^{98}Mo(α,2nγ) 2000Ge01,1971Le19

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh and Jun Chen	NDS 172, 1 (2021)	31-Jan-2021

2000Ge01: E=21.0, 24.7, 28.7 MeV alpha beams were produced from the Philips variable-energy cyclotron at the Paul Scherrer Institute (PSI) in Villigen, Switzerland. Target was 97.6% enriched ^{98}Mo on a capton foil. γ rays were detected with Compton-suppressed HPGe detectors. Measured Eγ, Iγ, γ(θ) (25°−90°), γγ-coin, and excitation functions. Deduced levels, J, π, band structures, γ-ray multipolarities, mixing ratios. Comparisons with theoretical calculations. Main measurements carried out at E(α)=25 MeV.

1971Le19: E=30 MeV alpha beam was produced from the Berkeley 88-inch cyclotron. Target was ≈5-20 mg/cm^2 ^{98}Mo in the form of powdered oxide. γ rays were detected with Ge(Li) detectors. Measured Eγ, Iγ, γγ-coin, γ(t), γ(θ) (90°−157°). Deduced levels. Comparisons with theoretical calculations. A total of 47 γ rays reported from 91 to 1629 keV. Authors state that estimated energy precision is ≈0.1-0.2 keV for strong γ rays but standard uncertainty is suggested as 1 keV due to additional systematic uncertainties from external calibrations.

Others:

1993GoZU: (α,2nγ) E=24.35 MeV. Measured relative γ-ray intensities for 35 γ rays.

1965Ch26: (α,2n ce), conversion electron spectrum showing ten γ rays in ^{100}Ru and ^{101}Ru.

All data are from 2000Ge01, unless otherwise stated.

^{100}Ru Levels

E(level)[†]	J^π[‡]	E(level)[†]	J^π[‡]	E(level)[†]	J^π[‡]	E(level)[†]	J^π[‡]
0.0[a]	0^+	2527.22[c] *5*	5^-	3218.13 *7*	8^-	4235.85[&e] *6*	10^-
539.48[a] *4*	2^+	2536.25 *13*	3^+	3263.65 *5*	8^+	4235.89[&] *6*	10^+
1130.32 *6*	0^+	2543.61 *9*	2	3354.69[d] *5*	8^-	4248.53 *8*	9^-
1226.42[a] *5*	4^+	2569.93[e] *5*	3^-	3368.99[e] *6*	7^-	4315.74[d] *7*	11^-
1362.19[b] *4*	2^+	2576.85[b] *6*	5^+	3446.56[b] *7*	7^+	4343.43[b] *9*	9^+
1740.99 *11*	0^+	2591.85[d] *5*	4^-	3503.39[c] *5*	9^-	4353.37[b] *6*	10^+
1865.16 *5*	2^+	2660.86 *6*	5^+	3550.11[b] *6*	8^+	4381.82 *9*	9^+
1881.08[b] *5*	3^+	2705.54[b] *5*	6^+	3575.53[d] *5*	9^-	4408.70 *9*	10^-
2051.59 *23*	0^+	2747.48[e] *6*	4^-	3576.42 *8*	7^+	4503.48 *7*	10^+
2062.67[b] *5*	4^+	2764.96 *8*	4^-[#]	3599.27[e] *6*	8^-	4663.48[e] *8*	11^-
2075.68[a] *5*	6^+	2775.14[@d] *6*	5^-	3609.98 *9*	7^+	4791.59 *7*	10^+
2099.20 *17*	2^+	2785.19 *5*	6^+	3661.45 *14*	6^-	4798.18[d] *6*	12^-
2166.87[c] *5*	3^-	2877.70 *10*	3^+[#]	3851.5 *4*	5,6	4818.59 *8*	10^+
2240.79 *16*	2^+	2911.46[e] *7*	5^-	3929.63 *7*	(8^+)	4917.79 *9*	12^+
2351.30 *5*	4^+	2951.53[c] *5*	7^-	3960.41[e] *6*	9^-	5010.49 *8*	11^+
2366.61 *6*	4^+	2963.65[d] *5*	6^-	3992.16[d] *6*	10^-	5066.20[e] *8*	12^-
2414.20 *24*	(4^+)	2967.56 *5*	6^+	4075.94 *12*	8	5125.34[a] *15*	12^+
2469.35[e] *9*	2^-	3060.07[a] *5*	8^+	4083.31[a] *6*	10^+	5162.39[c] *7*	13^-
2493.07 *6*	4^-[#]	3110.49 *17*	4[#]	4097.40 *7*	9^-	5274.69[d] *12*	13^-
2512.49 *7*	4^+	3139.28[d] *5*	7^-	4230.65[c] *6*	11^-	5713.09 *11*	14^+

[†] From least-squares fit to Eγ data. With gamma-ray energy uncertainties as stated, the least-squares fit was poor with normalized χ^2=3.6 and about 15 transitions deviating by more than 3 σ. Increasing minimum uncertainty to 0.03 keV gave normalized χ^2=2.25, which was still quite high as compared to the critical χ^2=1.3. In order to get an acceptable fit, the minimum uncertainty for Eγ was adjusted to 0.05 keV which resulted in normalized χ^2=1.4.

[‡] As proposed by 2000Ge01 based on γ(θ) data and band assignments. These are consistent with those in the Adopted Levels, with the exception of parentheses on several of the assignments in the Adopted dataset due to lack of strong supporting arguments.

[#] Different assignment in the Adopted Levels: $(3^+,4^+,5^+)$ for 2493 level; $2^+,3^+$ for 2765 and 2878 levels; $(2^+,3^+)$ for 3110 level.

[@] There may be a doublet populated near this energy (see the Adopted Levels).

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^{98}Mo(α,2nγ) 2000Ge01,1971Le19 (continued)

^{100}Ru Levels (continued)

& Doublet at 4235.8 keV proposed by 2000Ge01 based on γγ coin data and multipolarities deduced from γ(θ) data.
[a] Band(A): g.s. band.
[b] Band(B): Quasi-γ band.
[c] Band(C): Octupole band.
[d] Band(D): 4⁻ Band.
[e] Band(E): 2⁻ Band.

γ(^{100}Ru)

793.2γ (Iγ=2.1 *8*) and 803.6γ (Iγ=2.7 *4*) reported by 1971Le19 are not seen by 2000Ge01. The closest weak γ rays in 2000Ge01 are: 795.29 (Iγ=0.39 *2*) and 803.26 (Iγ=0.32 *2*), respectively.

$E_γ$[†]	$I_γ$[#]	E_i(level)	$J_i^π$	E_f	$J_f^π$	Mult.[@]	δ[&]	Comments
91.7[‡b] *10*	0.10 *3*	3354.69	8⁻	3263.65	8⁺			$I_γ$: from Iγ(91.7γ)/Iγ(391γ)=0.13 *3*/5.4 *4* (1971Le19).
128.3 *3*	0.05 *1*	2705.54	6⁺	2576.85	5⁺			
129.94 *10*	0.04 *1*	3576.42	7⁺	3446.56	7⁺			
148.720 *14*	0.70 *3*	3503.39	9⁻	3354.69	8⁻	D+Q	+0.05 *1*	A_2=−0.158 *18*
152.56 *4*	0.13 *1*	4235.89	10⁺	4083.31	10⁺	(D(+Q))	+0.04 *9*	A_2=+0.47 *8* Mult.: M1(+E2) in 2000Ge01.
155.68 *4*	0.13 *1*	2747.48	4⁻	2591.85	4⁻	D		A_2=+0.43 *10*; A_4=−0.29 *15* Mult.: ΔJ=0 transition.
166.38 *15*	0.03 *1*	2951.53	7⁻	2785.19	6⁺			
175.55 *6*	0.13 *2*	3139.28	7⁻	2963.65	6⁻			
175.84 *6*	0.23 *2*	2527.22	5⁻	2351.30	4⁺			
178.05 *9*	0.07 *1*	4408.70	10⁻	4230.65	11⁻			
187.760 *13*	1.37 *5*	3139.28	7⁻	2951.53	7⁻	(D+Q)	+0.17 *10*	A_2=+0.5 *3*
188		2963.65	6⁻	2775.14	5⁻			$E_γ$: from figure 11, not shown in table 1 of 2000Ge01.
191.93 *3*	0.28 *1*	5010.49	11⁺	4818.59	10⁺			
203.590 *14*	1.24 *4*	3263.65	8⁺	3060.07	8⁺	(D(+Q))	+0.18 *20*	A_2=+0.51 *4* Mult.: M1(+E2) in 2000Ge01.
215.48 *3*	0.39 *2*	3354.69	8⁻	3139.28	7⁻			
218.87 *4*	0.27 *1*	5010.49	11⁺	4791.59	10⁺	D+Q	+0.078 *8*	A_2=−0.12 *4*
228.1 *5*	0.05 *3*	3139.28	7⁻	2911.46	5⁻			
229.69 *5*	0.16 *1*	3368.99	7⁻	3139.28	7⁻	(D(+Q))	+0.02 *15*	A_2=+0.43 *6* Mult.: M1(+E2) in 2000Ge01.
238.351 *16*	0.98 *2*	4230.65	11⁻	3992.16	10⁻	D+Q	+0.33 *3*	A_2=+0.33 *3*; A_4=−0.15 *5* Sign of A_4 is inconsistent with ΔJ=1 transition.
239.74 *5*	0.17 *1*	3503.39	9⁻	3263.65	8⁺			
244.41 *13*	0.07 *1*	3599.27	8⁻	3354.69	8⁻	(D(+Q))	+0.2 *3*	A_2=+0.76 *16* Mult.: M1(+E2) in 2000Ge01.
245.97 *8*	0.13 *1*	2951.53	7⁻	2705.54	6⁺			
247.943 *17*	1.16 *2*	2775.14	5⁻	2527.22	5⁻	(M1+E2)	+0.6 *2*	A_2=+0.48 *3*; A_4=−0.06 *4* Mult.: ΔJ=0 transition.
254.486 *19*	0.83 *2*	3218.13	8⁻	2963.65	6⁻	Q		A_2=+0.385 *21*; A_4=−0.16 *3*
262.08 *3*	0.30 *1*	2967.56	6⁺	2705.54	6⁺	(D(+Q))	+0.17 *22*	A_2=+0.44 *7* Mult.: M1(+E2) in 2000Ge01.
270.08 *8*	0.09 *1*	4353.37	10⁺	4083.31	10⁺			
288.08 *11*	0.07 *1*	4791.59	10⁺	4503.48	10⁺			
294.61 *3*	0.37 *1*	3354.69	8⁻	3060.07	8⁺	D(+Q)	+0.08 *20*	A_2=+0.48 *4*; A_4=−0.07 *5* Mult.: ΔJ=0 transition.
301.63 *3*	0.35 *3*	2166.87	3⁻	1865.16	2⁺	D(+Q)	+0.03 *6*	A_2=−0.08 *3*; A_4=−0.09 *5* Sign of A_4 is inconsistent with ΔJ=1 transition.

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^{98}Mo(α,2nγ) 2000Ge01,1971Le19 (continued)

γ(^{100}Ru) (continued)

E_γ[†]	I_γ[#]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[@]	δ[&]	Comments
309.52 *9*	0.09 *1*	2660.86	5$^+$	2351.30	4$^+$			
312.62 *15*	0.11 *2*	3576.42	7$^+$	3263.65	8$^+$			
354.09 *4*	0.23 *1*	3139.28	7$^-$	2785.19	6$^+$	D(+Q)	+0.04 *6*	A_2=−0.19 *5*; A_4=−0.15 *8* Sign of A_4 is inconsistent with ΔJ=1 transition.
360.331 *23*	0.60 *1*	2527.22	5$^-$	2166.87	3$^-$	Q		A_2=+0.43 *3*; A_4=−0.20 *5*
364.055 *15*	1.57 *2*	3503.39	9$^-$	3139.28	7$^-$	Q		A_2=+0.438 *17*; A_4=−0.07 *3* A_2=+0.45 *10*; A_4=0.00 *15* (1971Le19)
371.774 *19*	1.18 *2*	2963.65	6$^-$	2591.85	4$^-$	Q		A_2=+0.410 *17*; A_4=−0.098 *25*
378.81 *11*	0.13 *1*	1740.99	0$^+$	1362.19	2$^+$			
381.21 *18*	0.08 *1*	3599.27	8$^-$	3218.13	8$^-$			
384.22 *3*	0.48 *2*	2911.46	5$^-$	2527.22	5$^-$	D+Q		A_2=+0.29 *3*; A_4=−0.21 *5* Mult.: ΔJ=0 transition.
390.981 *14*	4.19 *4*	3354.69	8$^-$	2963.65	6$^-$	Q		A_2=+0.413 *14*; A_4=−0.099 *21* A_2=+0.50 *6*; A_4=+0.12 *9* (1971Le19)
403.092[a] *15*	1.48[a] *3*	2569.93	3$^-$	2166.87	3$^-$	D+Q	+1.58 *7*	A_2=+0.713 *14*; A_4=+0.177 *20* A_2=+0.69 *20*; A_4=+0.24 *26* (1971Le19) I_γ: from the Adopted Gammas, it is estimated that most of the intensity of this γ is from 2570 level, only a minor component is from 3355 level.
403.092[a] *15*	1.48[a] *3*	3354.69	8$^-$	2951.53	7$^-$			
405.5 *5*	0.05 *3*	3368.99	7$^-$	2963.65	6$^-$			
416.8 *3*	0.05 *3*	3992.16	10$^-$	3575.53	9$^-$			
417.407 *20*	1.09 *2*	3368.99	7$^-$	2951.53	7$^-$	(M1+E2)	−0.21 *7*	A_2=+0.31 *4*
419.92 *16*	0.11 *2*	4503.48	10$^+$	4083.31	10$^+$			
[x]421.36 *10*	0.22 *2*							
424.318 *14*	2.1 *3*	2951.53	7$^-$	2527.22	5$^-$	(Q)		A_2=+0.32 *4*; A_4=−0.07 *8* A_2=+0.35 *10*; A_4=+0.07 *15* (1971Le19)
424.83 *21*	0.95 *22*	2591.85	4$^-$	2166.87	3$^-$	(D+Q)	+1.2 *3*	A_2=+0.92 *22*
430.34 *4*	0.45 *3*	2493.07	4$^-$	2062.67	4$^+$			
433.00 *15*	0.10 *2*	4663.48	11$^-$	4230.65	11$^-$			
436.352[a] *18*	1.62[a] *3*	2963.65	6$^-$	2527.22	5$^-$	D+Q	+0.69 *25*	A_2=+0.641 *20*; A_4=+0.12 *3* γ(θ) for doublet.
436.352[a] *18*	1.62[a] *3*	3575.53	9$^-$	3139.28	7$^-$			
438.4 *3*	0.08 *2*	4791.59	10$^+$	4353.37	10$^+$			
443.317 *16*	2.15 *3*	3503.39	9$^-$	3060.07	8$^+$	D(+Q)	+0.06 *6*	A_2=−0.156 *15* A_2=−0.34 *15*; A_4=+0.05 *23* (1971Le19)
460.01 *7*	0.23 *2*	3599.27	8$^-$	3139.28	7$^-$	D+Q	−2.8 *2*	A_2=−0.83 *7*; A_4=+0.31 *11*
464.9[‡b] *10*	1.5 *8*	2527.22	5$^-$	2062.67	4$^+$			I_γ: from Iγ(465γ)/Iγ(1301γ)=1.4 *7*/10.6 *9* (1971Le19).
465.33 *15*	0.08 *1*	4818.59	10$^+$	4353.37	10$^+$			
477.1 *5*	0.05 *3*	4075.94	8	3599.27	8$^-$			
478.467 *22*	0.82 *2*	3263.65	8$^+$	2785.19	6$^+$	Q		A_2=+0.42 *2*; A_4=−0.19 *4*
488.671 *20*	1.52 *2*	3992.16	10$^-$	3503.39	9$^-$	D+Q	+0.37 *2*	A_2=+0.343 *17*; A_4=+0.03 *3* A_2=+0.29 *15*; A_4=+0.26 *20* (1971Le19)
490.05 *4*	0.57 *2*	3550.11	8$^+$	3060.07	8$^+$	(Q)		A_2=+0.72 *3*
502.7 *3*	0.10 *4*	1865.16	2$^+$	1362.19	2$^+$			
515.47 *5*	0.63 *6*	3575.53	9$^-$	3060.07	8$^+$	D(+Q)	+0.09 *12*	A_2=−0.08 *3*
518.88 *6*	0.56 *5*	1881.08	3$^+$	1362.19	2$^+$	(D+Q)	+0.38 *6*	A_2=+0.22 *5*
521.86 *5*	0.66 *4*	4097.40	9$^-$	3575.53	9$^-$	(M1+E2)	−0.25 *7*	A_2=+0.32 *3*
539.509 *14*	100.0 *8*	539.48	2$^+$	0.0	0$^+$	Q		A_2=+0.340 *5*; A_4=−0.122 *7* A_2=+0.32 *2*; A_4=−0.07 *3* (1971Le19)
544.91 *14*	0.54 *10*	2911.46	5$^-$	2366.61	4$^+$			
551.881 *14*	2.83 *3*	3503.39	9$^-$	2951.53	7$^-$	Q		A_2=+0.414 *21*; A_4=−0.08 *3* A_2=+0.61 *13*; A_4=−0.04 *18* (1971Le19)

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^{98}Mo(α,2nγ) 2000Ge01,1971Le19 (continued)

γ(^{100}Ru) (continued)

E_γ [†]	I_γ [#]	E_i(level)	J^π_i	E_f	J^π_f	Mult. [@]	δ [&]	Comments
555.69 *6*	0.26 *1*	4791.59	10+	4235.89	10+			
557.98 *3*	0.54 *1*	3263.65	8+	2705.54	6+	Q		A_2=+0.31 *3*; A_4=−0.16 *5*
564.51 *15*	0.19 *3*	4917.79	12+	4353.37	10+			
565.7 *7*	0.05 *4*	4663.48	11−	4097.40	9−			
567.46 *9*	0.20 *2*	4798.18	12−	4230.65	11−			
572.41 *13*	0.10 *1*	4075.94	8	3503.39	9−	D(+Q)	+0.05 *7*	A_2=−0.27 *11*
580.52 *12*	0.11 *1*	2747.48	4−	2166.87	3−	(M1+E2)	+0.62 *16*	A_2=+0.43 *9*
582.82 *8*	0.23 *2*	4818.59	10+	4235.89	10+	(D+Q)	−0.26 *20*	A_2=+0.33 *9* Mult.: ΔJ=(0).
588.30 *10*	0.13 *2*	2469.35	2−	1881.08	3+			
590.844 *20*	0.86 *2*	1130.32	0+	539.48	2+			
593.93 *5*	0.32 *2*	3368.99	7−	2775.14	5−			
598.11[a] *7*	0.37[a] *2*	2660.86	5+	2062.67	4+			
598.11[a] *7*	0.37[a] *2*	2764.96	4−	2166.87	3−			
605.72 *4*	0.35 *1*	3960.41	9−	3354.69	8−			
608.9 *5*	0.05 *3*	3576.42	7+	2967.56	6+			
612.055[a] *18*	2.44[a] *4*	2493.07	4−	1881.08	3+			I_γ: from the Adopted Gammas, only a small fraction (≈0.1 units) is expected with placement from 2493 level, main placement (≈2.3 units) should be from 3139 level.
612.055[a] *18*	2.44[a] *4*	3139.28	7−	2527.22	5−	Q		A_2=+0.339 *16*; A_4=−0.139 *25* γ(θ) for doublet.
623.933 *14*	5.42 *5*	3575.53	9−	2951.53	7−	Q		A_2=+0.379 *20*; A_4=−0.11 *3* A_2=+0.30 *8*; A_4=−0.05 *12* (1971Le19)
[x]626.89 *9*	0.27 *3*							
629.79 *5*	0.70 *3*	2705.54	6+	2075.68	6+	(M1+E2)	+1.00 *7*	A_2=+0.246 *21*; A_4=−0.16 *3* Mult.: ΔJ=0 transition.
631.41 *5*	0.29 *4*	2512.49	4+	1881.08	3+			A_2=+0.240 *23*; A_4=−0.22 *4* Sign of A_4 is inconsistent with (4+ to 3+) ΔJ=1 transition.
636.54 *15*	0.83 *26*	4235.85	10−	3599.27	8−	(Q)		A_2=+0.61 *19*; A_4=−0.2 *3*
637.44 *7*	2.8 *3*	3992.16	10−	3354.69	8−	(Q)		A_2=+0.40 *4*; A_4=−0.02 *6* A_2=+0.28 *7*; A_4=−0.03 *10* (1971Le19)
638.81 *13*	0.10 *2*	1865.16	2+	1226.42	4+			
642.818 *19*	2.69 *4*	2705.54	6+	2062.67	4+	Q		A_2=+0.343 *20*; A_4=−0.17 *3*
647.752 *20*	1.55 *3*	3599.27	8−	2951.53	7−	D+Q	−0.30 *2*	A_2=−0.949 *8*; A_4=+0.072 *13*
654.78 *5*	0.50 *2*	1881.08	3+	1226.42	4+	D+Q	+2.1 *3*	A_2=−0.24 *3*
660.34 *11*	0.15 *2*	4235.85	10−	3575.53	9−			
666.15 *10*	0.16 *2*	3929.63	(8+)	3263.65	8+			
673.05 *8*	0.25 *2*	4248.53	9−	3575.53	9−			
678.54 *14*	0.12 *2*	2543.61	2	1865.16	2+			
686.973 *17*	81.91 *12*	1226.42	4+	539.48	2+	Q		A_2=+0.359 *4*; A_4=−0.124 *6* A_2=+0.29 *2*; A_4=−0.06 *3* (1971Le19)
689.3 *5*	0.05 *3*	2569.93	3−	1881.08	3+			
695.8 *3*	0.89 *4*	2576.85	5+	1881.08	3+	Q		A_2=+0.32 *6*; A_4=−0.28 *10*
700.7 *6*	1.29 *8*	2062.67	4+	1362.19	2+	Q		A_2=+0.24 *3*; A_4=−0.12 *4*
708.5 *5*	0.05 *3*	4791.59	10+	4083.31	10+			
709.43 *3*	2.69 *6*	2785.19	6+	2075.68	6+	(M1+E2)	+0.54 *8*	A_2=+0.400 *17*; A_4=−0.09 *3* Mult.: ΔJ=0 transition.
710.82 *5*	1.57 *8*	2591.85	4−	1881.08	3+	D(+Q)	+0.05 *8*	A_2=−0.16 *3*; A_4=−0.21 *5* Sign of A_4 is inconsistent with ΔJ=1 transition.
712.76 *13*	0.23 *3*	2775.14	5−	2062.67	4+			
722.677 *22*	0.18 *3*	2785.19	6+	2062.67	4+	(Q)		A_2=+0.146 *22*; A_4=−0.05 *4* E_γ: level-energy difference=722.52.

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^{98}Mo(α,2nγ) 2000Ge01,1971Le19 (continued)

γ(^{100}Ru) (continued)

E_γ †	I_γ #	E_i(level)	J^π_i	E_f	J^π_f	Mult. @	δ &	Comments
727.340 *20*	2.77 *4*	4230.65	11⁻	3503.39	9⁻	Q		A_2=+0.341 *13*; A_4=−0.060 *19* A_2=+0.29 *17*; A_4=+0.12 *25* (1971Le19)
728.48 *19*	0.19 *4*	4097.40	9⁻	3368.99	7⁻			
732.46 *5*	0.45 *2*	4235.85	10⁻	3503.39	9⁻	(M1+E2)	−1.05 *12*	A_2=−1.14 *4*; A_4=+0.27 *6*
734.84 *8*	0.33 *2*	1865.16	2⁺	1130.32	0⁺			Additional information 1.
736.93 *18*	0.13 *2*	2099.20	2⁺	1362.19	2⁺			
740.222 *19*	2.29 *3*	4315.74	11⁻	3575.53	9⁻	(Q)		A_2=+0.33 *4*; A_4=−0.06 *7* A_2=+0.8 *4*; A_4=+0.2 *8* (1971Le19)
742.27 *9*	0.28 *2*	3960.41	9⁻	3218.13	8⁻	(M1+E2)	+0.58 *12*	A_2=+0.62 *10*
750.8 *5*	0.05 *3*	5066.20	12⁻	4315.74	11⁻			
765.04 *6*	0.46 *2*	3550.11	8⁺	2785.19	6⁺	Q		A_2=+0.34 *4*; A_4=−0.21 *5*
ˣ772.97 *19*	0.20 *3*							
774.4 *3*	0.18 *4*	5010.49	11⁺	4235.89	10⁺			
779.79 *6*	0.81 *5*	2660.86	5⁺	1881.08	3⁺	Q		A_2=+0.54 *10*; A_4=−0.35 *16*
785.70 *20*	0.18 *3*	3446.56	7⁺	2660.86	5⁺			
795.30 *5*	0.39 *2*	5713.09	14⁺	4917.79	12⁺	(Q)		A_2=+0.22 *6*
803.26 *6*	0.32 *2*	4353.37	10⁺	3550.11	8⁺	(Q)		A_2=+0.28 *4*
806.021 *20*	1.00 *2*	4798.18	12⁻	3992.16	10⁻	Q		A_2=+0.28 *5*; A_4=−0.10 *8*
812.39 *8*	0.24 *2*	4315.74	11⁻	3503.39	9⁻			
819.62 *7*	0.28 *2*	4083.31	10⁺	3263.65	8⁺			
822.666 *17*	2.51 *3*	1362.19	2⁺	539.48	2⁺			
830.39 *4*	0.51 *2*	5066.20	12⁻	4235.85	10⁻			
834.45 *8*	0.79 *5*	4917.79	12⁺	4083.31	10⁺	(Q)		A_2=+0.21 *9*; A_4=−0.07 *13*
835.20 *20*	0.05 *1*	5066.20	12⁻	4230.65	11⁻			
836.187 *23*	2.41 *5*	2062.67	4⁺	1226.42	4⁺	D+Q	+1.85 *21*	A_2=+0.15 *3*; A_4=−0.19 *4* A_2=+0.31 *10*; A_4=+0.06 *16* (1971Le19) Mult.: ΔJ=0 transition.
ˣ840.92 *10*	0.29 *3*							
844.47 *7*	1.86 *20*	3550.11	8⁺	2705.54	6⁺			
846.71 *9*	0.50 *3*	5162.39	13⁻	4315.74	11⁻			
849.241 *15*	53.8 *7*	2075.68	6⁺	1226.42	4⁺	Q		A_2=+0.362 *12*; A_4=−0.105 *19* A_2=+0.29 *3*; A_4=−0.12 *4* (1971Le19)
ˣ854.2 *4*	0.34 *14*							
861.93 *10*	0.32 *3*	4791.59	10⁺	3929.63	(8⁺)			
866.29 *21*	0.15 *3*	2747.48	4⁻	1881.08	3⁺			
869.69 *16*	0.46 *8*	3446.56	7⁺	2576.85	5⁺	Q		A_2=+0.36 *4*; A_4=−0.11 *7*
870.99 *21*	0.38 *10*	3576.42	7⁺	2705.54	6⁺	D+Q	−0.12 *7*	A_2=−0.47 *12*
875.878 *12*	15.52 *12*	2951.53	7⁻	2075.68	6⁺	D(+Q)	−0.02 *3*	A_2=−0.219 *6*; A_4=+0.009 *9* A_2=−0.27 *4*; A_4=0.00 *6* (1971Le19)
883.8 *5*	0.05 *1*	3851.5	5,6	2967.56	6⁺			
886.5 *5*	0.05 *3*	3661.45	6⁻	2775.14	5⁻			
887.981 *17*	4.21 *6*	2963.65	6⁻	2075.68	6⁺	D(+Q)	−0.08 *10*	A_2=+0.388 *13*; A_4=−0.053 *20* A_2=+0.41 *8*; A_4=−0.11 *11* (1971Le19) Mult.: ΔJ=0 transition.
891.67 *8*	0.54 *3*	2967.56	6⁺	2075.68	6⁺	(M1+E2)	−0.17 *8*	A_2=+0.31 *3*
893.77 *9*	0.46 *4*	4248.53	9⁻	3354.69	8⁻	(M1+E2)	+0.52 *5*	A_2=+0.56 *3*
896.79 *8*	0.40 *3*	4343.43	9⁺	3446.56	7⁺	Q		A_2=+0.44 *7*; A_4=−0.27 *10*
904.80 *5*	0.88 *4*	2967.56	6⁺	2062.67	4⁺			
927.6 *5*	0.05 *3*	5010.49	11⁺	4083.31	10⁺			
931.72 *3*	0.47 *1*	5162.39	13⁻	4230.65	11⁻	(Q)		A_2=+0.17 *5*; A_4=−0.03 *7*
935.37 *9*	0.31 *2*	4381.82	9⁺	3446.56	7⁺			
936.94 *21*	0.19 *3*	4075.94	8	3139.28	7⁻			
943.62 *16*	0.12 *1*	3110.49	4	2166.87	3⁻			
ˣ946.32 *15*	0.15 *2*							A_2=+0.41 *13*
948.98 *11*	0.17 *1*	3609.98	7⁺	2660.86	5⁺	Q		A_2=+0.46 *13*; A_4=−0.19 *19*
953.38 *3*	0.62 *2*	4503.48	10⁺	3550.11	8⁺	(Q)		A_2=+0.29 *7*; A_4=−0.06 *11*

Continued on next page (footnotes at end of table)

^{98}Mo(α,2nγ) 2000Ge01,1971Le19 (continued)

γ(^{100}Ru) (continued)

E_γ[†]	I_γ[#]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[@]	δ[&]	Comments
959.03 *12*	0.44 *4*	5274.69	13⁻	4315.74	11⁻	(Q)		A_2=+0.36 *5*; A_4=−0.07 *7*
961.93 *8*	0.45 *3*	3929.63	(8⁺)	2967.56	6⁺	Q		A_2=+0.32 *9*; A_4=−0.10 *13*
[x]966.68 *15*	0.23 *4*							
969.2 *5*	0.05 *3*	2099.20	2⁺	1130.32	0⁺			
972.13 *6*	0.74 *4*	4235.89	10⁺	3263.65	8⁺	(Q)		A_2=+0.19 *8*; A_4=−0.07 *14*
[x]974.72 *17*	0.23 *4*							
984.439 *12*	16.95 *13*	3060.07	8⁺	2075.68	6⁺	Q		A_2=+0.327 *17*; A_4=−0.05 *3* A_2=+0.35 *3*; A_4=−0.11 *5* (1971Le19)
[x]994.13 *25*	0.25 *3*							
996.56 *15*	0.28 *3*	2877.70	3⁺	1881.08	3⁺	(D(+Q))	+0.05 *20*	A_2=+0.23 *9*
999.54 *7*	0.56 *3*	3576.42	7⁺	2576.85	5⁺	Q		A_2=+0.26 *4*; A_4=−0.09 *7*
1023.252 *15*	3.93 *4*	4083.31	10⁺	3060.07	8⁺	Q		A_2=+0.27 *4*; A_4=−0.06 *6* A_2=+0.45 *12*; A_4=−0.26 *17* (1971Le19)
[x]1036.98 *20*	0.16 *3*							
1042.03 *13*	0.39 *5*	5125.34	12⁺	4083.31	10⁺			
1043.80 *20*	0.33 *7*	5274.69	13⁻	4230.65	11⁻	Q		A_2=+0.42 *13*; A_4=−0.35 *20*
1051.51[b] *6*	0.50 *3*	2414.20	(4⁺)	1362.19	2⁺			A_2=+0.24 *5* E_γ,I_γ: a part of this γ ray may be from 2414 level, as in the Adopted Gammas (placement proposed by evaluators).
1054.01 *11*	0.55 *5*	4408.70	10⁻	3354.69	8⁻			
1063.67 *3*	0.91 *2*	3139.28	7⁻	2075.68	6⁺	D(+Q)	−0.03 *5*	A_2=−0.216 *18*
[x]1067.21 *15*	0.16 *2*							
1079.98 *13*	0.18 *2*	4343.43	9⁺	3263.65	8⁺	(M1+E2)	+2.84 *8*	A_2=+0.48 *5*; A_4=+0.37 *7*
[x]1098.95 *15*	0.16 *2*							
1107.10 *12*	0.19 *2*	2469.35	2⁻	1362.19	2⁺			
1117.99 *11*	0.20 *2*	4381.82	9⁺	3263.65	8⁺	D+Q	−0.11 *7*	A_2=−0.47 *10*
1124.84 *3*	0.79 *2*	2351.30	4⁺	1226.42	4⁺			
1134.21 *13*	0.15 *1*	3661.45	6⁻	2527.22	5⁻	D+Q	−0.16 *6*	A_2=−0.51 *7*; A_4=−0.20 *10* Sign of A_4 is inconsistent with ΔJ=1 transition.
1139.8 *7*	0.10 *8*	2366.61	4⁺	1226.42	4⁺			
[x]1141.00 *22*	0.34 *10*							
[x]1153.25 *20*	0.16 *2*							
1160.05 *7*	0.38 *2*	4663.48	11⁻	3503.39	9⁻	(Q)		A_2=+0.37 *8*; A_4=−0.12 *12*
1175.776 *23*	1.71 *2*	4235.89	10⁺	3060.07	8⁺	(Q)		A_2=+0.27 *4*; A_4=−0.07 *6*
1181.43 *12*	0.17 *1*	2543.61	2	1362.19	2⁺			
1188.012 *20*	1.57 *2*	3263.65	8⁺	2075.68	6⁺	Q		A_2=+0.31 *15*; A_4=−0.121 *23*
1201.4 *3*	0.06 *1*	1740.99	0⁺	539.48	2⁺			
1207.70 *5*	0.34 *2*	2569.93	3⁻	1362.19	2⁺			
[x]1224.38 *8*	0.40 *3*							
[x]1238.34 *12*	0.31 *3*							
1266.52 *22*	0.42 *12*	2493.07	4⁻	1226.42	4⁺			
1274.7 *5*	0.05 *1*	3851.5	5,6	2576.85	5⁺			
1293.30 *3*	1.55 *3*	4353.37	10⁺	3060.07	8⁺			
[x]1295.91 *19*	0.21 *3*							
1300.792 *12*	11.05 *10*	2527.22	5⁻	1226.42	4⁺	D(+Q)	+0.004 *6*	A_2=−0.230 *7*; A_4=−0.025 *13* A_2=−0.30 *10*; A_4=+0.03 *16* (1971Le19) Sign of A_4 is inconsistent with ΔJ=1 transition.
1309.5 *3*	0.11 *2*	2536.25	3⁺	1226.42	4⁺			
1325.56 *7*	0.48 *2*	1865.16	2⁺	539.48	2⁺			
1341.601 *18*	3.95 *5*	1881.08	3⁺	539.48	2⁺	(D+Q)		A_2=+0.183 *10* δ: +5.5 *5* or +0.35 *2*. Additional information 2.
[x]1344.32 *14*								

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^{98}Mo(α,2nγ) 2000Ge01,1971Le19 (continued)

γ(^{100}Ru) (continued)

E_γ †	I_γ #	E_i(level)	J^π_i	E_f	J^π_f	Mult. @	δ &	Comments
1350.40 *3*	1.42 *3*	2576.85	5+	1226.42	4+	D+Q		A_2=−0.40 *3*; A_4=+0.12 *4* δ: −3.4 *2* or −0.12 *4*. Additional information 4.
1362.172 *23*	1.84 *3*	1362.19	2+	0.0	0+	Q		A_2=+0.149 *22*; A_4=−0.11 *3*
1365.40 *3*	1.16 *3*	2591.85	4−	1226.42	4+	D(+Q)	−0.05 *12*	A_2=+0.263 *11*; A_4=−0.05 *2* Mult.: ΔJ=0 transition.
1370.95 *9*	0.38 *2*	3446.56	7+	2075.68	6+	D+Q	+0.12 *2*	A_2=−0.058 *24*; A_4=+0.13 *4*
ˣ1376.17 *16*	0.21 *2*							
ˣ1380.54 *8*	0.53 *3*							
ˣ1427.71 *13*	0.21 *2*							
ˣ1433.66 *22*	0.53 *16*							
1434.81 *20*	0.63 *18*	2660.86	5+	1226.42	4+	(M1+E2)	+0.38 *4*	A_2=+0.297 *21*
1474.37 *7*	0.42 *2*	3550.11	8+	2075.68	6+	Q		A_2=+0.39 *6*; A_4=−0.15 *9*
1479.143 *22*	1.83 *3*	2705.54	6+	1226.42	4+	Q		A_2=+0.314 *15*; A_4=−0.150 *24*
1512.10 *22*	0.12 *1*	2051.59	0+	539.48	2+			
1515.54 *12*	0.29 *2*	2877.70	3+	1362.19	2+			
1520.83 *12*	0.40 *2*	2747.48	4−	1226.42	4+	(D+Q)	+0.38 *15*	A_2=+0.58 *5* Mult.: E1+M2 in 2000Ge01.
1523.199 *24*	2.75 *4*	2062.67	4+	539.48	2+	Q		A_2=+0.228 *12*; A_4=−0.143 *18*
1534.40 *10*	0.48 *2*	3609.98	7+	2075.68	6+	D+Q	+2.6 *2*	A_2=+0.52 *6*; A_4=+0.39 *8*
ˣ1536.2 *3*								
1538.31 *22*	0.29 *2*	2764.96	4−	1226.42	4+			
ˣ1540.2 *3*	0.10 *2*							
1548.70 *12*	0.23 *2*	2775.14	5−	1226.42	4+			This γ is possibly also from a low-spin level near this energy. See comment for 2775 doublet in the Adopted Levels.
ˣ1552.46 *9*	0.25 *2*							A_2=−0.65 *5*
1558.80 *8*	1.11 *12*	2785.19	6+	1226.42	4+	Q		A_2=+0.179 *20*; A_4=−0.09 *3*
1560.1 *6*	0.23 *3*	2099.20	2+	539.48	2+			
ˣ1562.60 *22*	0.16 *3*							
1627.462 *22*	2.60 *4*	2166.87	3−	539.48	2+	D(+Q)	+0.02 *3*	A_2=−0.173 *6*; A_4=−0.103 *10* Sign of A_4 is inconsistent with ΔJ=1 transition.
ˣ1651.75 *24*	0.14 *2*							
1685.30 *24*	0.48 *8*	2911.46	5−	1226.42	4+			
ˣ1686.8 *4*	0.22 *10*							
1701.30 *15*	0.15 *1*	2240.79	2+	539.48	2+	D		A_2=−0.37 *7*
ˣ1705.44 *14*	0.17 *2*							
1731.7 *3*	0.08 *1*	4791.59	10+	3060.07	8+			
1741.24 *7*	0.38 *2*	2967.56	6+	1226.42	4+	Q		A_2=+0.285 *19*; A_4=−0.12 *3*
ˣ1775.1 *3*	0.11 *2*							
1811.79 *8*	0.49 *2*	2351.30	4+	539.48	2+			
1827.13 *5*	1.21 *3*	2366.61	4+	539.48	2+	Q		A_2=+0.150 *21*; A_4=−0.16 *3*
1865.12 *9*	0.43 *2*	1865.16	2+	0.0	0+			
ˣ1870.89 *12*	0.34 *3*							
1874.70 *23*	0.16 *2*	2414.20	(4+)	539.48	2+			
ˣ1886.17 *17*	0.21 *2*							
1972.83 *25*	0.12 *3*	2512.49	4+	539.48	2+			
1996.81 *13*	0.26 *2*	2536.25	3+	539.48	2+	D(+Q)	−0.2 *3*	A_2=−0.33 *10* Mult.: M1(+E2) in 2000Ge01.
2004.01 *13*	0.25 *2*	2543.61	2	539.48	2+			
2166.65 *16*	0.19 *2*	2166.87	3−	0.0	0+	[E3]		Additional information 3.

† As suggested by the least-squares fitting procedure, low uncertainties (<0.05 keV or so) in 2000Ge01 may be under-estimated. In

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^{98}Mo(α,2nγ) 2000Ge01,1971Le19 (continued)

γ(^{100}Ru) (continued)

the fitting procedure, minimum uncertainty of 0.05 keV was used.

‡ From 1971Le19 only.

Relative intensity measured at E(α)=25 MeV in 2000Ge01. Values are also available in 1971Le19 at 30 MeV and in 1993GoZU at E=24.35 MeV.

@ The mult=Q corresponds to ΔJ=2, quadrupole (most likely E2); mult=D+Q or D(+Q) corresponds to ΔJ=1, dipole+quadrupole (likely to be M1+E2 when δ indicates significant admixture, E1(+M2) when the transition is essentially dipole, except in some cases that are noted). 2000Ge01 assign E2 to ΔJ=2, Q transitions, M1+E2 to ΔJ=1, with significant admixtures, and E1(+M2) to ΔJ=1, almost pure dipole transitions. But it should be noted that $\gamma(\theta)$ data of 2000Ge01 are insensitive to parity assignment. Also when only A_2 value is available and it is positive, the mult assignment is given in parentheses, since there are several possible solutions in this situation.

& from $\gamma(\theta)$ in 2000Ge01.

[a] Multiply placed with undivided intensity.

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

[x] γ ray not placed in level scheme.

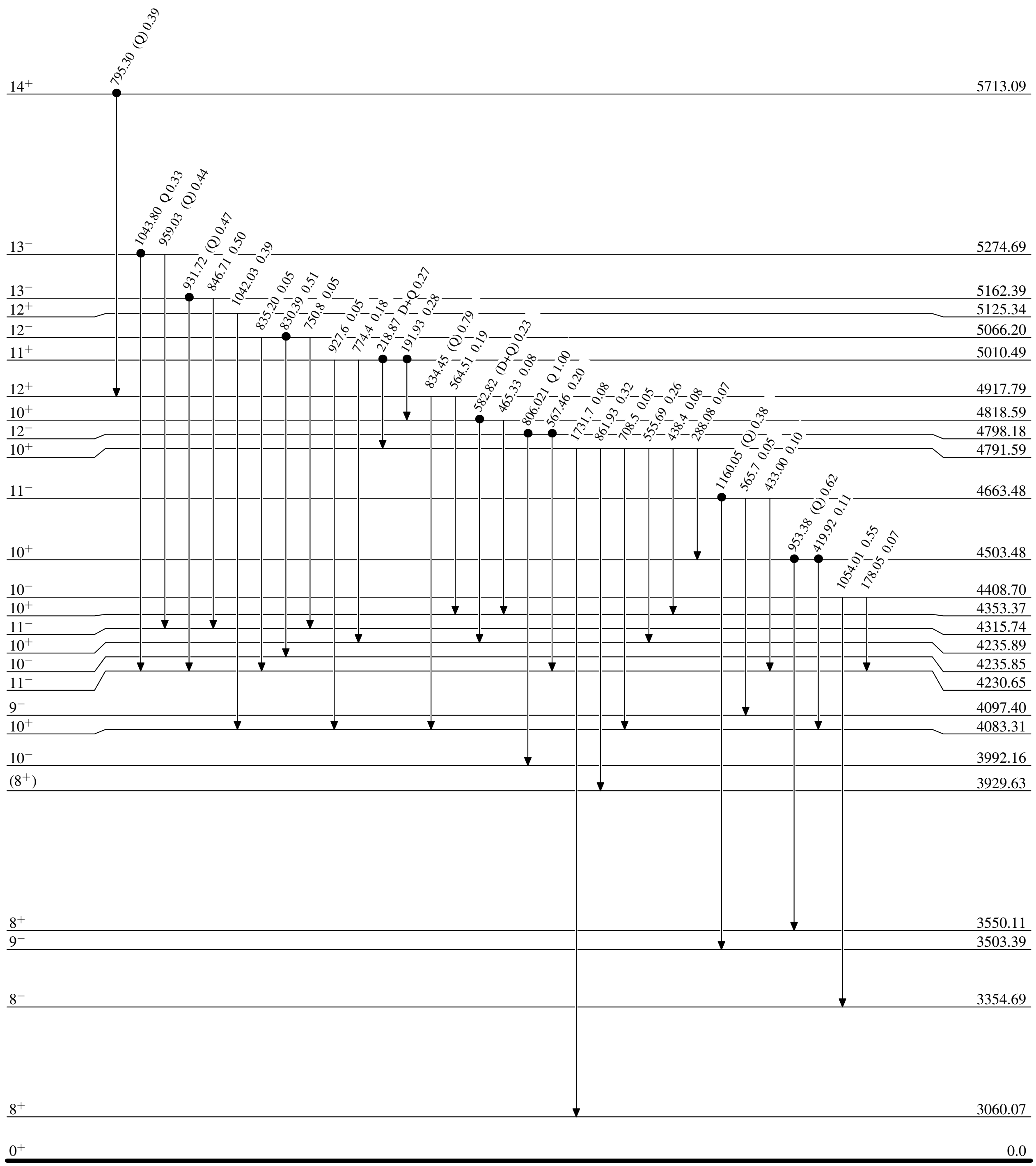
^{98}Mo(α,2nγ) 2000Ge01,1971Le19

Level Scheme

Intensities: Relative I_γ

Legend

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

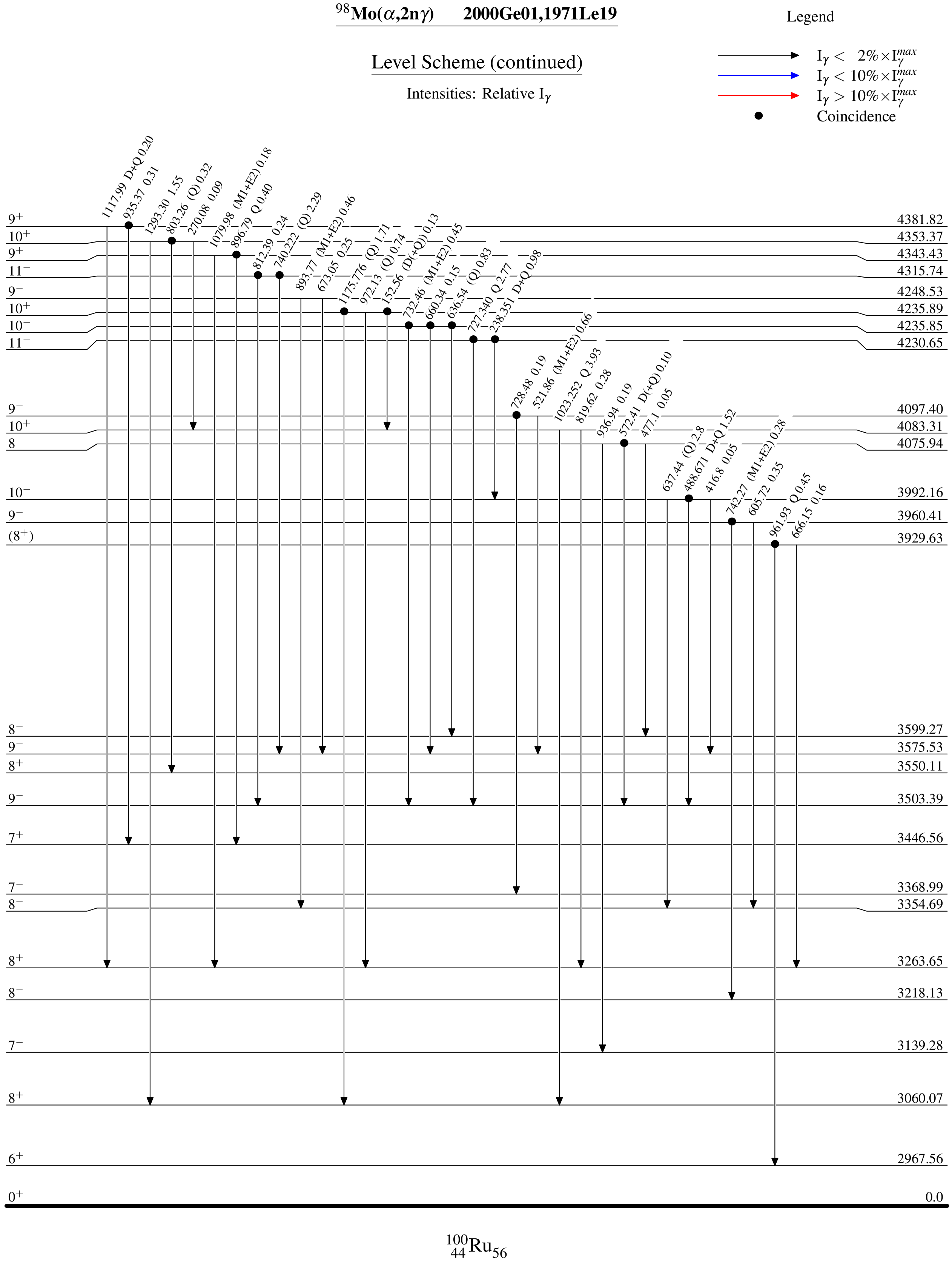


$^{100}_{44}Ru_{56}$

^{98}Mo(α,2nγ) 2000Ge01,1971Le19

Level Scheme (continued)

Intensities: Relative I_γ



^{98}Mo(α,2nγ) 2000Ge01,1971Le19

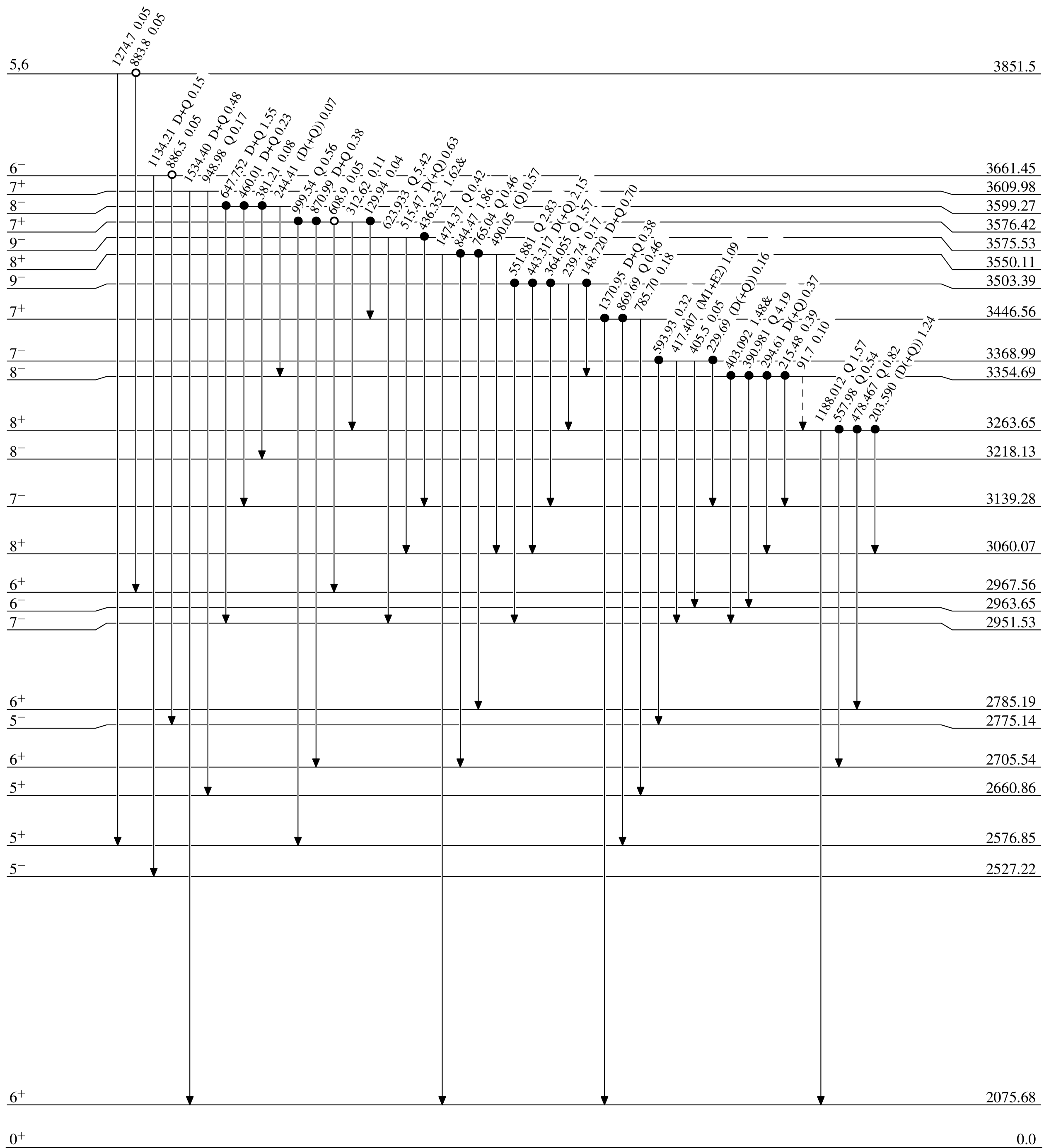
Level Scheme (continued)

Intensities: Relative I_γ

& 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)
- ● Coincidence
- ○ Coincidence (Uncertain)



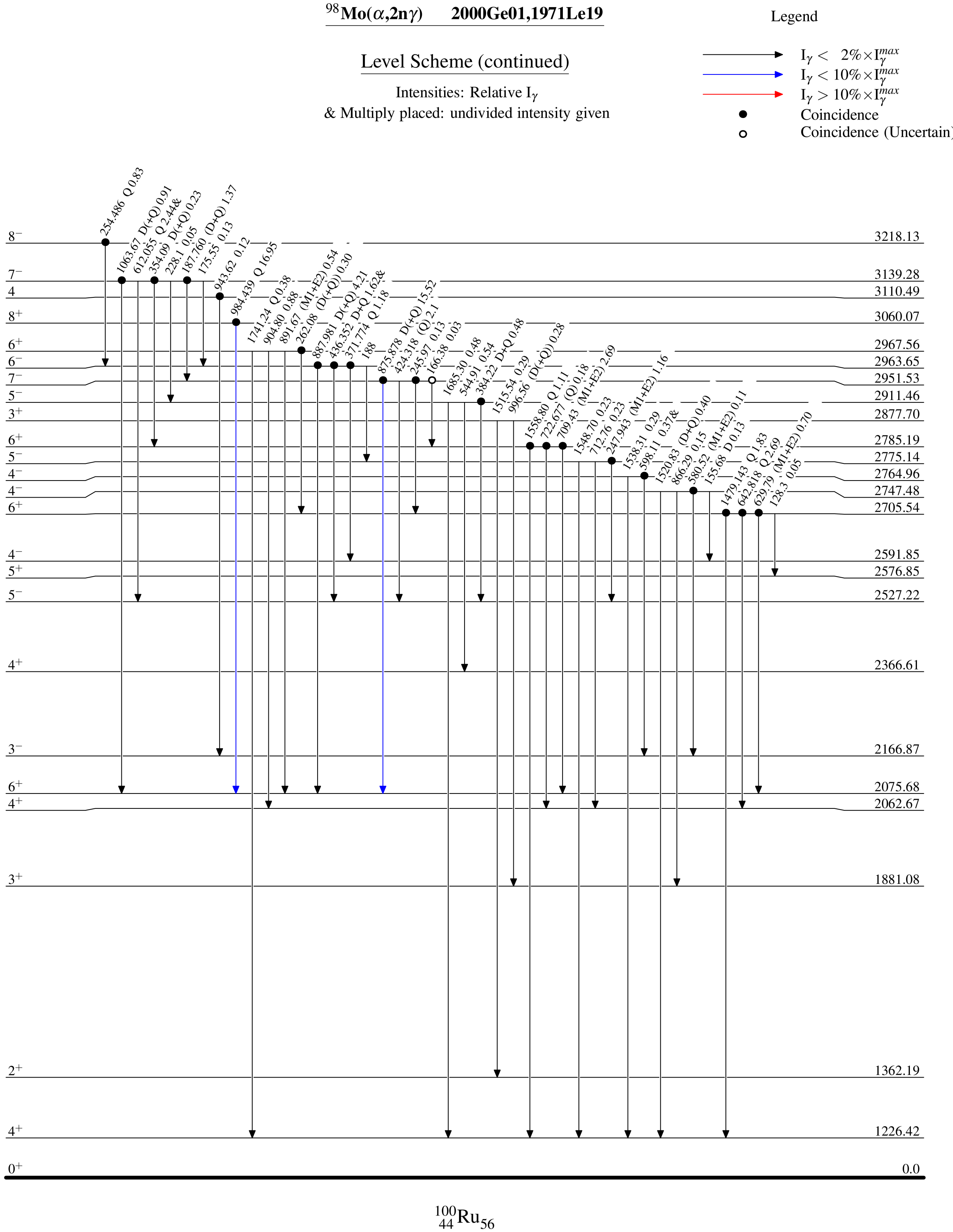
$^{100}_{44}Ru_{56}$

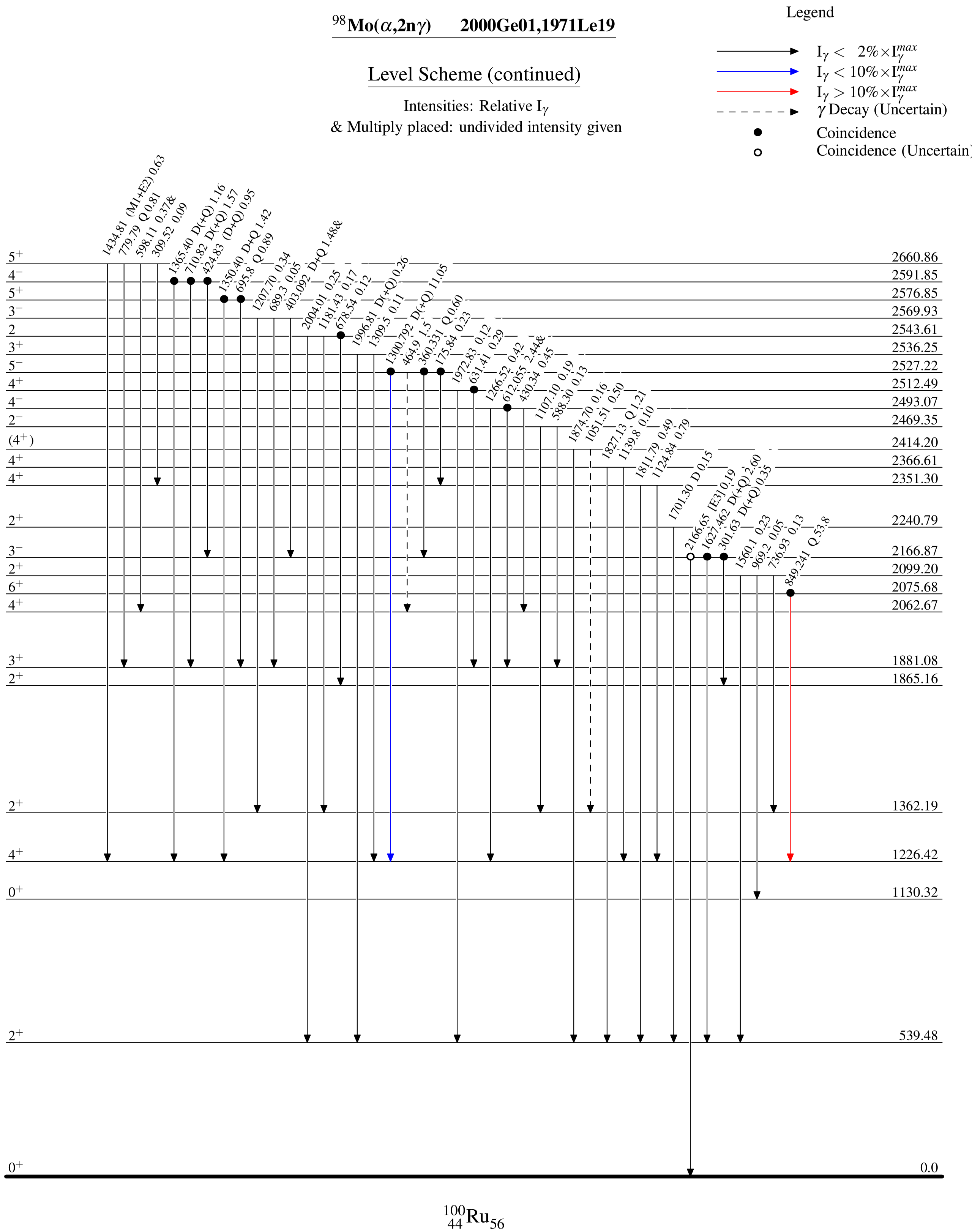
^{98}Mo(α,2nγ) 2000Ge01,1971Le19

Level Scheme (continued)

Intensities: Relative I_γ

& Multiply placed: undivided intensity given




^{98}Mo(α,2nγ) 2000Ge01,1971Le19
Level Scheme (continued)
Intensities: Relative I_γ
& 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)
Coincidence
Coincidence (Uncertain)
5+ 2660.86
4− 2591.85
5+ 2576.85
3− 2569.93
2 2543.61
3+ 2536.25
5− 2527.22
4+ 2512.49
4− 2493.07
2− 2469.35
(4+) 2414.20
4+ 2366.61
4+ 2351.30
2+ 2240.79
3− 2166.87
2+ 2099.20
6+ 2075.68
4+ 2062.67
3+ 1881.08
2+ 1865.16
2+ 1362.19
4+ 1226.42
0+ 1130.32
2+ 539.48
0+ 0.0
1434.81 (M1+E2) 0.63
779.79 Q 0.81
598.11 0.37&
309.52 0.09
1365.40 D(+Q) 1.16
710.82 D(+Q) 1.57
424.83 (D+Q) 0.95
1350.40 D+Q 1.42
695.8 Q 0.89
1207.70 0.34
689.3 0.05
403.092 D+Q 1.48&
2004.01 0.25
1181.43 0.17
678.54 0.12
1996.81 D(+Q) 0.26
1309.5 0.11
1300.792 D(+Q) 11.05
464.9 1.5
360.331 Q 0.60
175.84 0.23
1972.83 0.12
631.41 0.29
1266.52 0.42
612.055 2.44&
430.34 0.45
1107.10 0.19
588.30 0.13
1874.70 0.16
1051.51 0.50
1827.13 Q 1.21
1139.8 0.10
1811.79 0.49
1124.84 0.79
1701.30 D 0.15
2166.65 [E3] 0.19
1627.462 D(+Q) 2.60
301.63 D(+Q) 0.35
1560.1 0.23
969.2 0.05
736.93 0.13
849.241 Q 53.8
$^{100}_{44}Ru_{56}$

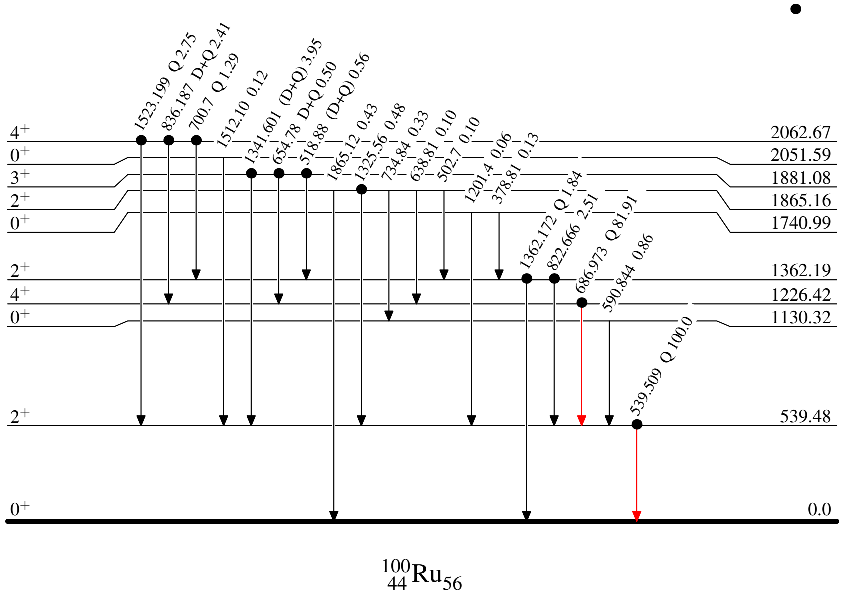
^{98}Mo(α,2nγ) 2000Ge01,1971Le19

Level Scheme (continued)

Intensities: Relative I_γ
& Multiply placed: undivided intensity given

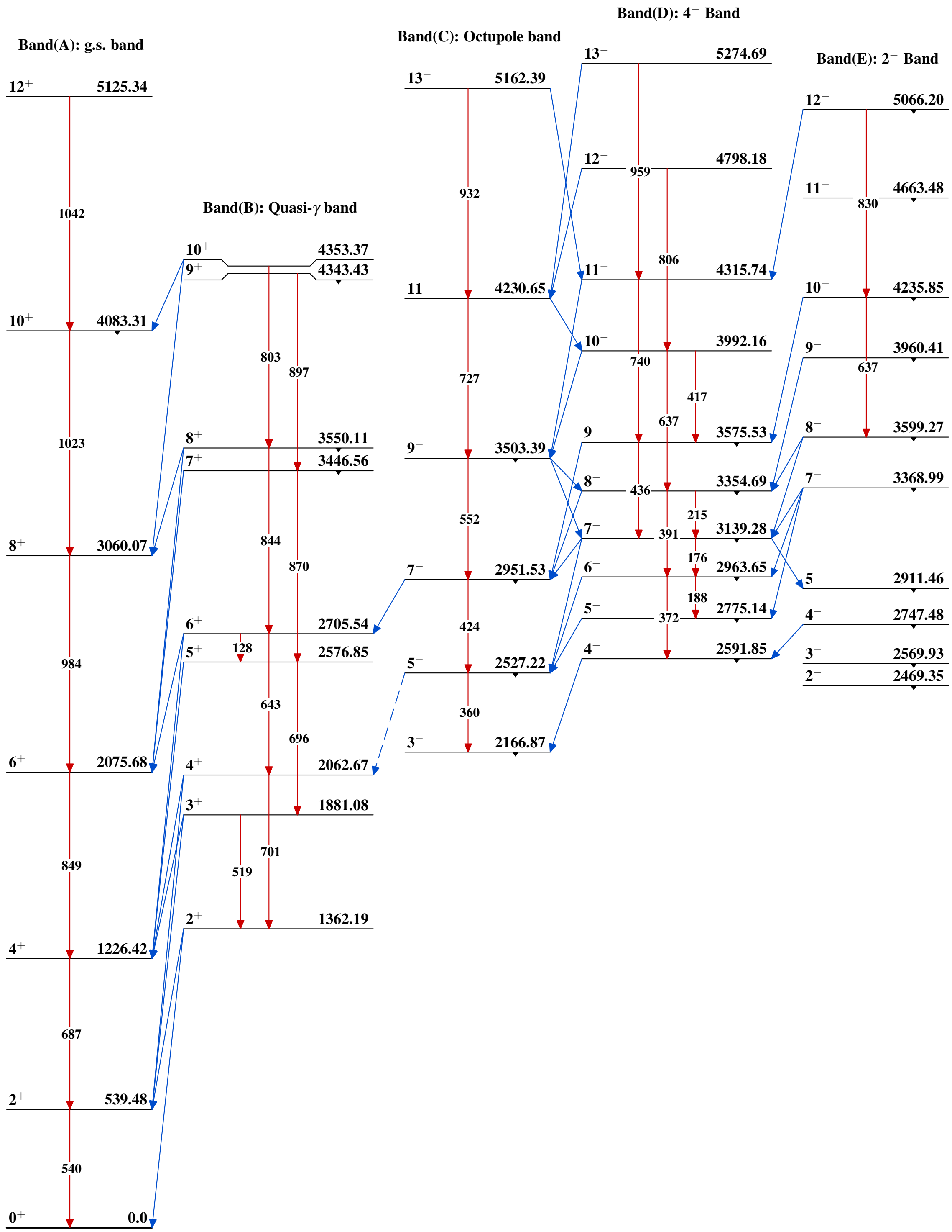
Legend

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



$^{100}_{44}Ru_{56}$

$^{98}Mo(\alpha,2n\gamma)$ 2000Ge01,1971Le19



$^{100}_{44}Ru_{56}$