

α - γ - decay studies of ^{253}No

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In a previous decay study of ^{257}Rf at SHIP [1] we also performed α - γ - coincidence measurements for the daughter nucleus ^{253}No . This isotope was recently studied at the RITU - separator in Jyväskylä using the reaction $^{207}\text{Pb}(^{48}\text{Ca},2n)^{253}\text{No}$ [2]. Three γ - lines of 152, 222 and 280 keV were observed in coincidence to α - decays attributed to ^{253}No [2]. Although our rate of nuclei was considerably lower we observed few α - γ -coincidences which confirmed the results of [2] (Fig.1 and Tab.1).

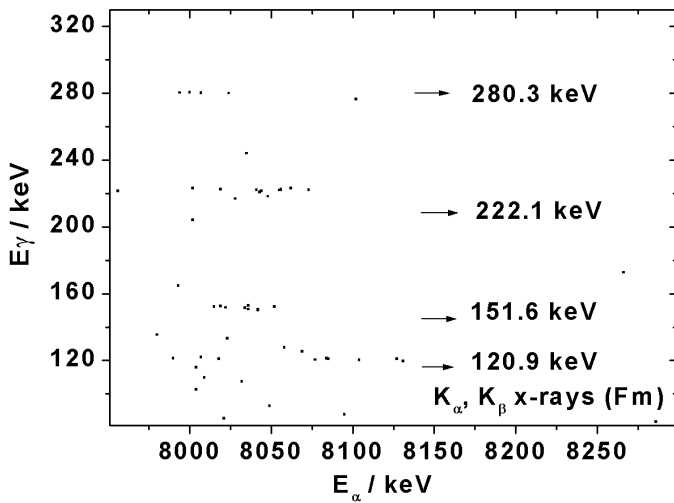


Figure 1: α - γ -coincidences assigned to the decay of ^{253}No .

The line at 120.9 keV is close to the value of 121.058 keV [3] expected for the $K_{\alpha 1}$ x-rays of Fm. Thus we interpret this line as x-rays emitted after K-conversion, while the other three lines are attributed to γ - transitions from one or several nuclear levels populated by the α - decay.

E_γ / keV	E_α / keV	events
280.3 ± 0.2	8006 ± 13	4
222.1 ± 0.7	8054 ± 11	8
	8010 ± 12	2
	7956	1
	7785	1
151.6 ± 0.6	8040 ± 7	6
	8019 ± 4	3
120.9 ± 0.6	8121 ± 15	3
	8082 ± 4	3
	8005 ± 14	3

Table 1: Summary of α - γ - coincidences for ^{253}No

The energy of the α - decays from ^{253}No is essentially located in a broad distribution at $E_\alpha = (7990-8080)$ keV with ΔE (FWHM) = 71 keV[1] at a detector resolution of 20 keV (FWHM), indicating a strong influence due to energy summing with conversion electrons. This broad distribution was divided

into three lines in [1] (see Tab. 2), which roughly agree with those coincident to the γ - rays. The hindrance factors are small, indicating favoured transitions. So, tentatively, we assign the γ - lines to the decay into the ground state band of ^{249}Fm from a level which is populated by the favoured α - transition from ^{253}No (see Fig. 2).

E_α / keV	i_{rel}	$T_{1/2} / \text{s}$	$T_{\alpha, \text{calc}} / \text{s}$	HF
8033 (average)	0.92 ± 0.02	77 ± 5	53	1.5
8011	0.33 ± 0.03	80 ± 9	62	3.9
8038	0.31 ± 0.03	74 ± 9	49	4.8
8063	0.28 ± 0.03	72 ± 8	29	9.6
8114	0.08 ± 0.02	$83 +24/-15$		

Table 2: α - decay energies assigned to ^{253}No [1].

Using level assignments $9/2^-$ [734] and $7/2^+$ [624] known for ground states of the lighter $N = 151$ (^{251}Fm , ^{249}Cf , ^{247}Cm) and $N = 149$ (^{247}Cd , ^{245}Cm , ^{243}Pu) isotones, respectively [3], we obtain the decay scheme shown in Fig. 2.

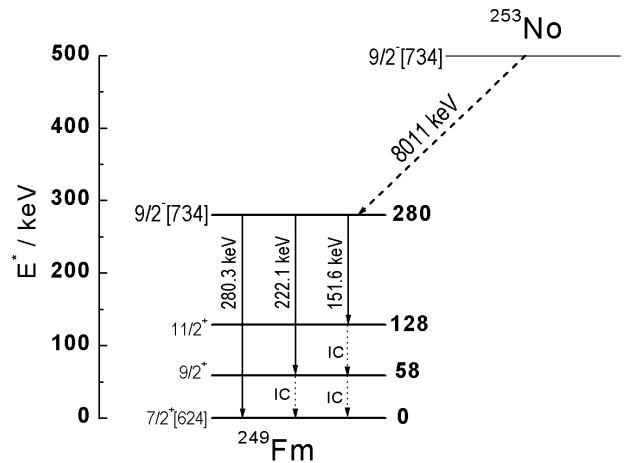


Figure 2: Tentative decay scheme of ^{253}No

This assignment is preliminary since a) measurements of conversion electrons [2] cannot exclude the multipolarity E2 for the 280.3 keV γ -transition, which is in conflict with E1 expected for a $9/2^- \rightarrow 7/2^+$ - transition, b) the measured sum energy, obtained from few events, of the α - particles and conversion electrons coincident to $E_\gamma = 151.6$ keV is lower than of those coincident to $E_\gamma = 222.1$ keV. However, according to Fig. 2 we would expect just the opposite result. Thus more sensitive measurements are necessary for a final assignment.

References

- [1] F.P. Heßberger et al. Z. Phys. A 359, 415 (1997)
- [2] R.-D. Herzberg, private communication, 2001
- [3] R.B. Firestone et al. Table of Isotopes, Wiley & Sons Inc. New York, Chicester, Brisbane, Toronto, Singapore 1996