

Magnonics in two-dimensional antiferromagnets

An important goal of modern spintronics is to bring data-processing to the terahertz (THz) scale. In this regard, the emerging field of antiferromagnetic (AFM) magnonics has drawn some interest as THz spin-wave modes have been readily detected, holding promise for the development of applications¹. However, so far, most research efforts have been focused on bulk materials, potentially leaving some interesting new physics in thin films and monolayers unexplored¹. Indeed, early theoretical work on AFM monolayers suggests the emergence of Dirac bands in the spin-wave dispersion of Néel antiferromagnets on a honeycomb lattice^{2,3}. However, this prediction has not yet been verified in simulations of actual materials leaving a gap in the literature. In this project, the student will explore the magnonics of AFM monolayers through a combination of ab initio calculations using density functional theory and atomistic spin dynamics simulations. Materials with different lattice types and magnetization (Néel, zigzag, stripy, ...) will be investigated in search of interesting new magnonic physics.

¹ A. Barman, G. Gubbiotti, S. Ladak, A. O. Adeyeye, M. Krawczyk, J. Gräfe, C. Adelman, S. Cotofana, A. Naeemi, V. I. Vasyuchka, *et al.*, *J. Phys.: Condens. Matter* **33** 413001 (2021).

² J. Fransson, A. M. Black-Schaffer, and A. V. Balatsky, *Phys. Rev. B* **94**, 075401 (2016).

³ S. A. Owerre, *J. Phys. Commun.* **1** 025007 (2017).