Spectroscopy of very heavy nuclei

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Since the first in-beam gamma-ray experiment for ^{254}No in 1998 a large number of in-beam and focal-plane experiments for studies of the very heavy nuclei of this region have been carried out at the RITU gas-filled recoil separator at JYFL by employing tagging techniques and ^{48}Ca induced cold fusion evaporation reactions. The differential pumping system at the target area of RITU, the replacement of the small Ge- detector arrays with the JUROGAM array of 43 large Ge+BGO detector units (total eff. at 1.3MeV around 4%), the commissioning of the GREAT focal-plane spectrometer and the new triggerless total data readout system have been important upgrades in improving sensitivity in these experiments. Also conversion-electron measurements with the SACRED spectrometer at the target area and with the GREAT pin- detectors at the focal plane have played important role in solving problems associated with highly converted transitions.

The first in-beam experiments focused on even-even (^{252,254}No, ^{250}Fm), studying the ground-state bands and allowing extraction of parameters such as the moments of inertia, and proving the deformed nature of these nuclei. Later, measurements have been carried out for odd-mass nuclei such as ^{253}No, ^{251}Md and ^{255}Lr, the latter with Z = 103 being the heaviest element so far studied in-beam. Conclusions about the underlying single-particle configurations are based on the observed M1-E2 characters of the observed rotational bands. Important information about the ordering of the single-particle orbits is obtained from decay-studies at the focal plane of RITU.

A recent focus has been on the non-yrast and isomeric states in ^{252,254}No and ^{250}Fm probed both in in-beam and focal plane experiments. The studies employed a calorimetric technique, whereby the summed energy from a cascade of conversion electrons is detected in a DSSSD detector at the focal plane, provides a tag for prompt and delayed gamma-rays. Such experiments have yielded data which can be used to determine the excitation energies and configurations of two-quasi-particle states in the region, providing a stringent test for current nuclear structure models.

An overview of recent results and new experimental techniques will be presented. Perspectives for developments of new devices for further studies in this region will be discussed.