NUSTAR Seminar

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Wednesday, Nov. 11, 2020 at 16:00 p.m.

Zoom-Meeting Room

(ID: 943 6718 7188, Passcode: 371024)

“Laser Spectroscopy at SHIP - the heaviest elements in the spotlight”

Laser spectroscopy probing the atomic level structure is a versatile tool to unveil fundamental atomic and nuclear properties. For the heaviest elements the atomic structure is of particular interest as their electron shell is strongly influenced by electron-electron correlations and relativistic effects while they are only scarcely investigated due to their limited availability.
Furthermore, enables laser spectroscopy the determination of subtle changes in the atomic level energies for different isotopes of the same element to infer properties of the center nucleus. In this talk the challenges in laser spectroscopy of the heaviest elements will be discussed in view of the recent laser spectroscopic experiments in nobelium (Z=102), employing the RAdiation Detected Resonance Ionization Spectroscopy (RADRIS) technique coupled to the velocity filter SHIP at GSI, Darmstadt. With this technique the identification and characterization of several atomic transitions in nobelium was possible for the first time [1], leading for example to an accurate determination of the first ionization potential of nobelium [2]. Measurements of an atomic transition in the isotopes $^{252\text{-}254}$No as well as resolving its hyperfine splitting in ^{253}No gave access to nuclear moments and differential charge radii [3]. More recent measurements employ a novel mode of the RADRIS technique where the desired nuclides are bred by radioactive decay on the capture filament extending the reach of the method to ^{255}No and, for the first time, to on-line produced $^{248\text{-}250}$ Fm isotopes. The studies of on-line produced heavy elements at GSI are complemented by offline studies of heavy actinide elements including einsteinium and fermium performed at Mainz University. For these investigations ^{257}Fm and $^{253\text{-}255}$Es became available in minute amounts in the ^{252}Cf production cycle in Oakridge and were provided by Florida state university. The present statues of laser spectroscopic studies will be presented and perspectives for experiments on superheavy elements will be discussed.

1. M. Laatiaoui, et al., Nature 538, 495 (2016).
2. P. Chhetri et al., PRL 120.26 (2018): 263003
3. S. Raeder et al., PRL 120.23 (2018): 232503

Convener: Michael Block
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