Coulomb excitation

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

1967Af03: E(^{12}C)=36.8 MeV; E(^{14}N)=43.3 MeV; and E(^{16}O)=48.6 MeV. Measured thick-target excitation functions (θ=42°); NaI.
1967Bl17: Eα=2.6 and 3.0 MeV; E(^{16}O)=15 MeV; and E(^{35}Cl)=14-30 MeV. Measured thick-target excitation functions, α(K)exp, γ's, and γ(t); pc, NaI.
1967Im01: E(^{14}N)=11.5 MeV. Measured γ's; NaI.
1969Go09: E(^{16}O)=25 MeV and E(^{35}Cl)=40 MeV. Measured thick-target excitation functions (0°,≈3π; 0°,55°,90°).
1970Bl02: Eα=3-5 MeV. Measured γ's.
1970Ea02: Eα=3-6 MeV. Measured thick-target excitation functions (55°) and $\gamma(\theta)$.
1979Pa12: E(p)=2.5 to 3.5 MeV; Eα=4 to 5 MeV. Measured thick-target excitation functions (55°) and $\gamma(\theta$=0°,90°).
1980Bu08: E(p)=1-3 MeV; E(^{3}He)=5.5-8.0 MeV; and Eα=2.75-5.7 MeV. Measured thick-target excitation functions (55°). See also (p,p′),(d,d′) and (p,p′γ).
1986Ta14: E(p)=2-4 MeV. Measured γ's, thick-target yields, γ excitation functions, and $\gamma(\theta$=0°−90°, 5 angles).
Others: see 1992Bu01.

Includes: (p,p′γ) (α,$\alpha'\gamma$) (^{14}N,^{14}N′γ) (^{35}Cl,^{35}Cl′γ) (^{3}He,^{3}He′γ) (^{12}C,^{12}C′γ) (^{16}O,^{16}O′γ)

^{45}Sc Levels

T(B),S(D) $T_{1/2}$ from 1967Bl17 (B(E3)↑<0.0001). Measured decay for ≈60 s.
T(F),S(G) Not adopted since 1986Ta14 note that the compound contribution to the excitation function is ≈50%.
T(I),S(J) If J(1409)=7/2.

S TV BE2↑'s are the unweighted averages of the following data ($10^{-3}e^2barn^2$), except as noted:

Ex	1986Ta14	1980Bu08	1979Pa12	1970Ea02	1970Bl02	1969Go09	1967Im01	1967Bl17	1967Af03
377	6.6 *6*		7.0 *6*	8.5 *6*		7.0 *7*	8.6 *17*	6.0 *10*	6.2 *12*
720	14.0 *14*	8.1 *7*	6.5 *5*	9.7 *7*	5.5 *5*	8.1 *20*		5.6 *11*	
1237	28 *4*	12.0 *9*	19.0 *25*	15.0 *25*	33 *10*		9.3 *19*		

TV1980Bu08 normalized to BE2↑(377)=0.0072 *5* from the 1977 *Nuclear Data Sheets* evaluation (1977Be63).

E(level)†	Jπ‡	$T_{1/2}$#	Beλ↑	Comments
0.0	7/2$^-$@			
12.40@ *5*	3/2$^+$@	325.8 ms *42*		$T_{1/2}$: mean lifetime τ=0.470 s *6* from timing of K x-rays in Coulomb excitation (1967Bl14). Authors of 1967Bl14 mentioned that the lifetime measured in this work superseded their earlier lifetime reported in 1964Ho14. Value of 0.32 s *1* from 1967Bl14 cited in NDS evaluations (2008Bu01,1992Bu01,1983Bu21,1977Be63,1970Le28) seems erroneous. Note by B. Singh, May 01, 2021.
376.7 *23*	3/2$^-$	43.3 ps *23*	0.0071 *4*	
543.08 *17*	5/2$^+$@	6.0 ps *9*	1.4×10^{-6}& *2*	
720.48 *14*	5/2$^-$	0.50 ps *36*	0.0082 *12*	
938.68 *15*	1/2$^+$			
974.44 *10*	7/2$^+$	0.36 ps *4*	7.5×10^{-6}& *8*	
1067.73 *30*	3/2$^-$	147 fs *34*	0.0042[a] *4*	
1237.14 *21*	11/2$^-$	1.47 ps *30*	0.020 *4*	
1409.20 *20*	$^-$	2.2 ps *4*	0.0036[a] *3*	
1662.15 *25*	9/2$^-$	77 fs *13*	0.0090[a] *8*	

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Coulomb excitation (continued)

^{45}Sc Levels (continued)

† From 1986Ta14 (ΔE(γ) not given) except for 12-keV state.
‡ From Coulomb excitation of level and γ(θ), except as noted.
# Calculated by evaluator from the adopted BEλ↑ values and the adopted γ and level properties, except as noted.
@ From the Adopted Levels.
& From 1986Ta14. B(E3)↑(543)=1.62×10^{-16} *13* and B(E2)↑(974)=0.0087 *7* (1979Pa12) not adopted. See 1983Bu21 and 1986Ta14.
[a] B(E2)↑'s from 1979Pa12. B(E2)↑(1068)<0.0090 (1970Ea02).

γ(^{45}Sc)

E_i(level)	J_i^π	E_γ†	I_γ†‡	E_f	J_f^π	Mult.#	δ@	Comments
12.40	3/2$^+$	12.4&	100&	0.0	7/2$^-$	M1,Q		α(K)exp=580 *120* (1967Bl17) Mult.: from upper limit on B(E3)↑ (1967Bl17). ≠E1 from α(K)exp. δ: δ>1.60 if M1+E2; δ=8.8×10^{-3} *41* if M2+E3 from α(K)exp. α(K)exp: From I(K x-ray)/I(12.4γ)=27.3 *28*.
376.7	3/2$^-$	364.3	91.26[a] *19*	12.40	3/2$^+$	D+Q@	−1.2 *+11−15*	δ: other: −0.34≤δ≤0.00 or δ≥+4.00 from γ(θ) (1970Ea02).
		376.7	8.74[a] *19*	0.0	7/2$^-$	E2[b]		
543.08	5/2$^+$	166.4	0.4 *2*	376.7	3/2$^-$			
		530.7	58.2 *4*	12.40	3/2$^+$	D+Q@	−0.8 *6*	
		543.1	41.3 *5*	0.0	7/2$^-$	E1+M2	+1.2 *+13−7*	
720.48	5/2$^-$	708.3	0.7 *3*	12.40	3/2$^+$	D+Q@	+1.2 *+14−5*	
		720.5	99.3 *5*	0.0	7/2$^-$	M1+E2	+0.18[e] *3*	δ: +1.0 *4* (1986Ta14) excluded by adopted $T_{1/2}$ and B(E2)↑.
938.68	1/2$^+$	563.0	17.6 *12*	376.7	3/2$^-$			
		926.7	82.4 *10*	12.40	3/2$^+$			
974.44	7/2$^+$	431.2	13.3[c] *17*	543.08	5/2$^+$	D+Q@	−0.8 *+4−9*	δ: other: −0.17 *2* (1979Pa12).
		962.1	27.9[c] *29*	12.40	3/2$^+$			
		974.4	58.8[c] *12*	0.0	7/2$^-$	E1+M2	−0.32 *+6−11*	
1067.73	3/2$^-$	347.4	27[d] *5*	720.48	5/2$^-$			
		691.1	73[d] *5*	376.7	3/2$^-$	M1+E2[b]	0.050[e] *1*	
1237.14	11/2$^-$	1237.1	100	0.0	7/2$^-$	E2(+M3)		δ: 0 or −0.10 *5*. Other: 0 from γ(θ) (1970Ea02).
1409.20	−	689.0	6.6 *10*	720.48	5/2$^-$			
		1032.6	4.4 *4*	376.7	3/2$^-$			
		1409.2	89.4 *4*	0.0	7/2$^-$	M1+E2[b]	−2.62[e] *62*	δ: other: −0.06 *5* or −3.3 *+3−8* (1986Ta14).
1662.15	9/2$^-$	253[f h]		1409.20	−			
		425.0	27.3[g] *26*	1237.14	11/2$^-$			
		942[f h]		720.48	5/2$^-$			
		1662.2	72.7[g] *31*	0.0	7/2$^-$			

† From 1986Ta14 (ΔE(γ) not given), except as noted.
‡ % photon branching ratio from each state.
# From γ(θ) and Coulomb excitation (1986Ta14), except as noted.
@ From γ(θ) (1986Ta14), except as noted.
& From 1967Bl17.
[a] Weighted average of Iγ(364)/Iγ(376)=10.5 *12* (1986Ta14), 10.3 3 (1969Go09), and 10.8 *5* (1967Bl17).

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Coulomb excitation (continued)

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

[b] From $\gamma(\theta)$ and Coulomb excitation (1979Pa12).
[c] Unweighted average of Iγ(431):Iγ(962):Iγ(974)=11.6 *12*:30.8 *16*:57.6 *13* (1986Ta14) and 15 *1*:25 *1*:60 *1* (1979Pa12).
[d] Unweighted average of Iγ(347)/Iγ(691)=21.8 *10*/78.2 *10* (1986Ta14) and 32 *1*/68 *1* (1979Pa12).
[e] From $\gamma(\theta)$ (1979Pa12).
[f] Looked for but not observed by 1986Ta14.
[g] Unweighted average of Iγ(425)/Iγ(1662)=24.9 *20*/76.1 *18* (1986Ta14) and 30 *1*/70 *1* (1979Pa12).
[h] Placement of transition in the level scheme is uncertain.

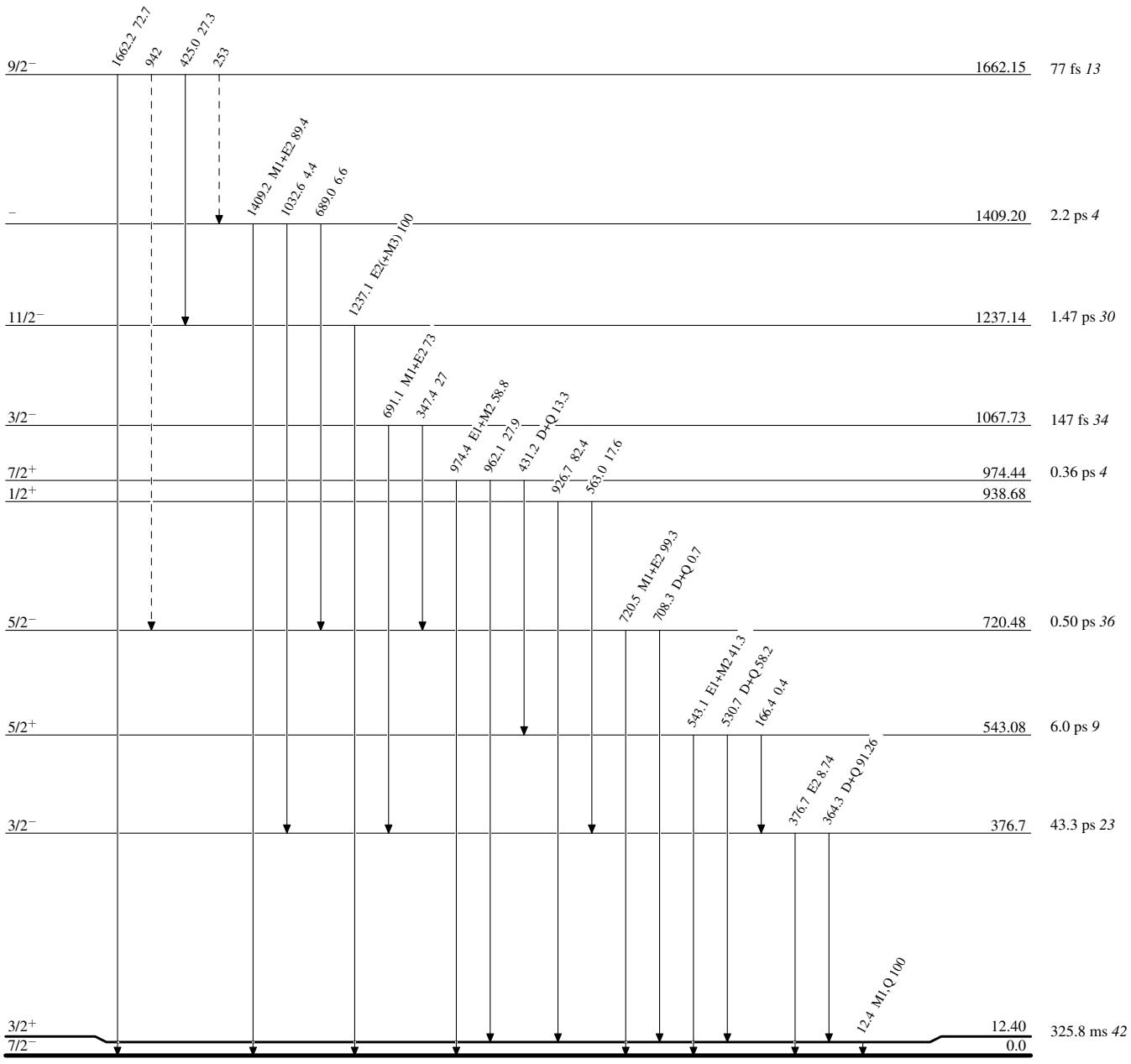
Coulomb excitation

Legend

Level Scheme

Intensities: % photon branching from each level

- - - - - - ► γ Decay (Uncertain)



$^{45}_{21}Sc_{24}$