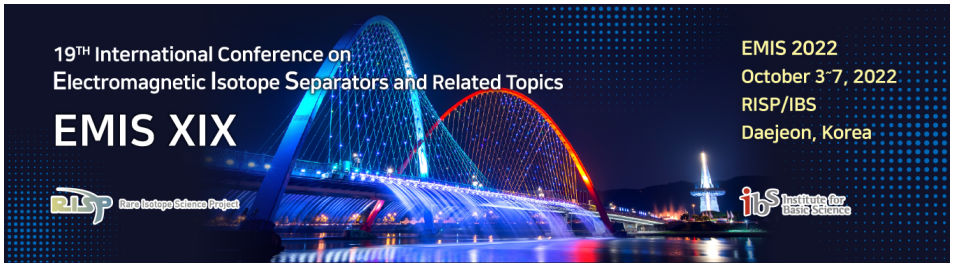

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Status of the JetRIS apparatus for laser spectroscopy of the heaviest elements

Friday, 7 October 2022 09:40 (20 minutes)

Laser spectroscopy measurements can provide information about fundamental properties of both atomic and nuclear structure. These measurements are of particular importance for the heaviest actinides and superheavy elements, where data are sparse. Recent resonance-ionization-spectroscopy experiments at GSI, Darmstadt, Germany, have focused on in-gas-cell measurements using the RADRIS technique [1,2], successfully measuring a strong ground-state transition in $^{252-254}$No [3]. However, the limited spectral resolution of these measurements hampers the precision, and eventually renders determining the nuclear moments and spins impossible. Furthermore, the subsequent collection and measurement cycle limits accessible isotopes to those with lifetime of at least about 1 s. To overcome these limitations, a new JetRIS apparatus has been constructed to perform laser spectroscopy of atoms in a hypersonic jet [4]. In JetRIS, the highly energetic recoil ions are slowed down in argon gas and guided by electric fields to a heated filament for neutralization. They are then extracted by the gas into a hypersonic gas jet. This gas jet provides a low-density and low-temperature environment, which will improve the spectral resolution by about an order of magnitude to hundreds of MHz [5]. In addition, it allows the continuous operation for fast extraction, giving access to short-lived nuclei.
In the near future a narrow-bandwidth and high-repetition-rate titanium:sapphire laser system will be added to the existing state-of-the-art, narrow-bandwidth dye laser system. This combination will ensure complete versatility and highest performance [6]. The setup was recently commissioned at the GSI within the FAIR phase-0 program. The obtained performance of the apparatus and the accompanying laser system will be discussed along with the future perspectives in the talk.

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