Adopted Levels, Gammas

History

Type	Author	Citation	Literature Cutoff Date
Update	Jun Chen and Balraj Singh	ENSDF	23-Nov-2022

$Q(\beta^-)=-12008$ *3*; S(n)=13054.6 *3*; S(p)=6130.65 *24*; $Q(\alpha)=-9082.94$ *25* 2021Wa16
$Q(\varepsilon)=5398.01$ *23*, S(2n)=32091 *13*, S(2p)=11725.39 *23* (2021Wa16).
Mass measurement by Penning trap method: 2010Ka30, mass excess=−19042.55 keV *24*, Q value for ε decay=5397.99 *24*.
2012Zh06: $^{9}Be(^{40}Ar,X)$ E=57 MeV/nucleon, measured fragment yield, momentum distributions at HIRFL facility; deduced target dependence on production cross section.
Theoretical calculations: 29 primary references for structure and eight for decay characteristics retrieved from the NSR database (www.nndc.bnl.gov/nsr/) are listed under 'document records'.
Additional information 1.

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    Isospin T=3/2 (quadruplet) states
     31Si            31S             ΔE(2)
    0,3/2+       6281,3/2+
  752,1/2+       6975,1/2+      -58
 1695,5/2+
 2317,3/2+
 2788,(5/2+)
 3133,7/2+
 3532,3/2-

 ΔE(2)=E(31S)-E(31P)-6281
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           Mirror States (T=1/2)
     31P             31S              ΔE
   0,1/2+          0,1/2+
 1266,3/2+       1249,3/2+        -17
 2233,5/2+       2235,5/2+        +2
 3134,1/2+       3079,1/2+        -55
 3295,5/2+       3285,(5/2)+      -10
 3414,7/2+       3351,(7/2)+      -63
 3507,3/2+       3436,3/2+        -71
 4190,5/2+       4080,3/2+,5/2+   -110
 4260,3/2+       4209,(1/2:5/2)+  -51
 4431,7/2-       4451,(7/2)-      +20
 4592,3/2+       4521, 3/2+       -71
 4634,7/2+       4584,(7/2)+      -50
 4780,5/2+       4720,(1/2:5/2)+  -60
 5015,(1/2,3/2)- 4971,3/2-,5/2-   -44
 5256,1/2+       5158,1/2+        -98
 5342,9/2+       5301,(9/2+)      -41
 5530,(5/2,7/2)+ 5510,3/2+,5/2+   -20

 ΔE=E(31S)-E(31P)
 For other possible mirror states see discussions
 in 2014Do04, 2012Do07 and 2009Wr02
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Adopted Levels, Gammas (continued)

^{31}S Levels

Cross Reference (XREF) Flags

A	^{31}Cl ε decay (190 ms)	I	^{28}Si(α,nγ)	Q	^{32}S(γ,nγ)
B	^{32}Ar εp decay (98 ms)	J	^{28}Si(^{6}Li,t)	R	^{32}S(p,d),(pol p,d)
C	^{2}H(^{30}P,^{31}Sγ)	K	^{28}Si(^{12}C,^{9}Be)	S	^{32}S(d,t)
D	^{9}Be(^{32}S,^{31}Sγ)	L	^{29}Si(^{3}He,n),(^{3}He,nγ)	T	^{32}S(^{3}He,α),(pol ^{3}He,α)
E	^{12}C(^{20}Ne,nγ),^{16}O(^{16}O,nγ)	M	^{30}Si(pol p,π^{-})	U	^{32}S(^{3}He,αγ)
F	^{24}Mg(^{12}C,αnγ)	N	^{31}P(p,n)	V	^{33}S(p,t)
G	^{24}Mg(^{16}O,n2αγ)	O	^{31}P(^{3}He,t) E=20 MeV		
H	^{28}Si(α,n)	P	^{31}P(^{3}He,t) E=25 MeV		

E(level)†	Jπ‡	$T_{1/2}$	XREF	Comments
0.0#	1/2+	2.5534 s *18*	ABCDEFGHIJ LMNO QRSTUV	%ε+%β^{+}=100 μ=0.48793 *8* (1976Mi16,2019StZV) XREF: M(50). Jπ: L(pol p,d)=L(d,t)=L(^{3}He,α)=0 from 0^{+}. $T_{1/2}$: from 2012Ba54, β detection of a pure source separated using Penning-trap. Others: 2.60 s 3 (1991Mi18), 2.562 s *7* (1980Wi13), 2.543 s *8* (1977Az01), 2.605 s *12* (1974Al03), 2.56 s *10* (1963Ne05), 2.61 s *5* (1960Li05), 2.58 s *6* (1960Wa04), 2.57 s *1* (1960Ja12), 2.75 s *25* (1963Va37), 2.72 s *2* (1958Mi85), 2.40 s *7* (1954Hu30,conference abstract), 2.66 s *3* (1952Ha30), 3.2 s *3* (1951Bo56), 2.6 s *2* (1949Mc17), 3.18 s *4* (1941El03), 3.2 s *2* (1941Wh02). Weighted average (NRM method) of 2012Ba54, 1991Mi18, 1980Wi13, 1977Az01, 1974Al03, 1963Ne05, 1960Li05, 1960Wa04 values is 2.5540 s 23. Evaluators prefer to adopt value from 2012Ba54 due to super-pure source by Penning-trap method. μ: β^{-} NMR method (1976Mi16, also 1980HuZX thesis).
1248.60# *8*	3/2+	0.50 ps *12*	ABCDEFGHIJ L N QRSTUV	XREF: H(1090). Jπ: ΔJ=1, M1+E2 γ to 1/2^{+}; L(p,t)=0(+2). $T_{1/2}$: DSAM in ^{32}S(^{3}He,αγ) (1971En02). Other: 0.8 ps *5* (stat) *+9−6* (syst), and 2.2 ps *33* (stat) *36* (syst) (2010Do03) from lineshape analysis in (^{37}Ca,Xγ); first from cluster HPGe detectors, second from Miniball HPGe detectors, both of RISING γ spectrometer.
2234.33# *11*	5/2+	222 fs *55*	ABCDEFGHIJ LMN QRSTUV	XREF: B(?). Jπ: ΔJ=2, E2 γ to 1/2^{+}; L(p,t)=2+4. $T_{1/2}$: DSAM in ^{32}S(^{3}He,αγ).
3076.54 *14*	1/2+		AB HI LMN QR TUV	XREF: B(?)M(3190). Jπ: L(^{3}He,α)=0. Also L(^{3}He,n)=0 and L(p,t)=2.
3284.21 *11*	5/2+		A EFG IJ L RSTUV	Jπ: L(^{3}He,α)=L(d,t)=L(p,t)=2; ΔJ=2 γ to 1/2^{+}.
3349.94# *17*	7/2+		A C EFG IJ L N QR TUV	Jπ: ΔJ=2 γ to 3/2^{+} in (α,nγ); 1/2 to 7/2 with π=+ from L(p,t)=2.
3434.93 *19*	3/2+		A IJ L N R TUV	Jπ: L(^{3}He,α)=2; L(p,t)=0+2.
4086.42 *18*	5/2+		A IJ L RST V	Jπ: L(^{3}He,n)=L(^{3}He,α)=L(d,t)=2; L(p,t)=2+4; ΔJ=1 γ to 3/2^{+}; 5/2 also favored by possible mirror state of 4190, 5/2^{+} in ^{31}P.
4207.88 *16*	(3/2)+		A I L T V	Jπ: L(p,t)=2; ΔJ=(0), dipole γ to 3/2^{+}; γ to 1/2^{+}; 3/2 favored by possible mirror state of 4260, 3/2^{+} in ^{31}P.
4449.86@ *23*	7/2−	0.55 ps *17*	C EFG IJ L R T	Jπ: L(^{3}He,α)=L(p,d)=3; ΔJ=1 γ to 5/2^{+}.

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Adopted Levels, Gammas (continued)

^{31}S Levels (continued)

E(level)[†]	J^{π}[‡]	XREF	Comments
			$T_{1/2}$: from DSAM in (^{20}Ne,nγ),(^{16}O,nγ).
4519.80 *24*	$3/2^+$	A L R T V	J^{π}: L(p,t)=0; L(^{3}He,α)=2.
4527.89 *22*	$(3/2^+)$	I	J^{π}: possible mirror state of 4593, $3/2^+$ in ^{31}P.
4583.22 *20*	$7/2^+$	EFG IJ L R T V	J^{π}: L(p,t)=2 from $3/2^+$; ΔJ=1 to $5/2^+$; ΔJ=2 γ to $3/2^+$; ΔJ=0 γ to $7/2^+$.
4602? *18*		T	E(level): existence of this tentative level reported only in (^{3}He,α) in one study is doubtful as it is not confirmed in any other reaction.
4709.6 *8*	$5/2^+,3/2^+$	I l R t	J^{π}: L(p,d)=2 from 0^+.
4718.07 *13*	$(5/2)^+$	A l t V	XREF: V(4730). J^{π}: log *ft*=5.1 from $3/2^+$ parent; L(^{3}He,α)=2 from 0^+; 5/2 favored by possible mirror state of 4780, $5/2^+$ in ^{31}P.
4866.19 *22*	$(1/2)^+$	A I L T V	J^{π}: log *ft*=5.0 from $3/2^+$ parent. L(^{3}He,α)=(1) is in disagreement with positive parity; shell model calculations (2018Be12) support $1/2^+$.
4970.8 *8*	$(3/2)^-$	A IJ L O R T	XREF: J(?)R(4978). E(level): there may be two different levels near this energy, one populated in ε decay and decaying by 4970.2γ, the other in (α,nγ) and decaying by 3722.5γ. J^{π}: L(^{3}He,α)=1 from 0^+; 3/2 favored by possible mirror state of 5015, $3/2^-$ in ^{31}P.
5022.56 *21*	$5/2^+$	A I L O R T	J^{π}: log *ft*=5.7 from $3/2^+$ parent; ΔJ=1 γ to $7/2^+$.
5156.2 *3*	$1/2^+$	A I L O R T	J^{π}: L(^{3}He,α)=L(p,d)=0 from 0^+.
5300.5[#] *3*	$9/2^+$	EFG I O R T	J^{π}: ΔJ=1 γ to $7/2^+$; L(p,d)=4 from 0^+.
5400.2 *8*	$(5/2^+)$	I O R T	XREF: O(5405)T(5407). J^{π}: ΔJ=1 γ to $7/2^+$; mirror of 5530, $(5/2)^+$ level in ^{31}P, based on data in (α,nγ).
5436.0 *8*	$(3/2^+)$	A O T	J^{π}: γ to $1/2^+$; possible ε feeding from $3/2^+$ parent; shell-model calculations (2018Be12) support $3/2^+$.
5518.3 *3*	$5/2^+$	I L O R T	J^{π}: L(p,d)=2 from 0^+; ΔJ=1 γ to $3/2^+$.
5675.2 *6*	$7/2^{(+)}$	F I L O R T	J^{π}: ΔJ=0 γ to $7/2^+$; mirror of 5773, $(7/2)^+$ level in ^{31}P based on data in (α,nγ).
5775.6 *3*	$(5/2)^+$	A L O R T	J^{π}: L(^{3}He,α)=L(p,d)=2 from 0^+; shell-model calculations (2018Be12) support $5/2^+$.
5826 *3*		O R T	E(level): weighted average of 5824 *3* from (^{3}He,t) E=20 MeV, 5829 *4* from (p,d), and 5826 *13* from (^{3}He,α).
5890.4 *3*	$(3/2)^+$	A L O R T	XREF: O(5896). E(level): see comment for 5891.5 level. J^{π}: L(^{3}He,α)=2 from 0^+; shell-model calculations (2018Be12) support $3/2^+$.
5891.6 *20*	$3/2^{(+)}$	I	E(level): from energy agreement, this level may be the same as 5890.1, but 4642.6γ is the only γ seen in (α,nγ). J^{π}: ΔJ=0 γ to $3/2^+$.
5977.3 *5*	$(9/2^+)$	EF I l O T	XREF: l(5985). J^{π}: L(^{3}He,α)=(4) from 0^+; mirror of 6078, $9/2^+$ level in ^{31}P based on (α,nγ).
5979 *10*	$3/2^+,5/2^+$	l R	XREF: l(5985). J^{π}: L(p,d)=2 from 0^+.
6129.5 *5*	$(5/2^+)$	A	J^{π}: possible ε feeding from $3/2^+$ parent; γ transitions to $7/2^+$ and $1/2^+$; shell-model calculations (2018Be12) support $5/2^+$.
6138.3 *6*	$(7/2^+)$	I OP R	J^{π}: ΔJ=0 or ΔJ=2 γ to $3/2^+$ from $\gamma(\theta)$ in (α,nγ) (2014Do04); 9/2 assigned from $\sigma(\theta)$ distribution in (^{3}He,t) (2011Pa14), but 7/2 cannot be ruled out. However, $3/2^+$ is clearly in disagreement with $\sigma(\theta)$ in (^{3}He,t). Possible mirror state of 6233 level in ^{31}P (2014Do04).
6157.7 *3*	(5/2,7/2)	C E I L OP R T	J^{π}: 5/2 from ΔJ=1 γ to $7/2^-$ from (^{20}Ne,nγ); 7/2 from ΔJ=0 γ to $7/2^-$

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Adopted Levels, Gammas (continued)

^{31}S Levels (continued)

E(level)[†]	J$^{\pi}$[‡]	T$_{1/2}$	XREF	Comments
				in (α,nγ) (2014Do04). But the $\sigma(\theta)$ distribution in (^{3}He,t) (2011Pa14) supports 5/2. 2014Do04 associated this level with 6399, 7/2$^+$ in ^{31}P, but 6399 level is assigned 7/2$^{(-)}$ in ^{31}P Adopted Levels.
6255.1 *3*	1/2$^+$		A OP R T	T=1/2 J$^{\pi}$: L(p,d)=L(^{3}He,α)=0 from 0$^+$; $\sigma(\theta)$ in (^{3}He,t) (2011Pa14). Possible mirror state of 6337, 1/2$^+$ in ^{31}P (2012Do07).
6279.10 *13*	3/2$^+$		A L OP V	T=3/2 XREF: V(6268). J$^{\pi}$: L(p,t)=0 from 0$^+$; log *ft*=3.4 from 3/2$^+$ parent; IAS of ^{31}Cl g.s. E(level): lowest T=3/2 state (1979Na07). Possible mirror state of 6381, 3/2$^+$ in ^{31}P (2012Do07).
6326.8 *5*	(3/2)		C I OP ST	J$^{\pi}$: 3/2 from ΔJ=0 γ to 3/2$^+$ from $\gamma(\theta)$ in (α,nγ) (2014Do04). 1/2$^+$ from $\sigma(\theta)$ distribution in (^{3}He,t) (2011Pa14) is in disagreement with anisotropic pattern of 5077.7γ in (α,nγ) data. 3/2$^+$ may not by completely ruled out by $\sigma(\theta)$ data in (^{3}He,t) as well as $\gamma(\theta)$ data in (α,nγ). Possible mirror state of 6496, 3/2$^-$ in ^{31}P (2014Do04).
6357.06 *22*	(5/2$^-$)		I OP S	E(level),J$^{\pi}$: 5/2 from ΔJ=1 γ to 3/2$^+$ in (α,nγ) (2014Do04). The $\sigma(\theta)$ distribution in (^{3}He,t) gives 3/2$^+$ (2011Pa14), which is inconsistent with $\gamma(\theta)$ data for 5108γ in (α,nγ). Possible mirror state of 6594, 5/2$^-$ in ^{31}p (2014Do04).
6375.6[@] *3*	9/2$^-$	170 fs *31*	C EF I OP RS V	J$^{\pi}$: L(p,d)=5 from 0$^+$; ΔJ=1 γ to 7/2$^+$. T$_{1/2}$: effective half-life from DSAM in (^{20}Ne,nγ) (2008Pa27). Possible mirror state of 6501, 9/2$^-$ in ^{31}P (2014Do04).
6390.46 *16*	3/2$^+$		A l R	%p=0.025 *+4−3* (2022Bu14) E(level),J$^{\pi}$: unambiguous *J$^{\pi}$* assignment made by 2016Be05 from identification of this level as isospin mixed with the IAR at 6279, 3/2$^+$; also log *ft*=4.1 from 3/2$^+$ parent. %p: deduced by 2022Bu14 based on measured β-delayed γ emissions I($\beta\gamma$)=0.0338 *18* from this level by 2018Be12 and β-delayed proton emission I(βp)=8.3×10^{-6} *+12−9* from this level by 2022Bu14.
6392.16 *22*	(5/2$^+$)		C I l S	J$^{\pi}$: ΔJ=1 γ to 3/2$^+$ in (α,nγ) (2014Do04). An L=2, 6361 *25* group in (^{3}He,n) may correspond to any of the 6357, 6377 or 6392 levels, but L value is consistent only with that for 6390 and/or 6392 levels. Possible mirror state of 6461, 5/2$^+$ in ^{31}P (2014Do04).
6392.93[#] *20*	11/2$^{(+)}$		EFG I OP T	J$^{\pi}$: ΔJ=2 γ to 7/2$^+$; ΔJ=1 γ to 9/2$^+$; possible mirror state of 6453, 11/2$^+$ in ^{31}P (2014Do04) from (α,nγ).
6402 *2*	(7/2$^-$)		OP RS	XREF: R(6411). J$^{\pi}$: possible mirror state of 6399, 7/2$^{(-)}$ in ^{31}P from (α,nγ).
6541.6 *4*	3/2$^{(-)}$		I L OP RST	J$^{\pi}$: ΔJ=0 γ to 3/2$^+$ from $\gamma(\theta)$ (2014Do04). (7/2,9/2) from $\sigma(\theta)$ in (^{3}He,t) (2011Pa14) is in disagreement with $\gamma(\theta)$ data in (α,nγ); possible mirror state of 6610, 3/2$^-$ in ^{31}P (2014Do04).

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Adopted Levels, Gammas (continued)

^{31}S Levels (continued)

E(level)†	Jπ‡	$T_{1/2}$	XREF	Comments
6582.4 *20*	($5/2^-$,$7/2^-$)		I OP RST	XREF: T(6593). Jπ: assignment in (α,nγ) by 2014Do04 based on mirror analogy with $(5/2,7/2)^-$ level at 6842 in ^{31}P, which is now assigned $(5/2)^-$ in ^{31}P Adopted Levels. $7/2^-$ assigned from σ(θ) in (^{3}He,t) (2011Pa14).
6634.64 *23*	$9/2^{(-)}$		EF I OP RST V	Jπ: ΔJ=1 γ to $7/2^+$ in (α,nγ) (2014Do04); 9/2 from σ(θ) in (^{3}He,t) (2011Pa14); possible mirror state of 6796, $9/2^-$ in ^{31}P (2014Do04).
6648 *4*			S	
6720 *1*	5/2		L OP rST	Jπ: σ(θ) distribution in (^{3}He,t) (2011Pa14).
6749 *2*	$3/2^+$		OP rST	Jπ: σ(θ) distribution in (^{3}He,t) (2011Pa14).
6796 *25*			L	
6832.7@ *3*	$11/2^{(-)}$	125 fs *24*	EFG OP RST	Jπ: ΔJ=2 γ to $7/2^-$; ΔJ=1 γ to $9/2^+$ in (^{20}Ne,nγ); 11/2 from σ(θ) in (^{3}He,t) (2011Pa14); L(p,d)=(5,4), with better fit for L=5. $T_{1/2}$: effective half-life from DSAM in (^{20}Ne,nγ) (2008Pa27).
6836? *2*			O	
6870 *1*	$1/2^+$,$3/2^+$,$5/2^+$		OP RST V	XREF: V(6860). Jπ: L=0+2 in (p,d) from 0^+. 11/2 from σ(θ) distribution in (^{3}He,t) (2011Pa14) is in disagreement. There could be two different levels near this energy.
6936 *2*	$1/2^+$,$3/2^+$,$5/2^+$		A L OP S V	XREF: L(6921)V(6919). E(level): from ^{31}Cl ε decay. Jπ: log *ft*=5.0 from $3/2^+$ parent.
6959 *2*	($1/2^+$)		OP RS	E(level): weighted average of values from (^{3}He,t). Jπ: proposed in (^{3}He,t) E=20 MeV (2009Wr02).
6972 *2*	$1/2^+$		OP ST	E(level): weighted average of values from (^{3}He,t). Jπ: L(^{3}He,α)=0 from 0^+.
7010 *10*			l V	XREF: l(7006). E(level): from (p,t). Jπ: L(^{3}He,n)=0 from $1/2^+$ gives $1/2^+$,$3/2^+$ for a group at 7006 *25* which could be a composite peak of 7010+7037 levels.
7036? *2*	($1/2^+$)		O	E(level),Jπ: from (^{3}He,t), possibly a doublet with 7037 level.
7037 *2*	$(5/2)^+$		A l OP RST	XREF: l(7006)R(7041)T(7036). Jπ: L(p,d)=L(^{3}He,α)=2 from 0^+; assigned as T=1/2, $5/2^+$ in (p,d) (2022Bu13).
7050.1 *8*	($1/2^+$,$3/2^+$,$5/2^+$)		A OP	Jπ: log *ft*=5.7 from $3/2^+$ parent. In ε decay, 2018Be12 suggest $1/2^+$.
7150.0 *8*	$5/2^+$,$3/2^+$,$1/2^+$		A L V	XREF: L(7112)V(7140). Jπ: log *ft*=5.5 from $3/2^+$ parent. In ε decay, 2018Be12 suggest $5/2^+$.
7157.5 *11*	$3/2^+$,$5/2^+$		A O R T	E(level): from (p,d). Jπ: L(^{3}He,α)=L(p,d)=2 from 0^+.
7196 *2*			O R T	XREF: R(?). E(level): from (^{3}He,t) E=20 MeV.
7302.4 *5*	$11/2^{(+)}$		EF O R T	Jπ: ΔJ=2 γ to $7/2^+$; 908.5γ to $11/2^{(+)}$.
7355 *3*	$1/2^+$,$3/2^+$,$5/2^+$		A	E(level): from ^{31}Cl ε decay. Jπ: log *ft*=5.6 from $3/2^+$.

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Adopted Levels, Gammas (continued)

^{31}S Levels (continued)

E(level)†	Jπ‡	XREF	Comments
7469 *3*		L O R	XREF: L(7445). E(level): from (^{3}He,t) and (p,d).
7501 *3*		O	
7517 *3*		A L O R T	XREF: A(?)O(7522). E(level): from (p,d). Other: 7519 *3* from (^{3}He,t) E=20 MeV.
7584 *2*		O R T	XREF: T(7600). E(level): from (p,d). Other: 7585 *3* from (^{3}He,t) E=20 MeV.
7640.8 *6*	$(11/2^-)$	F	Jπ: proposed in (^{12}C,$\alpha n\gamma$) based on γ to $(9/2^-)$.
7641 *3*		L O R T	XREF: L(7660)T(7660). E(level): from (^{3}He,t) E=20 MeV. Other: 7640 *9* from (p,d).
7699 *3*	$1/2^+,3/2^+,5/2^+$	A O	Jπ: log *ft*=4.5 from $3/2^+$ parent. E(level): weighted average of 7701 *3* from ^{31}Cl ε decay and 7698 *3* from (^{3}He,t) E=20 MeV.
7725 *3*	$(1/2,3/2,5/2^+)$	O R T	E(level): weighted average of 7723 *3* from (^{3}He,t) E=20 MeV and 7728 *4* from (p,d). Jπ: this level is a multiplet in (^{3}He,α) with L=1+2 favored over L=1+3; also L(p,d)=0+2 from 0^+ for the multiplet. Assignments are all possible values from L(^{3}He,α)=1,2 and L(p,d)=0,2.
7744 *3*		O R	XREF: R(?). E(level): from (^{3}He,t) E=20 MeV.
7774 *3*	$(1/2^+,3/2^+,5/2^+)$	A L O	E(level): from (^{3}He,t) E=20 MeV. Other: 7778 *17* from ^{31}Cl ε decay; 7768 *25* from (^{3}He,n). Jπ: log *ft*=5.7 from $3/2^+$.
7824 *3*		l O	XREF: l(7850).
7859 *3*		l O	XREF: l(7850).
7895 *2*	$1/2^+,3/2^+,5/2^+$	A L O R	XREF: L(?). E(level): from (p,d). Others: 7894 *3* from ^{31}Cl ε decay and (^{3}He,t) E=20 MeV, 7888 *25* from (^{3}He,n). Jπ: log *ft*=4.9 from $3/2^+$.
7907 *3*	$1/2^+$	O R	E(level): weighted average of 7905 *3* from (^{3}He,t) E=20 MeV and 7912 *5* from (p,d). Jπ: L(p,d)=0 from 0^+.
7932 *3*		O	
7945 *3*		O	
7973 *3*		L O	XREF: L(7985).
8015 *3*		O	
8022 *3*	$1/2^+,3/2^+,5/2^+$	A R	XREF: R(?). E(level): this level may be the same as 8015 and/or 8030. Jπ: log *ft*=4.6 from $3/2^+$.
8030? *3*		O	
8044.5 *12*	$1/2^+\&3/2^+,5/2^+$	O R	E(level),Jπ: doublet from (p,d), with L=0+2 from 0^+.
8060? *3*		O	
8071 *3*		L O R	XREF: L(8082?).
8122 *17*	$1/2^+,3/2^+,5/2^+$	A O	XREF: A(8122)O(8106?). Jπ: log *ft*=5.4 from $3/2^+$.
8130 *2*		O R	E(level): from (p,d). Other: 8131 *3* from (^{3}He,t) E=20 MeV.
8178 *3*		L O R	E(level): from (^{3}He,t) E=20 MeV. Other: 8171 *12* from (p,d), 8183 *25* from (^{3}He,n).
8210? *2*		O R	XREF: O(?)R(?). E(level): weighted average of 8209 *3* from (^{3}He,t) E=20 MeV and 8211 *2* from (p,d).
8229 *3*		O R	XREF: R(8221?).
8268 *10*	$1/2^+,3/2^+,5/2^+$	A O	E(level): from (^{3}He,t) E=20 MeV. Other: 8270 *17* from ^{31}Cl ε

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{31}S Levels (continued)

E(level)†	Jπ‡	XREF	Comments
			decay.
			Jπ: log ft=5.4 from 3/2+.
8330 *8*		M O	E(level): from (^{3}He,t) E=20 MeV.
8386 *3*		l O R	XREF: l(8362)O(8382).
			E(level): from (p,d).
8424 *3*	1/2+,3/2+,5/2+	A L O R	XREF: L(8453).
			E(level): weighted average of 8429 *3* from ^{31}Cl ε decay, 8418 *5* from (^{3}He,t) E=20 MeV, and 8422 *2* from (p,d).
			Jπ: log ft=5.0 from 3/2+.
8460.8@ *4*	(13/2−)	EF	Jπ: proposed in (^{20}Ne,nγ) and (^{12}C,αnγ) based on γ to (11/2−).
8498 *5*	1/2+	A O R	XREF: R(8517).
			E(level): from (^{3}He,t) E=20 MeV.
			Jπ: L(p,d)=0 from 0+.
8563 *2*		O R	E(level): from (p,d). Other: 8562 *8* from (^{3}He,t) E=20 MeV.
8702 *17*	1/2+,3/2+,5/2+	A	Jπ: log ft=5.2 from 3/2+ parent.
8746 *3*		R	
8788 *3*	3/2+,5/2+	R	Jπ: L(p,d)=2.
8815 *3*		O R	XREF: O(8813).
8860 *17*	(1/2+,3/2+,5/2+)	A	Jπ: log ft=5.7 from 3/2+ parent.
8904 *6*		O R	E(level): from (p,d). Other: 8904 *20* from (^{3}He,t) E=20 MeV.
8973 *4*		O R	XREF: O(8969).
9001 *3*		O R	XREF: O(9004).
9031 *17*	1/2+,3/2+,5/2+	A	Jπ: log ft=5.4 from 3/2+ parent.
9077 *20*		O	
9154.2# *7*	(13/2+)	EF O R	Jπ: ΔJ=1 γ to 11/2(+).
9207 *5*		O R	XREF: O(9190).
9226 *25*		O	
9293? *2*		R	
9332 *30*		O	
9423 *7*	3/2+,5/2+	O R	XREF: O(9398).
			Jπ: L(p,d)=2 from 0+.
9499? *8*		R	
9561? *10*		R	
9606 *14*		R	
9641? *4*		R	
9777? *2*		R	
9833 *7*		R	
10145.8 *10*	(13/2−)	EF R	Jπ: proposed in (^{20}Ne,nγ) based on γ to 11/2(−). 15/2− proposed in (^{12}C,αnγ).
10282? *4*		R	
10360? *4*		R	
10577 *13*		M R	XREF: M(10580).
10800? *5*		R	
13.30×10^{3} *10*		K M	XREF: M(13330).

† From a least-squares fit to Eγ for levels populated in γ-ray studies, others are weighted averages of available values.
‡ For levels populated in (^{20}Ne,nγ) and (^{16}O,n2αγ), ascending spins are assumed as the excitation energy rises. The yrast sequences of positive and negative parities are also assumed in spin assignments. In particle-transfer reactions, target $J^{\pi}=0^{+}$ for (^{3}He,α), (d,t) and (p,d) reactions; 1/2+ for (^{3}He,n); 3/2+ for (p,t).
# Member of yrast π=+ sequence.
@ Member of yrast π=− sequence.

Adopted Levels, Gammas (continued)

$\gamma(^{31}S)$

E_i(level)	J_i^π	E_γ†	I_γ†	E_f	J_f^π	Mult.@	δ	α&	Comments
1248.60	3/2+	1248.68 *10*	100	0.0	1/2+	M1+E2	+0.35 *2*	3.58×10^{-5} *5*	B(M1)(W.u.)=0.020 *+6−4*; B(E2)(W.u.)=7.0 *+24−15* α(K)=2.122×10^{-5} *30*; α(L)=1.637×10^{-6} *23*; α(M)=1.381×10^{-7} *20* α(IPF)=1.280×10^{-5} *19* E_γ: weighted average of 1248.40 *20* from ^{31}Cl ε decay, 1248.4 *3* from ^{32}Ar εp decay, 1248.9 *1* from (^{20}Ne,nγ), 1248.5 *1* from (α,nγ), 1248.9 *2* from (^{3}He,n), and 1249.0 *10* from (^{3}He,$\alpha\gamma$). Others: 1249 *7* from (^{32}S,^{31}Sγ), 1248 *6* from (γ,nγ); 1249.8 *1* from (^{12}C,αnγ) is discrepant. Mult.,δ: From $\alpha\gamma(\theta)$ in ^{32}S(^{3}He,$\alpha\gamma$).
2234.33	5/2+	985.84 *20*	0.352 *17*	1248.60	3/2+				E_γ: weighted average of 985.62 *23* from ^{31}Cl ε decay and 986.0 *2* from (α,nγ). I_γ: other: 5.5 *11* in (α,nγ) is discrepant.
		2234.19 *22*	100 *5*	0.0	1/2+	E2		0.000438 *6*	B(E2)(W.u.)=7.9 *+26−16* α(K)=8.34×10^{-6} *12*; α(L)=6.43×10^{-7} *9*; α(M)=5.42×10^{-8} *8* α(IPF)=0.000429 *6* E_γ: weighted average of 2233.97 *20* from ^{31}Cl ε decay and 2234.4 *2* from (α,nγ). Others: 2235.8 *8* from (^{12}C,αnγ), 2235.6 *4* from (^{3}He,n), 2236.1 *5* from (^{20}Ne,nγ) seem somewhat discrepant. Mult.,δ: $\alpha\gamma(\theta)$ in ^{32}S(^{3}He,$\alpha\gamma$) gives δ(M3/E2)=−0.05 *4* but RUL=10 for B(M3)(W.u.) suggests δ very near zero.
3076.54	1/2+	840 *10*		2234.33	5/2+				E_γ: from (^{3}He,$\alpha\gamma$) only.
		1827.93 *25*	7.3 *5*	1248.60	3/2+				E_γ,I_γ: others: 1827.5 *10* from (α,nγ) and 1830 *10* from (^{3}He,$\alpha\gamma$).
		3076.24 *20*	100 *5*	0.0	1/2+				
3284.21	5/2+	1049.96 *23*	32.7 *12*	2234.33	5/2+	(M1+E2)			E_γ: weighted average of 1049.66 *21* from ^{31}Cl ε decay, 1050.4 *2* from (^{20}Ne,nγ), and 1049.8 *2* from (α,nγ). Other: 1051.4 *3* from (^{12}C,αnγ) is discrepant. I_γ: weighted average of 32.0 *12* from ^{31}Cl ε decay, 35.9 *26* from (^{20}Ne,nγ), and 35 *7* from (^{3}He,$\alpha\gamma$). Other: 18.7 *6* from (α,nγ) is discrepant. Mult.: D+Q from DCO in (^{20}Ne,nγ), ΔJ=0; (M1+E2) from $\Delta\pi$, where parity assignments of connecting levels are uniquely established from independent arguments.
		2035.60 *21*	100 *5*	1248.60	3/2+	(M1+E2)		0.00031 *4*	α(K)=9.4×10^{-6} *5*; α(L)=7.2×10^{-7} *4*; α(M)=6.09×10^{-8} *32*

Adopted Levels, Gammas (continued)

$\gamma(^{31}S)$ (continued)

E_i(level)	J^π_i	E_γ[†]	I_γ[†]	E_f	J^π_f	Mult.[@]	δ	α[&]	Comments
									α(IPF)=0.00030 *4* E_γ: weighted average of 2035.24 *20* from ^{31}Cl ε decay, 2035.8 *2* from (^{20}Ne,nγ), 2035.5 *2* from (α,nγ), and 2036.6 *4* from (^{3}He,n). Others: 2035.9 *8* from (^{12}C,αnγ) and 2040 *10* from (^{3}He,$\alpha\gamma$). Mult.,δ: +0.21 *11* or +1.9 *2* for J(3284)=5/2; +1.3 *6* for J(3284)=3/2 (1970Mo08) in (^{3}He,$\alpha\gamma$); (M1+E2) from $\Delta\pi$, where parity assignments of connecting levels are uniquely established from independent arguments.
3284.21	5/2$^+$	3284.21 *23*	24.7 *14*	0.0	1/2$^+$	(E2)		0.000908 *13*	α(K)=4.45×10^{-6} *6*; α(L)=3.42×10^{-7} *5*; α(M)=2.89×10^{-8} *4* α(IPF)=0.000903 *13* E_γ: weighted average of 3283.57 *31* from ^{31}Cl ε decay, 3285.3 *11* from (^{20}Ne,nγ), 3285.8 *14* from (^{12}C,αnγ), 3284.4 *2* from (α,nγ), and 3290 *10* from (^{3}He,$\alpha\gamma$). I_γ: weighted average of 25.3 *14* from ^{31}Cl ε decay and 23.8 *18* from (^{20}Ne,nγ). Other: 18.2 *6* in (α,nγ) seems discrepant. Mult.: Q, ΔJ=2 from $\gamma(\theta)$ in (α,nγ); (E2) from $\Delta\pi$, where parity assignments of connecting levels are uniquely established from independent arguments.
3349.94	7/2$^+$	270[#a] *10*	≤8[#]	3076.54	1/2$^+$	[M3]		0.0118 *18*	α(K)=0.0109 *17*; α(L)=0.00088 *14*; α(M)=7.3×10^{-5} *12*
		1110[#a] *10*	≤27[#]	2234.33	5/2$^+$				
		2101.7 *3*	100	1248.60	3/2$^+$	(E2)		0.000374 *5*	α(K)=9.29×10^{-6} *13*; α(L)=7.16×10^{-7} *10*; α(M)=6.04×10^{-8} *8* α(IPF)=0.000364 *5* E_γ: weighted average of 2100.79 *25* from ^{31}Cl ε decay, 2101.9 *5* from (^{12}C,αnγ), 2101.7 *2* from (α,nγ), and 2102.2 *5* from (^{3}He,n). Other: 2102.4 *2* from (^{20}Ne,nγ) seems discrepant. Mult.: Q from DCO in (^{12}C,αnγ), with ΔJ=2; (E2) from $\Delta\pi$, where parity assignments of connecting levels are uniquely established from independent arguments.
		3351[a] *6*	≤8	0.0	1/2$^+$	[M3]		0.000441 *6*	α(K)=7.90×10^{-6} *11*; α(L)=6.09×10^{-7} *9*; α(M)=5.14×10^{-8} *7* α(IPF)=0.000432 *6* Eγ from (γ,nγ), Iγ from (^{3}He,$\alpha\gamma$). δ(E4/M3)=−0.5 *5* or −2 *3* for J(3351)=7/2; δ(E2/M1)=+0.8 *6* for 3/2.
3434.93	3/2$^+$	360[#a] *10*	≤4[#]	3076.54	1/2$^+$				
		1200[#a] *10*		2234.33	5/2$^+$				
		2186.33 *33*	83 *5*	1248.60	3/2$^+$				E_γ: other: 2184.7 *5* in (α,nγ) seems discrepant. ^{32}S(^{3}He,$\alpha\gamma$) only resolved the summed branching of the 2190 and 1200 γ-rays which is 100 *4*.

$\gamma(^{31}S)$ (continued)

E_i(level)	J^π_i	E_γ[†]	I_γ[†]	E_f	J^π_f	Mult.[@]	δ	α[&]	Comments
3434.93	3/2+	3434.70 *32*	100 *6*	0.0	1/2+	(M1+E2)	−0.6 *2*	0.000870 *21*	α(K)=4.03×10⁻⁶ *6*; α(L)=3.10×10⁻⁷ *5*; α(M)=2.62×10⁻⁸ *4* α(IPF)=0.000866 *21* Mult.,δ: D+Q from αγ(θ) in ^{32}S(^{3}He,αγ); (M1+E2) from Δπ, where parity assignments of connecting levels are uniquely established from independent arguments.
4086.42	5/2+	1852.19 *25*	34.4 *23*	2234.33	5/2+				
		2837.60 *32*	100 *6*	1248.60	3/2+	(M1)		0.000602 *8*	α(K)=5.29×10⁻⁶ *7*; α(L)=4.07×10⁻⁷ *6*; α(M)=3.44×10⁻⁸ *5* α(IPF)=0.000597 *8* E_γ: other: 2837.5 *16* from (α,nγ). Mult.: D, ΔJ=1 from γ(θ) in (α,nγ); (M1) from Δπ, where parity assignments of connecting levels are uniquely established from independent arguments.
		4085.2 *8*	3.1 *13*	0.0	1/2+	[E2]		1.20×10⁻³ *2*	α(K)=3.22×10⁻⁶ *5*; α(L)=2.475×10⁻⁷ *35*; α(M)=2.088×10⁻⁸ *29* α(IPF)=0.001199 *17*
4207.88	(3/2)+	2959.23 *31*	57 *3*	1248.60	3/2+	(M1)		0.000651 *9*	α(K)=4.97×10⁻⁶ *7*; α(L)=3.82×10⁻⁷ *5*; α(M)=3.23×10⁻⁸ *5* α(IPF)=0.000646 *9* E_γ: weighted average of 2959.09 *31* from ^{31}Cl ε decay and 2959.6 *5* from (α,nγ). Mult.: 2014Do04 assign ΔJ=1 from γ(θ) in (α,nγ), but the level in 2014Do04 requires ΔJ=0, dipole; (M1) from Δπ, where parity assignments of connecting levels are uniquely established from independent arguments.
		4207.43 *31*	100 *6*	0.0	1/2+				
4449.86	7/2−	1165.7 *4*	100	3284.21	5/2+	(E1)		5.30×10⁻⁵ *8*	B(E1)(W.u.)=0.00079 *+35−19* α(K)=1.457×10⁻⁵ *20*; α(L)=1.123×10⁻⁶ *16*; α(M)=9.47×10⁻⁸ *13* α(IPF)=3.72×10⁻⁵ *6* E_γ: unweighted average of 1166.2 *3* from (^{20}Ne,nγ), 1166.1 *5* from (^{12}C,αnγ), and 1164.9 *2* from (α,nγ). Mult.: D with ΔJ=1 from DCO in (^{20}Ne,nγ); (E1) from Δπ, where parity assignments of connecting levels are uniquely established from independent arguments.
		2215[a]		2234.33	5/2+				E_γ: γ from (^{20}Ne,nγ) only.
4519.80	3/2+	4519.28 *32*	100	0.0	1/2+				
4527.89	(3/2+)	3279.1[‡] *2*	100	1248.60	3/2+				
4583.22	7/2+	1232.9 *5*	100 *5*	3349.94	7/2+	(M1)		3.29×10⁻⁵ *5*	α(K)=2.108×10⁻⁵ *30*; α(L)=1.626×10⁻⁶ *23*; α(M)=1.372×10⁻⁷ *19* α(IPF)=1.005×10⁻⁵ *15* E_γ: unweighted average of 1233.8 *5* from (^{20}Ne,nγ),

From ENSDF

$^{31}_{16}S_{15}$-10

Adopted Levels, Gammas (continued)

γ(^{31}S) (continued)

E_i(level)	J_i^π	E_γ †	I_γ †	E_f	J_f^π	Mult. @	α &	Comments
								1232.8 *2* from (^{12}C,αnγ), and 1232.1 *2* from (α,nγ). I_γ: from (^{20}Ne,nγ). Other: 100 *6* from (α,nγ). Mult.: ΔJ=0 from γ(θ) in (α,nγ); (M1) from Δπ, where parity assignments of connecting levels are uniquely established from independent arguments.
4583.22	7/2$^+$	1298.8 *2*	70 *10*	3284.21	5/2$^+$	(M1)	4.06×10^{-5} *6*	α(K)=1.919×10^{-5} *27*; α(L)=1.480×10^{-6} *21*; α(M)=1.249×10^{-7} *17* α(IPF)=1.985×10^{-5} *28* E_γ: weighted average of 1299.1 *2* from (^{20}Ne,nγ), 1298.4 *3* from (^{12}C,αnγ), and 1298.7 *1* from (α,nγ). I_γ: unweighted average of 60 *4* from (^{20}Ne,nγ) and 80 *6* from (α,nγ). Mult.: DCO in (^{20}Ne,nγ) with ΔJ=1; (M1) from Δπ, where parity assignments of connecting levels are uniquely established from independent arguments.
		3334.2‡ *8*	69 *6*	1248.60	3/2$^+$	(E2)	0.000928 *13*	α(K)=4.35×10^{-6} *6*; α(L)=3.35×10^{-7} *5*; α(M)=2.82×10^{-8} *4* α(IPF)=0.000924 *13* Mult.: Q, ΔJ=2 from γ(θ) in (α,nγ); (E2) from Δπ, where parity assignments of connecting levels are uniquely established from independent arguments.
4709.6	5/2$^+$,3/2$^+$	1425.3‡ *8*	100	3284.21	5/2$^+$			
4718.07	(5/2)$^+$	1283.32 *37*	7.0 *11*	3434.93	3/2$^+$			
		1368.34 *29*	≤2.9	3349.94	7/2$^+$			
		1433.89 *22*	65 *4*	3284.21	5/2$^+$			
		2483.60 *22*	76 *4*	2234.33	5/2$^+$			
		3469.13 *31*	18.3 *13*	1248.60	3/2$^+$			
		4717.34 *32*	100 *6*	0.0	1/2$^+$			
4866.19	(1/2)$^+$	3617.40 *31*	100 *6*	1248.60	3/2$^+$			E_γ: other: 3619.0 *3* from (α,nγ) is discrepant.
		4865.8 *6*	70 *4*	0.0	1/2$^+$			
4970.8	(3/2)$^-$	3722.5‡ *20*		1248.60	3/2$^+$	(E1)	1.57×10^{-3} *2*	α(K)=2.69×10^{-6} *4*; α(L)=2.071×10^{-7} *29*; α(M)=1.747×10^{-8} *24* α(IPF)=0.001570 *22* E_γ: γ from (α,nγ) only.
		4970.2 *9*		0.0	1/2$^+$			E_γ: γ from ε decay only.
5022.56	5/2$^+$	1672.6‡ *2*	100 *8*	3349.94	7/2$^+$	(M1)	0.0001332 *19*	α(K)=1.234×10^{-5} *17*; α(L)=9.51×10^{-7} *13*; α(M)=8.03×10^{-8} *11* α(IPF)=0.0001198 *17* E_γ: other: 1672.53 *29* from ^{31}Cl ε decay. I_γ: from ^{31}Cl ε decay. Other: 100 *20* from (α,nγ). Mult.: ΔJ=1 from γ(θ) in (α,nγ); (M1) from Δπ, where parity assignments of connecting levels are uniquely established from independent arguments.
		1738.52 *36*	55 *6*	3284.21	5/2$^+$			

Adopted Levels, Gammas (continued)

$\gamma(^{31}S)$ (continued)

E_i(level)	J^π_i	E_γ†	I_γ†	E_f	J^π_f	Mult.@	α&	Comments
5022.56	5/2+	2787.7 *8*	15 *3*	2234.33	5/2+			
		3773.2 *5*	68 *6*	1248.60	3/2+			E_γ,I_γ: other: 3774.0 *30* with Iγ=70 *10* from (α,nγ).
5156.2	1/2+	3907.3 *4*	10.8 *10*	1248.60	3/2+			
		5155.7 *6*	100 *10*	0.0	1/2+			
5300.5	9/2+	1949.8 *3*	100	3349.94	7/2+	(M1)	0.0002360 *33*	α(K)=9.55×10^{-6} *13*; α(L)=7.36×10^{-7} *10*; α(M)=6.21×10^{-8} *9* α(IPF)=0.0002256 *32* E_γ: unweighted average of 1949.2 *2* from (^{20}Ne,nγ), 1949.8 *5* from (^{12}C,αnγ), and 1950.3 *2* from (α,nγ). Mult.: D from DCO in (^{20}Ne,nγ) and (^{12}C,αnγ), with ΔJ=1; (M1) from Δπ, where parity assignments of connecting levels are uniquely established from independent arguments.
5400.2	(5/2+)	2050.2‡ *8*	100	3349.94	7/2+	D		Mult.: ΔJ=1 from γ(θ) in (α,nγ).
5436.0	(3/2+)	4187.4 *15*	17 *4*	1248.60	3/2+			
		5435.4 *9*	100 *35*	0.0	1/2+			
5518.3	5/2+	2166.7‡ *10*	28‡ *6*	3349.94	7/2+			
		4269.5‡ *3*	100‡ *22*	1248.60	3/2+	(M1)	1.12×10^{-3} *2*	α(K)=2.93×10^{-6} *4*; α(L)=2.255×10^{-7} *32*; α(M)=1.903×10^{-8} *27* α(IPF)=0.001115 *16* Mult.: ΔJ=1 from γ(θ) in (α,nγ); (M1) from Δπ, where parity assignments of connecting levels are uniquely established from independent arguments.
5675.2	7/2(+)	2325.2‡ *6*	100	3349.94	7/2+	D		E_γ: other: 2322.3 *14* from (^{12}C,αnγ) is discrepant. Mult.: ΔJ=0 from γ(θ) in (α,nγ).
5775.6	(5/2)+	3541.10 *27*	100	2234.33	5/2+			
5890.4	(3/2)+	2605.9 *5*	17 *3*	3284.21	5/2+			
		3656.01 *37*	100 *7*	2234.33	5/2+			
		5889.7 *8*	41 *5*	0.0	1/2+			
5891.6	3/2(+)	4642.6‡ *20*	100	1248.60	3/2+	D		Mult.: ΔJ=0 from γ(θ) in (α,nγ).
5977.3	(9/2+)	1394.0 *4*	100	4583.22	7/2+			E_γ: weighted average of 1393.9 *6* from (^{20}Ne,nγ), 1394.2 *4* from (^{12}C,αnγ) and 1393.8 *6* from (α,nγ).
		3743 *4*		2234.33	5/2+			E_γ: from (^{12}C,αnγ) only.
6129.5	(5/2+)	2779.5 *6*	100 *7*	3349.94	7/2+			
		6128.7 *10*	≤4.7	0.0	1/2+			
6138.3	(7/2+)	2785.7‡ *20*	100‡ *20*	3349.94	7/2+			
		4889.5‡ *6*	100‡ *20*	1248.60	3/2+	(Q)		Mult.: γ(θ) in (α,nγ) gives mult=D with ΔJ=0 or Q with ΔJ=2, but level scheme requires ΔJ=(2).
6157.7	(5/2,7/2)	1707.6‡ *3*	100‡ *12*	4449.86	7/2−	D		Mult.: DCO in (^{20}Ne,nγ) gives ΔJ=1, but ΔJ=0 in (α,nγ).
		2873.9‡ *6*	29‡ *6*	3284.21	5/2+			E_γ: other: 2875.3 *8* from (^{20}Ne,nγ) is discrepant.
		3922 *4*		2234.33	5/2+			E_γ: from (^{30}P,^{31}Sγ) only.
6255.1	1/2+	2970.9 *4*	12.6 *13*	3284.21	5/2+			

Adopted Levels, Gammas (continued)

$\gamma(^{31}S)$ (continued)

E_i(level)	J^{π}_i	E_{γ}[†]	I_{γ}[†]	E_f	J^{π}_f	Mult.[@]	α[&]	Comments
6255.1	1/2$^+$	4020.2 *5*	12.0 *13*	2234.33	5/2$^+$			
		6254.3 *6*	100 *9*	0.0	1/2$^+$			
6279.10	3/2$^+$	1412.91 *30*	0.73 *6*	4866.19	(1/2)$^+$			
		1561.01 *29*	0.92 *7*	4718.07	(5/2)$^+$			
		1759.05 *34*	0.64 *7*	4519.80	3/2$^+$			
		2071.11 *22*	5.1 *3*	4207.88	(3/2)$^+$			
		2192.63 *28*	0.97 *8*	4086.42	5/2$^+$			
		2843.9 *4*	0.74 *6*	3434.93	3/2$^+$			
		2995.04 *31*	10.2 *5*	3284.21	5/2$^+$			
		3202.2 *4*	0.72 *6*	3076.54	1/2$^+$			
		4044.7 *30*	100 *5*	2234.33	5/2$^+$			
		5030.1 *6*	17.2 *16*	1248.60	3/2$^+$			
		6278.4 *6*	27.9 *27*	0.0	1/2$^+$			
6326.8	(3/2)	5077.7[‡] *5*	100[‡]	1248.60	3/2$^+$	D		Mult.: ΔJ=0 from $\gamma(\theta)$ in (α,nγ).
		6330 *5*		0.0	1/2$^+$			E_{γ}: from ^{2}H(^{30}P,^{31}Sγ) only.
6357.06	(5/2$^-$)	5108.0[‡] *2*	100	1248.60	3/2$^+$	D		Mult.: ΔJ=1 from $\gamma(\theta)$ in (α,nγ).
6375.6	9/2$^-$	1925.7[‡] *2*	100[‡] *2*	4449.86	7/2$^-$	(M1)	0.0002264 *32*	B(M1)(W.u.)=0.0118 *+25−19* α(K)=9.75$\times10^{-6}$ *14*; α(L)=7.51$\times10^{-7}$ *11*; α(M)=6.34$\times10^{-8}$ *9* α(IPF)=0.0002158 *30* Mult.: DCO in (^{20}Ne,nγ) and $\gamma(\theta)$ in (α,nγ), ΔJ=1; (M1) from $\Delta\pi$, where parity assignments of connecting levels are uniquely established from independent arguments.
		3025.4[‡] *3*	54[‡] *2*	3349.94	7/2$^+$	(E1)	1.26$\times10^{-3}$ *2*	B(E1)(W.u.)=5.1$\times10^{-5}$ *+12−8* α(K)=3.49$\times10^{-6}$ *5*; α(L)=2.68$\times10^{-7}$ *4*; α(M)=2.264$\times10^{-8}$ *32* α(IPF)=0.001254 *18* I_{γ}: from ^{2}H(^{30}P,^{31}Sγ). Mult.: ΔJ=1 from $\gamma(\theta)$ in (α,nγ), (E1) from $\Delta\pi$, where parity assignments of connecting levels are uniquely established from independent arguments.
6390.46	3/2$^+$	2182.52 *25*	13.9 *11*	4207.88	(3/2)$^+$			
		3106.28 *31*	48.6 *26*	3284.21	5/2$^+$			
		3313.56 *33*	26.6 *15*	3076.54	1/2$^+$			
		4155.84 *31*	100 *6*	2234.33	5/2$^+$			
		5141.3 *6*	24.4 *24*	1248.60	3/2$^+$			
		6389.5 *7*	12.0 *12*	0.0	1/2$^+$			
6392.16	(5/2$^+$)	5143.1[‡] *2*	100	1248.60	3/2$^+$	D		Mult.: ΔJ=1 from $\gamma(\theta)$ in (α,nγ).
6392.93	11/2$^{(+)}$	1091.0 *4*	28 *2*	5300.5	9/2$^+$	D		E_{γ}: weighted average of 1090.7 *10* from (^{20}Ne,nγ), 1090.5 *7* from (^{12}C,αnγ), and 1091.2 *4* from (α,nγ). I_{γ}: other: 12.0 *13* in (^{20}Ne,nγ) seems discrepant. Mult.: ΔJ=1 from $\gamma(\theta)$ in (α,nγ).

Adopted Levels, Gammas (continued)

$\gamma(^{31}S)$ (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[@]	α[&]	Comments
6392.93	$11/2^{(+)}$	3042.9[‡] *1*	100[‡] *2*	3349.94	$7/2^+$	(E2)	0.000809 *11*	α(K)=5.01×10^{-6} *7*; α(L)=3.86×10^{-7} *5*; α(M)=3.25×10^{-8} *5* α(IPF)=0.000803 *11* E_γ,I_γ: others: 3042.4 *4* with $I\gamma$=100 *5* from (^{20}Ne,nγ) and 3042.2 *10* from (^{12}C,αnγ). Mult.: DCO in (^{20}Ne,nγ) and $\gamma(\theta)$ in (α,nγ), ΔJ=2.
6541.6	$3/2^{(-)}$	5292.5[‡] *4*	100	1248.60	$3/2^+$	D		Mult.: ΔJ=0 from $\gamma(\theta)$ in (α,nγ).
6582.4	$(5/2^-,7/2^-)$	3298.0[‡] *20*	100	3284.21	$5/2^+$			
6634.64	$9/2^{(-)}$	2049.2[a] *6*		4583.22	$7/2^+$			E_γ: poor fit. Level-energy difference=2052.2. This γ from (^{20}Ne,nγ) only, not seen in (α,nγ).
		2184.9[‡] *4*	23[‡] *3*	4449.86	$7/2^-$			E_γ: other: 2187.2 *5* from (^{20}Ne,nγ) is discrepant.
		3284.7[‡] *2*	100[‡] *3*	3349.94	$7/2^+$	D		Mult.: DCO in (^{20}Ne,nγ) and $\gamma(\theta)$ in (α,nγ), ΔJ=1.
6832.7	$11/2^{(-)}$	1532.2 *2*	38.7 *18*	5300.5	$9/2^+$	(E1)	0.000301 *4*	B(E1)(W.u.)=0.00043 *+11−6* α(K)=9.16×10^{-6} *13*; α(L)=7.06×10^{-7} *10*; α(M)=5.95×10^{-8} *8* α(IPF)=0.000291 *4* Mult.: DCO in (^{20}Ne,nγ), ΔJ=1.
		2382.8 *3*	100 *4*	4449.86	$7/2^-$	(E2)	0.000509 *7*	B(E2)(W.u.)=7.4 *+16−13* α(K)=7.47×10^{-6} *10*; α(L)=5.75×10^{-7} *8*; α(M)=4.85×10^{-8} *7* α(IPF)=0.000501 *7* Mult.: DCO in (^{20}Ne,nγ), ΔJ=2.
7050.1	$(1/2^+,3/2^+,5/2^+)$	7049.2 *8*	100	0.0	$1/2^+$			
7150.0	$5/2^+,3/2^+,1/2^+$	5900.8 *8*	100	1248.60	$3/2^+$			
7302.4	$11/2^{(+)}$	908.5 *9*	18.9 *24*	6392.93	$11/2^{(+)}$			E_γ: unweighted average of 909.4 *5* from (^{20}Ne,nγ) and 907.6 *5* (^{12}C,αnγ). I_γ: from (^{20}Ne,nγ).
		3952.7 *6*	100 *7*	3349.94	$7/2^+$	(E2)	1.16×10^{-3} *2*	α(K)=3.37×10^{-6} *5*; α(L)=2.60×10^{-7} *4*; α(M)=2.191×10^{-8} *31* α(IPF)=0.001153 *16* E_γ,I_γ,Mult.: from (^{20}Ne,nγ), with Mult=Q, ΔJ=2 from DCO. Other: E=3951 *3* from (^{12}C,αnγ).
7640.8	$(11/2^-)$	1006.1 *5*		6634.64	$9/2^{(-)}$			E_γ: from (^{12}C,αnγ).
		3192 *6*		4449.86	$7/2^-$			E_γ: from (^{12}C,αnγ).
8460.8	$(13/2^-)$	1628.3 *4*	100 *9*	6832.7	$11/2^{(-)}$			E_γ: weighted average of 1628.2 *4* from (^{20}Ne,nγ) and 1629.0 *15* from (^{12}C,αnγ).
		2084.6 *6*	<30	6375.6	$9/2^-$			E_γ: weighted average of 2084.4 *11* from (^{20}Ne,nγ) and

From ENSDF

$^{31}_{16}S_{15}$-14

Adopted Levels, Gammas (continued)

$\gamma(^{31}S)$ (continued)

E_i(level)	J^π_i	E_γ[†]	I_γ[†]	E_f	J^π_f	Mult.[@]	Comments
							2084.7 *6* from ($^{12}C,\alpha n\gamma$). I_γ: from ($^{20}Ne,n\gamma$).
9154.2	$(13/2^+)$	1852.1 *8*	<8	7302.4	$11/2^{(+)}$		E_γ: from ($^{12}C,\alpha n\gamma$). Other: 1852.1 *14* from ($^{20}Ne,n\gamma$). I_γ: from ($^{20}Ne,n\gamma$).
		2760.7 *11*	100 *6*	6392.93	$11/2^{(+)}$	D	E_γ,I_γ: from ($^{20}Ne,n\gamma$). Other: 2761.7 *30* from ($^{12}C,\alpha n\gamma$). Mult.: DCO in ($^{20}Ne,n\gamma$), $\Delta J=1$.
		3176 *3*		5977.3	$(9/2^+)$		E_γ: from ($^{12}C,\alpha n\gamma$) only.
10145.8	$(13/2^-)$	3312.9 *10*	100	6832.7	$11/2^{(-)}$		E_γ: from ($^{20}Ne,n\gamma$). Other: 3313 *3* from ($^{12}C,\alpha n\gamma$).

† From ^{31}Cl ε decay, unless otherwise noted.

‡ From $^{28}Si(\alpha,n\gamma)$.

Estimated values from ($^3He,\alpha\gamma$).

@ From $\gamma(\theta)$ in (α,nγ), unless otherwise noted. For assignments given in parentheses only based on $\gamma(\theta)$ or DCO ratios, Mult=D or Q are from those arguments while magnetic or electric characters assigned from $\Delta\pi$ with parities of relevant levels uniquely determined from other independent arguments.

& Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on γ-ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

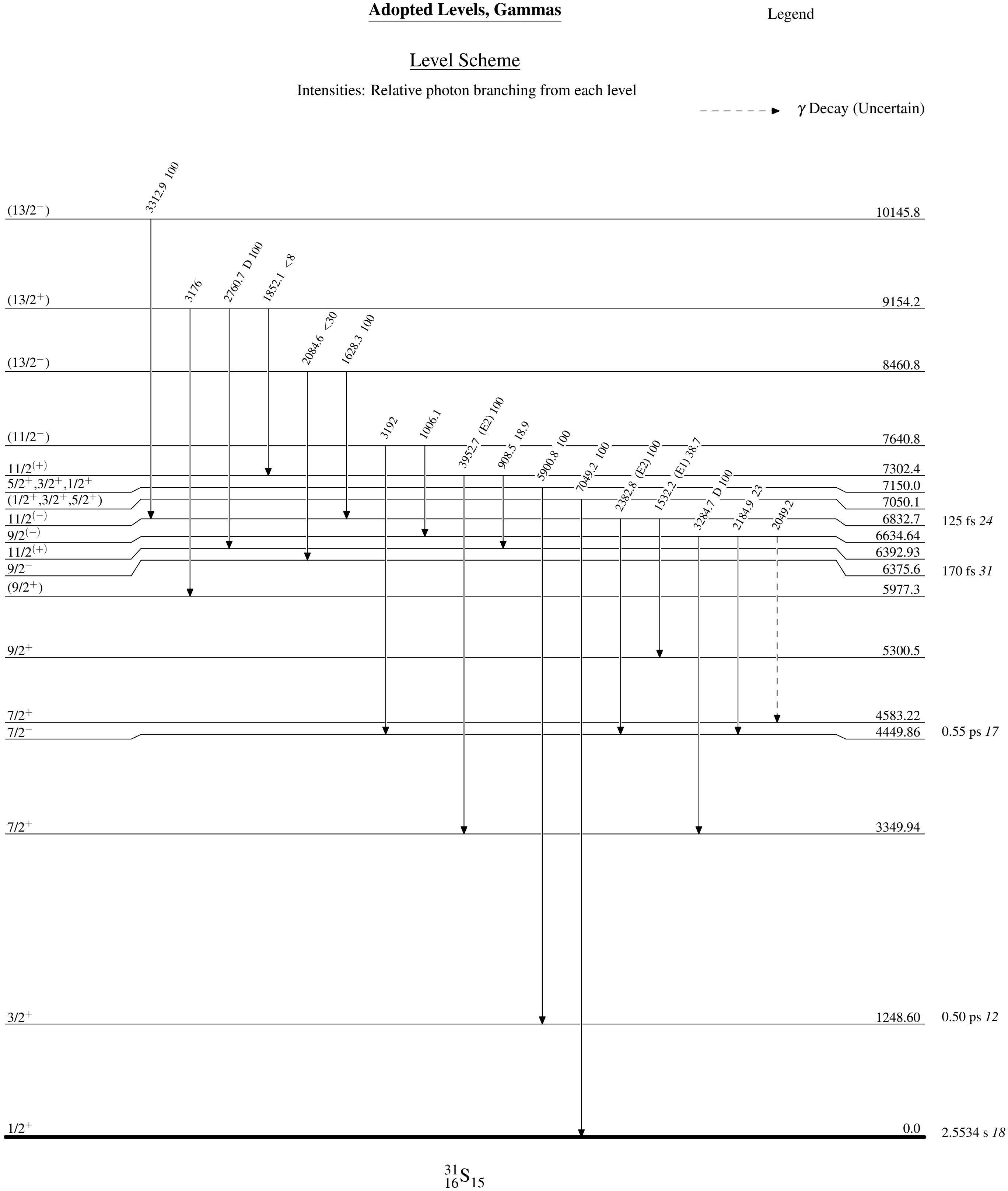
a Placement of transition in the level scheme is uncertain.

$^{31}_{16}S_{15}$-15

Adopted Levels, Gammas

Level Scheme

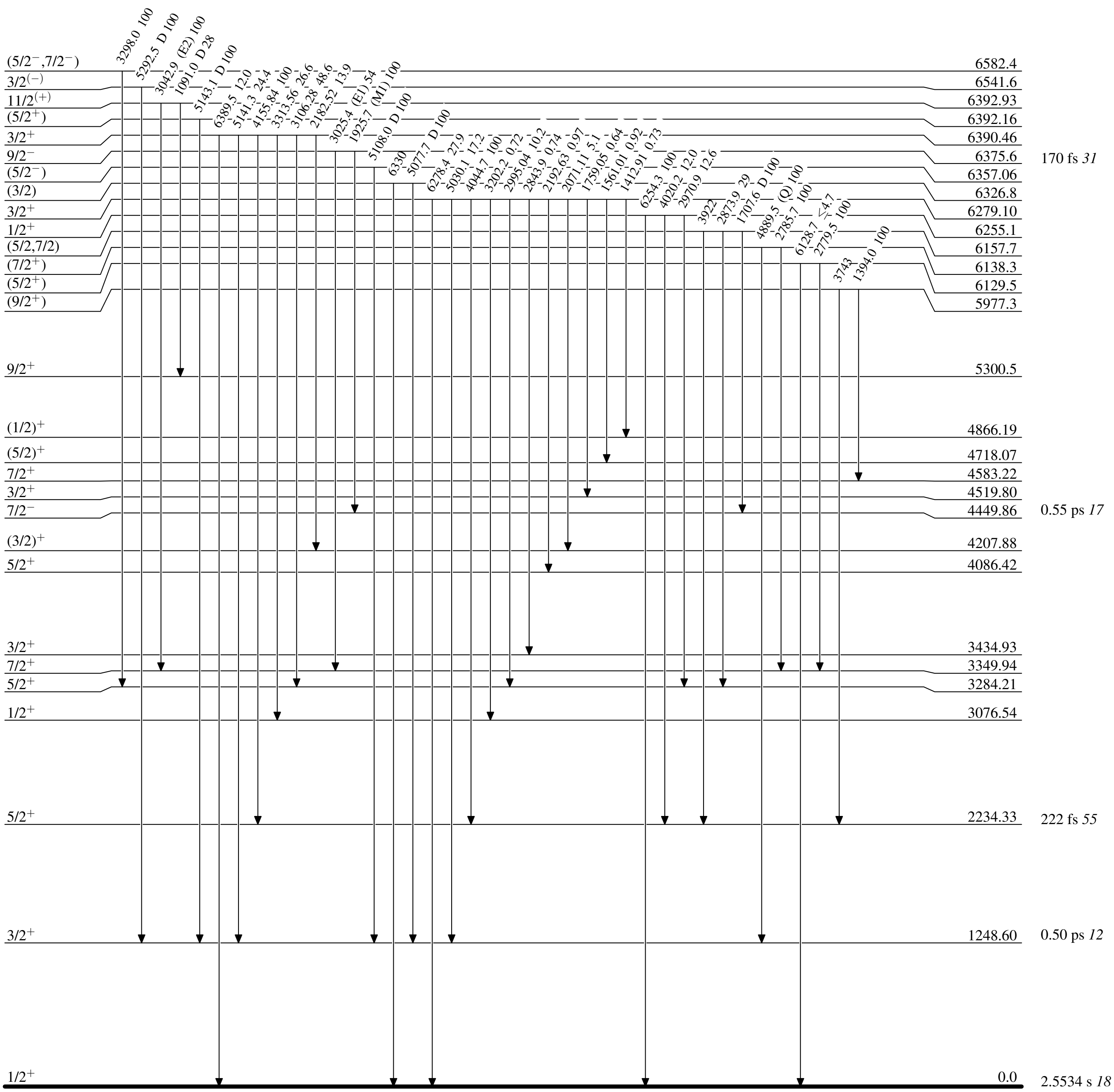
Intensities: Relative photon branching from each level



Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level



$^{31}_{16}S_{15}$

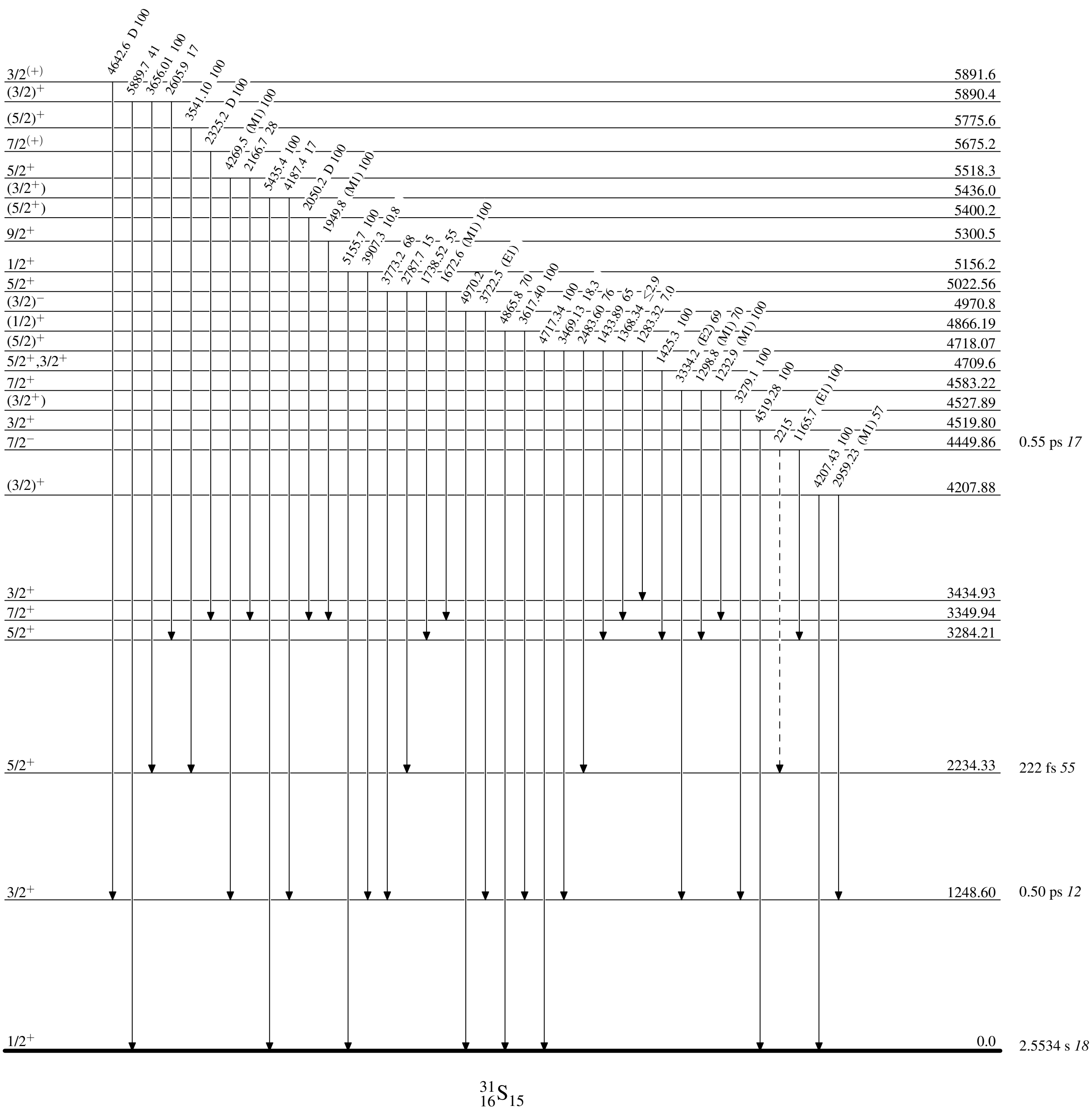
Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level

Legend

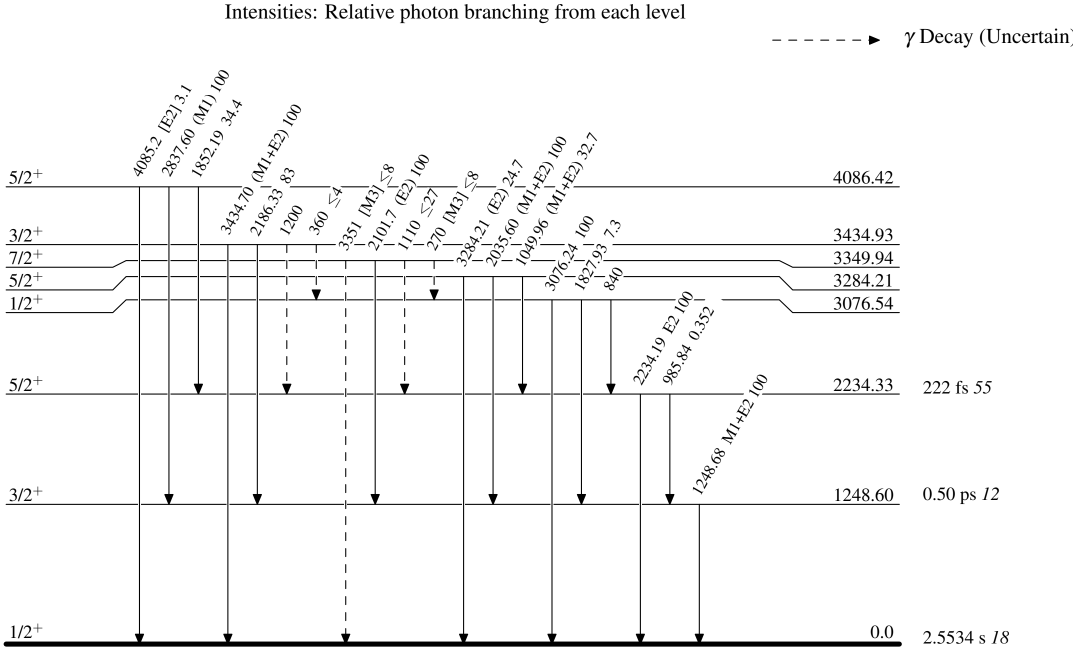
γ Decay (Uncertain)



Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level



$^{31}_{16}S_{15}$