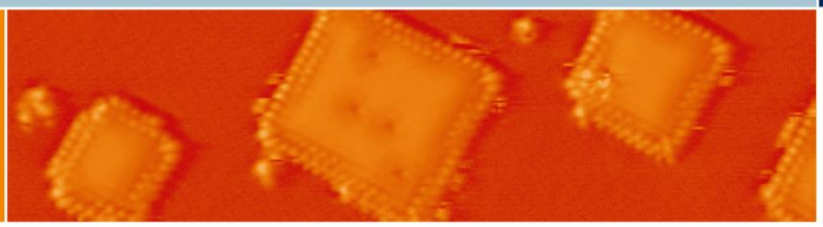
Funktionalität Oxidischer Grenzflächen

SFB 762



MARTIN-LUTHER-UNIVERSITÄT
HALLE–WITTENBERG

KOLLOQUIUM

Time: 17:15 h
Room: Gustav-Mie-Hörsaal

Thursday,

May 17th, 2018

Martin Luther University
Institute of Physics
Theodor-Lieser-Str. 9
06120 Halle

Coffee will be served from 17:00.

NEW VENUE

Gustav-Mie-Hörsaal
Theodor-Lieser-Str. 9

Prof. Christos Panagopoulos

Nanyang Technological University, Singapore

Tunable Room Temperature Skyrmions

Recent advances in thin film growth and in calculation capabilities in condensed matter physics enabled the synthesis of atomically flat surfaces and heterostructures, and the prediction of their electronic properties. Progress on Rashba interfaces, symmetry protected states and non-collinear spin textures allow novel spin, charge phenomena to emerge often robust to disorder and thermal fluctuations, with much promise for room temperature applications.
Using particle-like spin structures as a paradigm, I will argue the states induced by engineering spin orbit coupling and inversion symmetry breaking open a broad perspective, with significant impact in the practical technology of spin topology (Fig. 1). In one such example, multilayers of Ir/Fe(*x*)/Co(*y*)/Pt enable us tailor the magnetic interactions governing skyrmion (Sk) properties, thereby tuning their thermodynamic stability parameter by an order of magnitude. We have shown that Sk's exhibit a smooth crossover between isolated (metastable) and disordered lattice configurations across samples, while their size and density can be tuned by factors of 2 and 10, respectively.

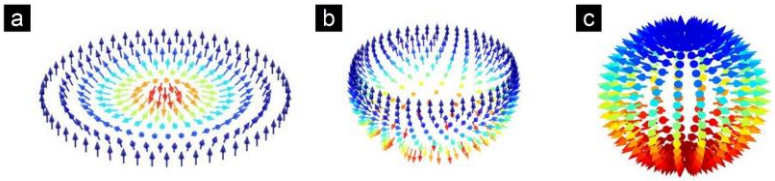


Figure 1: (a-c) Projection of a Néel skyrmion texture: (a) Original 2D configuration. (b) Outermost spins gradually curve inwards, eventually closing up, giving (c) 3D spin configuration of a unit sphere.

For a systematic investigation of the magnetization dynamics, more recently we determined the damping parameter characterizing the magnetization response, and identified a gyrotropic Sk excitation that persists over a wide range of temperatures and across varying sample compositions. Furthermore, to tailor the phenomenology of nanoscale Sk's, including topological stability and malleability we studied their formation and evolution at zero field through confinement effects. The zero field Sk size can be as small as 50 nm, and varies by a factor of 4 with dot size and magnetic parameters.
Time permitting, I will discuss a detailed microscopic investigation which allowed us identify magnetic structures forming via Sk-Sk interaction and their role in designing and interpreting electrical signatures in materials and devices hosting Sk's. In particular, we establish a direct correspondence between Sk's and their topological Hall signature in multilayer films by combining transport and magnetic force microscopy measurements over a wide range of temperature and magnetic field.
Through these studies, I will discuss quantifiable insights towards understanding Sk stability and dynamics in multilayers, and immediate directions for exploiting their properties in nanoscale devices.