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X-ray Emission Study Performed for H-like Lead at CRYRING@ESR

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The study of x-ray emission associated with Radiative Recombination at "cold"temperature conditions, as it prevails at electron cooler devices in ion storage rings, allows for a stringent test of atomic structure and the subsequent x-ray emission characteristics. In particular, for heavy, highly charged ions at high Z it enables to investigate in detail the prevailing cascade decay dynamics and provides detailed insight into the final state population of the recombination process itself.
We report on an experiment where bare lead ions (Pb^{82+}) were decelerated down to 10 MeV/u in the ESR storage ring at GSI-Darmstadt and injected into CRYRING@ESR [1] and, subsequently, the x-ray emission of H-Like Pb associated with radiative recombination were studied at the electron cooler. For this purpose, at the electron cooler dedicated vacuum chambers were used, equipped with beryllium view ports allowing for x-ray detection under 0° and 180° with respect to the ion beam axis. The x-ray detection was accomplished by using two standard high-purity germanium x-ray detectors. In order to suppress the dominant background, stemming from x-ray emission by the electron beam (bremsstrahlung) and the natural background, an ion detector (channel electron multiplier) was operated downstream to the cooler, enabling to record x-rays in coincidence with down-charged Pb^{81+}ions from electron-cooler section.
Even though in this very first beam time with bare, decelerated high-Z ions in CRYRING@ESR only a low intensity of $2{\times}10^5$ ions per injection was possible, a few days of continuous operation were sufficient to accumulate meaningful spectral information when combining the signals in both x-ray detectors with the particle detector. The x-ray spectrum associated with radiative recombination is governed by intense Ly-α radiation as well as by Balmer and even Paschen transition providing a unique opportunity for finale-state selective recombination studies.
This research has been conducted in the framework of the SPARC collaboration, experiment E138 of FAIR Phase-0 supported by GSI. It is further supported by the European Research Council (ERC) under the European Union's Horizon 2020 research as well as by the innovation program (Grant No 682841 "ASTRUm") and the grant agreement n° 6544002, ENSAR2. B. Zhu acknowledges CSC Doctoral Fellowship 2018.9-2022.2; we acknowledge substantial support by ErUM-FSP APPA (BMBF n° 05P19SJFAA) too.

Reference:
[1] M. Lestinsky et al., Eur. Phys. J.-Spec. Top. 225, 797 (2016)

Is this abstract from experiment?

Yes

Name of experiment and experimental site

1S Lamb shift, GSI Darmstadt (Germany)

Is the speaker for that presentation defined?

No

Details

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Internet talk

No

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