CRETE CENTER FOR QUANTUM COMPLEXITY AND NANOTECHNOLOGY

UNIVERSITY OF CRETE
DEPARTMENT OF PHYSICS

CAPACITIES

ΓΕΝΙΚΟ ΣΕΜΙΝΑΡΙΟ ΤΜΗΜΑΤΟΣ ΦΥΣΙΚΗΣ

PHYSICS COLLOQUIUM

Thursday, 12 October 2016

17:00 -18:00

3rd Floor Seminar Room

"Spin topology for applications at room temperature"

Prof. Christos Panagopoulos

Nanyang Technological University, Singapore

Abstract

Recent advances in thin film growth and in calculation capabilities in condensed matter physics enabled the synthesis of atomically flat surfaces and heterostructures, and the prediction of their electronic properties. A prototype laboratory infrastructure including an integrated network of techniques, enables the study of tailor-made materials architectures e.g., magnetoelectrics, ultrathin magnets, superconductors, quantum Archimedean lattices, and atomic scale spin valves[1].

A common thread across architectures of interest, especially heavy metal compounds and multilayers is that the spin orbit coupling (SOC) strength at surfaces and interfaces is comparable to the other relevant energy scales, and thus plays a pivotal role[2]. Novel spin-charge phenomena emerge often robust to disorder and thermal fluctuations, with much promise for room temperature applications[2,3].

I will mention the notable progress on Rashba interfaces, symmetry protected states, non-collinear spin textures, and techniques to generate, stabilize and manipulate them in devices. Using particle-like spin structures as a paradigm, I will demonstrate the states induced by SOC and inversion symmetry breaking in magnetic multilayers open a broad perspective, with significant impact in the practical technology of spin topology.

Importantly, our coherent effort in Singapore lead to the modulation of interfacial properties for functional skyrmions at room temperature[4]. A novel materials platform allows us tune skyrmion size and density, thermodynamic stability parameter, and the crossover between isolated and disordered-lattice configurations, pointing towards the development of skyrmion-based memory devices. I will present recent results on the nucleation, electrical signature, collective spin excitation modes, current-induced formation and dynamics of sub-50nm skyrmions.

[1] http://phynelab.org/Facility/chris/
[2] Nature ***539***, 509 (2016)
[3] Proc. Natl. Acad. Sci., ***114***, 3815 (2017)
[4] Nature Materials, doi:10.1038/nmat4934 (2017)