

$^{79}\text{Br}(\alpha,2n\gamma), ^{68}\text{Zn}(^{16}\text{O},p2n\gamma)$ 1976Fr10

Type	Author	History	Citation	Literature Cutoff Date
Full Evaluation	M. Shamsuzzoha Basunia		NDS 199,271 (2025)	1-Sep-2024

Additional $(\alpha,2n\gamma)$ data are included with the [$^{68}\text{Zn}(^{19}\text{F},\alpha2n\gamma), ^{79}\text{Br}(\alpha,2n\gamma)$ E=27 MeV] data set.

$E\alpha=22.5$ MeV: 98.6% ^{79}Br target; measured $E\gamma$, $I\gamma$, $\gamma\gamma$ coin, $\gamma(\theta)$ at 7 angles between 53° and 148° ; Ge(Li) (resolution 2.3-2.5 keV for $E\gamma=1.33$ MeV), coin time resolution of 20 ns.

$E(^{16}\text{O})=52$ MeV: enriched ^{68}Zn target; measured $E\gamma$, $I\gamma$, $\gamma(\theta)$ at 6 angles between -30° and 105° .

Data quoted here are from $(\alpha,2n\gamma)$ reaction (except as noted); the $(^{16}\text{O},p2n\gamma)$ data are, in general, consistent but less precise (1976Fr10).

 ^{81}Rb Levels

$E(\text{level})^\dagger$	$J^\pi^\ddagger$	$E(\text{level})^\dagger$	$J^\pi^\ddagger$	$E(\text{level})^\dagger$	$J^\pi^\ddagger$	$E(\text{level})^\dagger$	$J^\pi^\ddagger$
0	$3/2^-^\#$	612.5	$7/2^-$	1174.6		2295.6?	
86.2	$9/2^+^\#$	630.7		1305?		2576.6 15	$(17/2^-)$
153.7	$5/2^-^\#$	709.1	$13/2^+$	1416.6	$(11/2^-)$	2608.1	$21/2^+$
245.4		828.1		1464.3		3295.6	$(21/2^-)$
301.7		913.6	$9/2^-$	1584.1	$17/2^+$	3765.1?	
434.1	$7/2^+, 11/2^+$	922.8?		1739.6	$(13/2^-)$		
462.7		987.3	$11/2^+$	1774.2	$(11/2^+, 15/2^+)$		
486.8		1035.2		1919.7	$(11/2^+, 15/2^+)$		

† From a least-squares fit to $E\gamma$ assuming $\Delta E=0.5$ keV for for all γ rays and omitting questionable placements, except for levels with all questionable γ .

‡ Authors' values. Based on $\gamma(\theta)$, $I\gamma$ and $(\text{HI},x\text{n}\gamma)$ branching systematics, assuming J^π from Adopted Levels for g.s., 86 level, 154 level.

$^\#$ From Adopted Levels.

 $\gamma(^{81}\text{Rb})$

$E_\gamma^\dagger$	$I_\gamma^\ddagger$	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. $^\#$	Comments
(86.3)		86.2	$9/2^+$	0	$3/2^-$		
148	9.0	301.7		153.7	$5/2^-$		$A_2=+0.02$ 4; $A_4=+0.02$ 4
154	100 10	153.7	$5/2^-$	0	$3/2^-$	D(+Q)	$A_2=-0.06$ 1; $A_4=-0.02$ 1
159	1.3	245.4		86.2	$9/2^+$		
217 @	12.2 @	462.7		245.4			
245 @	43 @	245.4		0	$3/2^-$		
278	19	987.3	$11/2^+$	709.1	$13/2^+$	D	$A_2=-0.24$ 3; $A_4=-0.03$ 3
301	16	913.6	$9/2^-$	612.5	$7/2^-$	D	$A_2=-0.26$ 3; $A_4=-0.09$ 4
323	2.6	1739.6	$(13/2^-)$	1416.6	$(11/2^-)$		
326	5.8	1035.2		709.1	$13/2^+$		$A_2=+0.26$ 11; $A_4=-0.06$ 13
329 ^a	<1	630.7		301.7			E_γ : seen only in coincidence spectra.
333	2.1	486.8		153.7	$5/2^-$		
336 ^a	1.1	1919.7	$(11/2^+, 15/2^+)$	1584.1	$17/2^+$		
348	34	434.1	$7/2^+, 11/2^+$	86.2	$9/2^+$	D	$A_2=-0.25$ 2; $A_4=-0.03$ 2
394	2.9	828.1		434.1	$7/2^+, 11/2^+$		
459	32	612.5	$7/2^-$	153.7	$5/2^-$		$A_2=+0.17$ 2; $A_4=-0.01$ 2
463	4.0	462.7		0	$3/2^-$		$A_2=+0.16$ 8; $A_4=-0.02$ 10
477 &	11.2 &	630.7		153.7	$5/2^-$		
477 &	11.2 &	1464.3		987.3	$11/2^+$		
487	8.1	486.8		0	$3/2^-$		

Continued on next page (footnotes at end of table)

$^{79}\text{Br}(\alpha,2n\gamma), ^{68}\text{Zn}(^{16}\text{O},p2n\gamma)$ **1976Fr10 (continued)** $\gamma(^{81}\text{Rb})$ (continued)

$E_\gamma^\dagger$	$I_\gamma^\ddagger$	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. [#]	Comments
489 ^a		922.8?		434.1	7/2 ⁺ , 11/2 ⁺		E_γ : shown only in drawing. Not adopted by the evaluator.
503	1.6	1416.6	(11/2 ⁻)	913.6	9/2 ⁻		
545 ^a		630.7		86.2	9/2 ⁺		E_γ : from level scheme only.
553 [@]	32 [@]	987.3	11/2 ⁺	434.1	7/2 ⁺ , 11/2 ⁺		
562 [@]	11 [@]	1174.6		612.5	7/2 ⁻		
582 ^a	<1	828.1		245.4			E_γ : seen only in coincidence spectra.
612	11	612.5	7/2 ⁻	0	3/2 ⁻	Q	$A_2=+0.38$ 3; $A_4=-0.02$ 3
623	116 12	709.1	13/2 ⁺	86.2	9/2 ⁺	Q	$A_2=+0.35$ 2; $A_4=-0.08$ 2
677 ^a		922.8?		245.4			E_γ : shown only in drawing. Not adopted by the evaluator.
688		1174.6		486.8			E_γ : shown only in drawing.
719	3.2	3295.6	(21/2 ⁻)	2576.6	(17/2 ⁻)	Q	$A_2=+0.26$ 10; $A_4=-0.21$ 14
760	32	913.6	9/2 ⁻	153.7	5/2 ⁻	Q	$A_2=+0.30$ 2; $A_4=-0.09$ 3
787	7.1	1774.2	(11/2 ⁺ , 15/2 ⁺)	987.3	11/2 ⁺	Q	$A_2=+0.22$ 4; $A_4=-0.07$ 5
804	16	1416.6	(11/2 ⁻)	612.5	7/2 ⁻	Q	$A_2=+0.24$ 5; $A_4=-0.19$ 7
826 [@]	30 [@]	1739.6	(13/2 ⁻)	913.6	9/2 ⁻	Q	$A_2=+0.14$ 2; $A_4=-0.05$ 2
837	4.0	2576.6	(17/2 ⁻)	1739.6	(13/2 ⁻)	Q	A_2 and A_4 from ($^{16}\text{O}, p2n\gamma$).
871 ^a	2.8	1305?		434.1	7/2 ⁺ , 11/2 ⁺		$A_2=+0.56$ 10; $A_4=-0.15$ 12
875	57 6	1584.1	17/2 ⁺	709.1	13/2 ⁺	Q	$A_2=+0.33$ 1; $A_4=-0.10$ 1
879 ^a	<3	2295.6?		1416.6	(11/2 ⁻)		
901	2.0	987.3	11/2 ⁺	86.2	9/2 ⁺	D+Q	$A_2=-0.57$ 3; $A_4=+0.38$ 21
932 [@]	8 [@]	1919.7	(11/2 ⁺ , 15/2 ⁺)	987.3	11/2 ⁺	Q	$A_2=+0.35$ 4; $A_4=-0.05$ 4
949	17	1035.2		86.2	9/2 ⁺		$A_2=-0.84$ 6; $A_4=+0.02$ 7
1024	16	2608.1	21/2 ⁺	1584.1	17/2 ⁺	Q	$I_\gamma, \text{Mult.}$: $\gamma\gamma$ indicates this is a doublet. From $\gamma(\theta)$, mult=D+Q for doublet.
1060 ^a		1305?		245.4			$A_2=+0.45$ 5; $A_4=-0.21$ 6
1065	18	1774.2	(11/2 ⁺ , 15/2 ⁺)	709.1	13/2 ⁺	D	E_γ : shown only in drawing.
1157 ^a	2.2	3765.1?		2608.1	21/2 ⁺		$A_2=-0.19$ 3; $A_4=+0.05$ 4
1211	13	1919.7	(11/2 ⁺ , 15/2 ⁺)	709.1	13/2 ⁺	D	$A_2=-0.25$ 5; $A_4=+0.08$ 6

[†] From 1976Fr10; uncertainties not stated by authors.

[‡] Relative photon intensity from ($\alpha, 2n\gamma$) at $E_\alpha=22.5$ MeV; based on $\gamma(\theta)$ when $\gamma(\theta)$ measured, based on $\theta=125^\circ$ datum otherwise. The authors report that uncertainties range from 10% for the strongest lines to 50% for very weak lines. The evaluator has chosen to assign 10% for the three strongest lines ($I_\gamma \approx 50$ -120) only. The authors do not enumerate I_γ data from the ($^{16}\text{O}, p2n\gamma$) reaction.

[#] From $\gamma(\theta)$. From reaction systematics, authors further conclude that all transitions for which mult is indicated here take place between levels of the same parity.

[@] Impurity line superimposed on this γ ; E_γ , I_γ are for doublet.

& Multiply placed with undivided intensity.

^a Placement of transition in the level scheme is uncertain.

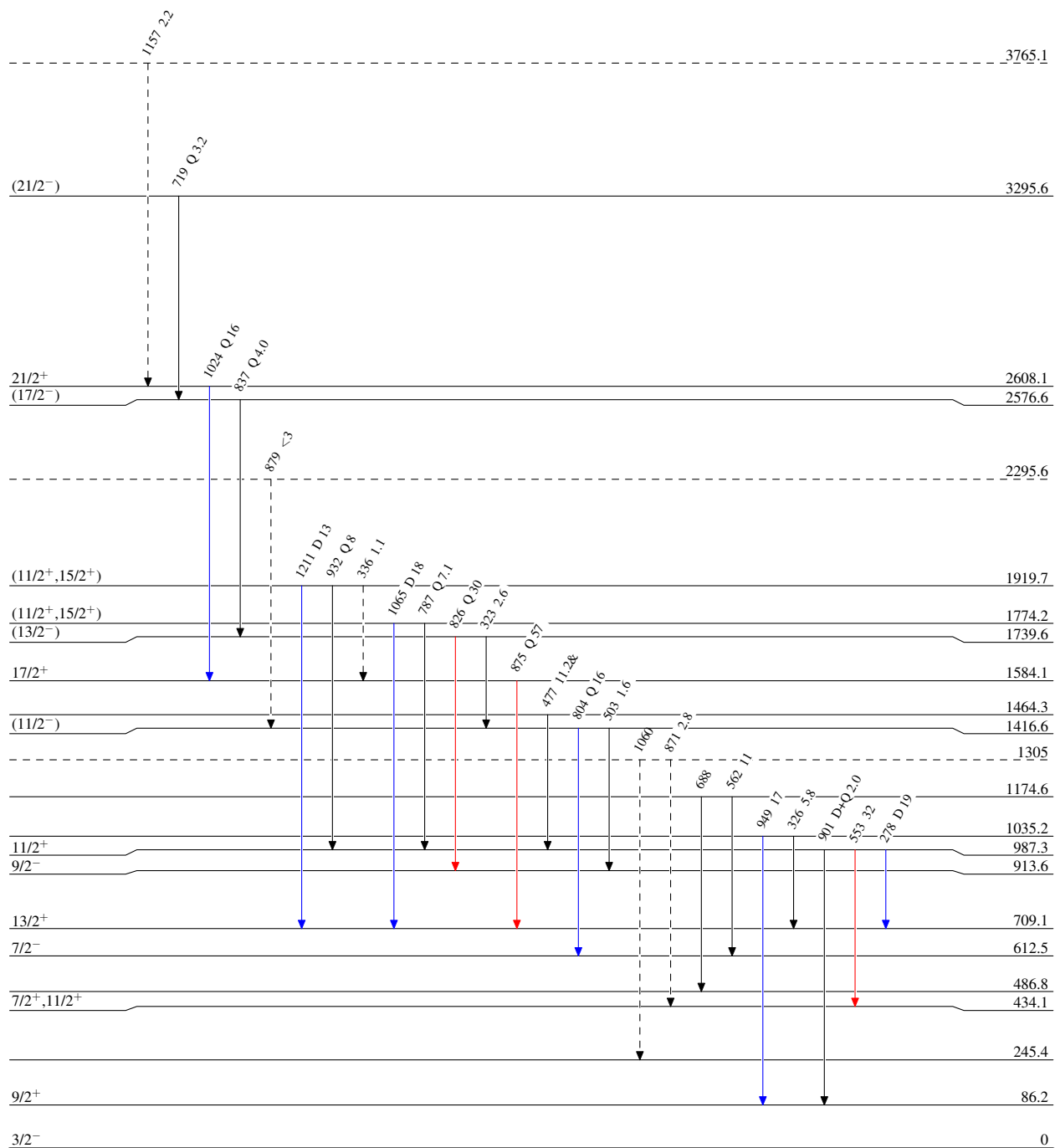
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Level Scheme

Intensities: relative I_γ from $^{79}\text{Br}(\alpha, 2n\gamma)$, $E=22.5$ MeV
& Multiply placed: undivided intensity given

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)



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Level Scheme (continued)

Intensities: relative I_γ from $^{79}\text{Br}(\alpha,2n\gamma)$, $E=22.5$ MeV
& Multiply placed: undivided intensity given

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)

