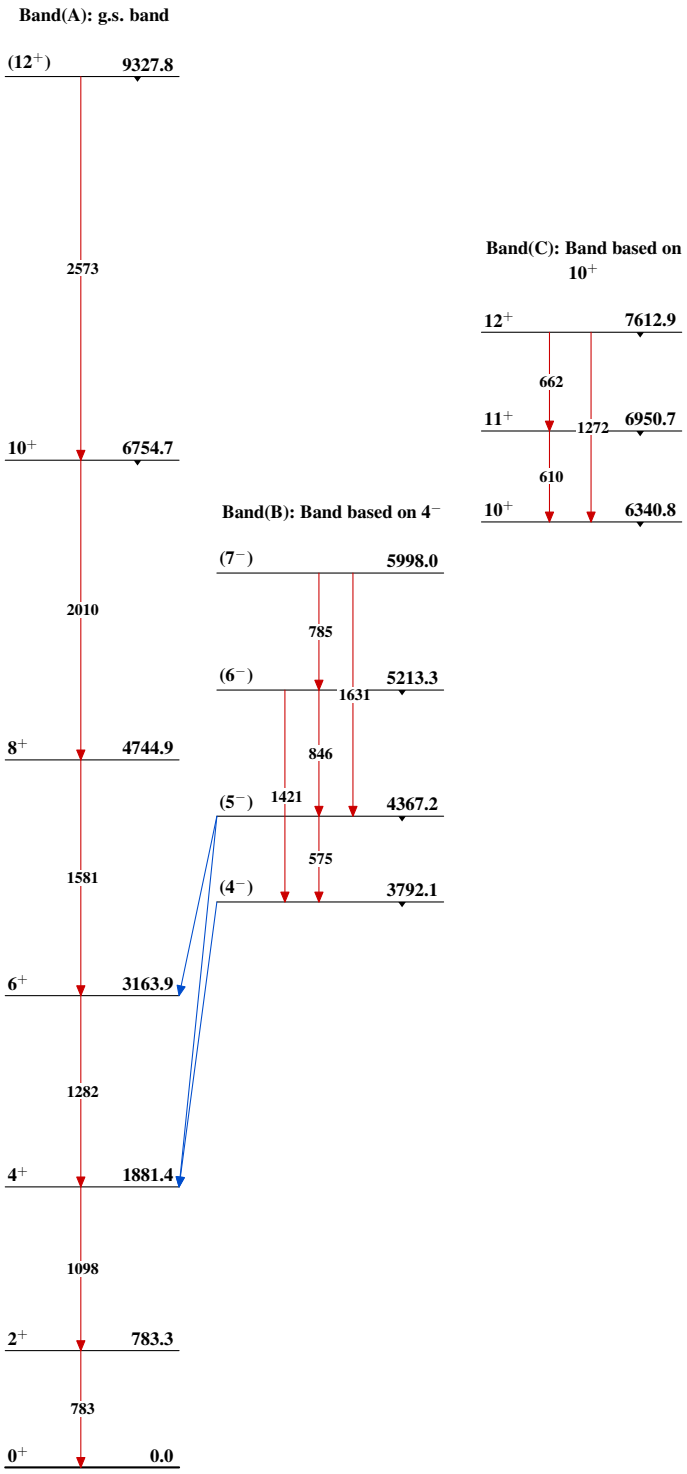
Intensities: Relative I_γ

Legend
$I_\gamma < 2\% \times I_\gamma^{max}$
$I_\gamma < 10\% \times I_\gamma^{max}$
$I_\gamma > 10\% \times I_\gamma^{max}$



$^{50}_{24}Cr_{26}$

^{28}Si(^{28}Si,α2pγ) 1998Ca26,1998Br34,2002Br41



$^{50}_{24}Cr_{26}$