LASER SPECTROSCOPY ON NOBELIUM AT GSI

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Precision measurements of optical transitions of the heaviest elements validate state-of-the-art atomic calculations describing relativistic effects and electron correlations which affect physical and chemical properties of these elements. Isotope shift and hyperfine structure of an optical transition furthermore reveal nuclear ground state properties such as deformation, magnetic moment, and spin of the investigated isotopes. To date, no spectroscopy data on atomic levels is available for any element beyond fermium (Z=100). These elements are produced in complete fusion-evaporation reactions at accelerator facilities on-line, resulting in production rates of at most a few ions per second.

The sensitive Radiation Detected Resonance Ionization Spectroscopy (RADRIS) technique was developed for laser spectroscopy on nobelium (Z=102) in a buffer-gas filled stopping cell. Nobelium ions are separated from the primary beam by the velocity filter SHIP at GSI, Darmstadt. Subsequently, they are thermalized in high-purity argon gas, accumulated on a filament, thermally evaporated as neutrals from the filament, and eventually laser ionized, which is detected by their characteristic alpha-decay.

Optical transitions in nobelium were identified for the first time in an experiment in 2015. Here the $^1S_0$->$^1P_1°$ ground state transition was observed, and transitions to high lying Rydberg levels were found. In addition, the isotope shift in the $^1S_0$->$^1P_1°$ transition was studied for $^{252-254}$No, as well as the hyperfine splitting in ^{253}No.

In this contribution, the experimental results will be presented and compared to state-of-the-art atomic and nuclear models. Perspectives for future measurements in heavier elements will be addressed.