

$^{46}\text{Ti}(^{58}\text{Ni},4\text{p}\gamma)$ **2000ApZY**

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

2000ApZY: E=215 MeV. Measured E_γ , I_γ , $\gamma\gamma$, $\gamma\gamma(\theta)$ (DCO), and $\gamma(\theta)$ using Gammasphere array equipped with 88 HPGe detectors, and Microball array with a 4π CsI light-charged particle detector to detect evaporated charged particles for channel selection.

2000ApZY is a preprint from D.E. Appelbe, received at McMaster University on June 10, 2000, and the data have never been published.

 ^{100}Pd Levels

E(level) [†]	J^π [@]	E(level) [†]	J^π [@]	E(level) [†]	J^π [@]	E(level) [†]	J^π [@]
0.0 ^b	0 ⁺	4634.8 ⁹	10 ⁽⁻⁾	6459.3 ^c	8 15 ⁽⁺⁾	9872.9 ^d	12 (20 ⁻)
665.5 ^b	3 2 ⁺	4761.9 ^b	7 12 ⁺	6690.7 [‡]	9 (14 ⁻)	10107.0 ^e	12 21 ⁽⁻⁾
1416.1 ^b	5 4 ⁺	4778.9 ^c	7 11 ⁽⁺⁾	6705.9 ^e	8 15 ⁽⁻⁾	10138.6 [#]	11 21 ⁽⁻⁾ ^a
2189.3 ^b	6 6 ⁺	4864.3 ^e	7 11 ⁽⁻⁾	6938.8 ⁹	16 ⁽⁺⁾	10227.3 ^{‡f}	12 21 ⁽⁻⁾
2505.4 ^g	8 5 ⁻	4946.6 ^g	8 (11 ⁻)	7083.6 ¹³	(15 ⁺) ^{&}	10607.3 ^{#d}	13 (21 ⁻) ^a
2988.2 ^b	6 8 ⁺	5076.9 ^c	8 12 ⁽⁺⁾	7272.4 ⁹	(15 ⁺)	11214.3 ^d	13 22 ⁽⁻⁾
3178.5 ⁷	8 ⁽⁺⁾	5453.2 ^c	8 13 ⁽⁺⁾	7341.9 ¹⁰	16 ⁽⁺⁾	11428.5 ^{‡f}	14 23 ⁽⁻⁾
3231.5 ^g	7 7 ⁻	5670.2 ^e	8 13 ⁽⁻⁾	7646.5 ^e	9 17 ⁽⁻⁾	11824.9 ^d	13 23 ⁽⁻⁾
3439.8 ⁷	(8 ⁺)	5707.2 ^b	8 14 ⁺	7834.9 ¹⁰	(17 ⁺)	13165.1 ^{‡f}	15 25 ⁽⁻⁾
3869.1 ^b	7 10 ⁺	5879.4 ¹⁸	(13 ⁺)	7971.1 ¹⁰	18 ⁽⁺⁾	13208.8 ^{#d}	14 24 ⁽⁻⁾ ^a
4054.5 ^e	7 9 ⁽⁻⁾	5919.6 ^c	8 14 ⁽⁺⁾	8305.5 ¹¹	18 ⁽⁺⁾	14458.8 [‡]	15 (26 ⁻)
4092.6 ^g	8 9 ⁽⁻⁾	6065.1 ^g	8 (13 ⁻)	8718.4 ^e	11 19 ⁽⁻⁾	15015.5 ^f	15 27 ⁽⁻⁾
4145.5 ^c	7 10 ⁽⁺⁾	6135.3 ¹⁰	14 ⁽⁺⁾	9691.5 ¹¹	20 ⁽⁺⁾		

[†] From least-squares fit to E_γ data.

[‡] Level not supported in other reactions ([2001Pe05](#) and/or [2001Zh26](#)). The deexciting γ ray is placed differently in other reactions and in the Adopted Levels, Gammas.

[#] Level not reported in any other study, thus treated as tentative by the evaluators.

[@] As proposed by [2000ApZY](#) based on $\gamma(\theta)$, $\gamma\gamma(\theta)$ (DCO) data and band assignments. The assignments in the Adopted Levels are the same in most cases, except that many are given in parentheses there and in some cases level energies differ due to reordering of $\gamma\gamma$ cascades.

[&] (16⁺) in the Adopted Levels.

^a (25⁻) in the Adopted Levels.

^b Band(A): Yrast cascade.

^c Seq.(B): γ cascade based on 10⁽⁺⁾.

^d Seq.(C): γ cascade based on 20⁽⁻⁾.

^e Seq.(D): γ cascade based on 9⁽⁻⁾.

^f Seq.(E): γ cascade based on 21⁽⁻⁾.

^g Seq.(F): γ cascade based on 5⁻.

 $\gamma(^{100}\text{Pd})$

DCO values correspond to stretched quadrupole gated spectra, DCO(D) indicates $\Delta J=1$, dipole gated value.

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$^{46}\text{Ti} (^{58}\text{Ni}, 4p\gamma)$ 2000ApZY (continued)

$\gamma(^{100}\text{Pd})$ (continued)

E_γ	I_γ	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. &	Comments
190.4 3	7.04 24	3178.5	8 ⁽⁺⁾	2988.2	8 ⁺	D ^c	DCO=1.06 5; A ₂ =+0.08 2; A ₄ =-0.62 3
261.6 6	0.26 7	3439.8	8 ⁽⁺⁾	3178.5	8 ⁽⁺⁾	D ^c	DCO=0.84 55
276.6 6	2.53 12	4145.5	10 ⁽⁺⁾	3869.1	10 ⁺	D ^c	DCO=0.52 6
298.0 10	0.16 4	5076.9	12 ⁽⁺⁾	4778.9	11 ⁽⁺⁾		
309.8 10	0.13 3	4946.6	11 ⁽⁻⁾	4634.8	10 ⁽⁻⁾		
323.8 ^d 10	1.11 11	6459.3	15 ⁽⁺⁾	6135.3	14 ⁽⁺⁾		
376.0 10	1.03 6	5453.2	13 ⁽⁺⁾	5076.9	12 ⁽⁺⁾	D ^b	DCO(D)=0.94 17
466.1 [‡] 5	6.72 24	5919.6	14 ⁽⁺⁾	5453.2	13 ⁽⁺⁾	D ^b	DCO=0.68 4; A ₂ =-0.12 3; A ₄ =-0.20 5
480.2 [‡] 6	6.22 22	6938.8	16 ⁽⁺⁾	6459.3	15 ⁽⁺⁾	D ^b	DCO=0.68 4; A ₂ =-0.24 3; A ₄ =-0.24 5
493.0 3	0.9 3	7834.9	17 ⁽⁺⁾	7341.9	16 ⁽⁺⁾	D ^b	DCO(D)=0.85 15
539.8 3	1.33 22	6459.3	15 ⁽⁺⁾	5919.6	14 ⁽⁺⁾	D ^b	DCO(D)=0.83 14
542.2 5	2.59 15	4634.8	10 ⁽⁻⁾	4092.6	9 ⁽⁻⁾		
558.7 [@] 7	0.84 5	15015.5	27 ⁽⁻⁾	14458.8?	26 ⁽⁻⁾		E _γ : placement from 13504, (25 ⁻) level in the Adopted Levels, Gammas.
593.3 10	0.93 8	5670.2	13 ⁽⁻⁾	5076.9	12 ⁽⁺⁾		
606.6 [†] 5	0.40 6	11214.3	22 ⁽⁻⁾	10607.3?	21 ⁽⁻⁾		
609.9 [‡] 6	4.59 17	11824.9	23 ⁽⁻⁾	11214.3	22 ⁽⁻⁾	D ^b	DCO=0.45 5; A ₂ =-0.16 4; A ₄ =-0.28 6
614.8 3	0.47 5	4054.5	9 ⁽⁻⁾	3439.8	8 ⁽⁺⁾		
616.5 2	0.60 7	4761.9	12 ⁺	4145.5	10 ⁽⁺⁾		
625.6 [#] 3	0.65 7	6690.7?	14 ⁽⁻⁾	6065.1	13 ⁽⁻⁾		E _γ : placement from 5574, (12 ⁻) level in the Adopted Levels, Gammas.
633.3 3	1.11 8	4778.9	11 ⁽⁺⁾	4145.5	10 ⁽⁺⁾		
665.5 3	100 3	665.5	2 ⁺	0.0	0 ⁺	Q ^a	DCO=0.90 5; A ₂ =+0.083 8; A ₄ =-0.154 14
674.0 ^{†d} 10	0.33 11	5453.2	13 ⁽⁺⁾	4778.9	11 ⁽⁺⁾		
682.0 [‡] 7	3.02 18	6135.3	14 ⁽⁺⁾	5453.2	13 ⁽⁺⁾	D ^b	DCO(D)=0.81 16; A ₂ =-0.46 9; A ₄ =-0.2 1
691.3 [‡] 4	9.2 3	5453.2	13 ⁽⁺⁾	4761.9	12 ⁺	(D) ^b	DCO=0.79 6; A ₂ =+0.19 4; A ₄ =-0.27 8
706.2 ^{†d} 10	<0.2	4145.5	10 ⁽⁺⁾	3439.8	8 ⁽⁺⁾		
707.6 ^d 10	1.11 11	7646.5	17 ⁽⁻⁾	6938.8	16 ⁽⁺⁾		
718.8 4	0.65 6	4864.3	11 ⁽⁻⁾	4145.5	10 ⁽⁺⁾		
726.1 7	9.2 4	3231.5	7 ⁻	2505.4	5 ⁻	Q ^a	DCO=1.27 13; A ₂ =+0.33 3; A ₄ =-0.18 5
733.8 [†] 8	1.46 10	10607.3?	21 ⁽⁻⁾	9872.9	20 ⁽⁻⁾		
750.6 3	91 3	1416.1	4 ⁺	665.5	2 ⁺	Q ^a	DCO=1.00 2; A ₂ =+0.215 25; A ₄ =-0.19 4
752.5 6	9.5 4	6459.3	15 ⁽⁺⁾	5707.2	14 ⁺		
771.0 10	0.78 20	4864.3	11 ⁽⁻⁾	4092.6	9 ⁽⁻⁾		
773.2 3	79.2 25	2189.3	6 ⁺	1416.1	4 ⁺	Q ^a	DCO=1.10 6; A ₂ =+0.242 9; A ₄ =-0.189 15
786.1 3	0.91 8	6705.9	15 ⁽⁻⁾	5919.6	14 ⁽⁺⁾		
798.7 4	64.2 20	2988.2	8 ⁺	2189.3	6 ⁺	Q ^a	DCO=1.04 4; A ₂ =+0.227 11; A ₄ =-0.203 18
805.7 4	33.4 11	5670.2	13 ⁽⁻⁾	4864.3	11 ⁽⁻⁾	Q ^a	DCO=1.03 4; A ₂ =+0.35 2; A ₄ =-0.10 3
809.6 4	27.7 9	4864.3	11 ⁽⁻⁾	4054.5	9 ⁽⁻⁾	Q ^a	DCO=0.90 4
823.1 3	4.57 16	4054.5	9 ⁽⁻⁾	3231.5	7 ⁻	Q ^a	DCO=0.91 8
842.8 ^{†d} 13	0.33 9	5919.6	14 ⁽⁺⁾	5076.9	12 ⁽⁺⁾		
854.0 2	1.86 13	4946.6	11 ⁽⁻⁾	4092.6	9 ⁽⁻⁾	(Q) ^a	DCO=0.83 12
861.1 3	6.0 3	4092.6	9 ⁽⁻⁾	3231.5	7 ⁻	Q ^a	DCO=0.96 5
876.1 [‡] 3	17.0 6	4054.5	9 ⁽⁻⁾	3178.5	8 ⁽⁺⁾	D ^b	DCO=0.67 4; A ₂ =-0.36 3; A ₄ =-0.20 4
881.2 4	49.5 15	3869.1	10 ⁺	2988.2	8 ⁺	Q ^a	DCO=0.93 4
892.5 4	31.6 10	4761.9	12 ⁺	3869.1	10 ⁺	Q ^a	DCO=0.88 5; A ₂ =+0.310 17; A ₄ =-0.17 3
909.3 ^d 5	2.23 15	5670.2	13 ⁽⁻⁾	4761.9	12 ⁺		
909.8 ^d 3	<0.2	4778.9	11 ⁽⁺⁾	3869.1	10 ⁺		
931.1 ^d 10	1.11 11	5076.9	12 ⁽⁺⁾	4145.5	10 ⁽⁺⁾		

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$^{46}\text{Ti}(^{58}\text{Ni},4p\gamma)$ 2000ApZY (continued) $\gamma(^{100}\text{Pd})$ (continued)

E_γ	I_γ	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. &	Comments
940.6 4	33.4 10	7646.5	17 ⁽⁻⁾	6705.9	15 ⁽⁻⁾	Q ^a	DCO=1.01 3; A ₂ =+0.38 2; A ₄ =-0.22 4
945.0 6	17.7 6	5707.2	14 ⁺	4761.9	12 ⁺	Q ^a	DCO=1.03 6; A ₂ =+0.367 11; A ₄ =-0.23 2
967.2 10	0.32 12	4145.5	10 ⁽⁺⁾	3178.5	8 ⁽⁺⁾		
989.6 6	10.9 4	3178.5	8 ⁽⁺⁾	2189.3	6 ⁺	Q ^a	DCO=1.07 8; A ₂ =+0.34 3; A ₄ =-0.18 5
995.7 6	1.22 12	4864.3	11 ⁽⁻⁾	3869.1	10 ⁺		
1006.0 ^d 19	0.22 10	6459.3	15 ⁽⁺⁾	5453.2	13 ⁽⁺⁾		
1020 ^d 3	0.33 9	6938.8	16 ⁽⁺⁾	5919.6	14 ⁽⁺⁾		
1032.3 4	2.2 3	7971.1	18 ⁽⁺⁾	6938.8	16 ⁽⁺⁾	Q ^a	DCO=1.02 11; A ₂ =+0.26 7; A ₄ =-0.4 1
1036.1 4	35.1 11	6705.9	15 ⁽⁻⁾	5670.2	13 ⁽⁻⁾	Q ^a	DCO=1.20 6; A ₂ =+0.34 3; A ₄ =-0.16 4
1066.0 3	4.40 18	4054.5	9 ⁽⁻⁾	2988.2	8 ⁺	D ^b	DCO=0.72 3; A ₂ =+0.07 1; A ₄ =-0.1 2
1071.9 6	25.1 8	8718.4	19 ⁽⁻⁾	7646.5	17 ⁽⁻⁾	Q ^a	DCO=0.97 5; A ₂ =+0.35 4; A ₄ =-0.31 6
1089.4 [‡] 9	9.1 5	2505.4	5 ⁻	1416.1	4 ⁺	D ^b	DCO=0.75 6; A ₂ =-0.11 3; A ₄ =-0.09 5
1100.5 [†] 16	0.67 22	5879.4	(13 ⁺)	4778.9	11 ⁽⁺⁾		
1107.1 8	5.39 19	11214.3	22 ⁽⁻⁾	10107.0	21 ⁽⁻⁾	D ^b	DCO=0.49 5
1118.4 [#] 2	1.33 8	6065.1	(13 ⁻)	4946.6	(11 ⁻)		E _γ : placement of 1116 from 6686, (14 ⁻) level and 1122 from 6069, (13 ⁻) in the Adopted Levels, Gammas.
1154.1 6	2.81 14	9872.9	(20 ⁻)	8718.4	19 ⁽⁻⁾	D ^b	DCO=0.62 9
1157.3 ^d 10	0.92 13	5919.6	14 ⁽⁺⁾	4761.9	12 ⁺	Q ^a	DCO=1.2 3
1164.0 10	0.87 9	7083.6	(15 ⁺)	5919.6	14 ⁽⁺⁾		
1201.1 [@] 6	2.68 11	11428.5?	23 ⁽⁻⁾	10227.3?	21 ⁽⁻⁾	Q ^a	DCO=0.93 11 E _γ : placement from 11653, (22 ⁺) level in the Adopted Levels, Gammas.
1207.8 10	2.44 18	5076.9	12 ⁽⁺⁾	3869.1	10 ⁺	Q ^a	DCO=0.72 14; A ₂ =+0.35 8; A ₄ =-0.2 1
1218.0 10	1.11 11	11824.9	23 ⁽⁻⁾	10607.3?	(21 ⁻)		
1230.9 6	4.45 18	6938.8	16 ⁽⁺⁾	5707.2	14 ⁺	Q ^a	DCO=0.90 12; A ₂ =+0.32 7; A ₄ =-0.2 1
1294.1 [@] 3	0.81 5	14458.8?	(26 ⁻)	13165.1?	25 ⁽⁻⁾		E _γ : placement from 12946, (23 ⁺) level in the Adopted Levels, Gammas.
1366.7 6	3.57 14	8305.5	18 ⁽⁺⁾	6938.8	16 ⁽⁺⁾	Q ^a	DCO=0.9 2
1383.9 5	4.18 17	13208.8	24 ⁽⁻⁾	11824.9	23 ⁽⁻⁾	D ^b	DCO=0.6 1 Mult.: ΔJ=1, dipole from DCO=0.6 1 is in conflict with ΔJ=2, quadrupole from 2001Pe05 and 2001Zh26.
1386.0 3	1.1 6	9691.5	20 ⁽⁺⁾	8305.5	18 ⁽⁺⁾	Q ^a	DCO=0.9 2
1388.9 6	15.0 5	10107.0	21 ⁽⁻⁾	8718.4	19 ⁽⁻⁾	Q ^a	DCO=1.31 15; A ₂ =+0.37 2; A ₄ =-0.26 3
1420.2 [†] 3	1.82 11	10138.6?	21 ⁽⁻⁾	8718.4	19 ⁽⁻⁾	(Q) ^a	DCO=0.7 2 E _γ : in $^{72}\text{Ge}(^{35}\text{Cl},\alpha p2n\gamma)$ (2001Zh26), a 1419.0γ is placed from 9384 to 7965 level.
1422.3 6	2.40 12	7341.9	16 ⁽⁺⁾	5919.6	14 ⁽⁺⁾	Q ^a	DCO(D)=0.58 10
1508.9 [@] 6	3.00 12	10227.3?	21 ⁽⁻⁾	8718.4	19 ⁽⁻⁾	Q ^a	DCO=1.13 24 E _γ : placement from 15015, (25 ⁺) level in the Adopted Levels, Gammas.
1565.2 3	1.10 9	7272.4	(15 ⁺)	5707.2	14 ⁺		
1718.2 5	2.09 9	11824.9	23 ⁽⁻⁾	10107.0	21 ⁽⁻⁾	Q ^a	DCO=1.1 2
1736.6 [@] 5	2.08 8	13165.1?	25 ⁽⁻⁾	11428.5?	23 ⁽⁻⁾	Q ^a	E _γ : placement from 10452, (20 ⁺) in the Adopted Levels, Gammas. Mult.: ΔJ=2, quadrupole from DCO=1.1 2 is in conflict with ΔJ=1, E1 from γ(θ,pol) in 2001Pe05 and ΔJ=1 in 2001Zh26.
1850.1 [@] 3	0.79 4	15015.5	27 ⁽⁻⁾	13165.1?	25 ⁽⁻⁾		E _γ : placement from 13504, (24 ⁺) level in the Adopted Levels, Gammas.

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 $^{46}\text{Ti}(^{58}\text{Ni},4\text{p}\gamma)$ 2000ApZY (continued) $\gamma(^{100}\text{Pd})$ (continued)

[†] γ not reported in other high-spin studies (2001Pe05,2001Zh26).

[‡] Negative sign of A_4 is inconsistent with $\Delta J=1$, dipole or dipole+quadrupole transition.

[#] 626-1118 cascade is defined as 1116-626 in $^{72}\text{Ge}(^{35}\text{Cl},\alpha\text{p}2\text{n}\gamma)$ (2001Zh26), and also in the Adopted Levels, Gammas. The 1118 γ in 2000ApZY seems to correspond to 1116.0 γ and 1122.0 γ . No line at 1116, 1118 or 1122 is reported in $^{50}\text{Cr}(^{58}\text{Ni},4\text{p}\alpha\gamma)$ (2001Pe05).

[@] 1850-1737-1201-1509 cascade is reordered as 1850-1510-1201-1737 in 2001Pe05 which is given in the Adopted Levels, Gammas. The 558-1293 cascade is from 13504 level in the Adopted Levels, Gammas rather than the 15015 level here.

[&] Explicit assignments are not given by 2000ApZY, the evaluators have suggested assignments based on $\gamma(\theta)$ and $\gamma\gamma(\theta)$ of 2000ApZY.

^a $\gamma(\theta)$ and/or $\gamma\gamma(\theta)$ data consistent with $\Delta J=2$, quadrupole.

^b $\gamma(\theta)$ and/or $\gamma\gamma(\theta)$ data consistent with $\Delta J=1$, dipole or dipole+quadrupole.

^c $\gamma(\theta)$ and/or $\gamma\gamma(\theta)$ (DCO) consistent with $\Delta J=0$, dipole or dipole+quadrupole.

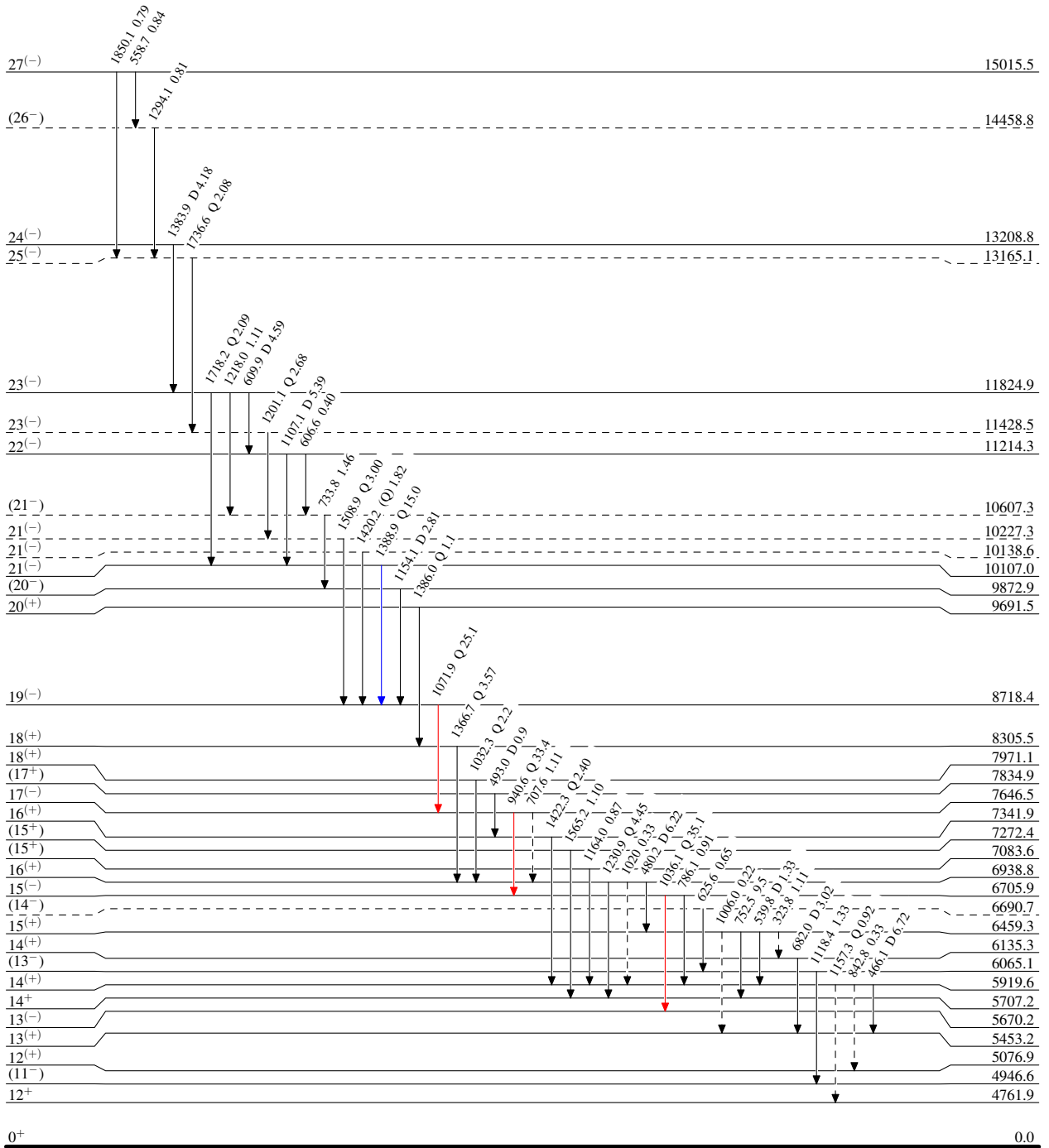
^d Placement of transition in the level scheme is uncertain.

$^{46}\text{Ti}(^{58}\text{Ni},4p\gamma)$ 2000ApZY

Legend

Level Scheme
Intensities: Relative I_γ

- $I_\gamma < 2\% \times I_\gamma^{max}$
- $I_\gamma < 10\% \times I_\gamma^{max}$
- $I_\gamma > 10\% \times I_\gamma^{max}$
- - - - γ Decay (Uncertain)



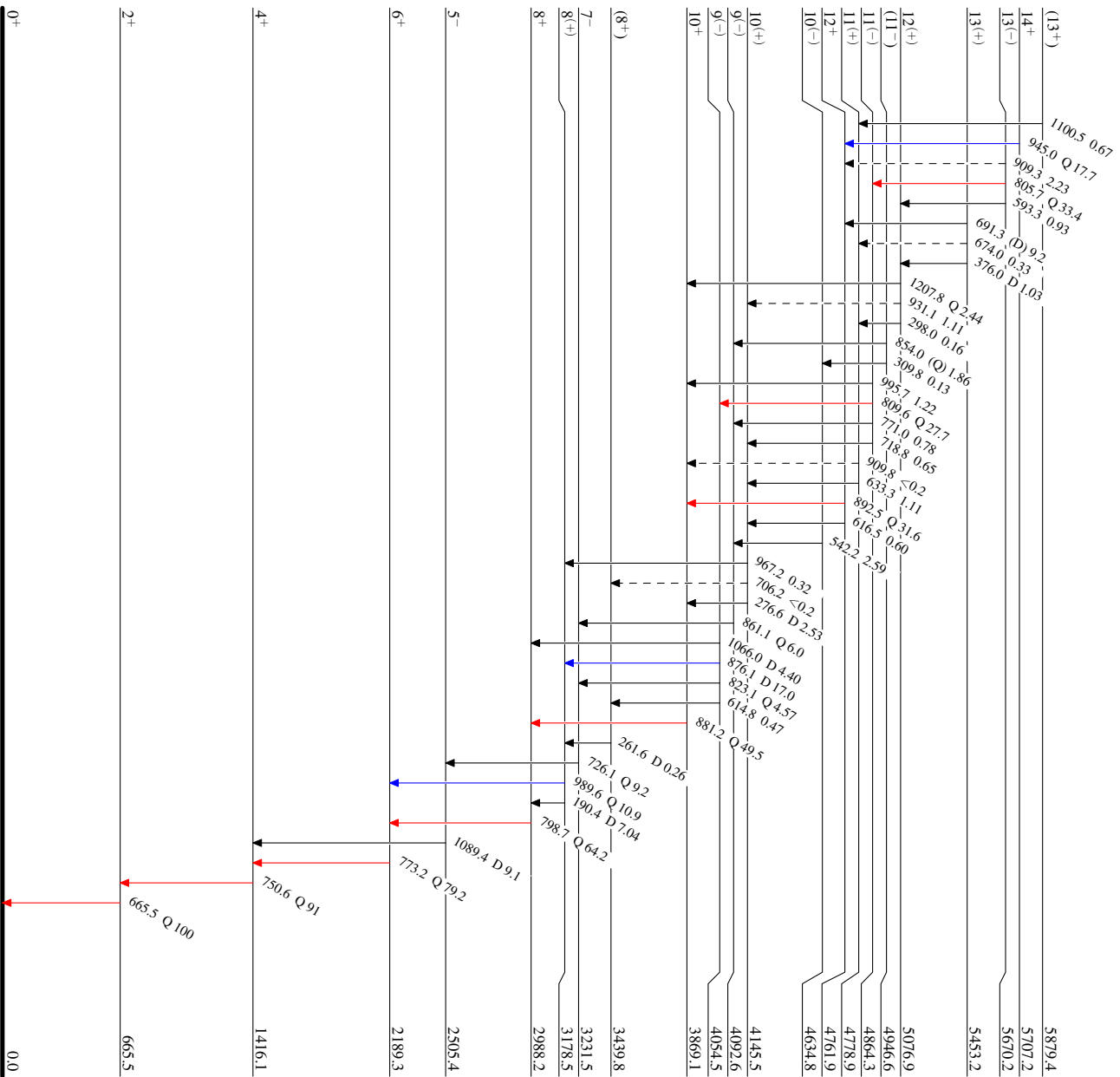
⁴⁶Ti(⁵⁸Ni,4p)_γ 2000APZY

Level Scheme (continued)

Intensities: Relative I_γ

Legend

- I_γ < 2% × I_{max}
- I_γ < 10% × I_{max}
- I_γ > 10% × I_{max}
- - - γ Decay (Uncertain)



$^{46}\text{Ti}(^{58}\text{Ni},4p\gamma)$ 2000ApZY