Contribution ID: **177** Type: **Talk**

Laboratory X-ray Astrophysics with PolarX-EBIT

Thursday, 26 August 2021 18:00 (30 minutes)

The next generation of x-ray satellite missions, like XRISM or Athena, will be equipped with state-of-the-art instrumentation, delivering high-resolution spectra. However, the accuracy of parameters like elemental composition, velocity, density, and temperature will be limited by the uncertainties and availability of atomic data, like line positions, line strengths, and cross-sections for different atomic-scale processes. Reliable access to these quantities is necessary to gain insight into formation and evolution of hot astrophysical objects, like active galactic nuclei (AGN), in which accretion of mass onto super-massive black holes and mass outflows provide feedback mechanisms during the co-evolution of AGNs with their host galaxies.

PolarX-EBIT is a compact electron beam ion trap (EBIT), based on an assembly of room-temperature permanent magnets [1]. It uses a monoenergetic electron beam to generate highly charged ions (HCI) by stepwise electron impact ionization. These ions form a stationary prolate ion cloud, which can be used as a target for ultrabrilliant x-ray photon beams from synchrotrons and free-electron laser (FEL) light sources. A novel off-axis electron gun allows the photon beam to leave the interaction region and be made available for downstream setups. This enables high-precision spectroscopy experiments, providing atomic data for processes involving resonant photoexcitation for a wide range of ion species, commonly found in different astrophysical plasmas.

We present results of experiments conducted at the synchrotron facilities PETRA III in Hamburg, with PolarX-EBIT's regular site of operation at beamline P01, and BESSY II in Berlin. The measurements provided relative line strengths and bounds for natural line widths of transitions in Ne-like Fe^{16+} [2], revealed strong two-electron-one-photon (TEOP) transitions in Li-like O^{5+} [3], uncovered a previously unknown systematic energy shift in widely used reference spectra in the soft x-ray regime [4], and demonstrated the potential of emission from metastable excited states in HCI as tool for spectroscopic plasma density diagnostics.

[1] P. Micke *et al.*, Rev. Sci. Instrum. 89, 063109 (2018).
[2] S. Kühn *et al.*, Phys. Rev. Lett. 124, 225001 (2020).
[3] M. Togawa *et al.*, Phys. Rev. A 102, 052831 (2020).
[4] M. A. Leutenegger et al., Phys. Rev. Lett. 125, 243001 (2020).

Is this abstract from experiment?

Yes

Name of experiment and experimental site

PolarX-EBIT/DESY

Is the speaker for that presentation defined?

Yes

Details

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Internet talk

Yes

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