Skyrmions and spirals in 2D chiral magnets

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Recent developments have led to an explosion of activity on 3D chiral magnetic materials. Experiments have directly probed topological spin textures known as skyrmions, and have revealed their non-trivial properties with the potential for novel applications. However, skyrmions are observed only in a rather limited region of the temperature-field phase diagram in 3D. In this talk I will argue that skyrmions are much more readily stabilized in two-dimensions. I will present theoretical results on 2D systems – thin films, surfaces and interfaces – where a combination of broken inversion symmetry and Rashba spin-orbit coupling (SOC) leads to chiral magnetic interactions [1]. This results in a spiral ground state at H=0 and skyrmion crystals [2] at finite fields. I will show that skyrmions are particularly stable in systems with easy-plane magnetic anisotropy, which also arises naturally from Rashba SOC. I will also discuss the potential relevance of our results to oxide-interfaces, like LaAlO3/SrTiO3, where there are tantalizing hints of magnetism.

[1] S. Banerjee, O. Erten and M. Randeria, Nature Physics 9, 626 (2013).
[2] S. Banerjee, J. Rowland, O. Erten and M. Randeria, arXiv:1402.7082.