Beitrag ID: **29** Typ: **nicht angegeben**

High-Resolution Spectroscopy of X-Ray Transitions in He-like Uranium at the CRYRING@ESR

Mittwoch, 1. Juni 2022 15:55 (5 Minuten)

Helium-like ions are the simplest atomic multibody systems and their study along the isoelectronic sequence provides a unique testing ground for the interplay of the effects of correlation, relativity and quantum electrodynamics. However, for high-Z ions with nuclear charge Z > 54, where inner-shell transition energies reach up to 100 keV, there are currently no data available to challenge state-of-the-art theory [1]. In this context the development of metallic magnetic calorimeter (MMC) detectors is of particular importance. Their high spectral resolution of a few tens of eV FWHM at 100 keV incident photon energy in combination with a broad spectral acceptance down to a few keV will enable new types of precision x-ray studies [2].

In a recent beam time at CRYRING@ESR we employed for the first time MMC-type detectors at the 0° and 180° view ports of the electron cooler to perform precision spectroscopy of hard x-rays from high-Z ions, namely U90+. By exploiting the time resolution of MMC detectors for the first time to set a coincidence condition on the detection of photons together with down-charged ions, we succeeded in obtaining high-resolution spectra from a few keV to above 100 keV [3]. A spectral resolution between 70 and 90 eV was achieved for the K_alpha lines, thus enabling for the first time to resolve the substructure of these transitions in a high-Z system. While the measurement was quite successful as a proof-of-principle, the obtained spectra suffer from low statistics as more than half of the allocated beam time was lost due to tuning and outages of the accelerator. Only in the last few days a stable operation with an acceptable beam intensity of 2 x 10^6 ions was achieved.

To fully exploit the physics potential of the demonstrated experimental scheme and also as a crucial stepping stone towards the long-standing goal of a new 1s Lamb shift measurement in hydrogen-like uranium, we want to apply for 10 days of beam time to run again with U91+ as the primary beam.

Hauptautoren: WEBER, Günter (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI)); STÖHLKER, Thomas (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI)); GUMBERIDZE, Alexandre (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI)); SPILLMANN, Uwe (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI)); TROTSENKO, Sergiy (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI)); BERNITT, Sonja (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI)); LESTINSKY, Michael (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI)); HENGSTLER, Daniel (Kirchhoff Institute for Physics); FLEISCHMANN, Andreas (Uni Heidelberg); Prof. ENSS, Christian (Kirchhoff-Institut für Physik); Herr HAHN, Christoph (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI)); PFÄFFLEIN, Philip (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI)); ZHU, Binghui (Helmholtz Institute Jena); KRÖGER, Felix (FSU Jena, IOQ Jena, HI Jena)

Vortragende(r): WEBER, Günter (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI))

Sitzung Einordnung: Cryring@ESR