Coulomb excitation 2006Ra08

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	Jun Chen	NDS 146, 1 (2017)	30-Sep-2017

2006Ra08: ^{12}C(^{138}Ce,^{138}Ce′γ) E=480 MeV ^{138}Ce beam of about 1 pnA was produced from the ATLAS accelerator at ANL. Target was 1 mg/cm^2 ^{12}C. γ rays were detected with the Gammasphere array of 98 HPGe detectors in 15 rings. Measured Eγ, Iγ, $\gamma\gamma$-coin, $\gamma(\theta)$, DSA. Deduced levels, J, π, lifetimes, γ-ray multipolarities and mixing ratios. Comparisons with neighboring nuclei.

2014Na15: ^{24}Mg(^{138}Ce,^{138}Ce′γ) E=480 MeV ^{138}Ce beam of about 1.7 enA was produced from ATLAS-ANL facility. Target was 0.85 mg/cm^2 ^{24}Mg followed by a 15.7 mg/cm^2 thick layer of natural copper. γ rays were detected with the Gammasphere array of 100 HPGe detectors and recoils were detected with a silicon detector. Measured Eγ, Iγ, (particle)γ-coin. Deduced lifetime of first 2$^+$ state by recoil-distance (RDDS) method using Yale plunger device, and g factor of first 2$^+$ state by time-dependent recoil into vacuum (TDRIV) following Coulomb excitation. Comparison with predictions from large-scale shell-model (lssm) and quasiparticle phonon model (qpm).

1989Lo01: ^{138}Ce(α,$\alpha'\gamma$) E=9,10 MeV alpha beam was produced from the Cologne FN tandem accelerator. Target was made from material containing ^{138}Ce and ^{142}Ce. γ rays were detected with Ge detectors. Measured γ, relative $\sigma(\theta)$. Deduced B(E2) from $\sigma(\theta)$ relative to B(E2)(^{142}Ce).

1989Ga24: ^{138}Ce(p,p′γ) E=3.0 MeV. Measured γ, $\sigma(\theta)$. Deduced β_2, B(E2) from $\sigma(\theta)$.

^{138}Ce Levels

E(level)[†]	J$^\pi$[‡]	T$_{1/2}$[&]	Comments
0.0	0$^+$		
788 *1*	2$^+$	1.98 ps *4*	B(E2)↑=0.45 *3*; β_2=0.126 *8* g=0.26 *8* (2014Na15) T$_{1/2}$: weighted average of 2.06 ps *14* from average B(E2)↑ of 1989Lo01 and 1989Ga24, and 1.97 ps *4* from RDDS (2014Na15). B(E2): weighted average of 0.45 *3* (1989Lo01) and 0.461 *50* (1989Ga24). β_2: from average B(E2). The g factor measured by 2014Na15 relative to g(first 2$^+$)=0.21 *5* for ^{142}Ce. Statistical uncertainty=0.05, uncertainty from value in ^{142}Ce is 0.06.
1476.4 *12*	0$^+$[#]		
1510.3 *7*	2$^+$	0.834 ps *20*	
1826.4 *12*	4$^+$		
2142.7 *8*	2$^+$	123 fs *7*	
2177.3 *9*	3$^-$		B(E3)↑=0.163 *9* (2006Ra08)
2236.7 *8*	2$^+$	56.8 fs *35*	
2470.7 *8*	(2$^+$)[@]	109 fs *6*	
2642.2 *8*	2$^+$[#]	66 fs *32*	

[†] From a least-squares fit to γ-ray energies.
[‡] From 2006Ra08 based on $\gamma(\theta)$ and RUL, unless otherwise noted.
[#] From Adopted Levels.
[@] 2$^+$ from 2006Ra08 and brackets are added by the evaluator since no experimental evidence is given in 2006Ra08.
[&] From DSA method (2006Ra08), unless otherwise noted. 2006Ra08 does not explain the source of the uncertainties. Usually, a ≈5%−10% systematic uncertainty due to slowing-down process should be included.

Coulomb excitation 2006Ra08 (continued)

$\gamma(^{138}Ce)$

A_2, A_4 values are from 2006Ra08.

E_γ[†]	I_γ[†]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[‡]	δ[‡]	Comments
667 *1*	1.97 *3*	2177.3	3^-	1510.3	2^+			
688 *1*	0.069 *6*	1476.4	0^+	788	2^+			
722 *1*	7.33 *6*	1510.3	2^+	788	2^+	M1+E2	−1.97 *+32−25*	A_2=−0.172 *8*; A_4=−0.018 *11*
788 *1*	1000.0 *1*	788	2^+	0.0	0^+	E2		A_2=+0.112 *5*; A_4=−0.003 *7*
1038 *1*	2.565 *15*	1826.4	4^+	788	2^+			A_2=+0.347 *10*; A_4=−0.033 *13*
1354 *1*	1.173 *13*	2142.7	2^+	788	2^+	M1+E2	−0.83 *+6−8*	A_2=−0.203 *15*; A_4=−0.005 *15*
1389 *1*	4.10 *3*	2177.3	3^-	788	2^+	E1+M2	−0.025 *+12−19*	A_2=−0.191 *9*; A_4=−0.006 *12*
1448 *1*	2.263 *15*	2236.7	2^+	788	2^+	M1+E2	0.18 *+5−4*	A_2=+0.308 *14*; A_4=+0.012 *18*
1510 *1*	9.68 *6*	1510.3	2^+	0.0	0^+			A_2=+0.201 *7*; A_4=−0.056 *10*
1682 *1*	0.411 *5*	2470.7	(2^+)	788	2^+			
1854 *1*	0.250 *10*	2642.2	2^+	788	2^+			
2143 *1*	0.378 *8*	2142.7	2^+	0.0	0^+			
2237 *1*	1.811 *25*	2236.7	2^+	0.0	0^+			A_2=+0.298 *21*; A_4=−0.08 *3*
2471 *1*	0.508 *13*	2470.7	(2^+)	0.0	0^+			
2642 *1*	0.087 *35*	2642.2	2^+	0.0	0^+			I_γ: deduced from branching ratio in Adopted Gammas.

[†] From 2006Ra08. Values of intensities given by 2006Ra08 have been divided by 1000.
[‡] From 2006Ra08 based on $\gamma(\theta)$.

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Level Scheme

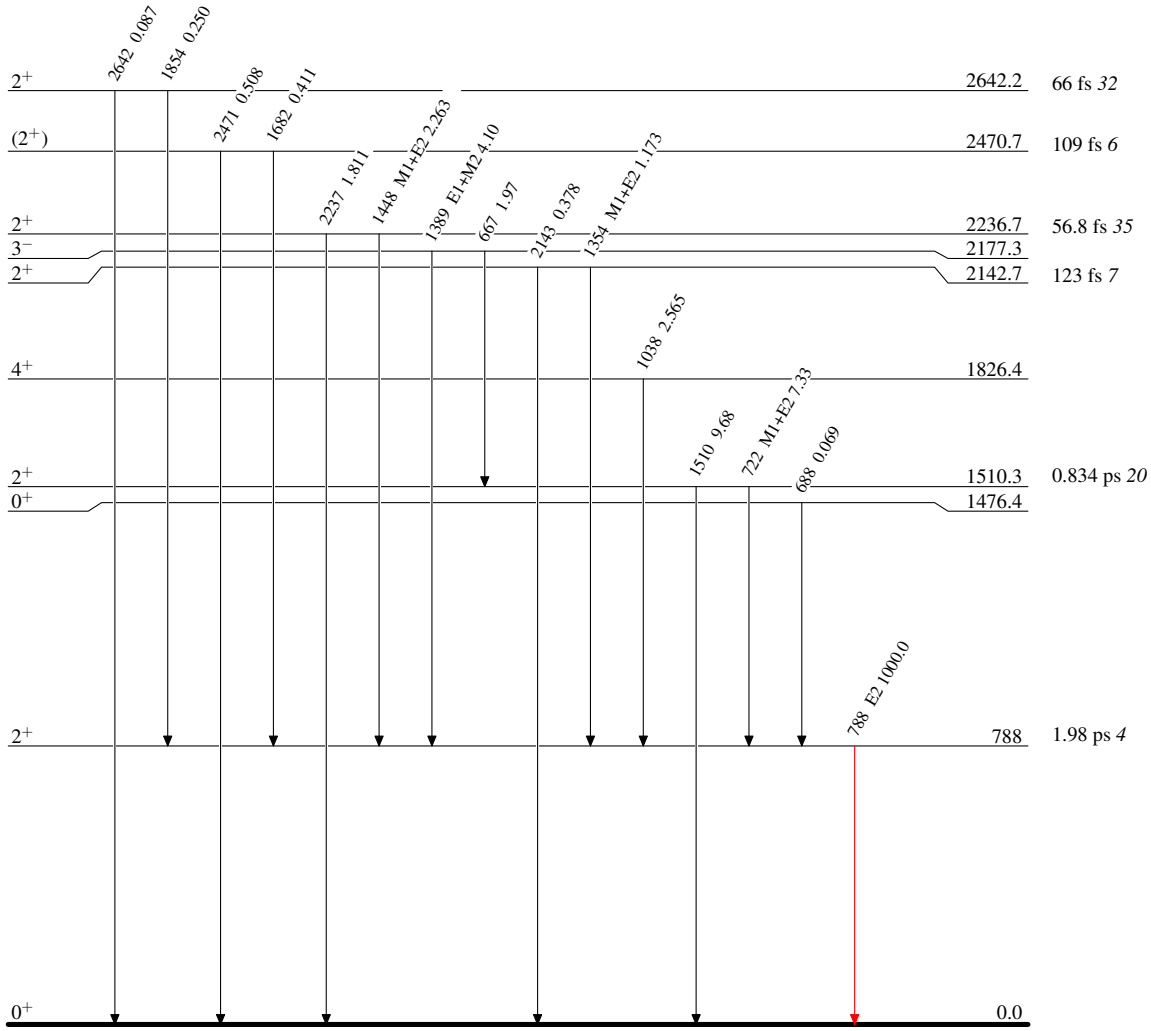
Intensities: Relative I_γ

Legend

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

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

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



$^{138}_{58}Ce_{80}$