Coulomb excitation 1999Wi11

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	C. D. Nesaraja	NDS 146, 387 (2017)	31-Aug-2017

1999Wi11, 1998WiZY (both references are from the same group and experiment): ^{244}Pu(^{208}Pb,^{208}Pb′γ), E(^{208}Pb)=1300 MeV. ^{244}Pu was bombarded with the ^{208}Pb beam at ATLAS. The 300 μg/cm^2 target was electroplated onto a thick Au foil to stop the Pu recoils and the beam. Measured triple and quadrupole γ-coincidences using the Gammasphere array comprised of 101 Compton suppressed Ge detectors. Backbending in the yrast band was observed revealing a $\pi i_{13/2}$ alignment. The role of octupole correlations were investigated in Pu isotopes. Comparison of the g.s alignment and octupole rotational bands were made. Branching ratios for the E1 transitions linking the negative parity band to the yrast band were analyzed. Energy staggering between odd-spin, negative parity and even-spin, positive parity bands were compared.

1983Sp03: ^{244}Pu(^{208}Pb,^{208}Pb′γ), E(^{208}Pb)=1061 MeV, 1102 MeV. 0.25 μg/cm^2 ^{244}Pu bombarded with ^{208}Pb beam. Gammas measured in three Ge detectors located at θ=30° and ±150° relative to the beam and two NaI detectors. Pb recoils were detected in two position-sensitive avalanche detectors, covering an angular range of 17°≤θ ≤58° and −52°≥θ≥ −88°, respectively. Measured γ-Pb recoil coincidences that were corrected for large Doppler shift. Deduced J^π.

1973Be44, 1974Mc15, 1971Fo17: ^{244}Pu(α,α'), E(α)=17 MeV ^{4}He ions from the EN tandem Van de Graaf at Oak Ridge National Laboratory bombarded a 20-30 μg/cm^2 ^{244}Pu target. Elastic and in elastically scattered ions were observed at θ_{lab}=150° using the Enge split-pole magnetic spectrometer equipped with a position-sensitive proportional detector at the focal plane with FWHM=15 keV. Determined E2 and E4 from the experimental excitation probabilities of the 0^+, 2^+, and 4^+ states in the g.s rotational band. Extracted deformation parameters from reduced transition probabilities (see also 1977Mi11).

Other: 1999Cl07 (Collective modes studied by Coulomb Excitation).

Quadrupole and hexadecapole deformations were calculated from experimental B(E2) and B(E4) values by 1973Be44 and 1977Mi11.

Backbending in the Yrast band was observed by 1983Sp03 and 1999Wi11 at $J^\pi=22^+$. It was interpreted as due to $i_{13/2}$ proton alignment under the influence of the Coriolis force. See 1983Sp03, 1999Wi11, and 1999Cl07 for discussions.

^{244}Pu Levels

E(level)[†]	J^π[‡]	$T_{1/2}$	Comments
0.0[@]	0^+		
44.2[@] *4*	2^+	158 ps *11*	B(E2)↑=13.61 *18* (1973Be44) Additional information 1. E(level): From Adopted Levels. Other measurement: B(E2)=13.83 *37* (1971Fo17). Quadrupole moment was obtained from B(E2) measurements: Q(20)=11.79 *16* (1971Fo17). $T_{1/2}$: From B(E2) for α=7.8×10^2 *3* (α calculated from BrICC).
149.9[@] *6*	4^+		B(E4)↑=0.09 *+55−9* (1973Be44) Additional information 2. E(level): From Adopted Levels.
313.0[@] *5*	6^+[#]		
530.2[@] *7*	8^+[#]		
708 *4*	$(2^+,3^-)$		E(level): From 1974Mc15. B(E2)=0.045 *13* if $J^\pi=2^+$; B(E3)=0.30 *10* if $J^\pi=3^-$ (1974Mc15).
797.8[@] *8*	10^+[#]		
960[&] *4*	3^-		E(level): From 1974Mc15. B(E3)=0.37 *7*, if $J^\pi=3^-$. However, if $J^\pi=2^+$, then B(E2)=0.059 *13* (1974Mc15).
1020 *4*	(2^+)		E(level): From 1974Mc15. B(E2)=0.195 *18* if $J^\pi=2^+$; However if $J^\pi=3^-$, then B(E3)=1.16 *12* (1974Mc15).
1111 *4*	(3^-)		E(level): From 1974Mc15. B(E3)=0.59 *10*, if $J^\pi=3^-$; However if $J^\pi=2^+$, then B(E2)=0.104 *18*(1974Mc15).
1111.4[@] *9*	12^+[#]		
1201.5[&] *8*	7^-		
1390.5[&] *8*	9^-		

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Coulomb excitation 1999Wi11 (continued)

^{244}Pu Levels (continued)

E(level)†	Jπ‡	E(level)†	Jπ‡	E(level)†	Jπ‡	E(level)†	Jπ‡
1466.7@ *10*	14^{+}#	2284.5@ *11*	18^{+}#	3360.0& *13*	21^{-}	4606.1@ *17*	28^{+}
1623.3& *9*	11^{-}	2567.8& *10*	17^{-}	3686.3@ *14*	24^{+}	4690.2& *20*	27^{-}
1859.2@ *10*	16^{+}#	2737.9@ *12*	20^{+}#	3784.0& *15*	23^{-}	5085.7@ *20*	30^{+}
1898.9& *9*	13^{-}	2952.2& *12*	19^{-}	4145.2@ *15*	26^{+}#	5589.6@ *22*	32^{+}
2214.9& *10*	15^{-}	3211.0@ *13*	22^{+}	4227.2& *17*	25^{-}	6119.7@ *24*	34^{+}

† From least-squares fit to Eγ data by the evaluator, except as noted. E=44.2 keV, and 149.9 keV have been held fixed during the the least-squares fit.
‡ From band structure.
# In addition to the band structure arguments, J^{π} for levels observed by 1983Sp03 are from systematic impact-parameter dependence of the γ-ray yields, the particle-γ directional correlation, and the γ-multiplicity measurements.
@ Band(A): K=0 Ground-state band.
& Band(B): Octupole band.

γ(^{244}Pu)

E_γ†	E_i(level)	J_i^π	E_f	J_f^π	Comments
(44.2 *4*)	44.2	2^{+}	0.0	0^{+}	E_γ: Gamma was not observed; energy is deduced from level energy difference.
(105.7 *7*)	149.9	4^{+}	44.2	2^{+}	E_γ: Gamma was not observed; energy is deduced from level energy difference.
163.1 *5*	313.0	6^{+}	149.9	4^{+}	E_γ: 162.4 *4* was measured by 1983Sp03.
189.0 *5*	1390.5	9^{-}	1201.5	7^{-}	
217.2 *5*	530.2	8^{+}	313.0	6^{+}	E_γ: 216.4 *4* was measured by 1983Sp03.
233.1 *5*	1623.3	11^{-}	1390.5	9^{-}	
267.4 *5*	797.8	10^{+}	530.2	8^{+}	E_γ: 266.5 *6* was measured by 1983Sp03.
275.6 *5*	1898.9	13^{-}	1623.3	11^{-}	
283.3 *5*	2567.8	17^{-}	2284.5	18^{+}	
313.5 *5*	1111.4	12^{+}	797.8	10^{+}	E_γ: 312.4 *8* was measured by 1983Sp03.
316.1 *5*	2214.9	15^{-}	1898.9	13^{-}	
353.1 *5*	2567.8	17^{-}	2214.9	15^{-}	
355.1 *5*	1466.7	14^{+}	1111.4	12^{+}	E_γ: 353.7 *10* was measured by 1983Sp03.
355.9 *5*	2214.9	15^{-}	1859.2	16^{+}	
384.4 *5*	2952.2	19^{-}	2567.8	17^{-}	
392.5 *5*	1859.2	16^{+}	1466.7	14^{+}	E_γ: 391.0 *11* was measured by 1983Sp03.
407.8 *5*	3360.0	21^{-}	2952.2	19^{-}	
424.0 *8*	3784.0	23^{-}	3360.0	21^{-}	
425.3 *5*	2284.5	18^{+}	1859.2	16^{+}	E_γ: 423.8 *12* was measured by 1983Sp03.
432.1 *5*	1898.9	13^{-}	1466.7	14^{+}	
443.2 *8*	4227.2	25^{-}	3784.0	23^{-}	
453.4 *5*	2737.9	20^{+}	2284.5	18^{+}	E_γ: 451.5 *14* was measured by 1983Sp03.
458.9 *5*	4145.2	26^{+}	3686.3	24^{+}	E_γ: 457.7 *14* was measured by 1983Sp03.
460.9 *8*	4606.1	28^{+}	4145.2	26^{+}	
463.0 *10*	4690.2	27^{-}	4227.2	25^{-}	
473.1 *5*	3211.0	22^{+}	2737.9	20^{+}	E_γ: 473.1 keV and 475.3 keV gammas could not be resolved in the spectrum taken by 1983Sp03, and Eγ=472.0 25 was listed for the doublet.
475.3 *5*	3686.3	24^{+}	3211.0	22^{+}	E_γ: 473.1 keV and 475.3 keV gammas could not be resolved in the spectrum taken by 1983Sp03, and Eγ=472.0 25 was listed for the doublet.
479.6 *10*	5085.7	30^{+}	4606.1	28^{+}	
503.9 *10*	5589.6	32^{+}	5085.7	30^{+}	
511.8 *5*	1623.3	11^{-}	1111.4	12^{+}	
530.1 *10*	6119.7	34^{+}	5589.6	32^{+}	

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Coulomb excitation 1999Wi11 (continued)

$\gamma(^{244}Pu)$ (continued)

E_γ †	E_i(level)	J_i^π	E_f	J_f^π	E_γ †	E_i(level)	J_i^π	E_f	J_f^π
592.9 *5*	1390.5	9^-	797.8	10^+	787.7 *5*	1898.9	13^-	1111.4	12^+
671.3 *5*	1201.5	7^-	530.2	8^+	825.4 *5*	1623.3	11^-	797.8	10^+
708.6 *5*	2567.8	17^-	1859.2	16^+	860.5 *5*	1390.5	9^-	530.2	8^+
747.9 *5*	2214.9	15^-	1466.7	14^+					

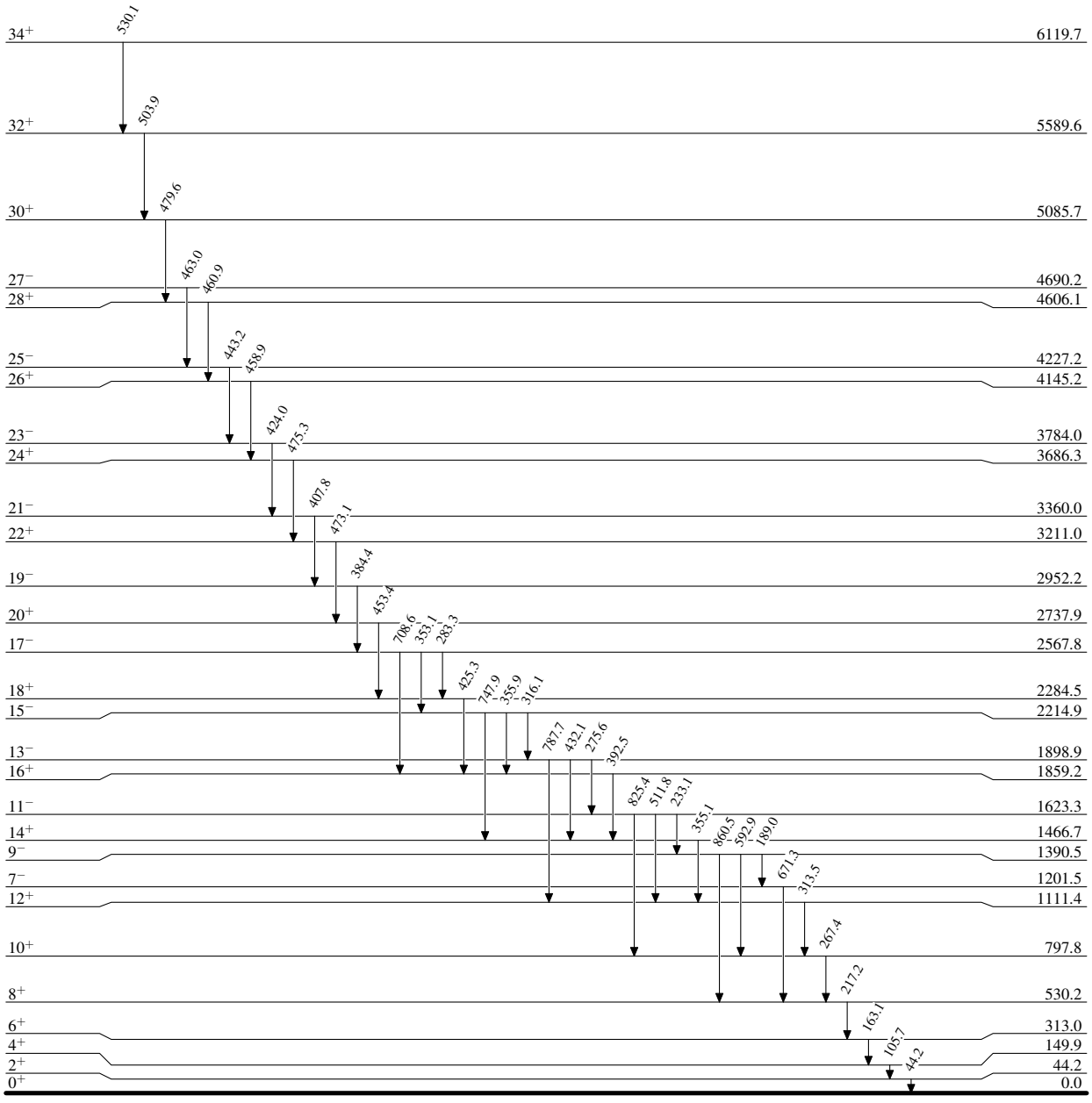
† Measurements by the authors of 1999Wi11, except as noted. The gamma energies were not listed in paper; they were provided by R.V.F. Janssens (Priv. Comm: 2016JaZZ). Uncertainties were provided by Janssens: were of the order of 0.5 keV for the strong transitions (up to 26^+ and 21^-) and 0.8-1 keV higher up in the bands. See also 1998WiZY where the transitions in the positive band are indicated on a coincidence spectrum. Earlier measurements by 1983Sp03 are also given for comparison. The transitions de exciting levels above the 26^+ state of the g.s. band and the transitions de exciting the negative parity states were seen by 1999Wi11 only.

Legend

Coulomb excitation 1999Wi11

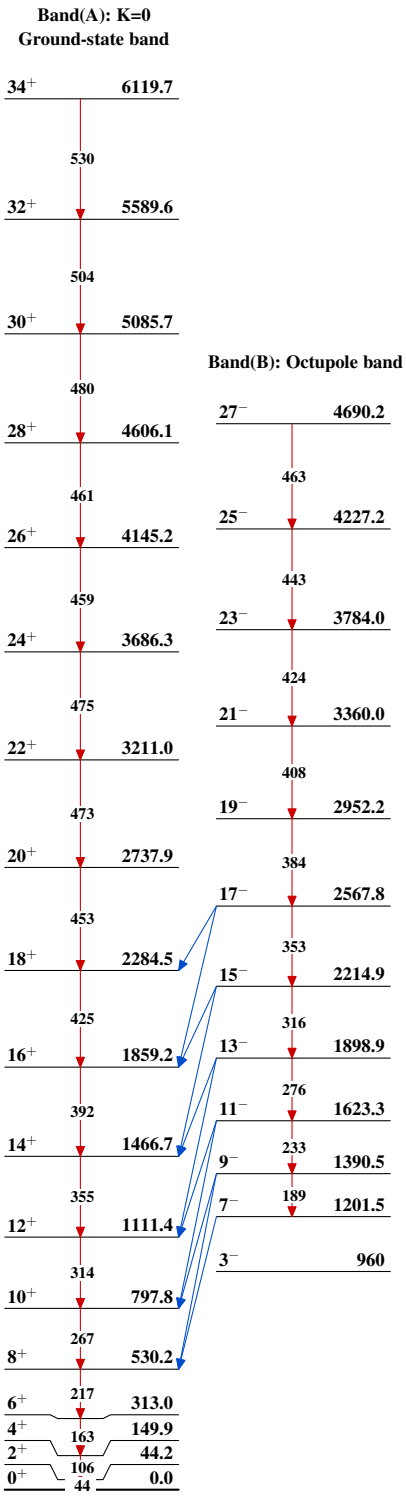
Level Scheme

γ Decay (Uncertain)



$^{244}_{94}Pu_{150}$

Coulomb excitation 1999Wi11



$^{244}_{94}Pu_{150}$