

Adopted Levels, Gammas

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	Jun Chen	NDS 152, 1 (2018)	30-Sep-2017

$Q(\beta^-) = -17810$  SY;  $S(n) = 16993.8$  7;  $S(p) = 4547.27$  22;  $Q(\alpha) = -6105.12$  21 [2017Wa10](#)

$\Delta(Q(\beta^-)) = 200$  (syst, [2017Wa10](#)).

$S(2n) = 31750$  40,  $S(2p) = 6404.90$  20,  $Q(\epsilon p) = 1600.19$  28 ([2017Wa10](#)).

First identification of  $^{38}\text{Ca}$  nuclide was by [1966Ha32](#) via  $^{40}\text{Ca}(p,t)$  according to [2011Am01](#) compilation of isotope discovery.

[Additional information 1](#).

Mass measurement: [2011Er02](#), [2008Ge08](#), [2007Ge07](#), [2007Ri08](#), [2006Bo11](#).

 $^{38}\text{Ca}$  LevelsCross Reference (XREF) Flags

<b>A</b>	$^{39}\text{Ti}$ $\epsilon p$ decay (28.5 ms)	<b>E</b>	$^{36}\text{Ar}(^3\text{He}, n\gamma)$
<b>B</b>	$^{39}\text{Sc}$ p decay:?	<b>F</b>	$^{40}\text{Ca}(p, t)$
<b>C</b>	$^{24}\text{Mg}(^{16}\text{O}, 2n\gamma)$	<b>G</b>	Coulomb excitation
<b>D</b>	$^{36}\text{Ar}(^3\text{He}, n)$		

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Isospin T=1 (triplet) states

$^{38}\text{Ar}$	$^{38}\text{Ca}$	$\Delta E(1)$	$^{38}\text{K}$	$\Delta E(2)$
$0, 0^+$	$0, 0^+$		$130, 0^+$ T=1	
$2167, 2^+$	$2213, 2^+$	+46	$2401, 2^+$ T=1	+104, +58
$3377, 0^+$	$3084, 0^+$	-293		
$3810, 3^-$	$3704, 3^-$	-106		
$3937, 2^+$	$3684, 2^+$	-253		
$\Delta E(1) = E(^{38}\text{Ca}) - E(^{38}\text{Ar})$			$E(^{38}\text{K}) - E(^{38}\text{Ca}) - 130$	
$\Delta E(2) = E(^{38}\text{K}) - E(^{38}\text{Ar}) - 130$ ,				

E(level) <sup>†</sup>	J <sup>π</sup>	T <sub>1/2</sub> <sup>‡</sup>	XREF	Comments
0	0 <sup>+</sup>	443.76 ms 35	<b>A CDEFG</b>	$\% \epsilon + \% \beta^+ = 100$ T <sub>1/2</sub> : weighted average of 443.63 ms 35 ( <a href="#">2015BI02</a> ), 443.77 ms 36 ( <a href="#">2011Pa38</a> ), 443.8 ms 19 ( <a href="#">2010BI09</a> ), 430 ms 12 ( <a href="#">1980Wi13</a> ), 450 ms 70 ( <a href="#">1972Zi02</a> ), 439 ms 12 ( <a href="#">1969Ga27</a> ), and 470 ms 20 ( <a href="#">1968Ka15</a> ). Other: 660 ms 50 ( <a href="#">1957CI23</a> ), based on the observation of a 3.5 MeV $\gamma$ which could not be confirmed in the studies afterwards.
2213.2 10	2 <sup>+</sup>	0.56 ps +16-10	<b>A CDEFG</b>	B(E2) $\uparrow$ =0.0096 21 XREF: D(2224). J <sup>π</sup> : L(p,t)=2 from 0 <sup>+</sup> ; Coulomb excitation from 0 <sup>+</sup> . T <sub>1/2</sub> : from B(E2) $\uparrow$ . Other: 68 fs +30-28 from DSAM in ( $^3\text{He}, n\gamma$ ). B(E2) $\uparrow$ from <a href="#">1999Co23</a> in Coulomb excitation.
3083.7 12	0 <sup>+</sup>	19 ps +10-7	<b>DEF</b>	J <sup>π</sup> : L(p,t)=0 from 0 <sup>+</sup> .
3683.9 5	2 <sup>+</sup>	29 fs +15-9	<b>dEfG</b>	B(E2) $\uparrow$ =0.0122 30 J <sup>π</sup> : L(p,t)=2; L( $^3\text{He}, n$ )=2 or 2+3 for a doublet; Coulomb excitation from 0 <sup>+</sup> . T <sub>1/2</sub> : from B(E2) $\uparrow$ and adopted $\gamma$ -ray branching ratios. Other: <5.5 fs from DSAM in ( $^3\text{He}, n\gamma$ ). B(E2) $\uparrow$ from <a href="#">1999Co23</a> in Coulomb excitation.
3703.5 10	(3 <sup>-</sup> )	0.16 ps +7-6	<b>dEf</b>	J <sup>π</sup> : systematics of even-even nuclides; L( $^3\text{He}, n$ )=2+3 for a doublet composed of 3684 and 3703 levels. L(p,t) also shows some evidence of presence of L=3 component.
4193.5 15	(5 <sup>-</sup> )		<b>EF</b>	E(level): other: 4191 5 from (p,t). J <sup>π</sup> : L(p,t)=(5) from 0 <sup>+</sup> .

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**Adopted Levels, Gammas (continued)** $^{38}\text{Ca}$  Levels (continued)

E(level) <sup>†</sup>	J <sup>π</sup>	T <sub>1/2</sub> <sup>‡</sup>	XREF	Comments
4383.9 11	2 <sup>+</sup>	24 fs +12-8	dEF	E(level): other: 4385 4 from (p,t). J <sup>π</sup> : L(p,t)=2 from 0 <sup>+</sup> ; L( <sup>3</sup> He,n)=2+5 for a doublet.
4412 30	(5 <sup>-</sup> )		d	J <sup>π</sup> : L( <sup>3</sup> He,n)=2+5 for a doublet.
4748 5	0 <sup>+</sup>		D F	E(level): other: 4751 5 from ( <sup>3</sup> He,n). J <sup>π</sup> : L( <sup>3</sup> He,n)=0 from 0 <sup>+</sup> . L(p,t)=(3) is inconsistent. There may be a doublet near this energy, but due to tentative nature of L(p,t), the evidence for two levels is not sufficient.
4860 40	(3 <sup>-</sup> )		D	E(level): from ( <sup>3</sup> He,n). J <sup>π</sup> : L( <sup>3</sup> He,n)=3,(2+4). This group may be a doublet in ( <sup>3</sup> He,n); L=(2+4) may correspond to 4899, 2 <sup>+</sup> level from (p,t).
4902 4	2 <sup>+</sup>		F	J <sup>π</sup> : L(p,t)=2 from 0 <sup>+</sup> .
5164 7	2 <sup>+</sup>		D F	XREF: D(5140). E(level): other: 5140 60 from ( <sup>3</sup> He,n). J <sup>π</sup> : L( <sup>3</sup> He,n)=2 from 0 <sup>+</sup> . J <sup>π</sup> : L(p,t)=2 from 0 <sup>+</sup> .
5266 4	2 <sup>+</sup>		F	
5430 6			F	
5601 7	3 <sup>-</sup>		D F	XREF: D(5560). E(level): other: 5560 60 from ( <sup>3</sup> He,n). J <sup>π</sup> : L( <sup>3</sup> He,n)=3 from 0 <sup>+</sup> .
5704 5			F	
5816 7	(4 <sup>+</sup> )		D F	XREF: D(5790). E(level): other: 5790 40 from ( <sup>3</sup> He,n). J <sup>π</sup> : L( <sup>3</sup> He,n)=(4) from 0 <sup>+</sup> .
6136 6			F	
6277 3	0 <sup>+</sup>		F	J <sup>π</sup> : L(p,t)=0 from 0 <sup>+</sup> .
6485 6			F	
6601 3			F	
6704 3			F	
6770 13			D F	E(level): other: 6760 50 from ( <sup>3</sup> He,n).
6801 12			F	
6950 5			F	
7041 8			F	
7176 4			d F	XREF: d(7200).
7208 15			d F	XREF: d(7200).
7480 9			D F	E(level): other: 7470 50 from ( <sup>3</sup> He,n).
7801 3			F	
8026 5			F	
8189 6			F	
8322 5			F	
8507 9			F	
8587 3			F	
8672 6			F	
8717 8			F	
8924 9			F	
8994 9			F	
9073 9			F	
9157 8			F	
9230 9			F	
9296 8			F	
9735 8			F	
9809 6			F	
10104 9			F	
10410 9			F	
10557 8			F	
10946 11			F	
11089 11			F	

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Adopted Levels, Gammas (continued) $^{38}\text{Ca}$  Levels (continued)

<u>E(level)<sup>†</sup></u>	<u>XREF</u>
11189 <i>13</i>	<b>F</b>
11861 <i>11</i>	<b>F</b>

<sup>†</sup> From a least-squares fit to  $\gamma$ -ray energies for levels connected with  $\gamma$  transitions and from (p,t) for the rest, unless otherwise noted.

<sup>‡</sup> From DSAM in ( $^3\text{He},n\gamma$ ), unless otherwise noted.

 $\gamma(^{38}\text{Ca})$ 

<u>E<sub>i</sub>(level)</u>	<u>J<sub>i</sub><sup><math>\pi</math></sup></u>	<u>E<sub><math>\gamma</math></sub><sup>†</sup></u>	<u>I<sub><math>\gamma</math></sub></u>	<u>E<sub>f</sub></u>	<u>J<sub>f</sub><sup><math>\pi</math></sup></u>	<u>Comments</u>
2213.2	2 <sup>+</sup>	2213.13	100	0	0 <sup>+</sup>	B(E2)(W.u.)=2.5 6 E <sub><math>\gamma</math></sub> : other: 2212.5 <i>14</i> from $^{39}\text{Ti}$ $\varepsilon p$ decay, 2206 <i>10</i> from Coulomb excitation.
3083.7	0 <sup>+</sup>	870.5 5	100	2213.2	2 <sup>+</sup>	B(E2)(W.u.)=8 +3-5
3683.9	2 <sup>+</sup>	1471 <sup>‡</sup>	19 <i>14</i>	2213.2	2 <sup>+</sup>	E <sub><math>\gamma</math></sub> : other: 1448 25 from Coulomb excitation. I <sub><math>\gamma</math></sub> : from Coulomb excitation.
		3683.7 5	100 <i>14</i>	0	0 <sup>+</sup>	B(E2)(W.u.)=3.2 <i>12</i> E <sub><math>\gamma</math></sub> : other: 3685 <i>21</i> from Coulomb excitation. I <sub><math>\gamma</math></sub> : from Coulomb excitation.
3703.5	(3 <sup>-</sup> )	1490.22 <i>11</i>	100	2213.2	2 <sup>+</sup>	B(E1)(W.u.)=0.0011 +7-3
4193.5	(5 <sup>-</sup> )	490		3703.5	(3 <sup>-</sup> )	
4383.9	2 <sup>+</sup>	2170.6 4	100	2213.2	2 <sup>+</sup>	

<sup>†</sup> From ( $^3\text{He},n\gamma$ ), unless otherwise noted.

<sup>‡</sup> Placement of transition in the level scheme is uncertain.

Adopted Levels, Gammas

Legend

Level Scheme

Intensities: Relative photon branching from each level

-----►  $\gamma$  Decay (Uncertain)

