MA 39: Poster Magnetism II

Time: Wednesday 18:00–21:00 Location: P2

MA 39.1 Wed 18:00 P2

Observation of negative orbital torque from Vanadium — •Jose Omar Ledesma Martin[1], Nikhil Vijayan[1], Durgesh Kumar[1], Ao Du[1], Lei Gao[2], Zijie Xiao[2], Hai I. Wang[2], Rahul Gupta[1], Gerhard Jakob[1], Sachin Krishnia[1], Yuriy Mokrousov[1,3], and Mathias Kläui[1] — [1]Institute of Physics, Johannes Gutenberg University Mainz, Germany — [2]Max Planck Institute for Polymer Research, Germany — [3]Peter Grünberg Institut and Institute for Advanced Simulation, Forschungszentrum Jülich and JARA, Germany

Vanadium is predicted to exhibit a large orbital Hall effect. This effect is measured using ST-FMR, second-harmonic Hall, and THz emission, and all techniques reveal a negative orbital torque, in contrast to previous predictions and measurements that report a positive sign. The consistency in the results suggests the intrinsic origin of the OHE in our V samples. The torque magnitude depends strongly on the choice of ferromagnet: FeCoB/V, sensitive mainly to SHE-driven currents, shows only a weak response, whereas Ni/V, which efficiently converts OHE-driven currents, exhibits a torque nearly seven times larger. The torque increases with V thickness while remaining negative, and the extracted parameters indicate a large negative orbital Hall conductivity and long orbital diffusion length. Our results show that V generates strong orbital Hall currents with minimal spin Hall contribution and that itinerant interfacial orbital currents play a decisive role in determining both the efficiency and the sign of the torque (1).

(1) Vijayan, N. et al., arXiv:2508.16339 (2025).

MA 39.2 Wed 18:00 P2

Transport and spin torque in van der Waals heterostructures — •Nils Stüber[1], Sadeed Hameed[1], Aditya Kumar[1], Xinran Wang[1], Durgesh Kumar[1], Aravind Puthirath Balan[1], and Mathias Kläui[1,2] — [1]Institute of Physics, Johannes Gutenberg-Universität, Mainz, Germany — [2]Center for Quantum Spintronics, Department of Physics, Norwegian University of Science and Technology, Trondheim, Norway

Graphene serves as an ideal spin-transport channel due to its long spin relaxation times and possible near-ballistic transport. In Ni/Gr heterostructures, the strength of the Spin Hall effect can be tuned via gate voltage, enabled by the Dirac-cone band structure.

In this work, we investigate spin-current generation in graphene induced by proximity-driven spin-orbit coupling (SOC) from epitaxially grown Ni(111). The SOC arises from hybridization between the graphene*s π-electrons and the Ni 3d orbitals.

We perform spin-torque ferromagnetic resonance (ST-FMR) to study the dependence of the spin-current signal on the Ni thickness and to identify the origin of the generated spin current. Additionally, THz emission experiments were carried out to detect the inverse Spin Hall effect in graphene, revealing a significantly different signal compared to CoFe/Gr heterostructures.

MA 39.3 Wed 18:00 P2

Tuning Spin-Charge Conversion at the hybrid heavy-metal/ organic semiconductor interface via Doping — Parul Devi[1], •Devamrutha I S[1], Zhitian Ling[2], Ashish Moharana[1], David Anthofer[1], Tomasz Marszalek[2], and Angela Wittmann[1] — [1]Institut für Physik, Johannes Gutenberg-Universität Mainz, Deutschland — [2]Max-Planck-Institut für Polymerforschung, Mainz, Deutschland

Spintronics, the way forward to device miniaturization, leverages electron spin rather than charge. Though inorganic materials were predominantly given more attention in spin transport studies, organic semiconductor (OSC)/magnetic hybrid interfaces are quickly gaining interest, owing to the flexibility, scalability, and structural tunability of organic materials. Here, we probe the role of the charge carrier concentration of the OSC on the spin injection and spin-charge conversion efficiency in hybrid heterostructures via spin pumping. For this, we probe the inverse spin Hall effect (ISHE) in a ferrimagnetic insulator/ heavy-metal/ OSC heterostructure and systematically dope the conjugated polymer PBTTT with F4-TCNQ. We observed that the ISHE amplitude in the heavy metal increases by a factor of 4 upon adsorption of the PBTTT layer while doping reduces the signal. These results open the door to charge doping as an effective tool to control spin injection across hybrid interfaces.

MA 39.4 Wed 18:00 P2

Chirality controlled quantum transport in kagome AV3Sb5 — •Li Cheng and Qun Yang — Max Planck Institute of Microstructure Physics

Kagome metals AV3Sb5 exhibit a rich interplay among charge-density waves (CDWs), structural chirality, unconventional superconductivity, and anomalous Hall transport. Recent theoretical progress shows that layer-dependent phase shifts between CDW wave vectors can generate helical stacking and chiral electronic structures, while experiments reveal strong correlations between chirality and anomalous charge transport. In parallel, distorted kagome compounds display intertwined CDW and magnetic orders with enhanced tunability under external stimuli.

Motivated by these developments, this project aims to establish a predictive first-principles framework that connects CDW chirality with spin/orbital polarization as well as anomalous transport, and to uncover the microscopic mechanisms driving anomalous Hall responses in kagome systems. We further propose to explore pressure, strain, and temperature as external knobs for switching chirality and controlling emergent electronic and magnetic functionalities.

MA 39.5 Wed 18:00 P2

Tunable Topological Spin Pump in the XXZ Chain via Incommensurate Boundary Drives. — •Anshuman Tripathi[1], Mircea Trif[2], and Thore Posske[1] — [1]I. Institute for Theoretical Physics, University of Hamburg, Hamburg, Germany — [2]International Research Centre MagTop, Institute of Physics, Polish Academy of Sciences, Warsaw, Poland

We investigate an interacting XXZ spin-1/2 chain driven quasiadiabatically at its boundaries by two incommensurate phase drives. The independently evolving phases result in a quasi-periodic trajectory on a two-dimensional torus, which generates a robust topological spin pump in the ground state. We show that the pumped spin is determined by an effective Chern number defined over the drive-phase torus, whose value is set by the number of degeneracy points enclosed by the trajectory. These degeneracy points increase systematically with the chain length and can be tuned through the exchange anisotropy, providing direct control of the topological pumping strength. Our results demonstrate that incommensurate multi-tone driving enables a versatile and robust realization of topological pumps in interacting quantum spin chains.

MA 39.6 Wed 18:00 P2

Ab-initio calculated linear, quadratic and cubic magneto-optic Kerr effect spectra — •Martin Zeman[1], Maik Gaerner[2], Robin Silber[3], Martin Veis[1], Timo Kuschel[2,4], and Jaroslav Hamrle[1,5] — [1]Charles University Prague, Czech Republic — [2]Bielefeld University, Germany — [3]VSB - Technical University of Ostrava, Czech Republic — [4]Johannes Gutenberg University Mainz, Germany — [5]Czech Technical University, Prague, Czech Republic

The cubic magneto-optic Kerr effect originates from higher-order symmetry terms in cubic crystals. Using density-functional theory within WIEN2k, we calculate the linear, quadratic, and cubic MOKE contributions. First, the permittivity tensor is calculated for different magnetization orientations using the Kubo formula (linear response theory). Then, the individual contributions are separated using expected dependence on the magnetization direction, as predicted by the symmetry. Here we limit to ferromagnetic materials of cubic symmetry, bcc Fe, fcc Co, fcc Ni, and Heusler compounds Co_2FeSi and AuMnSb, whose magneto-optic response is described by principal spectra K, G_s, $2G_{44}$, and ΔH. Surprisingly, the strength of the cubic contribution ΔH is of similar order as the quadratic ones G_s, $2G_{44}$, which has also been confirmed by experimentally [1,2].

[1] M. Gaerner et al., Phys. Rev. Appl. **22**, 024066 (2024)
[2] R. Silber et al, Phys. Rev. B **100**, 064403 (2019)

MA 39.7 Wed 18:00 P2

Application of 3D Nano-Lithography in Magnetism — •Jana Kredl[1], Christian Denker[1], Cornelius Fendler[2], Julia Bethune[1], Nina Meyer[1], Theresa Brinker[1], Finn-F. Stiewe[1], Tobias Kleinke[1], Chris Badenhorst[1], Alena Rong[1], Robin Silber[3], Mark Doerr[1], Raghvendra Palanakar[1], Toni Hache[6], Neha Jah[1], Uwe T. Bornscheuer[1], Marcel Kohlmann[1], Hauke Lars Heyen[1], Michaela Lammel[4], Alexander Paarmann[5], Andy Thomas[4], Robert Blick[2], Jakob Walowski[1], Michaela Dalcea[1], and Markus Muenzenberg[1] — [1]University of Greifswald, Germany — [2]University of Hamburg — [3]VSB-Technical University of Ostrava, Czech Republic — [4]IFW Dresden, Gemany — [5]Fritz Haber Institute of the Max Planck Society, Berlin, Germany — [6]Helmholtz-Zentrum Dresden-Rossendorf, Germany

3D 2-Photon-Lithography, originally developed for 3D photonic crystals, opens a wide range of new possible applications in many fields, e.g. life sciences, micro-optics and mechanics. We will present our recent applications of 3D 2-Photon-lithography and show 3D evaporation masks for in-situ device fabrication using different deposition angles, infra-red laser light focusing lenses directly fabricated on optical fibers, tunnel structures for guiding growth of neurons [1], pillars for investigation of cell mechanics and master-mold fabrication for Polydimethylsiloxane (PDMS) micro-fluidic channels. Based on our experience we will discuss possible applications in magnetism. [1] C. Fendler et al., Adv. Biosys. 5 (2019) doi: 10.1002/adbi.201970054

MA 39.8 Wed 18:00 P2

Mapping the Interaction Field in Artificial Spin Ices — •Brindaban Ojha, Matías P. Grassi, and Vassilios Kapaklis — Department of Physics and Astronomy, Uppsala University, Uppsala, Sweden

Artificial spin ice (ASI) consists of lithographically patterned nanomagnet arrays that interact through dipolar coupling. Although these interactions can be tuned by adjusting nanomagnet dimensions, periodicity, and thickness, their detailed distribution and influence on magnetization reversal remain incompletely understood. We study square ASI structures with nanomagnet widths corresponding to aspect ratios (length/width) of 3 and 4.5, while keeping the length fixed at ~450 nm, and probe their interaction fields using First-Order Reversal Curve (FORC) analysis. ASI with an aspect ratio of 4.5 shows a single central peak in the FORC distribution, whereas the aspect-ratio-3 system displays both a central peak and an asymmetric 'boomerang'-shaped feature. To understand these signatures, we perform micromagnetic simulations using MuMax. After relaxation from a random state, lower-aspect ratio ASI develops multidomain or vortex-like states, while higher-aspect-ratio ASI stabilizes in single-domain configurations due to enhanced shape anisotropy. The simulations confirm that the central FORC peak corresponds to single-domain switching in the higher-aspect ratio ASI, whereas the 'boomerang' feature arises from an intermediate S-shaped reversal mode in the lower-aspect ratio system. These results demonstrate how geometry governs interaction-field distributions and reversal mechanisms in ASI.

MA 39.9 Wed 18:00 P2

Element- and Depth-Selective Magnetometry of Buried Magnetic Layers by MCD-HAXPES at PETRA III — •Andrei Gloskovskii[1], Christoph Schlueter[1], and Gerhard Fecher[2] — [1]Photon Science / DESY, Hamburg — [2]Max Planck Institute for Chemical Physics of Solids, Dresden

Magnetic circular dichroism (MCD) in hard X-ray photoelectron spectroscopy (HAXPES) provides direct element-specific access to magnetization in deeply buried layers. The MCD signal follows a simple $\cos(\theta)$ dependence on the angle between the X-ray polarization vector and the sample magnetization. Depth-selective magnetic sensitivity is achieved by exploiting near-total-reflection and waveguide excitation geometries, where the depth resolution is controlled by shaping the spatial intensity profile of the incident hard X-ray field inside the multilayer structure. In both cases, the probing depth is tuned by redistributing the X-ray excitation field inside the sample rather than by changing the emission angle or the kinetic energy of the photoelectrons. Using Co-based alloys as model systems, we show that MCD-HAXPES provides element- and depth-resolved magnetic contrast in complex multilayer stacks. The method is particularly powerful for disentangling interface and bulk magnetization in buried heterostructures. In addition to the methodological aspects, this contribution also presents an overview of recent user activities at beamline P22 (PETRA III), where an increasing number of external user groups have successfully applied MCD-HAXPES for depth-resolved magnetic studies and have already published a broad range of high-impact results.

MA 39.10 Wed 18:00 P2

Interferometric measurements of Yttrium-Iron-Garnet cantilevers — Sumiya Saleem[1], •Richard Boucher[1], Seth Kaufman[1], and Georg Schmidt[1,2] — [1]Martin-Luther-Universität Halle-Wittenberg Insitut für Physik, Halle, Germany. — [2]Interdisziplinäres Zentrum für Materialwissenschaften, Martin-Luther-Universität Halle-Wittenberg, Halle, Germany.

Interferometric effects provide a sensitive detection of displacement, including those related to the resonance oscillations of cantilevers. We fabricate Yttrium-Iron-Garnet (YIG) cantilevers using a room-temperature pulsed laser deposition of amorphous YIG, lift-off method, followed by an anneal in oxygen yielding single-crystal structures [1]. By combining these in an interferometer built on the basis of the work of Pernpeitner [2] and Jörg [3] we have looked at the resonance frequency dependence on YIG cantilever length in the micrometre range, which will be compared with the work of Seo [4], various theoretical models, and COMSOL simulations, showing excellent agreement with theoretical results. We further show that these cantilevers can be driven to a non-linear regime, indicated via a characteristic Duffing non-linearity at high driving powers.

[1] P. Trempler et al, APL, 117, 232401 (2019) [2] M. Pernpeitner PhD thesis, TUM. [3] P. Jörg Bachelor's thesis, TUM [4] Y-J. Seo, APL., 110, 132409 (2017)

MA 39.11 Wed 18:00 P2

Spin-lattice coupling as a source of chiral phonons in cubic magnets — •Yelyzaveta A. Borysenko, Daniel Schick, and Ulrich Nowak — Department of Physics, University of Konstanz, 78457 Konstanz, Germany

Hybrid spintronic device concepts can be implemented based on angular momentum, as this can be transferred over significant distances and effectively exchanged between different quasiparticles. The understanding, control, and effective generation of angular momentum is crucial for such applications.

The creation and manipulation of chiral phonons introduces an additional degree of freedom, as they can couple to other quasiparticles in a chirality-selective manner as well as transfer angular momentum obtained from magnons. Chiral phonons mainly occur in materials with inversion-symmetry breaking, although recent works proved that they can be also generated in materials preserving this symmetry due to spin-lattice coupling [1], which was also experimentally demonstrated with ultrafast demagnetization in a nickel thin film [2].

In this work, we linearize the coupled equations of motion for the spin and lattice degrees of freedom assuming a coupling term of anisotropy type. We describe the appearance of chiral phonons induced by spin-lattice coupling comparing cubic ferromagnets and antiferromagnets, calculate angular momentum of the modes and discuss the chirality selective coupling of magnon and phonon bands.

[1] M. Weißenhofer et al., Phys. Rev. Lett. 135, 216701 (2025);
[2] S. R. Tauchert et al., Nature 602, 73 (2022);

MA 39.12 Wed 18:00 P2

Optical manipulation of spin based AC-nanooscillators — •Niklas Dornquast[1], Kevin Jäckel[1], Jakob Walowski[1], Tim Böhnert[2], and Markus Münzenberg[1] — [1]University of Greifswald, Germany — [2]The International Iberian Nanotechnology Laboratory (INL), Portugal

With the steady rise of artificial intelligence and the end of Moore's law, a novel approach for computational capabilities arises to fulfill the ever-increasing demand, while keeping energy consumption low. The research field of spintronics provides new possibilities for such energy-efficient technology by also utilizing the transport of electron spin in addition to charge transport, opening up operation processing in a higher Gigahertz frequency range. Devices that realize such utilization of electron spin are, for example, spintronic AC-nanooscillators such as Spin-Torque-nanooscillators (STNOs) and Spin-Hall-nanooscillators (SHNOs). Additionally, these types of nanooscillators have the prospect of being used in a whole new computer architecture based on the human brain, called "neuromorphic computing". We investigate the effects of femtosecond laser pulses (<100 fs) of different polarities on such nanooscillators by optimizing the lasers' parameters to increase oscillation efficiency as well as manipulate the oscillation frequency optically.

MA 39.13 Wed 18:00 P2

Cubic magneto-optic Kerr effect in (001)-oriented thin films at grazing incidence of light — •Marius Krause[1], Maik Gaerner[1], Robin Silber[2], Jaroslav Hamrle[3], and Timo

Kuschel[1,4] — [1]Bielefeld University, Germany — [2]VSB - Technical University of Ostrava, Czech Republic — [3]Charles University Prague, Czech Republic — [4]Johannes Gutenberg University Mainz, Germany

We investigate the cubic magneto-optic Kerr effect (CMOKE) in thin films of cubic crystal structures. CMOKE is proportional to third order in magnetization ($\propto M^3$) and was recently observed in Ni(111) thin films with 45° incidence of light [1]. At this angle of incidence, no CMOKE could be observed for (001)-oriented Ni thin films so far. However, we could observe a distinct CMOKE signal in Ni(001) at grazing incidence. Similar behaviour is found in other materials with (001)-oriented cubic crystal structure, indicating that grazing-incidence CMOKE is a more general feature of this crystal orientation. In this contribution, we present first experimental results of grazing-incidence CMOKE and discuss the incidence-angle dependence of CMOKE for different materials and crystal orientations. Our findings open new possibilities for CMOKE-based characterization of materials with (001)-oriented crystal structures.

[1] M. Gaerner et al., Phys. Rev. Appl. 22, 024066 (2024)

MA 39.14 Wed 18:00 P2

Generation of Floquet-like sidebands in spin-wave systems induced by surface accustic waves — •Tim Vogel, Matthias Wagner, Björn Heinz, and Philipp Pirro — Fachbereich Physik and Landesforschungszentrum OPTIMAS, RPTU Kaiserslautern-Landau

The interaction between spin waves (SWs) and surface accoustic waves (SAWs) offers promising opportunities for advanced magnonic and spintronic applications. In this work, we investigate the generation of Floquet-like frequency combs in the GHz spin-wave spectrum with low-frequency SAWs in the MHz range as the Floquet-drive. We study the excitation of these states by coupling SAWs of different frequencies and incidence angles to SWs in both Damon-Eshbach and backward-volume geometry. We further explore these effects in multiple material systems to validate an analytical model describing the modified spin-wave dispersion under SAW driving. Our results contribute to a deeper understanding of magnon-phonon interactions and the conditions under which Floquet-like states emerge.

We acknowledge funding by the European Union via Horizon Europe project MandMEMS, Grant No. 101070536.

MA 39.15 Wed 18:00 P2

Growth and magnetic characterization of freestanding single-crystalline SrRuO3 /La0.7Sr0.3MnO3 oxide bilayers — •Diana Rata, Lilly Patschinsky, Elin Vocks, Alexander Much, Oleksandr Dolynchuk, Antonia Rieche, and Kathrin Dörr — Institute of Physics, Martin Luther University Halle*Wittenberg, 06099 Halle, Germany

We report the successful fabrication of freestanding epitaxial SrRuO3 /La0.7Sr0.3MnO3 (SRO/LSMO) heterostructures. LSMO and SRO layers were first prepared by PLD on a water-soluble sacrificial oxide Sr3Al2O6 (SAO), which was epitaxially grown on a SrTiO3 (100) substrate, followed by selective release and transfer of the membranes onto SiO2 wafers. The structure was characterized by X-ray diffraction. Our findings reveal that the epitaxial growth and strain of SAO layer is strongly affected by the subsequent growth condition (e.g., oxygen partial pressure) of upper oxide layers and influences strongly the quality and integrity of the oxide membranes. Magnetic characterization show that the freestanding SRO/LSMO membranes retain the key magnetic signatures of their corresponding bilayers. Notably, in the case of freestanding single-layer SrRuO3, we observe an enhancement of the magnetic response compared to its epitaxial single layer, suggesting strain relaxation and reduced substrate clamping as important factors. These results highlight the potential of freestanding oxide membranes for flexible integration and for exploring strain-decoupled magnetic phenomena in functional single-crystalline freestanding oxide bilayers.

MA 39.16 Wed 18:00 P2

Magnetic Anisotropy in Ordered and Disordered CoPd Alloys: A First-Principles Study — •Christian Maas, Michael Czerner, and Christian Heiliger — Institute for Theoretical Physics, Justus Liebig University Giessen

Understanding the magnetic anisotropy in magnetic materials is crucial for designing devices like sensors or data storage. In this work, we present ab initio density functional theory calculations of the magnetocrystalline anisotropy of $Co_xPd_{(1-x)}$ alloys with varying concentrations as well as $L1_0$ like $[CoPd]_x[PdCo]_{(1-x)}$ structures. We also show results for ordered layer structures with different thicknesses of Co and Pd layers. For our calculations, we employ the relativistic screened Korringa-Kohn-Rostoker Green's function method. The alloys are treated within the coherent potential approximation. Additionally, we explore the magnetic anisotropy of thin $Co_xPd_{(1-x)}$ films, considering both the magnetocrystalline and shape anisotropy.

MA 39.17 Wed 18:00 P2

Tailoring magnetic textures and investigation of magnetization processes in 3D via geometrical transformation — •Aman Singh[1], Timo Schmidt[2], Ivan Soldatov[1], Manfred Albrecht[2], Rudolf Schäfer[1], and Volker Neu[1] — [1]Leibniz IFW Dresden, D-01069 Dresden, Germany — [2]Institute of Physics, University of Augsburg, D-86159 Augsburg, Germany

Control over magnetic domains and domain walls is crucial for developing magnetic systems and devices. Here, we use a simple technique that uses a self-assembled reversible geometrical transformation from a flat 2D state to a rolled-up 3D state and back to the 2D state to create periodic up-down magnetization patterns in TbFe by applying a homogeneous magnetic field in the 3D state. We present how the magnetization patterns can be deterministically tailored simply by selecting the magnitude and direction of the applied magnetic field in the 3D state, which would otherwise require much more elaborate processes. This approach further provides a unique pathway to access and visualize magnetization processes in 3D by investigating the imprinted domains in the unrolled state of material magnetized at various fields in the 3D state. We further show that the overall 3D magnetization evolution can be reconstructed from recoil measurements in the 2D state when combined with the intrinsic anisotropy of the material. Finally, we discuss how this platform can be extended to investigate anisotropy changes in magnetostrictive materials, opening new possibilities for studying and engineering 3D magnetic states through reversible shape transformation.

MA 39.18 Wed 18:00 P2

Exploring spin reorientation and structural stability in distorted kagome metal — •Jayjit Kumar Dey[1], Tomke Glier[2], Sourav Chowdhury[1], Mouli Roy-Chowdhury[3], Subhajit Nandy[1], Amir-Abbas Haghighirad[4], Dmitry Reznik[2], and Moritz Hoesch[1] — [1]Deutsches Elektronen-Synchrotron (DESY), Hamburg, Germany — [2]University of Colorado Boulder, Boulder, CO, USA — [3]Université Grenoble Alpes, CEA, CNRS, Grenoble INP, SPINTEC, Grenoble, France — [4]Karlsruhe Institute of Technology, Karlsruhe, Germany

Distorted kagome metals have emerged as fertile platforms for investigating the interplay between geometrical frustration, magnetoelastic coupling, and exotic electronic states. In this work, we investigate the magnetic anisotropy and spin-reorientation behavior of TbAgGe and DyAgGe using X-ray magnetic circular dichroism (XMCD) and X-ray magnetic linear dichroism (XMLD) at the rare-earth M4,5-edges. XMCD reveals strong magnetocrystalline anisotropy and highlights the gradual evolution of 4f-moment orientation under applied magnetic field. Complementary XMLD measurements provide direct evidence of exchange-driven spin arrangement and local crystal field anisotropy. The robustness of the hexagonal crystal framework is evidenced by Extended X-ray absorption fine structure (EXAFS) and Raman spectroscopy, with no evidence of symmetry breaking despite noticeable shifts in bond angles and interlayer spacing. These results establish spin dynamics and structural stability in distorted kagome systems.

MA 39.19 Wed 18:00 P2

More is not always better: the case of $Mn_{0.56}Ge_{0.09}Sb_{0.23}Te$ — Tijmen Groot[1], Marie Tardieux[1], Laura T. Corredor[2,3], Manaswini Sahoo[4], Anja U.B. Wolter[4], and •Anna Isaeva[1,2,3] — [1]University of Amsterdam, The Netherlands — [2]TU Dortmund University, Germany — [3]Research Center Future Energy Materials and Systems, Germany — [4]Leibniz IFW Dresden, Germany

In the quest to optimize magnetic topological materials within the $(MnX_2Te_4)(X_2Te_3)_n$ family [1], Mn enrichment appears to be a viable strategy that enhances the ferrimagnetic ground state and the Curie temperature. We recently reported the most Mn-rich phases derived from $MnSb_2Te_4$, achieving T_C = 58-73 K [2-3], nearly satisfying one key requirement for potential applications.

Our further attempts to tune T_C show that not only Mn richness but also lattice symmetry plays a key role. Here we present the cubic, Mn-rich compound $Mn_{0.56}Ge_{0.09}Sb_{0.23}Te$ ($Fm\bar{3}m$, $a = 5.9320(2)$ Å), as identified by powder and single-crystal XRD, SEM/EDX, and DC susceptibility. Due to the statistical disorder of Mn, Ge, and Sb over the cationic sites, it loses ferrimagnetic order in favor of an A-type antiferromagnetic arrangement with a low $T_N = 25$ K. This ground state is also supported by DFT+U calculations across a wide range of plausible compositions.

References: [1] National Science Review 11 (2024), nwad282; [2] Mater. Today Phys. 38 (2023), 101265; [3] Chem. Mater. 37 (2025), 1446-1456.

MA 39.20 Wed 18:00 P2

Magnetic Domain Structure of Erbium thin films — •Ujjval Mishra, Patrick Härtl, and Matthias Bode — University of Würzburg, Experimental Physics 2, Am Hubland, D-97074 Würzburg, Germany

Rare-earth metal (REM) films exhibit diverse magnetic behaviors governed by the indirect RKKY coupling of localized $4f$ moments, leading to complex long-range order. Building on prior studies of REM surface magnetism [1-5], we investigate the magnetic properties of epitaxial Erbium (Er) thin films. Er, a heavy rare-earth element with two unpaired $4f$ electrons, crystallizes in a hexagonal close-packed structure and remains paramagnetic above $T_N = 85$ K. Below $T_C = 20$ K, it adopts a conical ferromagnetic phase with the cone axis parallel to the c direction and a semi-cone angle of 29.6° at 6 K [6].

Spin-polarized scanning tunneling microscopy (SP-STM) reveals a complex domain structure in Er(0001) films epitaxially grown on W(110). At 4.5 K, domain walls are predominantly pinned to structural defects, while external magnetic fields around 2 T induce a maze-like contrast, confirming their magnetic origin. These findings highlight the intricate coupling between structural defects and magnetic domain evolution in Er(0001) thin films.

[1] P. Härtl et al., Phys. Rev. B **105**, 174431 (2022). [2] P. Härtl et al., Phys. Rev. Lett. **133**, 186701 (2024). [3] P. Härtl et al., Phys. Rev. B **110**, 184405 (2024). [4] P. Härtl et al., Phys. Rev. B **112**, 024416 (2025). [5] P. Härtl et al., Phys. Rev. B **112**, 174402 (2025). [6] W. C. Koehler et al., J. Appl. Phys. **36**, 1078 (1965).

MA 39.21 Wed 18:00 P2

First-principles study of Mn mono- and bilayers on the Ta(001) surface — •Leo Kollwitz, Tim Drevelow, and Stefan Heinze — Institute of Theoretical Physics and Astrophysics, Kiel University, Leibnizstraße 15, 24098 Kiel, Germany

The magnetic order in ultrathin $3d$ transition-metal films on surfaces can be strongly influenced by the substrate. A prominent example is a Mn monolayer on W(001), in which the prototypical antiferromagnetic Mn exhibits strong ferromagnetic exchange coupling [1]. Deposition of an additional Mn layer, however, leads to a checkerboard antiferromagnetic order in the surface layer, while the magnetic moment of the Mn interface layer is quenched moment [2]. Here, we study the magnetism in Mn mono- and bilayers on the Ta(001) surface by density functional theory (DFT) via the Fleur code [3]. Surprisingly, the Ta substrate leads to a very similar behavior of magnetic order in the Mn mono- and bilayer as on the W(001) surface, contrary to the trend observed for Fe monolayers [4]. Our DFT calculations show a strong dependence of the magnetic moments of the lower Mn layer on the interlayer distance as well as the magnetic configuration. Based on the DFT results we parameterize an atomistic spin Hamiltonian.

[1] P. Ferriani *et al.*, Phys. Rev. B **72**, 024452 (2005)
[2] S. Meyer *et al.*, Phys. Rev. Res. **2**, 012075(R) (2020)
[3] The Fleur project, www.flapw.de
[4] P. Ferriani *et al.*, Phys. Rev. Lett. **99**, 187203 (2007)

MA 39.22 Wed 18:00 P2

prospects of studying circularly polarised phonons in 2D magnetic materials — •Hanna Shirin Pulikkal Hamza[1], Lukas Nöding[1], Helya Alaei[1], Ahmed Hassanien[1], Mashood Tariq Mir[1], Zdeněk Sofer[2], Jochen Mikosch[1], Thomas Baumert[1], and Arne Senftleben[1] — [1]Institute of Physics,University of Kassel, 34132 Kassel, Germany — [2]UCT Prague

It has been proposed that circularly polarised phonons can induce transient magnetisation in materials when driven by ultrafast laser pulses via the atomistic scale Barnett effect. In this ongoing study, we want to directly link the observation of circular atomic motion with magnetisation in 2D Van der Waals room temperature ferromagnetic materials. We have recently induced circularly polarised coherent phonons by a pair of femto-second laser pulses in a non-magnetic material namely graphite and detected the resulting lattice dynamics using Ultrafast Electron Diffraction (UED). In this contribution, we will review the results on graphite and show our recent progress in exfoliating ferromagnetic 2D materials. Furthermore, we will explore magnetisation measurements of our microscopic samples using Kerr microscopy and vibrating sample magnetometry.

MA 39.23 Wed 18:00 P2

D-wave Chiral Phonons from Electron-Phonon Coupling — •Dimos Chatzichrysafis[1] and Alexander Mook[1,2] — [1]Johannes Gutenberg Universität, Mainz — [2]University of Münster

Chiral phononics, the field of study of phonons carrying finite orbital angular momentum has recently attracted wide interest due to its rich, versatile physics and potential applications.

In search of mechanisms to generate unconventional phonon orbital angular momentum textures, we demonstrate theoretically that d-wave chiral phonons can emerge even in the absence of electronic spin order. We show that by considering an electronic system hosting a d-wave orbital angular momentum texture, non-relativistic electron-phonon coupling leads to the formation of d-wave chiral phonons.

In this way we expand the potential platforms of chiral phononics and offer application routes unique to d-wave textures, such as orbital phonon splitters.

MA 39.24 Wed 18:00 P2

Phonon Pumping Experiments — •Jeremias Mütschele, Luise Holder, Michaela Lammel, Richard Schlitz, and Sebastian T. B. Goennenwein — Department of Physics, University of Konstanz, Konstanz, Germany

Phonons carrying angular momentum have recently attracted significant attention in the field of spintronics, as they are considered promising candidates for information carriers that do not require electrical currents. The coupling of phonons to spin-wave excitations (magnons) opens up opportunities to manipulate them, and consequently the transmitted information, via magnon-phonon interactions. However, engineering such hybrid quasiparticles, known as magnon-phonon-polaritons, remains a major experimental challenge. To gain deeper insight into the properties of magnon-phonon-polaritons, we investigate phonon pumping from a ferromagnetic thin film into a paramagnetic bulk crystal under various geometrical configurations. We find that our approach enables the selective excitation and analysis of distinct magnon-phonon-polariton modes. This could open a pathway to tailor phonon-based information transport.

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Thorium-229 as a Chiral Phonon Detector — •Martin Pimon[1], Kjeld Beeks[2], Thorsten Schumm[2], and Andreas Grüneis[1] — [1]Institute of Theoretical Physics, TU Wien, Vienna, Austria — [2]Institute of Atomic and Subatomic Physics, TU Wien, Vienna, Austria

The thorium-229 isotope features an exceptionally low-energy nuclear metastable excited state 8.4 eV above the ground state. This property makes it a viable candidate for probing level splitting in nuclear sub-levels using modern high-precision laser spectroscopy methods.

Magnetic interactions play a significant role in this level splitting, highlighting the potential of thorium-229 as a novel atomic-sized detector for the magnetic moment of chiral phonons. Moreover, the electric field gradient from the surrounding crystal lattice introduces additional level splitting, providing insights into structural properties.

By incorporating thorium atoms into an ionic crystal, our proposed technique enables the direct observation of both magnetic and electric interactions from within the crystal itself. This approach leverages high sensitivity to phonon-related phenomena, presenting a promising avenue for detecting chiral phonons.

In this poster, we will review the contributions to nuclear level splitting and explore the challenges and benefits of utilizing the thorium-229 nucleus as a detector for chiral phonons.