Journal of Physics D: Applied Physics

ROADMAP • OPEN ACCESS

The 2020 skyrmionics roadmap

C Back[1], V Cros[2], H Ebert[3], K Everschor-Sitte[4], A Fert[2], M Garst[5], Tianping Ma[6], S Mankovsky[3], T L Monchesky[7], M Mostovoy[8] + Show full author list

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Presetend at BLTP Journal club by: Kaushal K. Kesharpu

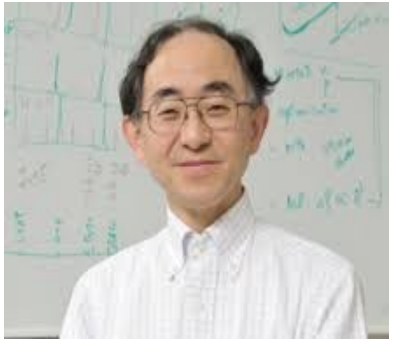
Skyrmion-based hybrid systems

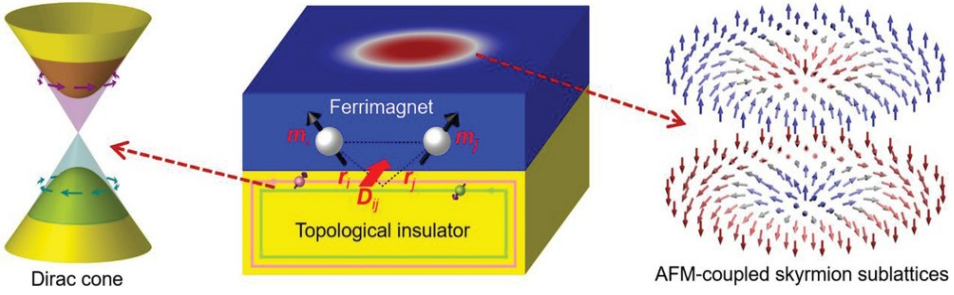
Major Research Area (THEORY)

- *The skyrmion structures on the Topological insulators (TI) and Topological superconductors (TS)*
- Skyrmion motion driven by the current in TI and TS
- Top. Spin structures on 3D mag. TI
- Search For Mag. Non-centrosymmetric superconductors
- The interplay of skyrmion structures in real and momentum space

NAOTO NAGOSA,

Strong Correlation Theory Research Group, Strong Correlation Physics Division, RIKEN CEMS, JAPAN





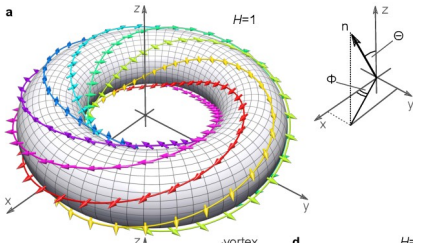
Skyrmions in confined geometry

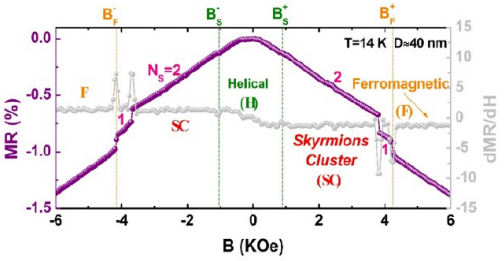
Jiadong Zhang

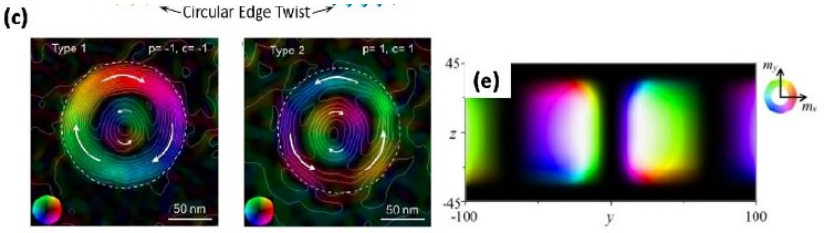
Department of Physics and Materials Science Program, University of New Hampshire, Durham, USA

Major Research Area (THEORY)

- *Better understanding the stability, dynamics and interaction of skyrmions*
- Interaction between sample edge, skyrmions, defects needs to be understood
- Numerical simulation package to include dipolar interactions and boundary effects
- The dynamics of hopfion states and its 3D properties
- Understand the tunneling magneto resistance experiments better







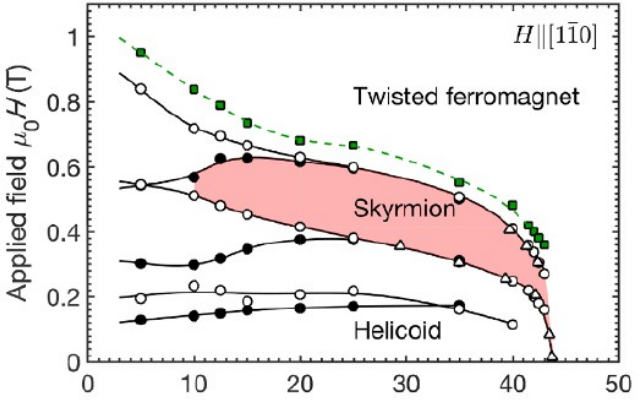
Epitaxial thin films on bulk substrate

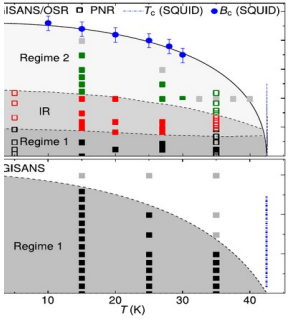
Theodore Mochesky

Department of Physics,
Dalhousie University,
Canada

Major Research Area (THEORY)

- *Effect of cyrstallographic grains of B20 materials on Si(111), MgO, SiC(001) substrates*
- Micro magnetic calculation of the magnetic phases on chiral boundary of epitaxial layers for out-of-plane field
- Systematically investigate the influence of grain size on the magnetic phase diagram due to conflicting report on B20 films from neutron, x-ray and electronic transport measurements
- Effect of chiral grain boundaries on nucleation of skyrmions





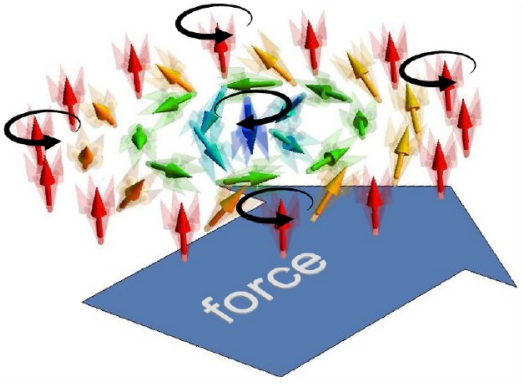
Skyrmion as particle

Major Research Area (THEORY)

- *Go away from the simple Landau-Lifscithz-Gilbert approximation*
- How the damping term in Thiele equation is affected due to external factors.
- Effect of defects on the dynamics of Skyrmions in Thiele equation.
- Include role of internal degrees of freedoms generated due to apllied force in Skrymion dynamics. Needs more sophisticated analysis then Thiele equation

Achim Rosch

Institute for Theoretical Physics
University of Cologne
Cologne, Germany



$$\mathbf{M}(\mathbf{r}_i,t) = \mathbf{M}_0(\mathbf{r}_i - \mathbf{R}(t)) + \delta\mathbf{M}(\mathbf{r}_i,t) \qquad \mathbf{G}\times\dot{\mathbf{R}}(t) + \Gamma\dot{\mathbf{R}}(t) = \mathbf{F}(\mathbf{R}(t),t).$$

Skyrmions in achiral magnets

Major Research Area (THEORY)

- *Heisenberg exchange interaction and Long-range interaction stabilize skyrmions*
- Search for Magnetically frustrated Mott insulators hosting skyrmions
- Static and dynamic properties of hopfion, hedgehogs on frustrated magnets
- Effect of helicity on the spin seeback effect, topological magnon in frustrated magnet have to be studied

Maxim Mostovoy

Zernike Institute for Advanced Materials, University of Groningen
Netherlands