

$^{40}\text{Ca}(^{36}\text{Ar},\alpha 2p\gamma), ^{58}\text{Ni}(^{14}\text{N},pn\gamma)$ 1986He17,1989My01,2008Lj01

Type	Author	History	Citation	Literature Cutoff Date
Full Evaluation	G. Gürdal, E. A. Mccutchan		NDS 136, 1 (2016)	1-Jul-2016

- 1986He17:** $^{58}\text{Ni}(^{14}\text{N},pn)$ with $E(^{14}\text{N})=39$ MeV. Beam was provided by FN tandem accelerator at Universitat Koln. A 67.8% enriched $0.9 \mu\text{g}/\text{cm}^2$ Ni target. $20 \mu\text{m}$ thick Ta stopper. γ -rays were measured using 3 Ge detectors. Neutrons were detected using a circular 4-segment NE213 detector. Measured $E\gamma$, $I\gamma$, γn coin, $T_{1/2}$ by recoil-distance Doppler shift method.
- $^{40}\text{Ca}(^{20}\text{Ar},\alpha 2p\gamma)$ with $E(^{40}\text{Ar})=115$ MeV. Beam was provided by VICKSI accelerator at Berlin. A $350 \mu\text{g}/\text{cm}^2$ Ca target with 96.9% ^{40}Ca on a thin $0.8 \mu\text{m}$ Al foil was used. $20 \mu\text{m}$ thick Ta foil used as a stopper. γ -rays were measured using three Ge(Li) detectors. Measured: $E\gamma$, $I\gamma$ and $T_{1/2}$ by recoil-distance Doppler shift method. Authors adopted average $T_{1/2}$ from two experiments.
- 1989My01:** $^{40}\text{Ca}(^{36}\text{Ar},\alpha 2p)$ with $E(^{36}\text{Ar})=145$ MeV. Beam was provided by VICKSI accelerator at Berlin. A 99.96% enriched $1 \text{ mg}/\text{cm}^2$ Ca target on a thin $50 \text{ mg}/\text{cm}^2$ Bi was used. γ -rays were measured using ORIS spectrometer which consisted of 12 BGO shielded Ge(Li) detectors. Measured: $E\gamma$, $I\gamma$, $\gamma\gamma$ coin, DCO ratios (not given in the publication). Other: [1988MyZZ](#).
- 2008Lj01:** $^{40}\text{Ca}(^{36}\text{Ar},\alpha 2p)$ with $E(^{36}\text{Ar})=136$ MeV. Beam was provided by accelerator at Legnaro. $0.5 \text{ mg}/\text{cm}^2$ enriched ^{40}Ca target on a $2.0 \text{ mg}/\text{cm}^2$ gold foil was used. $10 \text{ mg}/\text{cm}^2$ thick gold stopper. γ -rays were measured using GASP array of 38 Ge detectors. Cologne plunger was used to measure level lifetimes. Events with at least two prompt γ -rays detected in coincidence were recorded. Measured $E\gamma$ and $T_{1/2}$ using recoil-distance Doppler shift method.
- 2003LiZW:** $^{40}\text{Ca}(^{36}\text{Ar},\alpha 2p)$, $E(^{36}\text{Ar})=104$ MeV. ATLAS facility at ANL. Gammasphere and FMA were used. Measured $E\gamma$.

 ^{70}Se Levels

E(level) [†]	$J^{\pi a}$	$T_{1/2}^{\#}$	Comments
0.0 [‡]	0 ⁺		
944.7 [‡]	2 ⁺	2.22 ps <i>14</i>	$T_{1/2}$: Other: 1.0 ps 2 from recoil distance Doppler shift method (deduced using singles data) in 1986He17 .
1600.9	2 ⁺	3.3 [@] ps 9	
2011.4	(0 ⁺)		E(level): seen by 1986He17 only. J^{π} adopted in 1986He17 based on literature.
2038.0 [‡]	4 ⁺	0.97 ps 7	$T_{1/2}$: Other: 1.0 ps 2 from recoil distance Doppler shift method (deduced using singles data) in 1986He17 .
2382.4	4 ⁺	<12 ^{&} ps	
2516.8	3 ⁻	4.2 [@] ps 6	
2553.3	(4 ⁺)		
3001.7 [‡]	6 ⁺	1.32 ps <i>21</i>	$T_{1/2}$: Other: 2.7 ps 6 from recoil distance Doppler shift method, (deduced using singles data) in 1986He17 .
3356.3	(6 ⁺)		
3386.0	5 ⁽⁻⁾	6.1 [@] ps <i>17</i>	
3522.0	5 ⁻	<9 ^{&} ps	
3645.5	(6 ⁺)		
3786.0	6 ⁻		
3913.4	7 ⁻	<15 ^{&} ps	
4035.0 [‡]	8 ⁺	<4 ^{&} ps	
4323.0	(7 ⁻)		
4408.5	(7,8 ⁻)		
4603.8	(8,9 ⁺)		
4895.2	(9)		
4951.8	(9)		
5203.9 [‡]	10 ⁺		
5207.5	(8,9 ⁻)		
5691.3	(10 ⁺)		
5805.1	(11 ⁻)		
6013.8			
6487.6	(10,11 ⁻)		

Continued on next page (footnotes at end of table)

$^{40}\text{Ca}(^{36}\text{Ar},\alpha 2p\gamma), ^{58}\text{Ni}(^{14}\text{N},pn\gamma)$ **1986He17,1989My01,2008Lj01** (continued) ^{70}Se Levels (continued)

E(level) [†]	J ^π ^a	T _{1/2} [#]	Comments
6507.0 [‡]	12 ⁺		
6874.4	(13 ⁻)		
6955.5	(12 ⁺)		
7303.5	(13 ⁻)	1.6 ns 2	T _{1/2} : quoted by 1989My01 ; generalized centroid-shift method. J ^π : proposed based on Weisskopf estimates in 1989My01 .
7938.4 [‡]	(14 ⁺)		
8347.2	(14,15 ⁻)		
9493.4 [‡]	(16 ⁺)		

[†] From a least-squares fit to E_γ's, by evaluators, unless indicated otherwise.

[‡] Yrast band.

[#] From recoil distance Doppler shift method (RDDS) in [2008Lj01](#), except where noted. Side feeding contributions in [2008Lj01](#) were eliminated in the analysis using coincidences.

@ From recoil distance Doppler shift method in [1986He17](#), using singles data.

& Effective lifetime from recoil distance Doppler shift method in [1986He17](#), using singles data, not corrected for side feedings.

^a From DCO ratios observed in [1989My01](#) (DCOs are not given in the publication), unless stated otherwise.

 $\gamma(^{70}\text{Se})$

E _γ [†]	I _γ [‡]	E _i (level)	J _i ^π	E _f	J _f ^π	Comments
127.3		3913.4	7 ⁻	3786.0	6 ⁻	
264.0		3786.0	6 ⁻	3522.0	5 ⁻	
348.0 [#]		4951.8	(9)	4603.8	(8,9 ⁺)	
348.0 [#]		7303.5	(13 ⁻)	6955.5	(12 ⁺)	
486.7		4895.2	(9)	4408.5	(7,8 ⁻)	
495.1		4408.5	(7,8 ⁻)	3913.4	7 ⁻	
527.3	2.7 13	3913.4	7 ⁻	3386.0	5 ⁽⁻⁾	
569.0		4603.8	(8,9 ⁺)	4035.0	8 ⁺	
619.3		3001.7	6 ⁺	2382.4	4 ⁺	
656.1	8.1 21	1600.9	2 ⁺	944.7	2 ⁺	
690.2		4603.8	(8,9 ⁺)	3913.4	7 ⁻	
781.5	7.1 14	2382.4	4 ⁺	1600.9	2 ⁺	
796.5		7303.5	(13 ⁻)	6507.0	12 ⁺	
869.3		3386.0	5 ⁽⁻⁾	2516.8	3 ⁻	
909.9		5805.1	(11 ⁻)	4895.2	(9)	
911.7	19 4	3913.4	7 ⁻	3001.7	6 ⁺	
937.0		4323.0	(7 ⁻)	3386.0	5 ⁽⁻⁾	
944.6	100	944.7	2 ⁺	0.0	0 ⁺	
963.7	21.2 15	3001.7	6 ⁺	2038.0	4 ⁺	
973.9		3356.3	(6 ⁺)	2382.4	4 ⁺	
981.8		4895.2	(9)	3913.4	7 ⁻	
1005.1	3.3 9	3522.0	5 ⁻	2516.8	3 ⁻	
1033.6		4035.0	8 ⁺	3001.7	6 ⁺	
1043.7		8347.2	(14,15 ⁻)	7303.5	(13 ⁻)	
1062.0		6013.8		4951.8	(9)	
1066.7	14 4	2011.4	(0 ⁺)	944.7	2 ⁺	E _γ : seen by 1986He17 only.
1069.3		6874.4	(13 ⁻)	5805.1	(11 ⁻)	
1087.4		5691.3	(10 ⁺)	4603.8	(8,9 ⁺)	
1093.3	51 3	2038.0	4 ⁺	944.7	2 ⁺	

Continued on next page (footnotes at end of table)

$^{40}\text{Ca}(^{36}\text{Ar},\alpha 2p\gamma), ^{58}\text{Ni}(^{14}\text{N},pn\gamma)$ **1986He17,1989My01,2008Lj01 (continued)** $\gamma(^{70}\text{Se})$ (continued)

E_γ^\dagger	I_γ^\ddagger	$E_i(\text{level})$	J_i^π	E_f	J_f^π	E_γ^\dagger	I_γ^\ddagger	$E_i(\text{level})$	J_i^π	E_f	J_f^π
1168.8		5203.9	10 ⁺	4035.0	8 ⁺	1431.4		7938.4	(14 ⁺)	6507.0	12 ⁺
1263.1		3645.5	(6 ⁺)	2382.4	4 ⁺	1437.9	7.3 16	2382.4	4 ⁺	944.7	2 ⁺
1264.2		6955.5	(12 ⁺)	5691.3	(10 ⁺)	1484	3.4 8	3522.0	5 ⁻	2038.0	4 ⁺
1280.1		6487.6	(10,11 ⁻)	5207.5	(8,9 ⁻)	1555.0		9493.4	(16 ⁺)	7938.4	(14 ⁺)
1294.1		5207.5	(8,9 ⁻)	3913.4	7 ⁻	1572	13.5 22	2516.8	3 ⁻	944.7	2 ⁺
1303.1		6507.0	12 ⁺	5203.9	10 ⁺	1600.9	6.3 13	1600.9	2 ⁺	0.0	0 ⁺
1321.3		4323.0	(7 ⁻)	3001.7	6 ⁺	1608.6		2553.3	(4 ⁺)	944.7	2 ⁺
1348	14.8 16	3386.0	5 ⁽⁻⁾	2038.0	4 ⁺	1656.2		5691.3	(10 ⁺)	4035.0	8 ⁺

[†] From [1989My01](#).

[‡] Relative intensity from $^{58}\text{Ni}(^{14}\text{N},pn\gamma)$ at $E(^{14}\text{N})=39$ MeV ([1986He17](#)) unless indicated otherwise; see [1986He17](#) for intensities from the $^{40}\text{Ca}(^{36}\text{Ar},\alpha 2p\gamma)$ reaction at $E(^{36}\text{Ar})=115$ MeV. I_γ and DCO ratios not given in [1989My01](#).

[#] Multiply placed.

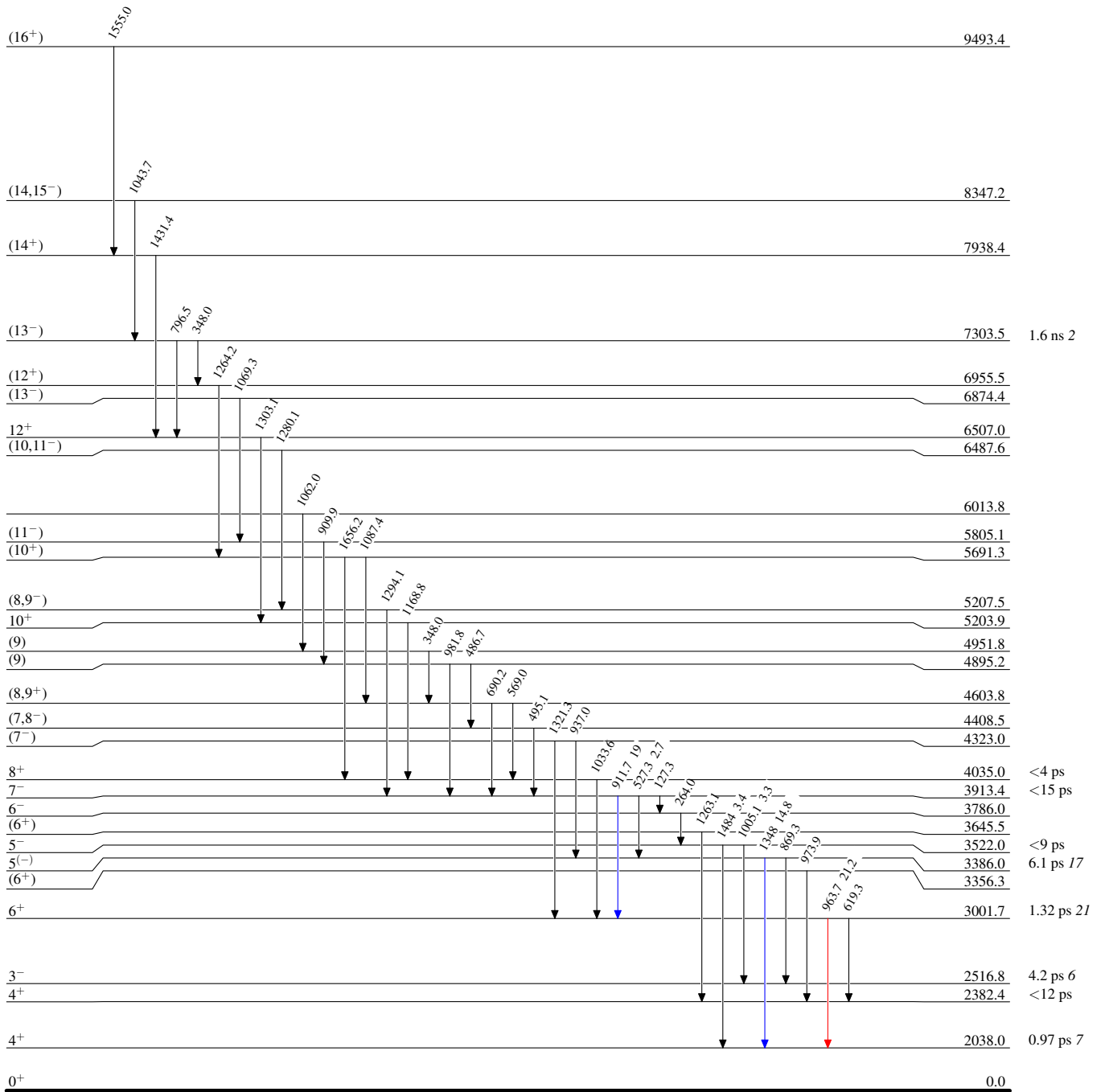
⁴⁰Ca(³⁶Ar,α2pγ), ⁵⁸Ni(¹⁴N,pnγ) 1986He17,1989My01,2008Lj01

Level Scheme

Intensities:

Legend

- ▶ I_γ < 2% × I_γ^{max}
- ▶ I_γ < 10% × I_γ^{max}
- ▶ I_γ > 10% × I_γ^{max}



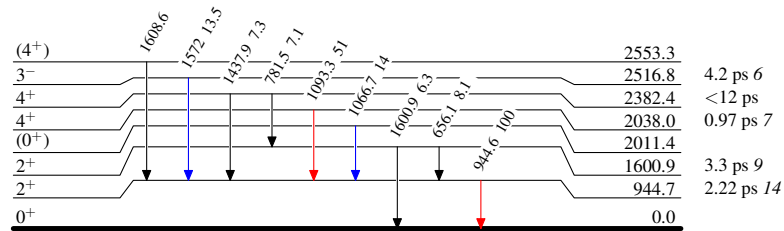
$^{40}\text{Ca}(^{36}\text{Ar},\alpha 2p\gamma), ^{58}\text{Ni}(^{14}\text{N},pn\gamma)$ 1986He17,1989My01,2008Lj01

Level Scheme (continued)

Legend

Intensities:

- \longrightarrow $I_\gamma < 2\% \times I_\gamma^{\max}$
- \longrightarrow $I_\gamma < 10\% \times I_\gamma^{\max}$
- \longrightarrow $I_\gamma > 10\% \times I_\gamma^{\max}$

 $^{70}_{34}\text{Se}_{36}$