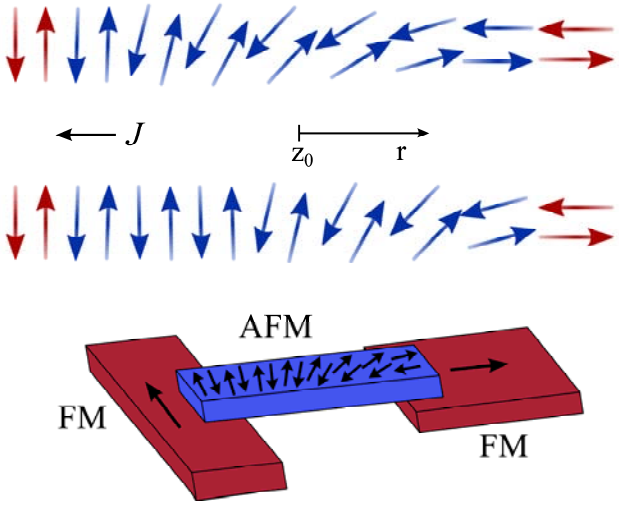
NTNU NanoLab

Staggered Dynamics in Antiferromagnets by Collective Coordinates

Antiferromagnets (AFMs) can be used to store and manipulate spin information, and new developments have created opportunities to use AFMs as active components in spintronics devices. The dynamics of AFMs are described by equations which are very complex and with many degrees of freedom. We present a theory which is conceptually much simpler and which uses collective coordinates to describe staggered field dynamics in antiferromagnetic textures. The theory includes effects from dissipation, external magnetic fields, as well as reactive and dissipative current-induced torques. We derive the equations of motion for the collective modes:

$$M^{ij}(\ddot{b}_j + a\gamma G_2 \dot{b}_j) = F^i$$

where M^{ij} is the acquired mass of the effective particles described by the collective coordinates b_j, $a\gamma G_2$ parameterizes dissipation, and F^i represent external forces. We conclude that, at low frequencies and amplitudes, currents induce collective motion in AFMs by means of dissipative rather than reactive torques.



"Staggered Dynamics in Antiferromagnets by Collective Coordinates", E.G. Tveten, A. Qaiumzadeh, O.A. Tretiakov, and A. Brataas, Phys. Rev. Lett. 100 127208 (2013)