^{48}Ca(n,n′γ) 1992Va06

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	Jun Chen	NDS 179, 1 (2022)	30-Nov-2021

1992Va06: E=4.8-8.0 MeV neutron beams were produced via ^{2}H(d,n) with deuterons from the 7-MV Van de Graaff accelerator. Target was 4.5 g 96% enriched ^{48}Ca. γ rays were detected with a Ge detector. Measured Eγ, Iγ, γ excitation functions, γ(θ), Doppler-shift attenuation. Deduced levels, J, π, $T_{1/2}$, γ-ray multipolarities, mixing ratios.

^{48}Ca Levels

E(level)[†]	Jπ[‡]	$T_{1/2}$[#]	Comments
0.0	0^+		
3832.6 *3*	2^+	42 fs *9*	
4284.2 *3*	0^+		
4504.0 *3*	4^+		Jπ: 2,4 from stretched Q to 2^+.
4507.7 *3*	3^-		Jπ: E3 γ to 0^+. 1.4 ps<$T_{1/2}$<13.9 ps.
4612.8 *3*	$3^{(+)}$	3.7 ps *+9−4*	Jπ: 3 from γ(θ).
5146.3 *3*	3,4,5		Jπ: 3,5 from γ(θ). Results are discrepant in the various experiments; see the Adopted Levels for discussion.
5261.4 *3*	$4^{(-)}$	5.1 ps *+14−8*	Jπ: 4 from γ(θ).
5312.3 *3*	2	232 fs *+28−13*	Jπ: 2,3,4 from γ(θ); Q γ to 0^+.
5370.9 *3*	3^-	1.80 ps *14*	
5730.1 *3*	5^-	0.90 ps *+49−21*	
6105.6 *3*	(2^+)	139 fs *+17−28*	
6336.8 *20*	2^+	191 fs *29*	Jπ: E2 γ to 0^+.
6345.7 *3*	4^+	180 fs *+35−13*	
6649.7 *3*	4^+	114 fs *+42−28*	Jπ: D or D+Q γ′s to 3^+ and 4^+; 4 or 6 from 1504γ(θ).
6686.7 *3*	$2^{(-)}$	69 fs *+56−52*	
6791.5 *20*	1	<6.9 fs	Jπ: 1 from γ(θ). 1992Va06 note that 6791γ(θ) consistent only with J=1 but assume (2^+) from (e,e′) (1985Wi06).
6806.1 *3*	2^+	83 fs *+44−38*	
6831.4 *6*	(3^-)		Jπ: (3) from γ(θ).
6896.7 *3*	(2^-)	55 fs *+83−55*	Jπ: 2,3,4 from γ(θ).
7008.2 *6*	3^-	69 fs *+18−14*	
7032.7 *6*	$(3)^-$		Jπ: (3,5) from γ(θ).
7296.7 *6*	(2^+)	<6.9 fs	Jπ: (E2) γ to 0^+.
7370.6 *20*	(0,1,2)		Jπ: γ only to 0^+.
7440.6 *20*	$2,3^-$	177.4 fs *70*	Jπ: 2,3 from γ(θ).
7497.9 *3*	(3^-)		
7569.3 *6*	≤4		Jπ: γ only to 2^+.

[†] From a least-squares fit to γ-ray energies.
[‡] From Adopted Levels. Supporting arguments from data in this dataset are given in the comments.
[#] From DSAM in 1992Va06.

γ(^{48}Ca)

A_2 and A_4 values given under comments are from E(n)=8.0 MeV (1992Va06).

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^{48}Ca(n,n′γ) 1992Va06 (continued)

γ(^{48}Ca) (continued)

E_γ[†]	σ(mb)[†]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[&]	δ[&]	Comments
451.6 *1*	13.6 *12*	4284.2	0^+	3832.6	2^+			A_2=+0.04 *5*.
468.7 *1*	13.9 *13*	5730.1	5^-	5261.4	$4^{(-)}$			A_2=−0.25 *14*.
642.7[‡] *1*	44.4 *37*	5146.3	3,4,5	4504.0	4^+	D		A_2=−0.17 *6*.
648.4 *1*	6.40 *65*	5261.4	$4^{(-)}$	4612.8	$3^{(+)}$	D		A_2=−0.38 *19*.
671.4 *1*	168 *14*	4504.0	4^+	3832.6	2^+	Q[a]		A_2=+0.31 *7*.
675.1 *1*	163 *13*	4507.7	3^-	3832.6	2^+	D		A_2=−0.21 *5*.
753.8 *1*	38.0 *33*	5261.4	$4^{(-)}$	4507.7	3^-	D		A_2=−0.36 *11*.
757.5[‡] *1*	11.0 *13*	5370.9	3^-	4612.8	$3^{(+)}$	D		A_2=+0.19 *10*.
780.1 *1*	105.7 *86*	4612.8	$3^{(+)}$	3832.6	2^+	D		A_2=−0.26 *5*.
803.9[‡] *1*	2.70 *46*	5312.3	2	4507.7	3^-	D		A_2=+0.22 *45*.
862.7[‡] *1*	11.1 *14*	5370.9	3^-	4507.7	3^-			A_2=−0.03 *19*, A_4=−0.19 *23*.
866.9 *1*	10.7 *12*	5370.9	3^-	4504.0	4^+	D		A_2=−0.23 *16*, A_4=−0.21 *18*.
1199.3 *1*	4.1 *19*	6345.7	4^+	5146.3	3,4,5			A_2=+0.02 *34*.
1226.0 *1*	8.8 *20*	5730.1	5^-	4504.0	4^+			A_2=+0.09 *17*.
1278[#d]		6649.7	4^+	5370.9	3^-			
1315.8 *1*	11.7 *12*	6686.7	$2^{(-)}$	5370.9	3^-			A_2=+0.07 *26*.
1480.2[‡] *1*	47.3 *39*	5312.3	2	3832.6	2^+	D+Q	+0.7 *6*	A_2=+0.11 *7*.
1504.0[‡] *1*	6.90 *82*	6649.7	4^+	5146.3	3,4,5	D		A_2=+0.05 *23*.
1525.7 *1*	3.10 *74*	6896.7	(2^-)	5370.9	3^-	D		A_2=−0.43 *53*.
1537.8 *1*	37.4 *34*	5370.9	3^-	3832.6	2^+	D		A_2=−0.31 *13*.
1597.8 *1*	19.0 *18*	6105.6	(2^+)	4507.7	3^-			A_2=−0.37 *7*.
1733.5[‡] *1*	4.9 *12*	6345.7	4^+	4612.8	$3^{(+)}$			A_2=−0.26 *24*.
1767.8 *1*	4.90 *72*	7497.9	(3^-)	5730.1	5^-			A_2=−1.18 *38*, A_4=−0.86 *48*.
1841.2[‡] *1*	24.2 *27*	6345.7	4^+	4504.0	4^+			A_2=+0.11 *10*.
2036.8 *1*	5.20 *51*	6649.7	4^+	4612.8	$3^{(+)}$	D		A_2=−0.79 *22*.
2073.9 *1*	3.0 *10*	6686.7	$2^{(-)}$	4612.8	$3^{(+)}$			A_2=+0.8 *12*.
2145.1[‡] *1*	10.2 *16*	6649.7	4^+	4504.0	4^+	D		A_2=−0.52 *14*, A_4=−0.90 *23*.
2273.1 *1*	2.60 *37*	6105.6	(2^+)	3832.6	2^+			A_2=−1.0 *7*.
2301.9 *1*	9.2 *13*	6806.1	2^+	4504.0	4^+			A_2=+0.37 *29*.
2389.0 *1*	8.9 *12*	6896.7	(2^-)	4507.7	3^-	D		A_2=−0.13 *30*.
2524.9 *5*	6.10 *77*	7032.7	$(3)^-$	4507.7	3^-	D+Q		A_2=−0.45 *25*. δ: large.
2974.8 *5*	6.6 *22*	6806.1	2^+	3832.6	2^+			A_2=−1.01 *36*.
2998.7 *5*	7.3 *10*	6831.4	(3^-)	3832.6	2^+	D		A_2=+0.23 *47*.
3175.5 *5*	27.2 *31*	7008.2	3^-	3832.6	2^+			A_2=−0.28 *23*.
3463.9 *5*	10.1 *11*	7296.7	(2^+)	3832.6	2^+			A_2=+0.44 *23*.
3736.6 *5*	6.2 *38*	7569.3	≤4	3832.6	2^+			A_2=+0.22 *42*.
3832.2 *5*	706 *58*	3832.6	2^+	0.0	0^+	E2[b]		A_2=+0.29 *4*.
4507.3 *5*	40.7 *46*	4507.7	3^-	0.0	0^+	E3[b]		A_2=+0.39 *9*.
5312.2 *5*	7.30[@] *84*	5312.3	2	0.0	0^+	Q[c]		
6336.4 *20*	17.1 *18*	6336.8	2^+	0.0	0^+	E2[b]		A_2=+0.28 *18*.
6791.0 *20*	10.8 *11*	6791.5	1	0.0	0^+	D		A_2=−0.70 *20*.
7298 *2*	2.10 *43*	7296.7	(2^+)	0.0	0^+	(E2)[b]		A_2=+0.81 *37*.
7370 *2*	10.70 *88*	7370.6	(0,1,2)	0.0	0^+			
7440 *2*	2.40 *54*	7440.6	$2,3^-$	0.0	0^+	Q,O[c]		

[†] From 1992Va06, obtained at E(n)=8.0 MeV. Values of σ(mb) are for production cross sections, for which the uncertainties quoted in 1992Va06 are statistical only and an additional 8% uncertainty from calibration as mentioned in 1992Va06 has been added in quadrature (by the evaluator).

[‡] Poor-fit; uncertainty has been increased to 0.3 keV in the fitting.

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^{48}Ca(n,n′γ) 1992Va06 (continued)

$\gamma(^{48}Ca)$ (continued)

Looked for but not observed.
@ Corrected for second escape peak of 6336γ.
& From $\gamma(\theta)$, except as noted.
a Stretched.
b From $\gamma(\theta)$ and comparison to RUL.
c 1992Va06 suggest E2 from comparison to RUL; however, B(M2)(W.u.)(5312γ)=0.30 *5* and B(M2)(W.u.)(7440γ)=0.581 *23*.
d Placement of transition in the level scheme is uncertain.

^{48}Ca(n,n′γ) 1992Va06

Level Scheme

Intensities: σ(mb) at E(n)=8.0 MeV

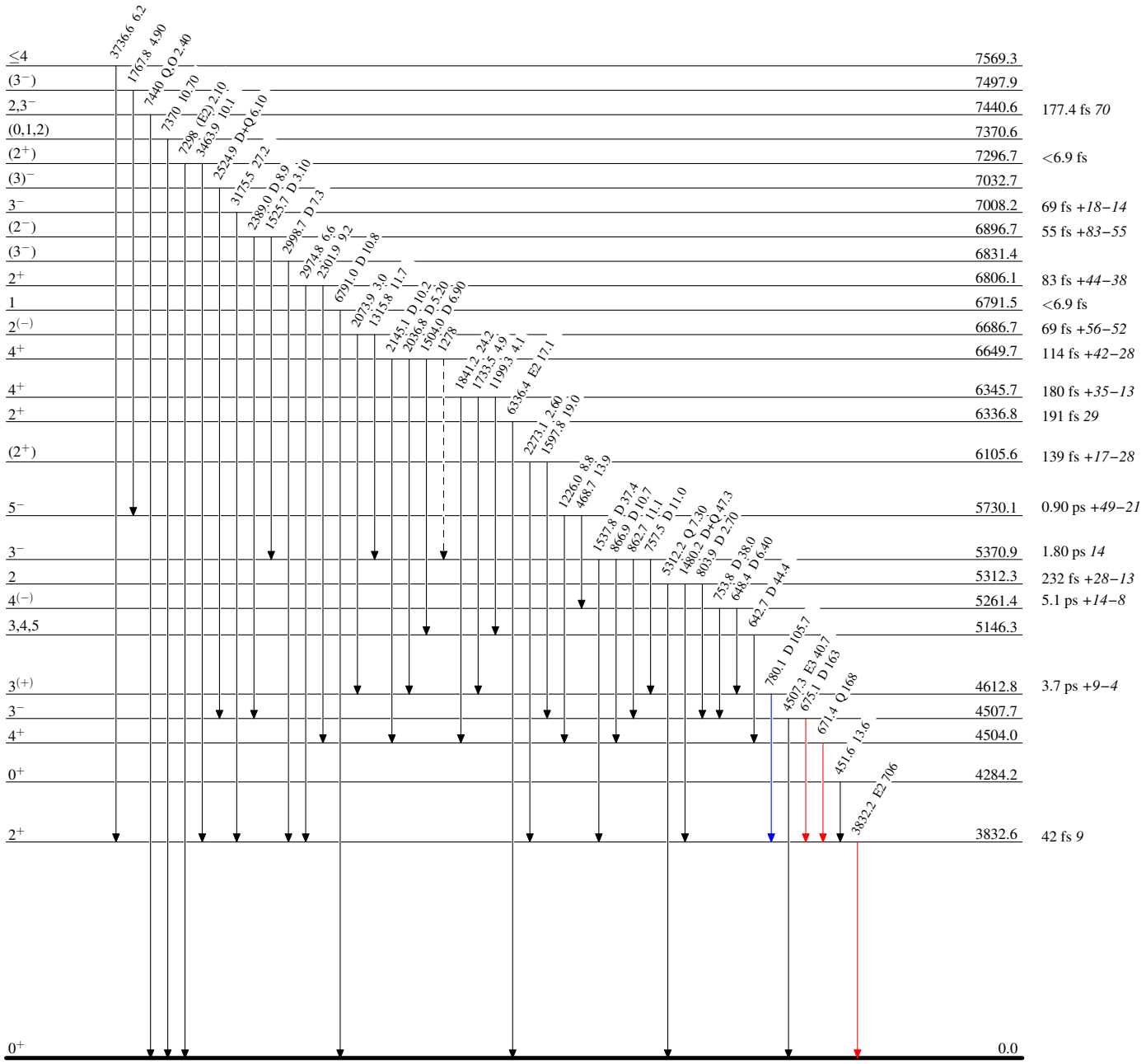
Legend

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

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

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

γ Decay (Uncertain)



$^{48}_{20}Ca_{28}$