^{96}Ru(^{40}Ca,2pnγ) 1999Pa46

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Yu. Khazov and A. Rodionov, F. G. Kondev	NDS 112, 855 (2011)	31-Oct-2010

1991Re03 (1991ReZY): ^{96}Ru(^{40}Ca,2pn), E=180 MeV; measured γγ, nγ, nγ, recoil-γ, n-recoil-γ coin.^{133}Sm; deduced levels, Jp, rotational band structure, configuration. POLYTESSA array, 10 Compton-suppressed detectors.

1999Pa46: ^{96}Ru(^{40}Ca,2pn), E=180 MeV; measured Eγ, Iγ, γγ- and (charged particle)γ-coin., γγ(θ)(DCO). ^{133}Sm; deduced high-spin levels, J, π, B(M1)/B(E2), configurations, deformation. Cranked mean field calculations. Tandem, the 8π spectrometer array of 20 Compton-suppressed HPGe detectors, a 70-element BGO inner ball, and a CsI detector array for charged particle detection.

Other: 1989Wa20.

The ^{133}Sm level scheme was built on the basis of γγ coin., DCO values analysis and calculations. Rotational structures were determined by examination of their dynamic moments of inertia and alignment gains (1999Pa46 and 1991Re03).

^{133}Sm Levels

E(level)[†]	Jπ[‡]	$T_{1/2}$	Comments
0.0[&]	(5/2+)	2.89 s 16	%ε+%β+=100; %εp>0
139.7[a] 6	(7/2+)		
314.7[&] 6	(9/2+)		
523.8[a] 6	(11/2+)		
762.9[&] 6	(13/2+)		
1032.0[a] 6	(15/2+)		
1326.4[&] 6	(17/2+)		
1640.4[a] 6	(19/2+)		
1976.0[&] 6	(21/2+)		
2326.2[a] 6	(23/2+)		
2692.1[&] 7	(25/2+)		
3064.4[a] 7	(27/2+)		
3429.5[&] 8	(29/2+)		
0.0+y[d]	(1/2−)	3.5 s 4	%ε+%β+<100; %IT=?; %εp=? Additional information 1. $T_{1/2}$: from Adopted Levels.
91.40+y[d] 20	(5/2−)		
290.5+y[d] 6	(9/2−)		
603.6+y[d] 8	(13/2−)		
1033.7+y[d] 8	(17/2−)		
1577.8+y[d] 8	(21/2−)		
2228.9+y[d] 9	(25/2−)		
2980.0+y[d] 10	(29/2−)		
3826.1+y[d] 11	(33/2−)		
4753.2+y[d] 11	(37/2−)		
5757.3+y[d] 13	(41/2−)		
0.0+z[#]	(7/2−)		Additional information 2.
101.3+z[@] 3	(9/2−)		
246.3+z[#] 3	(11/2−)		
436.7+z[@] 4	(13/2−)		
648.2+z[#] 4	(15/2−)		
900.5+z[@] 5	(17/2−)		
1154.4+z[#] 5	(19/2−)		

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^{96}Ru(^{40}Ca,2pnγ) 1999Pa46 (continued)

^{133}Sm Levels (continued)

E(level)[†]	J^{π}[‡]	Comments
1448.6+z[@] *5*	(21/2$^-$)	
1741.4+z[#] *5*	(23/2$^-$)	
2071.8+z[@] *5*	(25/2$^-$)	
2403.6+z[#] *6*	(27/2$^-$)	
2772.7+z[@] *6*	(29/2$^-$)	
3142.8+z[#] *7*	(31/2$^-$)	
3550.8+z[@] *6*	(33/2$^-$)	
3956.9+z[#] *7*	(35/2$^-$)	
4397.9+z[@] *8*	(37/2$^-$)	
4840.0+z[#] *9*	(39/2$^-$)	
5785.1+z[#] *11*	(43/2$^-$)	
0.0+u		Additional information 3.
80.9+u[c] *7*	(1/2$^+$)	
96.90+u[b] *10*	(3/2$^+$)	
231.02+u[c] *15*	(5/2$^+$)	
268.5+u[b] *5*	(7/2$^+$)	
491.1+u[c] *5*	(9/2$^+$)	
544.7+u[b] *7*	(11/2$^+$)	
843.2+u[c] *6*	(13/2$^+$)	
910.9+u[b] *7*	(15/2$^+$)	
1278.7+u[c] *7*	(17/2$^+$)	
1365.5+u[b] *9*	(19/2$^+$)	
1801.5+u[c] *8*	(21/2$^+$)	
1910.8+u[b] *10*	(23/2$^+$)	
2402.7+u[c] *9*	(25/2$^+$)	
2544.0+u[b] *11*	(27/2$^+$)	
3065.8+u[c] *9*	(29/2$^+$)	
3267.1+u[b] *11*	(31/2$^+$)	
3760.5+u[c] *10*	(33/2$^+$)	
4077.4+u[b] *12*	(35/2$^+$)	
4499.6+u[c] *11*	(37/2$^+$)	
4973.5+u[b] *15*	(39/2$^+$)	
5294.0+u[c] *12*	(41/2$^+$)	
5945.4+u[b] *17*	(43/2$^+$)	
7001.5+u?[b] *17*	(47/2$^+$)	

[†] From a least-squares fit to Eγ′s. Band assignment is from 1999Pa46.

[‡] On the basis of DCO measurements of 1999Pa46 and systematics.

[#] Band(A): 1-qp band based on the (7/2$^-$) state at 0.0+Z-keV, α=−1/2; possible configuration=ν7/2[523] ($h_{11/2}$).

[@] Band(a): 1-qp band based on the (9/2$^-$) state at 101.3+Z-keV, α=+1/2; possible configuration=ν7/2[523] ($h_{11/2}$).

[&] Band(B): 1-qp band based on the (5/2$^+$) g.s., α=+1/2; possible configuration=ν5/2[402] ($d_{5/2}$).

[a] Band(b): 1-qp band based on the (7/2$^+$) state at 139.7-keV, α=−1/2; possible configuration=ν5/2[402] ($d_{5/2}$).

[b] Band(C): 1-qp band based on the (1/2$^+$) state at 80.9+U-keV, α=+1/2; possible configuration=ν1/2[411] ($d_{3/2}$) which at high-spin may be crossed by the ν1/2[660] orbital. Probable highly-deformed band.

[c] Band(c): 1-qp band based on the (3/2$^+$) state at 96.90+U-keV, α=−1/2; possible configuration=ν1/2[411] ($d_{3/2}$) which at

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^{96}Ru(^{40}Ca,2pnγ) 1999Pa46 (continued)

^{133}Sm Levels (continued)

high-spin may be crossed by the ν1/2[660] orbital. Probable highly-deformed band.
[d] Band(D): 1-qp band based on the (1/2⁻) state at 0.0+Y-keV, possible configuration=ν1/2[541] ($h_{9/2}$), decoupled band.

γ(^{133}Sm)

When gating on stretched quadrupole transitions, DCO values are equal to ≈1.5 for known stretched quadrupole (E2) γ rays, while for known stretched dipole γ rays, the values are ≈0.75 (1999Pa46).

E_γ[†]	I_γ[‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[@]	Comments
91.4 *2*	34[#] *10*	91.40+y	(5/2⁻)	0.0+y	(1/2⁻)		
96.9 *1*	12[#] *9*	96.90+u	(3/2⁺)	0.0+u			
102.1 *5*	85[#] *15*	101.3+z	(9/2⁻)	0.0+z	(7/2⁻)		
134.1 *1*	18[#] *5*	231.02+u	(5/2⁺)	96.90+u	(3/2⁺)	D	DCO=0.79 *10*.
139.1 *8*	75 *7*	139.7	(7/2⁺)	0.0	(5/2⁺)	D	DCO=0.72 *2*.
145.0 *1*	100	246.3+z	(11/2⁻)	101.3+z	(9/2⁻)	D	DCO=0.70 *3*.
150.1 *6*	14[#] *7*	231.02+u	(5/2⁺)	80.9+u	(1/2⁺)	E2	DCO=1.60 *7*.
172.1 *5*	76 *7*	268.5+u	(7/2⁺)	96.90+u	(3/2⁺)	E2	DCO=1.61 *9*.
175.1 *2*	40 *6*	314.7	(9/2⁺)	139.7	(7/2⁺)		DCO=0.81 *8*.
190.9 *4*	51 *4*	436.7+z	(13/2⁻)	246.3+z	(11/2⁻)	D	DCO=0.81 *7*.
199.1 *5*	79 *7*	290.5+y	(9/2⁻)	91.40+y	(5/2⁻)	E2	DCO=1.68 *3*.
209.1 *1*	50[#] *7*	523.8	(11/2⁺)	314.7	(9/2⁺)	D	DCO=0.66 *7*.
211.1 *4*	49 *8*	648.2+z	(15/2⁻)	436.7+z	(13/2⁻)	D	DCO=0.65 *9*.
223.1 *5*	14[#] *8*	491.1+u	(9/2⁺)	268.5+u	(7/2⁺)	D	DCO=0.87 *3*.
239.1 *1*	24 *5*	762.9	(13/2⁺)	523.8	(11/2⁺)	D	DCO=0.75 *7*.
246.0 *3*	84 *6*	246.3+z	(11/2⁻)	0.0+z	(7/2⁻)	E2	DCO=1.46 *13*.
251.7 *5*	22 *6*	900.5+z	(17/2⁻)	648.2+z	(15/2⁻)		
255.5 *7*	21 *6*	1154.4+z	(19/2⁻)	900.5+z	(17/2⁻)		
259.1 *7*	35[#] *6*	491.1+u	(9/2⁺)	231.02+u	(5/2⁺)	E2	DCO=1.67 *8*.
269.1 *3*	20 *6*	1032.0	(15/2⁺)	762.9	(13/2⁺)	D	DCO=0.76 *4*.
276.1 *8*	93 *5*	544.7+u	(11/2⁺)	268.5+u	(7/2⁺)	E2	DCO=1.63 *3*.
292.8 *2*	13 *3*	1741.4+z	(23/2⁻)	1448.6+z	(21/2⁻)		
294.1 *2*	15 *3*	1448.6+z	(21/2⁻)	1154.4+z	(19/2⁻)		
294.1 *3*	14 *4*	1326.4	(17/2⁺)	1032.0	(15/2⁺)	D	DCO=0.62 *8*.
298.6 *5*	11[#] *8*	843.2+u	(13/2⁺)	544.7+u	(11/2⁺)	D	DCO=0.65 *7*.
313.1 *5*	57 *6*	603.6+y	(13/2⁻)	290.5+y	(9/2⁻)	E2	DCO=1.55 *2*.
314.1 *6*	16[#] *8*	1640.4	(19/2⁺)	1326.4	(17/2⁺)	D	DCO=0.85 *9*.
315.1 *7*	73 *7*	314.7	(9/2⁺)	0.0	(5/2⁺)	E2	DCO=1.55 *9*.
330.4 *1*	12[#] *8*	2071.8+z	(25/2⁻)	1741.4+z	(23/2⁻)		
331.9 *8*	11[#] *7*	2403.6+z	(27/2⁻)	2071.8+z	(25/2⁻)		
334.8 *5*	61 *5*	436.7+z	(13/2⁻)	101.3+z	(9/2⁻)	E2	DCO=1.55 *3*.
335.1 *9*	10[#] *9*	1976.0	(21/2⁺)	1640.4	(19/2⁺)	D	DCO=0.67 *5*.
350.1 *1*	9[#] *7*	2326.2	(23/2⁺)	1976.0	(21/2⁺)	D	DCO=0.68 *12*.
352.1 *3*	28[#] *8*	843.2+u	(13/2⁺)	491.1+u	(9/2⁺)	E2	DCO=1.60 *5*.
365.4 *7*	7[#] *10*	3429.5	(29/2⁺)	3064.4	(27/2⁺)	D	DCO=0.79 *10*.
366.1 *3*	85 *8*	910.9+u	(15/2⁺)	544.7+u	(11/2⁺)	E2	DCO=1.42 *8*.
366.1 *5*	11[#] *7*	2692.1	(25/2⁺)	2326.2	(23/2⁺)	D	DCO=0.74 *7*.
367.7 *2*	9[#] *7*	1278.7+u	(17/2⁺)	910.9+u	(15/2⁺)	D	DCO=0.70 *8*.
369.1 *1*	8[#] *9*	2772.7+z	(29/2⁻)	2403.6+z	(27/2⁻)		
370.4 *4*	7[#] *8*	3142.8+z	(31/2⁻)	2772.7+z	(29/2⁻)		

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^{96}Ru(^{40}Ca,2pnγ) 1999Pa46 (continued)

γ(^{133}Sm) (continued)

E_γ [†]	I_γ [‡]	E_i(level)	J^π_i	E_f	J^π_f	Mult. [@]	Comments
373.3 8	8[#] 9	3064.4	(27/2+)	2692.1	(25/2+)	D	DCO=0.69 8.
384.1 1	35 6	523.8	(11/2+)	139.7	(7/2+)	E2	DCO=1.68 8.
401.7 5	64 8	648.2+z	(15/2−)	246.3+z	(11/2−)	E2	DCO=1.56 3.
430.1 2	76 8	1033.7+y	(17/2−)	603.6+y	(13/2−)	E2	DCO=1.81 4.
435.1[&] 6	6[#] 5	1801.5+u	(21/2+)	1365.5+u	(19/2+)	D	DCO=0.72 8.
436.1 8	22[#] 8	1278.7+u	(17/2+)	843.2+u	(13/2+)	E2	DCO=1.49 5.
449.1 5	47 5	762.9	(13/2+)	314.7	(9/2+)	E2	DCO=1.69 9.
454.6 6	68 7	1365.5+u	(19/2+)	910.9+u	(15/2+)	E2	DCO=1.56 5.
464.1 3	62 7	900.5+z	(17/2−)	436.7+z	(13/2−)	E2	DCO=1.65 5.
506.2 1	25[#] 5	1154.4+z	(19/2−)	648.2+z	(15/2−)	E2	DCO=1.55 17.
509.1 5	27 6	1032.0	(15/2+)	523.8	(11/2+)	E2	DCO=1.57 5.
522.8 4	17[#] 6	1801.5+u	(21/2+)	1278.7+u	(17/2+)	E2	DCO=1.45 9.
544.1 1	66 6	1577.8+y	(21/2−)	1033.7+y	(17/2−)	E2	DCO=1.69 3.
545.3 3	61 5	1910.8+u	(23/2+)	1365.5+u	(19/2+)	E2	DCO=1.67 6.
548.1 1	33 6	1448.6+z	(21/2−)	900.5+z	(17/2−)	E2	DCO=1.47 7.
563.1 3	41 6	1326.4	(17/2+)	762.9	(13/2+)	E2	DCO=1.59 8.
587.4 4	49 5	1741.4+z	(23/2−)	1154.4+z	(19/2−)	E2	DCO=1.65 7.
601.2 2	14[#] 8	2402.7+u	(25/2+)	1801.5+u	(21/2+)	E2	DCO=1.52 4.
608.4 1	26 5	1640.4	(19/2+)	1032.0	(15/2+)	E2	DCO=1.67 7.
623.1 2	36 6	2071.8+z	(25/2−)	1448.6+z	(21/2−)	E2	DCO=1.66 8.
633.2 4	51[#] 8	2544.0+u	(27/2+)	1910.8+u	(23/2+)	E2	DCO=1.37 9.
649.1 3	30 5	1976.0	(21/2+)	1326.4	(17/2+)	E2	DCO=1.67 7.
651.1 4	38 4	2228.9+y	(25/2−)	1577.8+y	(21/2−)	E2	DCO=1.41 7.
662.3 9	42 6	2403.6+z	(27/2−)	1741.4+z	(23/2−)	E2	DCO=1.36 9.
663.1 4	10 8	3065.8+u	(29/2+)	2402.7+u	(25/2+)	E2	DCO=1.68 3.
685.9 1	20[#] 9	2326.2	(23/2+)	1640.4	(19/2+)	E2	DCO=1.57 4.
694.7 2	8[#] 10	3760.5+u	(33/2+)	3065.8+u	(29/2+)	E2	DCO=1.68 2.
700.9 5	25 5	2772.7+z	(29/2−)	2071.8+z	(25/2−)	E2	DCO=1.47 14.
716.1 7	25[#] 10	2692.1	(25/2+)	1976.0	(21/2+)		
723.1 2	32 5	3267.1+u	(31/2+)	2544.0+u	(27/2+)	E2	DCO=1.65 6.
737.1 6	12[#] 11	3429.5	(29/2+)	2692.1	(25/2+)		
738.1 4	14[#] 12	3064.4	(27/2+)	2326.2	(23/2+)		
739.1 2	33 5	3142.8+z	(31/2−)	2403.6+z	(27/2−)	E2	DCO=1.56 2.
739.1 4	6[#] 7	4499.6+u	(37/2+)	3760.5+u	(33/2+)		
751.1 5	36[#] 8	2980.0+y	(29/2−)	2228.9+y	(25/2−)	E2	DCO=1.70 8.
778.1 1	21 5	3550.8+z	(33/2−)	2772.7+z	(29/2−)	E2	DCO=1.44 1.
794.4 6	7[#] 11	5294.0+u	(41/2+)	4499.6+u	(37/2+)		
810.3 6	28 6	4077.4+u	(35/2+)	3267.1+u	(31/2+)		
814.1 2	21 5	3956.9+z	(35/2−)	3142.8+z	(31/2−)		
846.1 3	25[#] 7	3826.1+y	(33/2−)	2980.0+y	(29/2−)	E2	DCO=1.49 3.
847.1 4	15 6	4397.9+z	(37/2−)	3550.8+z	(33/2−)		
883.1 5	10[#] 9	4840.0+z	(39/2−)	3956.9+z	(35/2−)		
896.1 8	20 6	4973.5+u	(39/2+)	4077.4+u	(35/2+)		
927.1 2	18[#] 10	4753.2+y	(37/2−)	3826.1+y	(33/2−)		
945.1 7	7[#] 11	5785.1+z	(43/2−)	4840.0+z	(39/2−)		
971.9 8	13[#] 9	5945.4+u	(43/2+)	4973.5+u	(39/2+)		
1004.1 7	13[#] 12	5757.3+y	(41/2−)	4753.2+y	(37/2−)		
1055.7[&] 5	5[#] 8	7001.5+u?	(47/2+)	5945.4+u	(43/2+)		

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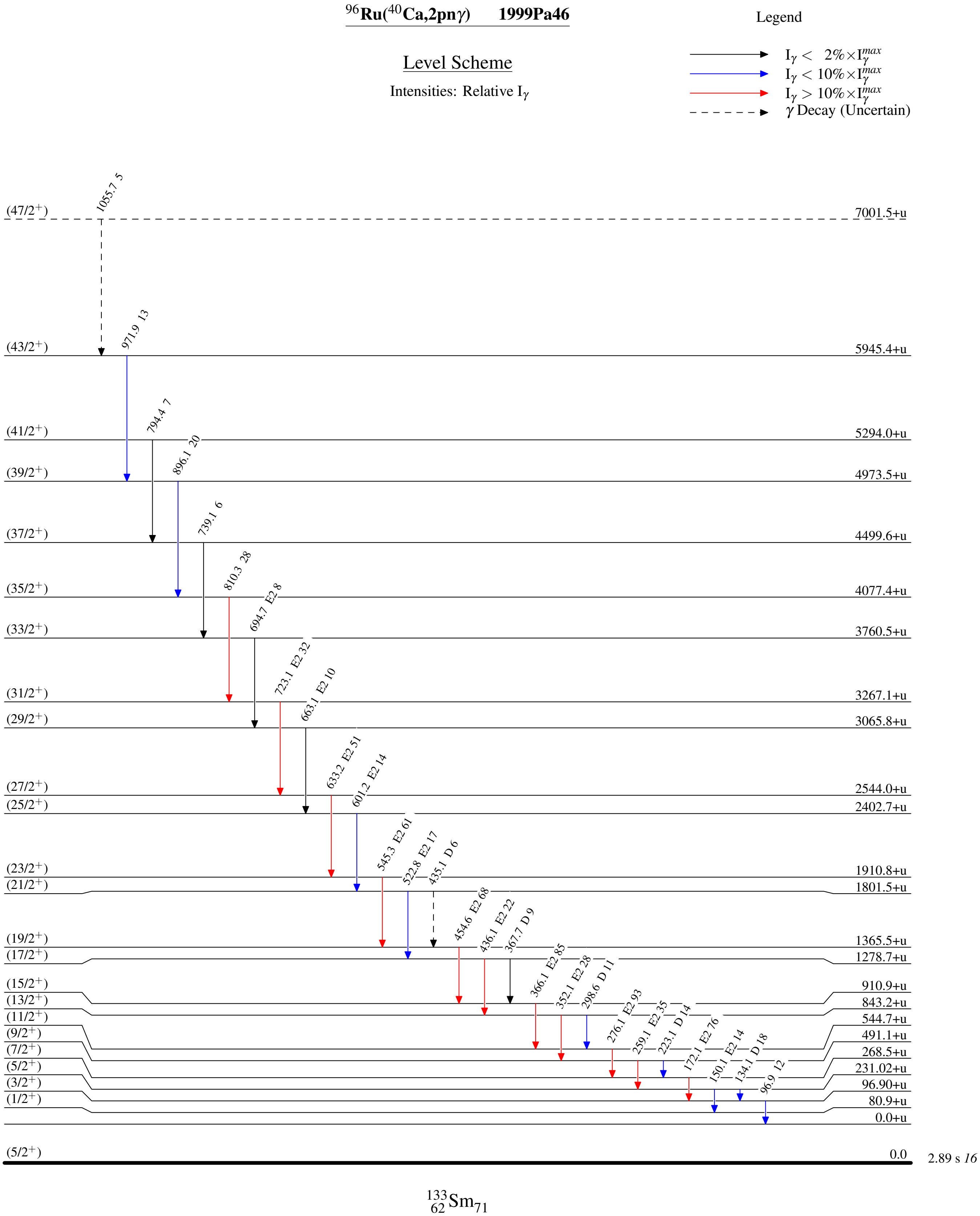
^{96}Ru(^{40}Ca,2pnγ) 1999Pa46 (continued)

γ(^{133}Sm) (continued)

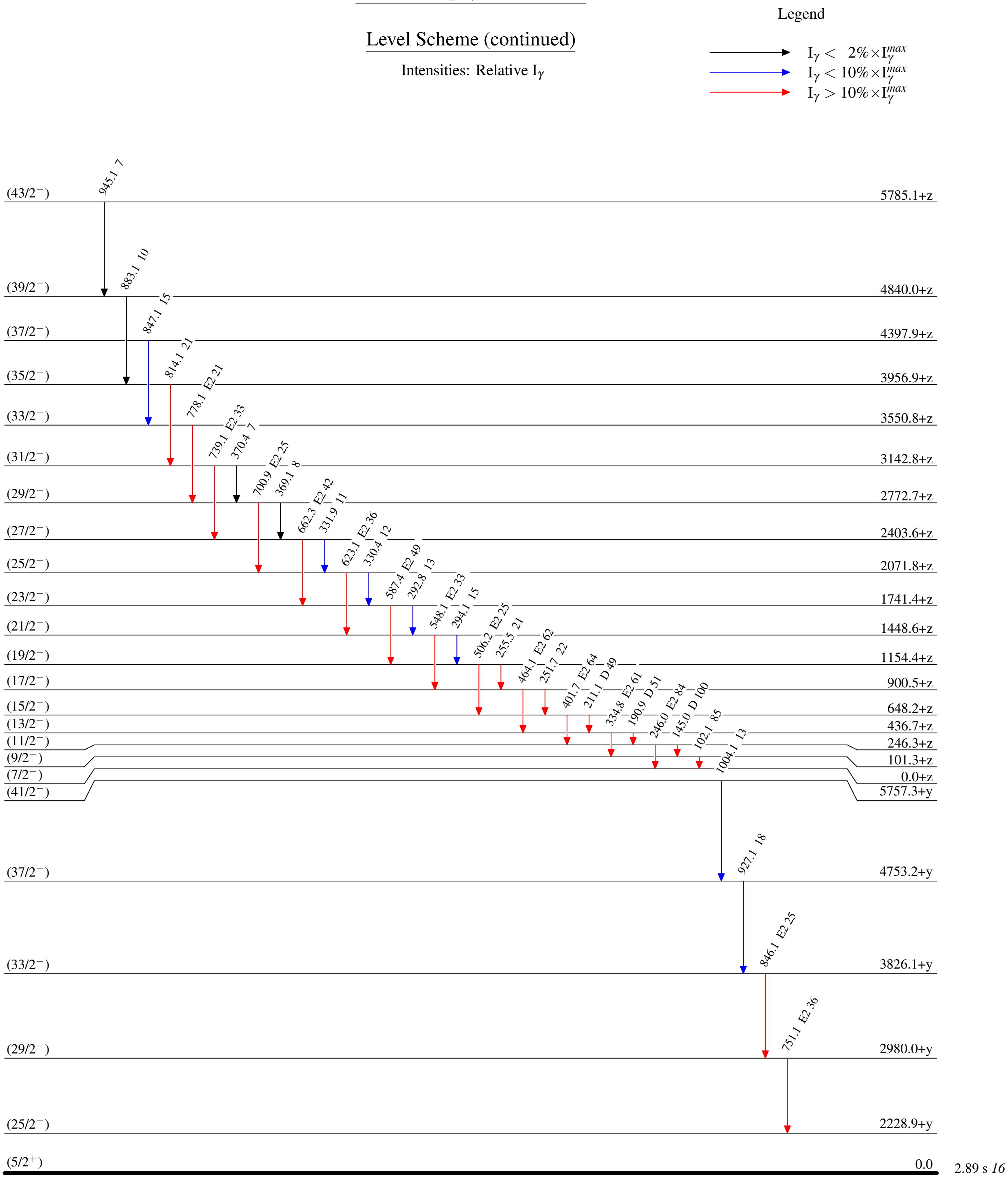
† Taken from 1999Pa46 which determined more complete level scheme; Eγ′s of 1991Re03 differ from Eγ′s of 1999Pa46 up to 3σ.
‡ Weighted average from 1996Pa46 and 1991Re03 when was available, except as noted.
# From 1999Pa46.
@ From DCO values, suggested by evaluators.
& Placement of transition in the level scheme is uncertain.


^{96}Ru(^{40}Ca,2pnγ) 1999Pa46
Level Scheme
Intensities: Relative I_γ
Legend
$I_\gamma < 2\% \times I_\gamma^{max}$
$I_\gamma < 10\% \times I_\gamma^{max}$
$I_\gamma > 10\% \times I_\gamma^{max}$
γ Decay (Uncertain)
(47/2+) 7001.5+u
1055.7 5
(43/2+) 5945.4+u
971.9 13
(41/2+) 5294.0+u
794.4 7
(39/2+) 4973.5+u
896.1 20
(37/2+) 4499.6+u
739.1 6
(35/2+) 4077.4+u
810.3 28
(33/2+) 3760.5+u
694.7 E2 8
(31/2+) 3267.1+u
723.1 E2 32
(29/2+) 3065.8+u
663.1 E2 10
(27/2+) 2544.0+u
633.2 E2 51
(25/2+) 2402.7+u
601.2 E2 14
(23/2+) 1910.8+u
545.3 E2 61
(21/2+) 1801.5+u
522.8 E2 17
435.1 D 6
(19/2+) 1365.5+u
454.6 E2 68
(17/2+) 1278.7+u
436.1 E2 22
367.7 D 9
(15/2+) 910.9+u
366.1 E2 85
(13/2+) 843.2+u
352.1 E2 28
298.6 D 11
(11/2+) 544.7+u
276.1 E2 93
(9/2+) 491.1+u
259.1 E2 35
223.1 D 14
(7/2+) 268.5+u
172.1 E2 76
(5/2+) 231.02+u
150.1 E2 14
(3/2+) 96.90+u
134.1 D 18
(1/2+) 80.9+u
96.9 12
0.0+u
(5/2+) 0.0 2.89 s 16
$^{133}_{62}Sm_{71}$

^{96}Ru(^{40}Ca,2pnγ) 1999Pa46

Level Scheme (continued)

Intensities: Relative I_γ

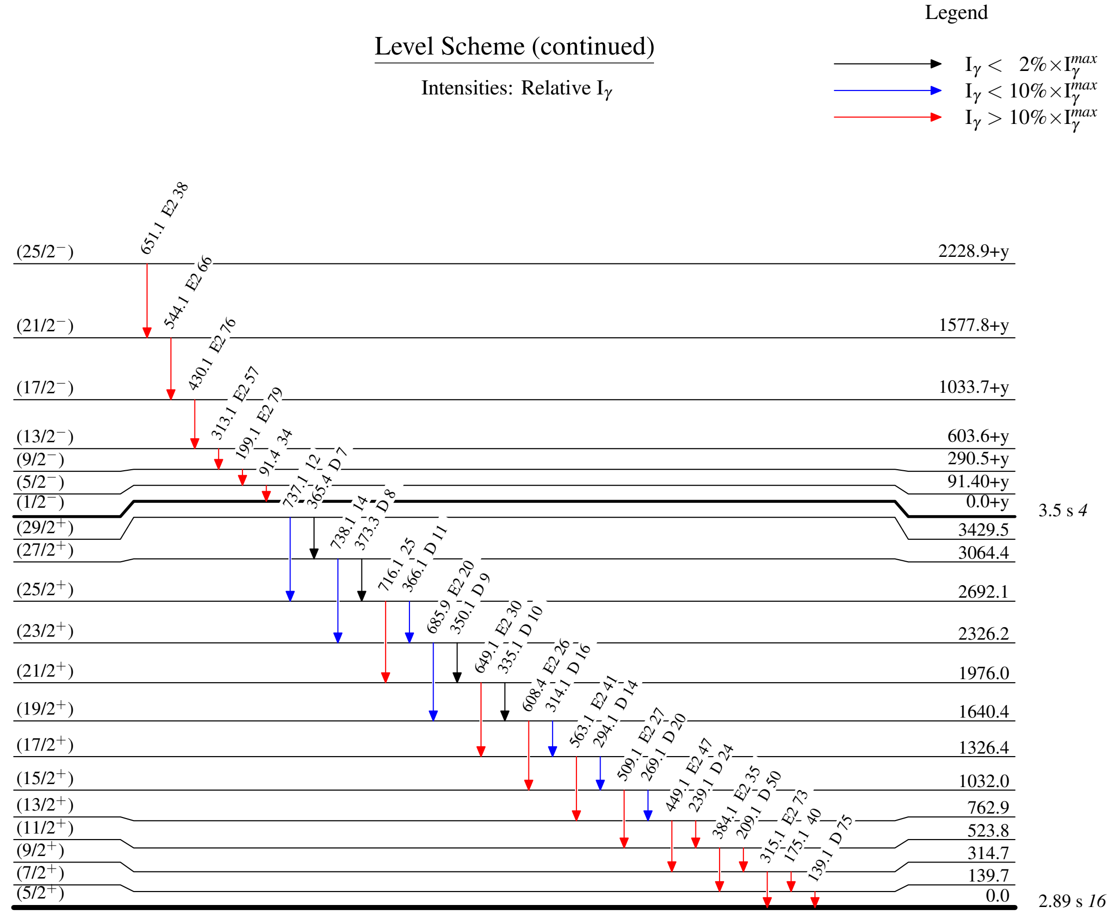


$^{133}_{62}Sm_{71}$

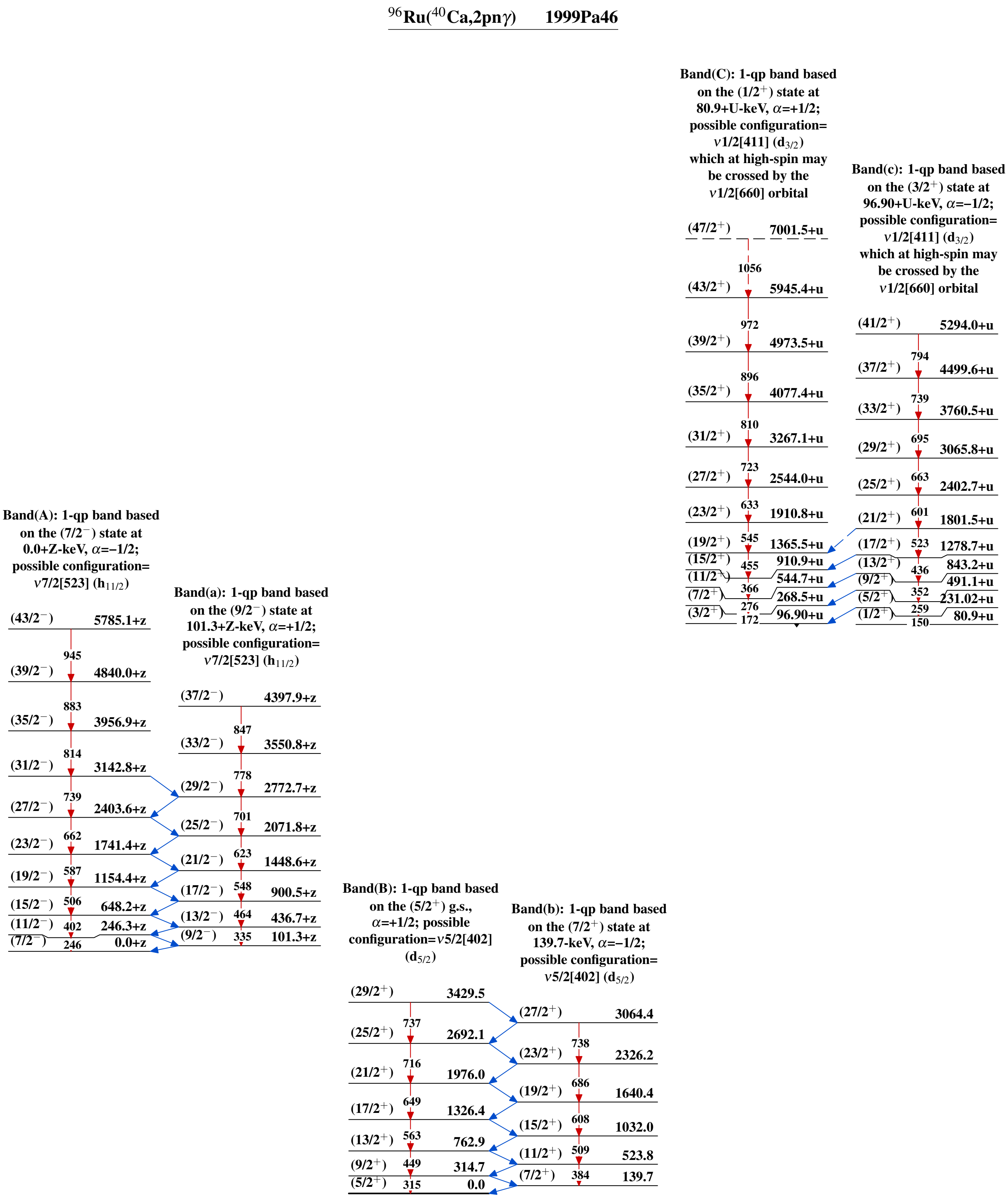
^{96}Ru(^{40}Ca,2pnγ) 1999Pa46

Level Scheme (continued)

Intensities: Relative I_γ



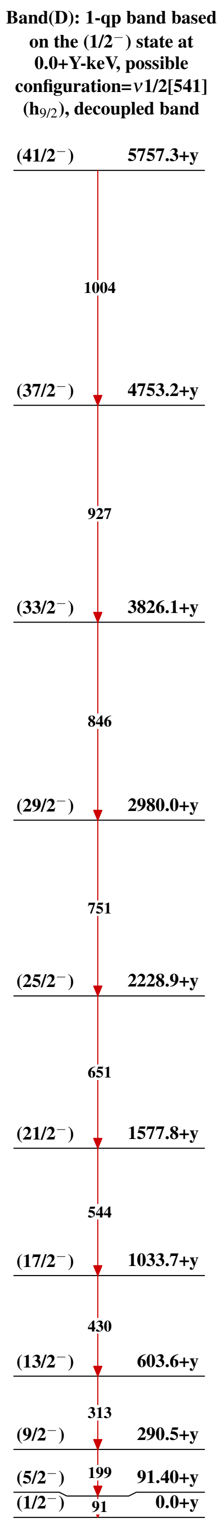
$^{133}_{62}Sm_{71}$



^{96}Ru(^{40}Ca,2pnγ) 1999Pa46
Band(C): 1-qp band based on the (1/2+) state at 80.9+U-keV, α=+1/2; possible configuration= ν1/2[411] (d3/2) which at high-spin may be crossed by the ν1/2[660] orbital
Band(c): 1-qp band based on the (3/2+) state at 96.90+U-keV, α=−1/2; possible configuration= ν1/2[411] (d3/2) which at high-spin may be crossed by the ν1/2[660] orbital
Band(A): 1-qp band based on the (7/2−) state at 0.0+Z-keV, α=−1/2; possible configuration= ν7/2[523] (h11/2)
Band(a): 1-qp band based on the (9/2−) state at 101.3+Z-keV, α=+1/2; possible configuration= ν7/2[523] (h11/2)
Band(B): 1-qp band based on the (5/2+) g.s., α=+1/2; possible configuration=ν5/2[402] (d5/2)
Band(b): 1-qp band based on the (7/2+) state at 139.7-keV, α=−1/2; possible configuration= ν5/2[402] (d5/2)
(47/2+) 7001.5+u
1056
(43/2+) 5945.4+u
972
(39/2+) 4973.5+u
896
(35/2+) 4077.4+u
810
(31/2+) 3267.1+u
723
(27/2+) 2544.0+u
633
(23/2+) 1910.8+u
545
(19/2+) 1365.5+u
455
(15/2+) 910.9+u
366
(11/2+) 544.7+u
276
(7/2+) 268.5+u
172
(3/2+) 96.90+u
(41/2+) 5294.0+u
794
(37/2+) 4499.6+u
739
(33/2+) 3760.5+u
695
(29/2+) 3065.8+u
663
(25/2+) 2402.7+u
601
(21/2+) 1801.5+u
523
(17/2+) 1278.7+u
436
(13/2+) 843.2+u
352
(9/2+) 491.1+u
259
(5/2+) 231.02+u
150
(1/2+) 80.9+u
(43/2−) 5785.1+z
945
(39/2−) 4840.0+z
883
(35/2−) 3956.9+z
814
(31/2−) 3142.8+z
739
(27/2−) 2403.6+z
662
(23/2−) 1741.4+z
587
(19/2−) 1154.4+z
506
(15/2−) 648.2+z
402
(11/2−) 246.3+z
246
(7/2−) 0.0+z
(37/2−) 4397.9+z
847
(33/2−) 3550.8+z
778
(29/2−) 2772.7+z
701
(25/2−) 2071.8+z
623
(21/2−) 1448.6+z
548
(17/2−) 900.5+z
464
(13/2−) 436.7+z
335
(9/2−) 101.3+z
(29/2+) 3429.5
737
(25/2+) 2692.1
716
(21/2+) 1976.0
649
(17/2+) 1326.4
563
(13/2+) 762.9
449
(9/2+) 314.7
315
(5/2+) 0.0
(27/2+) 3064.4
738
(23/2+) 2326.2
686
(19/2+) 1640.4
608
(15/2+) 1032.0
509
(11/2+) 523.8
384
(7/2+) 139.7

$^{133}_{62}Sm_{71}$

^{96}Ru(^{40}Ca,2pnγ) 1999Pa46 (continued)



$^{133}_{62}Sm_{71}$