Direct mass measurements above uranium with SHIPTRAP - Towards weighing superheavy elements

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The quest for the long sought island of spherically shell-stabilized nuclei beyond ^{208}Pb has been at the forefront of nuclear physics in the last decade when many new elements have been synthesized. These very heavy elements are a prime testing ground for nuclear structure theories since they owe their very existence to shell effects that stabilizes them against spontaneous fission. Direct high-precision mass measurements with Penning traps give access to the binding energy and allow the experimental study of the shell structure evolution. However, direct mass measurements of nuclides in this region of the nuclear chart are hampered by the very low production rates with which the nuclides of interest can be produced in complete-fusion reactions. Moreover, the reaction products have to be prepared at low energy for a precision experiment in an ion trap. The Penning trap mass spectrometer SHIPTRAP at GSI in Darmstadt has recently performed the first direct mass measurements above uranium. The masses of the nobelium isotopes with mass numbers 252-255 as well as the lawrencium isotope with mass number 255 and 256 have been measured directly. The accurate mass values provide new and reliable anchor points in this mass region. In addition, the results can be used to determine masses of heavier short-lived nuclides using known alpha decay energies. The yield of 256-Lr was only 2 particles per minute, the lowest yield for which a Penning trap mass measurement has ever been performed. The recent experimental results will be presented and the perspectives for accessing superheavy elements will be discussed.