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Manipulating the time reversal symmetry breaking superconductivity in Sr_2RuO_4 by uniaxial strain

Friday 6 November 2020 11:30 (20 minutes)

My work is focussed on one of the most compelling unconventional superconductors to date, Strontium Ruthenate (Sr_2RuO_4). It has become a benchmark for experimentation and theoretical analysis because its normal-state electronic structure is known with exceptional precision, and because of experimental evidence that its superconductivity breaks time-reversal symmetry (TRS)i.e. chiral. Measurements under uniaxial strain offer an ideal way to test for chirality because under uniaxial strain the superconducting and chiral transitions are predicted to split, allowing the empirical signatures of each to be identified separately.

By combining Muon spin relaxation (which is a unique tool to study structural and dynamical processes that are taking place in the bulk of a material in an atomic scale) and the application of uniaxial strain (which is a good way to perturb a material without introducing any disorder) I am searching for conclusive evidence regarding the superconducting order parameter of Sr_2RuO_4. For this purpose, we developed a uniaxial strain device1 that is expected to widen the range of applications of the Muon spin relaxation method. Using this device, we observed a large strain-induced splitting between the onset temperatures of superconductivity and TRSB in Sr_2RuO_4. Moreover, at high strain beyond the van Hove singularity, a new spin density wave ordered phase is observed2.

[1] C. Hicks et al. Piezoelectric-Driven Uniaxial Stress Apparatus for Muon Spin Rotation. JPS Conf. Proc. **21**, 011040 (2018)

[2]V. Grinenko, S. Ghosh et al, Split superconducting and time-reversal symmetry-breaking transitions and magnetic order in Sr_2RuO_4 under uniaxial stress. arXiv:2001.08152

Author: GHOSH, Shreenanda

Co-authors: Dr GRINENKO, Vadim (Institute for Solid State and Materials Physics, Technical University Dresden); Dr SARKAR, Rajib (Institute for Solid State and Materials Physics, Technical University Dresden); Dr ORAIN, Jean-Christophe (Laboratory for Muon Spin Spectroscopy, Paul Scherrer Institute); Dr NIKITIN, Artem (Laboratory for Muon Spin Spectroscopy, Paul Scherrer Institute); Mr ELENDER, Matthias (3Laboratory for Muon Spin Spectroscopy, Paul Scherrer Institute); Dr DAS, Debarchan (Laboratory for Muon Spin Spectroscopy, Paul Scherrer Institute); Dr GUGUCHIA, Zurab (3Laboratory for Muon Spin Spectroscopy, Paul Scherrer Institute); Mr BRUECKNER, Felix (Institute for Solid State and Materials Physics, Technical University Dresden); Dr BARBER, Mark E. (Max Planck Institute for Chemical Physics of Solids, Dresden); Dr PARK, Joonbum (Max Planck Institute for Chemical Physics of Solids, Dresden); Dr KIKUGAWA, Naoki (National Institute for Materials Science, Japan); Dr SOKOLOV, Dmitry A. (Max Planck Institute for Chemical Physics of Solids, Dresden); Dr BOBOWSKI, Jake S. (Physics, University of British Columbia, Canada); Mr MIYOSHI, Takuto (Department of Physics, Kyoto University, Japan); Prof. MAENO, Yoshiteru (Department of Physics, Kyoto University, Japan); Prof. MACKENZIE, Andrew P. (4Max Planck Institute for Chemical Physics of Solids, Dresden); Dr LUETKENS, Hubertus (Laboratory for Muon Spin Spectroscopy, Paul Scherrer Institute); Dr HICKS, Clifford W. (Max Planck Institute for Chemical Physics of Solids, Dresden,); Prof. KLAUSS, Hans-Henning (Institute for Solid State and Materials Physics, Technical University Dresden)

Presenter: GHOSH, Shreenanda

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