

³⁰Si(¹⁸O,p2n γ) 1998Be29,2001Be12,2004Be20

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	T. W. Burrows	NDS 109, 171 (2008)	30-Oct-2007

See also ²⁸Si(¹⁹F,2p γ), ³⁰Si(¹⁸O,p2n γ), ...

1998Be29, 1995Be06: E=60 MeV. Measured γ , $\gamma\gamma$, $\gamma\gamma(Q)(DCO)$, T_{1/2} by DSAM using GASP detector array (36 Compton-suppressed HPGe and 80 BGO scintillators. 40 Ge detectors for DSAM).

2001Be12: E=68 MeV. Measured E γ , I γ , $\gamma\gamma$ using EUROBALL IV array of high-efficiency cluster and clover detectors.

2004Be20: E=68 MeV. Measured E γ , I γ , lifetimes, $\gamma\gamma$ using EUROBALL IV array. Lifetimes estimated with application of the Recoil Filter Detector. However, other than a statement that T_{1/2}'s are between 40 fs and 800 fs, No values of level lifetimes are given In the paper.

⁴⁵Sc Levels

J(β),E(d) from the Adopted Levels. Level energy held fixed In the least-squares adjustment.

E(level) [†]	J π [‡]	T _{1/2} [#]	E(level) [†]	J π [‡]	T _{1/2} [#]
0 [@]	7/2 ⁻		7928.9 ^a 11	25/2 ^{+d}	<0.07 ps
12.40 ^{&} 5	3/2 ⁺		8003.0 15	19/2MPSYMBO<O27/2 ⁻	<0.07 ps
542.7 ^a 6	5/2 ⁺		8305.3? 15		
974.7 ^{&} 6	7/2 ⁺		8364.1 12	25/2 ^{+f}	<0.07 ps
1236.6 [@] 7	11/2 ⁻		8622.0 ^{&} 12	27/2 ^{+g}	0.19 ps 6
1354.2 ^b 9	(11/2 ⁻) ^c		8975.0 ^e 15	25/2 ^{-d}	
1433.4 ^a 6	9/2 ⁺		9164.0? 15		
2031.2 ^{&} 7	11/2 ⁺	0.97 ps 14	9481.1? 15		
2106.0 [@] 9	15/2 ⁻		10001.1? 16		
2562.8 ^a 8	13/2 ⁺	1.0 ps 3	10007.2 ^b 13	27/2 ^{-c}	
3295.0 ^{&} 9	15/2 ^{+d}	0.46 ps 5	10169.0 ^a 13	29/2 ^{+d}	
3363.3 ^b 10	15/2 ^{-c}		10299.2? 15		
3569.4 ^e 10	17/2 ^{-d}	<0.07 ps	10936.2? 15		
3692.5 [@] 10	19/2 ^{-d}	1.39 ps 14	11021.3 ^{&} 13	31/2 ^{+g}	
4055.2 ^a 9	17/2 ^{+f}	0.28 ps 6	11201.1 13	29/2 ^{+d}	
4895.2 ^{&} 10	19/2 ^{+g}	0.21 ps 4	12142.2? 16		
5417.9 [@] 11	23/2 ^{-d}	1.32 ps 14	12592.3 ^b 16	31/2 ^{-c}	
5516.1 ^b 10	19/2 ^{-c}		13372.1 16	31/2 ^{+d}	
5696.5 ^a 11	21/2 ^{+h}	0.28 ps 14	13674.6? 15		
5710.2 ^e 11	21/2 ⁻ⁱ		14516.3 ^a 15	33/2 ^{+d}	
6683.9 ^{&} 11	23/2 ^{+g}	0.17 ps 4	15313.3? 16		
7612.2 ^b 11	23/2 ^{-c}		15702.4 ^b 19	35/2 ^{-c}	
7696.3? 15			16461.2 ^{&} 15	35/2 ^{+d}	

[†] From least-squares fit to E γ 's assuming $\Delta E(\gamma)=1$ keV (evaluator).

[‡] As given by the authors, except As noted.

[#] From DSAM (1998Be29). Results for lower spin states consistent with previous work.

[@] Band(A): $\pi f_{7/2}^5$, $\alpha=-1/2$. 1998Be29 extended the negative parity structure In 1992Bu01 from 3693 keV to 10169 keV. 2001Be12 reassigned 7929, 25/2⁻, and 10169, 27/2⁻, As the 25/2⁺ and 29/2⁺ members of the $\pi d_{3/2}^{-1} f_{7/2}^6$ band.

[&] Band(B): $\pi d_{3/2}^{-1} f_{7/2}^6$, $\alpha=-1/2$. 1998Be29 extended the band labeled As 3/2(202) In 1992Bu01 from 3296 keV to 13601 keV.

2001Be12 further extended the structure to 16462 keV, identified the 16462 keV state As the 35/2⁺ member of this band instead

³⁰Si(¹⁸O,p2n γ) 1998Be29,2001Be12,2004Be20 (continued)

⁴⁵Sc Levels (continued)

- of the 13601 keV state As proposed by 1998Be29, and reassigned the 7929, 25/2⁻, and 10169, 27/2⁻, members of the $\pi f_{7/2}^5$ As the 25/2⁺ and 29/2⁺ members of of this band.
- ^a Band(C): $\pi d_{3/2}^{-1} f_{7/2}^6$, $\alpha=+1/2$. See footnote on the $\alpha=-1/2$ signature members of this band.
- ^b Band(D): Band based on (11/2⁻) (2004Be20). The deformation of this band exhibits similar behavior In magnitude and trend At high spins As that of the $\pi d_{3/2}^{-1} f_{7/2}^6$ band. This effect May point out that the deformation of ⁴⁵Sc is not directly related to the number of involved particle-hole excitations.
- ^c As proposed by 2004Be20; few details given. ADOPTED with reservations by the evaluator.
- ^d From DCO ratios and linear polarization In gammas (2001Be12). No details given. 7929 and 10169 keV states originally assigned 25/2⁻ and 27/2⁻ by 1998Be29 based on DCO ratios and comparison with shell model calculations, respectively. ADOPTED with reservations by the evaluator.
- ^e Band(E): $\pi f_{7/2}^5$, $\alpha=+1/2$. See footnote on the $\alpha=-1/2$ signature members of this band.
- ^f From measured DCO ratios and angular anisotropies of the γ 's (1995Be06). No details given.
- ^g Rotational-like cascade of high energy E2 γ 's feeding the 3296 keV, 15/2⁺, state (1998Be29). ADOPTED with reservations by the evaluator.
- ^h E2 cascade feeding 4056 keV, 17/2⁺, state and M1 intraband transitions between the two signatures (1998Be29).
- ⁱ 21/2⁻ and 25/2⁻ for the 5710 and 7929 keV states, respectively, from analysis of DCO ratios; 27/2⁻ for the 10169 keV state from comparison with shell model calculations (1998Be29). 2001Be12 assigned 25/2⁺ and 29/2⁺ based on DCO ratios and linear polarization In gammas. ADOPTED with reservations by the evaluator.

$\gamma(^{45}\text{Sc})$

DCO: from 1998Be29. DCO ratios are similar for γ 's between $\pi=+$ states differing by $\Delta J=1$ and $\Delta J=2$.

E_γ [†]	I_γ [†]	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. [‡]	δ	Comments
123 [#]	68 ^a	3692.5	19/2 ⁻	3569.4	17/2 ⁻	M1(+E2) ^{@&}	<0.003 [‡]	DCO=1.50 15
197	9	1433.4	9/2 ⁺	1236.6	11/2 ⁻			
258	48	8622.0	27/2 ⁺	8364.1	25/2 ⁺	M1(+E2) ^{&b}	<0.006 [‡]	DCO=1.69 42
292.5 [#]		5710.2	21/2 ⁻	5417.9	23/2 ⁻			
432	40	974.7	7/2 ⁺	542.7	5/2 ⁺			
457.5 ^c	85	2562.8	13/2 ⁺	2106.0	15/2 ⁻	D		
459	85	1433.4	9/2 ⁺	974.7	7/2 ⁺			
530	183 ^a	542.7	5/2 ⁺	12.40	3/2 ⁺			
532 ^c	68	2562.8	13/2 ⁺	2031.2	11/2 ⁺	D,E2		
543	83 ^a	542.7	5/2 ⁺	0	7/2 ⁻			
598	136 ^a	2031.2	11/2 ⁺	1433.4	9/2 ⁺	M1+E2 ^d	0.13 [‡] 7	DCO=1.72 15 Mult.: $\Delta J=1$ D+Q or $\Delta J=2$ Q from DCO. \neq Q from comparison to RUL; \neq E1+M2 from large DCO and small δ from comparison to RUL.
693 ^e		8622.0	27/2 ⁺	7928.9	25/2 ⁺			
732.5 ^c	161	3295.0	15/2 ⁺	2562.8	13/2 ⁺	M1,E2 ^{df}		DCO=2.02 12
760	10	4055.2	17/2 ⁺	3295.0	15/2 ⁺	D,E2		
794.5 ^c	18	2031.2	11/2 ⁺	1236.6	11/2 ⁻	D		
840	71	4895.2	19/2 ⁺	4055.2	17/2 ⁺	D,E2		
852 ^e		11021.3	31/2 ⁺	10169.0	29/2 ⁺			
869.3 ^g	783	2106.0	15/2 ⁻	1236.6	11/2 ⁻	D,Q ^{@h}		DCO=0.93 2
890.5 ^c	207	1433.4	9/2 ⁺	542.7	5/2 ⁺			
962	43	974.7	7/2 ⁺	12.40	3/2 ⁺			
975	101	974.7	7/2 ⁺	0	7/2 ⁻			
988	52	6683.9	23/2 ⁺	5696.5	21/2 ⁺	D,E2		

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³⁰Si(¹⁸O,p2n γ) **1998Be29,2001Be12,2004Be20** (continued)

γ (⁴⁵Sc) (continued)

E_γ [†]	I_γ [†]	E_i (level)	J_i^π	E_f	J_f^π	Mult. [‡]	Comments
1056.5 ^c	146 ^a	2031.2	11/2 ⁺	974.7	7/2 ⁺	D,E2	
1129	204	2562.8	13/2 ⁺	1433.4	9/2 ⁺	D,E2 ^{di}	DCO=0.94 4
1237 [#]	1000	1236.6	11/2 ⁻	0	7/2 ⁻		
1245 ^e		7928.9	25/2 ⁺	6683.9	23/2 ⁺		
1257 ^j		3363.3	15/2 ⁻	2106.0	15/2 ⁻		
1263.5 ^c	230	3295.0	15/2 ⁺	2031.2	11/2 ⁺	D,E2 ^{ik}	DCO=1.06 15
1326	87	2562.8	13/2 ⁺	1236.6	11/2 ⁻	D,E2	
1354 ^{js}		1354.2?	(11/2 ⁻)	0	7/2 ⁻		
1379 ^{es}		10001.1?		8622.0	27/2 ⁺		
1433	20	1433.4	9/2 ⁺	0	7/2 ⁻		
1463.7 ^g	75	3569.4	17/2 ⁻	2106.0	15/2 ⁻	M1,E2 ^{@f}	DCO=2.24 15
1492.5 ^c	89	4055.2	17/2 ⁺	2562.8	13/2 ⁺	D,E2 ^{di}	DCO=1.11 20
1547 ^e		10169.0	29/2 ⁺	8622.0	27/2 ⁺		
1586 [#]	472 ^a	3692.5	19/2 ⁻	2106.0	15/2 ⁻	D,E2 ^{@i}	DCO=0.96 5
1600.5 ^c	364	4895.2	19/2 ⁺	3295.0	15/2 ⁺	D,E2 ^{il}	DCO=1.15 10
1641	72	5696.5	21/2 ⁺	4055.2	17/2 ⁺	D,E2 ^{il}	DCO=0.88 11
1680.5 ^c	108	8364.1	25/2 ⁺	6683.9	23/2 ⁺	D+Q,E2 ^{bm}	DCO=2.22 46
1725 [#]	269	5417.9	23/2 ⁻	3692.5	19/2 ⁻	D,E2 ^{@i}	DCO=0.99 7
1789	329	6683.9	23/2 ⁺	4895.2	19/2 ⁺	D,E2 ⁱⁿ	DCO=0.96 9
1824 ^j		5516.1	19/2 ⁻	3692.5	19/2 ⁻		
1902 ^j		7612.2	23/2 ⁻	5710.2	21/2 ⁻		
1938.5	219	8622.0	27/2 ⁺	6683.9	23/2 ⁺	D,E2 ^{bm}	DCO=1.04 14
1946 ^j		5516.1	19/2 ⁻	3569.4	17/2 ⁻		
1949	114	4055.2	17/2 ⁺	2106.0	15/2 ⁻	D+Q,E2 ^{mo}	DCO=1.49 16
1986 ^{es}		7696.3?		5710.2	21/2 ⁻		
2004	56	5696.5	21/2 ⁺	3692.5	19/2 ⁻	D+Q,E2 ^{mo}	DCO=1.57 10
2009 ^{js}		3363.3	15/2 ⁻	1354.2?	(11/2 ⁻)		
2016.3 ^g	78	5710.2	21/2 ⁻	3692.5	19/2 ⁻	D+Q,Q ^{@h}	DCO=1.57 20
2096 ^j		7612.2	23/2 ⁻	5516.1	19/2 ⁻		
2127 ^j		3363.3	15/2 ⁻	1236.6	11/2 ⁻		
2142 ^p		5710.2	21/2 ⁻	3569.4	17/2 ⁻		
2153 ^j		5516.1	19/2 ⁻	3363.3	15/2 ⁻		
2194 ^j		7612.2	23/2 ⁻	5417.9	23/2 ⁻		
2231.5 ^c	36	7928.9	25/2 ⁺	5696.5	21/2 ⁺	D,E2	
2239.5 ^{cq}	93	10169.0	29/2 ⁺	7928.9	25/2 ⁺		
2395 ^j		10007.2	27/2 ⁻	7612.2	23/2 ⁻		
2400 <i>l</i>	64	11021.3	31/2 ⁺	8622.0	27/2 ⁺	D+Q,Q ^{rm}	DCO=1.03 20
2473 ^{es}		13674.6?		11201.1	29/2 ⁺		
2511 ^c	112	7928.9	25/2 ⁺	5417.9	23/2 ⁻	D+Q,E2 ^{@m}	DCO=1.94 27
2578.5 ^{cq}	53	11201.1	29/2 ⁺	8622.0	27/2 ⁺		
2585	53	8003.0	19/2MPSYMBO<O27/2 ⁻	5417.9	23/2 ⁻	D,E2	
2585 ^j		12592.3	31/2 ⁻	10007.2	27/2 ⁻		
2595 ^{es}		8305.3?		5710.2	21/2 ⁻		
2786 ^{es}		16461.2	35/2 ⁺	13674.6?			
2837 ^e		11201.1	29/2 ⁺	8364.1	25/2 ⁺		
2946		8364.1	25/2 ⁺	5417.9	23/2 ⁻		
3110 ^j		15702.4	35/2 ⁻	12592.3	31/2 ⁻		
3203 ^e		13372.1	31/2 ⁺	10169.0	29/2 ⁺		
3410 ^j		5516.1	19/2 ⁻	2106.0	15/2 ⁻		
3495 ^e		14516.3	33/2 ⁺	11021.3	31/2 ⁺		
3520 ^{es}		12142.2?		8622.0	27/2 ⁺		

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$^{30}\text{Si}(^{18}\text{O},\text{p}2\text{n}\gamma)$ **1998Be29,2001Be12,2004Be20** (continued) $\gamma(^{45}\text{Sc})$ (continued)

E_γ [†]	$E_i(\text{level})$	J_i^π	E_f	J_f^π	E_γ [†]	$E_i(\text{level})$	J_i^π	E_f	J_f^π
3557 ^e	8975.0	25/2 ⁻	5417.9	23/2 ⁻	4589 ^j	10007.2	27/2 ⁻	5417.9	23/2 ⁻
3746 ^{es}	9164.0?		5417.9	23/2 ⁻	4881 ^{es}	10299.2?		5417.9	23/2 ⁻
3920	7612.2	23/2 ⁻	3692.5	19/2 ⁻	5144 ^{es}	15313.3?		10169.0	29/2 ⁺
4063 ^{es}	9481.1?		5417.9	23/2 ⁻	5440 ^e	16461.2	35/2 ⁺	11021.3	31/2 ⁺
4347 ^e	14516.3	33/2 ⁺	10169.0	29/2 ⁺	5518 ^{es}	10936.2?		5417.9	23/2 ⁻

[†] From 1998Be29. Intensities are relative.

[‡] From comparison to RUL (evaluator), except As noted. Detailed multipolarity arguments by evaluator based on general discussion and DCO ratios In 1998Be29 and comparison to RUL.

Mean of 1998Be29 and 2004Be20.

@ DCO gated by 1237 γ .

& $\Delta J=1$ D+Q or $\Delta J=2$ Q from DCO. M1 from comparison to RUL.

^a Branching ratios In $^{28}\text{Si}(^{19}\text{F},2\text{p}\gamma)$, $^{30}\text{Si}(^{18}\text{O},\text{p}2\text{n}\gamma)$,... are discrepant.

^b DCO gated by 1789 γ .

^c Mean of 1998Be29 and 2001Be12.

^d DCO gated by 891 γ .

^e From 2001Be12.

^f $\Delta J=1$ D+Q or $\Delta J=2$ Q from DCO. \neq M2 from comparison to RUL; \neq E1+M2 from large DCO and small δ from comparison to RUL.

^g Mean of 1998Be29, 2001Be12, and 2004Be20.

^h $\Delta J=0$ D or $\Delta J=2$ Q from DCO.

ⁱ $\Delta J=0$ D or $\Delta J=2$ Q from DCO. \neq M2 from comparison to RUL.

^j From 2004Be20.

^k DCO gated by 1057 γ .

^l DCO gated by 1264 γ .

^m $\Delta J=1$ D+Q or $\Delta J=2$ Q from DCO. \neq M2 from comparison to RUL.

ⁿ DCO gated by 1600 γ .

^o DCO gated by 870 γ .

^p Mean of 2001Be12 and 2004Be20.

^q Placed As deexciting 10167, (27/2⁻), and 13601, (35/2⁺), respectively by 1998Be29.

^r DCO gated by 1938 γ .

^s Placement of transition in the level scheme is uncertain.

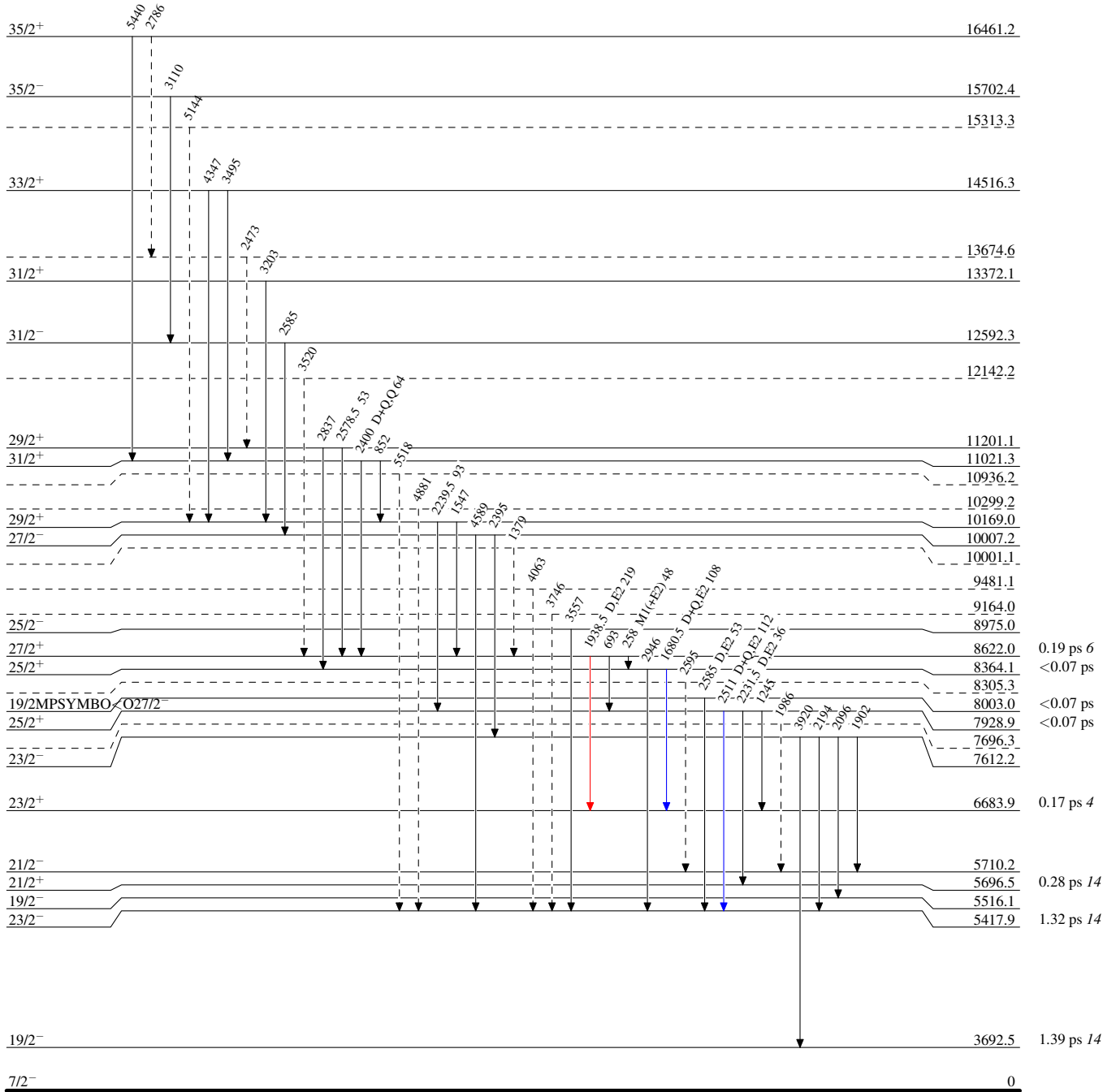
$^{30}\text{Si}(^{18}\text{O}, p2n\gamma)$ 1998Be29, 2001Be12, 2004Be20

Legend

Level Scheme

Intensities: Relative I_γ

- ▶ $I_\gamma < 2\% \times I_\gamma^{\text{max}}$
- ▶ $I_\gamma < 10\% \times I_\gamma^{\text{max}}$
- ▶ $I_\gamma > 10\% \times I_\gamma^{\text{max}}$
- - -▶ γ Decay (Uncertain)



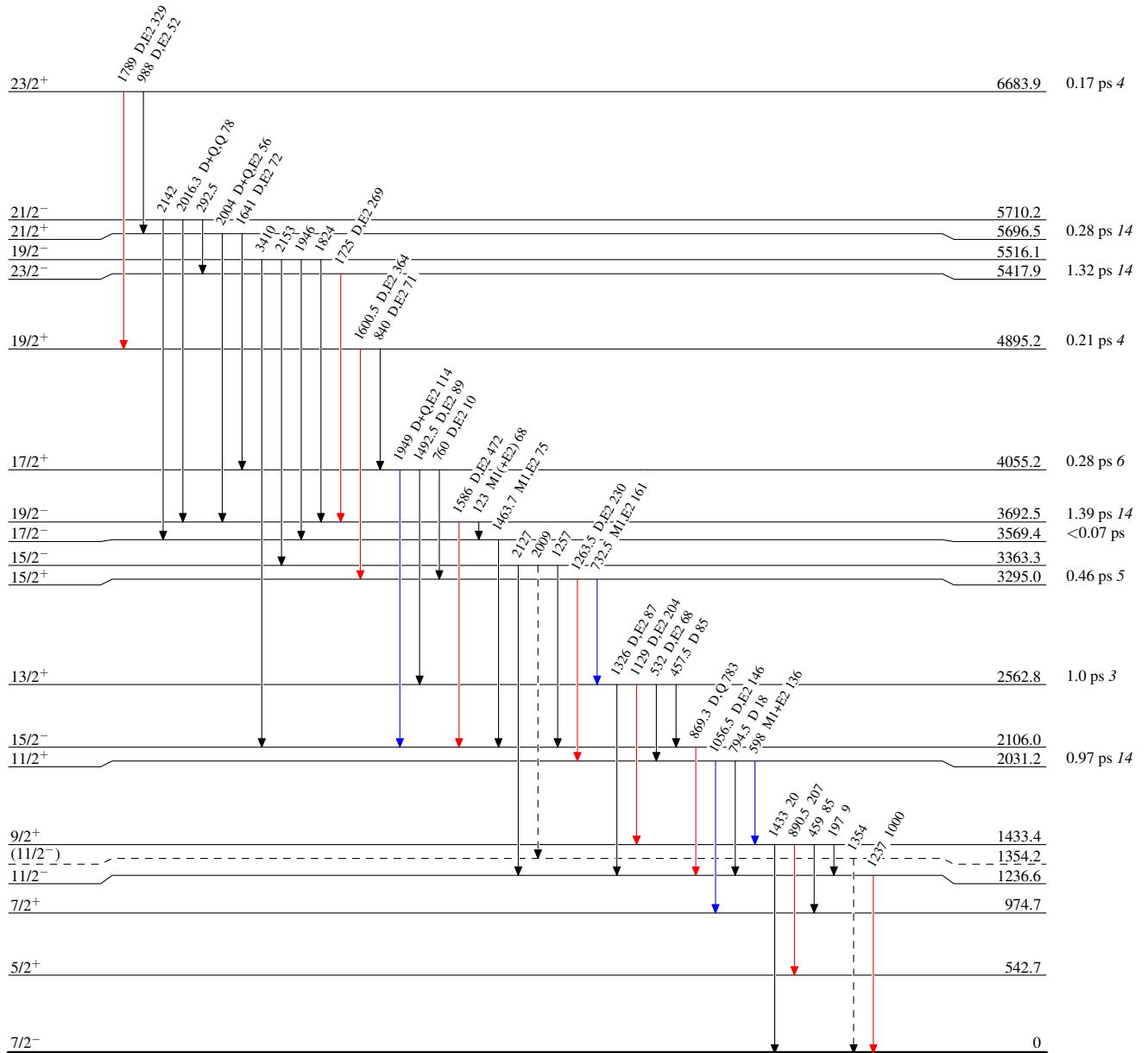
$^{30}\text{Si}(^{18}\text{O}, p2n\gamma)$ 1998Be29, 2001Be12, 2004Be20

Legend

Level Scheme (continued)

Intensities: Relative I_γ

- ▶ $I_\gamma < 2\% \times I_\gamma^{\text{max}}$
- ▶ $I_\gamma < 10\% \times I_\gamma^{\text{max}}$
- ▶ $I_\gamma > 10\% \times I_\gamma^{\text{max}}$
- - -▶ γ Decay (Uncertain)

 $^{45}_{21}\text{Sc}_{24}$

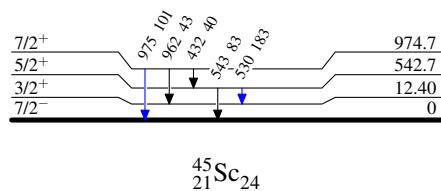
$^{30}\text{Si}(^{18}\text{O},\text{p}2\text{n}\gamma)$ 1998Be29,2001Be12,2004Be20

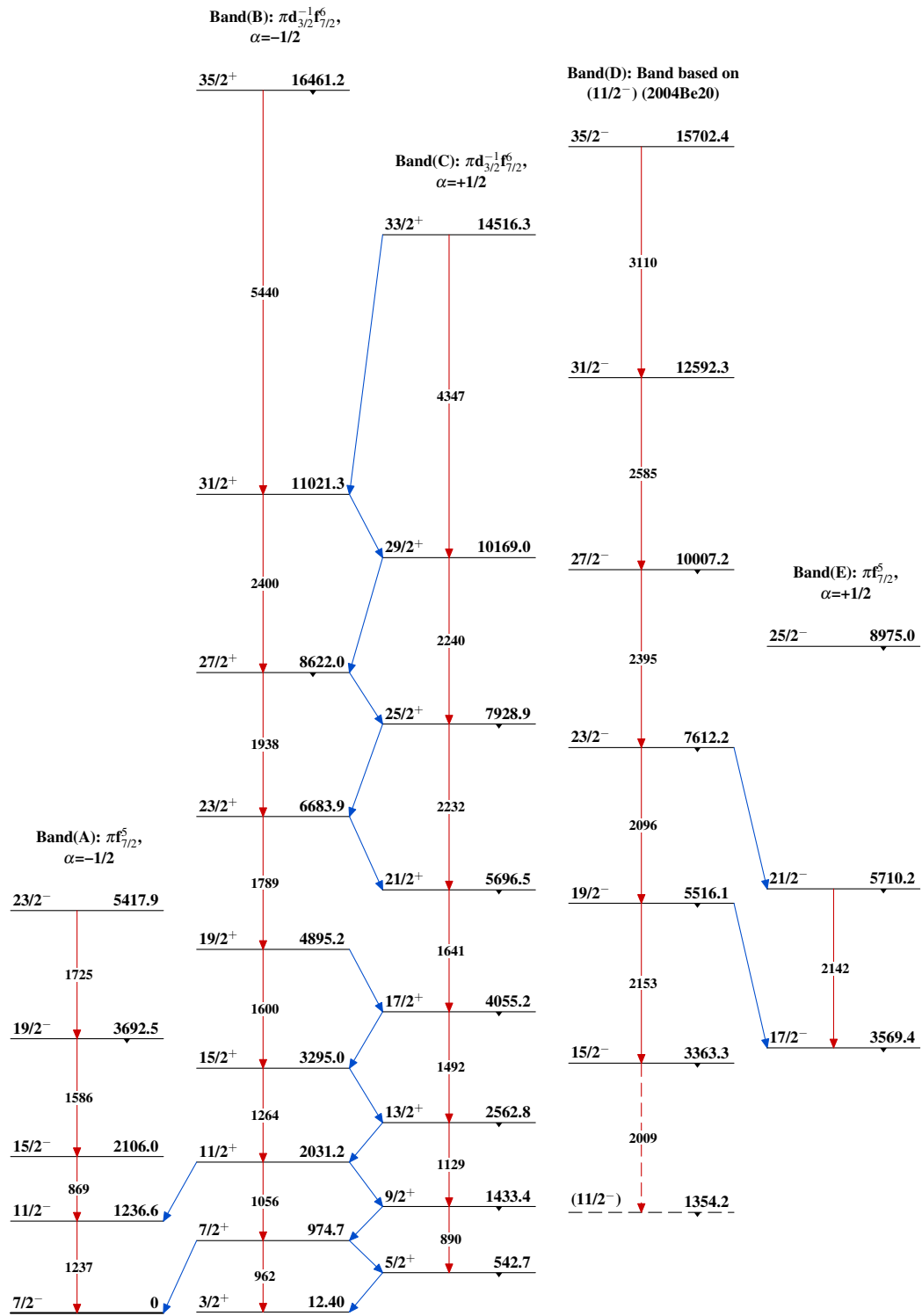
Level Scheme (continued)

Intensities: Relative I_γ

Legend

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



$^{30}\text{Si}(^{18}\text{O}, p2n\gamma)$ 1998Be29, 2001Be12, 2004Be20 $^{45}_{21}\text{Sc}_{24}$