Investigating Atomic and Nuclear Properties of the Heaviest Elements

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The heaviest elements attract interest from nuclear and atomic physics due to their distinct properties. Nuclear shell effects are responsible for their very existence stabilizing them against immediate disintegration. Strong relativistic effects influence their electronic structure and chemical behavior as certain orbitals are stabilized while others become less bound. Precision measurements of various atomic and nuclear properties improve our understanding of these exotic objects and probe the nature of the underlying forces. Accurate experimental data also challenge theoretical predictions and contribute to their improvement. Numerous precision measurements of ground state properties of radionuclides across the nuclear chart have been obtained in recent years utilizing ion trap and laser spectroscopy-based techniques. New methods for slowing down high-energy beams in buffer gas cells have opened the door to extend such experiments to more exotic nuclides from different production schemes. I will discuss recent high-precision mass measurements performed with SHIPTRAP at GSI and introduce a novel measurement technique that has boosted the achievable precision even further. In addition, I will address the prospects of resonance ionization laser spectroscopy of the elements above fermium, the last element in which atomic levels are experimentally known.