



2025 Helmholtz – OCPC – Programme for the involvement of postdocs in bilateral collaboration projects

PART A

Title of the project:

Mass measurement of heavy neutron-rich nuclides via time-of-flight mass spectrometry

Helmholtz Centre and/or institute:

GSI Helmholtz Centre for Heavy Ion Research

Project leader:

Dr. Wolfgang Pläß

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https://www.gsi.de/work/forschung/nustarennanustarennadivisions/frs_super_frs.htm

Department: (at the Helmholtz centre or Institute)

NUSTAR – FRS/Super-FRS Experiments

Programme Coordinator (Email, telephone and telefax)

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Description of the project (max. 1 page):

The study of exotic (short-lived) nuclei far off stability and their properties is an intense, worldwide effort. These nuclei are synthesized in Nature in nuclear reactions during the burning phases of stars, in thermo-nuclear runaways during star explosions, and in neutron star mergers. These macroscopic environments are governed by the microscopic properties of short-lived nuclei. In the laboratory, short-lived nuclei are produced and studied at accelerator facilities.

The FRS Ion Catcher experiment at GSI enables mass and lifetime measurements of exotic nuclei produced by projectile fragmentation or fission. The fragments are produced at relativistic energies in the target at the entrance to the fragment separator (FRS), spatially separated and energy-bunched in the FRS, slowed down and thermalized in a cryogenic stopping cell. A versatile RFQ beamline and a high-performance multiple-reflection time-of-flight mass spectrometer (MR-TOF-MS) enable a variety of experiments, including high-precision mass measurements, isomer measurements and mass-selected decay spectroscopy. At the same time, the FRS Ion Catcher serves as a test facility for the Super-FRS Ion Catcher at FAIR.

The goal of the research project is to gain an improved understanding of the nucleosynthesis of heavy chemical elements in the r nucleosynthesis process using direct mass measurements with the MR-TOF-MS at the FRS Ion Catcher in FAIR Phase-0.



The successful candidate will play a leading role in the upgrade program of the MR-TOF-MS in preparation of the experiment, increasing the mass resolving power, sensitivity and accuracy of the device. The candidate will be strongly involved in the preparation and execution of mass measurements with the FRS Ion Catcher of neutron-rich ^{208}Pb projectile fragments at the N=128 neutron shell gap, and in the data analysis. Furthermore, the candidate will also be involved in the operation of the facility and in the preparation and execution of other experiments with the FRS Ion Catcher.

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

We are looking for Chinese partners with strong interest in mass spectrometry (in particular time-of-flight mass spectrometry and RF quadrupole mass spectrometry) and/or experimental nuclear physics. It is anticipated that the collaboration will strengthen the research on exotic nuclei, and that synergies for the collaboration partners in the field of mass spectrometry instrumentation and software will arise, from which both partners will profit.

Required qualification of the postdoc:

- PhD in physics, engineering, or equivalent
- Experience with mass spectrometry and/or experimental nuclear physics
- Additional skills in some of the following fields would be desirable: vacuum technology, electronics, CAD, scientific simulations, ion optics, computer programming
- Willingness and ability to work in an internationally oriented team
- Language requirement: fluent in English