Isomeric states in ^{197,199}At and ^{203,205}Fr

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Recently a rotational band has been observed to feed the $13/2^+$ isomer in both ^{197}At and ^{199}At [1]. The evolution of the isomeric state itself when approaching the neutron mid-shell, from becoming yrast in ^{199}At and α-particle decaying in ^{193}At [2], has earlier been studied. Moreover, a spherical $29/2^+$ isomer has been identified to feed the $i_{13/2}$ band in ^{199}At. This high-spin isomer has been observed sporadically throughout the neutron-deficient odd-mass astatine isotopes.

Preliminary results from a recent recoil-decay tagging [7] study reveal decays from isomeric states detected in ^{203}Fr and ^{205}Fr for the first time. These could present a single-step decay of the intruding $13/2^+$ isomer to the ground state.

The experiments were performed at JYFL using the gas-filled recoil separator RITU [3] together with the Ge-detector array JUROGAM [4, 5] and the focal plane spectrometer GREAT [6].

[1] U. Jakobsson *et al.*, to be published
[2] H. Kettunen *et al.*, Eur. Phys. J. A **17**, 537 (2003)
[3] M. Leino *et al.*, Nucl. Instrum. Methods Phys. Res. B **99**, 635 (1995)
[4] C. W. Beausang *et al.*, Nucl. Instrum. Methods Phys. Res. A **313**, 37 (1992)
[5] C. Rossi Alvarez *et al.*, Nuclear Physics News **3**, 3 (1993)
[6] R. D. Page *et al.*, Nuc. Instrum. Methods B **204**, 634 (2003)
[7] E. S. Paul *et al.*, Phys. Rev. C **51**, 78 (1995)