



PhD position in the Marie Curie Doctoral Network TOPOCOM at Johannes Gutenberg University Mainz, Germany

In the EU-funded Doctoral Network TOPOCOM with six leading European Universities and two major Industrial Partners, one PhD position is available starting June 2024 in the **field of topological spin structures for unconventional computing and sensing**. In particular, we are studying the use of skyrmions, magnetic whirls with enhanced stability and dynamics for novel unconventional logic and computing as well as integrated sensor-logic applications.

Magnetic skyrmions are topological spin structures that we have demonstrated to be stable at room temperature in thin film systems (Nature Mater. (2016)). Such layered structures stabilize chiral skyrmions with diameters in the nanometer to micrometer range and enhanced topological stability. The skyrmions in these heterostructures are essentially 2D objects exhibiting topological phase transitions (Nature Nanotech. (2019)). Such two-dimensional magnetic skyrmions can be manipulated by electrical currents (Nature Phys. (2017), Nature Electron. (2020)) and the topological stabilization combined with thermal spin dynamics makes them useful as ideal information carriers for non-conventional neuromorphic computing (Nature Nano. (2019), Nature Commun. (2022), Adv. Mater. (2023)).

During the PhD, the successful applicant will perform **experiments in a collaboration with a network of leading academic and industrial partners** to develop systems hosting skyrmions for non-conventional computing approaches. He will explore skyrmion dynamics for stochastic computing, token-based Brownian, or reservoir computing and implement algorithms that allow for the performance evaluation of non-conventional computing. The network offers ideal possibilities for scientific exchange with leading groups in the field of high-quality materials discovery and deposition, advanced fabrication techniques, and leading-edge characterization techniques combined with state-of-the-art theory. **Extended external research training periods (secondments) will be scheduled at selected network partners**. In total, 11 PhD students will be trained in the network forming a strong team with complementing specializations on topological solitons in ferroic materials and their application in unconventional computing.

The **Physics Department at Johannes Gutenberg University Mainz** has been consistently ranked as one of the leading physics departments in Germany. In the recent Shanghai and CHE rankings it was selected for the excellence group in Europe and in 2018 and 2021 Physics in Mainz was ranked #1 in Germany by the German Research Foundation. It is particularly strong in condensed matter physics / materials sciences and houses the Excellence Research Centre TopDyn and the national German Collaborative Research Centre on Spintronics "Spin+X". Excellent students can additionally apply to the Max Planck Graduate Centre that provides an interdisciplinary Graduate Education experience with tailor-made training and a range of additional support measures.

Specific Requirements

Mobility Rule: Applicants must not have resided or carried out their main activity (work, studies, etc.) in Germany for more than 12 months in the 3 years immediately before the start of employment.

PhD Rule: Applicants must be doctoral candidates, i.e., not already in possession of a doctoral degree at the date of the recruitment. A masters degree or equivalent qualification in physics or a related subject is required.

Applications from women and other typically underrepresented groups are particularly welcome.

For enquiries and applications including a full CV and two references, contact Dr. Petra Fronk (Petra.Fronk@uni-mainz.de) or Prof. Dr. M. Kläui (klaui@uni-mainz.de, Tel. +49-6131-3924345) and see www.klaui-lab.de