

15th International Conference on Muon Spin Rotation, Relaxation and Resonance



Contribution ID: 111 Contribution code: P-MON-1

Type: Poster

Tunable anomalous Hall conductivity through volume-wise magnetic competition in a topological kagome magnet

Monday, 29 August 2022 18:40 (20 minutes)

Magnetic topological phases of quantum matter are an emerging frontier in physics and material science. Along these lines, several kagome magnets have appeared as the most promising platforms. Recently, we explored magnetic correlations in the kagome magnet $\text{Co}_3\text{Sn}_2\text{S}_2$ [1]. Using muon spin-rotation (μSR) and ARPES, we present evidence for competing magnetic orders in the topological kagome lattice of this compound. Our results show that while the sample exhibits an out-of-plane ferromagnetic ground state, an in-plane antiferromagnetic state appears at temperatures above 90 K, eventually attaining a volume fraction of 80% around 170 K, before reaching a non-magnetic state. Strikingly, the reduction of the anomalous Hall conductivity (AHC) above 90 K linearly follows the disappearance of the volume fraction of the ferromagnetic state. We further show that the competition of these magnetic phases is tunable through applying either an external magnetic field or hydrostatic pressure. Our results taken together suggest the thermal and quantum tuning of Berry curvature induced AHC via external tuning of magnetic order. μSR played a crucial role in this study, since it serves as an extremely sensitive local probe for detecting small moments and ordered magnetic volume fractions in the bulk of magnetic materials.

[1] Z. Guguchia et. al., Nature Communications **11**, 559 (2020).

Primary author: Dr GUGUCHIA, Zurab (Laboratory for Muon Spin Spectroscopy, Paul Scherrer Institute, CH-5232 Villigen PSI, Switzerland)

Co-authors: Dr VEREZHAK, Joel (Laboratory for Muon Spin Spectroscopy, Paul Scherrer Institute, CH-5232 Villigen PSI, Switzerland); Dr GAWRYLUK, D. (Laboratory for Multiscale Materials Experiments, Paul Scherrer Institut, 5232 Villigen PSI, Switzerland); Dr TSIRKIN, S.S. (Department of Physics, University of Z'urich, Winterthurerstrasse 190, Zurich, Switzerland); Dr YIN, J.-X. (Laboratory for Topological Quantum Matter and Spectroscopy, Department of Physics, Princeton University, Princeton, New Jersey 08544, USA); Dr BELOPOLSKI, I. (Laboratory for Topological Quantum Matter and Spectroscopy, Department of Physics, Princeton University, Princeton, New Jersey 08544, USA); Mr ZHOU, H. (CAS Center for Excellence in Topological Quantum Computation, University of Chinese Academy of Science, Beijing, China); Dr SIMUTIS, G. (Laboratory for Muon Spin Spectroscopy, Paul Scherrer Institute, CH-5232 Villigen PSI, Switzerland); Dr ZHANG, S.-S. (Laboratory for Topological Quantum Matter and Spectroscopy, Department of Physics, Princeton University, Princeton, New Jersey 08544, USA); Mr COCHRAN, T.A. (Laboratory for Topological Quantum Matter and Spectroscopy, Department of Physics, Princeton University, Princeton, New Jersey 08544, USA); Dr CHANG, G. (Laboratory for Topological Quantum Matter and Spectroscopy, Department of Physics, Princeton University, Princeton, New Jersey 08544, USA); Dr POMJAKUSHINA, E. (Laboratory for Multiscale Materials Experiments, Paul Scherrer Institut, 5232 Villigen PSI, Switzerland); Dr KELLER, L. (Laboratory for Neutron Scattering, Paul Scherrer Institut, CH-5232 Villigen PSI, Switzerland); Mrs SKRZECZKOWSKA, Z. (Laboratory for Multiscale Materials Experiments, Paul Scherrer Institut, 5232 Villigen PSI, Switzerland); Mr WANG, Q. (9Department of Physics and Beijing Key Laboratory of Opto-electronic Functional Materials and Micro-nano Devices, Renmin University of China, Beijing, China); Prof. LEI,

H. (Department of Physics and Beijing Key Laboratory of Opto-electronic Functional Materials and Micro-nano Devices, Renmin University of China, Beijing, China); Dr KHASANOV, R. (Laboratory for Muon Spin Spectroscopy, Paul Scherrer Institute, CH-5232 Villigen PSI, Switzerland); Dr AMATO, Alex (Laboratory for Muon Spin Spectroscopy, Paul Scherrer Institute, CH-5232 Villigen PSI, Switzerland); Prof. JIA, S. (CAS Center for Excellence in Topological Quantum Computation, University of Chinese Academy of Science, Beijing, China); Prof. NEUPERT, T. (Department of Physics, University of Zürich, Winterthurerstrasse 190, Zurich, Switzerland); Dr LUETKENS, H. (Laboratory for Muon Spin Spectroscopy, Paul Scherrer Institute, CH-5232 Villigen PSI, Switzerland); Prof. HASAN, M.Z. (Laboratory for Topological Quantum Matter and Spectroscopy, Department of Physics, Princeton University, Princeton, New Jersey 08544, USA)

Presenter: Dr GUGUCHIA, Zurab (Laboratory for Muon Spin Spectroscopy, Paul Scherrer Institute, CH-5232 Villigen PSI, Switzerland)

Session Classification: Posters

Track Classification: Strongly correlated electron systems