

2018 HGF – GSI – OCPC – Programme

For the involvement of postdocs in bilateral collaboration projects

Part A:
Title of the project:
Hypernuclear spectroscopy with the WASA detector and the fragment separator FRS at FAIR Phase 0
Helmholtz Centre and institute:
GSI Helmholtz Center for Heavy Ion Research GmbH
Project leader:
Dr. Takehiko R. Saito Email: T.Saito@gsi.de Tel: +49 - 6159 71 2032, fax: +49 - 6159 71 2902
Web-address:
www.gsi.de
Department: (at the Helmholtz centre or Institute)
FRS/NUSTAR
Contact Information: (Email, telephone and telefax)
Dr. Pradeep Ghosh Program Coordinator GSI Helmholtzzentrum für Schwerionenforschung Planckstrasse 1, 64291 Darmstadt Email: International@gsi.de or Pr.Ghosh@gsi.de Telephone: +49 – 6159 71 3257, Fax: +49 – 6159 71 3916
Description of the project :
<p>Hypernuclear physics addresses the importance to understand the baryon-baryon interaction with up-, down- and strange-quarks under the flavoured-SU(3) symmetry. It also contributes for understanding the nature of extreme astronomical objects such as a deep interior of neutron-stars. Hypernuclei have been studied experimentally for more than 6 decades by means of induced reactions of secondary meson- and primary electron-beams. Recently, hypernuclei have also been successfully studied in the HypHI Phase 0 experiment at GSI, the spokesperson of which is T.R. Saito, with peripheral collisions of heavy ion beams.</p> <p>Hypernuclei have also recently been studied by the STAR and ALICE collaborations with central collisions of ultra-relativistic heavy ion beams. By the methodology with the peripheral collision performed by HypHI, heavier hypernuclei with the mass $A > 3$ as well as hypernuclei with neutron- and proton-excess can be produced and studied in contrast to the</p>

hypernuclear production with central collisions. This method will enable to study 1) exotic hypernuclei at extreme isospin to investigate the isospin dependence of the ΛN - ΣN coupling and three-body force, and 2) hypernuclear lifetime at the best precision, which is very sensitive to the wave-function of hyperons inside hyper-nuclei.

This proposed project will develop a new method to study hypernuclei with peripheral collisions of heavy ion beams by employing the forward ion spectrometer FRS at GSI together with the WASA central detector for pion measurements. In this method, decay residues of the π^- -hypernuclear decay will be measured by a part of FRS in coincidence with π^- mesons measured by the WASA central detector located in the mid-focal plane of FRS. By this combination, the resolution and statistics of the hypernuclear spectroscopy will largely be improved in comparison to the HypHI experiment.

The experimental proposal for this project has been already approved by the GSI Program Advisory Committee with the highest grade "A", and we are planning to perform the first experiment in the second half of 2019 or later at FAIR Phase 0 by using projectiles of ${}^6\text{Li}$ or ${}^{12}\text{C}$ at 2 A GeV impinging in the carbon target. The physics subjects of this project are to further study the short lifetime of hypertriton and indications of the bound system with two neutrons and a Λ hyperon at the best resolution, that were observed formerly in the HypHI Phase 0 experiment. It should be noted that the hypernuclear experiment is defined as one of the day-1 experiments of NuSTAR at FAIR Phase 0 and 1. The proposed project will also contribute to develop the proposed hypernuclear project at the future Chinese accelerator facility HIAF (the leader of the project is also T.R. Saito), and it will make more strength in the collaboration between GSI/FAIR and Chinese institutions also in the field of hypernuclear physics.

The successful candidate will play a leading role in the preparation, commissioning and conduction of the experiment as well as in the data analyses. The successful candidate is also expected to play a role in the software development for Monte Carlo simulations and data analyses. The project will be performed with the super-FRS Experiment Collaboration of FAIR.

Description of existing or sought Chinese collaboration partner institute:

We are looking for Chinese partners with strong interest in the hypernuclear physics experiments. So far, potential collaboration partners are “Institute of Modern Physics (IMP)” and “Lanzhou University (LZU)” in Lanzhou, and the collaboration will be extended with other institutions. The project leader, T.R. Saito, already established a strong collaboration with IMP and LZU in 2016. T.R. Saito proposed a new hypernuclear project at Chinese Heavy Ion Accelerator Facility HIAF, which is currently under construction. Since then, T.R. Saito is leading the hypernuclear project for HIAF in China with a collaboration of IMP and LZU, these institutions also show their large interest to participate in the hypernuclear project with the Fragment Separator FRS and WASA at GSI (they are already in the approved proposal). Therefore, the GSI/FAIR-IMP-LZU collaboration for hypernuclear physics can be stronger through this program both for GSI/FAIR and HIAF. Candidates in the other institutions are also welcome if the institutions would like to collaborate on this hypernuclear project at GSI/FAIR as well as at HIAF. The establishment of a stronger collaboration between GSI/FAIR and Chinese partners for the hypernuclear physics will give benefits to both GSI/FAIR and HIAF because of large synergies between GSI/FAIR and HIAF.

Required qualification of the post-doc:

- PhD in experimental nuclear or particle physics
- Experience in one/some of Monte Carlo simulations, data analyses, detectors and electronics in nuclear and particle physics
- Additional skills in reconstructing charged particle tracks will be plus
- Language requirement: fluent in English

Part B:

Documents to be provided by the post-doc:

- Detailed description of the interest in joining the project (motivation letter)
- Curriculum vitae (CV)
- copies of degrees as a proof of education qualification
- List of publications (if any)
- 2 letters of recommendation

Part C:

Additional requirements to be fulfilled by the post-doc:

- Very good command of the English language
- Strong ability to work independently and in a team