The laser resonance chromatography approach – or how to tame superheavy cations

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Optical spectroscopy of superheavy elements is an experimental challenge. The production yields of the elements are extremely low, the half-lives are very short, and the atomic structure is uncharted experimental territory. Conventional spectroscopy techniques based on fluorescence detection are no longer suitable because they lack the sensitivity required to study superheavy elements. Resonance ionization spectroscopy has proven sensitive enough to study the atomic structure of the element nobelium (No, atomic number Z=102) [1] and is now being continuously developed to probe the next heavier element, lawrencium (Lr, Z=103).

Recently proposed laser resonance chromatography (LRC) [2] could remedy this situation by providing sufficient sensitivity for the study of superheavy ions and overcoming the difficulties associated with other methods.

Successful application of this method in the superheavy element region would not only improve our understanding of the existence and functioning of such synthetic atoms, but also provide valuable data for astronomers searching for possible production sites of such elements in the universe.

In my talk, I will introduce the LRC technique and setup and show initial results from inauguration experiments before presenting prospects for the spectroscopy of Lr+ cations.

[1] M. Laatiaoui et al., Nature **538** (2016) 495.
[2] M. Laatiaoui et al., PRL **125** (2020) 023002.