Physics
AT QUEENS COLLEGE

# Colloquium Notice


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## *Dynamics of Ferromagnetic and Antiferromagnetic Skyrmions*


Manipulating small spin textures that can serve as bits of information by electric currents is one of the main challenges in the field of spintronics. In this work we study the stability and current driven dynamics of Skyrmions and their lattices in two-dimensional ferromagnets [1,2] and antiferromagnets [3] with Dzyaloshinskii-Moriya interaction.

Ferromagnetic Skyrmions recently attracted a lot of attention because they are small in size and are better than domain walls at avoiding pinning sites while moved by electric current. Nevertheless, ferromagnetic Skyrmions also have certain disadvantages, such as the presence of stray fields and transverse dynamics, making them harder to employ in spintronic devices. To avoid these unwanted effects, we propose a novel topological object: the antiferromagnetic (AFM) Skyrmion [3] and explore its properties using analytical theory based on generalized Thiele equation and micromagnetic simulations. This topological texture has no stray fields and we show that its dynamics are faster compared to its ferromagnetic analogue. We obtain the range of stability and the dependence of AFM Skyrmion radius on the strength of Dzyaloshinskii-Moriya interaction coming from relativistic spin-orbit effects.

Moreover, we study the temperature effects on the stability and mobility of AFM Skyrmions. We find that the thermal properties, e.g. such as the antiferromagnetic Skyrmion radius and diffusion constant, are rather different from those for ferromagnetic Skyrmions. More importantly, we show that due to unusual topology the AFM Skyrmions do not have a velocity component transverse to the current (no topological Hall effect), and thus may be interesting candidates for spintronic memory and logic applications.



[1] I. A. Ado, O. A. Tretiakov, M. Titov, arXiv:1603.07994 (2016).
[2] U. Gungordu, R. Nepal, O. A. Tretiakov, K. Belashchenko, and A. A. Kovalev, Phys. Rev. B 93, 064428 (2016).
[3] J. Barker and O. A. Tretiakov, Phys. Rev. Lett., 116, 147203 (2016).


Friday
**May 13, 2016**
Starts at 12:15 PM
Coffee at 12:00 PM
Physics Conference Room, SB B326