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Challenging nuclear structure of the heaviest – opportunities at S^3

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When the liquid drop fission barrier vanishes in the fermium-rutherfordium region only the stabilization by quantum mechanics effects allows the existence of the observed heavier species. Those are in turn providing an ideal laboratory to study the strong nuclear interaction by in-beam methods as well as decay spectroscopy after separation [1].
Here we focus on the achievements of decay spectroscopy after separation (DSAS) for the deformed nuclei in the region Z=100-112 and N=152-162. They have the potential to provide direct links to the next heavier spherical closed shell nuclei via the investigation of single particle levels [2]. Particularly interesting features are meta-stable states due to nuclear deformation, so-called K isomers, which can be used to trace the spherical superheavy nuclei (SHN) and to locate the island of stability [3]. The application of coincidence and correlation methods, employing the detection of αs, γs, X-rays, conversion electrons and fission fragments, can be used as powerful tools to separate and study specific decay features like e.g. in the investigation of the ^{258}Db decay performed by Heßberger et al. [4].
High intensity accelerators, efficient in-flight separators and spectrometers, and highly efficient detectors with fast electronics are the essential ingredients for the success of the field. The new SPIRAL2 facility and, in particular, the separator-spectrometer setup S^3 [5] presently under construction at the accelerator laboratory GANIL in Caen, France, will offer great perspectives for the field [6].

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