^{254}No IT decay (265 ms) 2010Cl01,2010He10,2006He19

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh	NDS 156, 1 (2019)	31-Jan-2019

Parent: ^{254}No: E=1296 *2*; $J^{\pi}=(8^-)$; $T_{1/2}$=265 ms *2*; %IT decay=100.0

2010Cl01: ^{208}Pb(^{48}Ca,2nγ),E=221 MeV. The ^{48}Ca beam obtained from the 88-Inch Cyclotron of LBNL. Target=isotopically enriched ^{208}Pb, two ≈0.4 μg/cm^2 thick foils on a 35 μg/cm^2 carbon backing. The evaporated residues were separated using BGS and passed through multiwire proportional counter (MWPC) before being implanted in a 1 mm thick 16 by 16 double-sided silicon strip detector (DSSD) with an active area of 5 by 5 cm. A single, four-fold segmented HPGe Clover detector mounted behind the DSSD was used for γ detection. Measured Eγ, Iγ, ce, (recoils)γ-coin, (recoils)(ce)-coin, γ(ce)(t), γ(ce)(ce)(t), Eα, Iα, half-life of isomer.

2010He10: ^{208}Pb(^{48}Ca,2nγ),E=213.6,218.4 MeV. The ^{48}Ca beam obtained from the UNILAC of GSI. Target=isotopically enriched, ^{208}PbS, 450 μg/cm^2 thick backed on 40 μg/cm^2 Carbon substrate and covered with a 10 μg/cm^2 carbon layer. The evaporated residues were separated using SHIP and implanted in Si PIPS detector. The α particles and fission fragments were detected with six Si detectors surrounding the PIPS. The γ-rays were detected using Ge clover detector surrounding the SHIP separator. Measured Eγ, Iγ, $\gamma\gamma$, γ(ce)-coin, (particle)γ(t), fission and α decay branches. Ph.D. thesis by B. Sulignano, Johannes Gutenberg-University Mainz (2007) also describes the experiment at GSI, and tabulates γ-ray energies emitted by the decay of both the isomers.

2006He19 (also 2007Gr17, 2005Gr36, 2010Ju02): E=219 MeV. The fragments were separated from the beam using the gas-filled recoil separator RITU at Jyvaskyla facility. The fragments were implanted in a double-sided position sensitive Si detector DSSD at the GREAT spectrometer. Measured Eγ, Iγ, $\gamma\gamma$, γ(ce) coin with the GREAT spectrometer consisting of a double-sided position sensitive Si detector, a large segmented planar Ge detector and a large Clover Ge detector. In addition to the ground band up to 24^+, levels of $K^{\pi}=3^+$ band, and two high-spin isomers discovered. Ph.D. thesis by M. Venhart, Comenius University, Bratislava (2008) also describes the experiment at Jyvaskyla, and tabulates γ-ray energies emitted by the decay of both the isomers.

2006Ta19 (also 2010Se10): E=217 MeV. Measured Eγ, level lifetimes using Fragment Mass Analyzer to isolate residues of ^{254}No, which were later implanted into a double-sided Si strip detector. The γ rays were detected with three large Clover Ge detectors. Isomers identified through time and spatial correlations of electron signals and implanted ^{254}No nuclides. The isomer decay is expected to populate a rotational band in which most transitions will be highly converted. Comparison of experimental and theoretical 2-quasiparticle level energies. Identification of $K^{\pi}=8^-$, 266 ms and (14^+), 171 μs isomers in ^{254}No. The $K^{\pi}=(3^+)$ band extended.

2003Bu23 (also 2002Bu28): isomer half-life measured as ≈0.3 s from decay curve for conversion electrons. High-K value was proposed for the isomer state, with expected rotational band built on it.

1989La07, 1988Tu07: found no evidence for %SF decay mode.

1973Gh03: in ^{249}Cf(^{12}C,2p5n) and ^{246}Cm(^{12}C,4n) reactions, observation of 8.10-MeV α of ^{254}No g.s. was interpreted in terms g.s. being fed from an isomeric state of $T_{1/2}$=0.28 s *4*, and decaying predominantly by isomeric transitions, as no evidence was found for its α or SF decay modes, with an upper limit of 20%. Authors suggested that this isomer is probably a high-spin state, and proposed that two-quasiparticle configurations with $K^{\pi}=8^-$, and also other configurations with $K^{\pi}>8$.

Theoretical calculations of energies, and proposed 2-qp configurations with high K value for this isomer: 1976Iv04, 1991So15.

^{254}No Levels

E(level)[†]	J^{π}[‡]	$T_{1/2}$	Comments
0.0[#]	0^+	51.2 s *4*	$T_{1/2}$: from Adopted Levels, where this value is adopted from 2006He19.
44[#] *1*	2^+		
146[#] *1*	4^+		
304[#] *1*	6^+		
518[#] *1*	8^+		
987.5[@] *12*	(3^+)		
1033.7[@] *13*	(4^+)		
1091.0[@] *10*	(5^+)		
1160.2[@] *11*	(6^+)		

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^{254}No IT decay (265 ms) 2010Cl01,2010He10,2006He19 (continued)

^{254}No Levels (continued)

E(level)[†]	J$^{\pi}$[‡]	$T_{1/2}$	Comments
1242.9[@] *9*	(7$^+$)		
1296 *2*	(8$^-$)	265 ms *2*	%SF=0.020 *12* (2010He10); %$\alpha\leq$0.01 (2010He10) σ(265-ms isomer)/σ for ^{254}No channel=0.28 *2* (2010He10). 1989La07 deduced %SF≤0.19 *7* based on $T_{1/2}$(SF; isomer)≥150 s, deduced from measured $T_{1/2}$(SF;isomeric state)/$T_{1/2}$(SF;g.s.)≥0.005, assuming the isomeric ratio in their ^{208}Pb(^{48}Ca,2n) experiment was the same as [σ(isomeric state)/σ(g.s.)≈0.4] in ^{246}Cm(^{12}C,4n) reaction measured by 1973Gh03. No SF decay was detected by 1988Tu07 from ≈0.3−s isomer in ^{254}No. No evidence was found by 1973Gh03 for α or SF decay modes of this isomer, with an upper limit of 20%. E(level): from average of 1295 keV *2* (2010He10) and 1297 *2* (2010Cl01). $T_{1/2}$: from Adopted Levels. ν7/2[613]⊗ν9/2[734],K^{π}=8$^-$ configuration proposed by 2010Cl01. 2010He10, 2006Ta19 and 2006He19 proposed π9/2[624]⊗π7/2[514],K^{π}=8$^-$, However, 2010He10 and 2006He19 suggested that long half-life of this isomer may be due to contribution from 2-neutron configurations of ν7/2[624]⊗ν9/2[734] and ν7/2[613]⊗ν9/2[734],K^{π}=8$^-$.

[†] From least-squares fit to Eγ values, assuming 1 keV uncertainty for each γ ray, unless otherwise stated.
[‡] As proposed in 2010He10 and 2010Cl01, based on band structures.
[#] Band(A): K^{π}=0$^+$, g.s. band.
[@] Band(B): π1/2[521]⊗π7/2[514],K^{π}=(3$^+$) band.

γ(^{254}No)

Additional information 1.

E$_{\gamma}$[†]	I$_{\gamma}$	E$_i$(level)	J$_i^{\pi}$	E$_f$	J$_f^{\pi}$	Mult.	α[‡]	I$_{(\gamma+ce)}$	Comments
x		1296	(8$^-$)					49 *2*	I(γ+ce) branching=49% *2*, considering that I(γ+ce) branching for 53-keV γ ray is 47% *2* and that for 778γ is 3.6% *10* (2010He10).
(44)		44	2$^+$	0.0	0$^+$				
(45)		1033.7	(4$^+$)	987.5	(3$^+$)				Eγ=46 (2006He19). Transition shown by 2010Cl01, but numerical value not given.
53	25.7 *19*	1296	(8$^-$)	1242.9	(7$^+$)	(E1)	0.83 *5*	47 *2*	Eγ=52 (2010Cl01). Measured I(γ+ce) branching ratio=45.3 *21* (2010He10, text on page 59), with the authors note that the 53-keV transition represents 47% *2* of the decays of the isomer into the K=3 band. From these data, photon branching for 53γ=24.8 *19*. Branching ratio data are not provided in 2010Cl01, however, the authors estimate reduced hindrance factor f_{ν}=835 for 53-keV transition, and 183 for 778-keV transition, both assumed as E1, from which 2015Ko14 evaluation deduced relative photon branching ratio of 100 *3* for 53γ and 23.7 *24* for 778γ. Mult.: observation of strong γ ray in spectra is consistent with its being E1, and not with M1 or E2 for which the respective theoretical conversion coefficients are 83 and 630.

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$\gamma(^{254}No)$ (continued)

E_γ †	I_γ	E_i(level)	J_i^π	E_f	J_f^π	Mult.	α ‡	$I_{(\gamma+ce)}$	Comments
(58)		1091.0	(5^+)	1033.7	(4^+)				Eγ=57 (2006He19). Transition shown by 2010Cl01, but numerical value not given.
69		1160.2	(6^+)	1091.0	(5^+)				Eγ=70 (2010Cl01), 69 (2006He19).
82		1242.9	(7^+)	1160.2	(6^+)				Eγ=81 (2006He19).
102		146	4^+	44	2^+				
103		1091.0	(5^+)	987.5	(3^+)				Eγ=104 (2010Cl01), 103 (2006He19).
126		1160.2	(6^+)	1033.7	(4^+)				Expected line overlaps K-x rays. E_γ: 126 (2006He19), (128) (2010Cl01).
151		1242.9	(7^+)	1091.0	(5^+)				Eγ=152 (2010Cl01), 150 (2006He19). Iγ(152)/Iγ(82)=1.10 *40* (2006Ta19) for questionable γ rays.
159		304	6^+	146	4^+				
214		518	8^+	304	6^+				
778	3.6 *10*	1296	(8^-)	518	8^+	[E1]	0.00845	3.6 *10*	Measured I(γ+ce) or Iγ branching ratio=3.6 *10* (2010He10). Other: ≈4% in thesis by B. Sulignano (Mainz, 2007). Iγ(778)/Iγ(841)=0.03 *2*, 0.16 *5* (2010He10, uncertainty of 0.50 in 2010He10 is probably a misprint).
786		1091.0	(5^+)	304	6^+				E_γ: γ from 2010Cl01 only.
841 *1*		987.5	(3^+)	146	4^+				Eγ=842 (2010Cl01,2006Ta19); 841 (2006He19). Iγ(778)/Iγ(842)=0.03 *2*, 0.16 *50* (2010He10). Iγ(842)/Iγ(214)=0.31 *8* (2005Ee02).
856		1160.2	(6^+)	304	6^+				Eγ=857 (2010Cl01). Iγ(856)/Iγ(159)=0.40 *15* (2010He10).
887		1033.7	(4^+)	146	4^+				Eγ=888 (2010Cl01,2006Ta19); ; 887 (2006He19).
940		1242.9	(7^+)	304	6^+				E_γ: γ from 2010Cl01 only.
943 *1*		987.5	(3^+)	44	2^+				Eγ=944 (2010Cl01,2006Ta19); 943 (2006He19). Iγ(943)/Iγ(214)=0.86 *14* (2005Ee02).

† From 2010He10. Values from 2010Cl01, which are generally higher by 1 keV, are given under comments when different.

‡ Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on γ-ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

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Decay Scheme

Intensities: Relative $I_{(\gamma+ce)}$

%IT=100.0

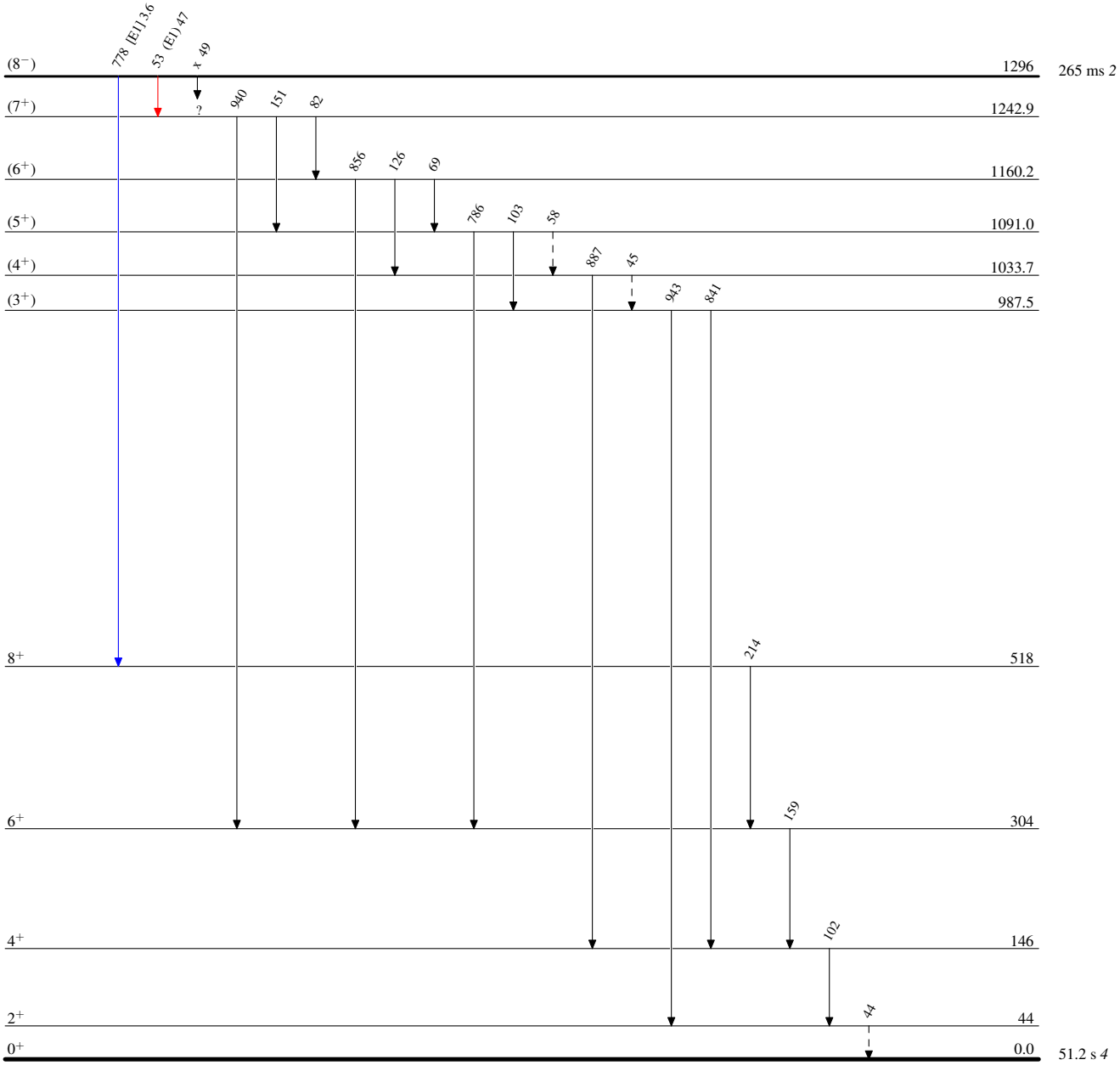
Legend

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

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

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

γ Decay (Uncertain)



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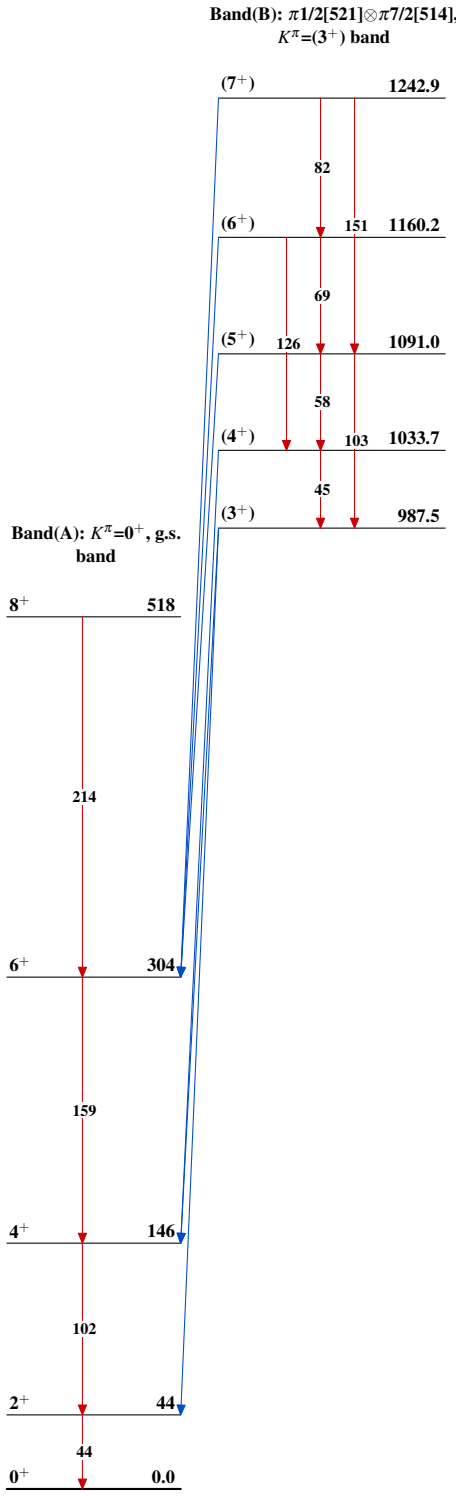

$^{254}_{102}No_{152}$