^{64}Zn(^{64}Zn,αnγ) 2012Sm04

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	Jun Chen	NDS 174, 1 (2021)	15-Apr-2021

2012Sm04: E=260 MeV ^{64}Zn beam was provided by the Argonne Tandem Linac Accelerator System (ATLAS) at Argonne National Laboratory. Target was a 500μg/cm^2 ^{64}Zn foil. γ rays were detected by the Gammasphere array consisting of 78 HPGe detectors; neutrons were detected by the Neutron Shell consisting of 30 BC501A scintillators; α particles were detected by the Microball charged-particle spectrometer consisting of 95 CsI(Tl) scintillators; recoils were dispersed and analyzed using Argonne Fragment Mass Analyzer. Measured Eγ, Iγ, $\gamma\gamma$-coin, nγ-coin, $\alpha\gamma$-coin, (recoil)γ-coin, $\gamma(\theta)$. Deduced levels, J, π, band structures, configurations, γ-ray multipolarities. Comparisons with Total Routhian Surface (TRS) and cranked shell-model (CSM) calculations.

^{123}Ce Levels

E(level)[†]	J$^\pi$[‡]	Comments
0+x[@]	(5/2$^+$)	E(level),J$^\pi$: this level may be the ground state of ^{123}Ce based on proton decay of g.s. of ^{123}Ce to ^{122}Ba.
0+y[#]	(7/2$^+$)	
0+z[&]	(7/2$^-$)	
270.70+z[&] *10*	(11/2$^-$)	
273.00+x[@] *10*	(9/2$^+$)	
335.80+y[#] *10*	(11/2$^+$)	
638.50+z[&] *15*	(15/2$^-$)	
669.40+x[@] *15*	(13/2$^+$)	
788.90+y[#] *15*	(15/2$^+$)	
1131.10+z[&] *18*	(19/2$^-$)	
1176.60+x[@] *18*	(17/2$^+$)	
1347.10+y[#] *18*	(19/2$^+$)	
1728.60+z[&] *20*	(23/2$^-$)	
1781.20+x[@] *20*	(21/2$^+$)	
1995.20+y[#] *20*	(23/2$^+$)	
2407.31+z[&] *23*	(27/2$^-$)	
2466.6+x[@] *3*	(25/2$^+$)	
2715.11+y[#] *23*	(27/2$^+$)	
3131.7+z[&] *3*	(31/2$^-$)	
3211.6+x[@] *11*	(29/2$^+$)	
3456.1+y[#] *3*	(31/2$^+$)	
3874.9+z[&] *4*	(35/2$^-$)	
3958.6+x[@] *15*	(33/2$^+$)	
4210.7+y[#] *4*	(35/2$^+$)	
4658.5+z?[&] *5*	(39/2$^-$)	
4778.6+x?[@] *18*	(37/2$^+$)	
4994.1+y[#] *5*	(39/2$^+$)	
5513.5+z?[&] *11*	(43/2$^-$)	
5833.1+y?[#] *11*	(43/2$^+$)	

[†] From a least-squares fit to γ-ray energies.
[‡] Tentative assignments as shown in level-scheme figure 4 of 2012Sm04, based on measured $\gamma(\theta)$ and band structures.

Continued on next page (footnotes at end of table)

^{64}Zn(^{64}Zn,αnγ) 2012Sm04 (continued)

^{123}Ce Levels (continued)

Band(A): ν5/2[413],α=−1/2. Spherical orbital=$g_{7/2}$.
@ Band(a): ν5/2[413],α=+1/2 Spherical orbital=$g_{7/2}$.
& Band(B): ν5/2[532],α=−1/2 Spherical orbital=$h_{11/2}$.

γ(^{123}Ce)

Assignment of γ cascades to ^{123}Ce is from subtraction of αpn, α2n and 2αn matrices from total projection of $\gamma\gamma$ matrix.
Angular-intensity ratio R=Iγ(≈140°)/Iγ(≈90°). Expected ratios are 0.7 for ΔJ=1, dipole and 1.2 for ΔJ=2, quadrupole transitions.

E_γ	I_γ	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†]	Comments
270.7 *1*	88 *6*	270.70+z	(11/2$^-$)	0+z	(7/2$^-$)	Q	R=1.1 *2*.
273.0 *1*	94 *8*	273.00+x	(9/2$^+$)	0+x	(5/2$^+$)	(Q)	R=0.77 *16*.
335.8 *1*	89 *4*	335.80+y	(11/2$^+$)	0+y	(7/2$^+$)	Q	R=1.1 *2*.
367.8 *1*	88 *6*	638.50+z	(15/2$^-$)	270.70+z	(11/2$^-$)	Q	R=1.07 *12*.
396.4 *1*	98 *8*	669.40+x	(13/2$^+$)	273.00+x	(9/2$^+$)	Q	R=1.3 *2*.
453.1 *1*	100 *4*	788.90+y	(15/2$^+$)	335.80+y	(11/2$^+$)	Q	R=1.2 *3*.
492.6 *1*	71 *11*	1131.10+z	(19/2$^-$)	638.50+z	(15/2$^-$)	(Q)	R=0.91 *19*.
507.2 *1*	95 *9*	1176.60+x	(17/2$^+$)	669.40+x	(13/2$^+$)	Q	R=1.4 *3*.
558.2 *1*	94 *4*	1347.10+y	(19/2$^+$)	788.90+y	(15/2$^+$)	Q	R=1.3 *2*.
597.5 *1*	62 *7*	1728.60+z	(23/2$^-$)	1131.10+z	(19/2$^-$)	Q	R=1.00 *17*.
604.6 *1*	94 *8*	1781.20+x	(21/2$^+$)	1176.60+x	(17/2$^+$)	Q	R=1.4 *3*.
648.1 *1*	94 *5*	1995.20+y	(23/2$^+$)	1347.10+y	(19/2$^+$)	Q	R=1.2 *2*.
678.7 *1*	41 *7*	2407.31+z	(27/2$^-$)	1728.60+z	(23/2$^-$)	Q	R=1.1 *3*.
685.4 *2*	85 *15*	2466.6+x	(25/2$^+$)	1781.20+x	(21/2$^+$)	(Q)	R=1.1 *4*.
719.9 *1*	86 *4*	2715.11+y	(27/2$^+$)	1995.20+y	(23/2$^+$)	Q	R=1.5 *3*.
724.4 *2*	34 *8*	3131.7+z	(31/2$^-$)	2407.31+z	(27/2$^-$)	Q	R=1.6 *5*.
741.0 *2*	85 *4*	3456.1+y	(31/2$^+$)	2715.11+y	(27/2$^+$)	Q	R=1.5 *4*.
743.2 *2*	21 *9*	3874.9+z	(35/2$^-$)	3131.7+z	(31/2$^-$)	Q	R=1.7 *5*.
745 *1*	86 *11*	3211.6+x	(29/2$^+$)	2466.6+x	(25/2$^+$)		
747 *1*	81 *11*	3958.6+x	(33/2$^+$)	3211.6+x	(29/2$^+$)		
754.6 *2*	80 *4*	4210.7+y	(35/2$^+$)	3456.1+y	(31/2$^+$)	Q	R=1.6 *4*.
783.4 *2*	68 *3*	4994.1+y	(39/2$^+$)	4210.7+y	(35/2$^+$)	Q	R=1.6 *6*.
783.6[‡] *2*	13 *8*	4658.5+z?	(39/2$^-$)	3874.9+z	(35/2$^-$)		
820[‡] *1*	51 *13*	4778.6+x?	(37/2$^+$)	3958.6+x	(33/2$^+$)		
839[‡] *1*	21 *4*	5833.1+y?	(43/2$^+$)	4994.1+y	(39/2$^+$)		
855[‡] *1*	5 *2*	5513.5+z?	(43/2$^-$)	4658.5+z?	(39/2$^-$)		

[†] From angular-intensity (anisotropy) ratio. Multipolarity=Q indicates ΔJ=2, quadrupole (most likely E2) transition. 2012Sm04 assign E2 for all the transitions.
[‡] Placement of transition in the level scheme is uncertain.

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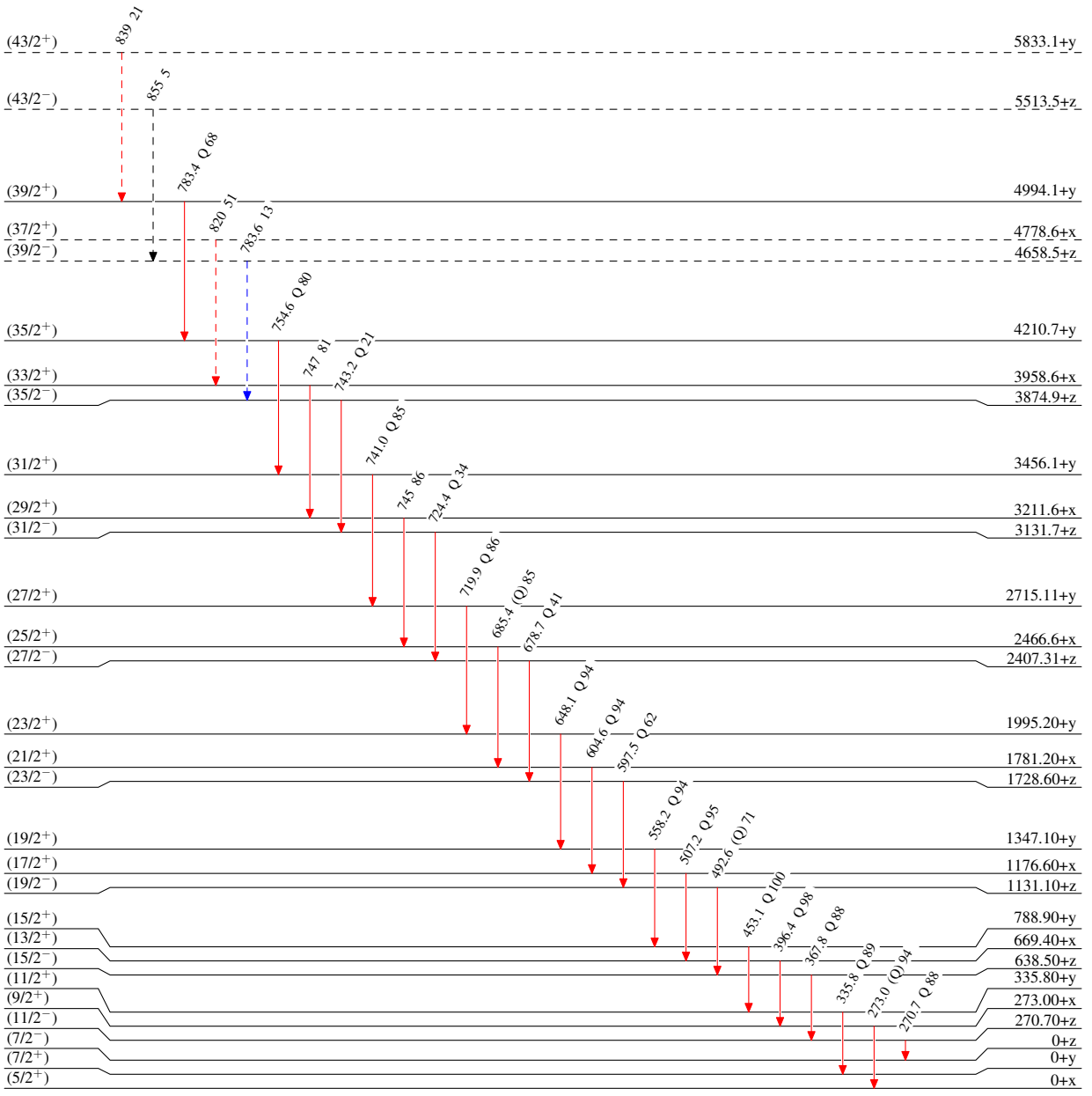
Level Scheme

Intensities: Relative I_γ

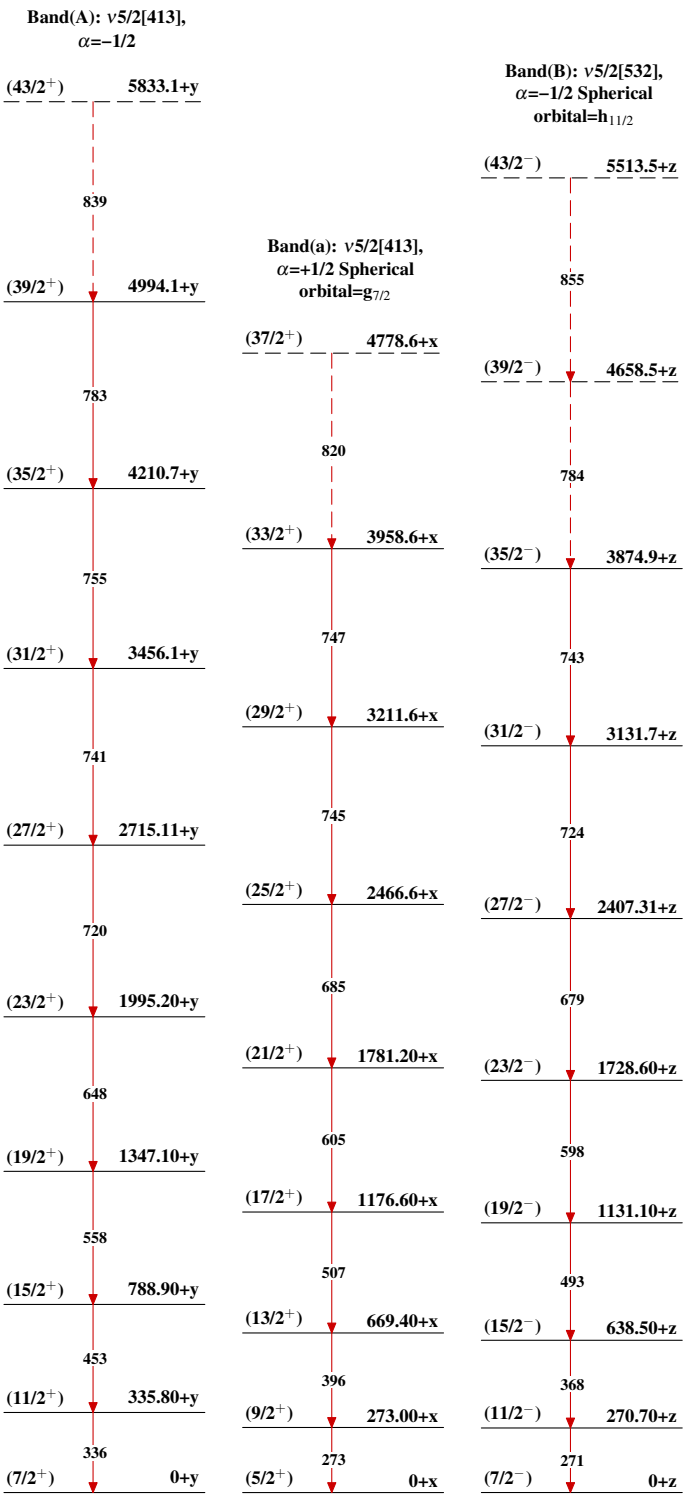
Legend

$I_\gamma < 2\% \times I_\gamma^{max}$
$I_\gamma < 10\% \times I_\gamma^{max}$
$I_\gamma > 10\% \times I_\gamma^{max}$
γ Decay (Uncertain)



$^{123}_{58}Ce_{65}$

$^{64}Zn(^{64}Zn,\alpha n\gamma)$ 2012Sm04



$^{123}_{58}Ce_{65}$