

$^{58}\text{Ni}(^3\text{He},p\gamma), ^{40}\text{Ca}(^{23}\text{Na},2pn\gamma)$ 1989Sc28,1977Ba50

Type	Author	History	Citation	Literature Cutoff Date
Full Evaluation	E. Browne, J. K. Tuli		NDS 114, 1849 (2013)	31-Dec-2012

$E(^3\text{He})=13$ MeV, $p\gamma(\theta)$ with magnetic spectrograph at 0° , FWHM=25-50 keV. NaI at $90^\circ-159^\circ$ (1977Ba50).

$E(^3\text{He})=12$ MeV, $\gamma\gamma$ (1989Sc28).

$E(^{23}\text{Na})=70$ MeV (1989Sc28).

Data are mainly taken from 1989Sc28, except as noted otherwise.

 ^{60}Cu Levels

E(level) [†]	J ^π @	Comments
0.0	2 ⁺	
62 <i>I</i>	1 ⁺	
287 <i>I</i>	2 ⁺	
334 <i>I</i>		
363 <i>I</i>	(1 ⁺)	
454 <i>I</i>	(3 ⁺)	
557 <i>I</i>	(4 ⁺)	
571 $\frac{3}{2}^-$ <i>I</i>		
600 $\frac{3}{2}^-$ <i>I</i>		
669 <i>I</i>	1 ⁺	
781 $\frac{3}{2}^-$ <i>I</i>	(3 ⁺)	
904 $\frac{3}{2}^-$ <i>I</i>		
915 <i>I</i>		
947 $\frac{3}{2}^-$ <i>I</i>		
975 $\frac{3}{2}^-$ <i>I</i>		
1007 <i>I</i>		
1249 $\frac{3}{2}^-$ <i>I</i>		
1368 $\frac{3}{2}^-$ <i>I</i>		
1422 <i>I</i>		
1427 $\frac{3}{2}^-$ <i>I</i>		
1505 $\frac{3}{2}^-$ <i>I</i>		
1604 <i>I</i>	(5 ⁺)	
1660 $\frac{3}{2}^-$ <i>I</i>		
1668 $\frac{3}{2}^-$ <i>I</i>		
1779 $\frac{3}{2}^-$ <i>I</i>	(5 ⁺)	
1791 $\frac{3}{2}^-$ <i>I</i>		
1878 $\frac{3}{2}^-$ <i>I</i>		
2027 <i>I</i>	(5 ⁺)	
2035 $\frac{3}{2}^-$ <i>I</i>		
2197 <i>I</i>	(6 ⁺)	
2246 $\frac{3}{2}^-$ <i>I</i>		
2350 $\frac{3}{2}^-$ <i>I</i>		
2519 $\frac{3}{2}^-$ <i>I</i>		
2524 $\frac{3}{2}^-$ <i>I</i>		
2536	(0 ⁺)	E(level): from 1977Ba50. J ^π : lowest T=2 state. J=0 confirmed by isotropic $\gamma(\theta)$.
2539 $\frac{3}{2}^-$ <i>I</i>		
2658 $\frac{3}{2}^-$ <i>I</i>		
2692 $\frac{3}{2}^-$ <i>I</i>	(6 ⁺)	

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$^{58}\text{Ni}(^3\text{He,p}\gamma)$, $^{40}\text{Ca}(^{23}\text{Na,2pn}\gamma)$ **1989Sc28,1977Ba50** (continued)

^{60}Cu Levels (continued)

E(level) [†]	J ^π @	Comments
2790 [#] 1		
2817 [‡] 1	(6)	
3066 [‡] 1		
3155 1	(6 ⁻)	
3191 [‡] 1	(7 ⁺)	
3315 [‡] 1		
3355 1	(7 ⁻)	
3575 [‡] 2		
3594 [‡] 2		
3624 [‡] 2		
3699 [‡] 2		
3773 [#] 2	(7 ⁻)	
3837 [#] 2		
3877 [‡] 2	(4 ⁺)&	
4093 [#] 2		
4479 [#] 2		
5824 [#] 3		

E(level): from a table in [1989Sc28](#), 5827 in the level scheme.

[†] Levels observed in both reactions in [1989Sc28](#), except as noted otherwise. Uncertainties not given, estimated by the evaluator.

[‡] Excited states observed only in the ($^3\text{He,p}\gamma$) reaction.

[#] Levels found only in the reaction ($^{23}\text{Na,2pn}\gamma$).

@ From Adopted Levels, except as noted otherwise.

& From γ decays to 2⁺ and (6⁺) states ([1989Sc28](#)).

$\gamma(^{60}\text{Cu})$

$E_i(\text{level})$	J_i^π	E_γ^\dagger	$I_\gamma^\#$	E_f	J_f^π	$E_i(\text{level})$	J_i^π	E_γ^\dagger	E_f	J_f^π
62	1 ⁺	62		0.0	2 ⁺	915		358	557	(4 ⁺)
287	2 ⁺	225		62	1 ⁺			461	454	(3 ⁺)
		287		0.0	2 ⁺	947		376	571	
334		272		62	1 ⁺			493	454	(3 ⁺)
363	(1 ⁺)	363		0.0	2 ⁺			947	0.0	2 ⁺
454	(3 ⁺)	167		287	2 ⁺	975		418	557	(4 ⁺)
		454		0.0	2 ⁺	1007		338	669	1 ⁺
557	(4 ⁺)	103		454	(3 ⁺)	1249		915	334	
		223		334		1368		1081	287	2 ⁺
		270		287	2 ⁺	1422		968	454	(3 ⁺)
		557		0.0	2 ⁺			1422@	0.0	2 ⁺
571		237		334		1427?		1427@	0.0	2 ⁺
		284		287	2 ⁺	1505		1051	454	(3 ⁺)
		571		0.0	2 ⁺	1604	(5 ⁺)	1047	557	(4 ⁺)
600		600		0.0	2 ⁺	1668		887	781	(3 ⁺)
669	1 ⁺	335	13	334		1779	(5 ⁺)	1222	557	(4 ⁺)
		669	87	0.0	2 ⁺			1325	454	(3 ⁺)
781	(3 ⁺)	327		454	(3 ⁺)	1791		1428	363	(1 ⁺)
		781		0.0	2 ⁺			1791@	0.0	2 ⁺
904		904		0.0	2 ⁺	1878		373	1505	

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${}^{58}\text{Ni}({}^3\text{He,p}\gamma)$, ${}^{40}\text{Ca}({}^{23}\text{Na},2\text{pn}\gamma)$ **1989Sc28,1977Ba50** (continued) $\gamma({}^{60}\text{Cu})$ (continued)

$E_i(\text{level})$	J_i^π	E_γ^\dagger	$I_\gamma^\#$	E_f	J_f^π	$E_i(\text{level})$	J_i^π	E_γ^\dagger	E_f	J_f^π
2027	(5 ⁺)	423		1604	(5 ⁺)	3315		1437	1878	
		1470		557	(4 ⁺)			1536	1779	(5 ⁺)
		2027		0.0	2 ⁺			1893	1422	
2035		1366		669	1 ⁺			2715	600	
2197	(6 ⁺)	1640		557	(4 ⁺)	3355	(7 ⁻)	1158	2197	(6 ⁺)
		1743		454	(3 ⁺)	3575		1051	2524	
2246		642		1604	(5 ⁺)			1378	2197	(6 ⁺)
2350		1793		557	(4 ⁺)			1971	1604	(5 ⁺)
2519		915		1604	(5 ⁺)			2628	947	
2524		2161		363	(1 ⁺)	3594		1397	2197	(6 ⁺)
2536	(0 ⁺)	1866 [‡]	59 5	669	1 ⁺	3624		1597	2027	(5 ⁺)
		2171 [‡]	16 5	363	(1 ⁺)	3699		1175	2524	
		2202 ^{‡@}	<4	334				2031	1668	
		2475 [‡]	25 5	62	1 ⁺			2784	915	
2539		935		1604	(5 ⁺)			2795	904	
2658		461		2197	(6 ⁺)	3773	(7 ⁻)	618	3155	(6 ⁻)
2692	(6 ⁺)	1088		1604	(5 ⁺)	3837		1640	2197	(6 ⁺)
2790		593		2197	(6 ⁺)	3877	(4 ⁺)	1680	2197	(6 ⁺)
2817	(6)	790		2027	(5 ⁺)			3877	0.0	2 ⁺
3066		2509		557	(4 ⁺)	4093		738	3355	(7 ⁻)
3155	(6 ⁻)	1551		1604	(5 ⁺)	4479		386	4093	
3191	(7 ⁺)	1587		1604	(5 ⁺)	5824		1734	4093	
3315		1288		2027	(5 ⁺)					

[†] Deduced from E(level) given in **1989Sc28**, unless indicated otherwise.

[‡] From **1977Ba50**.

[#] % Photon branching is given (**1977Ba50**).

[@] Placement of transition in the level scheme is uncertain.

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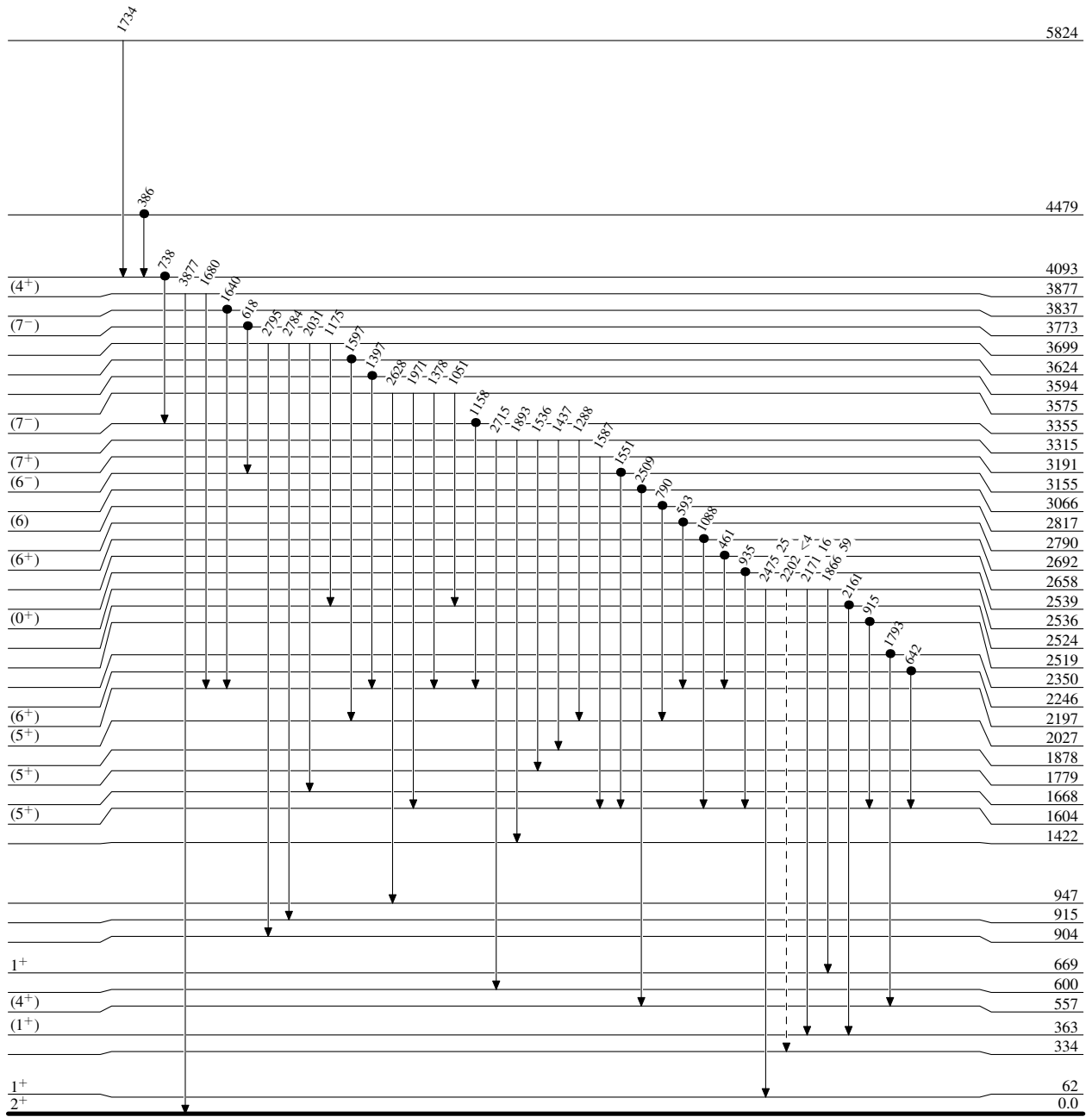
Legend

Level Scheme

Intensities: % photon branching from each level

-----▶ γ Decay (Uncertain)

● Coincidence



$^{60}_{29}\text{Cu}_{31}$

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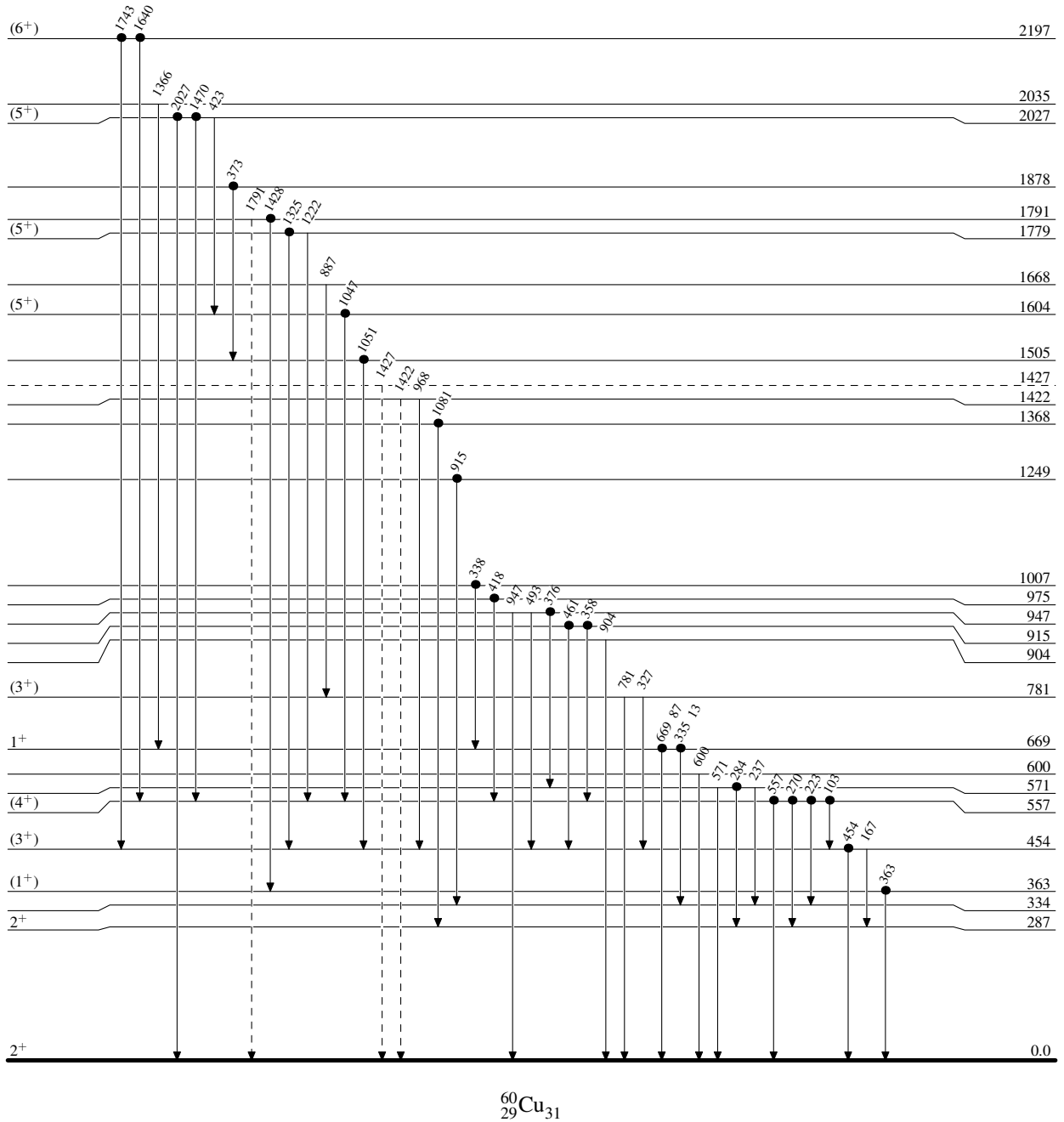
Legend

Level Scheme (continued)

Intensities: % photon branching from each level

-----► γ Decay (Uncertain)

● Coincidence



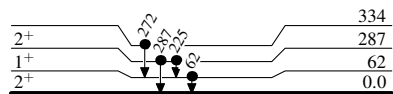
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Legend

Level Scheme (continued)

Intensities: % photon branching from each level

● Coincidence



$^{60}_{29}\text{Cu}_{31}$