TT 35: Cooperative Phenomena: Spin Structures and Magnetic Phase Transitions (joint session MA/TT)

Time: Tuesday 14:00–15:30 Location: POT/0151

TT 35.1 Tue 14:00 POT/0151

Stochastic Simulation of Phase Transitions in the Dissipative 2D XYZ-Model — •Franz Pöschl[1,2,3], Przemyslaw Zielinski[1,2,3], Xin Zhang[1,2,3], and Peter Rabl[1,2,3] — [1]Technical University of Munich, TUM School of Nat- ural Sciences, Physics Department, 85748 Garching, Germany — [2]Walther-Meißner-Institut, Bayerische Akademie der Wissenschaften, 85748 Garching, Germany — [3]Munich Center for Quantum Science and Technology (MCQST), 80799 Munich, Germany

The simulation of large, open quantum spin systems is a hard problem and for most cases it is not possible to get exact solutions. Therefore, we use methods in the class of the Truncated Wigner Approximations to tackle this problem. In our work we investigated the hybrid discrete-continuous truncated Wigner approximation and used it to determine the phase diagram of the dissipative 2D XYZ-model. We were able to simulate systems with several thousands of spins due to the linear scaling of the method and numerical optimization of our code. Hence we were able to simulate the phase transitions of the model and also characterize the different phases in the open quantum system.

TT 35.2 Tue 14:15 POT/0151

Large magnetoreflectance and optical anisotropy due to 4*f* flat bands in the frustrated kagome magnet HoAgGe — •Felix Schilberth[1,2], Luke DeFreitas[3], Khan Zhao[4,5], Florian Le Mardelé[6], Ivan Mohelsky[6], Milan Orlita[6], Philipp Gegenwart[5], Hua Chen[3], István Kézsmárki[1], and Sándor Bordács[2] — [1]Experimentalphysik V, Unversity of Augsburg — [2]Department of Physics, BME Budapest — [3]Department of Physics, Colorado State University — [4]School of Physics, Beihang University — [5]Experimentalphysik VI, Unversity of Augsburg — [6]LNCMI, Université Grenoble Alpes

We report peculiar optical properties of the frustrated itinerant magnet HoAgGe, which exhibits multiple magnetically ordered states obeying the kagome spin-ice rule. The optical conductivity is higher for light polarization perpendicular to the kagome plane both for the free carrier response and the interband transitions. The latter have strong contributions from Ho 4*f* flat bands located near the Fermi level, as revealed by our *ab initio* calculations, explaining the unusual anisotropy of the optical properties and the pronounced temperature dependence of the interband transitions for out-of-plane light polarization. The key role of Ho 4*f* states is further supported by the large variation of the magneto-reflectivity, following the field dependence of the magnetization in contrast to that of the magnetotransport data. Such heavy-electron bands near the Fermi level offer an efficient way to control transport and optical properties and we show that their ultrafast magneto-optical response is susceptible to the magnetic order.

TT 35.3 Tue 14:30 POT/0151

Transition between critical antiferromagnetic phases in the J1-J2 spin chain — Adam McRoberts[1], •Chris Hooley[2], and Andrew Green[3] — [1]International Centre for Theoretical Physics, Trieste, Italy — [2]Coventry University, Coventry, United Kingdom — [3]University College London, London, United Kingdom

The J1-J2 spin chain is one of the canonical models of quantum magnetism, and has long been known to host a critical antiferromagnetic phase with power-law decay of spin correlations. We show that there are, in fact, two distinct critical antiferromagnetic phases, where the roles of the local dimer field and its dual field are interchanged: the 'Affleck-Haldane' phase near the Heisenberg point J2 = 0, where the dimer field that parametrises local singlet order is gapless and part of a joint O(4) Neel-singlet order parameter; and the 'Zirnbauer' phase which appears at sufficiently large ferromagnetic J2, where the dimer field is gapped out and its dual field - the instanton density of the O(3) Neel field - is critical instead. The phases are so-named because each realises one of the competing pictures for how the O(3) non-linear sigma model with a topological theta term renormalises to the su(2) level 1 Wess-Zumino-Witten model. We support these predictions with density matrix renormalisation group calculations.

TT 35.4 Tue 14:45 POT/0151

Field-induced transitions in the charge-ordered Kagome metal FeGe — •Lilian Prodan[1], Jeremy Sourd[2], Pavlo Khanenko[2], Yurii Skourski[2], Sergei Zherlitsyn[2], and István Kézsmárki[1] — [1]EPV, Institute of Physics, University of Augsburg - Augsburg, Germany — [2]HLD-EMFL, Helmholtz-Zentrum Dresden-Rossendorf, Dresden, Germany

Kagome metals with strong electronic correlations have recently attracted significant interest as fertile platforms for emergent phenomena such as unconventional magnetism, topological transport, and symmetry-breaking instabilities. Among them, FeGe stands out due to its intriguing combination of noncollinear magnetism and charge ordering, making it a prime candidate for studying the coupling between spin, charge, and lattice degrees of freedom [1]. This compound orders antiferromagnetically below $\sim 410\ K$, develops a charge-density-wave state near $\sim 110\ K$, and forms a noncollinear spin structure below $\sim 60\ K$. To explore how these orders interact, we performed magnetization, sound-velocity, and magnetostriction measurements in static and pulsed magnetic fields up to 60 T. Our results reveal previously unreported transitions at high magnetic fields and allow us to construct an extended H-T phase diagram for FeGe. [1] X. Teng, et al., Nature **609**, 490-495 (2022).

TT 35.5 Tue 15:00 POT/0151

Successive field-induced phase transitions in the kagome magnet $ErMn_6Sn_6$ — •A. Kurtanidze[1,2], Sh. Yamamoto[1], K. Uhlirova[3], Y. Skourski[1], S. Zherlitsyn[1], J. Sourd[1], T. Herrmannsdörfer[1], E. Weschke[4], O. Prokhnenko[4], H. Nojiri[5], B. Eggert[6], A. Aubert[7], K. Kummer[8], K. Skokov[7], H. Wende[6], and J. Wosnitza[1,2] — [1]Hochfeld-Magnetlabor Dresden (HLD-EMFL), HZDR, Dresden, Germany — [2]Institut für Festkörper- und Materialphysik, TU Dresden, Germany — [3]Materials Growth and Measurement Laboratory (MGML), Charles University, Prague, Czech Republic — [4]Helmholtz-Zentrum Berlin für Materialien und Energie, BESSY II, Berlin, Germany — [5]Institute for Materials Research, Tohoku University, Sendai, Japan — [6]Faculty of Physics and Center for Nanointegration Duisburg-Essen (CENIDE), University of Duisburg-Essen, Germany — [7]Functional Materials, Material Science, TU Darmstadt, Germany — [8]ESRF, The European Synchrotron, Grenoble, France

The ternary stannides RMn_6Sn_6 (R = Sc, Y, Gd-Lu) with hexagonal $HfFe_6Ge_6$-type structure ($P6/mmm$) are a key platform for exploring coupled topological electronic and magnetic properties. We focused on single crystals of $ErMn_6Sn_6$ and observed successive field-induced phase transitions. Using element-specific x-ray magnetic circular and linear dichroism (XMCD/XMLD) measurements in pulsed magnetic fields up to 30 T, we revealed the microscopic nature of these transitions, supported by thermodynamic data. We discuss Er and Mn moment reorientations and their link to macroscopic results.

TT 35.6 Tue 15:15 POT/0151

Depinning by shaking of skyrmions by oscillating magnetic fields — •Rajendra Loke[1], Alla Bezvershenko[2], Petra Becker Bohaty[3], Achim Rosch[2], and Joachim Hemberger[1] — [1]II. Physikalisches Institut, University of Cologne, Zülpicher Str. 77, 50937 Cologne, Germany — [2]Institut for Theoretical Physics, University of Cologne , Zülpicher Str. 77, 50937 Cologne, Germany — [3]Institut for Geology und Mineralogy, University of Cologne , Zülpicher St. 49b, 50674 Cologne, Germanyy

Here we present our recent result on shaking the skyrmion lattice by oscillating transvers magnetic field. When a transvers field is applied in addition to the longitudinal external field, skyrmion strings try to align themselves parallel to the effective field. To do so, the tips of the skyrmion strings have to move large distances and thus have to overcome pinning forces before being able to follow the field lines. We employ linear and non-linear AC susceptometry as experimental probe. The signature of this pinning-depinning transition is observable as contribution to the magnetic susceptibility, to the magnetic loss, and as well in the higher harmonic susceptibility. According to theoretical predictions, due to the chiral nature of the material the depinning is connected to translational motion of the skyrmions.

[1] Jan Müller et al. PhysRevLett.119.137201 (2017) [2] Felix Rucker et al. arXiv: 2504.01133v1 [3] Nina del Ser et al. SciPost Phys. 15, 065 (2023).