2019 HGF – GSI – OCPC – Programme

for the involvement of postdocs in bilateral collaboration projects

Title of the project:

Synchrotron Accelerator: Commissioning of the HITRAP cooling Penning trap.

Helmholtz Centre and institute:

GSI Helmholtzzentrum für Schwerionenforschung GmbH

Project leader:

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Description of the project (max. 1 page)**:**

The HITRAP facility will provide heavy, highly charged ions at lowest energies. It is meant to link the production of ions like bare uranium at a beam energy of 400 MeV/nucleon with precision experiments at sub eV beam energy. For this, the ions are first decelerated and cooled in the experimental storage ring (ESR) down to 4 MeV/nucleon. Then up to 100 000 ions per bunch are extracted from the ring and decelerated in a linear decelerator. Then, the heavy, highly charged ions are injected at 6 keV/nucleon into a Penning trap for final cooling. The cooled ions are ejected in a well-defined bunch at variable energy for recapture into experiments in Penning traps, or for direct interaction with solids and gases.

Highly charged ions are captured dynamically in the cooling Penning trap by switching electric potentials fast enough. In a first step, they are overlapped with electrons for electron cooling. Then the electrons will be separated from the ions and resistive cooling sets in. Effective ejection at a few keV/charge ends the process.

The cooling Penning trap sits in a magnetic field of up to 6 Tesla. A superconducting magnet cooled liquid free to 4 K. creates the field. The trap uses the very same cryostat to help the vacuum pressure and allow for resistive cooling down to a few Kelvin.

The central topic of this project is the commissioning of the cooling Penning trap. For this there are two offline ion sources, one hot cathode source for singly charged ions and one EBIT for light, highly charged ions. The trap has been redesigned recently to find a more robust and reliable operational scheme. The ultimate goal is to proof and characterize electron cooling of highly charged ions.

Description of existing or sought Chinese collaboration partner institute (max. half page)**:**

We are looking for a collaboration partner to enhance our work on the field of Penning traps. Further collaboration possibilities open up on the diagnostics of low energy, low intensity ion beams and low noise electronics that is fit for operation at 4K.

Required qualification of the post-doc:

- PhD in Physics/Electrical Engineering
- Previous experience in at least three of the following fields: atomic physics, ion trapping, ion sources and beamlines, electronics, vacuum technique
- A proven ability to devise, implement and work with hands-on experimental equipment
- Interest or demonstrated expertise in cryogenic technology
- A good knowledge or the ability to learn in the fields of ion optics, simulations of low energy beams and clouds, and computer control.
- Additional skills in at least one high level programming language (C++, Python, LabVIEW etc.) Previous engineering and CAD knowledge and/or experience is advantageous, but not a necessity
- Experience in documenting the ongoing work and results
- Ability to work in a team work and good communication skills
- Language requirement: English (Cambridge level B2 or better, i.e. fluent in face to face communication and able to write technical reports)