

# Nilsson Levels in Odd Mass Odd Z Nuclei in the Region Z = (99-105)

F.P.Heßberger<sup>1</sup>, S. Hofmann<sup>1</sup>, D. Ackermann<sup>1,2</sup>, S. Antalic<sup>3</sup>, P. Cagarda<sup>1</sup>, I. Kojouharov<sup>1</sup>,  
P. Kuusiniemi<sup>1</sup>, R. Mann<sup>1</sup>, and S. Saro<sup>3</sup>

<sup>1</sup>GSI Darmstadt, Germany, <sup>2</sup>Johannes-Gutenberg-Universität Mainz, Germany, <sup>3</sup>Comenius University Bratislava, Slovakia

Similarities in nuclear structure are observed for isotopes of odd-Z elements with even neutron numbers. These can be used to explain the  $\alpha$ -spectra and to construct partial level schemes. Vice versa changes in the  $\alpha$ -decay pattern may reveal a change of the ground-state (gs) configuration of the daughter nuclei. Our investigations, so far concentrated on nuclei occurring in the  $\alpha$ -decay chains of  $^{257,257m}\text{Db}$  ( $T_z = -47/2$ ) [1], were extended recently to the members of  $\alpha$ -decay chains of  $^{247}\text{Md}$  ( $T_z = -45/2$ ) and  $^{255}\text{Lr}$  ( $T_z = -49/2$ ). Our preliminary results are summarized in table 1. In our irradiations of  $^{209}\text{Bi}$  with  $^{48}\text{Ca}$  we confirmed an activity of  $E_\alpha = 8470$  keV,  $T_{1/2} = 2.1$  s, observed at the RITU – separator (Jyväskylä, Finland) and attributed to an isomeric state  $^{255m}\text{Lr}$  [2]. A  $\gamma$ -line of 295.1 keV was observed in coincidence with  $\alpha$ -decays of the daughter product  $^{251}\text{Md}$ . In our irradiations of  $^{209}\text{Bi}$  with  $^{40}\text{Ar}$ ,  $\alpha$ -decay of an isomeric state  $^{247m}\text{Md}$  was observed for the first time. So far

only a fission branch was known. In coincidence with  $\alpha$ -particles from the gs decay of  $^{247}\text{Md}$ , two  $\gamma$ -lines of 157.2 and 209.8 keV were observed.

Based on the intensity ratio of  $\gamma$ - and x-rays, E1 multipolarity was assigned to the 295.1 keV- and 209.8 keV – lines. Based on the measured decay data the partial decay schemes of the  $T_z = -45/2, -49/2$  nuclei were constructed. They are shown in fig.1 together with that from  $^{257,257m}\text{Db}$  ( $T_z = -47/2$ ) [1]. Based on systematics the gs of  $^{255}\text{Lr}$ ,  $^{247,251}\text{Md}$  are assigned to  $7/2^- [514]$  and the isomeric states  $^{255m}\text{Lr}$ ,  $^{247m}\text{Md}$  to  $1/2^- [521]$ . In analogy to the situation in  $^{253}\text{Lr}$  [1], also in  $^{255}\text{Lr}$  the  $\alpha$ -line with the higher energy is tentatively attributed to the gs decay. Although the E1-character of the 295.1 keV and 209.8 keV transitions supports the assumption of transitions  $7/2^- [514] \rightarrow 7/2^+ [633]$  in  $^{247}\text{Es}$  and  $^{243}\text{Es}$ , respectively, the gs of the Es – isotopes cannot be assigned to  $7/2^+ [633]$  a priori, as

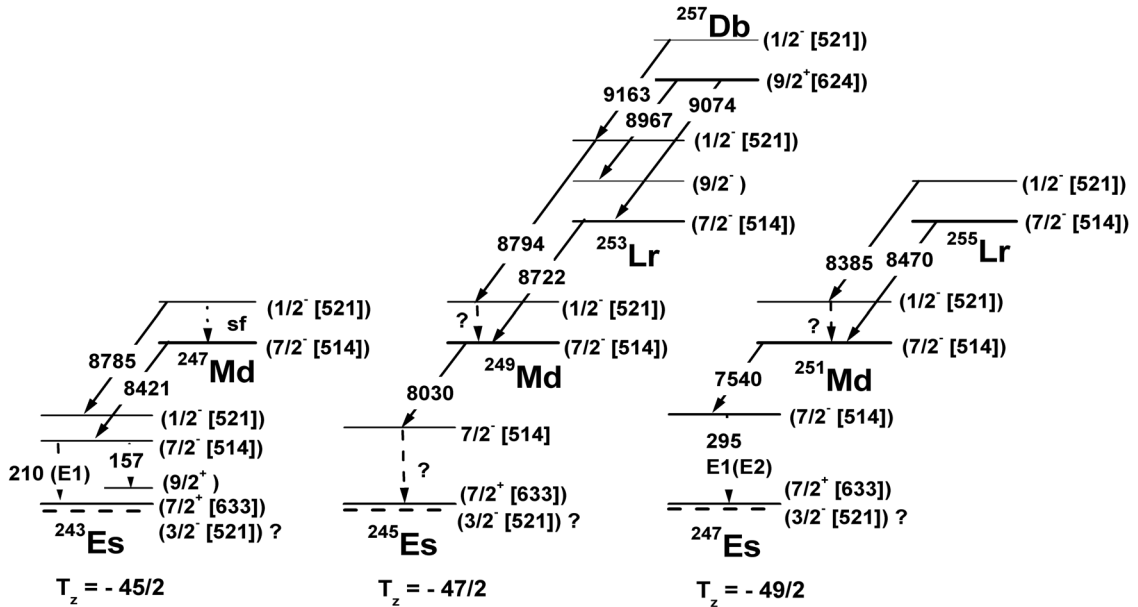


Fig1: Decay schemes of  $^{257}\text{Db}$ ,  $^{255}\text{Lr}$  and  $^{247}\text{Md}$

Isotope	$E_\alpha/\text{keV}$	$T_{1/2} / \text{s}$	$E_\gamma / \text{keV}$
$^{255m}\text{Lr}$	$8375 \pm 10$	$16.4 \pm 3.2$	
$^{255}\text{Lr}$	$8470 \pm 10$	$2.1 \pm 0.1$	
$^{251}\text{Md}$	$7530 \pm 10$		$295.1 \pm 0.2$
$^{247}\text{Md}$	$8421 \pm 10$	$1.4 \pm 0.1$	$209.8 \pm 0.1$ $157.2 \pm 0.4$
$^{247m}\text{Md}$	$8785 \pm 10$	$0.26 \pm 0.06$	
$^{243}\text{Es}$	$7895 \pm 10$	$26 \pm 1$	

Table 1: Summary of spectroscopic data obtained in irradiations of  $^{209}\text{Bi}$  with  $^{40}\text{Ar}$  and  $^{48}\text{Ca}$ , respectively.

in  $^{249,253}\text{Es}$  [3]. In  $^{251}\text{Es}$  the gs is assigned to  $3/2^- [521]$ , while  $7/2^+ [633]$  – level is located at  $E^* = 8.2$  keV [4]. Since a similar situation in  $^{243,245,247}\text{Es}$  cannot be excluded, the ordering of the two lowest levels in these nuclei is still uncertain.

## References

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