

2019 Helmholtz – OCPC – Program for the involvement of postdocs in bilateral collaboration projects

PART A

Title of the project: Time-of-flight neutron spectrometers for accelerator based neutron sources

Helmholtz Centre and institute:

Forschungszentrum Jülich, Jülich Centre for Neutron Science (JCNS-HBS)

Project leader: Prof. Dr. Thomas Brückel, Dr. Jörg Voigt, Dr. Thomas Gutberlet

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Description of the project:

Neutron scattering has proven to be one of the most powerful methods for the study of dynamics in condensed matter. The neutron wavelength is of the same order of magnitude as the typical length scales in condensed matter. Therefore, to resolve atomic, molecular and spin correlations in space from sub Å to μm range and in time from the ps to the μs range requires only a modest resolving power from 10 to 1000.

However, many applications of neutron spectroscopy are flux limited and therefore any new generation of neutron sources has boosted the development of new instrumentation. With the latest development of powerful spallation sources the source brightness has reached a new level. Accompanying these brightness gains with an optimized transport and analysis systems, new instruments at spallation sources promise versatile efficiency gains compared to existing instruments and therefore will enable completely new science.

Recently a concept for a pulsed source based on low energy nuclear reactions has been suggested by the Jülich Centre for Neutron Science (JCNS). Driven by accelerators in the energy range below 100 MeV, called High Brilliance Source (HBS), a neutron facility more flexible compared to high energy spallation sources can be designed. In particular different source repetition rates can be realized, tailored to the needs of an individual instrument. The low particle energy allows a more compact target-moderator- reflector assembly, bringing a larger fraction of the produced neutrons to thermal or cold energies.

Of particular interest are time-of-flight diffractometers and spectrometers at such sources. In this project our aim is to show that despite the less efficient neutron production the special features, namely the optimization of the instrument from the neutron source on, will enable instrument performance that is comparable or even superior to existing instruments at current neutron sources focusing the same science.

The project will design appropriate time-of-flight diffractometers and direct and indirect time-of-flight neutron spectrometers and simulate their performance using state-of-the-art simulation packages (VITESS, McStas). The results will be the basis for the construction of time-of-flight diffractometers and spectrometers at future compact accelerator based neutron sources of HBS type and medium power spallation sources as CSNS.

Description of existing or sought Chinese collaboration partner institute:

The Jülich Centre for Neutron Science has an international acknowledged and well developed expertise in the development, construction and operation of instruments for neutron research. It operates instruments at the major international neutron facilities as the MLZ in Garching, Germany, the ILL in Grenoble, France and the SNS in Oak Ridge, USA. Within this expertise an collaboration is established with the group of Prof. Yinguo Xiao (xiaoyg.sz@pku.edu.cn) from the School of Advanced Materials at Peking University Shenzhen Graduate School to develop state of the art time-of-flight diffractometers and spectrometers.

Prof. Xiao is one of the first users of the Chinese pulsed spallation neutron source CSNS located in Dongguan, Guangdong Province, which started operation in March 2018. He is actively engaged in the development of the high-resolution neutron diffractometers at CSNS. He has been working as PostDoc and research scientist for several years at the JCNS at Forschungszentrum Jülich within the Group of Prof. Thomas Brückel before he accepted the current professorship in Peking University. The common project will enable the improvement and further development of time-of-flight neutron diffractometers and spectrometers at both institutes and the communities in China and Germany. We also welcome collaboration with additional Chinese institution that deals with our proposed subject and shares our scientific interests.

Required qualification of the post-doc:

- PhD in condensed matter physics, materials sciences or related fields.
- Experience with X-ray and/or neutron scattering techniques are required
- Additional skills in programming are an asset

PART B

Documents to be provided by the post-doc, necessary for an application to OCPC via a postdoc-station in China, which is affiliated to a research institution like a university:

- Detailed description of the interest in joining the project (motivation letter)
- Curriculum vitae, copies of degrees
- List of publications
- 2 letters of recommendation
- Proof of command of English language

PART C

Additional requirements to be fulfilled by the post-doc:

- Max. age of 35 years
- PhD degree not older than 5 years
- Very good command of the English language
- Strong ability to work independently and in a team