^{137}Ba(α,2nγ),^{138}Ba(α,3nγ) 1984Vo12,1977Lu04,1976Lu07

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	P. K. Joshi, B. Singh, S. Singh, A. K. Jain	NDS 138, 1 (2016)	15-Oct-2016

1976Lu07: ^{138}Ba(α,3nγ) E=51 MeV. Measured γ(t).
1977Lu04: ^{138}Ba(α,3nγ) E=45-59 MeV. Measured excitation functions, γ's, $\gamma(\theta$=60°−125°, 5 angles), γ(t), and $\gamma\gamma$-coincidences.
1984Vo12: ^{137}Ba(α,2nγ) E=27 MeV. Measured 269,1607$\gamma(\theta$,H,t); NaI, T=300°, 650° K.
Except as noted, all data are from 1977Lu04. The decay scheme is based on the $\gamma\gamma$-coincidence data, intensity considerations, and observation that no γ's deexciting low-spin states known from decay studies were observed.

^{139}Ce Levels

E(level)	J$^\pi$[†]	T$_{1/2}$[‡]	Comments
0.0	3/2$^+$		
754.8 *10*	11/2$^-$	57.58 s *32*	%IT=100 T$_{1/2}$ and decay mode from the Adopted Levels.
2029.2 *15*	(11/2$^-$,13/2)		E(level): suggested on the basis of the energy-sum relation and excit. J$^\pi$: (11/2$^-$,13/2) from γ's to 11/2$^-$ and possible γ from (15/2$^-$).
2362.3 *15*	(15/2$^-$)		J$^\pi$: (15/2) from $\gamma(\theta)$ and excit. π=− from (E2) γ from (19/2$^-$).
2631.5 *18*	(19/2$^-$)	70 ns *5*	g=+0.405 *8* (1984Vo12) Configuration=νh$_{11/2}\otimes^{140}$Ce,first 4$^+$). g: from 1607$\gamma(\theta,\beta$,t). Other: g=0.199 *21* from 269$\gamma(\theta,\beta$,t) (269 peak may be contaminated, probably from ^{138}Ba(α,2n) γ's). J$^\pi$: J(2632)>J(2362) from excit; T$_{1/2}\leq$ ≈100 ns suggests mult(269γ)=Q (1977Lu04). π=− from comparison of g(exp)=+0.405 *8* to g(theory)=+0.40 *3* for the proposed configuration.
2819.3 *20*	(21/2$^-$)	≤3.0 ns	J$^\pi$: from $\gamma(\theta)$ and γ-deexcitation pattern.
3185.1 *23*	(23/2$^-$)		J$^\pi$: from $\gamma(\theta)$ and excit.
3481.7 *24*	(25/2)		
3702.0 *24*	(27/2)		E(level): suggested on the basis of the energy-sum relation and $\gamma\gamma$-coin.

[†] From the Adopted Levels. Contributing arguments are given as comments.
[‡] From γ(t) of 1976Lu07, except as noted. T$_{1/2}$(2632) from 269γ(t); 68 ns *5* from 1608γ(t). 1984Vo12 give 64 ns *4* from 1607γ(t) and 56 ns *6* from 269γ(t) for 2632 but do not discuss these values except to note that the 269 peak may be contaminated, probably from ^{138}Ba(α,2n) γ's.

$\gamma(^{139}$Ce)

Except for the delayed γ from the 11/2$^-$ to 3/2$^+$ transition, no delayed transitions were observed in delayed γ-spectra with delays of 10, 20, 40, 60, 100, 200, and 300 μs with respect to the beam pulses.

E$_\gamma$	I$_\gamma$[†]	E$_i$(level)	J$_i^\pi$	E$_f$	J$_f^\pi$	Mult.[‡]	α[a]	Comments
187.8	57 *6*	2819.3	(21/2$^-$)	2631.5	(19/2$^-$)	(M1+E2)		I$_\gamma$: 56 *7*.
220.1	10.3 *11*	3702.0	(27/2)	3481.7	(25/2)			I$_\gamma$: 9.8 *9*.
269.2	65 *4*	2631.5	(19/2$^-$)	2362.3	(15/2$^-$)	(E2)	0.0688	α(K)=0.0546 *8*; α(L)=0.01120 *16*; α(M)=0.00242 *4* α(N)=0.000526 *8*; α(O)=7.94×10^{-5} *12*; α(P)=3.54×10^{-6} *5* I$_\gamma$: 74 *4*. Mult.: D,E2 from comparison to RUL. ≠D from comparison of T$_{1/2}$(2632) with T$_{1/2}$(2632)=96 ns calculated from assumption that 2632 is [(^{140}Ce 4$^+$)(νh$_{11/2}^{-1}$)]19/2$^-$ with T$_{1/2}$(^{140}Ce 4$^+$)=5 ns (1976Lu07).

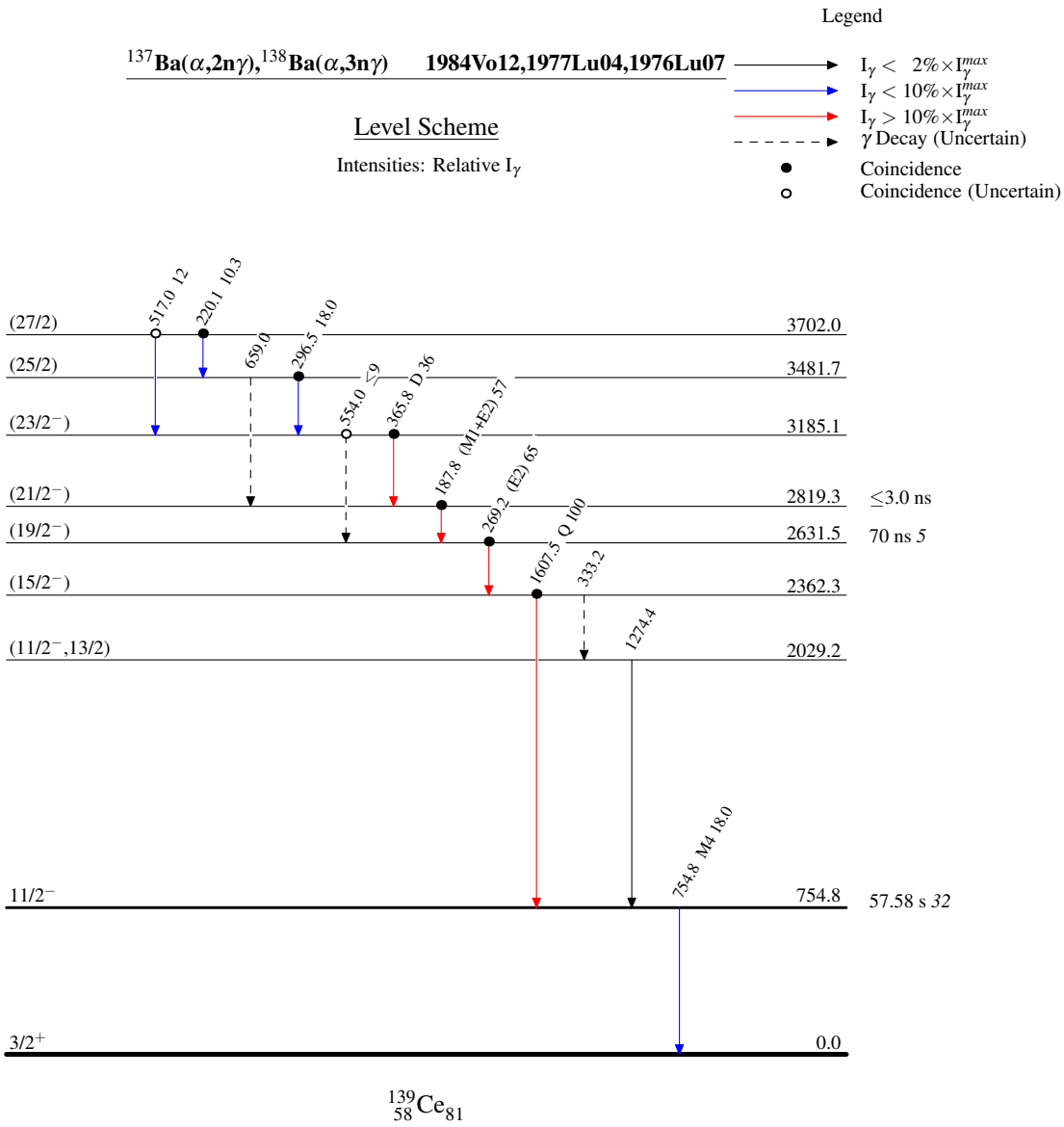
Continued on next page (footnotes at end of table)

^{137}Ba(α,2nγ),^{138}Ba(α,3nγ) 1984Vo12,1977Lu04,1976Lu07 (continued)

γ(^{139}Ce) (continued)

E_γ	I_γ[†]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[‡]	Comments
296.5	18.0[#] *17*	3481.7	(25/2)	3185.1	(23/2$^-$)		
333.2[b]		2362.3	(15/2$^-$)	2029.2	(11/2$^-$,13/2)		I_γ: ≤7.
365.8	36 *4*	3185.1	(23/2$^-$)	2819.3	(21/2$^-$)	D[@]	I_γ: 33.9 *21*.
517.0[&]	12[#] *4*	3702.0	(27/2)	3185.1	(23/2$^-$)		
554.0[&b]	≤9[#]	3185.1	(23/2$^-$)	2631.5	(19/2$^-$)		
659.0[&b]		3481.7	(25/2)	2819.3	(21/2$^-$)		I_γ: ≤5.
754.8	18.0 *15*	754.8	11/2$^-$	0.0	3/2$^+$	M4	Mult.: from Adopted Gammas. I_γ: 220 *11*.
1274.4		2029.2	(11/2$^-$,13/2)	754.8	11/2$^-$		I_γ: 18.7 *35*.
1607.5	100 *10*	2362.3	(15/2$^-$)	754.8	11/2$^-$	Q[@]	I_γ: 100 *8*.

[†] At E=52 MeV and θ=125° and in coincidence with the cyclotron burst. Data at 45 MeV without coincidence are given under comments.
[‡] From $\gamma(\theta)$, except as noted.
[#] Not observed at 45 MeV with no coincidence.
[@] Stretched.
[&] Placed on the basis of $\gamma\gamma$-coincidence data and energy sums.
[a] Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on γ-ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.
[b] Placement of transition in the level scheme is uncertain.


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)
Coincidence
Coincidence (Uncertain)
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Level Scheme
Intensities: Relative I_γ
(27/2) 3702.0
(25/2) 3481.7
(23/2−) 3185.1
(21/2−) 2819.3 ≤3.0 ns
(19/2−) 2631.5 70 ns 5
(15/2−) 2362.3
(11/2−,13/2) 2029.2
11/2− 754.8 57.58 s 32
3/2+ 0.0
517.0 12
220.1 10.3
659.0
296.5 18.0
≤9
554.0
365.8 D 36
187.8 (M1+E2) 57
269.2 (E2) 65
1607.5 Q 100
333.2
1274.4
754.8 M4 18.0

$^{139}_{58}Ce_{81}$