European Conference on Neutron Scattering 2023



Contribution ID: 7

Type: Talk (25 + 5 min)

Uniaxial Control of Quantum Matter

Monday 20 March 2023 11:00 (30 minutes)

Quantum matter is characterised by competing and intertwined orders. Here I will present our recent advances in using uniaxial pressure as a clean "surgical" tool to tune quantum phases while simultaneously obtaining microscopic insights via scattering experiments. In particular, we address two directions - minimizing the background and enabling the tuning in-situ.

First, we study spin order in cuprate superconductors characterized by small moments, which remains challenging for pressure studies. We overcome this challenge by designing a low-background uniaxial strain cell, optimizing the experiment based on neutron-tracing simulations and using aggressive focusing and energy analysis. We show that the spin order parameter in cuprates is uniaxial and coupled to the charge channel [1].

Second, to further improve the feasibility and speed of such experiments, we have designed a new in-situ uniaxial device for large-scale facility research based on an actuator-motor mechanism, efficient feedback loops and the sample-holder design enabling rapid exchange of the samples [2]. I will demonstrate the improved capabilities of this device reporting the control of charge order in cuprates and magnetic phases in skyrmion materials, respectively.

Simutis et al. in review and arXiv:2204.02304 (2022)
Simutis et al. in review and arXiv:2207.13194 (2022)

Authors: SIMUTIS, Gediminas (Paul Scherrer Institute); MAZZONE, Daniel (Paul Scherrer Institute); KÜSPERT, Julia (University of Zurich); ZOLLIKER, Markus (Paul Scherrer Institute); BOEHM, Martin (Institut Laue-Langevin); BOUR-DAROT, Frédéric (CEA); MANSSON, Martin (KTH); IVASHKO, Oleh (DESY); VON ZIMMERMANN, Martin (DESY); WHITE, Jonathan (Paul Scherrer Institute); CHANG, Johan (University of Zurich); SASSA, Yasmine (Chalmers University of Technology); CHRISTENSEN, Niels Bech (Technical University of Denmark); BARTKOWIAK, Marek (Paul Scherrer Institut); JANOSCHEK, Marc (Paul Scherrer Institut)

Presenter: SIMUTIS, Gediminas (Paul Scherrer Institute)

Session Classification: Neutron Methods

Track Classification: Magnetism, Superconductivity, Topological Systems, Magnetic Thin Films an other electronic phenomena