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Nuclear Data Sheets for A = 52

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Abstract: The 2000 evaluation of A=52 (2000Hu06) has been revised using experimental decay and reaction data. These data are summarized and presented, together with adopted level and transition properties.

Cutoff Date: March 1, 2006; all references entered into the Nuclear Structure Reference file by this date were considered.

General Policies and Organization of Material: See the January issue of the *Nuclear Data Sheets* or http://www.nndc.bnl.gov/nds/NDSPolicies.pdf.

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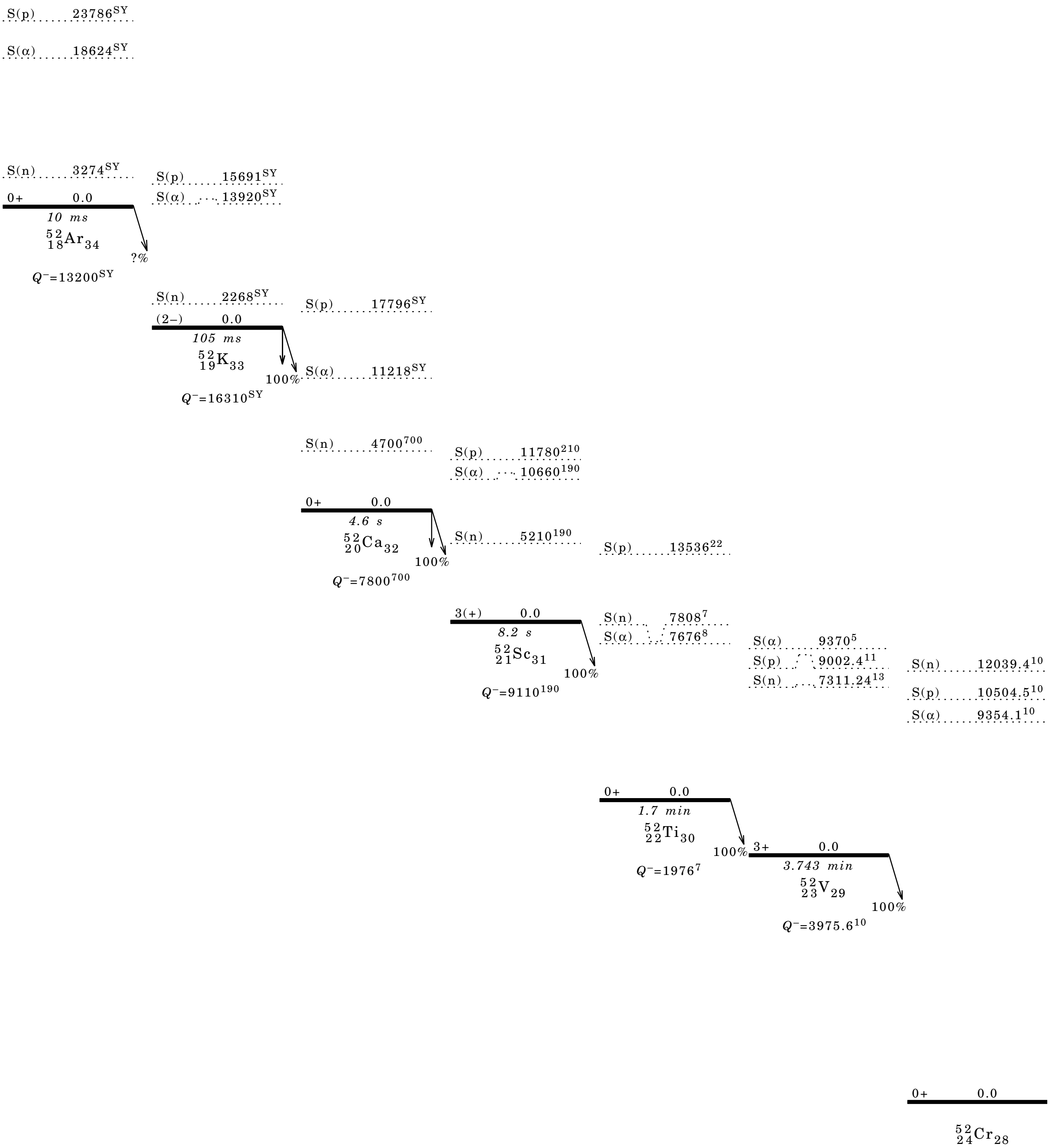
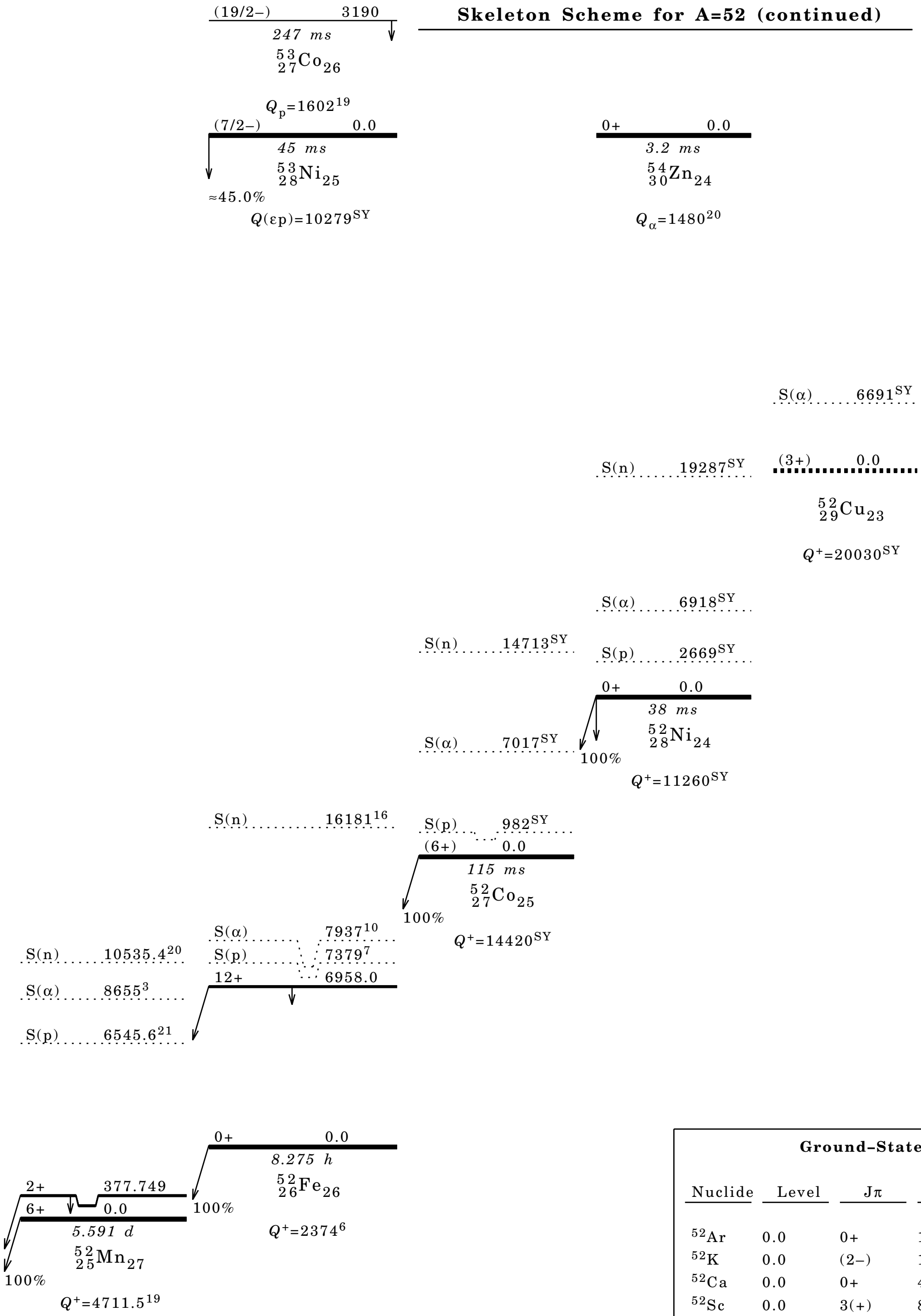
Index for A = 52

Skeleton Scheme for A=52



Skeleton Scheme for A=52 (continued)



Ground-State and Isomeric-Level Properties

Nuclide	Level	Jπ	$T_{1/2}$	Decay Modes
^{52}Ar	0.0	0+	10 ms	%β⁻=?
^{52}K	0.0	(2−)	105 ms *5*	%β⁻=100; %β⁻n≈64; %β⁻2n≈21
^{52}Ca	0.0	0+	4.6 s *3*	%β⁻=100; %β⁻n≤2
^{52}Sc	0.0	3(+)	8.2 s *2*	%β⁻=100
^{52}Ti	0.0	0+	1.7 min *1*	%β⁻=100
^{52}V	0.0	3+	3.743 min *5*	%β⁻=100
^{52}Cr	0.0	0+	stable	
^{52}Mn	0.0	6+	5.591 d *3*	%ε+%β⁺=100
	377.749	2+	21.1 min *2*	%ε+%β⁺=98.25 *5*; %IT=1.75 *5*
^{52}Fe	0.0	0+	8.275 h *8*	%ε+%β⁺=100
	6958.0	12+	45.9 s *6*	%ε+%β⁺=100; %IT<0.004
^{52}Co	0.0	(6+)	115 ms *23*	%ε+%β⁺=100
^{52}Ni	0.0	0+	38 ms *5*	%ε+%β⁺=100; %β⁺p=17.0 *14*
^{52}Cu	0.0	(3+)		%p=?
^{53}Co	3190	(19/2−)	247 ms *12*	%p=?; ...
^{53}Ni	0.0	(7/2−)	45 ms *15*	%εp≈45.0; ...
^{54}Zn	0.0	0+	3.2 ms *+18−8*	%2p=84 *13*; ...

Adopted Levels

$Q(\beta^-)$=13200 *SY*; S(n)=3274 *SY*; S(p)=23786 *SY*; $Q(\alpha)$=−18624 *SY* 2003Au03.

^{52}Ar Levels

E(level)	Jπ	$T_{1/2}$	Comments
0.0	0+	10 ms	$\%\beta^-$=? $T_{1/2}$: estimated from systematic trends in neighboring nuclides with the same Z or N (2003Au02).

$^{52}_{19}K_{33}$ $^{52}_{19}K_{33}$

Adopted Levels

$Q(\beta^-)$=16310 *SY*; S(n)=2268 *SY*; S(p)=15691 *SY*; $Q(\alpha)$=−13920 *SY* 2003Au03.

^{52}K Levels

E(level)	Jπ	$T_{1/2}$	Comments
0.0	(2−)	105 ms *5*	$\%\beta^-$=100; $\%\beta^-n\approx64$; $\%\beta^-2n\approx21$. $\%\beta^-n,\%\beta^-2n$: from 1997Au04. $\%\beta^-n\approx64$, $\%\beta^-2n\approx21$ estimated from $P_n(\%)=\%\beta^-n+2*\%\beta-2n=107$ *20* in 1985Hu03. $T_{1/2}$: from decay of the β−coincident neutron counting following ^{52}K (1983La23). Other: 110 ms *30* (1985Hu03). Jπ: estimated from systematic trends in neighboring nuclides with the same Z or N (2003Au02).

Adopted Levels, Gammas

$Q(\beta^-)=7.8\times10^3$ *7*; $S(n)=4.7\times10^3$ *7*; S(p)=17796 *SY*; Q(α)=−11218 *SY* 2003Au03.

^{52}Ca Levels

E(level)†	Jπ	$T_{1/2}$	Comments
0.0	0+	4.6 s *3*	%β⁻=100; %β⁻n≤2 (1983La23). $T_{1/2}$: from n−β(t) (1985Hu03).
2563.1 *10*	(2+)		Jπ: from systematics of even−even nuclides.
5590			%n=100.
5820			%n=100.
7030			%n=100.
8230			%n=100.
9210			%n=100.

† From ^{52}K β⁻ decay.

γ(^{52}Ca)

E(level)	Eγ
2563.1	2563.1 *10*

^{52}K β⁻ Decay 1985Hu03

Parent ^{52}K: E=0.0; Jπ=(2−); $T_{1/2}$=105 ms *5*; Q(g.s.)=16310 syst; %β⁻ decay=100.

Sources: produced by the fragmentation of a U target with 600−MeV proton beam, on−line mass separation, measured Eγ and γγ−coin with Ge(Li) detectors, βγ coin with Ge(Li) and β telescope (0.5 mm scintillator sheet), E(n) with NE110 plastic scintillator sheet.

^{52}Ca Levels

E(level)†	Jπ§	$T_{1/2}$§
0.0	0+	4.6 s *3*
2563.1‡ *10*	(2+)	
5590		
5820		
7030		
8230		
9210		

† From E(n)(c.m)+S(n), except as noted, assuming S(n)=4720 *700*.
‡ From Eγ.
§ From adopted levels.

β⁻ radiations

Eβ⁻	E(level)	Iβ⁻†	Log *ft*
(7100)	9210	14.5 *17*	4.16 *7*
(8080)	8230	23.3 *18*	4.13 *4*
(9280)	7030	41.9 *24*	4.21 *4*
(10490)	5820	17.1 *10*	4.89 *4*
(10720)	5590	3.2 *3*	5.67 *5*
(13750)	2563.1	<20	<5.9

† From measurement of delayed neutron−β coin.

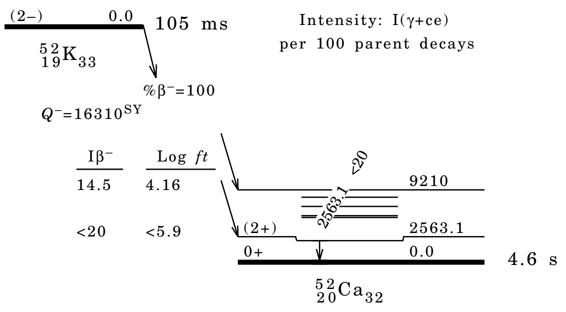
^{52}K β^- Decay 1985Hu03 (continued)

$\gamma(^{52}Ca)$

Eγ	E(level)	Iγ†	Comments
2563.1 *10*	2563.1	<20	Iγ: authors estimate Iβ(2563)<20 relative to ΣIβ⁻ (to unbound states)=100.

† Absolute intensity per 100 decays.

Decay Scheme



Adopted Levels, Gammas

Q(β⁻)=9110 *190*; S(n)=5210 *190*; S(p)=11780 *210*; Q(α)=−1.066×10^4 *19* 2003Au03.

^{52}Sc Levels

E(level)†	Jπ‡	$T_{1/2}$	Comments
0.0	3(+)	8.2 s *2*	%β⁻=100. Jπ: from the observed feedings with log $f^{1u}t$<8.5 to the 2+ and the 4+ states in ^{52}Ti. $T_{1/2}$: inferred from the ^{52}Sc–^{52}Ti β⁻ decay rate of 1050, 1214, 1268, and 1382 keV transitions in ^{52}Ti (1985Hu03).
675.21 *23*			
1636.43 *18*	1+		
2745.7 *7*	1+		
3458.1 *10*	0,1		
4265.7 *15*	1+		

† From least squares fit for Eγ.
‡ From the log *ft* values in ^{52}Ca β⁻ decay.

$\gamma(^{52}Sc)$

E(level)	Eγ†	Iγ‡
675.21	675.2 *3*	100
1636.43	961.2 *3*	100
	1636.4 *2*	71 *2*
2745.7	2070.4 *6*	100
3458.1	3458.0 *10*	100
4265.7	4265.5 *15*	100

† From ^{52}Ca β⁻ decay.
‡ Relative photon branching for each level.

^{52}Ca β^- Decay 1985Hu03

Parent ^{52}Ca: E=0.0; Jπ=0+; $T_{1/2}$=4.6 s *3*; Q(g.s.)=7850 *720*; %β^- decay=100.
Sources: produced by the fragmentation of a U target with 600–MeV proton beam, on–line mass separation, measured Eγ, Iγ, βγ coin, Ge(Li) and β telescope (0.5 mm scintillator sheet).

^{52}Sc Levels

E(level)	Jπ†	$T_{1/2}$
0.0	3(+)	8.2 s *2*
675.21 *23*		
1636.43 *18*	1+	
2745.7 *7*	1+	
3458.1 *10*	0,1	
4265.7 *15*	1+	

† From adopted levels.

β^- radiations

$E\beta^-$	E(level)	$I\beta^-$†‡	Log *ft*	Comments
(3600 *800*)	4265.7	1.4 *4*	5.8 *4*	
4060 *200*	1636.43	86.8 *13*	5.07 *18*	$E\beta^-$: from Fermi–Kurie plot analysis of the data (1985Hu03).
(4400 *800*)	3458.1	0.6 *3*	6.5 *4*	
(5100 *800*)	2745.7	11.2 *12*	5.57 *22*	
(7200 *800*)	675.21	<5	>6.6	

† From γ(+ce) intensity balance at each level.
‡ Absolute intensity per 100 decays.

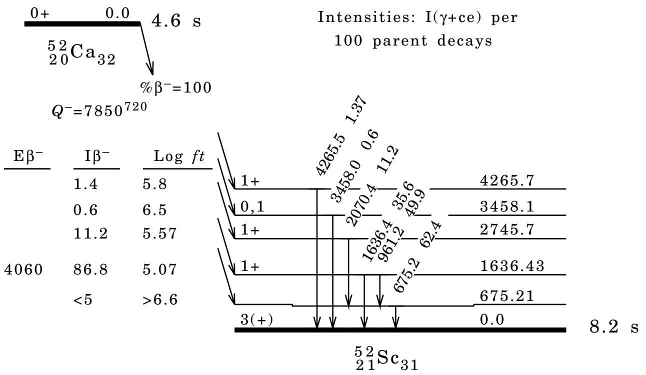
γ(^{52}Sc)

Iγ normalization: calculated by assuming that the intensity of the β transition to the ground state of ^{52}Sc (ΔJ=3) negligible and that the sum of the transition intensities of γ's feeding the g.s. is 100%.:

Eγ	E(level)	Iγ†‡
675.2 *3*	675.21	100 *2*
961.2 *3*	1636.43	80 *2*
1636.4 *2*	1636.43	57 *1*
2070.4 *6*	2745.7	18 *2*
3458.0 *10*	3458.1	1.0 *5*
4265.5 *15*	4265.7	2.2 *3*

† Photon intensity relative to Iγ=100 for the strongest transition. Uncertainties deduced from authors' quoted uncertainties on Iβ's.
‡ For absolute intensity per 100 decays, multiply by 0.624 *9*.

Decay Scheme



Adopted Levels, Gammas

Q(β⁻)=1976 *7*; S(n)=7808 *7*; S(p)=13536 *22*; Q(α)=−7676 *8* 2003Au03.

^{52}Ti Levels

Cross Reference (XREF) Flags

A	^{52}Sc β⁻ Decay	F	^{50}Ti(t,p)
B	^{48}Ca(^{6}Li,d)	G	^{50}Ti(t,pγ)
C	^{48}Ca(^{7}Li,p2nγ)	H	^{208}Pb(^{48}Ca,Xγ)
D	^{48}Ca(^{12}C,^{8}Be)	I	Coulomb Excitation
E	^{48}Ca(^{16}O,^{12}C)		

E(level)†	Jπ§	XREF	$T_{1/2}$‡	Comments
0.0@	0+	ABCDEFGHI	1.7 min *1*	%β⁻=100. $T_{1/2}$: from 1967Mo11.
1049.73@ *10*	2+	ABCDEFGHI	3.9 ps *4*	B(E2)↑=0.0567 *51*. $T_{1/2}$: from B(E2) in Coulomb excitation. Other: 3.3 ps *+56−15* DSAM in ^{50}Ti(t,pγ). Jπ: L(t,p)=2. XREF: D(1045)E(1045).
2264.2 *3*	2+	AB eFG I	35 fs *+20−13*	Jπ: L(t,p)=2. XREF: B(2260)e(2350).
2317.65@ *14*	4+	A CD F H		XREF: D(2300). Jπ: L(t,p)=4.
2431.62 *15*	2+	A eFG	≤70 fs	Jπ: L(t,p)=2. XREF: e(2350)F(2429).
3028.75@ *25*	(6+)	C H	25 ps *4*	Jπ: based on γ [E2] to 4+. $T_{1/2}$: RDM in ^{48}Ca(^{7}Li,p2nγ).
3143.2 *7*		A		
3349.9 *3*	4+	A F		Jπ: L(t,p)=4. XREF: F(3346).
3452.7 *3*	3−	A F		Jπ: L(t,p)=3. XREF: F(3447).
3588.8 *10*	2+	FG	<62 fs	Jπ: L(t,p)=2. XREF: F(3583). E(level): from (t,pγ).
3872 *8*	3−	F		Jπ: L(t,p)=3.
3922.2 *4*	2+	A FG		Jπ: L(t,p)=2. XREF: F(3916)G(3900).
4022.3 *4*		A		
4058 *8*	(4+)	F		Jπ: L(t,p)=(4).
4077.6 *7*		A		
4098 *8*	0+,1−	F		Jπ: L(t,p)=0,1.
4212 *6*	1−	FG		Jπ: L(t,p)=0,1. Anisotropic γ(θ) in (t,pγ). XREF: G(4230).
4286.1 *10*		A		
4287.8@ *4*	(8+)#	H		
4324 *8*	1−,0+	FG		Jπ: L(t,p)=1,0. XREF: G(4300).
4477.9 *4*		A		
4691 *8*	1−,0+	F		Jπ: L(t,p)=1,0.
4786.6 *4*	(2+)	A F		Jπ: L(t,p)=(2). XREF: F(4772).
4823 *8*		F		
4909 *8*		F		
5010 *8*		F		
6691.2@ *11*	(10+)#	H		
8855.2 *12*		H		
9086.2 *12*		H		

† Energies for levels connected by gammas are from least-squares fit to Eγ, others are from ^{50}Ti(t,p).
‡ From DSAM in ^{50}Ti(t,pγ), except as noted.
§ From L(t,p) values, except as noted.
# From assumption of preferential yrast feeding and the close correspondence between established and calculated levels.
@ (A): Yrast band.

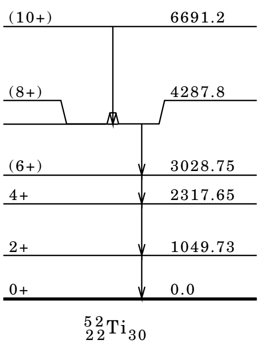
Adopted Levels, Gammas (continued)

$\gamma(^{52}Ti)$

E(level)	Eγ†	Iγ†@	Mult.#	δ#	Comments
1049.73	1049.7 *1*	100	[E2]		B(E2)↓(W.u.)=9.9 *11*.
2264.2	1214.5 *3*	100 *8*	D(+Q)	+0.03 *10*	B(M1)↓(W.u.)=0.31 *+23–14*.
	2265.2 *13*	13 *3*	[E2]		Iγ: <5 in (t,pγ). B(E2)↓(W.u.)=2.7 *+12–17*.
2317.65	1267.9 *1*	100			
2431.62	1381.9 *2*	100 *9*	M1+E2	−0.39 *8*	B(M1)↓(W.u.)>0.090; B(E2)↓(W.u.)>11. Mult.: from p−γ(θ) in (t,pγ) and RUL.
	2431.6‡ *2*	<18‡			
3028.75	711.1§ *2*	100	[E2]		B(E2)↓(W.u.)=10.9 *18*.
3143.2	2093.4 *7*	100			
3349.9	1032.3 *3*	100			
3452.7	1135.0 *3*	100			
3588.8	1157.2‡ *20*	≤22‡			
	1324.5‡ *20*	100‡ *12*			
	2539.0‡ *20*	45‡ *12*			
	3588.8‡ *20*	≤14‡			
3922.2	1491.0 *5*	77 *15*			Iγ: ≤18 in (t,pγ).
	1658.0‡ *5*	82‡ *9*	D+Q	−0.31 *22*	
	2872.0 *5*	100 *18*	Q(+D)	≤−0.46	
	3923 *3*	23 *8*			Iγ: ≤9 in (t,pγ).
4022.3	1758.2 *3*	100 *17*			
	2972.2 *5*	63 *12*			
4077.6	1646.0 *6*	100			
4212	3162‡ *8*		D(+Q)	+0.12 *13*	
	4212‡ *8*				
4286.1	1968.4 *9*	100			
4287.8	1259.0§ *2*				
4477.9	1025.0 *5*	64 *13*			
	1128.1 *3*	100 *14*			
4786.6	2468.8 *4*	100 *12*			
	3737.2 *11*	26 *6*			
6691.2	2405.0§ *6*				
8855.2	2164.0§ *6*				
9086.2	231.0§ *6*				
	2395.0§ *6*				

† From ^{52}Sc β^- decay, except as noted.
‡ From ^{50}Ti(t,pγ). Eγ recalculated from level energy differences by evaluator using adopted level energies.
§ From ^{208}Pb(^{48}Ca,Xγ).
\# From pγ(θ) in (t,pγ).
@ Relative photon branching from each level.

(A) Yrast band



^{52}Sc β⁻ Decay 1985Hu03

Parent ^{52}Sc: E=0.0; Jπ=3(+); $T_{1/2}$=8.2 s *2*; Q(g.s.)=9110 *190*; %β⁻ decay=100.
Sources: produced by the fragmentation of a U target with 600 MeV proton beam, on–line mass separation, measured Eγ, Iγ, βγ–coin, Ge(Li).

^{52}Ti Levels

E(level)	Jπ†	$T_{1/2}$†
0.0	0+	1.7 min *1*
1049.72 *10*	2+	
2264.2 *3*	2+	
2317.64 *14*	4+	
2431.58 *22*	2+	
3143.2 *7*		
3349.9 *3*	4+	
3452.7 *3*	3−	
3922.2 *4*	2+	
4022.3 *4*		
4077.6 *7*		
4286.1 *10*		
4477.9 *4*		
4785.9 *4*	(2+)	

† From adopted levels.

β⁻ radiations

Eβ⁻	E(level)	Iβ⁻†‡	Log *ft*
(4320 *190*)	4785.9	9.7 *13*	5.56 *11*
4590 *160*	3349.9	7.8 *16*	6.22 *12*
(4630 *190*)	4477.9	8.9 *12*	5.73 *11*
(4820 *190*)	4286.1	1.6 *5*	6.56 *16*
(5030 *190*)	4077.6	1.8 *6*	6.59 *17*
(5090 *190*)	4022.3	6.5 *10*	6.05 *11*
(5190 *190*)	3922.2	7.6 *11*	6.02 *10*
(5660 *190*)	3452.7	3.0 *12*	6.60 *19*
(5970 *190*)	3143.2	3.2 *7*	6.68 *12*
(6680 *190*)	2431.58	5.8 *14*	6.65 *12*
(6790 *190*)	2317.64	10.3 *33*	6.43 *15*
(6850 *190*)	2264.2	9.5 *16*	6.48 *10*
7040 *170*	1049.72	24.2 *35*	6.40 *5*

† Calculated from the γ–intensity balance at each level.
‡ Absolute intensity per 100 decays.

γ(^{52}Ti)

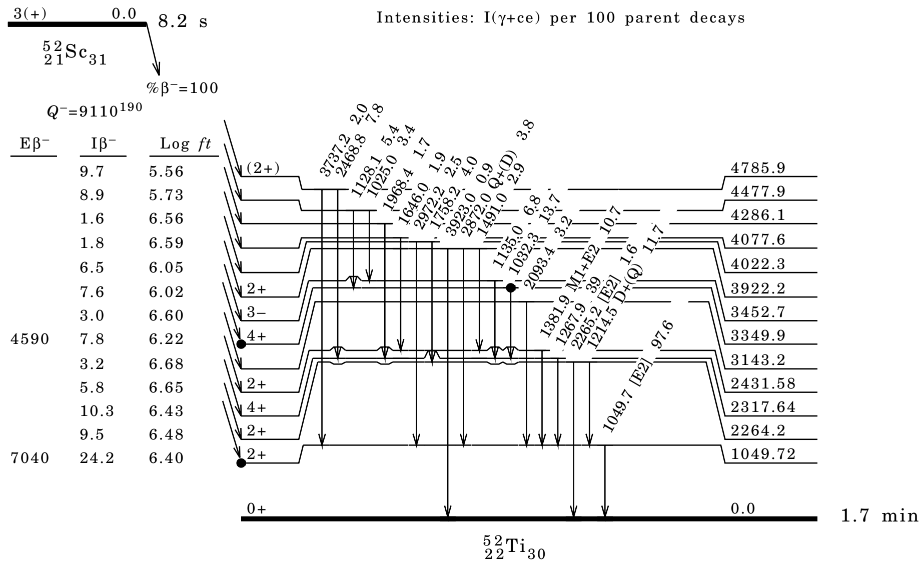
Iγ normalization: calculated by assuming that the intensity of the ΔJ=3 β transition to the ground state of ^{52}Ti is negligible and that the sum of the γ–intensity feeding the g.s. is 100%.

Eγ	E(level)	Iγ‡	Mult.†	δ†
1025.0 *5*	4477.9	3.5 *7*		
1032.3 *3*	3349.9	14 *1*		
1049.7 *1*	1049.72	100	[E2]	
1128.1 *3*	4477.9	5.5 *8*		
1135.0 *3*	3452.7	7 *1*		
1214.5 *3*	2264.2	12 *1*	D+(Q)	+0.03 *10*
1267.9 *1*	2317.64	40 *3*		
1381.9 *2*	2431.58	11 *1*	M1+E2	−0.39 *8*
1491.0 *5*	3922.2	3.0 *6*		
1646.0 *6*	4077.6	1.9 *6*		
1758.2 *3*	4022.3	4.1 *7*		
1968.4 *9*	4286.1	1.7 *5*		
2093.4 *7*	3143.2	3.3 *6*		
2265.2 *13*	2264.2	1.6 *4*	[E2]	
2468.8 *4*	4785.9	8 *1*		
2872.0 *5*	3922.2	3.9 *7*	Q+(D)	<−0.46
2972.2 *5*	4022.3	2.6 *5*		
3737.2 *11*	4785.9	2.1 *5*		
3923.0 *28*	3922.2	0.9 *3*		

† From adopted levels, gammas.
‡ For absolute intensity per 100 decays, multiply by 0.976 *5*.

^{52}Sc β^- Decay 1985Hu03 (continued)

Decay Scheme



^{48}Ca(^{6}Li,d) 1977Fu03

E=32 MeV, FWHM=50–125 keV, measured dσ/dΩ, the reaction products were analyzed with a magnetic spectrometer, DWBA analysis.

^{52}Ti Levels

E(level)	Jπ‡	σ†	Comments
0.0	0+	0.17	
1050 *20*	2+	0.13	σ: from σ(2+)/σ(g.s)=0.76.
2260 *20*			

† Reduced cross section s defined S=Ds(exp)/Ds(DWBA).
‡ From DWBA analysis of σ(θ).

^{48}Ca(^{7}Li,p2nγ) 1976Br29

E=28 MeV, measured γ–spectra and recoil distance with a Ge(Li).

^{52}Ti Levels

E(level)	Jπ†	$T_{1/2}$	Comments
0.0	0+		
1050	2+		
2317	4+		
3027	(6+)	25 ps *5*	$T_{1/2}$: based on RSM using the 1267–keV γ. The lifetime of the 2317–keV level was assumed too short to affect the result. The decay data obtained are consistent with this assumption.

† From adopted levels.

$^{48}Ca(^{7}Li,p2n\gamma)$ 1976Br29 (continued)

$\gamma(^{52}Ti)$

Approximate Eγ given only for those transitions relevant to $T_{1/2}$ measurement. No Iγ or uncertainties on Eγ reported.

E(level)	Eγ
1050	1050
2317	1267
3027	710

$^{48}Ca(^{12}C,^{8}Be)$ 1976Ma12

1976Ma12: E=56 MeV, measured σ(E(^{8}Be,θ)), Be was recorded by detecting two α particles in coincidence in a detection system consisted with eight rectangular, closely adjacent detectors, DWBA analysis.
1977Mo06: E=45 MeV, measured σ(θ), Be was recorded by detecting two α particles in coincidence in a closely spaced pair of large rectangular Si(Li) detectors, DWBA analysis.
All data are from 1976Ma12.

^{52}Ti Levels

E(level)	Jπ	L	S	Comments
0.0	0+	0	0.90	
1040	2+	2	0.061	E(level): E=1045 (1977Mo06).
2300	4+	4	0.032	

$^{48}Ca(^{16}O,^{12}C)$ 1978Ko01

E=56 MeV, ΔE–E tof telescope (time resolution 75–95 ps, energy resolution 200–300 keV (FWHM)). The energy spectrum was measured at θ(lab)=25 .

^{52}Ti Levels

E(level)	Comments
0.0	
1045	
≈2350	This level is a doublet. Assumed to be composed of 2+ at 2264 and 2+ at 2431.

$^{50}Ti(t,p)$ 1981Ma12,1971Ca19,1966Wi11

1981Ma12: E=15 MeV, FWHM≈25 keV, measured σ(θ,E(p)), the reaction products were momentum analyzed with a multi–angle spectrogragh over a laboratory angular range from 3.75 to 86.25 in 7.5 intervals, DWBA analysis.
1966Wi11: E=7.5 MeV, resolution 50 keV, measured σ(θ), E–ΔE solid–state detector system.
1971Ca19: E=13 MeV, measured σ(θ), Elbek–type magnetic spectrogragh and photographic plate, studied L=0 transition to g.s. only.

^{52}Ti Levels

E(level)†	L‡	S	Comments
0.0	0	2.4 *4*	S: DS/DW (mb/sr) at 12.5 (1971Ca19).
1050 *4*	2		
2262 *8*	2		
2316 *8*	4		
2429 *8*	2		
3346 *8*	4		
3447 *8*	3		
3583 *8*	2		

Continued on next page (footnotes at end of table)

^{50}Ti(t,p) 1981Ma12,1971Ca19,1966Wi11 (continued)

^{52}Ti Levels (continued)

E(level)†	L‡	E(level)†	L‡	E(level)†
3872 *8*	3	4212 *8*	0,1	4823 *8*
3916 *8*	2	4324 *8*	1,0	4909 *8*
4058 *8*	(4)	4691 *8*	1,0	5010 *8*
4098 *8*	0,1	4772 *8*	(2)	

† From 1981Ma12.
‡ From a comparison between the experimental angular distributions and those calculated using the DWBA (see 1981Ma12).

^{50}Ti(t,pγ) 1974Pr04

E=2.9 MeV, measured pγ(θ) with an angular correlation spectrometer which consisted of five 10*10 cm NaI(Tl) detectors positioned at angles 5 , 35 , 45 , 60 , and 90 with respect to the beam axis, measured pγ–coin and DSA, γ–ray detected with a 20 cm^3 Ge(Li), proton detected with 1000 m annular silicon counter. γ–data for levels ≥3900 keV were obtained with NaI detectors.

^{52}Ti Levels

E(level)	Jπ†	$T_{1/2}$
0.0	0+	
1049.8 *6*	2+	3.3 ps *+56–15*
2264.5 *10*	2	35 fs *+20–13*
2431.7 *12*	2+	≤70 fs
3588.8 *20*	≥1	≤62 fs
3900 *15*	1,2,3	
4230 *15*		
4300 *20*		

† From pγ(θ) and χ^2 analysis.

γ(^{52}Ti)

E(level)	Eγ	Iγ†	Mult.‡	δ‡
1049.8	1050	100		
2264.5	1215	≥95	D(+Q)	+0.03 *10*
	2265	≤5		
2431.7	1382	≥85	M1+E2	−0.39 *8*
	2432	≤15		
3588.8	1157	≤15		
	1324	69 *8*		
	2539	31 *8*		
	3589	≤10		
3900	1472	≤10		
	1641	45 *5*	D+Q	−0.31 *22*
	2853	55 *5*	Q(+D)	≤−0.46
	3900	≤5		
4230	3180		D(+Q)	+0.12 *13*
	4230			
4300	3250			
	4300			

† Branching ratio for each level.
‡ From pγ(θ).

Coulomb Excitation 2005Di05

Studied ^{52}Ti with intermediate–energy Coulomb excitation, ^{52}Ti produced $^{197}Au(^{76}Ge,X\gamma)$, $E(^{76}Ge)$=130 MeV/nucleon, A1900 fragment separator; 380 mg/cm^2 ^9Be fragmentation target.

^{52}Ti Levels

E(level)	Jπ†	$T_{1/2}$	Comments
0.0	0+		
1050	2+	3.9 ps *4*	B(E2)↑=0.0567 *51*. $T_{1/2}$: from B(E2).
2264	2+		

† From adopted levels.

$\gamma(^{52}Ti)$

E(level)	Eγ
1050	1050
2264	1214

$^{208}Pb(^{48}Ca,X\gamma)$ 2002Ja16

Includes $^9Be(^{86}Kr,X\gamma)$.
$E(^{48}Ca)$=305 MeV, measured Eγ using 101 Compton–suppressed Ge detectors of the Gammasphere multi–detector array.
$^9Be(^{86}Kr,X\gamma)$, E=140 MeV, measured Eγ using a double–sided Si strip detector(DSSD), two Si PIN detectors for β–particles, a Si PIN particle veto detector, six Ge detectors in a circular geometry, and a large volume Ge detector.

^{52}Ti Levels

E(level)	Jπ†
0.0‡	0+
1050.01‡ *20*	2+
2318.0‡ *3*	4+
3029.0‡ *4*	6+
4288.0‡ *4*	(8+)
6693.1‡ *8*	(10+)
8857.2 *9*	
9088.2 *9*	

† From assumption of preferential yrast feeding and the close correspondence between established and calculated levels.
‡ (A): Yrast band.

$\gamma(^{52}Ti)$

E(level)	Eγ
1050.01	1050.0 *2*
2318.0	1268.0 *2*
3029.0	711.0 *2*
4288.0	1259.0 *2*
6693.1	2405.0 *6*
8857.2	2164.0 *6*
9088.2	231.0 *6*
	2395.0 *6*

Adopted Levels, Gammas

Q(β⁻)=3975.6 *10*; S(n)=7311.24 *13*; S(p)=9002.4 *11*; Q(α)=–9370 *5* 2003Au03.

^{52}V Levels

Cross Reference (XREF) Flags

A ^{52}Ti β⁻ Decay (1.7 min)	E ^{51}V(n,γ) E=thermal
B ^{48}Ca(^{7}Li,3nγ),(^{11}B,α3nγ)	F ^{51}V(d,p)
C ^{50}Ti(^{3}He,p)	G ^{51}V(t,d)
D ^{50}Ti(α,d)	H ^{51}V(n,γ) E=0.75–11.3 MeV

E(level)[†]	Jπ[b]	XREF	$T_{1/2}$	Comments
0.0	3+	ABC EF	3.743 min *5*	$T_{1/2}$: from 1989Ab05. Others: 1953Sa11, 1954Ko07, 1963Ma41, 1965Bo42, 1965Ko09, 1968Re04, 1969Wy01. Jπ: L(d,p)=1 from 7/2–, L(^{3}He,p)=2. %β⁻=100.
17.156 *6*	2+,3+	A C Efg	1.08 ns *22*	$T_{1/2}$: from γγ(t) in (n,γ) E=thermal (1972Bo59). Jπ: γγ(θ) in (n,γ), M1 γ to 3+. XREF: C(19)f(20)g(20).
22.764 *3*	(4)+[d]	BCDEfg		Jπ: γγ(θ) in (n,γ), E2(+M1) γ to 3+. XREF: C(19)D(20)f(20)g(20).
141.611 *6*	1+	A C Efg		Jπ: log *ft*=4.04 from 0+.
147.845 *3*	4+	Efg		Jπ: from γ(circ pol), γγ(θ) in (n,γ), L(t,d)=1 from 7/2–. XREF: f(145)g(150).
436.635 *9*	2+	C EFG		Jπ: from γγ(θ), γ(circ pol) in (n,γ), L(t,d)=1 from 7/2–. XREF: C(442)F(431).
793.545 *13*	3+	EF		Jπ: from γγ(θ), γ(circ pol) in (n,γ), L(d,p)=1 from 7/2–. XREF: F(787).
845.943 *12*	4+[c]	C EFG		XREF: C(853)F(838)G(830).
881[&] *14*		F		
1289.847 *22*	(1)+	C EFG		Jπ: L(^{3}He,p)=(0+2). L(t,d)=1+3. XREF: C(1297)F(1277)G(1305).
1418.812 *14*	3+[c]	C EFG		XREF: C(1423)F(1417)G(1436).
1493.06 *20*	7+[d]	B F	1.8 ps *10*	$T_{1/2}$: from 0.7 ps to 2.8 ps in (^{7}Li,3nγ) (1977Na12).
1558.846 *16*	4+[c]	EFG		XREF: F(1557)G(1569).
1579.16 *4*		EF		
1664[‡] *6*	1+	C FG		Jπ: L(^{3}He,p)=0+2. XREF: C(1665)F(1660)G(1665).
1732.572 *17*	(3–,4–)	EF		Jπ: J≠2 from γ(circ pol) in (n,γ), L(d,p)=(0) on 7/2–. XREF: F(1729).
1759.623 *20*	3+	C EFg		Jπ: γ(circ pol) in (n,γ). L(^{3}He,p)=2. XREF: C(1766)F(1756)g(1775).
1770.173 *20*		E g		
1795.118 *16*	2+[c]	C EFg		XREF: C(1802)F(1792)g(1775).
1843[#] *12*	+	FG		Jπ: L(d,p)=3 from 7/2–.
2100.828 *13*	3+[c]	C EFG		XREF: C(2108)F(2097)G(2104).
2152[‡] *10*	1+	C FG		Jπ: L(^{3}He,p)=0+2. XREF: F(2143)G(2155).
2168.637 *17*	4+[c]	EF		XREF: F(2166).
2318.03 *3*	3+[c]	C EFG		XREF: C(2325)F(2321).
2347[&]		F		
2396 *10*	0+,(1+)	C		Jπ: L(^{3}He,p)=0+(2).
2427.656 *19*	2+,3+[c]	C EFG		XREF: C(2435)F(2432)G(2438).
2473[&] *13*		F		
2538.821 *24*	(3,4,5)+[c]	EFG		XREF: F(2541)G(2533).
2543.0 *3*	(9+)[d]	B	5.5 ps *4*	$T_{1/2}$: RDM, weighted average of 5.3 ps *4* (1976Br29) and 6.1 ps *7* (1977Na12) in (^{7}Li,3nγ).
2559.38 *5*		EF		
2591 *10*	1+	C		Jπ: L(^{3}He,p)=0+2.
2697 *10*	0+,(1+)	C		Jπ: L(^{3}He,p)=0+(2).
2743.05 *5*		E		
2775.88 *4*	+	C EFG		Jπ: L(t,d)=1 from 7/2–. XREF: C(2785)F(2781)G(2768).
2824.58 *3*		EF		
2858.876 *25*	(2,3,4)+[c]	Efg		XREF: f(2865)g(2848).
2881 *10*	1+,2+,3+	C		Jπ: L(^{3}He,p)=2.

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Adopted Levels, Gammas (continued)

^{52}V Levels (continued)

E(level)[†]	Jπ[b]	XREF	Comments
2910.38 *5*	+	EF	Jπ: L(d,p)=1 from 7/2−.
2987.29 *3*		E	
3009.15 *6*	+	EF	Jπ: L(d,p)=1 from 7/2−.
3059.54 *4*	(2,3)+	C EFG	Jπ: L(^{3}He,p)=(2), L(d,p)=1 from 7/2−. XREF: C(3066)F(3063)G(3058).
3149		C	
3184.31 *4*		E	
3194.269 *17*	4+[c]	EFG	
3198.91 *6*		E	
3243[@] *10*	+	C F	Jπ: L(d,p)=1+3 from 7/2−. XREF: C(3249)F(3238).
3315.20 *6*	+	EFG	Jπ: L(d,p)=1 from 7/2−. XREF: F(3314)G(3287).
3333.19 *5*		C E	
3450.04 *5*	−	EF	Jπ: L(d,p)=2 from 7/2−.
3473.79 *6*	+	EFG	Jπ: L(t,d)=1+3 from 7/2−.
3509 *13*	−	F	Jπ: L(d,p)=2 from 7/2−.
3538.51 *5*	(1,2)−	C EFG	Jπ: L(t,d)=4, probable L(^{3}He,p)=1, and probable configuration (π f7/2)(ν g9/2). XREF: C(3550)F(3548)G(3549).
3575.97 *4*	3+	C EF	Jπ: L(^{3}He,p)=2+4. XREF: C(3579)F(3586).
3644.97 *6*	+	EF	Jπ: L(d,p)=1 from 7/2−.
3687 *8*	−	C G	Jπ: L(t,d)=4 from 7/2−. XREF: C(3693)G(3684).
3729.61 *5*	3+[c]	C Ef	XREF: C(3726)f(3740).
3733.15 *3*	+	Ef	Jπ: L(d,p)=1 from 7/2−. XREF: f(3740).
3777.09 *3*	−	C E G	Jπ: L(t,d)=4 from 7/2−. XREF: C(3781)G(3769).
3808.51 *3*	1+,2+,3+	C E	Jπ: L(^{3}He,p)=2. XREF: C(3822).
3875 *12*	+	C G	Jπ: L(t,d)=3 from 7/2−. XREF: C(3894)G(3867).
3940 *10*	−	G	Jπ: L(t,d)=4 from 7/2−.
3960[&] *10*	+	F	Jπ: L(d,p)=1 from 7/2−.
4034 *10*	−	G	Jπ: L(t,d)=4 from 7/2−.
4108.70 *5*		C E	
4120 *10*	−	G	Jπ: L(t,d)=4 from 7/2−.
4278.70 *4*	−	C E G	Jπ: L(t,d)=4 from 7/2−. XREF: C(4276)G(4307).
4285.26 *6*		E	
4327 *15*	(8)−	CD FG	Jπ: L(α,d)=7. Strongest (t,d) level with L=4. XREF: D(4320)F(4320)G(4307).
4419.58 *6*		C EfG	Jπ: L(d,p)=2 from 7/2−, L(t,d)=1+3 from 7/2−. XREF: f(4430)G(4429).
4455 *15*	−	C f	Jπ: L(d,p)=2 from 7/2−. XREF: f(4430).
4483.00 *11*		C E	XREF: C(4496).
4518.90 *12*		E	
4533 *10*	−	G	Jπ: L(t,d)=4 from 7/2−.
4557 *15*	1+,2+,3+	C	Jπ: L(^{3}He,p)=2.
4609.44 *13*	1+	C E G	Jπ: L(^{3}He,p)=0+2. XREF: C(4622).
4717[§] *8*	+	C G	Jπ: L(t,d)=3 from 7/2−. XREF: C(4721)G(4715).
4755.02 *14*		E	
4772 *10*	+	G	Jπ: L(t,d)=1 from 7/2−.
4904[§] *8*	+	C G	Jπ: L(t,d)=3 from 7/2−. XREF: C(4910)G(4902).
4951 *15*		C	
4986[§] *9*	(1,2,3)+	C G	Jπ: L(^{3}He,p)=(2), L(t,d)=1+3. XREF: C(5000)G(4980).

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{52}V Levels (continued)

E(level)[†]	Jπ[b]	XREF	$T_{1/2}$	Comments
5038.88 *13*		E		
5080[§] *8*	–	C G		Jπ: L(t,d)=4 from 7/2–. XREF: C(5070)G(5085).
5096 *15*		C		
5187 *10*	–	G		Jπ: L(t,d)=4 from 7/2–.
5233 *15*		C		
5276[§] *8*	+	C G		Jπ: L(t,d)=1 from 7/2–. XREF: C(5273)G(5277).
5344[§] *11*	+	C G		Jπ: L(t,d)=1 from 7/2–. XREF: C(5360)G(5337).
5410 *15*	(1+,2+,3+)	C		Jπ: L(^{3}He,p)=(2).
5488[§] *12*	+	C G		Jπ: L(t,d)=1 from 7/2–. XREF: C(5506)G(5480).
5548[§] *8*	–	C G		Jπ: L(t,d)=4 from 7/2–.
5600 *15*		C		
5646[§] *8*	+	C G		Jπ: L(t,d)=1 from 7/2–.
5711 *15*		C		
5744[§] *8*	(1,2,3)+	C G		Jπ: L(^{3}He,p)=(2), L(t,d)=3 from 7/2–.
5813 *15*		C		
5851[§] *8*	+	C G		Jπ: L(t,d)=3 from 7/2–. XREF: G(5845).
5946[§] *8*	+	C G		Jπ: L(t,d)=3 from 7/2–. XREF: C(5936)G(5951).
6021 *15*		C		
6086[§] *8*	+	C G		Jπ: L(t,d)=3 from 7/2–. XREF: C(6084)G(6087).
6167[§] *8*	+	C G		Jπ: L(t,d)=1+3 from 7/2–. XREF: G(6166).
6225 *15*		C		
6277[§] *10*	+	C G		Jπ: L(t,d)=1 from 7/2–. XREF: C(6292)G(6270).
6326 *15*		C		
6374 *15*		C		
6406 *8*	+	C G		Jπ: L(t,d)=1+3 from 7/2–. XREF: C(6414)G(6403).
6472 *15*		C		
6519[§] *8*	+	C G		Jπ: L(t,d)=3 from 7/2–. XREF: C(6524)G(6517).
6557 *15*		C		
6590 *15*		C		
6640 *15*	1+,2+,3+	C		Jπ: L(^{3}He,p)=2.
6675 *15*		C		
6744 *15*		C		
6809 *15*		C		
6844 *15*		C		
6887[§] *12*		C g		XREF: C(6886)g(6890).
6919 *15*		C g		XREF: g(6890).
7110 *25*		G		
7311.22 *3*		DE G		XREF: G(7320).
7540 *25*		G		
7850 *25*		G		
8050 *25*		G		
8250[a] *25*		GH	3.7 keV[a] *4*	XREF: H(8200).
8400 *25*		G		
8620[a]		H	3.3 keV[a] *4*	
8760 *25*				
8838 *15*	0+	C		Jπ: L(^{3}He,p)=0. Identified as IAS ^{52}Ti g.s. in ^{50}Ti(^{3}He,p). T=4.
9060 *25*		G		
9310 *25*		G		
9510 *25*		G		
9600[a]		H	11.7 keV[a] *12*	

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{52}V Levels (continued)

E(level)†	XREF
10080 25	G
10650 25	G

† Levels connected by gammas are from least squares fit, Levels not connected by gammas are from ^{51}V(t,d), except as noted.
‡ From weighted average of values in ^{50}Ti(^{3}He,p), ^{51}V(d,p), and ^{51}V(t,d).
§ From weighted average of values in ^{50}Ti(^{3}He,p) and ^{51}V(t,d).
# From weighted average of values in ^{51}V(d,p) and ^{51}V(t,d).
@ From weighted average of values in ^{50}Ti(^{3}He,p) and ^{51}V(d,p).
& From ^{51}V(d,p).
a From ^{51}V(n,γ) E=0.75–11.3 MeV.
b L values from ^{51}V(d,p) do not impose many restrictions on the range of J values. Allowed spins are, therefore, not listed when only L from (d,p) is available. Refer to (d,p) data set. Parities, when given alone, are based on L in (d,p), except as noted.
c J is from γ(circ pol) in (n,γ). π is from L(d,p)=1.
d On the basis of comparison of yield with a fusion–evaporation calculation and of the level structure predicted by a shell–model calculation (1984De15), in (^{7}Li,3nγ), propose Jπ=5+,7+, and 9+, respectively, for levels at 22, 1493, and 2543.

γ(^{52}V)

E(level)	Eγ†	Iγ†	Mult.	δ	α	Comments
17.156	17.153 6	100	M1		7 3	δ,Mult.: Mult from α(K)exp in (n,γ). δ=0.066 +34–66 from α(exp) in (n,γ). From RUL one expects δ<0.0064. B(M1)↓(W.u.)=0.97 20.
22.764	22.764 3	100	E2(+M1)	>0.63	70 40	δ,Mult.: from (n,γ).
141.611	124.453 3	100				
147.845	125.082 3	100 20				
	147.845 4	17 4				
436.635	295.004 9	49				
	419.468 23	70				
	436.61 3	100 21				
793.545	356.87 5	1.2				
	645.69 3	100 23				
	776.41 4	1.2 2				
	793.54 3	28 5				
845.943	698.13 3	13 3				
	823.19 3	100 20				
	845.98 3	80 17				
1289.847	1148.28# 5	35# 7				
	1272.64 4	100 18				
1418.812	572.89 5	6.6 13				
	981.98 8	29 6				
	1270.91 4	17 4				
	1401.65 3	100 21				
	1418.78 3	100 21				
1493.06	1470.27‡ 20	100‡				
1558.846	712.90 3	16 3				
	1410.97 3	2.7 6				
	1536.17 9	0.93 18				
	1541.77 8	0.51 10				
	1558.79 3	100 19				
1579.16	1579.12 4	100				
1732.572	886.66 3	100 21				
	1584.70 5	23 5				
	1591.6 3	4.5 9				
	1709.78 3	79 15				
	1732.53 4	100 21				
1759.623	965.6 4	2.3 4				
	1322.92 3	92 19				
	1611.77 4	100 21				
	1618.05 9	5.2 10				
	1742.50 4	29 6				
1770.173	1333.60 5	100 19				
	1622.42 5	84 18				
	1747.33 4	40 8				
1795.118	505.27 3	6.1 12				
	1001.62 4	35 7				
	1358.50 3	94 18				
	1647.30 10	0.73 15				
	1653.46 4	3.7 7				
	1777.91 6	100 21				
	1795.05 3	7.9 15				
2100.828	541.79 18	1.9 4				
	682.02 3	23 4				
	1254.87 3	33 6				
	1307.28 3	54 11				
	1664.18 3	77 16				
	1952.92 4	100 21				
	2083.64 3	55 6				
	2100.83 4	42 4				
2168.637	1325 1	15				
	1375.06 3	6.1 12				
	2020.76 4	15.5 15				
	2145.84 3	100 9				
	2151.41 6	2.48 24				
	2168.59 5	7.5 8				
2318.03	899.02 9	67 13				
	1472.05 6	51 10				
	1524.56 5	53 11				
	2170.24 6	96 10				
	2300.76 6	42 4				
	2317.79 8	100 10				

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Adopted Levels, Gammas (continued)

γ(^{52}V) (continued)

E(level)	Eγ†	Iγ†	Mult.
2427.656	1634.04 3	82 17	
	1991.44 15	2.3 5	
	2286.03 4	32 3	
	2410.44 5	100 9	
	2427.59 4	40 5	
2538.821	806.45 8	15 3	
	979.94 12	15 3	
	1120.04 14	8.7 17	
	1692.96 4	28 5	
	1744.92 22	6.1 12	
	2515.98 7	100 10	
2543.0	1049.98‡§ 18	100‡	[E2]
2559.38	2122.66 7	100 10	
	2417.83# 9	47# 4	
	2559.36 9	50 4	
2743.05	972.6 3	9.7 16	
	1897.58 25	9.7 16	
	2601.43 10	20.2 24	
	2725.83 9	52 6	
	2742.96 6	100 10	
2775.88	1486.20 15	8.8 16	
	1930.04 10	31 6	
	2758.61 4	100 10	
2824.58	2030.75 9	23.4 21	
	2387.93 4	100 10	
	2807.35 4	81 8	
2858.876	758.43 23	1.6 3	
	2065.27 5	7.1 7	
	2420 1	100	
	2710.97 4	34 3	
	2841.64 4	59 6	
	2858.62 13	2.9 3	
2910.38	2472.73 6	100 11	
	2911.64 9	43 5	
2987.29	2550.60 19	8.6 7	
	2839.24# 20	19# 2	
	2970.15 5	59 6	
	2987.13 4	100 10	
3009.15	2163.20 6	100 10	
	2216.3 4	15.6 11	
	2860.59 24	30 3	
	3008.96 13	20.0 11	
3059.54	1641.6 3	10.8 22	
	1769.70 4	100 20	
	2266.06 9	34 3	
	2622.73 7	91 10	
	3059.33 7	87 4	
3184.31	1765.42 6	48 10	
	1894.11# 23	12.9# 22	
	2338.16 9	37 3	
	2390.82 5	100 10	
	2747.42 21	16.1 21	
	3184.14 25	7.5 11	
3194.269	655.41 4	12.5 25	
	1093.38 5	13 3	
	1399.44 11	4.6 9	
	1424.11 3	32 6	
	1635.42 4	26 5	
	1775.42 3	100 20	
	2348.21 8	12.8 12	
	3046.30 5	32.0 16	
	3171.35 7	5.31 25	
3198.91	2352.76 16	23 3	
	3051.05 8	64 3	
	3176.07 11	100 4	
	3198.29 25	13.0 14	
3315.20	2469.05 8	100 9	
	3292.42 10	71 3	
	3315.34 14	41 3	
3333.19	1537.6 3	12 3	
	1573.54 14	21 4	
	1914.27 8	40 9	
	2896.37 13	16.1 18	
	3310.48 10	19.6 9	
	3333.12 10	100 5	
3450.04	1131.99 11	44 9	
	1891.38 21	12.9 22	
	2656.46 9	100 10	
	3427.15 7	99 5	
	3432.46# 18	10.8# 11	
3473.79	1894.11# 23	23# 4	
	2054.98 15	40 4	
	2627.70 8	100 9	
	3326.3 3	15.1 19	
	3473.75 8	94 6	
3538.51	2692.74 17	14.7 15	
	2744.8 5	10.3 7	
	3101.71 6	100 5	
	3390.61 7	71 4	
3575.97	1148.28# 5	67# 14	
	1996.78# 14	14# 3	
	3139.26 6	100 5	
	3558.69 6	97 5	
3644.97	2799.00 23	26 3	
	2851.24 11	63 6	
	3622.06 8	100 6	
	3645.00 13	46 3	
3729.61	1301.95 9	55 10	
	1996.78# 14	28# 6	
	2439.27 24	16.4 15	
	2883.73 10	73 7	
	3706.71 7	100 4	
3733.15	1564.55 5	25 5	
	1973.48 6	20 4	
	2313.69# 23	4.8# 4	
	2442.86 19	4.8 4	
	2939.54 6	25 3	
	3296.54 11	26.0 15	
	3584.9 3	4.0 4	
	3593.5 7	2.6 4	
	3715.80 6	100 5	
3777.09	2006.95 6	97 10	
	2218.2 3	10.8 8	
	2931.07 4	100 10	
	3340.8 5	3.1 8	
	3629.06 7	50.8 23	
	3754.05 7	97 5	
	3760.03 12	13.8 8	
	3776.78 20	9.2 8	

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

γ(^{52}V) (continued)

E(level)	Eγ†	Iγ†
3808.51	1065.77 *18*	12 *3*
	2038.29 *5*	80 *8*
	2076.00 *7*	28 *3*
	2249.39 *9*	18.5 *16*
	2962.46 *5*	100.0 *16*
	3014.96 *7*	73 *4*
	3785.48 *8*	22.8 *11*
4108.70	2313.69# *23*	10.1# *8*
	2529.66 *24*	7.8 *8*
	2818.56 *18*	11.7 *16*
	3671.83 *6*	100 *5*
	3967.06 *12*	14.1 *8*
	4091.70 *15*	10.1 *8*
	4108.59 *15*	14.1 *8*
4278.70	1739.95 *3*	13 *3*
	2109.81 *11*	100 *10*
	2546.09 *20*	16.9 *14*
	3432.46# *18*	14.1# *14*
	3484.64 *10*	35.2 *14*
	4129.82 *18*	76 *4*
	4255.08 *15*	29.6 *14*
4285.26	1726.14 *16*	29 *6*
	2706.0 *5*	10.2 *20*
	3491.43 *9*	53.1 *20*
	4137.30 *16*	28.6 *20*
	4267.8 *3*	12.2 *20*
	4285.11 *8*	100 *4*
4419.58	1508.49 *10*	18 *3*
	1643.77 *16*	15 *3*
	1860.8 *5*	2.8 *7*
	2319.08 *9*	100 *10*
	2649.13 *24*	6.3 *7*
	2660.6 *4*	3.5 *7*
	3983.01 *12*	14.0 *7*
4483.00	1571.54 *19*	25 *6*
	1740.0 *3*	12 *3*
	2382.67 *14*	25 *3*
	2724.14# *20*	36# *4*
	2904.14 *18*	15.2 *14*
	4046.2 *6*	5.6 *14*
	4341.49 *10*	38.9 *14*
	4466.00 *8*	100 *6*
4518.90	1979.96 *5*	100 *20*
	2417.83# *9*	53# *5*
	2724.14# *20*	43# *5*
	2786.63 *14*	25 *3*
	3725.39 *10*	46.7 *17*
	4370.86 *13*	28.3 *17*
4609.44	1749.9 *4*	13 *3*
	1833.75 *7*	53 *11*
	2070.48 *6*	100 *10*
	2839.24# *20*	44# *5*
	2876.4 *3*	11.3 *16*
	3815.21 *22*	12.9 *16*
	4461.18 *19*	17.7 *16*
	4586.63 *10*	41.9 *16*
4755.02	1695.74 *14*	100 *21*
	2586.54 *19*	74 *5*
	3022.76 *22*	63 *5*
	4317.9 *4*	26 *5*
	4606.74 *20*	47 *5*
5038.88	1853.8 *5*	4.0 *10*
	2213.96 *21*	8.5 *10*
	3479.85 *21*	7.0 *5*
	4192.79 *7*	100 *5*
	5015.81 *12*	23.5 *10*
	5038.80 *16*	8.0 *5*

† From ^{51}V(n,γ), except as noted.
‡ From ^{48}Ca(^{7}Li,3nγ),(^{11}B,α3nγ).
§ B(E2)(W.u.)↓=7.0 *5*.
# Multiply placed; undivided intensity given.

^{52}Ti β^- Decay (1.7 min) 1967Mo11

Parent ^{52}Ti: E=0.0; Jπ=0+; $T_{1/2}$=1.7 min *1*; Q(g.s.)=1976 *7*; %β^- decay=100.
Source from ^{50}Ti(t,p) reaction, measured a low energy γ–ray spectrum with a thin NaI crystal with barylium window, measured γ–ray spectrum around the energy of 125 keV with a 2 cm^3 Ge(Li) detector, γγ–coin.

^{52}V Levels

E(level)	Jπ†
0.0	3+
17.153 *6*	2+,3+
141.606 *7*	1+

† From adopted levels.

^{52}Ti β^- Decay (1.7 min) 1967Mo11 (continued)

β^- radiations

$E\beta^-$	E(level)	$I\beta^{-\dagger}$	Log *ft*	Comments
(1834 *7*)	141.606	100	4.04 *3*	$I\beta^-$: no feeding to g.s., 17–keV level.

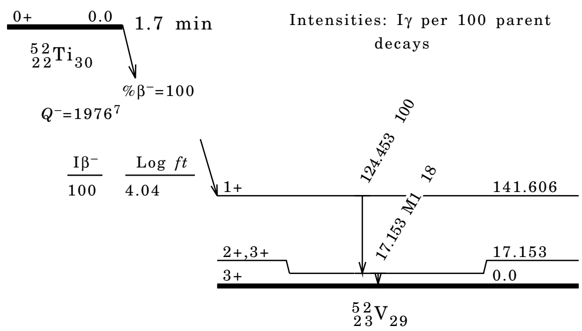
† Absolute intensity per 100 decays.

$\gamma(^{52}V)$

$E\gamma^\dagger$	E(level)	$I\gamma^{\ddagger\S}$	Mult.	Comments
17.153 *6*	17.153	18 *6*	M1	Mult.: from adopted γ's.
124.453 *3*	141.606	100		

† From ^{51}V(n,γ).
‡ From I(γ+ce) and α.
§ Absolute intensity per 100 decays.

Decay Scheme



^{48}Ca(^{7}Li,3nγ),(^{11}B,α3nγ) 1977Na12,1976Br29

1977Na12: E=25–50 MeV, RDM, γ(θ), γγ–coin, Ge(Li) detectors, 2.5 keV FWHM for 1.33 MeV.
1976Br29: E=28 MeV, measured γ–spectra with a Ge(Li), Lifetime with RDM.

^{52}V Levels

E(level)	$J\pi^\dagger$	$T_{1/2}$	Comments
0.0	3+		
23.0 *10*	(5+)		
1493.3 *11*	(7+)		$T_{1/2}$: 0.7 ps to 2.8 ps, RDM (1977Na12).
2543.3 *11*	(9+)	5.5 ps *4*	$T_{1/2}$: from weighted average of 5.3 ps *4* (1976Br29) and 6.1 ps *7* (1977Na12), RDM.

† From 1976Br29, based on a comparison of results of the experiment with stripping and β decay information, and with shell–model calculation of 1973Ho44.

$\gamma(^{52}V)$

E(level)	$E\gamma^\dagger$	$I\gamma^\ddagger$	Mult.
23.0	(23)		
1493.3	1470.27 *20*	100	[E2]
2543.3	1049.98 *18*	100	

† From 1977Na12.
‡ Branching ratio for each level, from 1977Na12.

$^{50}Ti(^{3}He,p)$ 1975Ca07

E=15 MeV, measured σ(E(p),θ), the reaction protons were momentum analyzed in a multi–angle magnetic spectrograph at angles ranging from 3.75 to 86.25 in steps of 7.7 , overall energy solution for the experiment was 25 keV FWHM. DWBA analysis.

Others: 1974Ha55, 1972Ha31, 1971Ha55.

^{52}V Levels

E(level)	Jπ	L§	dσ/dΩ(b/sr)	Comments
0.0	1+,2+,3+	2	54	
19 *10*		(2+4)	109	
142 *10*	1+	0+2	279	
442 *10*			9	
853 *10*	(3+,4+,5+)	(4)	17	
1297 *10*	(1+)	(0+2)	157	
1423 *10*			18	
1665 *10*	1+	0+2	580	
1766 *10*	1+,2+,3+	2	115	
1802 *10*			19	
2108 *10*			21	
2152 *10*	1+	0+2	129	
2325 *10*			11	
2396‡ *10*	0+,(1+)	0+(2)	233	Identified as possible fragment of AAS. See footnote.
2435 *10*	1+,2+,3+	2	42	
2591 *10*	1+	0+2	913	
2697‡ *10*	0+,(1+)	0+(2)	68	Identified as possible fragment of AAS. See footnote.
2785 *10*			28	
2881 *10*	1+,2+,3+	2	82	
3066 *15*	(1+,2+,3+)	(2)	22	
3149 *15*	(1+,2+,3+)	(2)	68	
3249 *15*			17	
3342 *15*			21	
3550 *15*			79	L: L=1 or L=0+2 with L=2 dominant.
3579 *15*	3+	2+4	21	L: data can be fit by either L=3 or L=4 dominated 2+4. Exclusion of L=3, and hence assignment of Jπ=3+, are based on consideration of (d,p) results.
3693 *15*			53	
3726 *15*			33	
3781 *15*			23	
3822 *15*	1+,2+,3+	2	65	
3894 *15*			13	
4107 *15*			46	
4276† *15*			80	
4327 *15*			62	
4419 *15*			41	
4455 *15*			19	
4496 *15*			61	
4557 *15*	1+,2+,3+	2	156	
4622 *15*	1+	0+2	147	
4721 *15*			93	
4910 *15*			29	
4951 *15*			62	
5000 *15*	(1+,2+,3+)	(2)	27	
5070 *15*			8	
5096 *15*			108	
5233 *15*			22	
5273 *15*			30	
5360 *15*			32	
5410 *15*	(1+,2+,3+)	(2)	57	
5506 *15*			39	
5549 *15*			56	
5600 *15*			78	
5646 *15*			106	
5711 *15*			65	
5745 *15*	(1+,2+,3+)	(2)	142	
5813 *15*			76	
5863 *15*			39	
5936† *15*			162	

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^{50}Ti(^{3}He,p) 1975Ca07 (continued)

^{52}V Levels (continued)

E(level)	dσ/dΩ(b/sr)	E(level)	Jπ	L[§]	dσ/dΩ(b/sr)
6021 *15*	89	6557 *15*			174
6084 *15*	185	6590 *15*			60
6169 *15*	98	6640 *15*	1+,2+,3+	2	63
6225 *15*	119	6675 *15*			74
6292 *15*	64	6744[†] *15*			248
6326 *15*	29	6809 *15*			45
6374 *15*	53	6844 *15*			90
6414 *15*	23	6886 *15*			81
6472 *15*	23	6919 *15*			63
6524 *15*	61	8838[#] *15*	0+	0	615

† Probable doublet.
‡ The pairing–vibration model predicts a T=3, Jπ=0+ anti–analog state (AAS), as well as the T=4 IAS, based on the ^{52}Ti g.s. as parent. These two are the only candidates for L=0 states in the right region to be fragments of AAS. However, the combined yield accounts for only ≈18% of that expected from the theoretical ratio σ(AAS)/σ(IAS)=3.
§ Assignments made by comparing observed angular distributions to DWBA calculations. Empirical criterion employed for distinguishing L=0 from L=0+2. See 1975Ca07 for details.
\# T=4. Identified as IAS ^{52}Ti g.s.

^{50}Ti(α,d) 1980Ok03

E=23.9 MeV, resolution≈80 keV FWHM, measured σ(θ), ΔE–E counter telescope.

^{52}V Levels

E(level)	Jπ	L	Comments
20		4	E(level): authors suggest population mainly of 23–keV state, since L=4 and DWBA calculation for population of g.s. and 17 level, if configuration is (π f7/2)(ν p3/2), gives ≈20% of σ.
4320 *30*	(8−)	7	Jπ: σ(DWBA) and σ(θ) give best agreement for configuration (π f7/2)(ν g9/2) coupled to J=8 with L=7. σ(α,d)/σ(^{3}He,p) suggests large spin.

^{51}V(n,γ) E=thermal 1991Mi08

Jπ(^{51}V)=7/2−.
1965Wh06: measured Eγ, Iγ, γγ–coin, γγ angular correlation, rent crystal spectrometer.
1966Va03: measured Eγ, Iγ, curved crystal spectrometer.
1967Ar08: measured Eγ, Iγ, Ge(Li) detector.
1967Ca03: measured γγ angular correlation, NaI(Tl) detectors.
1969Ra10: measured Eγ, Iγ.
1972Bo59: measured Iγ, $T_{1/2}$, and α(exp) for 17–keV level, fast–slow delayed coincidence system.
1984De15: polarized neutrons, measured Eγ, γ(circ pol), Iγ(θ,H,t). Ge(Li) detectors.
1991Mi08: measured Eγ, Iγ, Ge(Li) detector (FWHM: 2.2 keV at 1.33 MeV), pair spectrometer (FWHM: 2.3 keV at 2 MeV and 5.1 kev at 8 MeV).
Polarized (n,γ): see also 1965Ko10.
Resonance (n,γ): see 1970Ra47, 1966Go30.
Construction of level scheme takes into account γγ coin work of 1965Wh06, 1967Ar08, 1967Ca03.
Energy, intensity and placement of Gamma–ray are from 1991Mi08, except as noted.

^{52}V Levels

E(level)	Jπ[†]	$T_{1/2}$
0.0	3+	
17.155 *6*	2+,3+[‡]	1.08 ns[§] *22*
22.764 *3*	(4,5)+	
141.610 *6*		

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^{51}V(n,γ) E=thermal 1991Mi08 (continued)

^{52}V Levels (continued)

E(level)	Jπ†
147.845 *3*	4+‡
436.635 *9*	2+‡
793.543 *12*	3+‡
845.943 *12*	4+‡
1289.846 *22*	
1418.812 *14*	3+‡
1558.846 *16*	4+‡
1579.15 *4*	
1732.572 *17*	not 2‡
1759.617 *20*	3+‡
1770.173 *20*	
1795.118 *16*	2+‡
2100.829 *13*	3+‡
2168.636 *17*	4+‡
2318.03 *3*	3+‡
2427.655 *19*	2+,3+‡
2538.821 *24*	(3,4,5)+‡
2559.38 *5*	
2743.05 *5*	
2775.88 *4*	
2824.58 *3*	
2858.875 *25*	(2,3,4)+‡
2910.39 *5*	
2987.29 *3*	
3009.15 *6*	
3059.55 *4*	
3184.31 *4*	
3194.270 *17*	4+‡
3198.91 *6*	
3315.20 *6*	
3333.19 *5*	
3450.04 *5*	
3473.79 *6*	
3538.52 *5*	
3575.97 *4*	
3644.97 *6*	
3729.61 *5*	
3733.15 *3*	
3777.09 *3*	
3808.51 *3*	
4108.70 *5*	
4278.70 *4*	
4285.26 *6*	
4419.59 *6*	
4483.23 *9*	
4518.89 *12*	
4609.44 *12*	
4755.02 *14*	
5038.88 *13*	
7311.24# *13*	3−,4−@

† Based on γγ(θ) work of 1965Wh06, 1968BoZY, and 1967Ca03, except as noted.
‡ J: γ(circ pol) (1984De15). π: from L values in (d,p).
§ From γγ(t), see 1972Bo59.
\# Neutron capture state, from 2003Au03.
@ From s–wave neutron capture on 7/2− target nucleus.

γ(^{52}V)

E(level)	Eγ	Iγ
	x137.50‡ *4*	0.025‡#
	x139.74 *4*	
	x663.7‡ *4*	0.20‡#
	x749.5‡ *10*	<0.15‡#
	x754.2‡ *10*	<0.15‡#&
	x771.2‡ *10*	<0.15‡#
	x780.6‡ *10*	<0.15‡#
	x934.48 *5*	0.28 *6*
	x1097.2† *10*	1.2†@
	x1166.64 *5*	0.16 *3*
	x1181.71 *4*	0.18 *4*
	x1405.45 *4*	0.111 *22*
	x1438.18 *4*	0.17 *4*
	x1526.93 *3*	0.25 *5*
	x1530.66 *4*	0.106 *21*
	x1693.9† *10*	1.08@
	x1772.73 *4*	0.18 *4*
	x1820.66 *4*	0.103 *21*
	x1960.1† *10*	0.75@
	x2002.0† *10*	0.82@
	x2004.83 *4*	0.35 *4*
	x2051.0† *10*	0.54@
	x2397.18 *13*	0.020 *2*
	x2401.08 *5*	0.100 *10*
	x2499.53 *4*	0.136 *14*
	x2523.68 *5*	0.113 *11*
	x2681.30 *7*	0.145 *15*
	x2762.8† *10*	0.35@
	x2887.48 *4*	0.33 *3*
	x3264.41 *6*	0.125 *6*
	x3334.55 *10*	0.107 *5*
	x3419.6† *10*	0.15@
	x3442§ *3*	0.2§
	x3915.0† *10*	0.17@
	x4076.9† *10*	0.16@
	x4282.3† *10*	0.18@
	x4503.0† *10*	0.15@
	x4693.1† *10*	0.22@
	x4990.18 *10*	0.111 *6*
	x5267.8† *10*	0.22@
	x5297.6† *10*	0.16@
	x5445.7† *10*	0.11@
	x5562§ *3*	0.50§
	x5944.5† *10*	0.09@
	x6037.1† *10*	0.09@
	x6084.7† *10*	0.13@
	x6253.9† *10*	0.09@
	x6278.4† *10*	0.16@
	x6319.7† *10*	0.25@
	x6342.5† *10*	0.15@
	x6372.6† *10*	0.12@
	x6555.6† *10*	0.12@
	x6599.7† *10*	0.17@
	x6625.9† *10*	0.16@
	x6642.1† *10*	0.12@
	x6676.0† *10*	0.12@
	x6706.2† *10*	0.16@
	x6956.6† *10*	0.16@
	x7069.1† *10*	0.27@

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^{51}V(n,γ) E=thermal 1991Mi08 (continued)

γ(^{52}V) (continued)

E(level)	Eγ	Iγ	Mult.	δ	α	I(γ+ce)	Comments
17.155	17.153 *6*	3.0 *10*	M1		7 *3*		α(exp)=4.6 *18* (1972Bo59). Eγ: from 1989Du03. δ: from α(exp) one gets δ=0.066 *+34–66*. From RUL one expects δ<0.0064.
22.764	22.764[‡] *3*		E2(+M1)	>0.63	70 *40*	24 *4*	α(exp)=65 *+63–33* (1966Va03). δ: from α(exp). I(γ+ce): from ΣI(γ+ce) (feeding 22 level). Iγ: 1967Ar08 report 0.19<Iγ<0.45.
141.610	124.453[‡] *3*	2.5[‡#]					
147.845	125.082[‡] *3*	17.2[‡#]					
	147.845[‡] *4*	3.0[‡#]					
436.635	295.004[‡] *9*	2.6[‡#]					
	419.468[‡] *23*	3.7[‡#]					
	436.61 *3*	5.3 *11*					
793.543	356.87[‡] *5*	0.15[‡#]					
	645.69 *3*	13 *3*					
	776.41 *4*	0.16 *3*					
	793.54 *3*	3.7 *7*					
845.943	698.13 *3*	0.80 *16*					
	823.19 *3*	6.0 *12*					
	845.98 *3*	4.8 *10*					
1289.846	1148.28[a] *5*	0.094[a] *19*					
	1272.64 *4*	0.27 *5*					
1418.812	572.89 *5*	0.092 *18*					
	981.98 *8*	0.41 *8*					
	1270.91 *4*	0.24 *5*					
	1401.65 *3*	1.4 *3*					
	1418.78 *3*	1.4 *3*					
1558.846	712.90 *3*	1.06 *21*					
	1410.97 *3*	0.18 *4*					
	1536.17 *9*	0.062 *12*					
	1541.77 *8*	0.034 *7*					
	1558.79 *3*	6.7 *13*					
1579.15	1579.12 *4*	0.104 *21*					
1732.572	886.66 *3*	0.33 *7*					
	1584.70 *5*	0.076 *15*					
	1591.6 *3*	0.015 *3*					
	1709.78 *3*	0.26 *5*					
	1732.53 *4*	0.33 *7*					
1759.617	965.6 *4*	0.011 *2*					
	1322.92 *3*	0.44 *9*					
	1611.77 *4*	0.48 *10*					
	1618.05 *9*	0.025 *5*					
	1742.50 *4*	0.14 *3*					
1770.173	1333.60 *5*	0.62 *12*					
	1622.42 *5*	0.52 *11*					
	1747.33 *4*	0.25 *5*					
1795.118	505.27 *3*	0.20 *4*					
	1001.62 *4*	1.16 *23*					
	1358.50 *3*	3.1 *6*					
	1647.30 *10*	0.024 *5*					
	1653.46 *4*	0.121 *24*					
	1777.91 *6*	3.3 *7*					
	1795.05 *3*	0.26 *5*					
2100.829	541.79 *18*	0.026 *5*					
	682.02 *3*	0.32 *6*					
	1254.87 *3*	0.46 *9*					
	1307.28 *3*	0.75 *15*					
	1664.18 *3*	1.08 *22*					
	1952.92 *4*	1.4 *3*					
	2083.64 *3*	0.77 *8*					
	2100.83 *4*	0.59 *6*					

Continued on next page (footnotes at end of table)

$^{51}V(n,\gamma)$ E=thermal 1991Mi08 (continued)

$\gamma(^{52}V)$ (continued)

E(level)	Eγ	Iγ
2168.636	1325[†] 1	0.5[†@]
	1375.06 3	0.20 4
	2020.76 4	0.51 5
	2145.84 3	3.3 3
	2151.41 6	0.082 8
	2168.59 5	0.248 25
2318.03	899.02 9	0.110 22
	1472.05 6	0.084 17
	1524.56 5	0.088 18
	2170.24 6	0.159 16
	2300.76 6	0.070 7
	2317.79 8	0.165 17
2427.655	1634.04 3	0.53 11
	1991.44 15	0.015 3
	2286.03 4	0.207 21
	2410.44 5	0.65 6
	2427.59 4	0.26 3
2538.821	806.45 8	0.051 10
	979.94 12	0.051 10
	1120.04 14	0.030 6
	1692.96 4	0.096 19
	1744.92 22	0.021 4
	2515.98 7	0.346 35
2559.38	2122.66 7	0.068 7
	2417.83[a] 9	0.032[a] 3
	2559.36 9	0.034 3
2743.05	972.6 3	0.012 2
	1897.58 25	0.012 2
	2601.43 10	0.025 3
	2725.83 9	0.065 7
	2742.96 6	0.124 12
2775.88	1486.20 15	0.016 3
	1930.04 10	0.056 11
	2758.61 4	0.181 18
2824.58	2030.75 9	0.044 4
	2387.93 4	0.188 19
	2807.35 4	0.152 15
2858.875	758.43 23	0.019 4
	2065.27 5	0.085 9
	2420[†] 1	1.2[†@]
	2710.97 4	0.41 4
	2841.64 4	0.71 7
	2858.62 13	0.035 4
2910.39	2472.73 6	0.065 7
	2911.64 9	0.028 3
2987.29	2550.60 19	0.012 1
	2839.24[a] 20	0.027[a] 3
	2970.15 5	0.083 8
	2987.13 4	0.141 14
3009.15	2163.20 6	0.090 9
	2216.3 4	0.014 1
	2860.59 24	0.027 3
	3008.96 13	0.018 1
3059.55	1641.6 3	0.010 2
	1769.70 4	0.093 19
	2266.06 9	0.032 3
	2622.73 7	0.085 9
	3059.33 7	0.081 4
3184.31	1765.42 6	0.045 9
	1894.11[a] 23	0.012[a] 2
	2338.16 9	0.034 3
	2390.82 5	0.093 9
	2747.42 21	0.015 2
3184.31	3184.14 25	0.007 1
3194.270	655.41 4	0.101 20
	1093.38 5	0.108 22
	1399.44 11	0.037 7
	1424.11 3	0.26 5
	1635.42 4	0.21 4
	1775.42 3	0.81 16
	2348.21 8	0.104 10
	3046.30 5	0.259 13
	3171.35 7	0.043 2
3198.91	2352.76 16	0.016 2
	3051.05 8	0.044 2
	3176.07 11	0.069 3
	3198.29 25	0.009 1
3315.20	2469.05 8	0.034 3
	3292.42 10	0.024 1
	3315.34 14	0.014 1
3333.19	1537.6 3	0.014 3
	1573.54 14	0.024 5
	1914.27 8	0.045 9
	2896.37 13	0.018 2
	3310.48 10	0.022 1
	3333.12 10	0.112 6
3450.04	1131.99 11	0.041 8
	1891.38 21	0.012 2
	2656.46 9	0.093 9
	3427.15 7	0.092 5
	3432.46[a] 18	0.010[a] 1
3473.79	1894.11[a] 23	0.012[a] 2
	2054.98 15	0.021 2
	2627.70 8	0.053 5
	3326.3 3	0.008 1
	3473.75 8	0.050 3
3538.52	2692.74 17	0.020 2
	2744.8 5	0.014 1
	3101.71 6	0.136 7
	3390.61 7	0.096 5
3575.97	1148.28[a] 5	0.094[a] 19
	1996.78[a] 14	0.019[a] 4
	3139.26 6	0.140 7
	3558.69 6	0.136 7
3644.97	2799.00 23	0.009 1
	2851.24 11	0.022 2
	3622.06 8	0.035 2
	3645.00 13	0.016 1
3729.61	1301.95 9	0.037 7
	1996.78[a] 14	0.019[a] 4
	2439.27 24	0.011 1
	2883.73 10	0.049 5
	3706.71 7	0.067 3
3733.15	1564.55 5	0.068 14
	1973.48 6	0.054 11
	2313.69[a] 23	0.013[a] 1
	2442.86 19	0.013 1
	2939.54 6	0.067 7
	3296.54 11	0.071 4
	3584.9 3	0.011 1
	3593.5 7	0.007 1
	3715.80 6	0.273 14
3777.09	2006.95 6	0.126 13
	2218.2 3	0.014 1
	2931.07 4	0.130 13
	3340.8 5	0.004 1

Continued on next page (footnotes at end of table)

$^{51}V(n,\gamma)$ E=thermal 1991Mi08 (continued)

$\gamma(^{52}V)$ (continued)

E(level)	Eγ	Iγ
3777.09	3629.06 7	0.066 3
	3754.05 7	0.126 6
	3760.03 12	0.018 1
	3776.78 20	0.012 1
3808.51	1065.77 18	0.023 5
	2038.29 5	0.148 15
	2076.00 7	0.052 5
	2249.39 9	0.034 3
	2962.46 5	0.184 3
	3014.96 7	0.135 7
	3785.48 8	0.042 2
4108.70	2313.69[a] 23	0.013[a] 1
	2529.66 24	0.010 1
	2818.56 18	0.015 2
	3671.83 6	0.128 6
	3967.06 12	0.018 1
	4091.70 15	0.013 1
	4108.59 15	0.018 1
4278.70	1739.95 3	0.009 2
	2109.81 11	0.071 7
	2546.09 20	0.012 1
	3432.46[a] 18	0.010[a] 1
	3484.64 10	0.025 1
	4129.82 18	0.054 3
	4255.08 15	0.021 1
4285.26	1726.14 16	0.014 3
	2706.0 5	0.005 1
	3491.43 9	0.026 1
	4137.30 16	0.014 1
	4267.8 3	0.006 1
	4285.11 8	0.049 2
4419.59	1508.49 10	0.026 5
	1643.77 16	0.022 4
	1860.8 5	0.004 1
	2319.08 9	0.143 14
	2649.13 24	0.009 1
	2660.6 4	0.005 1
	3983.01 12	0.020 1
4483.23	1571.54 19	0.018 4
	1740.0 3	0.009 2
	2382.67 14	0.018 2
	2724.14[a] 20	0.026[a] 3
	2904.14 18	0.011 1
	4046.2 6	0.004 1
	4341.49 10	0.028 1
	4466.00 8	0.072 4
4518.89	1979.96 5	0.060 12
	2417.83[a] 9	0.032[a] 3
	2724.14[a] 20	0.026[a] 3
	2786.63 14	0.015 2
	3725.39 10	0.028 1
	4370.86 13	0.017 1
4609.44	1749.9 4	0.008 2
	1833.75 7	0.033 7
	2070.48 6	0.062 6
	2839.24[a] 20	0.027[a] 3
	2876.4 3	0.007 1
	3815.21 22	0.008 1
	4461.18 19	0.011 1
	4586.63 10	0.026 1
4755.02	1695.74 14	0.019 4
	2586.54 19	0.014 1
	3022.76 22	0.012 1
4755.02	4317.9 4	0.005 1
	4606.74 20	0.009 1
5038.88	1853.8 5	0.008 2
	2213.96 21	0.017 2
	3479.85 21	0.014 1
	4192.79 7	0.200 10
	5015.81 12	0.047 2
	5038.80 16	0.016 1
7311.24	2272.33 6	0.26 3
	2556.22 7	0.047 5
	2701.76 6	0.069 7
	2792.31 5	0.111 11
	2827.89 6	0.171 17
	2891.23 4	0.202 20
	3025.83 7	0.138 7
	3032.99 6	0.266 13
	3202.37 6	0.161 8
	3502.68 7	0.69 4
	3534.13 6	0.54 3
	3578.05 6	0.76 4
	3581.53 6	0.192 10
	3666.17 8	0.035 2
	3735.27 7	0.313 16
	3772.71 7	0.299 15
	3837.33 6	0.192 10
	3861.22 7	0.197 10
	3977.69 7	0.197 10
	3995.91 8	0.040 2
	4112.03 8	0.069 3
	4116.92 8	1.88 9
	4126.65 7	0.133 7
	4251.56 7	0.182 9
	4301.87 8	0.138 7
	4323.70 7	0.179 9
	4399.4 3	0.018 1
	4452.19 7	1.13 6
	4486.48 7	0.350 18
	4535.29 7	0.164 8
	4567.95 7	0.219 11
	4751.67 8	0.077 4
	4771.94 8	0.333 17
	4883.30 8	1.41 7
	4992.91 8	0.73 4
	5142.28 8	3.86 19
	5210.07 8	4.81 24
	5515.76 9	7.9 4
	5540.74 16	0.048 2
	5551.21 9	0.55 3
	5578.31 9	0.428 21
	5731.70 9	0.115 6
	5752.03 9	7.5 4
	5892.05 9	2.45 12
	6464.84 10	8.96 45
	6517.26 10	16.5 8
	6874.12 11	10.4 5
	7162.84 11	12.7 6
	7287.89 11	1.26 6
	7293.54 11	2.07 10
	7310.66 11	5.02 25

Footnotes continued on next page

^{51}V(n,γ) E=thermal 1991Mi08 (continued)

γ(^{52}V) (continued)

† From 1969Ra10.
‡ From 1966Va03.
§ From 1967Ar08.
# Photons per 100 n–captures in ^{51}V, obtained by normalizing to the Iγ=100 for the 1434γ in ^{52}Cr (Iγ(1434)=100% of ^{52}V g.s. decays). Uncertainties≈15–20%.
@ Photons per 100 n–captures in natural V from 1969Ra10. These numbers have not been corrected to photons per 100 captures in ^{51}V since the difference (≈4%) is statistically insignificant. It should be noted that Iγ(1443) (^{52}Cr) is given by 1969Ra10 as 69 *14*. Under equilibrium conditions this number should be ≈100 (see above). There is, however, no evidence of systematic ≈45% discrepancies among the Iγ data of 1969Ra10 and those of other work; thus, no effort has been made to correct for this ≈2 standard deviation anomaly. Uncertainties are reported as ≈±15%.
& 1967Ar08 report Iγ=0.6 *1* for Eγ=756.0 *5*.
a Multiply placed; undivided intensity given.
x γ ray not placed in level scheme.

^{51}V(n,γ) E=0.75–11.3 MeV 2000Ab40

E=0.75–11.3 MeV. White neutron source and standard tof.

^{52}V Levels

E(level)	Γ
8200	3.7 keV *4*
8620	3.3 keV *4*
9600	11.7 keV *12*

^{51}V(d,p) 1965Ca09,1960En07,1960Da02

Target Jπ=7/2–.
1965Ca09: E=10.1 MeV, magnetic spectrograph, 5 to 175 .
1960En07: E=7.5 MeV, multiple–gap spectrograph, 10 to 130 .
1960Da02: E=8.9 MeV, energy spectra of the proton recorded by photographic emulsions, 5 and 70 , magnetic spectrograph.
Others: 1964Bj01, 1958El42, 1953Sc56.
All data are from 1965Ca09, except as noted.

^{52}V Levels

E(level)	L#	(2J+1)S@
0.0	1	100
20 *9*	1	325
145 *9*	1	90
431 *11*	1	13
787 *12*	1	60
838 *12*	1	99
881 *14*		
1277 *18*		
1417 *10*	1	21
1492 *10*	1+3	0.5+14.3
1557‡ *10*	1	≈100
1580‡ *10*	1	≈10
1660 *12*		
1729 *12*	(0)	1.5
1756 *12*	1+3	2.5+17.5
1792 *12*	1	14
1843 *12*	3	14.5
2097 *12*	1	34
2143 *13*	3	77
2166 *13*	1	22
2321 *12*	1	21
2347†		
2432 *13*	1	19
2473 *13*		
2541 *12*	1	19
2563†		
2781 *12*	1	7
2823†		
2865 *13*	1	15
2913 *11*	1	1.7
3011 *13*	1	9
3063 *13*	1	31
3194 *14*	1	33
3238 *13*	1+3	1.5+22
3314 *13*	1	17
3436 *14*	2	2.6
3480 *13*	1	5
3509 *13*	2	6.5
3548 *14*		
3586 *15*	1	4.7
3657 *15*	1	3
3740§ *10*	1	
3960§ *10*	1	
4320§		
4430§ *20*	2	

† Level reported by 1960En07 only. Level energies given by 1960En07 are consistently 10–20 keV less than those of 1965Ca09 in this excitation region.
‡ Not resolved at forward angles.

Footnotes continued on next page

^{51}V(d,p) 1965Ca09,1960En07,1960Da02 (continued)

^{52}V Levels (continued)

§ Level reported by 1960Da02.
# From DWBA analysis (1965Ca09).
@ Relative (2J+1)S. See 1965Ca09 for details.

^{51}V(t,d) 1987Ka40

Target Jπ=7/2−.
E=33 MeV, total energy resolution 65 keV, measured E(d), σ(θ), DWBA analysis.

^{52}V Levels

E(level)	L	$C^2S'=C^2S(2J_f+1)/(2J_i+1)$
20 *10*	1	1.60
150 *10*	1	0.42
437 *10*	1	0.10
830 *10*	1	0.64
1305 *10*	1+3	0.016+0.03 *2*
1436 *10*	1	0.11
1569 *10*	1	0.27
1665 *10*	3	0.11
1775† *10*	1+3	0.16+0.61
1844 *10*	1	0.056
2104 *10*	1+3	0.23+0.26
2155 *10*	3	0.91
2317 *10*	1+3	0.10+0.12
2438 *10*	1+3	0.08+0.22
2533 *10*	1+3	0.072+0.18
2768 *10*	1	0.05
2848 *10*	3	0.11
3058 *10*	1	0.11
3194 *10*	1+3	0.16+0.24
3287 *10*	1	0.12
3479 *10*	1+3	0.072+0.16
3549 *10*	4	0.42
3684 *10*	4	0.29
3769 *10*	4	0.90
3867 *10*	3	0.30
3940 *10*	4	0.20
4034 *10*	4	0.32
4120 *10*	4	0.34
4307 *10*	4	1.18
4429 *10*	1+3	0.22+0.18
4533 *10*	4	0.33
4609 *10*	3	0.11
4715 *10*	3	0.33
4772 *10*	1	0.10
4902 *10*	3	0.24
4980 *10*	1+3	0.26+0.14
5085 *10*	4	0.20
5187 *10*	4	0.38
5277 *10*	1	0.40
5337 *10*	1	0.22
5480 *10*	1	0.29
5548 *10*	4	0.26
5646 *10*	1	0.18
5744 *10*	3	0.22
5845 *10*	3	0.33
5951 *10*	3	0.18
6087 *10*	3	0.17
6166 *10*	1+3	0.05+0.05
6270 *10*	1	0.13
6403 *10*	1+3	0.04+0.032
6517 *10*	3	0.12
6890 *25*		
7110 *25*		
7320 *25*		
7540 *25*		
7850 *25*		
8050 *25*		
8250 *25*		
8400 *25*		
8760 *25*		
9060 *25*		
9310 *25*		
9510 *25*		
10080 *25*		
10650 *25*		

† Authors' value of 1755 in their table is a misprint, see authors' text.

Adopted Levels, Gammas

Q(β⁻)=–4711.5 *19*; S(n)=12039.4 *10*; S(p)=10504.5 *10*; Q(α)=–9354.1 *10* 2003Au03.
Other reactions: ^{48}Ti(α,γ) E=6–12 MeV, 1976Fo04; ^{48}Ti(^{16}O,^{12}C) E=120 MeV (1979Da07); ^{53}Cr(^{12}C,^{13}C) E=18.5–33 MeV (1974PaZZ); ^{54}Fe(^{18}O,^{20}Ne) E=48,50 MeV (1972SiYD,1975PeZM).

^{52}Cr Levels

Cross Reference (XREF) Flags

A ^{52}V β⁻ Decay (3.743 min)
B ^{52}Mn ε Decay (5.591 d)
C ^{52}Mn ε Decay (21.1 min)
D (HI,xnγ)
E ^{50}Ti(^{3}He,n)
F ^{52}Cr(p,p'γ)
G ^{52}Cr(p,p')
H ^{50}Cr(t,p)
I ^{51}V(p,γ) E=res: IAR
J ^{51}V(^{3}He,d)
K ^{51}V(^{3}He,dγ)
L ^{55}Mn(p,α)
M ^{52}Cr(γ,γ'),(pol γ,γ')
N ^{52}Cr(e,e')
O Others:
^{52}Cr(π⁺,π⁺),(π⁺,π⁺')
^{52}Cr(n,n')
^{52}Cr(n,n'γ)
^{50}V(α,d)
^{50}Ti(^{16}O,^{14}C)
^{52}Cr(d,d')
^{52}Cr(^{3}He,^{3}He')
^{52}Cr(α,α')
^{52}Cr(^{7}Li,^{7}Li')
^{52}Cr(^{12}C,^{12}C'),(^{13}C,^{13}C')
^{52}Cr(^{16}O,^{16}O'),(^{18}O,^{18}O')
Coulomb Excitation
^{50}Cr(α,^{2}He)
^{53}Cr(p,d)
^{53}Cr(d,t),(pol d,t)
^{53}Cr(^{3}He,α)
^{54}Cr(p,t)
^{55}Mn(⁻,3nγ)
^{51}V(α,t)
^{56}Fe(d,^{6}Li)
Ni(K⁻,Xγ),(π⁺,Xγ),(π⁻,Xγ)

E(level)†	Jπ	XREF	$T_{1/2}$ l	Comments
0.0	0+	ABCDEFGHIJKLMNO	stable	rms charge radius=3.6424 fm *21* (2004An14). others: rms charge radius=3.61 fm *8*, muonic x–ray (1962Jo05), rms charge radius=3.674 fm *15* (1976Li19) (e,e').
1434.094 *14*	2+	ABCDEFGHIJKLMNO	0.793 ps *2*	Jπ: E2 γ to 0+. $T_{1/2}$: from 2000Er01. Other: 0.71 ps *3* (1987Ra01). =+3.0 *5* (1989Ra17); Q=–0.14 *8* (1975To06). Q=–0.082 *16* (1989Ra17); g=1.206 *64* (2000Er01).
2369.633 *18*	4+	ABCD FG IJKL NO	1.04 ps^{m} *+35–17*	Jπ: L(α,α')=4. B(E4)↑=0.00066 *8*. B(E4)↑: from weighted average of 0.00067 *12* in (e,e') and 0.00066 *10* in (π⁺,π⁺),(π⁺,π⁺'). $T_{1/2}$: other: 9.4 ps *+24–16*, DSAM (HI,xnγ). XREF: K(2368)L(2371)O(2372)O(2380).
2646.9 *6*	0+	A FGH L NO		Jπ: L(e,e')=0. XREF: H(2660)L(2650)N(2650)O(2650)O(2640)O(2650)O(2640)O(2650).
2767.770 *21*	4+	ABCD FG IJKL NO	1.9 ps *5*	Jπ: L(α,α')=4. $T_{1/2}$: DSAM, from weighted average of values 1.4 ps *+5–3* (^{3}He,dγ) and 2.5 ps *6* (HI,xnγ). XREF: N(2770)O(2770)O(2770)O(2770)O(2780)O(2770).
2964.790 *17*	2+	A C FGHIJKL NO	0.42 ps *8*	Jπ: E2 γ to 0+. $T_{1/2}$: from (p,p'γ). Others: 0.47 ps *+22–13*, DSAM (^{3}He,dγ), 31 fs *4* (n.n'γ). XREF: H(2974)N(2970)O(2960).
3113.865 *21*	6+	B D G IJKL NO	41.4 ps *14*	Jπ: L(p,p')=6, E2 γ to 4+. $T_{1/2}$: DSAM. Other: >1.8 ps (^{3}He,dγ), DSAM. XREF: N(3110)O(3110)O(3110)O(3110)O(3110).
3161.74 *6*	2+	A C FGHI KLMNO	0.066 ps *14*	Jπ: L(α,α')=2. $T_{1/2}$: from adopted B(E2). Others: 0.08 ps *+4–3* (^{3}He,dγ), 33 fs *5* (p,p'γ). B(E2)↑=0.00124 *23*. B(E2)↑: (e,e'). XREF: H(3175)O(3168).
3415.32 *3*	4+	AB D FG IJKL O	0.26 ps *7*	Jπ: L(p,p')=4. $T_{1/2}$: from weighted average of values 0.22 ps *+8–5* (^{3}He,dγ) and 0.33 ps *9* (HI,xnγ). XREF: J(3420)O(3420)O(3432)O(3418).

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{52}Cr Levels (continued)

E(level)[†]	Jπ	XREF	$T_{1/2}$[l]	Comments
3472.25 *14*	3+	A CD FG I KL O	7.2 ps *8*	Jπ: 1968Mo19 propose the existence of two levels in this vicinity separated by 3.0 keV, one decaying by 703γ and having a spin of 3, 5 (from p,p'γ(θ)), and another with spin 2 decaying by 2038γ. Subsequent work (1977Ya08, 1974Br04) shows that a single level at 3472.2 emits two γ's (704.6 (78%) and 2038.0 (22%)) and suggests that the two–level hypothesis was a result of an error in the energy assigned to the 704γ by 1968Mo19. Furthermore, the p,p'γ(θ) data on the 2038γ (1968Mo19) were found to be consistent with 3. $T_{1/2}$, together with L in transfer, suggest π=+. One further complication is the assignment of L=4 to the level by 1970Pr08 in (p,p'). L(p,p')=2+3. Thus existence of a Jπ=4+ level at 3472 is tentatively ruled out. $T_{1/2}$: RDM. Other: >1.9 ps (^{3}He,dγ), DSAM. XREF: O(3440)O(3450)O(3494)O(3460)O(3440).
3615.929 *22*	5+	B D G IJKL O	2.6 ps *12*	Jπ: log *ft*=6.15 from 6+, γ(θ) in (HI,xnγ); π from L(^{3}He,d)=1. XREF: J(3620)L(3619). $T_{1/2}$: from 1.4 ps<$T_{1/2}$<3.8 ps, lower limit, DSAM; upper, RDM. Other: >0.76 ps in (^{3}He,dγ).
3739.6[&]	1+,1–,2+	M		Jπ: From (γ,γ') (1998En05), based on values of reduced transition strengths(UP). B(M1)↑=0.008 *1*; B(E1)↑=0.0000009 *1*; B(E2)↑=0.0015 *2* (1998En05).
3771.72 *14*	2+	A C EFGH JKLMNO	10.9 fs *13*	Jπ: L(α,α')=2, L(^{3}He,d)=1. B(E2)↑=0.0076 *11* (1998En05). XREF: E(3700)H(3781)O(3780)O(3780)O(3767)O(3800)O(3800). $T_{1/2}$: from weighted average of values 11.1 fs *14* (n,n'γ) and 9 fs *4* (p,p'γ). Other: 7.7 fs *17* from B(E2)=0.0099 *4*. The B(E2) from weighted average of 0.0101 *5* (e,e') and 0.0095 *7* in (π^+,π^+),($\pi^+,\pi^{+'}$). Other: 0.14 ps *1* (e,e').
3948.5[d] *6*	2+	C Gh JKL O	33 fs[n] *6*	XREF: h(3957)O(3926). Jπ: L(p,p')=2,. $T_{1/2}$: other: 0.10 ps *+4–3* (^{3}He,dγ).
4015.51 *3*	5+	B D G IJKL O	0.61 ps *+27–19*	Jπ: log *ft*=6.625 from 6+, π from L(^{3}He,d)=1. $T_{1/2}$: from weighted average of values 0.58 ps *+32–19* (^{3}He,dγ) and 0.7 ps *5* (HI,xnγ). XREF: J(4020)O(4017).
4039.2 *6*	4+	D G IJKL NO	26 fs[n] *4*	Jπ: L(p,p')=L(α,α')=4. $T_{1/2}$: other: 0.51 ps *+25–14* (^{3}He,dγ). XREF: J(4033)O(4010)O(4030).
4100[b] *100*	3–	O		XREF: O(4200)O(4090). Jπ: L(n,n')=3.
4470	3–	O		E(level): from (^{3}He,^{3}He'). Jπ: L(^{3}He,^{3}He')=3.
4563.0 *8*	3–	C GH JKL NO	40 fs[n] *6*	Jπ: L(α,α')=3. $T_{1/2}$: other: 0.27 ps *+12–6* (^{3}He,dγ). XREF: H(4572)O(4600)O(4560). B(E3)↑=0.0066 *3*. B(E3) from weighted average of values 0.0065 *4* in (e,e') and 0.0068 *5* in (π^+,π^+),($\pi^+,\pi^{+'}$).
4611	(3,4)+	I O		Jπ: L(^{3}He,α)=3 on 3/2–. XREF: O(4605).
4627.32 *19*	4+	B G J L O		Jπ: L(p,p')=4. XREF: G(4630)L(4630)O(4630)O(4680).
4702 *5*	2+	E G J L O		Jπ: L(^{3}He,n)=2. XREF: E(4710)L(4706)O(4710).
4730	4+	J O		Jπ: L(α,α')=4. L(^{3}He,d)=1.
4742.3 *11*	2+	GHI L O		Jπ: L(t,p)=0. XREF: G(4738)H(4745).

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Adopted Levels, Gammas (continued)

^{52}Cr Levels (continued)

E(level)[†]	Jπ	XREF	$T_{1/2}$[l]	Comments
4750.32 *20*	8+	D O	0.64 ps *+20–17*	Jπ: γ(θ) in (HI,xnγ), E2 γ to 6+. XREF: O(4770).
4800.1[&]	1+,1–,2+	M		Jπ: From (γ,γ') (1998En05), based on values of reduced transition strengths(UP). B(M1)↑=0.009 *2*; B(E1)↑=0.0000010 *2*; B(E2)↑=0.00105 *20* (1998En05).
4806.19 *23*	(6+)	D G I L O	0.49 ps *+28–14*	Jπ: L(α,^{2}He)=4,6, γ(θ) in (HI,xnγ), M1+E2 γ to 5+. XREF: I(4808)L(4808)O(4770).
4815.70 *9*	1+,2+	C o		Jπ: log *ft*=5.55 from 2+, γ to 0+. XREF: o(4830).
4841.3[&] *11*	1+,1–,2+	G IJ LM o		XREF: G(4832)o(4830). B(M1)↑=0.011 *2*; B(E1)↑=0.00000126 *23*; B(E2)↑=0.00131 *24* (1998En05). Jπ: From (γ,γ') (1998En05), based on values of reduced transition strengths(UP).
4951 *4*	4+	G L O		Jπ: L(p,p')=4. XREF: L(4950)O(4980).
5054.3 *11*	4+	I O		Jπ: L(α,α')=4. XREF: O(5070).
5097.4 *11*	2+	G IJ LM O		Jπ: L(^{3}He,d)=1, excitation in (γ,γ'). XREF: J(5101)O(5070)O(5120).
5139 *5*	(6+)	G J L		Jπ: L(p,p')=5,6, L(^{3}He,d)=(3) from 7/2–.
5211 *4*		G L O		
5285 *5*	(4)–	G J L		Jπ: L(^{3}He,d)=0 from 7/2–. XREF: L(5281).
5346 *4*	4+,6+	G L O		Jπ: L(α,^{2}He)=4,6. XREF: O(5320).
5397.0 *3*	(7+)	D	0.14 ps *+12–9*	Jπ: L(^{3}He,α)=(1), M1+E2 γ to (6+).
5410 *4*	(2+)	GH j L O		Jπ: L(t,p)=(2). L(^{3}He,d)=1 for E=5420. XREF: H(5423)j(5420)O(5400).
5425 *5*	4+	G j L		Jπ: L(p,p')=4. XREF: j(5420)L(5422).
5432 *6*		G		
5446.4 *5*	4+	HIJ L O		Jπ: L(α,α')=4. XREF: H(5443)J(5450)L(5450)O(5450)O(5450).
5490.8[&]	1+,1–,2+	g LM		XREF: g(5494). B(M1)↑=0.008 *2*; B(E1)↑=0.0000009 *3*; B(E2)↑=0.00074 *20* (1998En05). Jπ: From (γ,γ') (1998En05), based on values of reduced transition strengths(UP).
5500[a]	3–	g N		XREF: g(5494). B(E3)↑=0.0013 *3* (1964Be32). Jπ: L(e,e')=3.
5541 *5*	4+	G L		Jπ: L(p,p')=4. XREF: L(5538).
5544.4[&]	(1+)	G LM O		B(M1)↑=0.19 *4*. Jπ: L(^{3}He,α)=(1). XREF: O(5560).
5563.5 *8*	+	G I L		Jπ: L(p,p')=5,6, L(^{3}He,d)=1 from 7/2–. XREF: G(5569)L(5571).
5584 *6*	+	G J L		Jπ: L(^{3}He,d)=1. XREF: J(5594).
5600[§] *15*	0+	e H		Jπ: L(t,p)=0. XREF: e(5650).
5664.4 *11*	(2)+	e G IJ L O		Jπ: L(p,p')=2. L(^{3}He,d)=1+3 from 7/2–. XREF: G(5661)J(5660)O(5640)O(5670).
5725.3 *12*	+	G IJ L O		Jπ: L(^{3}He,α)=3 from 3/2–. L(p,p')=5,6. XREF: G(5727)J(5720)O(5700)O(5710).
5737.5 *11*	(4+)	G I		Jπ: L(p,p')=(4).
5755[§] *15*	2+ to 5+	e H j		Jπ: L(t,p)=0. But L(^{3}He,d)=1 from 7/2–. XREF: e(5650)j(5751).

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Adopted Levels, Gammas (continued)

^{52}Cr Levels (continued)

E(level)[†]	Jπ	XREF	$T_{1/2}$[l]	Comments
5796.0[&]	1+,2+	G J LM		Jπ: from (γ,γ'),pol(γ,γ'), L(^{3}He,d)=1+3 from 7/2−. XREF: J(5790).
5811 *5*	5,6+	G		Jπ: L(p,p')=5,6.
5818 *6*		G		
5824.8 *4*	(8+)	D	1.0 ps *+6−4*	Jπ: γ(θ) in (HI,xnγ), M1+E2 γ to (7+).
5860.5 *11*		G IJ O		XREF: G(5853)J(5828)O(5830).
5865 *6*		G		
5873 *5*	3−	G		Jπ: L(p,p')=3.
5891[@]	3−,4−	J O		Jπ: L(^{3}He,d)=0 from 7/2−. XREF: O(5910).
5919 *5*	5,6+	G		Jπ: L(p,p')=5,6.
5953 *5*	2+	G J O		Jπ: L(p,p')=2. XREF: J(5945).
5960 *5*		G		
5996 *5*	3−	G J L O		Jπ: L(p,p')=3. XREF: J(5992)O(5990).
6026 *6*	+	GH J		Jπ: L(^{3}He,d)=1 from 7/2−.
6035.3 *12*		G I		
6055 *5*	2+	G		Jπ: L(p,p')=2.
6065 *7*		GH		XREF: H(6069).
6106 *6*	0+	E G J O		Jπ: L(^{3}He,n)=0. XREF: E(6100)J(6089)O(6130).
6136.7[&]	2+	G M		B(E2)↑≤0.0030 *11*. Jπ: L(p,p')=2. Excitation in (γ,γ').
6153 *8*	2+	GH		Jπ: L(t,p)=2.
6164 *12*	3−	G O		Jπ: L(α,α')=3. XREF: O(6160).
6175 *7*	2+	G O		Jπ: L(p,p')=2. XREF: O(6180).
6193 *6*	+	G J		Jπ: L(^{3}He,d)=1.
6205.4 *12*		G I		
6210 *10*		G		
6220 *6*		G		
6233 *10*	+	G J		Jπ: L(^{3}He,d)=1 from 7/2−.
6243 *5*	3−	G		Jπ: L(p,p')=3.
6252 *6*		G		
6272 *6*		G		
6293 *7*		G		
6324 *10*		G O		XREF: O(6330).
6349 *5*	+	G J		Jπ: L(^{3}He,d)=1. XREF: J(6364).
6365.3 *11*	≥8+	D		Jπ: γ(θ) in (HI,xnγ).
6375.4 *12*		G I		XREF: G(6372).
6389.5 *11*	+	IJ		Jπ: L(^{3}He,d)=1 from 7/2−.
6392 *10*	3−	G		Jπ: L(p,p')=3.
6426 *5*		G		
6437 *10*		G		
6453.4 *4*	9+	D	0.14 ps *+9−8*	Jπ: γ(θ) in (HI,xnγ), M1+E2 γ to (8+).
6459.6[&]	1+,1−,2+	G M		B(M1)↑=0.044 *25*; B(E1)↑=0.0000049 *28*; B(E2)↑=0.0029 *16* (1998En05). Jπ: From ^{52}Cr(γ,γ'), based on values of reduced transition strengths(UP).
6482 *5*	5,6+	G		Jπ: L(p,p')=5,6.
6493.8[&]	2+	G J M O	0.678 ps *13*	Jπ: L(p,p')=2. L(^{3}He,α)=0. $T_{1/2}$: from (γ,γ'). B(E2)↑=0.0687 *13*. B(E2)↑: From (γ,γ'). XREF: J(6500)O(6490).
6541 *10*		G		
6568 *10*		G		
6580 *5*	3−	G J NO		Jπ: L(α,α')=3. XREF: J(6610)N(6600)O(6540). B(E3)↑=0.0022 *3* (1964Be32).

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Adopted Levels, Gammas (continued)

^{52}Cr Levels (continued)

E(level)[†]	Jπ	XREF	$T_{1/2}$[l]	Comments
6637 5		G J		XREF: J(6625).
6678 5	+	E G J		Jπ: L(^{3}He,n)=0, L(^{3}He,d)=1 from 7/2–. XREF: E(6670).
6700[f] 20	–	O		Jπ: L(^{3}He,α)=2 from 3/2–.
6704 5	5,6+	G J		Jπ: L(p,p')=5. XREF: J(6720).
6760[e]	+	J O		Jπ: L(^{3}He,d)=1+3 from 7/2–. XREF: O(6740).
6795.4 12	3–	G I O		Jπ: L(p,p')=3. XREF: G(6786).
6810 30	2+	G J O		Jπ: L(p,p')=2. XREF: J(6814)O(6800)O(6790).
6871 5	5–	G		Jπ: L(p,p')=5.
6894[@]	+	J		Jπ: L(^{3}He,d)=1 from 7/2–.
6928[@]	+	J		Jπ: L(^{3}He,d)=1 from 7/2–.
6956 5	5,6+	G		Jπ: L(p,p')=5,6.
6993 5	3–	G J O		Jπ: L(p,p')=3.
7030[a] 10	1+	J N		Jπ: M1, (E1) excitation in (e,e'). L(^{3}He,d)=1. XREF: J(6993).
7080 10	+	G J		Jπ: L(^{3}He,d)=1.
7100	3–	NO		Jπ: L(α,α')=3. B(E3)↑=0.0028 3 (1964Be32).
7140[h] 7	+	G N		Jπ: M1 excitation in (e,e'). L(p,p')=4.
7170[a] 10	+	J N		XREF: J(7165). Jπ: M1 excitation in (e,e'). L(^{3}He,d)=1.
7217 10	2+	G J		Jπ: L(p,p')=2. XREF: J(7210).
7223[@]	+	J		Jπ: L(^{3}He,d)=1 from 7/2–.
7237.9 7	10+	D	0.16 ps +15–8	Jπ: From M1+E2 γ to 9+.
7260[a] 10	+	J N		Jπ: L(^{3}He,d)=1+3 from 7/2–, but M1, (M2) excitation in (e,e').
7278 10	4+	G J O		Jπ: L(p,p')=4. XREF: J(7273)O(7290).
7310[@]	+	J		Jπ: L(^{3}He,d)=1+3 from 7/2–.
7322[@]	+	J		Jπ: L(^{3}He,d)=1 from 7/2–.
7342[h] 7	1+	G J N		Jπ: M1 excitation in (e,e'). L(p,p')=2. XREF: J(7350)N(7340).
7359	+	J		Jπ: L(^{3}He,d)=1 from 7/2–.
7376 10	5–	G		Jπ: L(p,p')=5.
7395 10	+	J O		Jπ: L(α,^{2}He)=5,7, L(^{3}He,d)=1. XREF: J(7400)O(7390). E(level): From average of values in (^{3}He,d) and (α,^{2}He).
7409 10	3–	G O		Jπ: L(p,p')=3.
7450[‡g] 50	0+,2+	E		Jπ: L(^{3}He,n)=0+2.
7458 10	5,6+	G		Jπ: L(p,p')=5,6.
7482 10	3–	G		Jπ: L(p,p')=3.
7487	+	J		Jπ: L(^{3}He,d)=1 from 7/2–.
7524[h] 3	1+[i]	g j MN	0.47 fs 11	$T_{1/2}$: from $\Gamma^2_{\gamma0}/\Gamma$ in (γ,γ') and assumption that $\Gamma_{\gamma0}/\Gamma$=1. Value should thus be considered as an upper limit. XREF: N(7520). Jπ: L(^{3}He,d)=1 from 7/2–, L(p,p')=0.
7560[a] 20	+	g j NO		Jπ: from M1, M2 excitation in (e,e'). L(^{3}He,d)=1 from 7/2–. XREF: g(7540)j(7536)O(7570).
7585 10	3–	G		Jπ: L(p,p')=3.
7590	+	J		Jπ: L(^{3}He,d)=1+3 from 7/2–.
7679 10	5,6+	G J		Jπ: L(p,p')=5,6, L(^{3}He,d)=1+3 from 7/2–. XREF: J(7686).
7700[a] 10	1+	N		Jπ: M1 excitation in (e,e').
7730[&] 2	1+[i]	J M		Jπ: PI from L(^{3}He,d)=1 from 7/2–.
7738 10	3–	G		Jπ: L(p,p')=3.
7750	+	J O		Jπ: L(^{3}He,d)=1 from 7/2–, L(α,^{2}He)=5,7. XREF: J(7729).
7760[@]	+	J		Jπ: L(^{3}He,d)=1 from 7/2–.

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Adopted Levels, Gammas (continued)

^{52}Cr Levels (continued)

E(level)[†]	Jπ	XREF	$T_{1/2}$[l]	Comments
7810[b]	−	O		Jπ: L(α,t)=4.
7820 *10*	1+	G J		Jπ: M1 excitation in (e,e'). XREF: J(7815).
7823[h] *10*	3−	G		Jπ: L(p,p')=3.
7854[h] *7*	+	G J NO		Jπ: L(p,p')=4. M1, (M2) excitation in (e,e'), L(^{3}He,d)=1. XREF: G(7848)N(7860)O(7870).
7893 *10*	4+	G J		Jπ: L(p,p')=4. L(^{3}He,d)=1 from 7/2−. XREF: J(7905).
7896[&] *2*	1[i]	M		
7900[a]	3−	NO		Jπ: L(e,e')=3. B(E3)↑=0.0028 *3* (1964Be32).
7920[@]	+	J		Jπ: L(^{3}He,d)=1 from 7/2−.
7930[‡] *50*	+	E J		Jπ: L(^{3}He,n)=0, L(^{3}He,d)=1 from 7/2−. XREF: J(7967).
7967 *10*	3−	G		Jπ: L(p,p')=3.
8010	+	G J O		Jπ: L(^{3}He,d)=1 from 7/2−, L(α,t)=4 from 7/2−. XREF: J(7967).
8022 *10*	2+	G J		Jπ: L(p,p')=2 and L(^{3}He,d)=1.
8083	+	J MN		Jπ: L(^{3}He,d)=1 from 7/2−. XREF: N(8080).
8087[h] *9*	3−	G		Jπ: L(p,p')=3.
8100[&] *20*	8−	N		Jπ: M8 excitation in (e.e').
8121 *10*	+	G J		Jπ: L(^{3}He,d)=1, L(p,p')=0. XREF: J(8130).
8181 *10*	+	G J O		Jπ: L(^{3}He,d)=1, L(p,p')=0. XREF: J(8183).
8190[b]	−	O		Jπ: L(α,t)=4.
8213 *10*	0+	G		Jπ: L(p,p')=0.
8216.5 *9*	(11)	D J	0.24 ps *+17−9*	Jπ: from (HI,xnγ). XREF: J(8234).
8234		J		
8250[@]	+	J		Jπ: L(^{3}He,d)=1+3 from 7/2−.
8281[d] *10*	3−	G		Jπ: L(p,p')=3.
8283	+	J		Jπ: L(^{3}He,d)=1 from 7/2−.
8337[d] *10*	(4+)	G J		Jπ: L(p,p')=4,5, L(^{3}He,d)=1+3 from 7/2−. XREF: J(8330).
8350[@]	+	J		Jπ: L(^{3}He,d)=1 from 7/2−.
8374[d] *10*	3−	G		Jπ: L(p,p')=3.
8390[a] *10*	+	J N		Jπ: L(^{3}He,d)=1 from 7/2−. M1 excitation in (e,e'). XREF: J(8371).
8412[d] *10*	+	G J O		Jπ: L(^{3}He,d)=1. L(p,p')=0. XREF: J(8400).
8420[b]	6−	NO		Jπ: L(α,t)=4, M6 excitation in (e,e'). XREF: N(8450).
8451[@]	+	J		Jπ: L(^{3}He,d)=1.
8457 *10*	3−	G		Jπ: L(p,p')=3.
8505 *10*	3−	G		Jπ: L(p,p')=3.
8569 *10*	0+	G J O		Jπ: L(p,p')=0. XREF: J(8579)O(8580).
8600[a] *10*	3−	N		Jπ: L(e,e')=3. B(E3)↑=0.0022 *3* (1964Be32).
8617 *10*		G J		Jπ: L(p,p')=2,3,4. L(^{3}He,d)=1+3. XREF: J(8614).
8679[d] *10*	3−	G		Jπ: L(p,p')=3.
8710[‡g] *50*	+	E J N		Jπ: L(^{3}He,n)=0+2. L(^{3}He,d)=1+3 from 7/2−, D, E2 excitation in (e,e'). XREF: J(8700)N(8690).
8728 *10*	3−	G		Jπ: L(p,p')=3.
8778 *10*	3−	G		Jπ: L(p,p')=3.
8790 *10*	2	N		Jπ: Q excitation in (e,e').
8827 *10*		G		
8860 *10*	1+,2−	N		Jπ: M1,(M2) excitation in (e,e').
8890 *20*	1+,2−	NO		Jπ: M1,(M2) excitation in (e,e').

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Adopted Levels, Gammas (continued)

^{52}Cr Levels (continued)

E(level)†	Jπ	XREF	Comments
8940 *20*	(8−,6−)	N	Jπ: (M8,M6) excitation in (e,e').
9004[h] *9*	1+	G N	Jπ: M1 excitation in (e,e'). L(p,p')=0. XREF: G(9020).
9050[@] *10*	1+,2−	N	Jπ: M1,(M2) excitation in (e,e').
9080 *20*	(8−)	N	Jπ: (M8) excitation in (e,e').
9142.7[&] *6*	1+[i]	G MN	Jπ: M1 excitation in (e,e'). L(p,p')=0, 1+ in (γ,γ'). XREF: N(9140).
9200[#]	5−	O	Jπ: L(α,^{2}He)=5.
9214[&] *2*	1+	G MN	Jπ: M1 excitation in (e,e'). XREF: G(9221)N(9210).
9245[d] *10*	0+	G	Jπ: L(p,p')=0.
9320[h] *9*	1+[j]	G N	Jπ: M1 excitation in (e,e').
9370 *20*	1,2	N	Jπ: M1,M2 excitation in (e,e').
9420 *10*	1+	N	Jπ: M1 excitation in (e,e').
9440[h] *7*	3−	G N	Jπ: L(p,p')=3.
9450 *20*	8−	NO	Jπ: M8 excitation in (e,e'). XREF: O(9480).
9470 *20*	+	N	Jπ: M1, E2 excitation in (e,e').
9580 *10*	0+	E N	Jπ: L(^{3}He,n)=0. But M1,(E1) excitation in (e,e').
9612[h] *9*	1+[j]	G N	XREF: G(9620).
9660 *20*	8−	NO	Jπ: M8 excitation in (e,e'). XREF: O(9630).
9724[h] *9*	1+[j]	G MN	XREF: G(9740)M(9736)N(9720). Jπ: M1 excitation in (e,e').
9787[&] *3*	1[i]	M	
9830 *10*	1+	N	Jπ: M1 excitation in (e,e').
9878[h] *9*	1+[j]	E G N	Jπ: M1 excitation in (e,e'). XREF: E(9870)G(9870)N(9880).
9910 *20*	8−	N	Jπ: M8 excitation in (e,e').
9981[&] *3*	(−)	M	Jπ: π: based on asymmetrics for different g.s. dipole transition, see (γ,γ'),(pol γ,γ').
10008[h] *9*	1+[j]	G N	XREF: G(10000)N(10010).
10110 *20*	(8−)	NO	Jπ: (M8) excitation in (e,e'). XREF: O(10130).
10130 *20*	1,2−	NO	Jπ: D,M2 excitation in (e,e').
10180 *10*	2−	N	Jπ: M2 excitation in (e,e').
10240 *20*	1	N	Jπ: E1, (M1) excitation in (e,e').
10270 *20*	1,(2−)	N	Jπ: D, (M2) excitation in (e,e').
10300 *20*		N	Jπ: M2, M3,E3 excitation in (e,e').
10330 *20*	6−	NO	Jπ: M6 excitation in (e,e'). XREF: O(10280).
10340 *20*	1	N	Jπ: D excitation in (e,e').
10380[h] *14*	1+[j]	G N	Jπ: D excitation in (e,e').
10433[&] *4*	1+	MN	Jπ: M1 excitation in (e,e').
10464 *9*	1+[j]	G N	Jπ: M1 excitation in (e,e'). XREF: G(10480)N(10460).
10500 *20*	1	N	Jπ: D excitation in (e,e').
10510 *20*	(−)	N	Jπ: (M8, M6) excitation in (e,e').
10604[h] *12*	1+[j]	G N	XREF: G(10580)N(10610).
10710 *10*	1	N	Jπ: D excitation in (e,e').
10760 *10*	6+,8+	NO	Jπ: L(α,^{2}He)=6,8. XREF: O(10750).
10790 *9*	1+[j]	G N	Jπ: M1 excitation in (e,e').
10800 *20*	(−)	N	Jπ: (M8,M6) excitation in (e,e').
10820 *10*	1+,(2−)	N	Jπ: M1, (M2) excitation in (e,e').
10927[&] *3*	1+,2−	MN	Jπ: M1, M2 excitation in (e,e'). XREF: N(10920).
10970 *20*	0+[j]	G	Jπ: L(p,p')=0.
11000 *20*	8−	N	Jπ: M8 excitation in (e,e').
11070 *10*	1	N	Jπ: D excitation in (e,e').
11140 *10*	0+[j]	G N	Jπ: L(p,p')=0. XREF: G(11120).
11160 *20*	(1+),2	N	Jπ: (M1), Q excitation in (e,e').

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Adopted Levels, Gammas (continued)

^{52}Cr Levels (continued)

E(level)[†]	Jπ	XREF	Comments
11170 *20*	8−	NO	Jπ: M8 excitation in (e,e'). L(α,t)=4.
11229 *3*		I	
11256.5 *7*		e I	XREF: e(11280).
11264.9 *4*	3+[k]	e I O	XREF: e(11280)O(11260). T=3. IAS (^{52}V g.s.). Some authors identify 11256.5 state as g.s. IAS. However, from a comparison of relative M1 transition rates from 11264.9 state with Gamow–Teller β decay matrix elements for ^{52}V g.s. 1973Fa12 concluded that most of the IAS strength lies in the 11265 state. The 11256 state might still be a fragment of the g.s. IAS.
11270 *20*	8−	NO	Jπ: M8 excitation in (e,e').
11274.6[c] *6*	(5+)[k]	e I	XREF: e(11280). T=3. Identified as fragment of IAS (^{52}V 23 keV).
11291.1[c] *10*		I O	
11330 *20*	(1+),2−	N	Jπ: (M1), M2 excitation in (e,e').
11370 *20*	8−	NO	Jπ: M8 excitation in (e,e'). L(α,t)=4. XREF: O(11350).
11400.0[c] *4*	4+	I	T=3. Identified by 1974Ro44 as IAS (^{52}V 148 keV).
11402[h] *9*	0+,1+	G N	Jπ: M1 excitation in (e,e'). L(p,p')=0. XREF: G(11410)N(11400).
11510 *10*	2−	N	Jπ: M2 excitation in (e,e').
11550 *20*	8−	N	Jπ: M8 excitation in (e,e').
11570 *20*	(1+),2	N	Jπ: (M1),Q excitation in (e,e').
11610 *10*	2	N	Jπ: Q excitation in (e,e').
11656[c] *3*	1+,2−	I N	Jπ: M1, M2 excitation in (e,e'). XREF: N(11650).
11660 *20*	8−	NO	Jπ: M8 excitation in (e,e').
11691.8[c] *4*	2+[k]	I N	T=3. IAS (^{52}V 437 keV).
11713[c] *3*		I	
11725[c] *3*		I	
11745[c] *3*		I	
11765[&] *3*		M	
11770 *20*	8−	NO	Jπ: M8 excitation in (e,e'). XREF: O(11790).
11780 *20*	(1+),2−	N	Jπ: (M1),M2 excitation in (e,e').
11837[&] *3*		M	
11880 *20*	8−	N	Jπ: M8 excitation in (e,e').
11960 *20*	8−	N	Jπ: M8 excitation in (e,e').
12034.8[c] *4*	(8)−	I NO	Jπ: (M8) excitation in (e,e'). L(α,t)=4. XREF: O(12050).
12041.8[c] *4*	3+[k]	I	T=3. IAS (^{52}V 794 keV).
12050	−	O	Jπ: L(α,t)=4.
12099.9 *4*	4+[k]	I	T=3. IAS (^{52}V 846 keV).
12130 *20*	(8−,6−)	N	Jπ: (M8,M6) excitation in (e,e').
12240 *20*	6−	N	Jπ: M6 excitation in (e,e').
12260[#]	6+,8+	O	Jπ: L(α,^{2}He)=6,8.
12500[b]	−	O	Jπ: L(α,t)=4.
12560 *20*	1+[j]	O	
12665[c] *6*	3+	I	T=3. IAS (^{52}V 1419 keV)?
12730 *20*	8−	NO	Jπ: M8 excitation in (e,e'). L(α,t)=4. XREF: O(12700).
12734[c] *6*	7+[k]	I	T=3. IAS (^{52}V 1493 keV)?
12794.8 *7*	4+[k]	I	T=3. IAS (^{52}V 1559 keV)?
12900 *20*	1+[j]	G	

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Adopted Levels, Gammas (continued)

^{52}Cr Levels (continued)

E(level)†	Jπ	XREF	Comments
12977[c] 6	–[k]	I O	Jπ: L(α,t)=4. XREF: O(13010). T=3. IAS (^{52}V 1733 keV)?
12994[c] 6	+[k]	I	IAS (^{52}V 1760 keV)?
13038[c] 6	+[k]	I	IAS (^{52}V 1843 keV)?
13220 20	8–	N	Jπ: M8 excitation in (e,e').
13319[c]		I	
13393[c]	6–	I N	Jπ: M6 excitation in (e,e').
13419[c]	0+	E I	Jπ: L(^{3}He,n)=0. T=3.
13570 20	6–	N	Jπ: M6 excitation in (e,e').
13580[f] 20	(1,2)–	O	Jπ: L(^{3}He,α)=0 from 3/2–.
13630‡ 10	0+	E	Jπ: L(^{3}He,n)=0. T=3. IAS (^{52}V 2396 keV)?
13710 20	6–	N	Jπ: M6 excitation in (e,e').
13950‡ 50		E	
14030 20	6–	N	Jπ: M6 excitation in (e,e').
14110‡ 20	2+	E	Jπ: L(^{3}He,n)=2. T=3. IAS (^{52}V 2881 keV)?
14340 20	6–	N	Jπ: M6 excitation in (e,e').
14430 20	8–	NO	Jπ: M8 excitation in (e,e'). XREF: O(11470).
15270 20	6–	NO	Jπ: M6 excitation in (e,e'). L(α,t)=4. XREF: O(15280).
15482[b] 7	8–	NO	Jπ: M8 excitation in (e,e'). T=3.
16400 20	6–	N	Jπ: M6 excitation in (e,e').
16690 20	(8–)	N	Jπ: (M8) excitation in (e,e').

† Levels connected by gammas are from least squares fit, others from ^{52}Cr(p,p') for E(level)<8830 keV and from ^{52}Cr(e,e') for E(level)>8830 keV, except as noted.
‡ From ^{50}Ti(^{3}He,n).
§ From ^{50}Cr(t,p).
# From ^{50}Cr(α,^{2}He).
@ From ^{51}V(^{3}He,d).
& From ^{52}Cr(γ,γ'),(pol γ,γ').
a From ^{52}Cr(e,e').
b From ^{51}V(α,t).
c From ^{51}V(p,γ).
d From ^{52}Cr(p,p').
e From ^{52}Cr(α,α').
f From ^{53}Cr(^{3}He,α).
g Close doublet; not resolved in (^{3}He,n) tof spectra, but separated in angular distribution procedure.
h From weighted average of values in ^{52}Cr(e,e') and ^{52}Cr(p,p').
i Dipole transition in ^{52}Cr(γ,γ'),(pol γ,γ').
j Based on σ(θ), DWIA calculations in ^{52}Cr(p,p').
k IAS in ^{51}V(p,γ) E=res.
l From (HI,xnγ), DSAM, except as noted.
m From (^{3}He,dγ), DSAM.
n From (n,n'γ).

γ(^{52}Cr)

E(level)	Eγ†	Iγ†	Mult.[b]	Comments
1434.094	1434.068[&] 14	100	E2	B(E2)↓(W.u.)=10.21 3.
2369.633	935.538[&] 11	100	E2	B(E2)↓(W.u.)=66 +11–23.
2646.9	1212.8 6	100	E2	Eγ: from (p,p'γ).
2767.770	398.08[§] 9	1.76 14		Iγ: other: 1.36 17 in ^{52}V β^{-} decay.

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Adopted Levels, Gammas (continued)

γ(^{52}Cr) (continued)

E(level)	Eγ[†]	Iγ[†]	Mult.[b]	δ[b]	Comments
2767.770	1333.649 *17*	100.0 *10*	E2		B(E2)↓(W.u.)=6.0 *16*.
2964.790	1530.67[‡] *1*	100[‡] *4*	M1+E2	−6.25 *15*	B(M1)↓(W.u.)=0.00036 *8*; B(E2)↓(W.u.)=13 *3*.
	2965[‡] *1*	0.9[‡] *6*	E2[§]		B(E2)↓(W.u.)=0.005 *4*.
3113.865	346.02 *4*	1.09 *1*	E2[@]		B(E2)↓(W.u.)=2.58 *9*.
	744.233 *13*	100.0 *4*	E2[@]		B(E2)↓(W.u.)=5.14 *18*.
3161.74	1727.53[‡] *7*	100[‡] *5*	M1+E2	−0.18 *7*	B(M1)↓(W.u.)=0.057 *13*; B(E2)↓(W.u.)=1.4 *11*.
	3161.8[‡] *1*	10.0[‡] *14*	E2		B(E2)↓(W.u.)=0.21 *6*.
3415.32	647.47 *6*	100 *5*	M1+E2	0.22 *8*	B(M1)↓(W.u.)=(0.24 *7*); B(E2)↓(W.u.)=(60 *50*). δ: From (HI,xnγ) (1979St13).
	766.0[§c] *10*				
	1045.73[&] *4*	17 *5*			
	1981.12 *4*	8.5 *8*			Iγ: other: 21 *4* in ^{52}Mn ε decay.
3472.25	704.6[‡] *2*	100[‡] *31*	M1+E2	−0.14 *6*	B(M1)↓(W.u.)=0.007 *3*; B(E2)↓(W.u.)=0.6 *+6−4*.
	2038.0[‡] *2*	28[‡] *3*			
3615.929	200.58 *4*	1.80 *5*			
	502.06 *5*	5.0 *5*			
	848.18 *5*	78.9 *7*			
	1246.278 *15*	100.0 *14*			
3771.72	2337.44[a] *19*	100[‡] *14*	M1+E2	−0.20 *8*	B(M1)↓(W.u.)=0.12 *3*; B(E2)↓(W.u.)=2.0 *16*.
	3771.7[#] *2*	26[‡#] *6*	[E2]		B(E2)↓(W.u.)=1.2 *4*.
3948.5	1578[@]				
	3951[‡] *1*	100[‡]			
4015.51	399.57 *5*	46.9 *18*			Iγ: other: 33.3 *5* in (HI,xnγ).
	600.16 *5*	100 *3*			
	901.89 *18*	11.3 *11*			
	1247.88 *9*	97 *10*			
	1645.82 *4*	12.1 *8*			
4039.2	566.8[#]	100[#]			
4563.0	791[@]				
	3129[‡] *1*				
4627.32	2257.42 *19*	100			
4750.32	1636.4[#] *2*	100[#]	E2[#]		B(E2)↓(W.u.)=6.5 *+18−21*.
4806.19	790.0[#] *3*	100[#] *8*	(M1+E2)[#]	−0.16[#] *5*	B(M1)↓(W.u.)=(0.0613 *10*); B(E2)↓(W.u.)=(6 *4*).
	1189.7[#]	22[#] *4*			
	1693.9[#] *6*	23[#] *3*			
4815.70	3381.5[‡] *1*	100[‡] *20*			
	4815.4[‡] *2*	100[‡] *16*			
5097.4	3664.3		D,Q		Iγ: 0.27 *11* for Jπ=2+. Mult.: from W(130)/W(90)=0.94 *19*.
5397.0	590.9[#] *3*	100[#] *6*	M1+E2[#]	−0.27[#] *6*	B(M1)↓(W.u.)=0.617 *19*; B(E2)↓(W.u.)=290 *120*.
	1381.5[#] *5*	15.2[#] *16*			
5544.4	5544.4		D		Mult.: from W(130)/W(90)=1.89 *41*.
5824.8	427.9[#] *3*	100[#]	M1+E2[#]	−0.03[#] *4*	B(M1)↓(W.u.)=0.2808 *7*; B(E2)↓(W.u.)=3 *+9−3*.
6136.7	6136.6		Q		Mult.: from W(130)/W(90)=0.34 *14*.
6365.3	1615.0[#] *10*	100[#]			
6453.4	628.9[#] *5*	35[#] *18*	M1+E2[#]	+0.22[#] *+15−8*	B(M1)↓(W.u.)=0.131 *9*; B(E2)↓(W.u.)=40 *+50−40*.
	1056.0[#] *10*	26[#] *2*			
	1702.9[#] *5*	100[#] *5*	M1+E2[#]	−0.04[#] *+7−3*	B(M1)↓(W.u.)=0.01975 *11*; B(E2)↓(W.u.)=0.024 *+85−24*.
7237.9	784.5[#] *5*	100[#]	M1+E2[#]	−0.06[#] *+3−5*	
8216.5	978.5[#] *5*	100[#]	D+Q[#]	+0.10[#] *+5−8*	
11256.5	8291	100			
	8488	85			
11264.9	7648	<9			
	7792	<5			
	7850	39 *7*	(M1+E2)	+0.06 *9*	
	8150	25 *9*			
	8299	<5			
	8496	11 *7*			
	8895	100 *16*	(M1+E2)	+0.9 *+10−5*	
	9830	34 *5*	(M1+E2)	−0.30 *6*	
11274.6	4479	72 *12*			
	4899	24 *8*			
	5069	36 *12*			

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Adopted Levels, Gammas (continued)

γ(^{52}Cr) (continued)

E(level)	Eγ†	Iγ†	Mult.b	δb	Comments
11274.6	5239	20 *8*			
	5549	100 *12*			
	7258	60 *12*			
	7326	24 *8*			
	7859	8 *4*	(M1+E2)	+0.47 *10*	
	8904	56 *8*	(M1+E2)	+0.19 *10*	
11291.1	9856	100			
11400.0	5836	61 *5*			
	5953	29 *5*			
	7360				
	7384				
	7783	26 *3*			
	7985	21 *3*			
	8285	5 *3*			
	9030	100 *5*	(M1+E2)	0.5 *2*	δ: from (p,γ), see 1974Ro44.
11691.8	5302	33 *3*			
	6027	23 *3*			
	6245	53 *3*			
	6637	13 *7*			
	6854				
	6883				
	6949	37 *3*			
	7652				
	7676				
	8219	30 *7*			
	8277	7 *3*			
	8529	13 *3*			
	8726	27 *7*			
	8923	10 *3*			
	9322	27 *3*			
	10257	100 *7*			
12034.8	6471	22 *4*			
	6588	22 *4*			
	7404	48 *4*			
	8562	17 *9*			
	8620	100 *9*			
	9069	17 *9*			
	9266	74 *4*			
	9665	78 *4*			
	10600	48 *4*			
12041.8	6595	42 *4*			
	7233	19 *4*			
	8569	46 *4*			
	8627	19 *4*			
	8879	62 *4*			
	9076	7 *4*			
	9273	31 *4*			
	9672	100 *4*			
	10607	54 *4*			

E(level)	Eγ†	Iγ†
12099.9	6239	39 *9*
	6362	39 *9*
	6653	30 *9*
	7002	13 *4*
	7469	30 *4*
	8060	30 *4*
	8084	13 *2*
	8152	22 *4*
	8483	26 *4*
	8627	17 *3*
	8685	52 *9*
	9331	35 *4*
	9730	100 *9*
12794.8	9178	81
	10424	100

† Eγ<4 MeV from ^{52}Mn ε decay (5.591 d), Eγ>4 MeV from ^{51}V(p,γ), except as noted.
‡ From ^{52}Mn ε decay (21.1 min).
§ From ^{52}V β^- decay.
# From (HI,xnγ).
@ From ^{51}V(^{3}He,dγ).
& From weighted average of values in ^{52}Mn ε decay (5.591 d) and ^{52}V β^- decay.
a From weighted average of values in ^{52}Mn ε decay (21.1 min) and ^{52}V β^- decay.
b From γγ(θ) in ^{52}Cr(p,p'γ), except as noted.
c Placement of transition in the level scheme is uncertain.

^{52}V β^- Decay (3.743 min) 1977Ya08

Parent ^{52}V: E=0.0; Jπ=3+; $T_{1/2}$=3.743 min *5*; Q(g.s.)=3975.6 *10*; %β^- decay=100.
^{52}V–J: βγ–circular polarization rules out J(^{52}V)=2 and is consistent with J=3 (1967Bl10).
1977Ya08: chemically separated sources from ^{51}V(n,γ), measured Eγ, Iγ, a Compton suppression spectrometer system, several large volume Ge(Li).
1976Ar13: measured Eγ, Iγ, Ge(Li).
1971Ok03: measured Eγ, Iγ, γγ–coin, Ge(Li).
Decay scheme from 1977Ya08.

^{52}Cr Levels

E(level)	Jπ†	E(level)	Jπ†
0.0	0+	2964.775 *15*	2+
1434.081 *10*	2+	3161.65 *14*	2+
2369.596 *22*	4+	3415.22 *4*	4+
2647.1?	0+	3472.4 *3*	3+
2767.75 *3*	4+	3771.9 *5*	2+

† From adopted levels.

β^- radiations

$E\beta^-$	E(level)	$I\beta^-$†	Log *ft*
(203.7 *12*)	3771.9	0.0025 *14*	5.52 *25*
(503.2 *11*)	3472.4	0.002 *1*	6.95 *22*
(560.4 *10*)	3415.22	0.03 *1*	5.94 *15*
(814.0 *10*)	3161.65	0.008 *1*	7.11 *6*
(1010.8 *10*)	2964.775	0.116 *2*	6.305 *9*
(1207.9 *10*)	2767.75	0.570 *13*	5.914 *11*
(1606.0 *10*)	2369.596	0.052 *10*	7.45 *9*
(2541.5 *10*)	1434.081	99.22 *5*	5.0002 *15*

† Absolute intensity per 100 decays.

γ(^{52}Cr)

γ, Iγ from 1977Ya08, except as noted.
Iγ normalization: from ΣIγ(g.s.)=100.

Eγ	E(level)	Iγ‡	Mult.†	δ†	Comments
398.08 *9*	2767.75	0.008 *1*			Iγ: authors give Iγ=0.088 in their table iv and Iγ=0.008 in their drawing. From adopted branching from 2768 level, one expects Iγ=0.010.
647.47 *2*	3415.22	0.024 *2*	M1+E2	0.22 *8*	
704.6 *3*	3472.4	0.0018 *9*	M1+E2	−0.14 *6*	
766.0§ *10*	3415.22				1976Ar13 claim to have observed the 766γ with an intensity ≈1.3 times that of the 647.5. The Compton suppressed Ge(Li) spectra of 1977Ya08 demonstrate this is in error. 1978Be32 consider no evidence for 766γ in these spectra, and estimate Iγ(766)/Iγ(647) can not be greater than 0.05.
935.52 *2*	2369.596	0.061 *3*	E2		
1045.72 *5*	3415.22	<0.01			
1212.9§	2647.1?				1976Ar13 reported this γ with a relative intensity of 0.22 *5*. There is no evidence for a 1213–keV γ in the Compton suppressed Ge(Li) spectra of 1977Ya08. This, and the apparent absence of a 766–keV γ, claimed by 1976Ar13 to feed a level at 2647 keV, lead evaluators to doubt that the 2647–keV level is detectably populated.
1333.62 *3*	2767.75	0.588 *10*	E2		Eγ: authors' value of 1332.62 given in table iv is a misprint.
1434.06 *1*	1434.081	100 *1*	E2		
1530.67 *1*	2964.775	0.116 *2*	M1+E2	−6.25 *15*	
1727.52 *15*	3161.65	0.007 *1*	M1+E2	−0.18 *7*	
1981.1 *4*	3415.22	0.005 *1*			
2337.7 *5*	3771.9	0.0015 *9*	M1+E2	−0.20 *8*	

Continued on next page (footnotes at end of table)

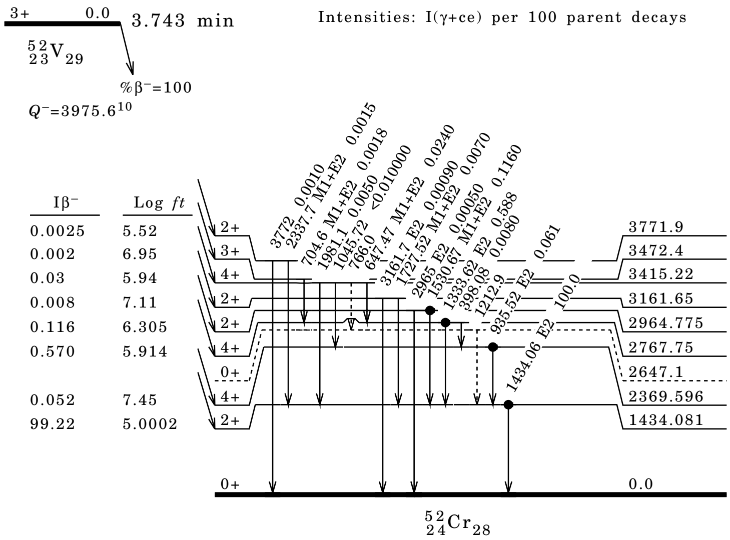
^{52}V β^- Decay (3.743 min) 1977Ya08 (continued)

$\gamma(^{52}$Cr) (continued)

Eγ	E(level)	Iγ‡	Mult.†
2965 *1*	2964.775	0.0005 *2*	E2
3161.7 *4*	3161.65	0.0009 *2*	E2
3772 *1*	3771.9	0.0010 *5*	

† From adopted gammas.
‡ For absolute intensity per 100 decays, multiply by 1.00 *1*.
§ Placement of transition in the level scheme is uncertain.

Decay Scheme



^{52}Mn ε Decay (5.591 d) 1978MeZK,1977Ya08

Parent ^{52}Mn: E=0.0; Jπ=6+; $T_{1/2}$=5.591 d *3*; Q(g.s.)=4711.5 *19*; %ε+%β⁺ decay=100.
Others: 1996La20, 1990Me15, 1980Iw03, 1979ArZT, 1975BaXO, 1972GeZF, 1967Pa22, 1966Fr05, 1962Wi08.
1977Ya08: chemically separated sources from ^{51}V(α,3n), measured Eγ, Iγ, a Compton suppression spectrometer system, several large volume Ge(Li) detectors.
Decay scheme from 1977Ya08.

^{52}Cr Levels

E(level)	Jπ†
0.0	0+
1434.111 *17*	2+
2369.654 *21*	4+
2767.786 *23*	4+
3113.883 *24*	6+
3415.33 *3*	4+
3615.946 *24*	5+
4015.52 *4*	5+
4627.13 *20*	4+

† From adopted levels.

^{52}Mn ε Decay (5.591 d) 1978MeZK,1977Ya08 (continued)

β⁺,ε Data

Eε	E(level)	Iβ⁺†‡	Iε†‡	Log *ft*	I(ε+β⁺)†‡
(84.4 *20*)	4627.13		0.0027 *6*	7.33 *10*	0.0027 *6*
(696.0 *19*)	4015.52		1.04 *5*	6.626 *21*	1.04 *5*
(1095.6 *19*)	3615.946		7.69 *6*	6.153 *4*	7.69 *6*
(1597.6 *19*)	3113.883	29.6 *4*	61.8 *5*	5.578 *4*	91.4 *5*

† Values deduced from intensity balance at each level, assuming no ε+β⁺ feeding of the g.s.
‡ Absolute intensity per 100 decays.

γ(^{52}Cr)

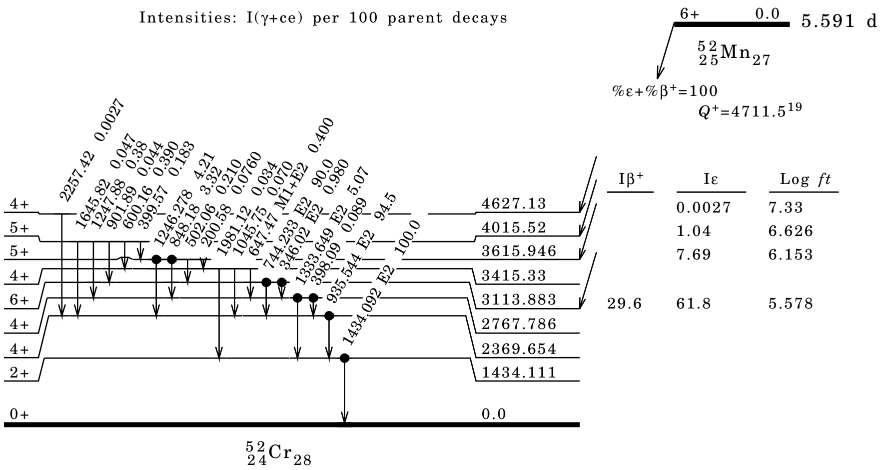
Experimental conversion information see 1966Fr05, 1962Wi08, 1960Ka20. γγ–coin: from 1967Pa22 and 1962Wi08.
Iγ normalization: from ΣIγ(g.s.)=100.

Eγ†	E(level)	Iγ†#	Mult.‡	δ‡
200.58 *4*	3615.946	0.076 *2*		
346.02 *4*	3113.883	0.98 *1*	E2	
398.09 *9*	2767.786	0.089 *7*		
399.57 *5*	4015.52	0.183 *7*		
502.06 *5*	3615.946	0.21 *2*		
600.16 *5*	4015.52	0.39 *1*		
647.47 *6*	3415.33	0.40 *2*	M1+E2	0.22 *8*
744.233 *13*	3113.883	90.0 *8*	E2	
848.18 *5*	3615.946	3.32 *3*		
901.89 *18*	4015.52	0.044 *4*		
935.544 *12*	2369.654	94.5 *9*	E2	
1045.75 *8*	3415.33	0.07 *2*		
1246.278 *15*	3615.946	4.21 *6*		
1247.88 *9*	4015.52	0.38 *4*		
1333.649 *17*	2767.786	5.07 *5*	E2	
1434.092 *17*	1434.111	100.0 *5*	E2	
ˣ1441§ *1*		0.003§ *2*		
1645.82 *4*	4015.52	0.047 *3*		
ˣ1839.14 *17*		0.005 *1*		
1981.12 *4*	3415.33	0.034 *3*		
2257.42 *19*	4627.13	0.0027 *6*		

† From 1978MeZK, except as noted.
‡ From adopted gammas.
§ From 1977Ya08.
\# For absolute intensity per 100 decays, multiply by 1.000 *3*.
ˣ γ ray not placed in level scheme.

Decay Scheme

Intensities: I(γ+ce) per 100 parent decays



^{52}Mn ε Decay (21.1 min) 1977Ya08

Parent ^{52}Mn: E=377.749 *5*; Jπ=2+; $T_{1/2}$=21.1 min *2*; Q(g.s.)=4711.5 *19*; %ε+%β^+ decay=98.25 *5*.
%ε+%β^+=98.25 *5*.
1977Ya08: chemically separated sources from ^{52}Fe ε decay, measured Eγ, Iγ, a Compton suppression spectrometer system, several large volume Ge(Li).
See also ^{52}Mn IT decay (21.1 min).

^{52}Cr Levels

E(level)	Jπ†	E(level)	Jπ†	E(level)	Jπ†
0.0	0+	2964.777 *15*	2+	3951.2 *10*	1,2(+)
1434.083 *10*	2+	3161.73 *6*	2+	4563.2 *10*	3−
2369.6 *10*	4+	3472.10 *20*	3+	4815.69 *9*	1+,2+
2767.5 *3*	4+	3771.69 *15*	2+		

† From adopted levels.

β^+,ε Data

Eε	E(level)	Iβ^+†‡	Iε†‡	Log *ft*	I(ε+β^+)†‡
(273.6 *19*)	4815.69		0.0049 *7*	5.55 *7*	0.0049 *7*
(526.0 *22*)	4563.2		≤0.00008	≥7.9	≤0.00008
(1138.0 *22*)	3951.2	$8.\times10^{-7}$ *3*	0.0007 *3*	7.65 *19*	0.0007 *3*
(1317.6 *19*)	3771.69	0.00036 *5*	0.0082 *11*	6.70 *6*	0.0086 *11*
(1617.1 *20*)	3472.10	0.013 *3*	0.023 *6*	6.43 *11*	0.036 *9*
(1927.5 *19*)	3161.73	0.164 *8*	0.074 *3*	6.079 *21*	0.238 *11*
(2124.5 *19*)	2964.777	0.038 *2*	0.0091 *4*	7.077 *20*	0.047 *2*
(3655.2 *19*)	1434.083	96.5 *20*	1.55 *4*	5.317 *10*	98.0 *20*

† Values deduced from intensity balance at each level, assuming no ε+β^+ feeding of the g.s.
‡ Absolute intensity per 100 decays.

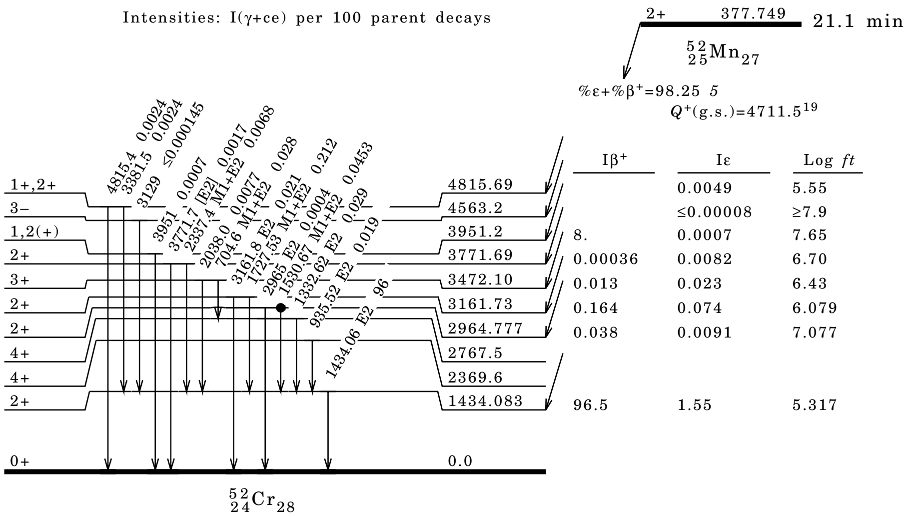
γ(^{52}Cr)

Eγ	E(level)	Iγ§	Mult.‡	δ‡
704.6 *2*	3472.10	0.029 *9*	M1+E2	−0.14 *6*
935.52	2369.6	0.02 *1*	E2	
1332.62	2767.5	0.03 *1*	E2	
1434.06 *1*	1434.083	100 *2*	E2	
1530.67 *1*	2964.777	0.047 *2*	M1+E2	−6.25 *15*
1727.53 *7*	3161.73	0.22 *1*	M1+E2	−0.18 *7*
2038.0 *2*	3472.10	0.008 *1*		
2337.4 *2*	3771.69	0.007 *1*	M1+E2	−0.20 *8*
x2847.7† *7*		0.0006 *5*		
2965 *1*	2964.777	0.0004 *3*	E2	
3129 *1*	4563.2	≤0.00015		
3161.8 *1*	3161.73	0.022 *3*	E2	
3381.5 *1*	4815.69	0.0025 *5*		
3771.7 *2*	3771.69	0.0018 *4*	[E2]	
3951 *1*	3951.2	0.0007 *3*		
4815.4 *2*	4815.69	0.0025 *4*		

† Assignment to 21.1–min ^{52}Mn tentative.
‡ From adopted gammas.
§ For absolute intensity per 100 decays, multiply by 0.965 *20*.
x γ ray not placed in level scheme.

^{52}Mn ε Decay (21.1 min) 1977Ya08 (continued)

Decay Scheme



^{50}Ti(^{3}He,n) 1975Bo14

1974Ev02: E=15, 18, 21 MeV, measured σ(E(n),θ), detectors consisting of a 1 m* 8 cm (diameter) NE 213 liquid scintillator viewed from both ends by XP 1041 photomultipliers.

1975Bo14: E=13.0 MeV, measures σ(E(n),θ), tof, 12 detectors placed between 0 and 55 at intervals of 5.0 , flight path of 17.5 M, energy resolution of 200 keV for the transition to the ground state of ^{56}Ni.

1975Al05: E=15 MeV, measured σ(E(n),θ), 10.2 cm (diameter) NE 213 liquid scintillators of thickness 2.5 cm or 3.8 cm mounted on 12.7 cm photomultipliers, flight path of 4 m.

All data are from 1975Bo14, except as noted.

^{52}Cr Levels

E(level)	L‡	σ†	Comments
0.0	0	410 *30*	
1400 *30*	2	54 *7*	
3700 *50*	(2)	30 *7*	
4710 *30*	2	70 *10*	
5650 *20*	0	133 *15*	Doublet. σ consistent with composite of 5600 and 5755 0+ levels.
6100 *30*	0	38 *4*	
6670 *20*	0	47 *7*	
7450§ *50*	0+2		
7930 *50*	0		Seen only by 1975Al05. Probably 7450+8710. L: from 1975Al05, θ=0 .
8710§ *50*	0+2	96 *5*	
9580 *20*	0	67 *7*	
9870 *50*			
11280 *20*		86 *7*	T=3. σ: θ at 35 . Identified as unresolved triplet of IAS of the three states in ^{52}V at 0.0, 17 and 23 keV with spins 2+, 3+ and 4+. Angular distribution can be well fit by L=2+4 (can also be fit with L=3, but existence of an additional state with Jπ=3− seems unlikely).
13420 *10*	0	230 *20*	T=3. Identified as IAS (^{52}V 2170 keV)?
13630 *10*	0	220 *20*	T=3. Identified as IAS (^{52}V 2390 keV)?
13950 *50*			
14110 *20*	2	102 *15*	T=3. Identified as IAS (^{52}V 2880 keV)?

Footnotes continued on next page

$^{50}Ti(^{3}He,n)$ 1975Bo14 (continued)

^{52}Cr Levels (continued)

† Cross section (b/sr c.m.) at θ=0 for L=0, at θ=20 for L=2. From 1975Bo14.
‡ From DWBA analysis, 1975Bo14, except as noted.
§ Pair of close–lying levels, unresolved in energy spectra but contributions separated in DWBA fits due to different angular distributions.

$^{50}Ti(^{16}O,^{14}C)$ 1989Og01,1971Le07

1971Le07: E=48 MeV, measures ^{14}C spectra, a two counter telescopes using solid–state detectors, overall resolution≈200 keV.
1989Og01: E=150 MeV, measured dσ/dΩ, QMG/2 spectrometer, a hybrid focal–plane detector consisting of two multiwire position detectors and a series of ionization chambers, overall energy resolution of ^{14}C: 100 keV.
Other works: 1972SiYD, 1971FaZM, 1972FaZX.

^{52}Cr Levels

E(level)†	σ§	E(level)†	σ§	E(level)†
0.0	≈190	4560‡	≈140	6740
1434	≈110	4740		6990
2370	≈70	4980‡	≈60	7290
2640‡	≈70	5210		7570
2768		5700		7870
2965	≈60	5950		8580
3114		6130		8890
3440		6330		
3780‡	≈70	6490		

† From 1989Og01, except as noted.
‡ From 1971Le07.
§ Cross section in b/sr at θ=40 , from 1971Le07.

$^{50}V(\alpha,d)$ 1978Ca12

Target Jπ=6+.
E=14 MeV, measured deuteron spectrum with ΔE–E telescope of surface barrier detectors from 90 to 140 .

^{52}Cr Levels

E(level)	Jπ	Comments
4750	(8+)	Jπ: compared integrated cross sections with Hauser–Feshbach integrated cross sections in the same angular interval (90 to 140).

$^{50}Cr(t,p)$ 1968Ch20,1971Ca19

1968Ch20: E=12.15 MeV, σ(θ,E(p)), multi–angle magnetic spectrograph.
1971Ca19: E=13 MeV, σ(θ), a solid–state counter telescope.
All data are from 1968Ch20, except as noted.

^{52}Cr Levels

E(level)	L‡	dσ/dΩ (peak)§
0.0	0	550
1442 *20*	2	7
2660† *10*	0	646

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^{50}Cr(t,p) 1968Ch20,1971Ca19 (continued)

^{52}Cr Levels (continued)

E(level)	L‡	dσ/dΩ (peak)§
2974 *20*		6
3175 *15*	2	117
3781 *20*	2	15
3957 *20*		4
4572 *20*	(3,4)	11
4745† *10*	0	150
5423 *15*	(2)	97
5443 *20*		14
5600 *15*	0	43
5755 *15*	0	82
5869 *20*	(2)	8
5973 *15*	(2)	49
6028 *20*		22
6069 *20*		12
6154 *20*	2	44

† From 1971Ca19.
‡ Deduced by 1968Ch20 by comparison of σ(θ) with those for states of known Jπ in ^{52}Cr, ^{54}Cr, ^{56}Cr.
§ Peak differential cross section (arbitrary units).

^{50}Cr(α,^{2}He) 1990Fi07

E=56 MeV, measured σ(θ), the detection of unbound reaction product ^{2}He is achieved by measuring the two breakup protons in coincidence, two protons detected with detector telescopes which were consist of a 300 m position–sensitive Si ΔE counter and a 5 mm Si(Li) E counter, DWBA analysis.

^{52}Cr Levels

E(level)	L
0.0	0
2770	4
3110	6
4770	4,6
5320	4,6
5990	4,5,6
6800	5,7
7390	5,7
7750	5,7
9200	5
10750	6,8
11260	6,8
12260	6,8

^{51}V(p,γ) E=res: IAR 1978Pr04,1974Ro44,1973Fa12

Target Jπ=7/2–.
1966Te01: E≈0.7–2.5 MeV, γ(θ), 11*10 cm NaI detector.
1967Ar19: E≈0.7–2.5 MeV, σ(θ).
1971De25: E≈1.2–2.4 MeV, γ(θ), a Ge(Li) detector.
1971Ah02, 1972Ah08: E<3.2 MeV, γ(θ), 5 in * 6 in NaI(Tl) detector.
1972Pr15: E=1.567, 1.629 MeV, γ(θ), 30 cm^{3} Ge(Li) detectors.
1973Fa12: E=0.74–0.82 MeV, γ(θ), 60 cm^{3} coaxial Ge(Li) detector.
1974Ro44: E=0.72–1.30 MeV, γ(θ), two NaI(Tl) detector, 10.2*10.2 cm 10.2*12.7 cm, respectively.
1978Pr04: E=0.7–2.0 MeV, γ(θ), 94 cm^{3} Ge(Li) detector with resolution 5.5 keV at 1.33 MeV.
A number of weak resonances reported by 1974Ro44 are not included here. See this reference for details.
Assignment of resonances as analogs of states in ^{52}V were made by all authors. Cases of disagreement are noted.
Others: 1977AwZY, 1976AwZZ, 1977RaZK, 1975RaYK.

^{52}Cr Levels

E(level)†	Jπ‡
0.0	0+
1434	2+
2369	4+
2768	4+
2965	2+
3114	6+
3162	2+
3414	4+
3472	3+
3616	5+
3947	
4015	5+

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$^{51}V(p,\gamma)$ E=res: IAR 1978Pr04,1974Ro44,1973Fa12 (continued)

^{52}Cr Levels (continued)

E(level)†	Jπ‡	S§	Comments
4039	4+		
4611	3,4+		
4630?			
4742			
4808			
4837			
5054			
5097			
5446			
5563			
5664			
5724			
5737			
5860			
6034			
6204			
6374			
6389			
6794			
S(p)+739 *2*		0.03 *1*	E(p)=739 *2* (1974Ro44).
S(p)+766 *2*		0.05 *2*	E(p)=766 *2* (1974Ro44). Other: 763 *6* (1966Te01).
S(p)+773 *2*	(3+)	0.06 *1*	E(p)=773 *2* (1974Ro44). IAS (^{52}V g.s.). Some authors identify resonance at 766 keV as g.s. IAS. However, from a comparison of relative M1 transition rates from S(p)+774 state with Gamow–Teller β decay matrix elements for ^{52}V g.s. 1973Fa12 concluded that most of the IAS strength lies in the E(p)=774 keV resonance. The 766 keV resonance might still be a fragment of the g.s. IAS. $T_{1/2}$: from γ(θ) (1973Fa12).
S(p)+784 *2*	(5+)	0.13 *3*	E(p)=784 *2* (1974Ro44). Others: 781 *10* (1967Ar19), 781 *6* (1966Te01). Identified as fragment of IAS (^{52}V 23 keV). Jπ: from γ(θ) (1973Fa12).
S(p)+800 *2*		0.06 *2*	E(p)=800 *2* (1974Ro44). Other: 795 *10* (1967Ar19).
S(p)+912 *2*	4+	0.58 *10*	E(p)=912 *2* (1974Ro44). Others: 915 (1972Ah08), 915 *10* (1967Ar19), 910 *6* (1966Te01). Identified by 1974Ro44 as IAS (^{52}V 148 keV). Jπ: from γ(θ) (1978Pr04).
S(p)+1174 *2*		0.84 *24*	E(p)=1174 *2* (1974Ro44).
S(p)+1210 *2*	2+	3.0 *8*	E(p)=1210 *2*(1974Ro44). Others: 1210 (1972Ah08), 1217 (1971De25), 1202 *10* (1967Ar19), 1210 *6* (1966Te01). IAS (^{52}V 437 keV). Jπ: from γ(θ) (1978Pr04).
S(p)+1232 *2*		0.56 *16*	E(p)=1232 *2* (1974Ro44).
S(p)+1244 *2*		1.2 *3*	E(p)=1244 *2* (1974Ro44).
S(p)+1265 *2*		1.5 *4*	E(p)=1265 *2* (1974Ro44).
S(p)+1558 *6*			E(p)=1558 *6* (1966Te01). Others: 1559 (1972Ah08), 1559 (1971De25). There is some confusion in the literature concerning the existence of a resonance at this energy and the correspondence of resonances observed by various authors. 1972Ah08 associated the resonance which they reported at E(p)=1559 keV with the resonances of 1966Te01 and 1967Ar19 (1565 and 1562 keV, respectively) which we associate with the S(p)+1566 keV level. See 1971De25 for information on γ decay.
S(p)+1564 *5*	3+	0.65# *15*	E(p)=1564 *5*. E(p) is from weighted average of 1562 *10* (1967Ar19) and 1565 *6* (1966Te01). Others: 1567 (1972Pr15), 1568 (1971De25). Jπ: IAS (^{52}V 793 keV (3+)) and this resonance state has a total branch of about 35% to the first two 4+ states, 1978Pr04 assigned 3+ to the level.
S(p)+1628 *5*	4+	5.4# *11*	E(p)=1628 *5*. E(p) is from weighted average of 1626 *10* (1967Ar19) and 1629 *6* (1966Te01). Others: 1620 (1972Ah08), 1629 (1971De25), 1629 (1972Pr15). IAS (^{52}V 846 keV). Jπ: this resonant state does not decay to any level whose spin is known to be less than 3. it has 23% branch to the first 4+ level and 6% branch to the 5+ state at 3.616 MeV, see 1978Pr04 for detail.
S(p)+2203 *6*			E(p)=2203 *6* (1966Te01). Other: 2205 (1972Ah08). IAS (^{52}V 1418 keV)?
S(p)+2273 *6*			E(p)=2273 *6* (1966Te01). IAS (^{52}V 1492 keV)?

Continued on next page (footnotes at end of table)

^{51}V(p,γ) E=res: IAR 1978Pr04,1974Ro44,1973Fa12 (continued)

^{52}Cr Levels (continued)

E(level)†	Jπ‡	Comments
S(p)+2333 *6*	4+	E(p)=2333 *6* (1966Te01). Others: 2329 (1977AwZY,1972Ah08), 2333 (1971De25). IAS (^{52}V 1559 keV)? Jπ: from γ(θ) (1971De25).
S(p)+2521 *6*		E(p)=2521 *6* (1966Te01). Other: 2514 (1972Ah08). IAS (^{52}V 1733 keV)?
S(p)+2538 *6*		E(p)=2538 *6* (1966Te01). Other: 2537 (1972Ah08). IAS (^{52}V 1759 keV)?
S(p)+2583 *6*		E(p)=2583 *6* (1966Te01). Other: 2576 (1972Ah08). IAS (^{52}V 1842 keV)?
S(p)+2870		E(p)=2870 (1972Ah08).
S(p)+2945		E(p)=2945 (1972Ah08).
S(p)+2972		E(p)=2972 (1972Ah08).

† For resonance states, E(level) is given as S(p)+E(p), where E(p) is the lab energy and S(p)=10504.5 *10* (2003Au03).
‡ Spins shown for levels were assumed in γ(θ) analyses, see 1978Pr04, except as noted.
§ Resonance strength S=(2J+1)Γ(γ)Γ(p)/Γ(eV). From 1974Ro44, except as noted.
# From 1972Pr15.

γ(^{52}Cr)

E(level)	Eγ†	Iγ‡	Mult.[e]	δ
S(p)+766	8291	54		
	8488	46		
S(p)+773	7648	<4		
	7792	<2		
	7850	17 *3*	M1+E2	+0.06 *9*
	8150	11 *4*		
	8299	<2		
	8496	5 *3*		
	8895	44 *7*	M1+E2	+0.9 *+10−5*
	9830	15 *2*	M1+E2	−0.30 *6*
S(p)+784	4479	18 *3*		
	4899	6 *2*		
	5069	9 *3*		
	5239	5 *2*		
	5549	25 *3*		
	7258	15 *3*		
	7326	6 *2*		
	7859	2 *1*	M1+E2	+0.47 *10*
	8904	14 *2*	M1+E2	+0.19 *10*
S(p)+800	9856	100		
S(p)+912	5836	23 *2*		
	5953	11 *2*		
	7360	a		
	7384	a		
	7783	10 *1*		
	7985	8 *1*		
	8285	2 *1*		
	9030	38 *2*	M1+E2	0.5[f] *2*
S(p)+1210	5302	10 *1*		
	6027	7 *1*		
	6245	16 *1*		
	6637[#]	4[@] *2*		
	6854	&		
	6883	&		
	6949	11 *1*		
	7652	b		
	7676	b		
	8219[#]	9[@] *2*		
	8277	2 *1*		

E(level)	Eγ†	Iγ‡
S(p)+1210	8529	4 *1*
	8726[#]	8[@] *2*
	8923	3 *1*
	9322	8 *1*
	10257	30 *2*
S(p)+1558	6471	5 *1*
	6588	5 *1*
	7404	11 *1*
	8562	4 *2*
	8620	23 *2*
	9069	4 *2*
	9266	17 *1*
	9665	18 *1*
	10600	11 *1*
S(p)+1564	6595	11 *1*
	7233	5 *1*
	8569	12 *1*
	8627	5 *1*
	8879	16 *1*
	9076	2 *1*
	9273	8 *1*
	9672	26 *1*
	10607	14 *1*
S(p)+1628	6239	9 *2*
	6362	9 *2*
	6653	7 *2*
	7002	3 *1*
	7469	7 *1*
	8060[d]	7[cd] *1*
	8084[d]	3.0[cd] *5*
	8152	5 *1*
	8483	6 *1*
	8627[d]	4.0[d] *6*
	8685	12 *2*
	9331	8 *1*
	9730	23 *2*
S(p)+2333	9178	25[§]
	10424	31[§]

Footnotes continued on next page

^{51}V(p,γ) E=res: IAR 1978Pr04,1974Ro44,1973Fa12 (continued)

γ(^{52}Cr) (continued)

† Only primary γ's are given.
‡ Photon branching ratio (%). Values are from 1973Fa12 (E(p)<900 keV) and 1978Pr04 (E(p)>900 keV), except as noted.
§ Branching ratio from 1977AwZY.
# From 1974Ro44.
@ From 1974Ro44. Not reported by 1978Pr04. If branch exists, the % branches of 1978Pr04 should be lowered.
& Iγ=3 *1* for the 6854, 6883 doublet.
a Iγ=8 *1* for the 7360, 7384 doublet.
b Iγ=5 *1* for the 7652, 7676 doublet.
c 1978Pr04 reported a branching of 12% *1* for the 8060, 8084 doublet.
d From 1972Pr15.
e From γ(θ) in 1973Fa12, except as noted. D+Q transitions assigned (M1+E2) from level scheme.
f From 1974Ro44.

^{51}V(^{3}He,d) 1992Ba16,1978Wa04

JPI(51V)=7/2–.
1992Ba16: E=15 MeV, multichannel magnetic spectrograph, 20 keV FWHM, measured σ(θ), 3.75 –71.25 , DWBA analyses.
1978Wa04: E=15 MeV, multigap magnetic spectrograph, 19 keV FWHM, measured σ(E(d),θ), DWBA analyses.
1965Ar06: E=22 MeV, E–ΔE identification system, 100–120 keV FWHM.
1973Pe12: E=10.48 MeV, FWHM=50 keV, measured σ(θ), counter telescope.
All data are from 1992Ba16, except as noted.

^{52}Cr Levels

E(level)	L	$(2J_f+1)C^2S/(2J_i+1)$
0.0	3	0.50
1434[†]	3	0.641
2370[‡]	3[‡]	0.490[‡]
2766[†]	3	0.692
2965		
3112[†]	3	1.810
3420[‡]	3[‡]	0.101[‡]
3620[‡]	1[‡]	0.020[‡]
3770	1	0.054
3950[‡]	1[‡]	0.013[‡]
4020[‡]	1[‡]	0.014[‡]
4033	1	0.0085
4565	1	0.0082
4628	1	0.060
4701	1	0.090
4740[‡]	1[‡]	0.104[‡]
4835	1	0.040
5101	1	0.39
5140[‡]	(3)[‡]	0.052[‡]
5285	0	0.0072
5420[‡]	1[‡]	0.195[‡]
5450[‡]	1[‡]	0.140[‡]
5594	1	0.12
5660[‡]	1+3[‡]	0.003+0.026[‡]
5720[‡]	1[‡]	0.061[‡]
5751	1	0.040
5790[‡]	1+3[‡]	0.050+0.124[‡]
5828	1	0.054
5891	0	0.0052
5945	1	0.0082
5992	1	0.026
6026	1	0.048
6089		
6192	1	0.040
6232	1	0.12
6364	1	0.074
6388	1	0.074
6500	1	0.020
6610[‡]		
6625		
6676	1	0.012
6720[‡]	1+3[‡]	0.009+0.020[‡]
6760[‡]	1+3[‡]	0.004+0.022[‡]
6814	1	0.031
6894	1	0.051
6928	1	0.10
6993	1	0.085
7079	1	0.13
7165	1	0.085
7210[‡]	1+3[‡]	0.023+0.057[‡]
7223	1	0.036
7260[‡]	1+3[‡]	0.034+0.150[‡]
7273	1	0.067
7310[‡]	1+3[‡]	0.077+0.117[‡]
7322	1	0.096
7350[‡]	1+3[‡]	0.038+0.073[‡]
7359	1	0.060
7400	1	0.30
7487	1	0.071
7536	1	0.025
7590[‡]	1+3[‡]	0.072+0.110[‡]
7686	1+3	0.016+0.25
7729	1	0.047
7760	1	0.046
7815	1	0.068
7853	1	0.073
7905	1	0.086
7920[‡]	1[‡]	0.060[‡]
7967	1	0.043
8020	1	0.068
8040[‡]		
8083	1	0.047

Continued on next page (footnotes at end of table)

$^{51}V(^{3}He,d)$ 1992Ba16,1978Wa04 (continued)

^{52}Cr Levels (continued)

E(level)	L	$(2J_f+1)C^2S/(2J_i+1)$
8130‡	1+3‡	0.020+0.056‡
8183	1	0.144
8234	1	0.106
8250‡	1+3‡	0.048+0.092‡
8283	1	0.080
8330‡	1+3‡	0.034+0.068‡
8350‡	1‡	0.030‡
8371	1	0.043
8400‡	1‡	0.041‡
8451	1	0.106
8579	1	0.038
8614	1+3	0.021+0.29
8700†	1+3	

† From 1965Ar06.
‡ From 1978Wa04.

$^{51}V(^{3}He,d\gamma)$ 1971Sp12

E=11.0 MeV, measured lifetime of levels by DSAM, a 37.5 cm^3 Ge(Li) of FWHM: 3.5 keV for 1.33 MeV.

^{52}Cr Levels

E(level)	Jπ†	$T_{1/2}$
0.0	0+	
1434	2+	0.69 ps *+31−17*
2369	4+	1.04 ps *+35−17*
2766	4+	1.4 ps *+5−3*
2965	2+	0.47 ps *+22−13*
3114	6+	>1.8 ps
3162	2+	0.08 ps *+4−3*
3414	4+	0.22 ps *+8−5*
3472	3+	>1.9 ps
3617	5+	>0.76 ps
3772	2+	
3947		0.10 ps *+4−3*
4015	5+	0.58 ps *+32−19*
4040	4+	0.51 ps *+25−14*
4563	3−	0.27 ps *+12−6*

† From adopted levels.

$\gamma(^{52}Cr)$

E(level)	Eγ†	Iγ‡
1434	1434	100
2369	934	100
2766	398	6 *3*
	1332	94 *3*
2965	1531	
3114	346	1.2 *2*
	744	98.8 *2*
3162	1728	88 *1*
3162	3162	12 *1*
3414	648	94.5 *15*
	1979	5.5 *15*
3472	703	
	2038	
3617	503	10 *3*
	851	37 *4*
	1248	53 *3*
3947	1578	
4015	399	
	601	
	1645	
4040	571	
4563	791	

† From level energy differences.
‡ From 1967Pa22.

$^{51}V(\alpha,t)$ 1989Pe06,1968Ma37,1978Le08

Target Jπ=7/2−.
1968Ma37: E=29 MeV, FWHM≈110 keV, σ(E(t),θ), E−ΔE semiconductor detector assembly, 1000 m thick stopping detector, 3 MM diam ΔE detector, DWBA analysis.
1978Le08: E=25 MeV, σ(E,θ), E−ΔE silicon semiconductor detector telescope, E−detectors were about 1 mm thick, ΔE detectors were from 60 to 140 m thick, DWBA analysis.
1989Pe06: E=80.9 MeV, σ(E,θ), QDDM spectrometer, DWBA analysis.
Others: 1976ToZK.
Data for E(level)<6000 are from 1968Ma37; others are from 1989Pe06, except as noted.

^{51}V(α,t) 1989Pe06,1968Ma37,1978Le08 (continued)

^{52}Cr Levels

E(level)	Jπ	L	C^2S	Comments
0.0	0+	3	0.50	C^2S: S=0.57 (1978Le08).
1430	2+	3	0.68 *10*	C^2S: S=0.82 (1978Le08).
2370	4+	3	0.53 *10*	
2770	4+	3	0.81 *10*	
3110 *40*	6+	3	1.72 *20*	
3440 *40*	3−	3,(1)	0.05 *5*	
3800 *40*		3,(1)	0.05 *5*	
4100 *100*				
4680 *100*		1		
5120 *100*		1		
5450 *100*		1		
5830 *100*		1		
7810		4	0.88†	
8010		4	0.46†	
8190		4	0.69†	
8420	6−	4	0.015	
9480	8−	4	0.032	
9630	8−	4	0.012	
10130	8−	4	0.019	
10280	6−	4	0.039	
11170	8−	4	0.047	
11350	8−	4	0.051	
11660	8−	4	0.012	
11790	8−	4	0.038	
12050	8−	4	0.045	
12500		4	0.67†	
12700	8−	4	0.011	
13010		4	0.36†	
14470	8−	4	0.020	
15280	6−	4	0.080	T=3.
15482 *7*	8−	4	0.121	T=3.

† C^2S', from 1989Pe06.

^{52}Cr(γ,γ'),(pol γ,γ') 1981Be32,1979Ku14,1983Sm02

1979Ku14: E=14 MeV, bremsstrahlung, Eγ, Iγ(θ) θ=125 , 150 , a 40 cm^3 Ge(Li) detector (overall energy resolution of the detector system was 8 keV (FWHM) for 9 MeV.
1983Sm02: (pol γ,γ'), E=9.14 MeV σ(total), σ(E,θ), two high–energy window 7.5*12.5 cm^2 NaI scintillation detectors.
1981Be32: (pol γ,γ'), E=7–9 MeV, bremsstrahlung, spectra and asymmetry of photon scattering, Ge(Li) detectors.
1998En05: electron beam of 7 MeV, HPGE detectors surrounded by a BGO suppression shield, measured Eγ, Iγ and γγ(θ).
Resonance fluorescence self–absorption experiment for the 1434 keV first excited state, see 1981Ah02.
Others: 1959Of14, 1964Bo22, 1982NoZW.

^{52}Cr Levels

E(level)†	Jπ@	$T_{1/2}$	Comments
0.0	0+		
1434.1#	2+	0.679 ps *13*	$T_{1/2}$: from $\Gamma_{\gamma0}$=673×10^{-6} eV *13*. Others: resonance fluorescence: 0.55 ps *14* (1959Of14), 0.76 ps *21* (1964Bo22).
3161.7#	2+		
3739.6#	1+,1−,2+&		B(M1)↑=0.008 *1*; B(E1)↑=0.0000009 *1*; B(E2)↑=0.0015 *2* (1998En05).
3770.5#	2+&		B(E2)↑=0.0076 *11* (1998En05).
4800.1#	1+,1−,2+&		B(M1)↑=0.009 *2*; B(E1)↑=0.0000010 *2*; B(E2)↑=0.00105 *20* (1998En05). Jπ=1+, 1−, 2+ for B(M1), B(E1), B(E2), respectively.
4841.3#	1+,1−,2+&		B(M1)↑=0.011 *2*; B(E1)↑=0.00000126 *23*; B(E2)↑=0.00131 *24* (1998En05).
5098.4#	1+,1−,2+&		B(M1)↑=0.085 *13*; B(E1)↑=0.0000094 *14*; B(E2)↑=0.0071 *12* (1998En05). Jπ=1+, 1−, 2+ for B(M1), B(E1), B(E2), respectively.
5490.8##	1+,1−,2+&		B(M1)↑=0.008 *2*; B(E1)↑=0.0000009 *3*; B(E2)↑=0.00074 *20* (1998En05).

Continued on next page (footnotes at end of table)

^{52}Cr(γ,γ'),(pol γ,γ') 1981Be32,1979Ku14,1983Sm02 (continued)

^{52}Cr Levels (continued)

E(level)†	Jπ@	Comments
5544.4#	1+,1−&	B(M1)↑=0.19 *4*; B(E1)↑=0.000021 *4* (1998En05).
5796.0#	1+,1−,2+&	B(M1)↑=0.017 *5*; B(E1)↑=0.0000019 *5*; B(E2)↑=0.0014 *4* (1998En05). Jπ=1+, 1−, 2+ for B(M1), B(E1), B(E2), respectively.
6136.7#	2+&	B(E2)↑≤0.0030 *11* (1998En05).
6459.6#	1+,1−,2+&	B(M1)↑=0.044 *25*; B(E1)↑=0.0000049 *28*; B(E2)↑=0.0029 *16* (1998En05).
6493.8#	2+&	B(E2)↑=0.0687 *13* (1981Ah02) Other: B(E2)↑=0.0061 *36* (1998En05).
7524‡ *3*	1+	$\Gamma^2_{\gamma0}/\Gamma$=0.97 eV *23* (1979Ku14).
7730 *2*	1−	$\Gamma^2_{\gamma0}/\Gamma$=1.75 eV *32* (1979Ku14).
7896 *2*	1−	$\Gamma^2_{\gamma0}/\Gamma$=5.7 eV *8* (1979Ku14).
8091‡ *3*	1	$\Gamma^2_{\gamma0}/\Gamma$=1.60 eV *35* (1979Ku14).
9142.7§ *6*	1+	$\Gamma^2_{\gamma0}/\Gamma$=2.68 eV *16* (1983Sm02). $\Gamma^2_{\gamma0}/\Gamma$=2.9 eV *5* (1979Ku14).
9214 *2*	1+	$\Gamma^2_{\gamma0}/\Gamma$=2.8 eV *6* (1979Ku14).
9736	(+)	
9787 *3*	1−	
9981 *3*	(−)	$\Gamma^2_{\gamma0}/\Gamma$=4.0 eV *6* (1979Ku14).
10433 *4*		
10927 *3*		
11765 *3*		
11837 *3*		

† From 1981Be32, except as noted.
‡ From 1979Ku14.
§ From 1983Sm02.
# From 1998En05, ΔE<1 keV.
@ J based on comparison of intensity ratios for the observed ground state transitions at scattering angles of 150 and 125 with theoretically calculated values, see 1979Ku14 for details. π based on asymmetries for different g.s. dipole transition (1981Be32), except as noted.
& From 1998En05, based on values of reduced transition strengths(UP).

γ(^{52}Cr)

E(level)	Eγ†	Mult.	Comments
3161.7	1727.6		
3770.5	2336.4		
5098.4	3664.3	D,Q	Iγ: 0.42 *15* for Jπ=1+ and 1−, 0.27 *11* for Jπ=2+. Mult.: from W(130)/W(90)=0.94 *19*.
5544.4	5544.4	D	Mult.: from W(130)/W(90)=1.89 *41*.
6136.7	6136.6	Q	Mult.: from W(130)/W(90)=0.34 *14*.

† From E(level)−1434.1.

^{52}Cr(e,e') 1985So05,1973Ph02,1964Be32

1985So05: E=29.6–57.3 MeV, excitation energy spectra, σ(θ). enriched (99.9%) targets, the multichannel detector system of the energy–loss electron facility consisted 36 overlapping scintillators backed up by a large Cerenkov counter.

1988So07: E=170–260 MeV, excitation energy spectra, natural Cr and enriched (99.87%) separated ^{52}Cr targets, quadrupole–dipole –dipole (QDD) spectrometer.

1964Be32: E=150, 180 MeV, σ(θ). natural target, double focusing spectrometer (over–all energy resolution of 0.35%).

1973Ph02: E=209 MeV, σ(θ) for 2+,3−,4+ levels, double focusing magnetic spectrometer (intrinsic resolution of 0.11%).

^{52}Cr Levels

E(level)†	Comments
0.0	Ground–state rms charge radius from elastic scattering: 3.674 fm *15* (1976Li19), 3.655 fm (1971Pe11).

Continued on next page (footnotes at end of table)

^{52}Cr(e,e') 1985So05,1973Ph02,1964Be32 (continued)

^{52}Cr Levels (continued)

E(level)†	L#	Comments
1430	2	B(E2)↑=0.067 *4*. B(E2)↑: from weighted average of 0.0634 *39* (1976Li19), 0.080 *8* (1978Po04), 0.071 *9* (1971Pe11), 0.0761 *30* (1975DeXW), and 0.052 *4* (1964Be32). Other: 0.0632 (1983Li02).
2370	4	B(E4)↑=0.00151 *5* (1975DeXW). B(E4)↑: Others: 0.00067 *12* (1975DeXW), 0.00101 (1983Li02).
2650	0	
2770	4	B(E4)↑=0.000482 (1983Li02).
2970	2	1964Be32 report L=4 and B(E4)=0.00050 *7*; however, the 2970 level has Jπ=2+.
3110	6	B(E6)=0.143×10^{-4} (1983Li02).
3160	2	B(E2)↑=0.00124 *23* (1976Li19). B(E2)↑: Others: 0.00155 *20* (1975DeXW), 0.0016 (1983Li02).
3770	2	B(E2)↑=0.0101 *5* (1975DeXW). B(E2)↑: Other: 0.0112 (1983Li02).
4040		
4560	3	B(E3)↑=0.0065 *4* (1964Be32). B(E3)↑: Other: 0.0076 *11* (1975DeXW).
5500‡	3	B(E3)↑=0.0013 *3* (1964Be32).
6600‡	3	B(E3)↑=0.0022 *3* (1964Be32).
7030 *10*	M1,(E1)	
7100‡	3	B(E3)↑=0.0028 *3* (1964Be32).
7140 *10*	M1	
7170 *10*	M1	
7260 *10*	M1,(M2)	
7340 *10*	M1	
7520 *10*	M1,(M2)	
7560 *20*	M1,(M2)	
7700 *10*	M1	
7820 *10*	M1	
7860 *10*	M1,(M2)	
7900‡	3	B(E3)↑=0.0028 *3* (1964Be32).
8080 *20*	M1,M2	
8100§ *20*	M8§	
8390 *10*	M1	
8450§ *20*	M6§	
8600 *10*	3	B(E3)↑=0.0022 *3* (1964Be32).
8690 *20*	M1,M2,E2	
8790 *10*	M2,(E2)	
8860 *10*	M1,(M2)	
8890 *20*	M1,M2	
8940§ *20*	(M8,M6)§	
9000 *10*	M1	
9050 *10*	M1,(M2)	
9080§ *20*	(M8)§	
9140 *10*	M1	
9210 *10*	M1	
9320 *10*	M1	
9370 *20*	M1,M2	
9420 *10*	M1	
9440 *20*	M1,E2	
9450§ *20*	M8§	
9470 *20*	M1,E2	
9580 *10*	M1,(E1)	
9610 *10*	M1	
9660§ *20*	M8§	
9720 *10*	M1	
9830 *10*	M1	
9880 *10*	M1	
9910§ *20*	M8§	
10010 *10*	M1,(M2)	
10110§ *20*	(M8)§	
10130 *20*	M1,M2,E1	
10180 *10*	M2	
10240 *20*	(M1),E1	

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^{52}Cr(e,e') 1985So05,1973Ph02,1964Be32 (continued)

^{52}Cr Levels (continued)

E(level)†	L#	E(level)†	L#	E(level)†	L#
10270 *20*	D,(M2)	11070 *10*	M1,(E1)	11880§ *20*	M8§
10300 *20*	M2,M3,E3	11140 *10*	M1,(E1)	11960§ *20*	M8§
10330§ *20*	M6§	11160 *20*	(M1),Q	12030§ *20*	(M8)§
10340 *20*	M1,E1	11170§ *20*	M8§	12130§ *20*	(M8,M6)§
10380 *20*	M1,E1	11270§ *20*	M8§	12240§ *20*	M6§
10430 *10*	M1	11330 *20*	(M1),M2	12730§ *20*	M8§
10460 *10*	M1	11370§ *20*	M8§	13220§ *20*	M8§
10500 *20*	M1,E1	11400 *10*	M1	13390§ *20*	M6§
10510§ *20*	(M8,M6)§	11510 *10*	M2	13570§ *20*	M6§
10610 *10*	M1,Q	11550§ *20*	M8§	13710§ *20*	M6§
10710 *10*	M1,(E1)	11570 *20*	(M1),Q	14030§ *20*	M6§
10760 *10*	M1	11610 *10*	M2,(E2)	14340§ *20*	M6§
10790 *10*	M1	11650 *10*	M1,(M2)	14430§ *20*	M8§
10800§ *20*	(M8,M6)§	11660§ *20*	M8§	15270§ *20*	M6§
10820 *10*	M1,(M2)	11690 *20*	(M1),Q	15470§ *20*	M8§
10920 *20*	M1,M2	11770§ *20*	M8§	16400§ *20*	M6§
11000§ *20*	M8§	11780 *20*	(M1),M2	16690§ *20*	(M8)§

† E<7 MeV from 1973Ph02. The authors take values from 1970Ra47. E>7 MeV from 1985So05, except as noted.
‡ From 1964Be32.
§ From 1988So07.
# The L values for the levels below 7140 are from the adopted Jπ's and those for above 7100 are from 1985So05, except as noted.

^{52}Cr(π^+,π^+),(π^+,$\pi^{+\prime}$) 1987Oa01,1988Oa01

Includes: ^{52}Cr(π^-,π^-),(π^-,$\pi^{-\prime}$).
1987Oa01,1988Oa01: E=180 MeV, FWHM=150 keV, measured σ(θ), energetic pion channel and spectrometer (EPICS) consisted a momentum dispersing channel and a high resolution spectrometer. analyzed using the distorted–wave impulse approximation (DWIA) calculations with collective–model transition densities.
1996Oa01: E=180 MeV, FWHM: 135 keV, measured σ(θ), energetic pion channel and spectrometer (EPICS).

^{52}Cr Levels

E(level)†	Jπ‡	L	Comments
0.0	0+		
1430	2+		B(E2)↑=0.0588 *23* (1987Oa01).
2370	4+		B(E4)↑=0.00066 *10* (1987Oa01).
2650§	0+§		
2770	4+		
2960	2+		
3160	2+		
3420	(4+)		
3770	2+		B(E2)↑=0.0095 *8* (1987Oa01).
4040	4+		
4560	3−		B(E3)↑=0.0068 *5* (1987Oa01).
4630	4+		
4710§	2+§	2	L: from 1988Oa01.

† From 1987Oa01, except as noted.
‡ DWIA analysis of σ(θ), from 1987Oa01, except as noted.
§ From 1988Oa01.

^{52}Cr(n,n'γ) 1978Ka21,1962Va24,1989Ge09

1962Va24: E=0.98–3.31 MeV, measured γ–spectrum, dσ/dΩ(Eγ,θ) NaI scintillation detector.
1978Ka21: E=0.84–3.97 MeV, measured γ–spectrum, dσ/dΩ(Eγ,θ) a 40 cm^3 Ge(Li) detector, plastic scintillation detector.
1989Ge09: fast neutrons, measured lifetimes of excited levels, DSAM. three Ge(Li) detectors with different volumes and energy resolution of the γ–ray of ^{60}Co of energy 1.33 MeV: 28 cm^3 (2.6 keV), 52 cm^3 (2.8 keV), 75 cm^3 (3.0 keV).
Others: see earlier evaluation (1978Be37).

^{52}Cr Levels

E(level)	Jπ§	$T_{1/2}$‡
0.0	0+	
1434	2+#	
2370	4+#	
2647	0+#	
2768	4+#	
2965	2+#	31 fs *4*
3114	6+	
3162	2+#	
3415	4+	
3472		
3771	2+	11.1 fs *14*
3948†		33 fs *6*
4040†		26 fs *5*
4563†		40 fs *6*

† From 1989Ge09.
‡ From 1989Ge09, DSAM.
§ From adopted Jπ values.
\# 1962Va24, on the basis of their own (n,n'γ) work, and (p,p') work of other authors, deduce several Jπ values that are consistent with the adopted values.

γ(^{52}Cr)

From 1978Ka21.

E(level)	Eγ	Iγ	Comments
1434	1434 *1*	100	
2370	936 *1*	100	
2647	1213 *1*	100	
2768	1334 *1*	100	
2965	1531 *1*	100	
3114	744 *1*	100	
3162	1728 *1*	88.6 *11*	
	3162 *1*	11.4 *11*	
3415	647 *1*	100	
3472	703 *1*	60 *7*	
	2038 *1*	40 *7*	
3771	2337 *1*	84	Iγ: assuming an 84% branching ratio for 2337γ (1978Ka21).
	(3771 *1*)	16	Eγ: 3771γ was not seen in 1978Ka21.

^{52}Cr(n,n') 1965St16,1973HoYG,1974KiZY

1965St16: E=14 MeV, tof, σ(E(n),θ), plastic scintillation detector.
1973HoYG: E=3.2 MeV, tof, σ(θ).
1974KiZY: E=6.44–8.56 MeV, tof, σ(θ), liquid scintillation detector.
1997Sm01: E=4.5–10 MeV, σ(θ), tof method and ten–angle detection system.

^{52}Cr Levels

E(level)†	Jπ†	L‡	$β_L$	Comments
1434	2+	2	0.21 *2*	$β_L$: 1973HoYG found $β_2$=0.16 from DWBA and Hauser–Feshbach analysis of low–energy scattering.
2370§				
4200	3–	3	0.18 *3*	From 1965St16.

† From adopted levels.
‡ From known Jπ.
§ Seen only by 1974KiZY.

^{52}Cr(p,p') 1985Fu10,1967Ka11,1969Pe02

1985Fu10: E=65 MeV, ΔE–E counter, energy resolution 15–22 keV FWHM, measured σ(θ).
1967Ka11: E=12 MeV, single–gap magnetic spectrograph, 6–8 keV FWHM, measured spectrum of p'.
1966Ma42: E=11,12 MeV, FWHM=8, 12 keV single–channel spectrograph, measured Q values.
1969Pe02: E=17.5 MeV, energy resolution 20 keV, surface barrier silicon detector, measured σ(θ).
1970Pr08: E=40 MeV, Ge(Li), 40 keV FWHM, measured σ(θ).
1983Dj05: E=201 MeV, overall energy resolution 60–70 keV, measured σ(θ), DWIA calculations, deduced 1+ states.
See 1970Pe09 for a study of relative contributions of direct and compound nucleus mechanisms at E(p)=11 MeV for excitation of 1.44 MeV 2+ state and 4.56 MeV 3– state.
Others: 1978An08, 1979AnZT, 1979KlZZ, 1980PrZV, 1980An35, 1983Og03, 1984KoZK, 1985Oz01, 1985Ko07.
All data are from 1985Fu10, except as noted.

^{52}Cr Levels

E(level)	Jπ[‡]	L	β_LR (fm)	Comments
0.0	0+			
1434[#] *3*	2+	2[b]	0.87[c] *4*	
2369 *5*	4+	4	0.33	
2647 *5*	0+	0	0.095	
2768 *5*	4+	4	0.30	
2965 *5*	2+	2	(0.08)	
3114 *5*	6+	6	0.35[c] *10*	
3162 *5*	2+	2	0.27	
3415 *5*	4+	4	0.13	
3472 *5*	3+	2+3		L: 1970Pr08 assign L=4 with βR=0.13 *2*.
3617[#] *3*				
3772 *5*	2+	2	0.28	
3949 *5*	1+	2		
4015 *5*	5+	4+6		
4040 *5*	4+	4	0.16	
4563 *5*	3–	3	0.61	
4630 *5*	4+	4	0.36	
4702 *5*				
4738 *5*	0+	0	0.145	L: 1969Pe02 assign L=2 with βR=0.22 *2*.
4802 *5*	5,6+	5,6		
4832 *5*	(3+)[†]			
4951[§] *4*	4+	4[b]	0.20[c] *5*	
5095 *5*	4+	4	0.15	
5139 *5*	5,6+	5,6		
5211[§] *4*				
5285 *5*	5,6+	5,6		1969Pe02 report L=(2) for a level at 5289.
5346[§] *4*				
5410[§] *4*				
5425 *5*	4+	4	0.32	1969Pe02 report L=4 for E=5450.
5432[§] *6*				
5450[§] *6*				
5494[§] *5*				
5541 *5*	4+	4	0.074	β_4R=0.07 (1989Fu07).
5546[§] *6*				
5569 *5*	5,6+	5,6		1969Pe02 report L=3 for a level at 5571.
5584[§] *6*				
5661 *5*	2+	2	0.095	
5727 *5*	5,6+	5,6		
5737?[&] *10*	(4+)	(4)[b]	0.25[c] *8*	
5798[§] *5*				
5811 *5*	5,6+	5,6		
5818[§] *6*				1969Pe02 report L=(3) and βR=0.24 *6* for E=5830.
5853[§] *5*				1969Pe02 report L=(3) and βR=0.24 *6* for E=5830.
5865[§] *6*				
5873 *5*	3–	3	0.082	
5919 *5*		5,6		
5953[§] *5*				1985Fu10 report L=2 and βR=0.17 for E=5957.
5960[§] *5*				1985Fu10 report L=2 and βR=0.17 for E=5957.
5996 *5*	3–	3	0.087	
6026[§] *6*				
6035[@] *10*				
6055 *5*		2	0.13	

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^{52}Cr(p,p') 1985Fu10,1967Ka11,1969Pe02 (continued)

^{52}Cr Levels (continued)

E(level)	Jπ‡	L	β_LR (fm)	Comments
6065§ *10*				
6106§ *6*				
6143 *5*	(2+)	2	0.07	
6153§ *8*				
6164@ *12*				
6175§ *7*	2+	2[b]	0.21[c] *3*	
6193§ *6*				
6205§ *5*		3		L=3 is reported by 1985Fu10 for E=6201, by 1969Pe02 for E=6220, and by 1970Pr08 for E=6210.
6210@ *10*				L: L=3 is reported by 1985Fu10 for E=6201, by 1969Pe02 for E=6220, and by 1970Pr08 for E=6210.
6220§ *6*				
6233§ *10*				
6243 *5*		3	0.074	Probably a composite of the 6233 and 6252.
6252§ *6*				
6272§ *6*				
6282@ *10*				Probably a composite of the 6272 and 6293.
6293§ *7*				
6324& *10*				
6349 *5*				1970Pr08 report L=4 for E=6350.
6372& *10*				
6392& *10*				1985Fu10 report L=3 and βR=0.048 for E=6382, and 1969Pe02 report L=(3) and βR=0.28 for E=6380.
6426 *5*				
6437& *10*				
6458 *5*				
6482 *5*	5,6+	5,6		
6493& *10*	2+	2[b]	0.21[c] *5*	
6541& *10*				
6568& *10*				
6580 *5*	3−	3	0.34	
6637 *5*				
6678 *5*				
6704 *5*	5,6+	5,6		
6786 *5*	3−	3	0.26	
6810§ *30*	(2+)	2[b]	0.22[c] *3*	
6871 *5*	5−	5	0.16	
6956 *5*	5,6+	5,6		
6993 *5*	3−	3	0.18	
7080 *10*	3−	3	0.34	
7140 *10*	4+	4	0.14	
7217 *10*	2+	2	0.10	
7278 *10*	4+	4	0.13	
7344 *10*	2+	2	0.074	
7376 *10*	5−	5	0.11	
7409 *10*	3−	3	0.091	
7458 *10*	5,6+	5,6		
7482 *10*	3−	3	0.13	
7540[a] *20*	1+[a]	0		
7585 *10*	3−	3	0.074	
7679 *10*	5,6+	5,6		
7738 *10*	3−	3	0.26	
7823 *10*	3−	3	0.12	
7848 *10*	4+	4	0.11	
7893 *10*	4+	4	0.12	
7967 *10*	3−	3	0.095	
8022 *10*	2+	2	0.10	
8089 *10*	3−	3	0.091	
8121 *10*	1+	0		
8181 *10*	1+	0		
8213 *10*	1+	0		
8281 *10*	3−	3	0.15	
8337 *10*	4+,5−	4,5		

Continued on next page (footnotes at end of table)

^{52}Cr(p,p') 1985Fu10,1967Ka11,1969Pe02 (continued)

^{52}Cr Levels (continued)

E(level)	Jπ‡	L	β_LR (fm)	Comments
8374 *10*	3−	3	(0.06)	
8412 *10*	1+	0		
8457 *10*	3−	3	0.13	
8505 *10*	3−	3	0.10	
8569 *10*	1+	0		
8617 *10*		2,3,4		
8679 *10*	3−	3	0.10	
8728 *10*	3−	3	0.10	
8778 *10*	3−	3	0.13	
8827 *10*				
9020[a] *20*	1+[a]	0		
9143 *10*	1+	0		
9221 *10*	1+	0		
9245 *10*	1+	0		
9320[a] *20*	1+[a]	0		
9440 *10*	3−	3	0.095	Jπ: 1983Dj05 reported Jπ=1+.
9620[a] *20*	1+[a]	0		
9740[a] *20*	1+[a]	0		
9870[a] *20*	1+[a]	0		
10000[a] *20*	1+[a]	0		
10380[a] *20*	1+[a]	0		
10480[a] *20*	1+[a]	0		
10580[a] *20*	1+[a]	0		
10790[a] *20*	1+[a]	0		
10970[a] *20*	1+[a]	0		
11120[a] *20*	1+[a]	0		
11410[a] *20*	1+[a]	0		
12560[a] *20*	1+[a]	0		
12900[a] *20*	1+[a]	0		

† Jπ assigned by 1985Fu10 but no angular distribution or discussion is given by the authors.
‡ Based on σ(θ) and DWBA analysis (1985Fu10).
§ From weighted average of values from 1966Ma42 and 1967Ka11.
# From weighted average of values from 1966Ma42, 1967Ka11, 1968Ra17.
@ From 1967Ka11.
& From 1966Ma42.
a From 1983Dj05.
b From 1969Pe02.
c From 1969Pe02. Uncertainties given for βR do not include 10% uncertainty due to normalization.

^{52}Cr(p,p'γ) 1968Mo19,1971As01,1965Ka12

1971As01: E=7 MeV, measured Doppler–shift attenuation, Ge(Li).
1968Mo19: E=6.54 MeV, measured p'γ coin, p'γ(θ), an annular silicon surface–barrier detector at 180 to the beam direction and 30 cm^3 Ge(Li) detector at 90 .
1965Ka12: E=2.5–7.5 MeV, measured p'γγ(θ), two 12.7 cm diam, 15.2 cm thick NaI crystals.
For studies devoted to reaction mechanisms see 1978Be37.
All data are from 1968Mo19, except as noted.

^{52}Cr Levels

E(level)	Jπ†	$T_{1/2}$‡
0.0	0+	
1434.2 *5*	2+	
2368.6 *8*	4+	
2647.0 *8*	0+	
2766.2 *8*	4+	
2965.8 *8*	2+	0.42 ps *8*
3162.5 *7*	2+	33 fs *5*

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^{52}Cr(p,p'γ) 1968Mo19,1971As01,1965Ka12 (continued)

^{52}Cr Levels (continued)

E(level)	Jπ†	$T_{1/2}$‡	Comments
3413.3 *10*	(4+)		
3469.6 *10*	3+		More recent work suggests that this is the same level as the 3472.
3472.7 *8*	3+		
3771.0 *6*	2+	9 fs *4*	

† From p'γ(θ) (1968Mo19), p'γγ(θ) (1965Ka12).
‡ From DSAM, 1971As01.

γ(^{52}Cr)

E(level)	Eγ	Iγ‡	Mult.	δ†	Comments
1434.2	1434.1 *6*		E2		
2368.6	934.5 *6*		E2		
2647.0	1212.8 *6*		E2		
2766.2	1332.0 *6*		E2		
2965.8	1531.5 *6*		M1+E2	−6.25 *15*	
3162.5	1728.4 *6*	88 *1*	M1+E2	−0.18 *7*	
	3162.8 *6*	12 *1*	E2		
3413.3	647.1 *6*		M1+E2	+0.1 *2*	δ: From 1968Mo19.
3469.6	703.4 *6*		M1+E2	−0.14 *6*	More recent work suggests that the energy of the 703γ is incorrect and should be 704.6.
3472.7	2038.4 *6*				
3771.0	2336.9 *6*	84 *4*	M1+E2	−0.20 *8*	δ: Other: −0.07 +0.38−0.46 (1968Mo19).
	3771.0 *6*	16 *4*			

† From p'γγ(θ) (1965Ka12), except as noted.
‡ Percent photon branching from each level.

^{52}Cr(d,d') 1968Ha31

E=7.5 MeV, measured σ(E(d),θ), a multi–angle spectrograph in the angular interval from 22.5 to 157.5 with an energy resolution of 8 keV.

Elastic scattering of deuterons and polarized deuterons, see 1977ChYO, 1973BaWF, 1977GoZX, 1979Go06, 1982MaZL.

^{52}Cr Levels

E(level)	L	β_L
1427 *4*	2	0.20
2372 *6*		
2766 *6*		
2965 *6*		

^{52}Cr(^{3}He,^{3}He') 1971Mo39,1969Ar10

1969Ar10: E=35.7 MeV, measured σ(E(^{3}He),θ).

1971Mo39: E=29 MeV, measured σ(E(^{3}He,θ)), a 90 cm scattering chamber and 10 surface barrier counter telescopes, ≈70 keV FWHM. DWBA analysis.

^{52}Cr Levels

E(level)‡	Jπ	L†	β_L‡
0.0	0+		
1430	2+	2	0.20
4470	3−	3	0.135

† From DWBA analysis.
‡ From 1969Ar10.

$^{52}Cr(\alpha,\alpha')$ 1970Br07,1966Me07,1978Ro12

1970Br07: E=44 MeV, measured σ(Eα',θ), rectangular solid–state detectors were used. They were lithium–drifted E–detectors with or without surface–barrier ΔE multi–detectors, between 80 and 400 keV FWHM, DWBA analysis.
1966Me07: E=50 MeV, measured σ(θ), α–particle detected in a unit consisting of four Si(Li) counters fixed at 2 intervals.
1978Ro12: E=15, 18, 19 MeV, measured σ(θ), two solid–state detector telescopes mounted in a 38 cm vertical scattering chamber DWBA analysis.
1990Ba23: E=25 MeV, FWHM: 150–250 keV, measured σ(θ), silicon surface–barriers detectors placed at five equi–spaced positions on each of the two moveable arms of scattering chamber.
1966Pe16: E=42 MeV, FWHM: 105 keV or 60 keV, measured σ(θ). Also quoted in 1996Oa01.
Others: 1965Ta06, 1980PiZS, 1983Co02, 1983Pe10.
All data are from 1970Br07, except as noted.

^{52}Cr Levels

E(level)	L§	$\beta_L R$ (fm)#	Comments
0.0			
1434†	2	0.62	β_2R=0.731 (1978Ro12).
2370†	4	0.17	
2650†			
2770	4	0.15	E(level): from 1990Ba23.
2960‡			
3160‡	(2,6)	0.16	1966Me07 and 1996Oa01 report L=2 for E=3160.
3450†	4		
3780†	2	0.33	
4010†	4		
4560	3	0.38	
4730†	4		
5070†	4		
5450	4	0.17	
5640†			
5910			
6160†	3		
6540†	3	0.12	
6760†			
7100†	3	0.21	
7900	(3)		

† From 1966Me07.
‡ From 1966Pe16.
§ From DWBA analysis.
\# From DWBA analysis of 1970Br07.

$^{52}Cr(^7Li,^7Li')$ 1973FoXW

E=22.1 MeV, resolution≈30 keV FWHM.

^{52}Cr Levels

E(level)
0.0
1434
2370
2768
3114†
3162†

† Not resolved.

$^{52}Cr(^{12}C,^{12}C'),(^{13}C,^{13}C')$ 1979Fu01,1979Po16,1976Le12

1979Fu01: ($^{13}C,^{13}C'$), E=105 MeV, measured σ(θ), a triple detector telescope comprising two ΔE detectors of thickness 28.7 m and 27.8 m, and a stopping detector (E) of thickness 900 m, an anticoincidence detector mounted behind the E–detector, DWBA analysis.

1979Po16 and 1976Le12: ($^{12}C,^{12}C'$),($^{13}C,^{13}C'$), E=16–32 MeV, 18–35 MeV, respectively, measured σ(θ), a double focusing magnetic spectrometer with a silicon position at the focal plane, DWBA analysis.

All data are from 1979Fu01, except as noted.

^{52}Cr Levels

E(level)	Comments
0.0	
1430	β_2=0.18 *4* (1979Fu01) with B(E2) taken as 0.063 (insensitive to actual value within 20%). β_2=0.25 (ion–ion nuclear potential) (1979Po16) with B(E2)=0.061 *5*.
4560	

$^{52}Cr(^{16}O,^{16}O'),(^{18}O,^{18}O')$ 1979Po08

1979Es04: ($^{16}O,^{16}O'$), E=56 MeV, σ(θ), 80 cm diam scattering chamber maintained at a vacuum of better than 10×10^{-6} Torr and essentially free of organic contaminants, nine couled Si surface–barrier detectors.

1979Po08: ($^{16}O,^{16}O'$),($^{18}O,^{18}O'$), E=30–42 MeV, σ(E), a double focusing magnetic spectrometer with a silicon position sensitive detector at the focal plane, DWBA analysis.

^{52}Cr Levels

E(level)	Comments
0.0	
1434	β_2=0.17 for ^{16}O bombardment, β_2=0.12 for ^{18}O bombardment (1979Po08).

Coulomb Excitation

1961Mc18: E(A)=6 MeV.
1978Ro12: E(A)=15, 18 MeV.
1979Po16: E(^{12}C)=16–32 MeV, E(^{13}C)=16–32 MeV.
1976Le12: E(^{12}C)=18–35 MeV, E(^{13}C)=18–35 MeV.
1960Ad01: E(^{16}O)=30.6 MeV.
1979Po08: E(^{16}O)=30–42 MeV, E(^{18}O)=30–42 MeV.
1987St07: E(^{16}O)=36 MeV, E(^{81}Br)=220,230,240 MeV.
1972WaYZ: E(^{16}O)=21–30 MeV, E(^{35}Cl)=60–79 MeV, also DSAM.
1975To06: E(^{32}S)=60 MeV, reorientation effect.

^{52}Cr Levels

E(level)	Jπ	$T_{1/2}$	Comments
0.0	0+		
1434	2+	0.83 ps *4*	B(E2)↑=0.056 *3*; Q=−0.14 *8* (1975To06); g=+1.50 *25* (1987St07). B(E2)↑: From weighted average of 0.066 *3* (1975To06), 0.069 *7* (1972WaYZ), 0.072 *9* (1966Mc18), 0.061 *5* (1979Po16), 0.059 *5*, 0.054 *5* (1979Po08), 0.060 *15* (1960Ad01), 0.062 *12* (1960Le07), 0.062 *22* (1960An09), 0.048 *2* (1965Si02), and 0.043 *9* (1967Af03). Others: 0.061 (1976Le12), 0.0588, 0.0933 (1978Ro12). $T_{1/2}$: from adopted B(E2). 1972WaYZ measured $T_{1/2}$ directly using DSAM (lineshape fitting) following Coulomb excitation using ^{35}Cl they obtained $T_{1/2}$=0.60 ps *9*.

^{53}Cr(p,d) 1967Wh02

Target Jπ=3/2−.
Other references: 1971Ma58, 1966Fr05, 1962Ma20.
1967Wh02: E=17.5 MeV, dE/dx−E solid state detector telescope, 50–75 keV FWHM, σ(θ).
1971Ma58: E=20 MeV, polarized beam, measured σ(θ), sixteen ΔE−E telescopes, ΔE detectors: silicon surface−barrier junction of 150 to 250 m thickness, E−detectors: lithium−drifted silicon junction of 3.5 to 4 mm thickness, overall energy resolution: 80 keV for protons, 80–150 keV for deuterons, DWBA analysis.

^{52}Cr Levels

E(level)†	L‡	C^2S‡§	Comments
0.0	1	0.51	C^2S: other: 0.56 (1971Ma58).
1434	1	0.18	An upper limit of S<≈0.27 is assigned for L=3 contribution.
2370	3	0.07	
2648	1	0.018	
2769	3	0.10	
2965			C^2S: <0.008 for p3/2, <0.08 for f7/2.
3115			
3161			C^2S: <0.015 for p3/2, <0.1 for f7/2.
3432#	@	@	
3494#	@	@	
3614	(3)	<0.04	
3767	3	0.36	
3926			Very weak.
4030	3	1.14	

† From 1966Fr05 and 1962Ma20.
‡ From 1967Wh02, based DWBA analysis.
§ Authors assume that L=1 corresponds to 2p3/2 and L=3 corresponds to 1f7/2.
# Unresolved doublet.
@ L=3, C^2S=2.3 for the 3432–3494 doublet.

^{53}Cr(d,t),(pol d,t) 1967Fi06,1981Bi04

Target Jπ=3/2−.
1967Fi06: ^{53}Cr(d,t), E=11.8 MeV, dE/dx−E counter telescopes, DWBA analysis.
1981Bi04: ^{53}Cr(pol d,t), E=11.0 MeV, measured vector analyzing power and σ(E(t),θ) with four solid−state counter telescopes, ≈100 keV FWHM.

^{52}Cr Levels

E(level)†	L§	C^2S‡	Comments
0.0	1	0.39	
1430	1+3		L=1 S=0.15, L=3 S≈0.13.
2370	3	0.1	
2640	1	0.01	
2770	3	0.12	
3460			Doublet. 1981Bi04 report L=3, C^2S=1.45.
3800	3	0.31	
4090	3	0.79	

† From 1967Fi06.
‡ See 1967Fi06 for details.
§ From DWBA analysis, 1967Fi06.

$^{53}Cr(^{3}He,\alpha)$ 1978Fo34,1969Da02

Target Jπ=3/2−.
1978Fo34: E=25 MeV FWHM≈20–25 keV, measured σ(Eα,θ), silicon position–sensitive detectors, 700 m or 1000 m thick, placed in the focal plane of a split–pole spectrometer, DWBA, coupled reaction channel analyses.
1969Da02: E=18 MeV, FWHM≈60 keV, σ(Eα,θ), Photographic emulsion planes placed in focal plane of a Browne–Buechner broad–range magnetic spectrograph at reaction angle from 5 to 35 , DWBA analysis.
All data are from 1969Da02, except as noted.
Other: 1985Po17.

^{52}Cr Levels

E(level)	L	C^2S	Comments
0.0	1		
1430 *20*	1+3	0.12+0.09	
2380 *20*	(3)	0.11	
2780 *20*	(3)	0.085	
3418† *20*	3†	1.39†	
3474† *20*	3†	1.08†	
3774† *20*	3†	0.31†	
4017† *20*	3†	1.03†	
4605† *20*	3†	0.19†	
4830 *20*	(3)	0.12	
5400 *20*	(1)	0.09	
5560 *20*	(1)	0.25	
5670 *20*	(1+3)	0.075+0.054	
5710† *20*	3†	0.70†	
6180† *20*	3†	0.48†	
6490 *20*	0	0.41	
6700 *20*	2	0.38	
6790 *20*	(1+3)	0.10+0.09	
11290 *20*	(3)	1.8	Broad peak interpreted by 1969Da02 as analog of state in ^{52}V.
13580 *20*	0	0.57†	Broad peak interpreted by 1969Da02 as analog of state in ^{52}V. E(level): from weighted average of values from 1978Fo34 and 1969Da02.

† From 1978Fo34.

^{54}Cr(p,t) 1967Wh02

E=17.5 MeV, dE/dx–E solid–state detector telescope, 50–75–keV FWHM, measured σ(θ).

^{52}Cr Levels

E(level)	L†	Comments
0.0	0	
1434	2	
2370		Weakly excited.
2648	0	
2769		Weakly excited.
3168	2	

† Values assigned by comparison of σ(θ) with those to states of known Jπ.

^{55}Mn($^{-}$,3nγ) 1971Ba10

Target Jπ=5/2−.
E≈0, Ge(Li), measured Eγ, Iγ, two Ge(Li) detectors.

^{52}Cr Levels

E(level)	Jπ†
0.0	0+
1433.5 *5*	2+
2370.3 *10*	4+

† From adopted levels.

γ(^{52}Cr)

E(level)	Eγ	Iγ†
1433.5	1433.5 *5*	7.2 *30*
2370.3	936.8 *8*	3.6 *12*

† Photons per 100 captures.

^{55}Mn(p,α) 1967Ka11

Target Jπ=5/2−.
1964Ve02: E=11–12.5 MeV, measured σ(E,θ), solid–state detectors with energy resolutions of ≈50 keV.
1967Ka11: E=12 MeV, measured A particles by a broad–range single–gap magnetic spectrograph, half–widths: 10–15 keV.
1967Br13: E=12 MeV, measured σ(E,θ) by a multi–gap spectrograph.
Others: 1957Ma25, 1960Og03, 1962Sh29, 1985Hs01.

^{52}Cr Levels

E(level)†	E(level)†	E(level)†
0.0	4040 *5*	5422 *8*
1434 *5*	4563 *5*	5432 *8*
2371 *5*	4630 *5*	5450 *6*
2650 *5*	4706 *5*	5494 *5*
2767 *5*	4743 *5*	5538 *5*
2965 *5*	4808 *5*	5546 *8*
3114 *5*	4837 *5*	5571 *5*
3163 *5*	4950 *5*	5585 *7*
3416 *5*	5097 *5*	5664 *5*
3472 *5*	5141 *5*	5725 *5*
3619 *5*	5211 *5*	5798 *5*
3772 *5*	5281 *5*	5996 *6*
3947 *5*	5346 *5*	
4016 *5*	5410 *5*	

† From 1967Ka11. The energies are an average of values from (p,p') and (p,α).

^{56}Fe(d,^{6}Li) 1973Ma46

1973Ma46: E=28, 36 MeV, measured σ(θ), 20–135 m and 30–100 m ΔE–E detectors, overall energy resolution: 80–250 keV FWHM.
1974Ce02: E=27.25 MeV, measured σ(θ), 20–135 m and 30–100 m ΔE–E detectors, overall energy resolution: 400 keV FWHM.
All data are from 1973Ma46, except as noted. A detailed microscopic analysis of transitions to g.s. and 1430–keV state is presented by 1974Ce02.
Other: 1972LeXX.

^{52}Cr Levels

E(level)	Jπ†	S‡	Comments
0.0	0+	0.088	
1430	2+	0.027	
2370	4+	0.040	
2650	0+	0.027	
3110?§	6+	<0.10	From the forward rise in σ(θ) typical of a J=2 state, the authors conclude that this peak probably contains the 3160 level; known to have J=2+. The evaluators note that 2964 level, also with Jπ=2+, could also be contributing to this peak.

† Assumed in DWBA analysis.
‡ Relative spectroscopic factor.
§ Not resolved.

Ni(K⁻,Xγ),(π⁺,Xγ),(π⁻,Xγ) 1972Ba55

Includes: Cu(K⁻,Xγ).
1978Ja19: Ni(π⁺,Xγ),(π⁻,Xγ), E=100, 120, 160 MeV, prompt and β⁻ delayed γ–spectra.
1972Ba55: Ni(K⁻,Xγ), Cu(K⁻,Xγ), separated 800 MeV/C K– beam was stopped in targets of Ni and Cu, measured Eγ and Iγ with Ge(Li).
All data are from 1972Ba55.

^{52}Cr Levels

E(level)
0.0
1433.6 *10*

γ(^{52}Cr)

E(level)	Eγ	Iγ†
1433.6	1433.6	40 *13*

† Photon intensity relative to I=100 for N=6 to N=5 x–ray transition (where n is principal quantum number) for Ni target. Iγ=20 *10* for Cu target.

(HI,xnγ)

Includes: (HI,xpγ), (α,xnγ), (α,2pγ).
1984Ko31: ^{7}Li(^{51}V,α2nγ) E=180 MeV, Eγ, αγ–coin.
2000Er01: ^{12}C(^{48}Ti,3αγ) E=110–120 MeV, measured γ–ray in coincidence with carbon ions using 12.7 cm *12.7 cm NaI(Tl) as well as 9 cm *9 cm BAF2.
1978Me19: ^{27}Al(^{28}Si,3pγ) E=65–81 MeV, σ(Eγ,E).
1979Me03: ^{28}Si(^{28}Si,4pγ) E=65–90 MeV, σ(Eγ,θ).
2000ApZX: ^{48}Ca(^{9}Be,5nγ) E=50 MeV, Eγ, Iγ,γγ, and γγ(θ)(DCO) using 8π spectrometer.
1974Br04: ^{49}Ti(α,nγ) E=14.5 MeV, RDM.
1979St13: ^{50}Ti(α,2nγ) E=24–33 MeV, γ(θ), p(Eγ), γγ–coin.
1977Be22: ^{50}Ti(α,2nγ) E=18–25 MeV, γ(θ), γγ–coin, DSAM.
1977Ev03: ^{50}Cr(α,2pγ) E=23.5, 27.2 MeV, γγ–coin. two 60 cm^{3} Ge(Li) counters.

Continued on next page (footnotes at end of table)

(HI,xnγ) (continued)

1987Ba72: $^{51}V(\alpha,p2n\gamma)$ E=30–45 MeV, RDM, DSAM, γ(θ), γγ–coin. Ge(Li) detector: 2.7 keV at 1333.6 keV (FWHM), HPGE detector: 2.4 keV at 1333.6 keV (FWHM).
1974Po15: $^{51}V(^{7}Li,\alpha2n\gamma)$,$(^{6}Li,\alpha n\gamma)$ E=25 MeV, RDM, DSA, γ(θ).
1985Io02: $^{51}V(^{7}Li,\alpha2n\gamma)$ E=18 MeV, αγ–coin, studied reaction mechanism.
Others: 1978BeZC, 1978Ha17, 1978TaZO.

^{52}Cr Levels

E(level)	Jπ†	$T_{1/2}$‡	Comments
0.0@	0+		
1434.22@ *10*	2+	0.793 ps *2*	g=1.206 *64* (2000Er01). $T_{1/2}$: From 2000Er01, DSAM. Other: 2.3 ps +6–5 (1977Be22).
2369.73@ *14*	4+	9.4 ps *+24–16*	$T_{1/2}$: from RDM, 1974Br04. Inconsistent with $T_{1/2}$=2.7 ps *+8–7* (DSAM) from 1977Be22. 1974Br04 explicitly take feeding into account, 1977Be22 make no correction. Other: 6.7 ps +35–17 (2000Er01).
2767.95 *20*	4+	2.5 ps *6*	$T_{1/2}$: other: 1.4 ps – 8.7 ps, lower limit from DSAM, upper limit from RDM, see 1974Po15.
3113.94@ *17*	6+	41.4 ps§ *14*	$T_{1/2}$: others: 45 ps *6* (1987Ba72) RDM, 2.5 ps *6* (1977Be22) DSAM. The DSAM result appears to be incorrect.
3415.4 *3*	4+	0.33 ps *9*	$T_{1/2}$: from 1974Po15. Others: 0.10 ps *+8–6* (1987Ba72), 0.44 ps *10* (1977Be22). Value of 1977Be22 not corrected for cascade feedings.
3471.8 *8*	3,5	7.2 ps *8*	$T_{1/2}$: from 1974Br04 (RDM). Other: 1.9 ps *+7–5* (1977Be22). Value of 1977Be22 not corrected for cascade feedings.
3615.9 *3*	5+		$T_{1/2}$: <3.8 ps (1974Br04) RDM, >1.4 ps (1974Po15) DSAM.
4015.6& *4*	5+	0.7 ps *5*	$T_{1/2}$: other: <1.2 ps (1987Ba72).
4038.6 *13*	4+		
4583.8 *10*	(6+)		
4750.4@ *3*	(8+)	0.64 ps *+20–17*	$T_{1/2}$: other: 0.7 to 4.2 ps, lower limit from DSAM, upper limit from RDM, see 1974Po15. 0.30 ps *+17–12* (1987Ba72).
4805.7& *4*	(6+)	0.49 ps# *+28–14*	$T_{1/2}$: 0.5 ps *+12–3* (1977Be22).
5396.7& *4*	(7+)	0.14 ps *+12–9*	
5632.6 *12*	(8+)		
5824.7& *5*	(8+)	1.0 ps *+6–4*	$T_{1/2}$: 0.29 ps *+17–10* (1987Ba72).
6365.4 *11*	≥8		
6452.4&	9+	0.14 ps# *+9–8*	$T_{1/2}$: 0.29 ps *+12–10* (1977Be22).
7237.9& *7*	10(+)	0.16 ps *+15–8*	$T_{1/2}$: from 1987Ba72. Jπ: from 2000ApZX.
8216.5& *9*	(11)	0.24 ps *+17–9*	$T_{1/2}$,Jπ: from 1987Ba72.
9439.8& *12*	12(+)		
10161.3& *12*	13(+)		

† From γ(θ) analysis of 1977Be22.
‡ From DSAM measurements of 1977Be22, except as noted.
§ Weighted average of values from 1974Br04 and 1974Po15.
\# From 1987Ba72, DSAM.
@ (A): γ cascade based on g.s.
& (B): γ cascade based on 5+.

γ(^{52}Cr)

E(level)	Eγ†	Iγ[a]	Mult.[c]	δ[c]	Comments
1434.22	1434.2‡ *1*	100.0 *51*	E2		DCO=0.96 *4* (2000ApZX).
2369.73	935.5‡ *1*	57.3 *20*	E2		DCO=1.13 *5* (2000ApZX).
2767.95	397.7# *5*	0.41[b] *3*			DCO=1.30 *25* (2000ApZX).
	1333.7‡ *2*	23.4 *10*	E2		DCO=0.87 *9* (2000ApZX).
3113.94	744.2‡ *1*	39.6 *12*	E2		DCO=1.08 *4* (2000ApZX).
3415.4	647.4‡ *2*	8.4# *5*	M1+E2	−0.22# *8*	DCO=1.27 *15* (2000ApZX).
3471.8	703.9@	2.61@ *42*			
	2037.4@	1.07@ *26*			
3615.9	501.5& *10*	0.35& *11*			
	847.5# *5*	4.8# *3*			
	1246.4§ *3*	4.4[b] *13*			
4015.6	400.4# *6*	2.5 *3*			Iγ: based on Iγ(398γ) and Iγ for the sum.
	600.5& *6*	11.1& *4*	D[d]		DCO=0.58 *11* (2000ApZX).

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(HI,xnγ) (continued)

γ(^{52}Cr) (continued)

E(level)	Eγ[†]	Iγ[a]	Mult.[c]	δ[c]	Comments
4015.6	902.4[&e] *9*	1.13[&] *13*			
	1247.5[&] *6*	9.5[&] *4*	D[d]		DCO=0.57 *10* (2000ApZX).
4038.6	566.8	1.61 *21*			
4583.8	1470.1[&] *7*	2.2[&] *3*			
4750.4	1636.4[‡] *2*	12.23 *53*	E2		DCO=1.02 *7* (2000ApZX).
4805.7	790.0 *3*	11.17 *90*	M1+E2	−0.16[#] *5*	DCO=1.02 *17* (dipole gated) (2000ApZX).
	1189.7[@]	2.24[@] *57*			
	1693.0[#] *6*	2.53 *36*			
5396.7	590.9 *3*	12.5[#] *8*	M1+E2	−0.27 *6*	δ: from 1977Be22. DCO=0.77 *8* (2000ApZX).
	1381.5[#] *5*	1.9[#] *2*			
5632.6	1049.4[&] *8*	1.98[&] *21*			
5824.7	427.9 *3*	11.2 *4*	M1+E2	−0.03 *4*	DCO=0.63 *6* (2000ApZX).
	1018.4[&] *10*	0.95[&] *16*			
6365.4	725.5[&e] *12*	0.23[&] *11*			
	1615.0[#] *10*	2.0[#] *10*			
6452.4	628.9[#] *5*	2.7[#] *14*	M1+E2	+0.22 *+15−8*	DCO=0.78 *7* (dipole gated) (2000ApZX).
	784.7[&] *6*	31.2[&] *10*	D[d]		DCO=0.55 *6* (2000ApZX).
	1056.0[&] *10*	2.03[&] *19*			
	1702.9 *5*	7.7 *4*	M1+E2	−0.04 *+7−3*	DCO=0.61 *6* (2000ApZX).
7237.9	784.5[#] *5*	4.2[#] *5*	M1+E2	−0.06 *+3−5*	Iγ: from γγ–coin spectra.
	883.7[&e] *10*	1.17[&] *16*			
	1413.6[&e] *10*	0.34[&] *16*			
	1606.0[&e] *20*	0.63[&] *16*			
8216.5	978.5[#] *5*	2.1[#] *2*	M1+E2	+0.10 *+5−8*	DCO=0.54 *6* (2000ApZX).
	1763.3[&] *10*	2.16[&] *23*			
9439.8	1222.4[&] *8*	6.6[&] *3*			
	2200.0[&] *10*	1.11[&] *11*			
10161.3	721.3[&] *10*	0.83[&] *11*			
	1943.6[&] *7*	17.6[&] *3*	Q[d]		DCO=1.10 *27* (2000ApZX).

† From weighted average of values from 1979St13 and 1977Ev03, except as noted.
‡ From weighted average of values from 1979St13, 1977Ev03, and 1974Po15.
§ From weighted average of values from 1979St13 and 1974Po15.
\# From 1979St13.
@ From 1977Be22.
& From 2000ApZX.
a Relative photon intensity, θ=125 , see 1977Be22.
b Calculated by evaluator from the branching (ε decay) and measured doublet Iγ (1977Be22).
c The χ^2 analysis of γ(θ), see 1987Ba72, except as noted.
d From DCO ratios. Mult=Q for ΔJ=2 and mult=D for ΔJ=1 or 0, See 2000ApZX.
e Placement of transition in the level scheme is uncertain.

Adopted Levels, Gammas

Q(β⁻)=–2374 *6*; S(n)=10535.4 *20*; S(p)=6545.6 *21*; Q(α)=–8655 *3* 2003Au03.
Other reactions:
^{51}V(^{3}He,2n): 1984Ha10.
^{51}V(^{12}C,4p7n): 1984Ha10, 1984Pa13.
^{52}Cr(d,2n): E=6–27 MeV 1987We05; E=8–20 MeV calculated σ(E), 1987Mu08.
^{54}Fe(α,α'pnγ): 1975DrZU.
^{55}Mn(γ,3nγ): 1974Di13.
^{55}Mn(p,3np): 1979MiZT.
Fe(a,3pxn), Ni(5p,xn): 1983Mi18.
^{59}Co(d,3p6n): E=9–85 MeV, 1983Mi21.
^{59}Co(^{3}He,4p6n): E=14–130 MeV, 1983Mi11; E=5–50 MeV, 1986Ja09.
^{59}Co(a,3n2a): E=10–120 MeV, 1987Ra08.
Other reaction: ^{55}Mn(γ,3n).

^{52}Mn Levels

Cross Reference (XREF) Flags

A ^{52}Mn IT Decay (21.1 min)	F ^{50}Cr(α,pnγ),^{51}V(α,3nγ)	K ^{52}Cr(^{3}He,t)
B ^{52}Fe ε Decay (8.275 h)	G ^{50}Cr(α,d)	L ^{54}Fe(p,^{3}He)
C ^{52}Fe ε Decay (45.9 s)	H ^{51}V(^{3}He,2nγ)	M ^{54}Fe(d,α)
D (HI,xnγ)	I ^{52}Cr(p,n)	N ^{54}Fe(d,αγ)
E ^{50}Cr(^{3}He,p)	J ^{52}Cr(p,nγ)	

E(level)[†]	Jπ	XREF	$T_{1/2}$[e]	Comments
0.0	6+	ABCD F HIJKLMN	5.591 d *3*	%ε+%β⁺=100. =+3.063 *1*; Q=+0.50 *7* (1989Ra17). : Weighted average of values 3.0622 *12* (atomic beam) and 3.0632 *13* (N/RD) given in 1989Ra17 with an uncertainty arising from that in the ^{55}Mn calibration value. $T_{1/2}$: from 1977Ya08. Jπ: paramagnetic resonance (1976Fu06), allowed ε decay to 6+.
377.749 *5*	2+	AB EF IJKLM	21.1 min *2*	=+0.00768 *8* (1989Ra17). %ε+%β⁺=98.25 *5*; %IT=1.75 *5*. $T_{1/2}$: from 1959Ju40. Others: 21.3 min (1940He01), 20.1 min *8* (1956Ru45); 22.1 min *3* (1965Ka12). $T_{1/2}$: stripped atom $T_{1/2}$(^{52}Mn^{25+})=22.7 min *30* (1995Ir01). Jπ: atomic beams (1976Fu06) and E4 γ to 6+.
546.438 *6*	1+	B DE G IJKLM	1.85 ns *7*	Jπ: log *ft*=4.7 from 0+. $T_{1/2}$: from 1961Na06. Other: 12 ns *2* (1959Ju40).
731.66 *25*	4+	D F JKLMN	3.6 ps *14*	Jπ: γ(θ) in (p,nγ), and L(p,^{3}He)=4.
825.2 *4*	3+	DEF JKLMN	0.17 ps *+4–3*	XREF: E(828)L(820). Jπ: L(d,α)=2+(4) and L(p,^{3}He)=2+4.
869.89 *18*	7+	CDEFG JKLMN	0.12 ps *+6–8*	XREF: E(850)L(867). $T_{1/2}$: others: <0.38 ps (HI,xnγ), 0.05 ps *+6–3* (^{51}V(α,3nγ)). Jπ: γ(θ) in (HI,xnγ) and L(p,^{3}He)=6.
884.2 *3*	3,4	e JK N	1.4 ps	Jπ: γ(θ) in (p,nγ). D+Q γ to 4+.
886.9 *3*	2	e J N	0.06 ps *+3–4*	Jπ: γ(θ) in (p,nγ).
1232.3 *3*		J N	0.14 ps *+19–8*	
1253.7 *4*	5+	e g JKLMN	0.018 ps *55*	Jπ: L(d,α)=4+6.
1279.0 *4*	5+[a]	DeFg J N	0.25 ps *+17–8*	
1417.688? *18*		B		
1646.9 *5*		J MN	0.37 ps *+24–17*	
1683.8 *4*	5+[a]	EFG JKLMN	0.25 ps *+17–8*	Jπ: agrees with 3+,4+,5+ assignment from (d,α) and L=4 in (p,^{3}He) and (α,d), but disagrees with 1+,2+ 3+ assignment from L=2 in (^{3}He,p) for level at 1680 keV *30*. Perhaps level seen in (^{3}He,p) is 1647 keV.
1956.0 *20*	(6+)	JKLM		Jπ: L(p,^{3}He)=6. Consistent with 5+,6+,7+ from (d,α).
2044.2 *7*	3+,4+,5+	JKLM		Jπ: L(p,^{3}He)=4.
2130.0 *20*	3+,4+,5+	E G JKLM		Jπ: L(α,d)=4 and L(p,^{3}He)=4.
2252.6 *5*	3+,4+,5+	JKLM		Jπ: L(p,^{3}He)=4.

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Adopted Levels, Gammas (continued)

^{52}Mn Levels (continued)

E(level)[†]	Jπ	XREF	$T_{1/2}$[e]	Comments
2285.94 *22*	8+[a,b]	CD F M	<0.069 ps[f]	$T_{1/2}$: From (α,3nγ) (1987Ba72). Other: <0.69 ps in (HI,xnγ) (1976Av06).
2337.2 *5*	(3+)	E G JKLMN	0.05 ps *+2−4*	XREF: E(2345)G(2350). Jπ: (1+,2+,3+) from L(p,^{3}He)=(2) and 3+,4+,5+ from L(α,d)=4.
2473.6 *6*	0+,1+	E J LMN	0.32 ps *+16−4*	XREF: E(2471)L(2476). Jπ: L(^{3}He,p)=0.
2631.2 *5*	1+	E G JKLM		XREF: E(2634)G(2640)K(2629)L(2629)M(2629). Jπ: L=0+2 in (d,α), (p,^{3}He) and (^{3}He,p).
2645 *5*		K		
2677 *10*		E K		XREF: K(2667).
2710.2 *6*	7+[d]	DE LM		XREF: E(2714).
2771 *3*		K		
2785[@] *4*	(4+)	E KL		XREF: E(2788). Jπ: L(p,^{3}He)=(4).
2796[@] *3*	+	E G K M		XREF: E(2803)G(2800). Jπ: L(d,α)=2, L(α,d)=(0).
2815 *4*		K		
2848 *3*		g KLM		XREF: L(2850).
2858 *5*		e g K M		XREF: g(2860).
2872[@] *4*		E g K		
2903 *5*	1+	E G K M		XREF: G(2900). Jπ: L(α,d)=2, L(^{3}He,p)=0.
2907.6 *3*	9+[b]	CD F	0.08 ps[g] *6*	$T_{1/2}$: other: <0.4 ps in (HI,xnγ) (1976Av06).
2926.0 *5*	0+	E IJKL		XREF: E(2929)I(2912)L(2923). T=2. Jπ: IAS (^{52}Cr g.s.). Identified in (p,n), (^{3}He,t), (p,^{3}He), (^{3}He,p). L(^{3}He,p)=0.
2955 *5*		K M		
2973 *4*	(5+,6+,7+)	E g KLM		XREF: L(2968). Jπ: from L(^{3}He,p)=6, but L=(1) reported for level at 2968 keV in (p,^{3}He). Perhaps two distinct states are involved.
2982 *3*		g K M		XREF: g(2990).
3022	3+,4+,5+	L		Jπ: L(p,^{3}He)=4.
3077 *4*		K		
3097	3+,4+,5+	L		Jπ: L(p,^{3}He)=4.
3106 *4*		K M		
3130 *20*		G		
3199 *3*	5+,6+,7+	KLM		XREF: L(3196). Jπ: L(p,^{3}He)=6.
3213 *10*	0+,1+	E		Jπ: L(^{3}He,p)=0.
3226 *4*	3+,4+,5+	KLM		XREF: L(3228). Jπ: L(p,^{3}He)=4.
3245[§] *10*	(1+)	E G		XREF: G(3260). Jπ: L(^{3}He,p)=(0+2).
3297 *5*	(1+,2+,3+)	E K M		Jπ: L(^{3}He,p)=(2).
3333 *3*	(2−,3−,4−)	E KLM		XREF: E(3337)L(3330). Jπ: L(p,^{3}He)=(3).
3351 *5*		K		
3386 *3*	(3+)	KLM		XREF: L(3380). Jπ: L=(2+4) in (d,α) and (p,^{3}He).
3423 *3*		E KLM		XREF: E(3418)L(3420). Jπ: L(d,α)=3, L(p,^{3}He)=4, L(^{3}He,p)=2 for contradictory assignments. Could be more than one level.
3476[‡] *9*	(3+,4+,5+)	E G K		XREF: E(3480)G(3460)K(3490). E(level): weighted average of (^{3}He,p) and (α,d). Jπ: L(α,d)=(4).
3506 *3*	(3+,4+,5+)	KLM		XREF: L(3500). Jπ: L(p,^{3}He)=4.
3573 *5*	1+	E KLM		XREF: E(3575)L(3567). Jπ: L(p,^{3}He)=0+2.
3602.2 *6*	8+[d]	D G		

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Adopted Levels, Gammas (continued)

^{52}Mn Levels (continued)

E(level)[†]	Jπ	XREF	$T_{1/2}$[e]	Comments
3620 *6*		M		
3640 *6*		KLM		XREF: L(3635).
3655 *6*		KLM		XREF: L(3660).
3706 *6*	(2−,3−,4−)	LM		XREF: L(3711). Jπ: L(p,^{3}He)=(3).
3738 *4*	3+,4+,5+	LM		XREF: L(3742). Jπ: L(d,α)=4.
3776[§] *10*	1+,2+,3+	E K		XREF: K(3773). Jπ: L(^{3}He,p)=2.
3797.6 *11*	(9+)	D		
3837.2 *4*	11+[d]	CD F	15.1 ps *10*	$T_{1/2}$: RDM, weighted average of values 15.0 ps *14* in ^{51}V(α,3nγ) (1987Ba72) and 15.2 ps *14* in (HI,xnγ) (1976Av06).
3884[@] *6*		E g K		
3891.4 *5*	8+	D		
3898 *4*		g M		XREF: g(3900).
3936 *4*		M		
3974[‡] *8*	1+	E M		Jπ: L(^{3}He,p)=0+2.
3987 *6*		M		
4040 *20*		G		E(level): may be same as 4061 level.
4061 *4*		M		
4129 *8*		M		Jπ: L(d,α)=4. May be same as 4136. If so, one gets Jπ=3+.
4136 *10*		E		Jπ: L(^{3}He,p)=2. May be same as 4129. If so, Jπ=3+. E(level): same as 4129 keV level?
4163.6 *4*	10+[d]	D F	0.14 ps[g] *+24−11*	
4236[‡] *6*		E M		Jπ: L(d,α)=6,5.
4281[‡] *6*	1+,2+,3+	E M		Jπ: L(^{3}He,p)=2.
4314 *10*		E G		XREF: G(4340).
4376[‡] *6*	1+	E G M		XREF: G(4340). Jπ: L(^{3}He,p)=0+2.
4390 *30*	(2+)[c]	K		
4439[‡] *10*	3+	E M		XREF: M(4450). Jπ: L(^{3}He,p)=2. L(d,α)=4.
4461 *10*		E		
4500[‡] *7*		E K M		Jπ: L(^{3}He,p)=0+2, L(d,α)=3 for contradictory J assignments. (2)+ in (^{3}He,t) from σ(θ) compared with σ(θ) for states for known J.
4540 *10*		M		
4620 *10*	2−,3−,4−	M		Jπ: L(d,α)=3.
4679.5 *5*	9−[d]	DE		
4697[‡] *7*		E M		XREF: E(4704)M(4690).
4837 *10*	0+,1+	E		Jπ: L(^{3}He,p)=0.
4953 *10*	1+	E		Jπ: L(^{3}He,p)=0+2.
5043 *10*		E		
5069[§] *10*	(2+)[c]	E K		
5313 *10*		E		
5403 *10*		E		
5466 *10*		E		
5491 *10*	0+,1+	E		T=(2). Possible IAS (^{52}Cr 2647 keV) in (^{3}He,p). Jπ: L(^{3}He,p)=0.
5520 *30*	8−	G		From configuration=($f_{7/2}$,$g_{9/2}$)8−.
5751[§] *10*		E G		
5782 *10*		E		
5809 *10*		E		
5840 *10*		E		
5857.5 *6*	11+	D		
5874 *10*	1+,2+,3+	E		Jπ: L(^{3}He,p)=2.
6061.0 *8*	11−	D		
6260 *30*	6−	G		From configuration=($g_{9/2}$,$p_{3/2}$)6−.
6990 *30*	6−	G		From configuration=($g_{9/2}$,$p_{3/2}$)6−.
7467.4 *7*	12+[d]	D G		XREF: G(7480).

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{52}Mn Levels (continued)

E(level)†	Jπ	XREF
7701.8 *7*	(12+)	D
8152.5 *6*	13+	D
8384.4 *9*	(13+)	D
8582.3 *8*	(13−)	D
8787.4 *13*		D
8894.4 *9*	14+	D
9372.3 *9*	13−	D
9906.4 *11*	13+	D
10178.4 *9*		D
11204.3 *13*		D
12066.5 *15*	(16+)	D

† Levels connected by gammas are from least squares fits, others from (d,α), except as noted.
‡ Weighted average values of (^{3}He,p) and (d,α).
§ From (^{3}He,p).
@ From (^{3}He,t).
a From (α,pnγ), based on evaporation–model analysis.
b From (HI,xnγ), based on excitation function and γ(θ) interpreted in context of evaporation model.
c From (^{3}He,t), based on empirical comparison of angular distribution with those for transitions to states of known spin.
d From (HI,xnγ) (2003Ax01) based on angular distribution and Compton polarization measurements.
e From (d,αγ) (1978DoZM) DSAM, except as noted.
f From (HI,xnγ) (1976Av06) DSAM.
g From ^{51}V(α,3nγ) (1987Ba72) DSAM.

γ(^{52}Mn)

E(level)	Eγ†	Iγ†	Mult.	δ&	α	Comments
377.749	377.748§ *5*	100	E4		7.0×10^{-4} *11*	B(E4)↓(W.u.)=0.146 *5*.
546.438	168.688§ *2*	100	M1+E2			δ: −5.5<δ<+0.03 in (p,nγ).
731.66	353.7 *5*	8.6	E2			Mult.: from γ(θ) in (p,nγ) and RUL. B(E2)↓(W.u.)=200 *80*.
	731.5 *5*	100	E2			B(E2)↓(W.u.)=60 *24*. Mult.: from γ(θ) in (p,nγ) and RUL.
825.2	447.4 *5*	100	(M1+E2)			δ: −0.038 *10* or −0.005 *10* in (p,nγ).
869.89	869.9‡ *2*	100	M1+E2	−0.10 *5*		δ: other: +0.04 *+2−3* in (α,pnγ). B(M1)↓(W.u.)=0.276 *3*; B(E2)↓(W.u.)=8 *8*.
884.2	152.2 *5*	2.9	D+Q			δ=−0.56 *10* if J(884)=4. Mult.: D+Q in (α,pnγ) for J=4.
	506.6 *5*	100				
886.9	340.4 *5*	11	D(+Q)	<0.03		
	508.8 *5*	100				
1232.3	345.1 *5*	19				
	500.8 *5*	47				
	854.6 *5*	100				
1253.7	521.8 *5*	24				
	708@					
	1253.7 *5*	100				
1279.0	394.6 *5*	66				
	453.6 *5*	100				
1417.688?	1039.928§ *17*	100				
1646.9	414.7 *5*	100				
	762.7 *5*	36				
1683.8	404.4 *5*	15				
	952.1 *5*	31				
	1684.1 *5*	100				
1956.0	1956 *2*	100				
2044.2	1218.9 *5*	100				
2130.0	2130 *2*	100				
2252.6	2252.5 *5*	100				
2285.94	1416.1‡ *2*	100‡ *6*	(M1+E2)	−0.30 *10*		δ: other: +0.03 *+3−5* in (α,pnγ), (α,3nγ). B(M1)↓(W.u.)>0.0088?; B(E2)↓(W.u.)>0.36?
	2285.9‡ *4*	10.4‡ *21*	(E2)			Iγ: other: 61 *17* in (HI,xnγ), 40 *11* in (α,pnγ). B(E2)↓(W.u.)>0.11.
2337.2	1450.2 *5*	81				
	1512.0 *5*	100				

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Adopted Levels, Gammas (continued)

γ(^{52}Mn) (continued)

E(level)	Eγ†	Iγ†	Mult.	δ&	Comments
2473.6	1586.7 *5*	100			
2631.2	2084.7 *5*	100			
2710.2	1840@				
	2710@				
2907.6	621.7‡ *2*	100‡ *6*	(M1+E2)	−0.08 *7*	B(M1)↓(W.u.)=(0.6 *5*); B(E2)↓(W.u.)=(21 *+41−21*). Iγ: other: 61 *17* in (HI,xnγ), 40 *11* in (α,pnγ).
	2037.6‡ *4*	98‡ *6*	(E2)		B(E2)↓(W.u.)=9 *7*.
2926.0	2379.5 *5*	100			
3602.2	892@				
	2732@				
	3602@				
3797.6	890@				
3837.2	929.5‡ *2*	100	(E2)		B(E2)↓(W.u.)=4.7 *4*.
3891.4	984@				
	1181@				
	1606@				
	3021@				
4163.6	325@				
	1256.5# *3*	100#			
	1876@				
4679.5	788@				
	1077@				
	1772@				
	2394@				
	3809@				
	4679@				
5857.5	1695@				
	2020@				
	2949@				
6061.0	1381@				
7467.4	1610@				
	3630@				
7701.8	3539@				
	3864@				
8152.5	451@				
	685@				
	2295@				
	4315@				
8384.4	4547@				
8582.3	2521@				
	4745@				
8787.4	1320@				
8894.4	510@				
	742@				
9372.3	3311@				
	5535@				
9906.4	1012@				
	1522@				
10178.4	1596@				
	2026@				
11204.3	1832@				
12066.5	2160@				

† From (p,nγ), except as noted.
‡ From ^{52}Fe ε decay (45.9 s).
§ From ^{52}Fe ε decay (8.275 h).
# From (α,pnγ).
@ From (HI,xnγ).
& From (HI,xnγ), except as noted.

^{52}Mn IT Decay (21.1 min) 1977Ya08

Parent ^{52}Mn: E=377.749 *5*; Jπ=2+; $T_{1/2}$=21.1 min *2*; %IT decay=1.75 *5*.
1977Ya08: chemically separated sources from ^{52}Fe ε decay, measured Eγ, Iγ, a Compton suppression spectrometer system, several large volume Ge(Li) detectors.
See also ^{52}Mn ε decay (21.1 min).
Feeding of 21.1–min ^{52}Mn in ^{52}Fe ε decay (8.275 h)=100%.

^{52}Mn IT Decay (21.1 min) 1977Ya08 (continued)

^{52}Mn Levels

E(level)	Jπ	$T_{1/2}$	Comments
0.0	6+	5.591 d *3*	
377.739 *5*	2+	21.1 min *2*	%ε+%β^{+}=98.25 *5*; %IT=1.75 *5*.

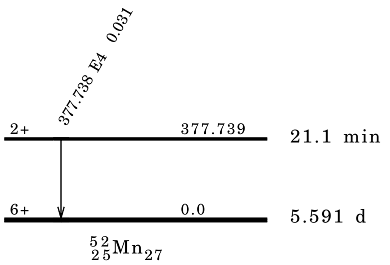
γ(^{52}Mn)

Eγ	E(level)	Iγ†	Mult.	α
377.738 *5*	377.739	100	E4	7.0×10^{-4} *11*

† For absolute intensity per 100 decays, multiply by 0.000306 *13*.

Decay Scheme

Intensities: I(γ+ce) per 100 parent decays %IT=1.75 *5*



^{52}Fe ε Decay (8.275 h) 1990Me15

Parent ^{52}Fe: E=0.0; Jπ=0+; $T_{1/2}$=8.275 h *8*; Q(g.s.)=2374 *6*; %ε+%β^{+} decay=100.

Source from mass separation and/or chemical purification, measured Eγ, Iγ with the automated multi–spectrometer γ–ray counting facility. Sources were counted individually and in combination on several different calibrated spectrometer systems utilized various detectors ranging from small (X–ray) detectors to large volume high–purity Ge detectors.

See also ^{52}Mn IT decay (21.1 min).

See also ^{52}Mn ε decay (21.1 min).

See also 1977Ya08.

^{52}Mn Levels

E(level)	Jπ†	$T_{1/2}$	Comments
0.0	6+	5.591 d *3*	$T_{1/2}$: From adopted levels.
377.749 *5*	2+	21.1 min *2*	$T_{1/2}$: From adopted levels. %ε+%β^{+}=98.25 *5*; %IT=1.75 *5*.
546.438 *6*	1+		
1417.688 *18*			

† From adopted levels.

^{52}Fe ε Decay (8.275 h) 1990Me15 (continued)

β^+,ε Data

Eε	E(level)	Iβ+†	Iε†	Log *ft*	I(ε+β+)†
(956 *6*)	1417.688		0.96	5.8	0.96
1825 *12*	546.438	55.49	43.61	4.7	99.1

† Absolute intensity per 100 decays.

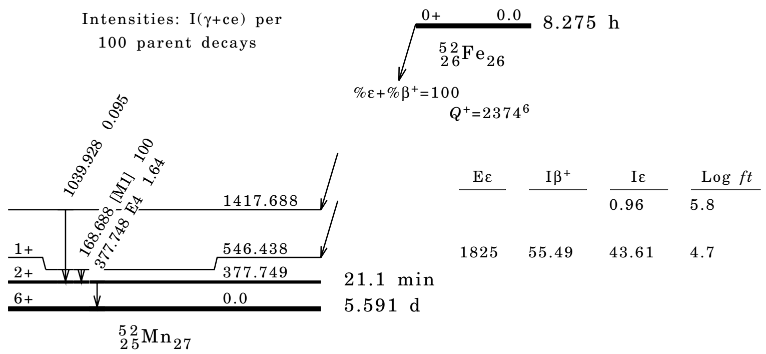
γ(^{52}Mn)

Iγ normalization: from I(ε+β+)=I(γ+ce)(169γ)+I(1040γ)=100. Based on log *ft*>11.0 for a second–forbidden transition, I(ε+β+) feeding to the g.s. is <0.00005%.

Eγ	E(level)	Iγ†‡	Mult.	α
168.688 *2*	546.438	1032 *20*	[M1]	8×10^{-3} *8*
377.748 *5*	377.749	17.1 *2*	E4	7.0×10^{-4} *11*
x704.6 *2*		0.3 *1*		
1039.928 *17*	1417.688	0.99 *4*		
x1530.709 *19*		0.47 *2*		
x1727.57 *8*		2.2 *1*		

† I(1434γ)=1000 in ^{52}Cr.
‡ For absolute intensity per 100 decays, multiply by 0.0961 *19*.
x γ ray not placed in level scheme.

Decay Scheme



^{52}Fe ε Decay (45.9 s) 1979Ge02

Parent ^{52}Fe: E=6958.0 *4*; Jπ=12+; $T_{1/2}$=45.9 s *6*; Q(g.s.)=2374 *6*; %ε+%β+ decay=100.
^{52}Fe–$T_{1/2}$: From 1979Ge02.
1979Ge02: source produced in ^{40}Ca(^{14}N,pn), measured γ–ray singles and γγ–coin, Ge(Li) detectors. An upper limit on the direct γ–decay branch of the ^{52}Fe isomer is 0.004.
Others: 1977KaZV, 1975Ge01, 1978GeZZ.

^{52}Mn Levels

E(level)	Jπ†	$T_{1/2}$	Comments
0.0	6+	5.591 d *3*	$T_{1/2}$: From adopted levels.
869.90 *19*	7+		
2285.98 *23*	8+		
2907.7 *3*	(9+)		
3837.2 *4*	11+		

† From adopted levels.

^{52}Fe ε Decay (45.9 s) 1979Ge02 (continued)

β^+,ε Data

Eε	E(level)	Iβ$^+$†	Iε†	Log *ft*	I(ε+β$^+$)†	Comments
5350 *130*	3837.2	99.58	0.42	4.8	100	Eε: from E(β^+)=4330 *130* as quoted by 1979Ge02. The authors estimate direct ε+β^+ feeding to other excited levels to be <5%.

† Absolute intensity per 100 decays.

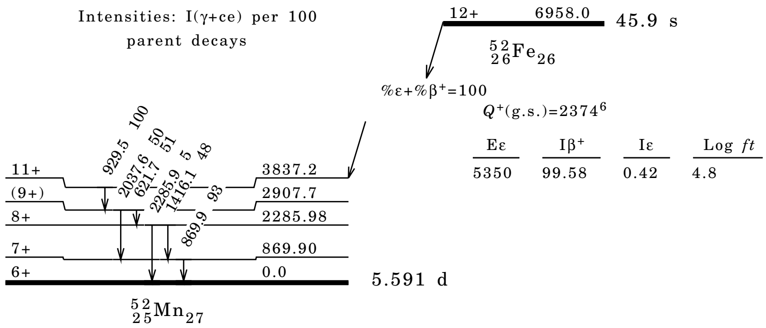
γ(^{52}Mn)

Eγ	E(level)	Iγ†
621.7 *2*	2907.7	51 *3*
869.9 *2*	869.90	93 *5*
929.5 *2*	3837.2	100
1416.1 *2*	2285.98	48 *3*
2037.6 *4*	2907.7	50 *3*
2285.9 *4*	2285.98	5 *1*

† Absolute intensity per 100 decays.

Decay Scheme

Intensities: I(γ+ce) per 100 parent decays



^{50}Cr(^{3}He,p) 1971Ha24,1973Gu14,1968Ra05

1971Ha24: E=16.5 MeV, measured σ(E(p),θ), multiangle spectrograph, nuclear emulsions, overall energy resolution≈15 keV FWHM.
1973Gu14: E=35 MeV, measured σ(E(p),θ), ΔE–E telescope, ΔE: surface barrier detector, E: Ge(Li), Si(Li), resolution≈80 keV FWHM.
1968Ra05: E=12 MeV, measured σ(E(p),θ), multiple-gap spectrograph, nuclear emulsions, 35 keV FWHM.
Others: 1971Ha55, 1977DrZM.

^{52}Mn Levels

E(level)†	Jπ[d]	L@	dσ/dΩ#
381 *10*			52
554 *10*			122
828 *10*			60
850‡ *30*		2,(6)[b]	
881 *10*			95
1240‡ *30*		6[b]	
1680‡ *30*		2[b]	
2130‡ *30*			
2345 *10*	(1+,2+,3+)	(2)[a]	74
2471 *10*	0+,(1+)	0	1149

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$^{50}Cr(^{3}He,p)$ 1971Ha24,1973Gu14,1968Ra05 (continued)

^{52}Mn Levels (continued)

E(level)†	Jπ[d]	L@	dσ/dΩ#	Comments
2634 *10*	1+	0+2	3663	L: from 1971Ha24, but 1968Ra05 report L=0, 1973Gu14 report L=2.
2677 *10*			69	
2714 *10*			39	
2788 *10*		[c]		
2803 *10*		[c]		
2859 *10*			180	
2873 *10*			180	
2903 *10*	0+,1+	0[a]	218	
2929 *10*	0+,1+	0	1520	T=2. IAS (^{52}Cr g.s.) (1968Ra05,1971Ha24).
2972 *10*	6+,(5+,7+)[e]	6[b]	47	
3213 *10*	0+,1+	0[a]	228	
3245 *10*		(0+2)&	312	
3296 *10*		(2)[a]	74	
3337 *10*			70	
3418 *10*	1+,2+,3+	2[a]	184	
3480 *10*			244	
3575§ *10*	0+,1+	0	497	
3776 *10*	1+,2+,3+	2	315	
3885 *10*			85	1971Ha24 report L=(4), 1973Gu14 report L=0+2.
3975 *10*	1+[e]	0+2[b]	169	
4136 *10*	(3+)[e]	2[b]	135	
4237 *10*			258	
4281 *10*	1+,2+,3+	2[a]	245	
4314§ *10*			146	
4375 *10*	1+	0+2	1224	
4439 *10*	1+,2+,3+	2[a]	204	
4461 *10*			51	
4500 *10*	1+	0+2[a]	418	
4679 *10*			109	
4704 *10*			185	
4837 *10*	0+,1+	0	250	
4953§ *10*	1+[e]	0+2[b]	259	
5043 *10*			175	
5069 *10*			172	
5313 *10*			149	
5403 *10*			268	1968Ra05 report L=(0+2), 1973Gu14 report L=2.
5466 *10*			463	
5491 *10*	0+,1+	0	2169	T=(2). IAS(^{52}Cr 2647 keV level) (1971Ha24)?.
5751 *10*			650	
5782 *10*			783	
5809 *10*			345	
5840 *10*			746	
5874 *10*	1+,2+,3+	2	311	

† From 1971Ha24, except as noted.
‡ Level reported by 1973Gu14 only.
§ Doublet.
\# Peak differential cross section (arbitrary units) (1971Ha24).
@ From DWBA analyses. Values reported in more than one work without contradiction are given without comment.
& Reported by 1968Ra05 only.
[a] Reported by 1971Ha24 only.
[b] Reported by 1973Gu14 only.
[c] Combined 2788+2803 line reported L=2, dσ/dΩ=543 (1971Ha24), 2800 line L=2 (1968Ra05), L=2 for E=2800 (1973Gu14).
[d] Based on the L value and (^{3}He,p) selection rule for a 0+ target by 1971Ha24, except as noted.
[e] From 1973Gu14 based on L value.

$^{50}Cr(\alpha,pn\gamma),^{51}V(\alpha,3n\gamma)$ 1977Ev03,1987Ba72

1977Ev03: $^{50}Cr(\alpha,pn\gamma)$ E=23.5, 27.2 MeV, γγ coin, nγ coin. two 60 cm^3 Ge(Li) counter, two conical NE 213/RCA 8854 counters.
1987Ba72: $^{51}V(\alpha,3n\gamma)$ E=30–45 MeV, RDM, DSAM, γ(θ), γγ-coin. Ge(Li) detector: 2.7 keV at 1333.6 keV (FWHM), HPGE detector: 2.4 keV at 1333.6 keV (FWHM).
All data are from 1977Ev03, except as noted.

^{52}Mn Levels

E(level)	Jπ†	$T_{1/2}$‡	Comments
0.0	6+		
378.0 *10*	2+		
732.0 *10*	4+		
825.4 *11*	3+		
869.61 *20*	7+	0.05 ps *+6−3*	
1279.0 *12*	5+		
1683.6 *3*	5+		
2285.6 *3*	8+	<0.069 ps	
2907.2 *3*	9+	0.08 ps *6*	
3836.9 *5*	11+	15.0 ps *14*	$T_{1/2}$: RDM.
4163.7 *5*	10+	0.14 ps *+24−11*	

† From 1976St19, based on γ(θ) in (^{33}S,3pnγ), evaporation-model analysis of two-point excitation function and shell-model calculations.
‡ From 1987Ba72, DSAM, except as noted.

γ(^{52}Mn)

E(level)	Eγ	Iγ‡	Mult.†	δ†	Comments
378.0	(378)				
732.0	732				
825.4	447.4 *4*				
869.61	869.6 *2*	591 *73*	D+Q	+0.04 *+2−3*	
1279.0	453.6 *4*				
1683.6	1683.6 *3*				
2285.6	1416.0 *2*	188 *35*	D+Q	+0.13 *+5−3*	
	2285.6	5	Q		Iγ: from 1987Ba72.
2907.2	621.6 *2*	100	D+Q	+0.03 *+3−5*	
	2037.5 *3*	40 *11*	Q		
3836.9	929.7 *3*	55 *12*			
4163.7	1256.5 *3*	31 *9*			

† From γ(θ), 1987Ba72.
‡ Iγ relative to Iγ(622)=100. Only intensities of yrast cascade gammas are given. Intensities are from singles for E(α)=23.5 MeV.

$^{50}Cr(\alpha,d)$ 1974Ga16,1994Fi01

1974Ga16: E=31.2 MeV, measured σ(E(d),θ), ΔE–E telescope, surface barrier detector, FWHM=45 keV.
1994Fi01: E=55.4 MeV, measured σ(E(d),θ). FWHM=120 keV, θ(lab)=15 – 25 (2.5 steps), 30 – 70 (5 steps), a ΔE–E silicon detector telescope, a 300 m ΔE counter, three 2 mm E counters, DWBA analysis.
All data are from 1974Ga16, except as noted.

^{52}Mn Levels

E(level)	Jπ‡	L	Comments
550 *20*			
880 *20*	7+	(6)	configuration=($(f_{7/2})^2$)7+ (1994Fi01).
1260 *20*		4	
1680 *20*		4	
2130 *20*		4	
2350 *20*		4	

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$^{50}Cr(\alpha,d)$ 1974Ga16,1994Fi01 (continued)

^{52}Mn Levels (continued)

E(level)	Jπ‡	L	Comments
2640 *20*		2	
2800 *20*		(0)	
2860 *20*		2,4	
2900 *20*		2	
2990 *20*			
3130 *20*			
3260 *20*			
3460 *20*		(4)	
3600 *20*			
3900 *20*			
4040 *20*			
4340† *30*			
5520† *30*	8−		configuration=$(f_{7/2},g_{9/2})$8− (1994Fi01).
5790† *30*			
6260† *30*	6−		configuration=$(g_{9/2},p_{3/2})$6− (1994Fi01).
6990† *30*	6−		configuration=$(g_{9/2},p_{3/2})$6− (1994Fi01).
7480† *30*			

† From 1994Fi01.
‡ From 1994Fi01, based on angular distributions and DWBA analysis.

$^{51}V(^{3}He,2n\gamma)$ 1976St19

Target Jπ=7/2−.
E=6–26 MeV, measured G–ray excitation function, G–spectra, γγ coin with Ge(Li) detectors.
All data are from 1976ST19, except as noted.
Other: 1984Ha10.

$^{52}Cr(p,n)$ 1966Ri09,1988Wa07,1967Co13

1966Ri09: E=3.2–9.5 MeV, measured σ(E), BF3 counters, the "counter ratio" technique.
1988Wa07: E=120 MeV, overall energy resolution: ≈300 keV, measured σ(θ), large volume neutron detectors, tof, 130 m, DWBA analysis.
1967Co13: E=13 MeV, measured σ(θ), NE 213 liquid scintillators, tof technique.
Others: 1979Bi08, 1980AnYW, 1982Bi04, 1984Zh02, 1985Bl12, 1967Go17.

^{52}Mn Levels

E(level)†	Comments
0.0	
383 *10*	
544 *10*	
2912 *20*	T=2. Identified by 1967Co13, 1967Go14 as IAS (^{52}Cr g.s.). E(level): from 1967Co13.
3.6×10^{3}‡ *1*	
4.4×10^{3}‡ *1*	
5.0×10^{3}‡ *1*	

† From 1966Ri09, except as noted.
‡ From 1988Wa07.

$^{52}Cr(p,n\gamma)$ 1973De03,1976Ta14

1973De03: E=8.0–10.0 MeV; measured Eγ, Iγ, nγ coin, 40 cm^3 coaxial Ge(Li) detector (FWHM=3 keV), 5–in diam*3–in cylindrical NE 213 liquid scintillator.
1976Ta14: E=6.3–7.3 MeV; measured γ(θ), 42 cm^3 Ge(Li) detector rotated to 0 , 31 , 55 , 70 and 90 with respect to the proton beam direction.
Level scheme from 1973De03.

^{52}Mn Levels

E(level)	Jπ†	Comments
0.0	6+	
378.1 *5*	2+	
546.4 *6*	1+	
731.8 *4*	4	Jπ: γ(θ) for g.s. transition implies J=4–8, 354–keV transition implies J=0–4.
825.5 *6*	2,3	
869.7 *5*		Jπ: high spin (based on excitation function) (1976Ta14).
884.4 *5*	3,4	
887.1 *6*	2	
1232.5 *5*	2 to 4	
1253.7 *4*	4 to 6	
1279.2 *5*		
1647.2 *6*		
1683.9 *4*		
1956.0 *20*		
2044.4 *8*		
2130.0 *20*		
2252.6 *5*		
2337.4 *6*		
2473.8 *8*		
2631.2 *8*		
2926.0 *8*		

† From 1976Ta14, based on γ(θ) and compared with the predictions of compound nuclear statistical model. Jπ of g.s. and first two excited states taken from adopted levels.

$\gamma(^{52}Mn)$

E(level)	Eγ†	Iγ‡	Mult.	Comments
546.4	168.1 *5*	70.6	D+Q	−5.4<δ<+0.03 (1976Ta14).
731.8	353.7 *5*	5.6	Q	δ: authors assumed negligible L=3 admixture.
	731.5 *5*	64.9	Q	δ: authors assumed negligible L=3 admixture.
825.5	447.4 *5*	100	D+Q	δ=−0.038 *10* from E(p)=6.85 MeV data, δ=−0.005 *10* from E(p)=6.50 MeV data, if J(826)=3 (1976Ta14).
869.7	869.7 *5*	9.7		
884.4	152.2 *5*	3.1	D+Q	δ=−0.56 *10* if J(884)=4 (1976Ta14).
	506.6 *5*	(108)		Iγ: partially obscured by annihilation radiation.
887.1	340.4 *5*	9.4	D(+Q)	δ: 0.03<(1976Ta14).
	508.8 *5*	(86)		Iγ: partially obscured by annihilation radiation.
1232.5	345.1 *5*	7.6		
	500.8 *5*	18.4		
	854.6 *5*	39.5		
1253.7	521.8 *5*	4.2		
	1253.7 *5*	17.7		
1279.2	394.6 *5*	19.3		
	453.6 *5*	29.3		
1647.2	414.7 *5*	18.0		
	762.7 *5*	6.4		
1683.9	404.4 *5*	2.0		
	952.1 *5*	4.2		
	1684.1 *5*	13.6		
1956.0	1956§ *2*	8.7		
2044.4	1218.9 *5*	6.2		
2130.0	2130§ *2*	14.1		
2252.6	2252.5 *5*	14.5		
2337.4	1450.2 *5*	6.0		

Continued on next page (footnotes at end of table)

^{52}Cr(p,nγ) 1973De03,1976Ta14 (continued)

γ(^{52}Mn) (continued)

E(level)	Eγ[†]	Iγ[‡]
2337.4	1512.0 *5*	7.4
2473.8	1586.7 *5*	12.8
2631.2	2084.7 *5*	6.1
2926.0	2379.5 *5*	3.1

† From 1973De03.
‡ Intensity relative to Iγ(447)=100 at E(p)=10 MeV from 1973De03. Uncertainties ≈25% for strong transitions and 50% to 100% for the weaker ones.
§ Possible doublet.

^{52}Cr(^{3}He,t) 1973De03,1969Br04

1973De03: E=19 MeV, measured σ(E(t),θ), θ=40 , sensitive plates placed in the focal plane of the Enge split–pole spectrograph, FWHM: 15 keV.
1969Br04: E=30.2 MeV, measured σ(E(t),θ), solid state counter telescopes (ΔE: 250 m, Δ: 3 mm), the final resolution in the triton spectra: 100 KeV.
All data are from 1973De03, except as noted.

^{52}Mn Levels

E(level)[#]	Jπ[§]	σ (40)[†]	E(level)[#]	Jπ[§]	σ (40)[†]	E(level)[#]	Jπ[§]	σ (40)[†]
0.0	6+	7.2	2667 *10*	2+	≈2.0	3226 *4*	(5+)	1.6
378 *1*	2+	9.3	2771 *3*		6.0	3297 *5*		2.0
546 *1*	1+	8.8	2785 *4*		3.8	3333 *3*		2.0
732 *1*	4+	6.3	2796 *3*	+	8.3	3351 *5*		3.7
826 *1*	7+	32	2815 *4*		8.3	3386 *3*	(3+)	5.0
870 *1*	7+	36	2848 *3*		11	3423 *3*		12
884 *2*		18	2858 *5*		14	3490 *10*		3.8
1252 *1*	5+	12	2872 *4*		4.9	3506 *3*	+	4.3
1683 *1*	+	2.6	2903		5.1	3573 *5*	1+	4.2
1954 *2*	+	5.0	2926[&] *5*	0+	95 *17*	3640 *6*		
2046 *4*		5.0	2955 *5*		2.4	3655 *6*		
2130 *5*	+	1.5	2973 *4*			3773 *4*	+	5.4
2252 *2*	+	3.8	2982 *3*			3884 *6*		3.3
2338 *2*		2.7	3077 *4*		3.2	4390[@] *30*	(2+)	31[‡] *9*
2629 *3*	1+	20	3106 *4*	+	2.8	4500[@] *30*	(2+)	21[‡] *6*
2645 *5*		≈8.0	3199 *3*	+	1.1	5070[@] *30*	(2+)	11[‡] *4*

† Cross sections (40) in b. The cross section uncertainties are estimated to be 25%.
‡ From 1969Br04 (cross section, 12.5 to 69).
§ Spin assignments based on comparison of angular distributions with those to states of known spin. Parity assumed by authors on the basis of shell–model arguments.
# From 1973De03, except as noted. 1973De03 also include excitation energies from the (d,α) reaction.
@ From 1969Br04.
& T=2. Identified as IAS (^{52}Cr g.s.).

^{54}Fe(p,^{3}He) 1975Gu05,1978Ko27

1975Gu05: E=40.2 MeV, FWHM≈35 keV, measured σ(θ), from 6 to 60 with 4 steps in general, the particles detected with a single wire charge–division gas proportional counter placed in the focal plane of an Enge split–pole spectrograph.
1978Ko27: E≈42–46 MeV; measured particle spectra, QDDD spectrograph, a detector consisting of a 60 cm resistive–wire proportional counter backed by a plastic scintillator provided position and particle identification in the QDDD.
Others: 1981YaZU, 1982Ha35.
All data are from 1975Gu05, except as noted.

^{52}Mn Levels

$T_{1/2}$: from 1978Ko27, except as noted.

E(level)	Jπ‡	L†	dσ/dΩ§	Comments
0.0	6+	6	3	T=1. IAS (^{52}Fe 5659–keV level).
374	2+	2	31	T=1. IAS (^{52}Fe 6047–keV level).
541	1+	0+2	9.5	
728	4+	4	9	T=1. IAS (^{52}Fe 6422–keV level).
820	3+	2+4	14.5	
867	7+	6	25	
1252	5+	4	11.5	
1680		4	1.4	
1953	6+	6	1.2	
2047	4+	4	1.3	
2130		4	1.9	
2248		4	2.2	
2337		(2)	1	
2476			29	
2629		0+2	34	
2712		6	5.5	
2787		(4)	20	
2850			33	
2923		0	80	T=2. IAS (^{52}Cr g.s.) (1975Gu05).
2968		(1)	36	
3022		4	50	
3097		4	3	
3196		6	3.3	
3228		4	1.8	
3330		(3)	22	
3380		(2+4)	8.8	
3420		4	27	
3500		4	11	
3567		0+2	10	
3635			4.7	
3660			6.5	
3711		(3)	3.2	
3742			3.2	

† Based on DWBA calculations.
‡ Identified by 1975Gu05 as having wavefunction dominated by configuration=$(1f_{7/2})^{-4}$.
§ Peak cross section, b/sr. Δσ≈±20%.

$^{54}Fe(d,\alpha)$ 1973De03,1973Ga07

1973Ga07: E=15 MeV, <20 keV (FWHM), measured σ(θ), Buechner–type magnet and α sensitive plates, DWBA analysis.
1973De03: E=17 MeV, ≈15 keV (FWHM), measured σ(θ), α sensitive plates placed in the focal plane of the Enge split–pole spectrograph, DWBA analysis.
1972Ke04: E=15 MeV, measured σ(Eα,θ), Si detector, ≈25 keV (FWHM), DWBA analysis. .
1971Gu03: E=28 MeV, ≈80 keV (FWHM), measured σ(Eα,θ), DWBA analysis.
Others: 1964Bj01, 1968Ra05.
Low–lying states are expected to have strong configuration=$(^1f_{7/2})^{-4}$ components in their wavefunctions, and predominantly seniority=2. The direct (d,α) reaction should excite strongly odd–J states, but excitation of even–J, seniority=2 states is forbidden. Configuration assignments have been made by most authors on this basis.

^{52}Mn Levels

E(level)[†]	Jπ[a]	L[#]	dσ/dΩ[§]	Comments
0.0	(6+)	(6)[@]	3.0	
378 *1*	(2+)	(2)[@]	1.6	
546 *1*	(1+)	(2)[@]	10	L: 1972Ke04 reported L=0+2.
732 *1*	4+	4	2.3	
826 *1*	3+	2(+4)	27	L: 1973De03 reported L=2. 1973Ga07 and 1972Ke04 reported L=2+4.
870 *1*	7+	6	250	
1252 *1*	5+	4+6	82	L: from 1973De03 and 1972Ke04. 1973Ga07 and 1971Gu03 reported L=4.
1646 *2*			≈1.3	
1683 *1*	3+,4+,5+	4	8.5	L: from 1973De03, 1973Ga07 and 1971Gu03. 1972Ke04 reported L=2+4.
1954 *2*	5+,6+,7+	6	3.4	
2046 *4*			≈2.5	
2130 *5*			11	L: 1973De03 assigned L=4. 1973Ga07 assigned L=0+2, 1971Gu03 assigned L=(2).
2252 *2*	3+,4+,5+	4	9.8	
2285 *5*			≈2.5	
2338 *2*			5.0	L: 1973De03 assigned L=2,3. 1973Ga07 assigned L=0+2.
2475 *2*			22	L: 1973De03 assigned L=0+2 or L=1. 1973Ga07 assigned L=3. 1971Gu03 assigned L=0, 1972Ke04 assigned L=1+3.
2629 *3*	1+	0+2	40	
2711 *3*		(5)	56	L: 1973Ga07 and 1972Ke04 assigned L=5, 1971Gu03 assigned L=(3).
2796 *3*	1+,2+,3+	2	21	
2848 *3*				
2858 *5*				dσ/dΩ: 1973De03 reported combined DS/DW=97 (UB/SR)for unresolved 2848+2858 pair.
2903 *5*			21	1973Ga07 assigned L=5. 1972Ke04 assigned L=(2).
2955 *5*			2.5	
2973 *4*				
2982 *3*				dσ/dΩ: 1973De03 reported DS/DW=4.4 for unresolved 2973+2982 pair.
3106 *4*			5.0	1973De03 reported L=(2) and 1973Ga07 report L=(5) for E=3080.
3199 *3*			11	L: 1973De03 assigned L=4. 1972Ke04 assigned L=0.
3226 *4*		4(+6)[@]	12	
3297 *5*		(2)	≈3.0	L: from 1972Ke04.
3333 *3*			26	L: 1973De03 assigned L=(2+4). 1973Ga07 assigned L=3.
3386 *3*		(2+4)	11	
3423 *3*		3	110	L: from 1973Ga07.
3506 *3*		4,5[‡]	46	L: 1973De07 assigned L=4.
3573 *5*	1+	0	17	L: from 1973De03, 1972Ke04. 1973Ga07 assigned L=0+2. 1971Gu03 assigned L=(3).
3620 *6*			3.9	
3640 *6*		&	15	
3655 *6*		&	15	
3706 *6*			5.6	
3738 *4*		4	16	L: from 1973De03, 1971Gu03. 1973Ga07 assigned L=2.
3898 *4*			12	L: 1973De03 assigned L=(2). 1973Ga07 assigned L=5.
3936 *4*			3.7	
3973 *6*				
3987 *6*				dσ/dΩ: 1973De03 reported DS/DW=10 (UB/SR) for unresolved pair and L=(4). L: 1973Ga07 assigned L=0+2 to level at 3984 *10*.
4061 *4*				
4129 *8*	3+,4+,5+	4		
4235 *8*		6,5[‡]	19	
4281 *8*			18	1973De03 assigned L=(2). 1973Ga07 assigned L=5.
4377 *8*	1+	0+2	20	
4450[‡] *10*		4[‡]		
4500[‡] *10*		3[‡]		
4540[‡] *10*		3,4[‡]		

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^{54}Fe(d,α) 1973De03,1973Ga07 (continued)

^{52}Mn Levels (continued)

E(level)†	L#
4620‡ *10*	3‡
4690‡ *10*	

† From 1973De03, except as noted. The energies of 1973De03 are averages of values from (d,α) and (^{3}He,t).
‡ From 1973Ga07.
§ Cross section (30) in b/sr, from 1973De03. ΔS≈25%.
# L–assignments reported by two or more authors are given. except as noted. L–value assignments are from DWBA analysis.
@ From 1973De03.
& 1973Ga07 report L=5,6 for E=3647.
a Empirical consideration of spin–dependent effects applied. Also see comments above on even–odd effects in configuration=($^1f_{7/2}$)$^{-4}$, seniority=2 states (1973De03,1973Ga07).

^{54}Fe(d,αγ) 1978DoZM

E=4.8–5.0 MeV, DSAM, a 45 cm^3 Ge(Li) detector, αγ–coin with the Ge(Li) and 300 micron thick silicon surface barrier detector.
Others: 1977BhZH, 1984Pi07.

^{52}Mn Levels

E(level)	$T_{1/2}$†	E(level)	$T_{1/2}$†	E(level)	$T_{1/2}$†
731.5	3.6 ps *14*	886.5	0.06 ps *+3–4*	1647.1	0.37 ps *+24–17*
825.3	0.17 ps *+4–3*	1232.4	0.14 ps *+19–8*	1683.7	0.25 ps *+17–8*
869.7	0.12 ps *+6–8*	1253.5	0.018 ps *55*	2337.0	0.05 ps *+2–4*
884.4	1.4 ps	1278.9	0.25 ps *+17–8*	2473.2	0.32 ps *+16–4*

† Doppler shift attenuation method.

(HI,xnγ) 1976St19,1976Av06,1978Me19

1976St19: ^{24}Mg(^{32}S,3pnγ), E=70–120 MeV, γγ–coin, γ(θ), Ge(Li) detectors.
1976Av06: ^{39}K(^{16}O,2pnγ), E=37–52 MeV, pγ coin, γγ coin, γ(θ), a 40 cm^3 coaxial Ge(Li) detector of 3.7 keV resolution (FWHM) at 1.33 MeV. pγ–coin with the Ge(Li) and an annular silicon detector at 180 , γγ–coin with two Ge(Li) detectors.
1978Me19: ^{27}Al(^{28}Si,2pnγ), E=65–81 MeV, σ(Eγ,θ), γγ–coin. a Ge(Li) detector of ≈2.8 keV resolution (FWHM) at 1332 keV. γγ–coin with two Ge(Li) detectors.
1979Me03: ^{28}Si(^{28}Si,3pnγ), E=65–90 MeV, σ(Eγ,θ), γγ–coin. a Ge(Li) detector of ≈2.3 keV resolution (FWHM) at 1332 keV, a Si(Li) detector used to look for low–energy photons, γγ–coin with two Ge(Li) detectors.
1980DeZA: ^{27}Al(^{32}S,α2pnγ), E=130 MeV, γγ–coin.
1983Th05: ^{27}Al(^{28}Si,2pnγ), ^{28}Si(^{28}Si,3pnγ), E=65–90 MeV, deduced relative σ.
2003Ax01: ^{24}Mg(^{32}S,3pnγ) E=130 MeV, Gasp spectrometer plus the ISIS array, ^{28}Si(^{28}Si,3pnγ) E=110 MeV, 4 π γ–array Euroball III with ISIS and Neutron–Wall. E=115 MeV, Gasp spectrometer plus the ISIS array.

^{52}Mn Levels

E(level)†	Jπ‡	$T_{1/2}$#	Comments
0.0	6+		
(377.1 *7*)			
546.0 *8*			
731.5 *5*	4+		Jπ: from adopted levels.
824.4 *8*	3+§		
869.4 *3*	7+	<0.38 ps	
883.7 *10*			
886.1 *13*			
1254.0 *13*	5+§		

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(HI,xnγ) 1976St19,1976Av06,1978Me19 (continued)

^{52}Mn Levels (continued)

E(level)[†]	Jπ[‡]	$T_{1/2}$[#]	Comments
1278.3 *9*	(5+)[§]		
1682.4 *9*	(5+)[§]		
2043.4 *13*			
2285.1 *4*	8+	<0.69 ps	
2709.8 *6*	7+[§]		
2906.9 *4*	9+	<0.4 ps	
3601.9 *6*	8+[§]		
3796.9 *11*	(9+)[§]		
3836.0 *5*	11+[§]	15.2 ps *14*	$T_{1/2}$: RDM (1976Av06).
3890.9 *6*	8+[§]		
4161.0 *6*	10+[§]		
4679.0 *5*	9−[§]		
5856.1 *7*	11+[§]		
6060.1 *8*	11−[§]		
7466.1 *8*	12+[§]		
7700.1 *8*	(12+)[§]		
8151.1 *7*	13+[§]		
8383.2 *10*	(13+)[§]		
8581.2 *9*	(13−)[§]		
8786.1 *13*			
8893.2 *10*	14+[§]		
9371.3 *9*	13−[§]		
9905.2 *12*	13+[§]		
10177.2 *10*			
11203.3 *14*			
12065.2 *15*	(16+)[§]		

† From a least-squares fix to the Eγ values.
‡ From excitation functions and γ(θ) analyses, 1976St19, 1976Av06, except as noted.
§ From 2003Ax01 based on angular distribution and Compton polarization measurements.
# From DSAM results of 1976Av06, except as noted.

γ(^{52}Mn)

E(level)	Eγ[†]	Iγ[@]	Mult.[#]	δ[#]
(377.1)	377.7			
546.0	168.9[‡] *3*	0.041		
731.5	355			
	731.3 *5*	<20		
824.4	447.2[‡] *4*	0.044		
869.4	869.3 *3*	100	D+Q	−0.10 *5*
883.7	507[a]			
886.1	509[a]			
1254.0	708[a]			
1278.3	395[a]			
	453.8[&] *6*	0.015[&]		
1682.4	404[a]			
	951[a]			
2043.4	1219[a]			
2285.1	1415.5 *3*	58 *15*	D+Q	−0.30 *10*
	2285.8[§] *10*	<7	Q	
2709.8	1840[a]			
	2710[a]			
2906.9	621.7 *3*	98 *13*	D+Q	−0.08 *7*
	695[a]			
	2037.7 *5*	60 *17*	Q	
3601.9	892[a]			
	2732[a]			
	3602[a]			
3796.9	890[a]			
3836.0	929.1 *3*	106 *14*	Q	

E(level)	Eγ[†]
3890.9	984[a]
	1181[a]
	1606[a]
	3021[a]
4161.0	325[a]
	1254[a]
	1876[a]
4679.0	788[a]
	1077[a]
	1772[a]
	2394[a]
	3809[a]
	4679[a]
5856.1	1695[a]
	2020[a]
	2949[a]
6060.1	1381[a]
7466.1	1610[a]
	3630[a]
7700.1	3539[a]
	3864[a]
8151.1	451[a]
	685[a]
	2295[a]
	4315[a]
8383.2	4547[a]

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(HI,xnγ) 1976St19,1976Av06,1978Me19 (continued)

γ(^{52}Mn) (continued)

E(level)	Eγ[†]
8581.2	2521[a]
	4745[a]
8786.1	1320[a]
8893.2	510[a]
	742[a]
9371.3	3311[a]
	5535[a]
9905.2	1012[a]
	1522[a]
10177.2	1596[a]
	2026[a]
11203.3	1832[a]
12065.2	2160[a]

† Weighted average of 1976St19, 1976Av06 and 1978Me19, except as noted.
‡ Weighted average of 1976Av06 and 1978Me19.
§ From 1976St19.
\# From model–dependent γ(θ) analysis of 1976Av06.
@ Relative to Iγ(869)=100, from 1976St19.
& From 1978Me19.
a From 2003Ax01.

Adopted Levels, Gammas

Q(β⁻)=−14420 *SY*; S(n)=16181 *16*; S(p)=7379 *7*; Q(α)=−7937 *10* 2003Au03.

^{52}Fe Levels

Ispin and analog state assignments taken from ^{54}Fe(p,t) and ^{50}Cr(^{3}He,n). Analogs identified in both reactions are given.

Cross Reference (XREF) Flags

A ^{53}Co P Decay (247 ms)	F ^{52}Co ε Decay
B ^{50}Cr(^{3}He,n)	G ^{53}Ni εp Decay
C ^{50}Cr(^{3}He,nγ)	H ^{28}Si(^{28}Si,2p2nγ)
D ^{50}Cr(α,2nγ)	I ^{9}Be(^{55}Ni,Xγ)
E ^{54}Fe(p,t)	J Coulomb Excitation

E(level)†	Jπ‡	XREF	$T_{1/2}$§	Comments
0.0@	0+	ABCDEF HIJ	8.275 h *8*	$T_{1/2}$: from 1974Ro18. Others: 8.23 h *4* (1967Pa22). $T_{1/2}$: stripped atom $T_{1/2}$($^{52}Fe^{26+}$)=12.5 h *+15−12* (1995Ir01). %ε+%β⁺=100.
849.45@ *10*	2+	ABCDEFGHIJ	7.8 ps *10*	XREF: B(840). B(E2)↑=0.082 *10* (2004Yu07). $T_{1/2}$: from B(E2) (Coulomb excitation). Other: >0.7 ps DSAM ^{50}Cr(^{3}He,nγ). Jπ: from B(E2) (Coulomb excitation).
2384.55@ *17*	4+	BCDEF	0.22 ps *5*	$T_{1/2}$: other: 0.28 ps *+14−21* DSAM ^{50}Cr(^{3}He,nγ). XREF: B(2360). Jπ: from E2 γ to 2+.
2758.8 *7*	2+	BC E	0.17 ps *5*	Jπ: L(^{3}He,n)=2. $T_{1/2}$: other: 0.14 ps *+9−5* DSAM ^{50}Cr(^{3}He,nγ). XREF: B(2750)E(2762).
3585.0& *3*	4+	BC E H	0.28 ps# *+21−7*	XREF: B(3590)E(3583). Jπ: from E2 γ to 2+.
4145.6 *20*	0+	BC E		XREF: B(4160)E(4142).
4325.5@ *3*	6+	C EF H		XREF: E(4326). Jπ: from E2 γ to 4+.
4396.3 *3*	3−	C E H		XREF: E(4400).
4456 *8*	2+	B E		XREF: B(4430).
4850.6 *11*	(5−,6+)	C E	0.5 ps# *+23−2*	XREF: E(4869).
4872.2& *3*	6+	H	0.21 ps *8*	
4896 *15*		E		
5137.4 *3*	5−	C E H		XREF: E(5134). Jπ: from E2 γ to 3−.
5328 *8*	4+	E		
5363 *5*	0+	B E		XREF: B(5360).
5439 *15*		E		
5483 *20*	4+	E		
5529 *20*	4+	E		
5563 *8*	(3−)	E		
5654.5 *4*	6+	EF		IAS (^{52}Mn g.s.). T=1.
5718 *8*	0+	b E		XREF: b(760). Jπ: L(^{3}He,n)=0. E(level): 5718+5792 are doublet.
5792 *10*		b E		
5829 *5*	2+	B E		XREF: B(5820).
5965 *15*	4+	E		
6034 *5*	2+	b E		IAS (^{52}Mn 378 keV)? see ^{54}Fe(p,t). XREF: b(6070). T=1.
6044 *5*	2+	b E		IAS (^{52}Mn 378 keV)? see ^{54}Fe(p,t). XREF: b(6070). T=1.
6174 *15*	(6+)	E		
6231 *15*		E		

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{52}Fe Levels (continued)

E(level)†	Jπ‡	XREF	$T_{1/2}$§	Comments
6360.7@ *4*	8+	H	0.15 ps *5*	$T_{1/2}$: 1998Ur05 determined the lifetime of this level from the best fit of the experimental spectrum with that obtained after summing the calculated line shape of the 2035 γ–ray and the experimental line shape of the 2045 contaminant line from ^{49}Cr.
6416 *5*	4+	E		IAS (^{52}Mn 732 keV)? see ^{54}Fe(p,t). T=1.
6454 *15*		E		
6483 *5*	2+	E		
6493.1& *4*	8+	H	0.18 ps *4*	
6531 *10*	3−	B E		Jπ: L(^{3}He,n)=3. XREF: B(6520).
6564 *8*		E		
6634 *10*	(0+)	E		
6714 *8*	2+	B E		XREF: B(6700). Jπ: L(^{3}He,n)=2.
6744 *15*		E		
6772 *8*	(2+)	E		
6882 *5*	1−	E		
6927 *15*	0+	E		
6958.0 *4*	12+	H	45.9 s *6*	%ε+%β$^+$=100; %IT<0.004 (2003Au02). 1979Ge02 searched for γ decay branch cascading through 2385–keV 4+ level and 850–keV 2+ level, found upper limit for γ decay branch of isomer relative to β$^+$ decay to be <0.004 (2σ limit). E(level): from 2005Ga20; others: 6957.3 keV *5* (2003Ax01,2004Ur02) and 6820 keV *130* (1998Ur05). $T_{1/2}$: from 1979Ge02. Jπ: from E4 γ to 8+.
7013 *5*	3−	E		
7124 *10*	(4+)	B E		XREF: B(7120).
7261 *15*	(6+)	b E		XREF: b(7280).
7289 *8*		b E		XREF: b(7280).
7338 *10*		b E		XREF: b(7280).
7381.9@ *4*	10+	H		
7463 *8*	2+	B E		XREF: B(7470).
7510 *15*		E		
7611 *10*	6+	b E		T=1.
7636 *15*	4+	b E		T=1. XREF: b(7640).
7787 *10*		b E		
7817 *15*		b E		XREF: b(7820).
7935 *10*	2+	E		
8037 *12*	0+	B E		XREF: B(8050). T=1. IAS (^{52}Mn 2474 keV) in ^{50}Cr(^{3}He,n).
8067 *8*		E		
8097 *10*		E		
8122 *15*		E		
8146 *10*	3−	E		
8184 *10*		E		
8207 *8*	(3−)	E		
8240 *10*		E		
8327 *10*	(3−)	E		
8354 *5*	2+	B E		IAS (^{52}Mn 2796 keV) in ^{50}Cr(^{3}He,n) and ^{54}Fe(p,t). XREF: B(8360). T=(1).
8401 *8*	2+	E		
8425 *15*		E		
8461 *10*		E		
8511 *8*	4+	E		
8535 *5*	4+	E		

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{52}Fe Levels (continued)

E(level)[†]	Jπ[‡]	XREF	Comments
8561 *5*	0+	B E	A doublet with energy splitting of 4 keV in (p,t). IAS (^{52}Cr g.s., ^{52}Mn 2926 keV) in ^{54}Fe(p,t) and ^{50}Cr(^{3}He,n). XREF: B(8570). T=2.
8618 *8*		E	
8661 *15*	(4+)	E	
8677 *10*		E	
8727 *15*		E	
8748 *10*	4+	E	T=(1).
8770 *10*	(3−)	E	
8832 *10*		E	
8872 *10*		E	
8900 *8*	(2+)	E	
8936 *10*		E	
8962 *10*	(6+)	E	
8985 *10*		b E	XREF: b(9010).
9044 *15*		b E	XREF: b(9010).
9059 *15*		E	
9130 *50*		B	
9213 *8*		b E	XREF: b(9250).
9279 *8*	4+	b E	XREF: b(9250).
9311 *8*		E	
9338 *10*		E	
9357 *15*		E	
9458 *10*		b E	XREF: b(9470).
9497 *8*		b E	XREF: b(9470).
9770 *50*		B	
10006 *5*	(2+)	B E	IAS (^{52}Mn 4390 keV) in ^{54}Fe(p,t) and ^{50}Cr(^{3}He,n). XREF: B(10060). T=(2).
10049 *10*		E	
10332 *5*	0+	B E	XREF: B(10310).
10810 *50*		B	
10990 *20*	0+	B	Jπ: L(^{3}He,n)=0. IAS (^{52}Cr 2647 keV, ^{52}Mn 5491 keV) in ^{50}Cr(^{3}He,n). T=2.
11440 *50*		B	
11640 *50*		B	
11780 *30*	2+	B	Jπ: L(^{3}He,n)=2. IAS (^{52}Cr 3162 keV) in ^{50}Cr(^{3}He,n). T=2.

† Levels connected by gammas are from least squares fit, others from ^{54}Fe(p,t), except where seen only in (^{3}He,n).
‡ From L value in ^{54}Fe(p,t), with S=0 neutron pair transfer assumed, except as noted.
§ DSAM, from ^{28}Si(^{28}Si,2p2nγ), except as noted.
# DSAM, from ^{50}Cr(^{3}He,nγ).
@ (A): g.s. band.
& (B): 4+ band (2004Ur02).

γ(^{52}Fe)

E(level)	Eγ[†]	Iγ[†#]	Mult.[@]	Comments
849.45	849.43[§] *10*	100	E2	B(E2)↓(W.u.)=14.2 *19*.
2384.55	1535.27[§] *15*	100	E2	B(E2)↓(W.u.)=26 *6*.
2758.8	1910 *2*	32 *11*		
	2760 *1*	100 *11*		
3585.0	2735.0[‡] *3*	100[‡] *11*	E2	Mult.: Angular distribution analysis could not be performed for the 2735 and 2753 transitions in 1998Ur05 since their broadened lineshapes were overlapping. B(E2)↓(W.u.)=1.1 *+3−9*.
4145.6	3296 *2*	100		

Continued on next page (footnotes at end of table)

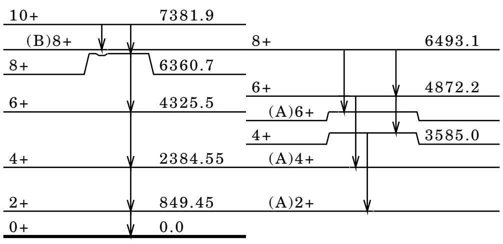
Adopted Levels, Gammas (continued)

γ(^{52}Fe) (continued)

E(level)	Eγ†	Iγ†#	Mult.@	α	Comments
4325.5	1941.0‡ *3*	100‡ *5*	E2		
4396.3	3546.3‡ *3*	100‡ *21*			
4850.6	2466 *1*	100			
4872.2	1286.7‡ *3*	23‡ *5*			
	2488.0‡ *3*	100‡ *7*			
5137.4	740.6‡ *3*	28‡ *3*	E2		
	1553‡ *1*	5‡ *2*			Eγ: Uncertainty assigned to transition by evaluators. Mult.: ΔJ=1 transition (implied by spin assignment made in 1998Ur05).
	2380 *1*	40 *20*			
	2753.0‡ *3*	75‡ *8*			Iγ: Intensity of transition has been corrected for the angular distribution by 1998Ur05, as specified in literature. Mult.: Angular distribution analysis could not be performed for the 2735 and 2753 transitions by ^{28}Si(^{28}Si,2p2nγ) 1998Ur05 since their broadened lineshapes were overlapping; the authors assume this γ–ray to be of ΔJ=1 character.
	4286 *4*	100 *40*			
5654.5	1328.95§ *25*	100			
6360.7	2035.3‡ *3*	100‡ *14*			
6493.1	1620.8‡ *3*	68‡ *14*			
	2167.6‡ *3*	100‡ *10*			
6958.0	465.0‡ *3*	75‡ *25*	E4	0.0167	B(E4)↓(W.u.)=0.0003 *3*.
	597.1‡ *3*	100‡ *33*	E4	0.0057	B(E4)↓(W.u.)=4.×10^{-5} *+5−4*.
7381.9	888.5‡ *3*	88‡ *6*			
	1021.4‡ *3*	100‡ *19*			

† From ^{50}Cr(^{3}He,nγ), except as noted.
‡ From ^{28}Si(^{28}Si,2p2nγ).
§ From ^{52}Co ε decay.
\# Relative photon branching for each level.
@ Typical values of R(ado), in ^{28}Si(^{28}Si,2p2nγ), for θ=60 in the gasp geometry are ≈1.17 for a stretched ΔJ=2 transition and ≈0.85 for a stretched ΔJ=1 transition. See 1998Ur05 and 2005Ga20.

(A) g.s. band **(B) 4+ band (2004Ur02)**



$^{52}_{26}Fe_{26}$

^{52}Co ε Decay 1997Ha04

Parent ^{52}Co: E=0; Jπ=(6+); $T_{1/2}$=115 ms *23*; Q(g.s.)=14420 syst; %ε+%β^+ decay=100.
^{52}Co–$T_{1/2}$: From 1997Ha04.
Source produced by ^{40}Ca(^{14}N,2n) E=62 MeV. HPGe detectors and scin; measured Eγ, Iγ.
See also 1990MiZK, 1995HaZS.

^{52}Fe Levels

E(level)	Jπ†	$T_{1/2}$†
0.0	0+	8.275 h *8*
849.44 *10*	2+	
2384.73 *18*	4+	
4326.4 *4*	(6+)	
5655.4 *5*	6+	

† From adopted levels.

β^+,ε Data

Eε	E(level)	Log *ft*	I(ε+β^+)†
(8765)	5655.4	≈3.4	100

† Absolute intensity per 100 decays.

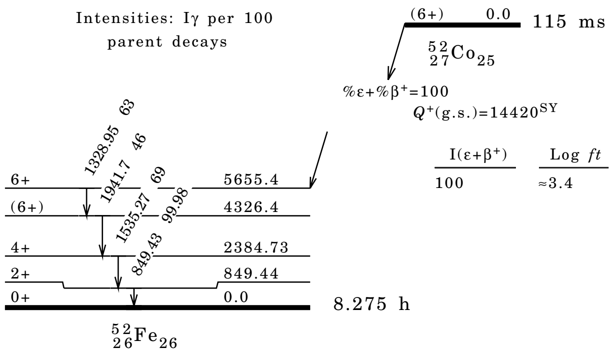
γ(^{52}Fe)

Iγ normalization: from assuming mult=[E2] for 849γ, α=0.00012 22.

Eγ	E(level)	Iγ†	Comments
849.43 *10*	849.44	100	Iγ: possibly overestimated; source may contain an expected but yet unobserved 2+ isomer of ^{52}Co (1997Ha04).
1328.95 *25*	5655.4	63 *7*	
1535.27 *15*	2384.73	69 *6*	
1941.7 *4*	4326.4	46 *10*	Iγ: connected for contribution from ^{50}Mn decay γ.

† For absolute intensity per 100 decays, multiply by 0.9998.

Decay Scheme



^{53}Co P Decay (247 ms) 1970Ce04,1972Ce01,1976Vi02

Parent ^{53}Co: E=3190; Jπ=(19/2–); $T_{1/2}$=247 ms *12*; Q(g.s.)=1602 *19*; %p decay=?
^{53}Co–$T_{1/2}$: From 1972Ce01. Others: 260 ms *20* (1976Vi02), 242 ms *15* (1970Ce04), 218 ms (1993Xu04).
^{53}Co–E: From 1972Ce01.
1970Ce04,1972Ce01: ^{53}Co produced by ^{54}Fe(p,2n), E=35 MeV, measured E(p), I(p), a counter telescope, 14 m ΔE detectors, 50 m E detector.
1976Vi02: ^{53}Co produced by ^{40}Ca(^{16}O,p2n), E=65 MeV, measured: E(p), $T_{1/2}$, a semiconductor counter telescope, 14–19 m for the ΔE detectors, 107–250 m for the E detectors.
1993Xu04: ^{53}Co produced by ^{28}Si(^{28}Si,p2n), E=104, 115.5, and 127.2 MeV, measured: E(p), $T_{1/2}$, three particle telescopes, each consisting of three semiconductor detectors: 20 m for the ΔE detector, 250 m for the E detector, 250 m for the E_{rej} detector which was used as a rejection detector to eliminate positron interference.

^{52}Fe Levels

E(level)	Jπ†
0.0	0+
(849)	2+

† From adopted levels.

Protons

Particle normalization: from comparison of measured and calculated σ for ^{54}Fe(p,2n) (1972Ce01).

E(p)	E(^{52}Fe)	I(p)	Comments
≈750	(849)	<0.006	E(p): From 1972Ce01. Ip: p decay to 2+ 849–keV state in ^{52}Fe was not observed. other: <0.05 (1976Vi02).
1590 *30*	0.0	≈1.5	E(p): From 1972Ce01. Others: 1570 *30* (1970Ce04), 1540 (1993Xu04), and 1590 (1976Vi02).

^{53}Ni εp Decay 1976Vi02

Parent ^{53}Ni: E=0.0; Jπ=(7/2–); $T_{1/2}$=45 ms *15*; Q(g.s.)=10279 syst; %εp decay≈45.0.
^{53}Ni–$T_{1/2}$: From 1976Vi02. Other: < 85 ms (1993Xu04).
1976Vi02: ^{53}Ni produced by ^{40}Ca(^{16}O,3n), E=65 MeV, measured: E(p), $T_{1/2}$, a semiconductor counter telescope, 14–19 m for the ΔE detectors, 107–250 m for the E detectors. Other: 1979ViZY.
1993Xu04: ^{53}Ni produced by ^{28}Si(^{28}Si,3n), E=104, 115.5, and 127.2 MeV, measured: E(p), $T_{1/2}$, three particle telescopes, each consisting of three semiconductor detectors: 20 m for the ΔE detector, 250 m for the E detector, 250 m for the E_{rej} detector which was used as a rejection detector to eliminate positron interference.

^{52}Fe Levels

E(level)	Jπ†
849	2+

† From adopted levels.

Delayed protons

E(p)	E(^{52}Fe)	I(p)†	E(^{53}Co)	Comments
1940 *50*	849	100	4390	E(p): from 1976Vi02. Other: E(p)=1920 (1993Xu04).

† For intensity per 100 decays, multiply by ≈0.45.

^{9}Be(^{55}Ni,Xγ) 2005Wo01

E=171 MeV/nucleon, Measured Eγ, Iγ, (particle)γ–coin, EUROBALL Ge–Cluster detectors, MINIBALL Ge detectors, BaF2–HECTOR detectors, fragment separator.

^{52}Fe Levels

E(level)	Jπ†
0.0	0+
849	2+

† From adopted levels.

γ(^{52}Fe)

E(level)	Eγ
849	849

^{28}Si(^{28}Si,2p2nγ) 1998Ur05,2004Ur02,2005Ga20

Includes Si(^{36}Ar,Xγ) from 2003Ax01 and 2005Ga20.
1998Ur05,2004Ur02: E=115 MeV. Measured Eγ, Iγ, γγ, γγ(θ), (charged particle)γ (coin), and lifetimes with the GASP array of 40 Compton–suppressed large volume HPGe detectors, an inner ball of 80 BGO crystals and the ancillary charged–particle detector ISIS, of 40 E–ΔE Si telescopes. see also 1998Le43.
2005Ga20, 2003Ax01: Si(^{36}Ar,Xγ) at E=170 MeV (2005Ga20), 209 MeV (2003Ax01), measured Eγ, Iγ, γγ, βγ coin, γγ(θ) using two composite Ge detectors (a Cluster and a large Clover), a 60% single Ge crystal, a second single crystal low–energy Ge detector and a plastic scintillator.
All data are from 1998Ur05, unless otherwise stated.

^{52}Fe Levels

E(level)‡	Jπ†	$T_{1/2}$§	Comments
0.0#	0+		
849.57# *24*	2+		
2383.9# *3*	4+	0.22 ps *5*	
3584.8@ *3*	4+		Jπ: from ^{52}Fe adopted levels.
4324.9# *3*	6+	0.17 ps *5*	
4396.1 *4*	3−		
4871.7@ *3*	6+	0.21 ps *8*	
5136.9 *4*	5−		Jπ: from adopted levels.
6360.21# *24*	8+	0.15 ps *5*	$T_{1/2}$: 1998Ur05 determined the lifetime of this level from the best fit of the experimental spectrum with that obtained after summing the calculated line shape of the 2035 γ–ray and the experimental line shape of the 2045 contaminant line from ^{49}Cr.
6492.63@ *22*	8+	0.18 ps *4*	
6957.5 *4*	12+	45.9 s *6*	%IT<0.004 (1979Ge02). E(level): from 2005Ga20; Others: 6957.3 keV *5* (2003Ax01,2004Ur02) and 6820 keV *130* (1998Ur05). $T_{1/2}$: from ^{52m}Fe ε decay (1979Ge02).
7381.4# *3*	10+		

† Assignments are based on the R(ADO) analysis of γ–rays by 1998Ur05, unless otherwise stated.
‡ From least–squares fit to Eγ's; ΔEγ=0.3 keV assumed for each transition, unless otherwise stated.
§ From DSAM in 1998Ur05.
# (A): g.s. band.
@ (B): 4+ band (2004Ur02).

^{28}Si(^{28}Si,2p2nγ) 1998Ur05,2004Ur02,2005Ga20 (continued)

γ(^{52}Fe)

R(ADO)=[[Iγ(θ)+Iγ(180 −θ)]/2]/Iγ(90). Values given for R(ADO) were measured by 1998Ur05 at θ=60 .

E(level)	Eγ	Iγ†	Mult.‡	Comments
849.57	849.5 *3*			
2383.9	1534.5 *3*	100.0 *6*		R(ADO)=1.16 *4*.
3584.8	2735.0 *3*	15.0 *17*		
4324.9	1941.0 *3*	55 *3*		R(ADO)=1.15 *6*.
4396.1	3546.3 *3*	7.0 *15*		R(ADO)=0.92 *8*.
4871.7	1286.7 *3*	5.0 *10*		
	2488.0 *3*	21.9 *15*		R(ADO)=1.34 *19*.
5136.9	740.6 *3*	5.5 *6*	E2	R(ADO)=1.27 *11*.
	1553 *1*	1.0 *5*		Eγ: Uncertainty assigned to transition by evaluators. Mult.: ΔJ=1 transition (implied by spin assignment made in 1998Ur05).
	2753.0 *3*	10.0 *20*		Iγ: Intensity of transition has been corrected for the angular distribution by 1998Ur05.
6360.21	2035.3 *3*	21 *3*		R(ADO)=1.46 *18*.
6492.63	1620.8 *3*	14 *3*		
	2167.6 *3*	20.7 *20*		R(ADO)=1.24 *11*.
6957.5	465.0§ *3*	0.009§ *3*	E4§	B(E4)↓(W.u.)=0.0035 *13*.
	597.1§ *3*	0.012§ *4*	E4§	B(E4)↓(W.u.)=0.00046 *17*.
7381.4	888.5 *3*	11.5 *8*		R(ADO)=1.20 *8*.
	1021.4 *3*	13.1 *25*		

† Extracted from the 90 spectrum in coincidence with the 850 keV 2+ to 0+ transition in 1998Ur05, so as to avoid the uncertainties introduced by the line shape broadening.

‡ Typical values of R(ADO), in 1998Ur05, for θ=60 in the gasp geometry are ≈1.17 for a stretched ΔJ=2 transition and ≈0.85 for a stretched ΔJ=1 transition.

§ From 2005Ga20. Intensities based on combined information of γγ coin matrices with and without β–detector veto. For details on methods used to evaluate the intensity, refer to 2005Ga20. Intensity is in photons/100 decays.

^{50}Cr(^{3}He,n) 1975Bo14,1975Al05,1972Ev02

1975Bo14: E=13 MeV, measured σ(θ,E(n)), tof (time resolution: 1.3–2 ns FWHM, 17.5–meter path). The neutrons were detected in 12 detectors placed between 0 and 55 at intervals of 5 . DWBA analysis.

1975Al05: E=15 MeV, measured σ(θ,E(n)), tof (time resolution: ≈0.75 ns FWHM, 4–meter path). The neutrons were detected in 10.2 cm diameter NE 213 liquid scintillators of thickness 2.5 cm or 3.8 cm mounted on 12.7 cm photomultipliers. DWBA analysis.

1972Ev02: E=18,21 MeV, measured σ(θ,E(n)), tof (energy resolution: 220–500 keV at 28 MeV, 8.7–meter path), The neutrons were detected in 12.7 cm diameter NE 213 liquid scintillator of thickness 2.54 cm coupled to an XP 1041 photomultipliers. DWBA analysis. See also 1974Ev02.

1975Al05 concentrate on 0+ pairing–vibrational states. Discussion and classification of 0+ states in terms of pairing–vibration model also undertaken by 1972Ev02. See these works for details.

All data are from 1975Bo14, except as noted.

^{52}Fe Levels

E(level)	L	dσ/dΩ†
0.0	0	620 *20*
840 *30*	2	70 *10*
2360 *50*	4	14 *3*
2750 *30*	2	28 *5*
3590 *30*	4	40 *5*
4160 *20*	0	230 *15*
4430 *30*	2	54 *15*
5360 *30*	0	19 *5*
5760 *20*	0	180 *20*
5820 *30*	2	28 *10*
6070 *30*	(2)	30 *7*
6520 *30*	3	52 *7*
6700 *30*	2	75 *10*
7120 *50*		

Continued on next page (footnotes at end of table)

$^{50}Cr(^{3}He,n)$ 1975Bo14,1975Al05,1972Ev02 (continued)

^{52}Fe Levels (continued)

E(level)	L	dσ/dΩ†	Comments
7280 *50*			
7470 *30*	2	25 *5*	
7640 *50*			
7820 *50*			
8050 *20*	0	690 *40*	T=1. Identified as IAS (^{52}Mn 2474 keV), see 1975Bo14 and 1975Al05.
8360 *20*	2	140 *15*	T=1. Identified as IAS (^{52}Mn 2796 keV).
8570 *20*	0	420 *50*	T=2. Identified as IAS (^{52}Mn 2926 keV, ^{52}Cr g.s.).
9010 *30*	2	68 *10*	
9130 *50*			
9250 *50*			
9470 *50*			
9770 *50*			
10060 *30*	2	55 *7*	T=2. Identified as IAS (^{52}Mn 4439 keV, ^{52}Cr 1434 keV).
10310 *20*	0	95 *7*	
10810 *50*			
10990 *20*	0	185 *15*	T=2. Identified as IAS (^{52}Mn 5491 keV, ^{52}Cr 2647 keV).
11440 *50*			
11640 *50*			
11780 *30*	2	60 *10*	T=2. Identified as IAS (^{52}Cr 3162 keV).

† dσ/dΩ (b/sr c.m.) at θ=0 for L=0, θ=20 for L=2, θ=25 for L=3, θ=35 for L=4.

$^{50}Cr(^{3}He,n\gamma)$ 1977Ir02

E=8 MeV, measured nγ–coin, γγ–coin, DSAM. a vertical–type 55 cm^{3} Ge(Li) detector, a horizontal–type 55 cm^{3} Ge(Li) detector, liquid scintillotos NE–213 neutron detector.
Other: 1976GeZZ.

^{52}Fe Levels

E(level)	Jπ†	$T_{1/2}$‡	Comments
0.0	0+		
849.6 *7*	2+	>0.7 ps	
2385.7 *10*	4+	0.28 ps *+14–21*	
2759.8 *9*	2+	0.14 ps *+9–5*	
3586.7 *12*	4+	0.28 ps *+21–7*	
4145.8 *21*	0+		
4329.7 *23*	6+		Jπ: 1944 γ is very weak as the yrast 6+ to 4+ transition.
4397 *3*	3–		
4851.7 *14*	(5–,6+)	0.5 ps *+23–2*	
5139.6 *13*			

† From adopted levels, except as noted.
‡ DSAM measurements.

$\gamma(^{52}Fe)$

E(level)	Eγ	Iγ†
849.6	849.5 *7*	100
2385.7	1536.0 *7*	26 *2*
2759.8	1910 *2*	6 *2*

Continued on next page (footnotes at end of table)

$^{50}Cr(^3He,n\gamma)$ 1977Ir02 (continued)

$\gamma(^{52}Fe)$ (continued)

E(level)	Eγ	Iγ†
2759.8	2760 *1*	19 *2*
3586.7	2737 *1*	12 *2*
4145.8	3296 *2*	5 *2*
4329.7	1944 *2*	2 *1*
4397	3547 *3*	6 *2*
4851.7	2466 *1*	12 *2*
5139.6	2380 *1*	2 *1*
	4286 *4*	5 *2*

† Relative photon intensity.

$^{50}Cr(\alpha,2n\gamma)$ 1977Ev03

E=23.5, 27.2 MeV, measured σ(90 ,Eγ), γγ coin, nnγ coin. two 60 cm^3 Ge(Li) counters, two conical NE 213/RCA 8854 counters.

^{52}Fe Levels

E(level)	Jπ†
0.0	0+
848.3 *9*	2+
2383.3 *13*	4+

† From adopted levels.

$\gamma(^{52}Fe)$

E(level)	Eγ	Iγ†
848.3	848.3 *9*	4 *1*
2383.3	1535.0 *9*	

† Photon intensity normalized to Iγ=100 for 870–keV (7+) to g.s. (6+) transition in ^{52}Mn produced in the experiment via $^{50}Cr(\alpha,pn)$. The small relative yield of ^{52}Fe is discussed (1977Ev03).

Coulomb Excitation 2004Yu07

$^{197}Au(^{52}Fe,^{52}Fe'\gamma)$ at $E(^{52}Fe)$=65.2 MeV/nucleon.

^{52}Fe produced by impinging the primary beam of ^{58}Ni at 140 MeV/nucleon on a 376 mg/cm2 ^9Be target, and selecting in the large–acceptance a 1900 fragment separator. A ^{197}Au (257.7 mg/cm2) target used for Coulomb excitation.

Measured Eγ, γ(scattered ^{52}Fe) coin, cross section with segmented germanium array of 18 detectors, the intrinsic energy resolution of the detectors is approximately 2.5–2.8 keV at 1332 keV, a total of 13 segmented HPGe detectors were mounted in the array for the present experiment, six detectors in the ring at 37 to the beam direction, and seven in the 90 ring.

See also 2004Mu09 and 2005Ga15.

^{52}Fe Levels

E(level)	Jπ	$T_{1/2}$	Comments
0.0	0+		
849.1 *5*	2+	7.8 ps *10*	$T_{1/2}$: from B(E2). B(E2)↑=0.082 *10*.

Coulomb Excitation 2004Yu07 (continued)

$\gamma(^{52}Fe)$

E(level)	Eγ
849.1	849.1 *5*

$^{54}Fe(p,t)$ 1978De18,1977Su01,1971Vi03

1977Su01: E=51.9 MeV, magnetic spectrograph, ≈80 keV FWHM, measured σ(E(t),θ).
1978De18: E=45 MeV, magnetic spectrograph, ≈15 keV FWHM, measured σ(E(t),θ).
1971Vi03: E=40 MeV, ΔE–E silicon counter telescope, ≈100 keV FWHM, measured σ(θ).
Others: 1978Ko27, 1978ShZK, 1979Sh09, 1981Ku11.

^{52}Fe Levels

E(level)[†]	L[&]	(σ/2π)(b)	Comments
0.0	0	13.4	
850 *5*	2	6.0	
2385 *5*	4	1.5	
2762 *5*	(2)	0.27	
3583 *5*	4	1.3	L: from 1978De18 and 1977Su01. 1971Vi03 assigned L=2.
4142 *10*	0	0.57	
4326 *8*		0.55	
4400 *5*	3	6.7	L: from 1978De18 and 1977Su01. 1971Vi03 assigned L=4.
4456 *8*	2	0.44	
4869 *15*	(5,6)	0.44	1971Vi03 assigned L=(5), 1977Su01 assigned L=(5,6).
4896 *15*		0.11	
5134 *8*	5	2.7	L: from 1978De18. 1971Vi03 assigned L=(3).
5328 *8*	4	0.92	
5363 *5*	0	3.1	
5439 *15*		0.32	
5483 *20*	4	0.11	
5529 *20*	4	0.10	
5563 *8*	(3)	0.25	
5652 *8*	6	1.6	T=1 (1978De18). Identified as IAS (^{52}Mn g.s.), see 1978De18, 1977Su01, 1971Vi03.
5718 *8*	0	0.66	
5792 *10*		0.48	
5829 *5*	2	0.88	
5965 *15*	4	0.26	
6034[#] *5*	2	3.9	T=1 (1978De18).
6044[#] *5*	2	2.6	T=1 (1978De18).
6174 *15*	(6)	0.23	
6231 *15*		0.15	
6416 *5*	4	4.7	T=1 (1978De18,1977Su01,1978Ko27). This level appears to correspond to 6390 keV *20* level of 1977Su01 and 6380 keV *30* level of 1971Vi03. 1977Su01 and 1978De18 assigned L=4. 1971Vi03 assigned L=5.
6454 *15*		0.49	
6483 *5*	2	0.85	
6531 *10*		0.27	
6564 *8*		0.39	
6634 *10*	(0)	0.25	
6714 *8*		0.65	L: L=2 for E=6670 (1971Vi03).
6744 *15*			
6772 *8*	2	0.19	
6882 *5*	1	0.25	
6927 *15*	0	2.0	
7013 *5*	3	0.95	
7124 *10*	(4)	0.31	
7261 *15*	(6)	0.32	
7289 *8*		0.61	
7338 *10*		0.13	
7463 *8*	2	0.60	

Continued on next page (footnotes at end of table)

^{54}Fe(p,t) 1978De18,1977Su01,1971Vi03 (continued)

^{52}Fe Levels (continued)

E(level)†	L&	(σ/2π)(b)	Comments
7510 *15*		0.20	
7611 *10*	6	0.84	T=1 (1978De18).
7636 *15*	4	0.73	T=1 (1978De18).
7787 *10*		0.26	
7817 *15*		0.16	
7935 *10*	2	0.60	
8037 *15*	0	0.17	
8067 *8*		0.23	
8097 *10*		0.32	
8122 *15*		0.13	
8146 *10*	3	0.18	
8184 *10*		0.27	
8207 *8*	(3)	0.54	
8240 *10*		0.72	
8327 *10*	(3)	0.64	
8354 *5*	2	1.6	T=(1) (1978De18).
8401 *8*	2	0.55	
8425 *15*		0.25	
8461 *10*			
8511 *8*	4	0.76	
8535 *5*	4	2.7	
8561‡ *5*	0	7.3	T=2 (1978De18). Identified as IAS (^{52}Cr g.s., ^{52}Mn 2926 level). See 1978De18, 1971Vi03, 1978Ko27.
8618 *8*		0.55	
8661 *15*	(4)	0.27	
8677 *10*		0.34	
8727 *15*			
8748 *10*	4	1.3	T=(1) (1978De18).
8770 *10*	(3)	0.87	
8832 *10*		0.31	
8872 *10*			
8900 *8*	(2)	0.44	
8936 *10*		0.35	
8962§ *10*	(6)	2.2	T=(1) (1978De18).
8985 *10*			
9044 *15*		0.29	
9059 *15*		0.46	
9213 *8*		0.56	
9279 *8*	4	1.3	
9311 *8*			
9338 *10*		0.76	
9357 *15*			
9458 *10*		0.36	
9497 *8*		0.57	
10006 *5*	(2)	1.4	T=(2) (1978De18). Identified as IAS (^{52}Cr 1434 keV, ^{52}Mn 4390 keV), see 1978De18 and 1971Vi03.
10049 *10*		0.56	
10332 *5*	0	1.5	

† From 1978De18, except as noted. Level energies of 1978De18 are systematically ≈25 keV higher than those of 1977Su01.
‡ Doublet of 0+ states separated by ≈4 keV (1978De18).
§ Level with probable multiplet structure (1978De18).
# 1971Vi03 and 1977Su01 reported a single state at 6020 keV, which is probably an unresolved combination of these states. 1971Vi03 assigned L=2 to the 6020 level, in agreement with the values quoted here from 1978De18. 1977Su01 assign L=4. L=2 is favored by the evaluators.
& Assignments based on analysis of angular distribution data of 1977Su01 and 1978De18. Both works also include DWBA fits with assumed shell–model configurations.

Adopted Levels

$Q(\beta^-)$=−11260 *SY*; S(n)=14713 *SY*; S(p)=982 *SY*; $Q(\alpha)$=−7017 *SY* 2003Au03.
Populated by $^{40}Ca(^{14}N,2n)$ (1997Ha04,1990MiZK), and $Ni(^{58}Ni,X)$ (1987Po04).

^{52}Co Levels

Cross Reference (XREF) Flags

A ^{52}Ni ε Decay

E(level)	Jπ	XREF	$T_{1/2}$	Comments
0.0	(6+)	A	115 ms *23*	$T_{1/2}$: from 1997Ha04. %ε+%β$^+$=100. Jπ: based on apparently allowed ε to 6+ state in ^{52}Fe and analogy to ^{44}V (4 particles in f7/2 shell, 4 holes in f7/2 shell for ^{52}Co).
≈2320	(0)+	A		Jπ: probable superallowed decay with log *ft*≈3.7 from 0+ ^{52}Ni.

^{52}Ni ε Decay 1994Fa06

Parent ^{52}Ni: E=0; Jπ=0+; $T_{1/2}$=38 ms *5*; Q(g.s.)=11260 syst; %ε+%β$^+$ decay=100.
Source produced by $Ni(^{58}Ni,X)$, E=68 MeV/nucleon, thick natural nickel target, mass separation at GANIL. Implanted the ^{52}Ni in a silicon detector (150 m) in a microstrip gas counter.
Measured the half–life of ^{52}Ni and the energies of β–delayed protons emitted during the decay of ^{52}Ni. Two Proton lines have been observed at EP=1060 *50* and 1340 *60* keV with branching ratios of 0.06 *1* and 0.11 *1*, respectively.
Analyzed origin of the two proton peaks: The proton line at 1340 keV is attributed to two decays from an IAS (0+, ispin=2, DM=−31516 keV) and a 1+ level (22 kev below the IAS) of ^{52}Co to the ground state of ^{51}Fe, respectively. The proton line at 1060 keV is also explained by two decays from the IAS to the first excited state in ^{51}Fe and other 1+ level (294 kev below the IAS) in ^{52}Co to the ground state of ^{51}Fe, respectively. The IAS and two 1+ levels in ^{52}Co are populated from the ground state of ^{52}Ni.
Partial decay scheme is proposed by 1994Fa06.

^{52}Co Levels

E(level)	Jπ†	$T_{1/2}$†	Comments
0.0	(6)+	115 ms *23*	
≈2320	(0)+		E(level): from measured Ep=1340 *60* (1994Fa06) to ^{51}Fe(g.s.) and adopted Sp(^{52}Co)=980 syst.

† From adopted levels.

β$^+$,ε Data

Eε	E(level)	Iβ$^+$	Iε	Log *ft*	I(ε+β$^+$)	Comments
(8940)	≈2320	17.0 *14*	0.016 *2*	3.72 *8*	17 *2*	I(ε+β$^+$): from %I(p)=11 *1* for Ep=1340 *60* and %I(p)=6 *1* for Ep=1060 *50* (1994Fa06), assuming these are transitions from the ^{52}Co IAS to the ground and first excited states of ^{51}Fe, respectively. However, the 1340 p could include a small component from a postulated 1+ state ≈ 22 keV below the IAS and the 1060 p could alternatively feed the ^{51}Fe g.s. from a postulated 1+ level ≈294 keV below the IAS, Also γ deexcitation of the IAS cannot be ruled out.

Adopted Levels

Q(β⁻)=−20030 *SY*; S(n)=19287 *SY*; S(p)=2669 *SY*; Q(α)=−6918 *SY* 2003Au03.
Produced by Ni(^{58}Ni,X), 1987Po04, 1994Fa06. Projectile fragments isotope separation. Ions identified by time−of−flight and energy loss in Si detector.

^{52}Ni Levels

Cross Reference (XREF) Flags

A ^{54}Zn 2p Decay: 3.2 ms

E(level)	Jπ	XREF	$T_{1/2}$	Comments
0.0	0+	A	38 ms *5*	%ε+%β⁺=100; %β⁺p=17.0 *14* (1994Fa06). %β⁺p: A low energy (<500 keV)p group may have gone undetected in 1994Fa06's experiment. $T_{1/2}$: from 1994Fa06, $T_{1/2}$ was determined on the basis of the proton−peak intensities as a function of the elapsed after implantation.
1480 *20*		A		E(level): Decay energy of two proton emission from ^{54}Zn from seven events.

^{54}Zn 2p Decay: 3.2 ms 2005Bl15

Parent ^{54}Zn: E=0.0; Jπ=0+; $T_{1/2}$=3.2 ms *+18−8*; Q(g.s.)=1480 *20*; %2p decay=84 *13*.
^{54}Zn−$T_{1/2}$: From decay−time distribution of first decay events after ^{54}Zn implantation; total of seven events.
^{54}Zn−Q(g.s.): S(2p)=1510 *410* (sys,2003Au03).
^{54}Zn: Mass excess=−6.58 MeV *4*; deduced from 2p decay energy and mass excess of −22.64 MeV *4* for ^{52}Ni (from C. Dossat, Ph.D. thesis (University Bordeaux I, 2004)).
^{54}Zn−%2p decay: %2p=87 *+10−17* (2005Bl15).
First Identification of ^{54}Zn nuclide.
^{54}Zn isotope produced by the Ni(^{58}Ni^{26+},X) quasifragmentation reaction at E=74.5 MeV/nucleon. Fragments mass−separated by the α−LISE3 separator and identified on event−by−event basis with two micro−channel plate (MCP) detectors and four Si detectors.
Measured E(fragments), Eβ, fragment energy loss, time of flight with four Si detectors and a double−sided Si−strip detector (DSSSD). The detector setup of 2005Bl15 yielded eight fragment identification parameters to unambiguously identify the different fragments and reject any background. All eight parameters of an event had to lie within three σ's of the predefined values in order to be accepted. σ=100fb. β−delayed proton decay of ^{52}Ni with energies comparable to those in ENSDF were also observed, indicating the occurrence of 2p radioactivity.

^{52}Ni Levels

E(level)	Jπ	Comments
0.0	0+	
1480 *20*		E(level): Decay energy of two proton emission from ^{54}Zn from seven events.

$^{52}_{29}Cu_{23}$ $^{52}_{29}Cu_{23}$

Adopted Levels

S(p)=−1523 *SY*; Q(α)=−6691 *SY* 2003Au03.

^{52}Cu Levels

E(level)	Jπ	Comments
0.0?	(3+)	%p=? (2003Au02). Jπ: estimated from systematic trends in neighboring nuclides with the same Z or N (2003Au02).

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