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Nuclear structure studies of heavy nuclei

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The investigation of the structure and stability of the heaviest elements has been a constant theme in nuclear physics research since the 1940's. In the last decade or so, a wealth of new data has been produced, both in terms of new elements (up to Z=118) and in detailed spectroscopic studies of nuclei with masses above 240. Such studies provide data concerning nuclear parameters such as masses, decay modes, half-lives, moments of inertia, single-particle properties, etc., in systems with the highest possible number of protons. The main focus of current experiments is the search for the next closed proton- and neutron- shells beyond the doubly magic 208Pb. This search can be made directly, by producing nuclei in the region of interest (Z>112 and N>176), or indirectly through the study of lighter deformed nuclei where the orbitals of interest at sphericity are active at the Fermi surface.

Nuclei in the region of 254No are produced with cross-sections large enough to allow in-beam studies using recoil-decay tagging techniques. Advances in digital electronics and data acquisition have led to the observational limit in this region being pushed down to the level of ten nanobarns, as demonstrated by recent studies of 246Fm and 256Rf. In addition, the capabilities of focal plane spectrometer devices have been greatly improved, which has recently allowed the structure of a number of high-K isomeric states to be determined in a systematic manner. New instruments such as the recently commissioned SAGE combined conversion-electron and gamma-ray spectrometer provide additional information such as conversion coefficients to aid determination of transition multipolarities.

Examples of recent highlights in in-beam studies of heavy elements will be presented.

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