

$^{82}\text{Se}(\alpha, 5n\gamma)$ 2022Mu09

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

Adapted/Edited the XUNDL dataset compiled by C. Ngwetsheni (Univ. Western Cape), M. Lazaric (Univ. New Mexico), and B. Singh (McMaster), Dec 17, 2022.

2022Mu09: $E(\alpha)=65, 68$ MeV. Measured $E\gamma$, $I\gamma$, $\gamma\gamma$ -coin, $\gamma\gamma(\theta)(\text{ADO})$, $\gamma\gamma(\text{linear polarization})$ using AFRODITE array with eight Compton-suppressed clover Ge detectors at the iThemba Labs. Deduced high-spin levels, J^π , B(M1)/B(E2), bands, quasiparticle alignments, configurations, chiral doublet bands, and pseudospin-chiral triplet bands. Comparison with constrained covariant density functional theory, and multiparticle plus rotor model calculations.

[Additional information 1.](#)

 ^{81}Kr Levels

Band assignments are listed with $\alpha=+1/2$ and $\alpha=-1/2$ signature partners.

E(level) [†]	J^π [‡]	E(level) [†]	J^π [‡]	E(level) [†]	J^π [‡]	E(level) [†]	J^π [‡]
0.0 [@]	7/2 ⁺	2133.6 [#]	17/2 ⁺	3487.1 ^c	21/2 ⁻	4959.9 ^g	25/2 ⁻
49.0 [#]	9/2 ⁺	2164.2 ^a	13/2 ⁻	3554.6 ^b	21/2 ⁺	5042.4 ^j	27/2 ⁺
191.3 ^{&}	1/2 ⁻	2418.6 ^c	13/2 ⁻	3620.5 ⁱ	21/2 ⁺	5406.4 ^d	27/2 ⁻
456.4 ^a	5/2 ⁻	2531.4 ^d	15/2 ⁻	3646.4 ^g	21/2 ⁻	5576.8 ^l	27/2 ⁺
700.1 ^{&}	5/2 ⁻	2554.6 ^h	(15/2 ⁻)	3852.8 ^f	21/2 ⁻	5754.1 ⁱ	29/2 ⁺
872.6 [@]	11/2 ⁺	2692.2 ^b	17/2 ⁺	3953.3 ^j	23/2 ⁺	6053.5 ^m	(29/2 ⁺)
901.7 ^a	7/2 ⁻	2697.2 ^c	17/2 ⁻	4095.3 ^d	23/2 ⁻	6147.6 ^c	(29/2 ⁻)
933.3 ^b	11/2 ⁺	2782.4 ^e	15/2 ⁻	4199.2 ^h	(23/2 ⁻)	6312.4 ^k	29/2 ⁺
975.0 [#]	13/2 ⁺	2825.6 ^g	17/2 ⁻	4296.1 ^e	23/2 ⁻	6525.0 ^j	31/2 ⁺
1348.0 ^a	9/2 ⁻	3058.6 ^d	19/2 ⁻	4467.8 ⁱ	25/2 ⁺	7042.1 ^l	(31/2 ⁺)
1441.9 ^{&}	9/2 ⁻	3090.1 ^f	17/2 ⁻	4510.7 [@]	(23/2 ⁺)	7321.7 ⁱ	(33/2 ⁺)
1605.8 ^b	13/2 ⁺	3169.9 ^h	(19/2 ⁻)	4709.3 ^c	25/2 ⁻	7532.5 ^m	(33/2 ⁺)
1827.5 ^a	11/2 ⁻	3192.7 [@]	19/2 ⁺	4735.0 ^m	25/2 ⁺	9048.1 ⁱ	(37/2 ⁺)
1840.2	13/2 ⁺	3389.5 [#]	21/2 ⁺	4838.1 ^f	(25/2 ⁻)		
1991.4 [@]	15/2 ⁺	3453.5 ^e	19/2 ⁻	4903.1 ^k	25/2 ⁺		

[†] From a least-squares fit to $E\gamma$ data, assuming 0.5 keV uncertainty for each $E\gamma$ value, however level uncertainties are not listed as of the evaluation guidelines.

[‡] As given by 2022Mu09, based on previous assignments for low-lying levels, and from multipolarity, ΔJ , and band assignments for high-spin and high-lying levels in the present work.

[#] Band(A): Band #1, $\nu g_{9/2}^{-1}$, $\alpha=+1/2$.

[@] Band(a): Band #1, $\nu g_{9/2}^{-1}$, $\alpha=-1/2$.

[&] Seq.(H): γ cascade based on 1/2⁻.

^a Seq.(I): γ cascade based on 5/2⁻.

^b Seq.(J): γ cascade based on 11/2⁺.

^c Band(B): Band #5, based on 13/2⁻, $\alpha=+1/2$. Configuration: $\pi(g_{9/2}p_{3/2})\otimes\nu g_{9/2}^{-1}$ (2022Mu09). Bands #5 and #6 interpreted by authors as chiral-doublet partners, and band #7 as pseudospin partner of band #5, thus forming a pseudospin-chiral triplet band structure.

^d Band(b): Band #5, based on 15/2⁻, $\alpha=-1/2$. See comment for $\alpha=+1/2$ signature partner.

^e Band(C): Band #6, based on 15/2⁻, $\alpha=-1/2$. Interpreted as chiral-doublet partner of band #5, with configuration: $\pi(g_{9/2}p_{3/2})\otimes\nu g_{9/2}^{-1}$ (2022Mu09). Bands #5, #6 and #7 form a pseudospin-chiral triplet band structure.

Continued on next page (footnotes at end of table)

$^{82}\text{Se}(\alpha, 5n\gamma)$ 2022Mu09 (continued) ^{81}Kr Levels (continued)

- ^f Band(c): Band #6, based on $17/2^-$, $\alpha=+1/2$. See comment for $\alpha=-1/2$ signature partner.
- ^g Band(D): Band #7, based on $17/2^-$, $\alpha=+1/2$. Interpreted as pseudospin partner of band #5, with configuration: $\pi(g_{9/2}f_{5/2})\otimes\nu g_{9/2}^{-1}$ (2022Mu09). Bands #5, #6 and #7 form a pseudospin-chiral triplet band structure.
- ^h Band(d): Band #7, based on $(15/2^-)$, $\alpha=-1/2$. See comment for $\alpha=+1/2$ signature partner.
- ⁱ Band(E): Band #2, based on $21/2^+$, $\alpha=+1/2$. Configuration: $\pi g_{9/2}^2\otimes\nu g_{9/2}^{-1}$ (2022Mu09), with bands #2 and #3 interpreted by authors as chiral-doublet partners.
- ^j Band(e): Band #2, based on $23/2^+$, $\alpha=-1/2$. See comment for $\alpha=+1/2$ signature partner.
- ^k Band(F): Band#3, based on $25/2^+$, $\alpha=+1/2$. Interpreted as chiral-doublet partner of band #2, with configuration: $\pi g_{9/2}^2\otimes\nu g_{9/2}^{-1}$ (2022Mu09).
- ^l Band(f): Band#3, based on $27/2^+$, $\alpha=-1/2$. See comment for $\alpha=+1/2$ signature partner.
- ^m Band(G): Band based on $25/2^+$, 4780.

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

R_{ADO} and Pol values from Fig. 3a and 3b, respectively in 2022Mu09. Authors mention that $R_{\text{ADO}}\approx 1.3$ expected for stretched quadrupole, and ≈ 0.8 for stretched dipole. Pol values are positive for electric and negative for magnetic transitions.

E_γ [†]	$E_i(\text{level})$	J_i^π	E_f	J_f^π
48.8	49.0	9/2 ⁺	0.0	7/2 ⁺
102.3	975.0	13/2 ⁺	872.6	11/2 ⁺
112.7	2531.4	15/2 ⁻	2418.6	13/2 ⁻
127.8	2825.6	17/2 ⁻	2697.2	17/2 ⁻
136.5	2554.6	(15/2 ⁻)	2418.6	13/2 ⁻
142.0	2133.6	17/2 ⁺	1991.4	15/2 ⁺
165.6	2697.2	17/2 ⁻	2531.4	15/2 ⁻
191.5	191.3	1/2 ⁻	0.0	7/2 ⁺
196.8	3389.5	21/2 ⁺	3192.7	19/2 ⁺
206.4	3852.8	21/2 ⁻	3646.4	21/2 ⁻
230.6	3620.5	21/2 ⁺	3389.5	21/2 ⁺
233.0	3058.6	19/2 ⁻	2825.6	17/2 ⁻
242.0	4095.3	23/2 ⁻	3852.8	21/2 ⁻
243.5	700.1	5/2 ⁻	456.4	5/2 ⁻
264.4	3090.1	17/2 ⁻	2825.6	17/2 ⁻
266.8	4735.0	25/2 ⁺	4467.8	25/2 ⁺
271.1	2825.6	17/2 ⁻	2554.6	(15/2 ⁻)
283.5	3453.5	19/2 ⁻	3169.9	(19/2 ⁻)
294.0	2825.6	17/2 ⁻	2531.4	15/2 ⁻
307.7	3090.1	17/2 ⁻	2782.4	15/2 ⁻
332.5	3953.3	23/2 ⁺	3620.5	21/2 ⁺
336.8	2164.2	13/2 ⁻	1827.5	11/2 ⁻
344.0	3169.9	(19/2 ⁻)	2825.6	17/2 ⁻
361.5	3058.6	19/2 ⁻	2697.2	17/2 ⁻
363.3	3453.5	19/2 ⁻	3090.1	17/2 ⁻
366.9	2531.4	15/2 ⁻	2164.2	13/2 ⁻
399.0	3852.8	21/2 ⁻	3453.5	19/2 ⁻
412.7	4709.3	25/2 ⁻	4296.1	23/2 ⁻
427.5	3620.5	21/2 ⁺	3192.7	19/2 ⁺
428.5	3487.1	21/2 ⁻	3058.6	19/2 ⁻
443.1	4296.1	23/2 ⁻	3852.8	21/2 ⁻
445.2	901.7	7/2 ⁻	456.4	5/2 ⁻
446.1	1348.0	9/2 ⁻	901.7	7/2 ⁻
449.5	4095.3	23/2 ⁻	3646.4	21/2 ⁻
456.2	456.4	5/2 ⁻	0.0	7/2 ⁺

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$^{82}\text{Se}(\alpha, 5n\gamma)$ **2022Mu09** (continued) $\gamma(^{81}\text{Kr})$ (continued)

E_γ †	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult.	Comments
472.2	3169.9	(19/2 ⁻)	2697.2	17/2 ⁻		
476.5	3646.4	21/2 ⁻	3169.9	(19/2 ⁻)		
509.0	700.1	5/2 ⁻	191.3	1/2 ⁻		
514.2	4467.8	25/2 ⁺	3953.3	23/2 ⁺		
527.8	3058.6	19/2 ⁻	2531.4	15/2 ⁻		
533.0	2697.2	17/2 ⁻	2164.2	13/2 ⁻		
535.2	3090.1	17/2 ⁻	2554.6	(15/2 ⁻)		
542.0‡	4838.1	(25/2 ⁻)	4296.1	23/2 ⁻		
552.5	4199.2	(23/2 ⁻)	3646.4	21/2 ⁻		
558.2	3090.1	17/2 ⁻	2531.4	15/2 ⁻	M1	$R_{\text{ADO}}=1.09$ 12; Pol=-0.17 5.
558.5	2692.2	17/2 ⁺	2133.6	17/2 ⁺		
563.7	3953.3	23/2 ⁺	3389.5	21/2 ⁺		
564.0	2697.2	17/2 ⁻	2133.6	17/2 ⁺		
574.5	5042.4	27/2 ⁺	4467.8	25/2 ⁺		
588.0	3646.4	21/2 ⁻	3058.6	19/2 ⁻	M1+E2	$R_{\text{ADO}}=1.15$ 15; Pol=-0.09 7.
591.3	2418.6	13/2 ⁻	1827.5	11/2 ⁻		
608.0	4095.3	23/2 ⁻	3487.1	21/2 ⁻		
614.5	4709.3	25/2 ⁻	4095.3	23/2 ⁻		
616.0‡	3169.9	(19/2 ⁻)	2554.6	(15/2 ⁻)		
627.5	3453.5	19/2 ⁻	2825.6	17/2 ⁻		
630.0	1605.8	13/2 ⁺	975.0	13/2 ⁺		
661.3	2825.6	17/2 ⁻	2164.2	13/2 ⁻		
670.5	3453.5	19/2 ⁻	2782.4	15/2 ⁻		
673.1	1605.8	13/2 ⁺	933.3	11/2 ⁺		
673.5	5576.8	27/2 ⁺	4903.1	25/2 ⁺		
697.3	5406.4	27/2 ⁻	4709.3	25/2 ⁻		
704.0	2531.4	15/2 ⁻	1827.5	11/2 ⁻		
705.5	2697.2	17/2 ⁻	1991.4	15/2 ⁺		
711.4	5754.1	29/2 ⁺	5042.4	27/2 ⁺		
722.5	2164.2	13/2 ⁻	1441.9	9/2 ⁻		
730.0	7042.1	(31/2 ⁺)	6312.4	29/2 ⁺		
733.0	1605.8	13/2 ⁺	872.6	11/2 ⁺		
735.6	6312.4	29/2 ⁺	5576.8	27/2 ⁺		
741.8	1441.9	9/2 ⁻	700.1	5/2 ⁻		
756.7	3453.5	19/2 ⁻	2697.2	17/2 ⁻		
761.0	3953.3	23/2 ⁺	3192.7	19/2 ⁺		
762.0	3852.8	21/2 ⁻	3090.1	17/2 ⁻		
771.0	6525.0	31/2 ⁺	5754.1	29/2 ⁺		
781.8	4735.0	25/2 ⁺	3953.3	23/2 ⁺	(M1+E2)	$R_{\text{ADO}}=1.12$ 14; Pol=-0.06 5.
790.0	3487.1	21/2 ⁻	2697.2	17/2 ⁻		
794.0	3852.8	21/2 ⁻	3058.6	19/2 ⁻		
797.0	7321.7	(33/2 ⁺)	6525.0	31/2 ⁺		
809.3	4296.1	23/2 ⁻	3487.1	21/2 ⁻	(M1+E2)	$R_{\text{ADO}}=1.15$ 11; Pol=-0.03 2.
816.0	2164.2	13/2 ⁻	1348.0	9/2 ⁻		
821.1	3646.4	21/2 ⁻	2825.6	17/2 ⁻		
823.3	872.6	11/2 ⁺	49.0	9/2 ⁺		
834.3	2825.6	17/2 ⁻	1991.4	15/2 ⁺	E1	$R_{\text{ADO}}=0.80$ 10; Pol=+0.11 4.
841.7	5576.8	27/2 ⁺	4735.0	25/2 ⁺		
842.0	4296.1	23/2 ⁻	3453.5	19/2 ⁻		
847.1	4467.8	25/2 ⁺	3620.5	21/2 ⁺		
852.1	2692.2	17/2 ⁺	1840.2	13/2 ⁺		
853.0	901.7	7/2 ⁻	49.0	9/2 ⁺		
862.6	3554.6	21/2 ⁺	2692.2	17/2 ⁺		
864.5	4959.9	25/2 ⁻	4095.3	23/2 ⁻		
865.5	1840.2	13/2 ⁺	975.0	13/2 ⁺		

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$^{82}\text{Se}(\alpha, 5n\gamma)$ **2022Mu09** (continued) $\gamma(^{81}\text{Kr})$ (continued)

$E_\gamma^\dagger$	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult.	Comments
872.7	872.6	11/2 ⁺	0.0	7/2 ⁺		
884.4	933.3	11/2 ⁺	49.0	9/2 ⁺		
890.0	4510.7	(23/2 ⁺)	3620.5	21/2 ⁺		
891.6	1348.0	9/2 ⁻	456.4	5/2 ⁻		
901.5	901.7	7/2 ⁻	0.0	7/2 ⁺		
906.7	1840.2	13/2 ⁺	933.3	11/2 ⁺		
925.8	975.0	13/2 ⁺	49.0	9/2 ⁺		
925.9	1827.5	11/2 ⁻	901.7	7/2 ⁻		
926.0	2531.4	15/2 ⁻	1605.8	13/2 ⁺		
933.6	933.3	11/2 ⁺	0.0	7/2 ⁺		
942.0	2782.4	15/2 ⁻	1840.2	13/2 ⁺		
949.5	3646.4	21/2 ⁻	2697.2	17/2 ⁻	E2	$R_{\text{ADO}}=1.39$ 15; Pol=+0.08 4.
950.0	4903.1	25/2 ⁺	3953.3	23/2 ⁺	M1+E2	$R_{\text{ADO}}=1.03$ 14; Pol=-0.11 8.
954.6	2782.4	15/2 ⁻	1827.5	11/2 ⁻		
976.7	2418.6	13/2 ⁻	1441.9	9/2 ⁻		
985.5	1441.9	9/2 ⁻	456.4	5/2 ⁻		
1011.0	6053.5	(29/2 ⁺)	5042.4	27/2 ⁺		
1016.3	1991.4	15/2 ⁺	975.0	13/2 ⁺		
1029.1	4199.2	(23/2 ⁻)	3169.9	(19/2 ⁻)		
1037.0	4095.3	23/2 ⁻	3058.6	19/2 ⁻		
1058.8	3192.7	19/2 ⁺	2133.6	17/2 ⁺		
1078.4	4467.8	25/2 ⁺	3389.5	21/2 ⁺		
1086.2	2692.2	17/2 ⁺	1605.8	13/2 ⁺		
1089.1	5042.4	27/2 ⁺	3953.3	23/2 ⁺		
1108.9	5576.8	27/2 ⁺	4467.8	25/2 ⁺		
1114.5	4735.0	25/2 ⁺	3620.5	21/2 ⁺		
1118.8	1991.4	15/2 ⁺	872.6	11/2 ⁺		
1121.3	4510.7	(23/2 ⁺)	3389.5	21/2 ⁺		
1140.9	4199.2	(23/2 ⁻)	3058.6	19/2 ⁻		
1156.0	3852.8	21/2 ⁻	2697.2	17/2 ⁻	E2	$R_{\text{ADO}}=1.36$ 16; Pol=+0.08 6.
1158.5	2133.6	17/2 ⁺	975.0	13/2 ⁺		
1175.8	2782.4	15/2 ⁻	1605.8	13/2 ⁺		
1188.8	2164.2	13/2 ⁻	975.0	13/2 ⁺		
1201.8	3192.7	19/2 ⁺	1991.4	15/2 ⁺		
1222.3	4709.3	25/2 ⁻	3487.1	21/2 ⁻		
1230.8	2164.2	13/2 ⁻	933.3	11/2 ⁺		
1237.5	4296.1	23/2 ⁻	3058.6	19/2 ⁻	E2	$R_{\text{ADO}}=1.36$ 16; Pol=+0.10 7.
1255.8	3389.5	21/2 ⁺	2133.6	17/2 ⁺		
1270.0	6312.4	29/2 ⁺	5042.4	27/2 ⁺		
1286.3	5754.1	29/2 ⁺	4467.8	25/2 ⁺		
1291.8	2164.2	13/2 ⁻	872.6	11/2 ⁺		
1299.0	1348.0	9/2 ⁻	49.0	9/2 ⁺		
1311.0	5406.4	27/2 ⁻	4095.3	23/2 ⁻		
1313.7	4959.9	25/2 ⁻	3646.4	21/2 ⁻		
1318.1	4510.7	(23/2 ⁺)	3192.7	19/2 ⁺		
1318.5	6053.5	(29/2 ⁺)	4735.0	25/2 ⁺		
1345.8	4735.0	25/2 ⁺	3389.5	21/2 ⁺	E2	$R_{\text{ADO}}=1.47$ 16; Pol=+0.07 4.
1348.1	1348.0	9/2 ⁻	0.0	7/2 ⁺		
1409.5	6312.4	29/2 ⁺	4903.1	25/2 ⁺		
1420.8	3554.6	21/2 ⁺	2133.6	17/2 ⁺		
1438.3	6147.6	(29/2 ⁻)	4709.3	25/2 ⁻		
1465.0	7042.1	(31/2 ⁺)	5576.8	27/2 ⁺		
1472.7	4959.9	25/2 ⁻	3487.1	21/2 ⁻		
1479.0	7532.5	(33/2 ⁺)	6053.5	(29/2 ⁺)		
1482.9	6525.0	31/2 ⁺	5042.4	27/2 ⁺		

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$^{82}\text{Se}(\alpha, 5n\gamma)$ **2022Mu09** (continued) $\gamma(^{81}\text{Kr})$ (continued)

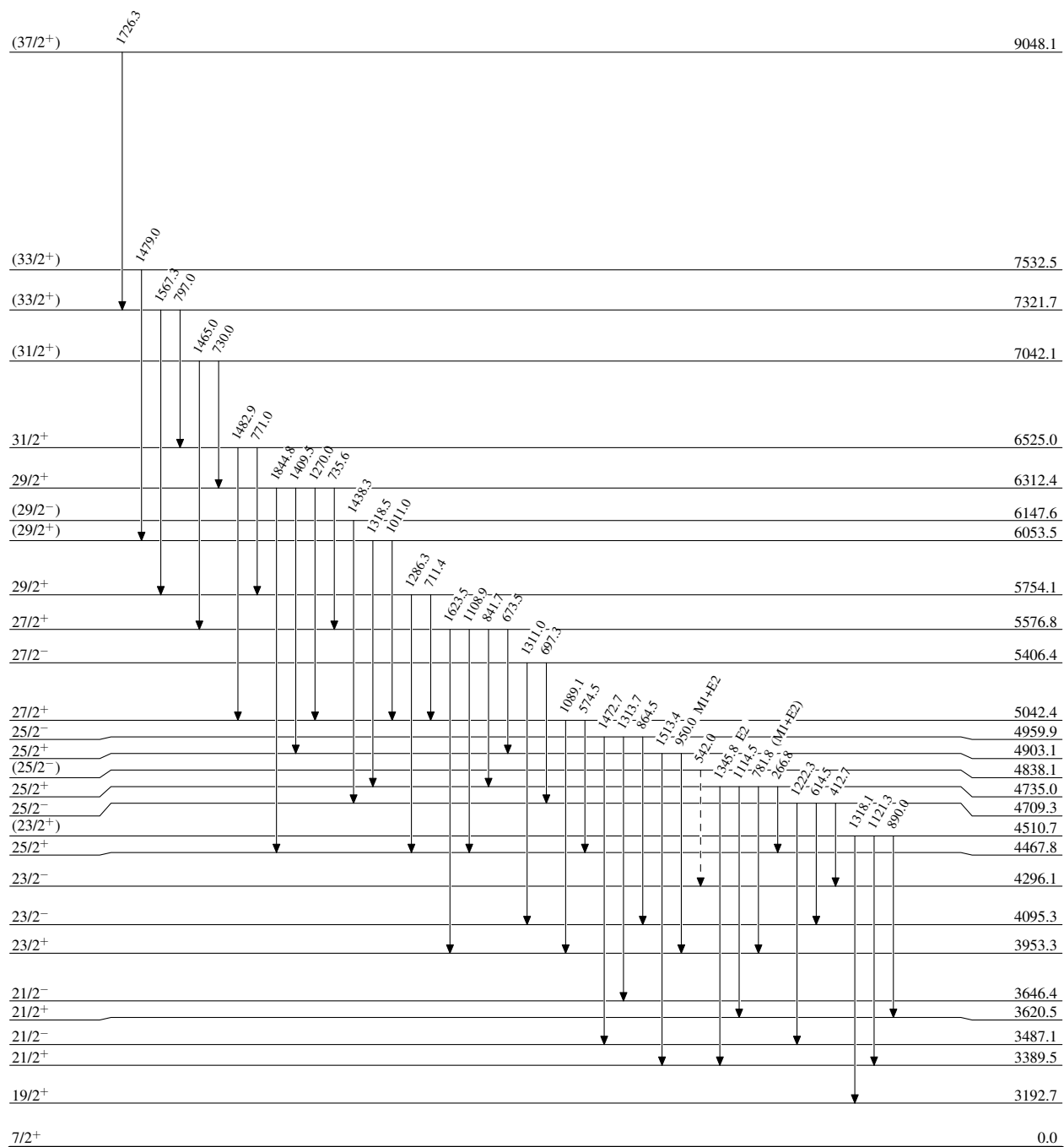
$E_\gamma^\dagger$	$E_i(\text{level})$	J_i^π	E_f	J_f^π	$E_\gamma^\dagger$	$E_i(\text{level})$	J_i^π	E_f	J_f^π
1486.8	3620.5	21/2 ⁺	2133.6	17/2 ⁺	1726.3	9048.1	(37/2 ⁺)	7321.7	(33/2 ⁺)
1513.4	4903.1	25/2 ⁺	3389.5	21/2 ⁺	1778.7	1827.5	11/2 ⁻	49.0	9/2 ⁺
1556.3	2531.4	15/2 ⁻	975.0	13/2 ⁺	1791.0	1840.2	13/2 ⁺	49.0	9/2 ⁺
1567.3	7321.7	(33/2 ⁺)	5754.1	29/2 ⁺	1808.0	2782.4	15/2 ⁻	975.0	13/2 ⁺
1623.5	5576.8	27/2 ⁺	3953.3	23/2 ⁺	1844.8	6312.4	29/2 ⁺	4467.8	25/2 ⁺
1717.4	2692.2	17/2 ⁺	975.0	13/2 ⁺					

[†] From **2022Mu09**.[‡] Placement of transition in the level scheme is uncertain.

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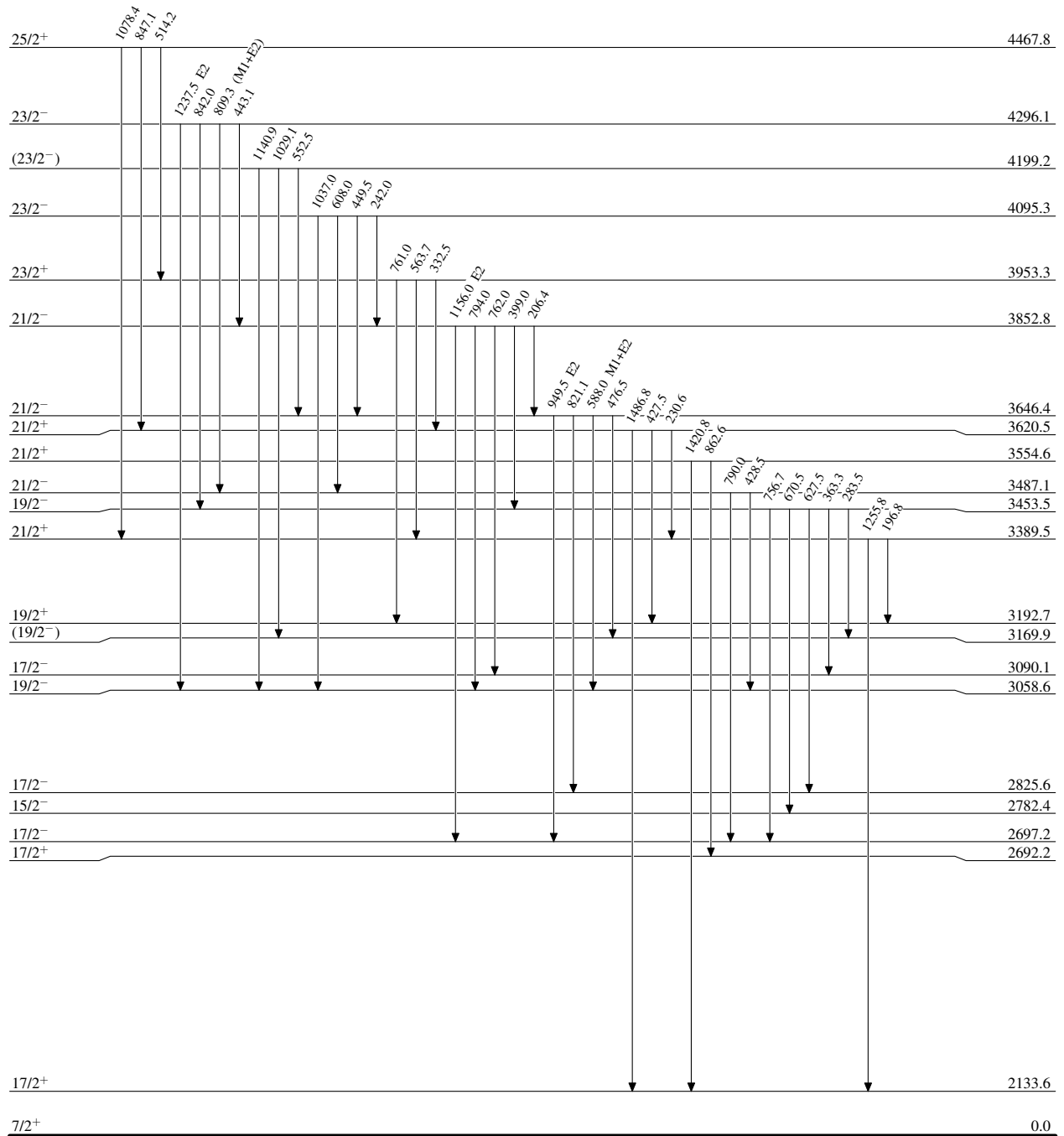
Legend

Level Scheme

-----► γ Decay (Uncertain)

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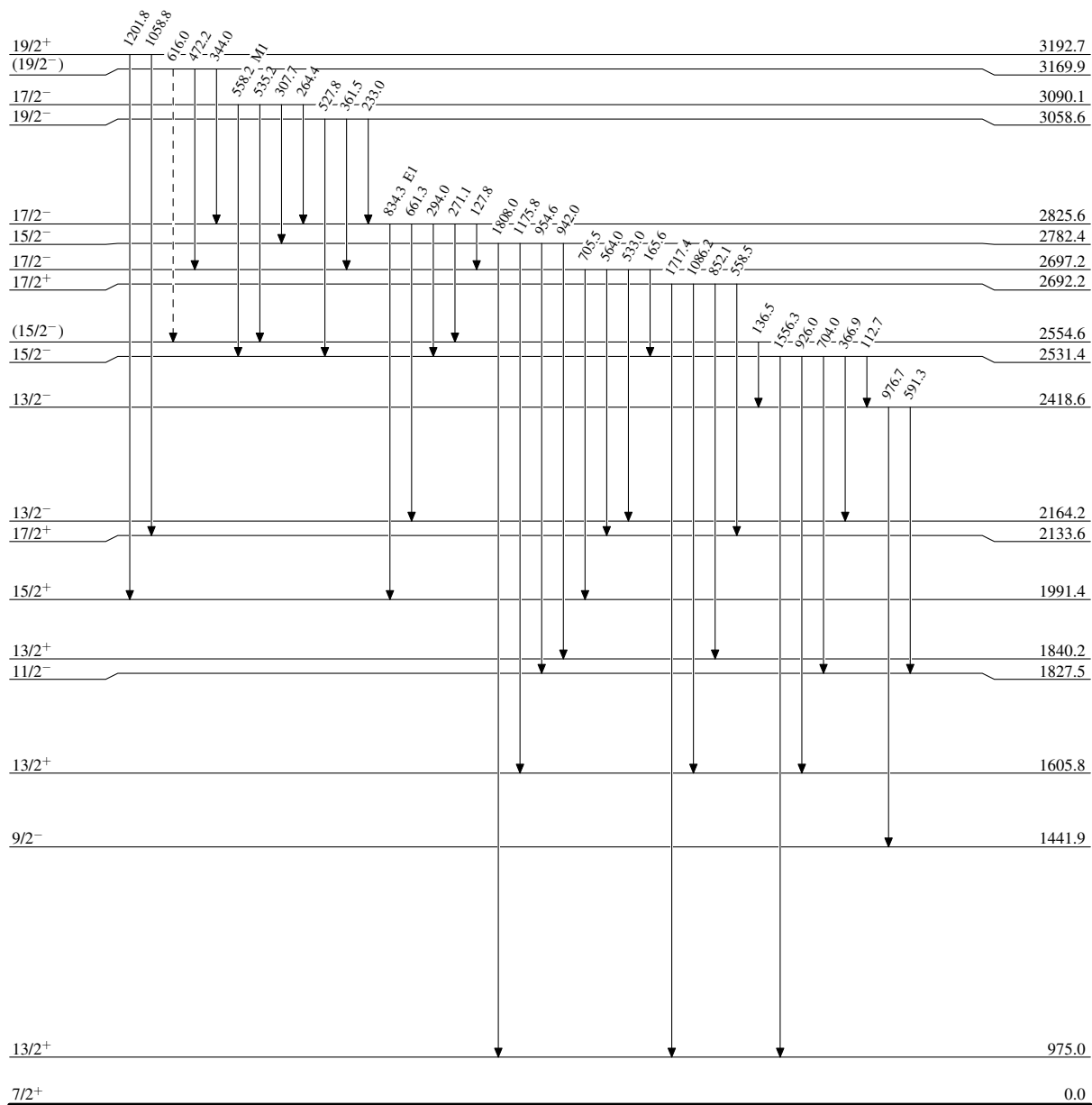
Level Scheme (continued)



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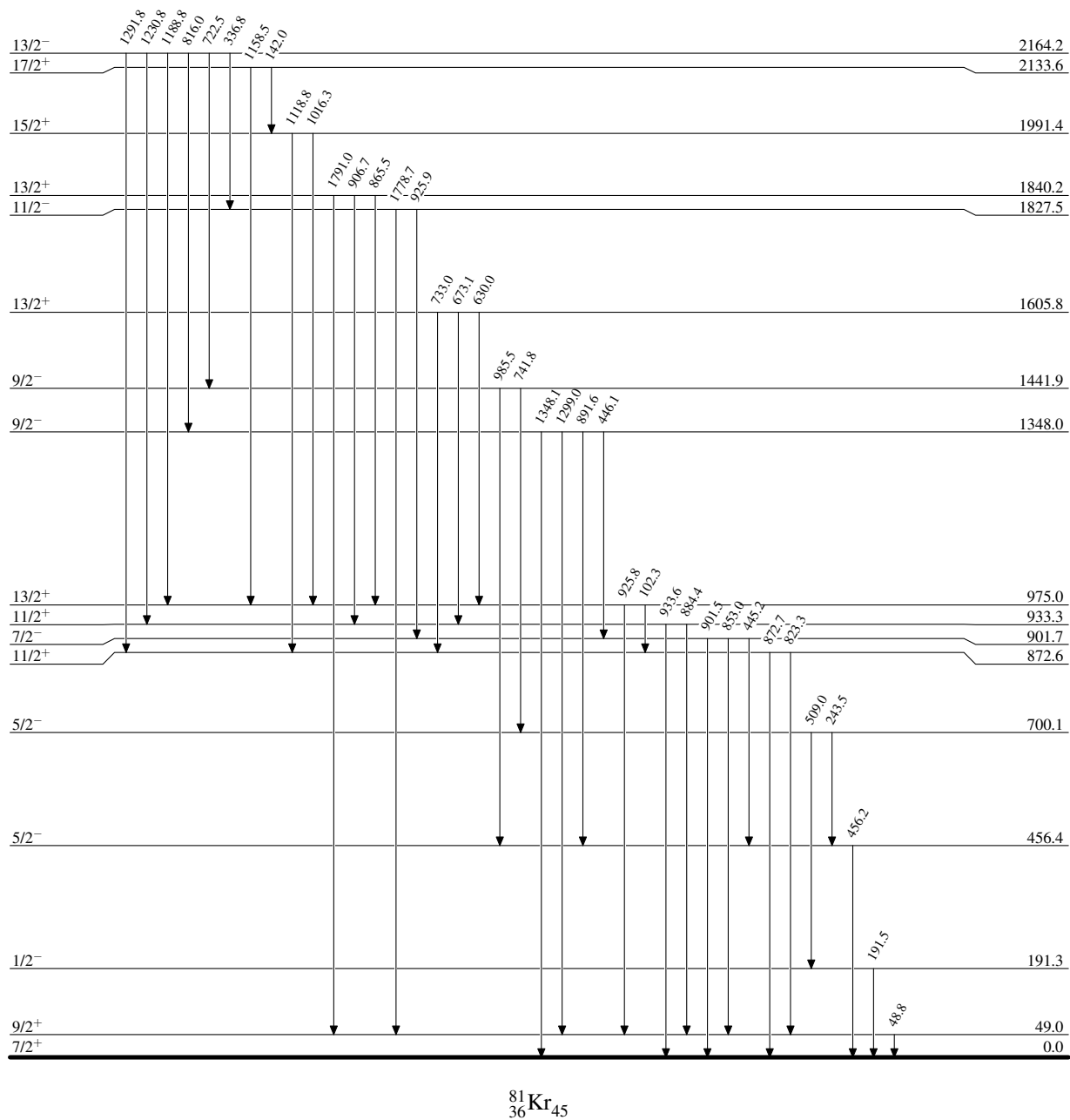
Legend

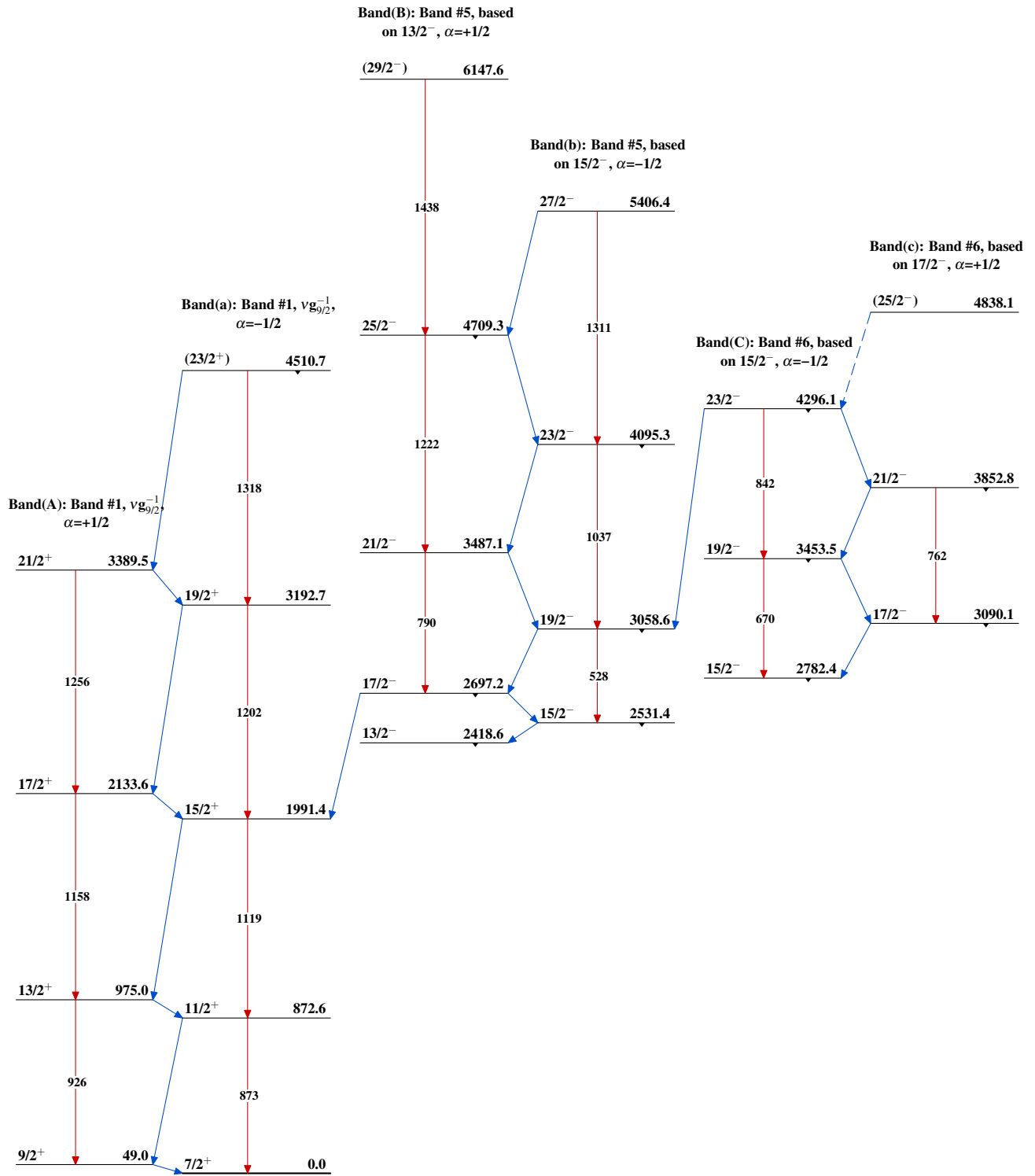
Level Scheme (continued)

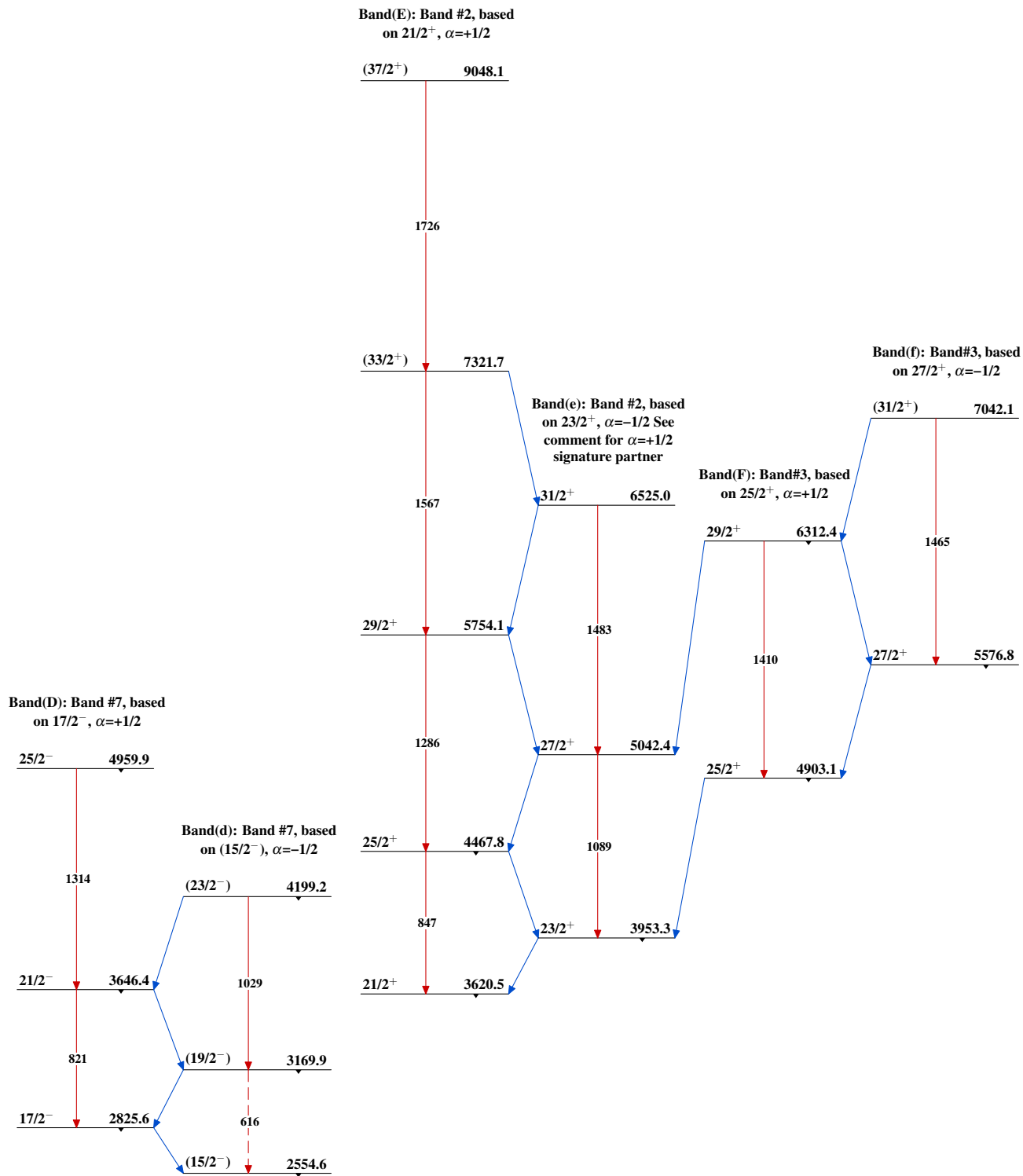
-----► γ Decay (Uncertain) $^{81}_{36}\text{Kr}_{45}$

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Level Scheme (continued)

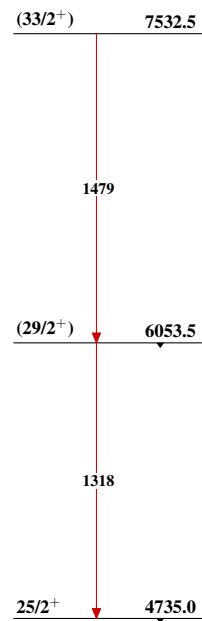


$^{82}\text{Se}(\alpha,5n\gamma)$ 2022Mu09

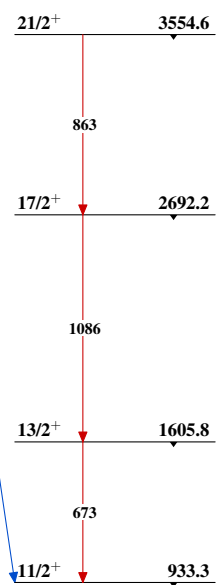
$^{82}\text{Se}(\alpha,5n\gamma)$ 2022Mu09 (continued) $^{81}_{36}\text{Kr}_{45}$

$^{82}\text{Se}(\alpha,5n\gamma)$ 2022Mu09 (continued)

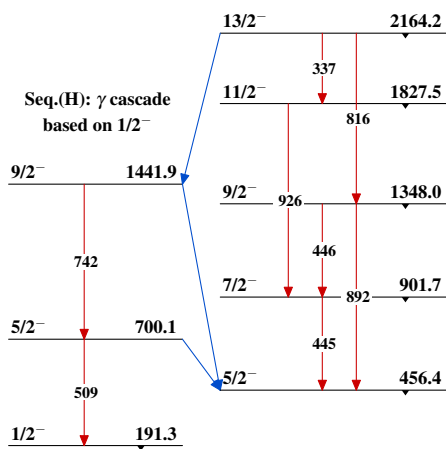
Band(G): Band based on
 $25/2^+$, 4780



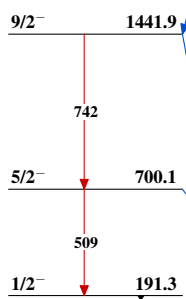
Seq.(J): γ cascade
based on $11/2^+$



Seq.(I): γ cascade based on $5/2^-$



Seq.(H): γ cascade
based on $1/2^-$



$^{81}_{36}\text{Kr}_{45}$