Nuclear Structure at the Limit: The Heaviest Elements

M. Leino

Department of Physics, University of Jyväskylä, P.O. Box 35, 40014 Jyväskylä, Finland.

The study of the structure and decay properties of nuclei with $Z \geq 100$ has progressed significantly during the past few years. This is the result of technical developments, in particular the introduction of the recoil decay tagging method for in-beam studies and the construction of versatile focal plane detector systems for decay studies. In-beam studies are presently possible down to the cross section level of 100 nb and α-γ and α-e^- coincidence measurements can be made in the sub-nb region.

The ground state rotational bands of three even-even nuclides, ^{250}Fm and ^{252,254}No, have been measured up to spin $\approx 20\hbar$ using γ spectroscopy, and for ^{250}Fm and ^{254}No the results have been complemented in the low-spin region by conversion electron measurements. Tentative evidence for transitions linking the ground state bands with higher lying bands has also been gained. For ^{254}No, detailed information on isomeric states has very recently been collected in focal plane decay studies.

For odd-A nuclei, fragmentation of the decay paths and competing strongly converted M1-transitions make in-beam structure studies even more challenging than for even-even nuclei. Nevertheless, some preliminary results for ^{251}Md, ^{253}No and ^{255}Lr are encouraging.

Abundant information on the structure of very heavy nuclei is still coming from decay studies, mainly α spectroscopy after in-flight separation. New information is available for several isotopes of Lr, No, and Md.

Finally, regarding the production of new elements a wealth of new data is available, including the synthesis of El. 113 in a cold fusion reaction and independent confirmation of the GSI work on elements Ds, Rg and 112. In many cases, unequivocal identification of the produced nuclei is still missing, and firm conclusions concerning nuclear structure are difficult to draw. However, even on the basis of only a few observed events, some new information on nuclei such as ^{269,270}Hs, ^{270}Ds and ^{261}Rf is available.