Departamento de Física de Materiales

Unconventional Magnetism in Spintronics: the emergence of Altermagnetism and its new variants

Jairo Sinova

Johannes Gutenberg University Mainz, Germany

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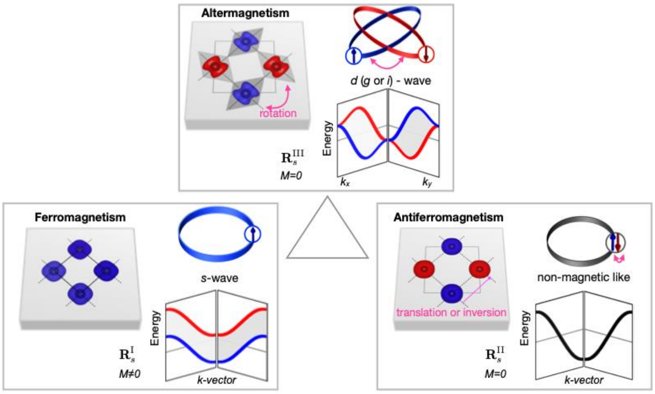
SALA DE GRADOS, FACULTAD DE CIENCIAS QUÍMICAS, UCM

(PASILLO ENTRE LAS FACULTADES DE CC. QUÍMICAS Y CC. FÍSICAS)

The discovery of d-wave magnetic order in momentum space has motivated a closer look at the symmetry classification of collinear magnetic systems. This has emerged as the third basic collinear magnetic ordered phase of altermagnetism, which goes beyond ferromagnets and antiferromagnets. Altermagnets exhibit an unconventional spin-polarized d/g/i-wave band structure in reciprocal space, originating from the local sublattice anisotropies in direct space. This gives properties unique to altermagnets (e.g., the spin-splitter effect), while also having ferromagnetic (e.g., polarized currents) and antiferromagnetic (e.g., THz spin dynamics and zero net magnetization) characteristics useful for spintronics device functionalities. A key consequence of d-wave magnetism is a new ability to manipulate its magnetic textures. We present a phenomenological theory of altermagnets, able to describe their unique magnetization dynamics and to model magnetic textures in this emergent collinear magnetic ordered phase. Focusing on the prototypical d-wave altermagnets, e.g. RuO_2, we can explain intuitively the unique lifted degeneracy of their magnon spectra, and show that the altermagnetic domain walls, in contrast to antiferromagnets, have a finite gradient of the magnetization projection along the easy axis orientation, with its strength and direction connected to the altermagnetic anisotropy. This gradient generates a ponderomotive force in the domain wall in the presence of an external magnetic field, allowing the possibility to control the domains in a magnetically compensated ordered phase.



References:

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