Spin orbit coupling and magnetism for room temperature applications

Christos Panagopoulos

Professor of Physics and Applied Physics & National Research Foundation Investigator

Nanyang Technological University, Singapore

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

A common thread across several 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. Novel spin-charge phenomena emerge often robust to disorder and thermal fluctuations, with much promise for room temperature applications.

I will discuss the notable progress made 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 that the states induced by SOC and inversion symmetry breaking open a broad perspective with significant impact in the practical technology of spin topology.

Christos Panagopoulos received his PhD from the University of Cambridge (Trinity College) in 1997. He has since held positions as a Trinity College Research Fellow and Royal Society University Research Fellow at the University of Cambridge - United Kingdom, Associate Professor of Physics at the University of Crete - Greece, and Professor of Physics and Applied Physics & Research Professor at the Nanyang Technological University – Singapore. He is concurrently, an Investigator of the National Research Foundation, Prime Minister's Office – Singapore and Affiliate Professor at the Cavendish Laboratory, University of Cambridge. For his research, he raised as lead principal investigator 23 million Euros through competitive grants in Europe and Asia. He received education and training from the Royal Society & Imperial College on The Business of Science, chaired a number of panels on research and education, and serves as reviewer on strategic initiatives for research Centers in North America, Singapore and Europe. Honors include, European Young Investigators Award (European Union), Marie Curie Excellence Grants Award (European Union), Investigatorship Award (Singapore), Invited Professor at the Venture Business Laboratory (Japan) and the Chinese Academy of Sciences (China), and his election as Research Fellow at Trinity College, Cambridge (United Kingdom), the National Research Foundation (Singapore) and The Royal Society (United Kingdom). He has published more than 100 research articles in condensed matter physics, delivered numerous key note speeches and courses in international graduate schools, and over 200 invited presentations at conferences and universities.