

Helmholtz Call for 2019 CSC Fellowship Applicants

Helmholtz Centre: Forschungszentrum Jülich GmbH – www.fz-juelich.de

Department/Institute: Ernst Ruska Centre (ER-C)
http://www.fz-juelich.de/er-c/EN/Home/home_node.html;jsessionid=D5B169649F4A81B3C6322FF9B481040B

Supervising scientist: Dr. Knut Müller-Caspary, Prof. Dr. Rafal Dunin-Borkowski

University for Registration (for those looking for a dissertation): -

Research Field: Solid State Physics/Materials Science

Position: PhD Student Joint PhD Student

Research Area:

Ferroelectric materials possess a spontaneous electrical polarisation which can be used in a wide scope of applications in information technology. In particular, research focuses on non-volatile random access memories (RAM) and ferroelectric tunnel junctions. Moreover, multiferroic materials, in which both ferroelectricity and ferromagnetism are present, are promising in the field of spintronics or multi-state data storage using both the magnetic and the electric degrees of freedom.

In this project, momentum-resolved Scanning Transmission Electron Microscopy (STEM) is used to characterise ferroelectric and multiferroic oxide-based nanostructures. In particular, the formation of domains is to be investigated for different geometries of, e.g., ferroelectric tunnel junctions. To this end, a methodology is to be developed that uncouples the effects of the very strong atomic electric fields and the long-range polarisation, as well as the magnetisation. This involves both using the outstanding aberration-corrected electron microscopy infrastructure for ultrafast electron diffraction at Forschungszentrum Jülich, and the interpretation of the 4D data sets by comprehensive simulations. In a second step, this methodology can be used to quantitatively map electrical polarisations and magnetism in real devices in situ, i.e. under an external electric field applied to the specimen inside the microscope, so as to correlate macroscopic (dys)function to microscopic physical properties.

Specific Requirements:

The candidate should have a M.Sc. degree in physics, with a preferred focus on solid-state physics, nanotechnology or materials science. Programming skills in any language (e.g. C, C++, Matlab, Python) will be beneficial. As a member of the moreSTEM group at ER-C, the candidate will be part of a team with a vivid mutual exchange of expertise and ideas, and enthusiasm to explore new scientific territory is expected. This PhD takes place in an international research environment at Forschungszentrum Jülich and the RWTH Aachen University, which makes excellent skills in English language mandatory (spoken and written). This project takes place in cooperation with a Chinese partner group, for which a stay at Jülich of 24 months is foreseen. Completing the aforementioned work packages to include the characterisation of nanostructures from that group is highly welcome, and seen as a possible basis for tight cooperations in future.

Duration of stay: 24 months

Work Place: Forschungszentrum Jülich, Germany (near Cologne)

Earliest Start: September 2019

Language Requirement: Excellent command of English language, spoken & written. A German language course will be offered parallel to the project.

Name and Address of the Supervisor: Dr. Knut Müller-Caspary (Group leader) & Prof. Dr. Rafal Dunin-Borkowski, Forschungszentrum Jülich, 52425 Jülich, Germany.
Email: k.mueller-caspary@fz-juelich.de