π-magnetism and transport in graphene nanostructures

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Atomic-scale control over size, shape, and composition of graphene nanostructures has become a reality through on-surface synthesis whereby suitably designed precursor molecules are assembled and reacted on a metal substrate under vacuum conditions. This has led to the realization of fascinating open-shell nanographenes and nanoribbons with interesting topological, magnetic, and electron transport properties [1].

In this talk I will provide an overview of the emerging field of π-magnetism in graphene-based nanostructures and present some of our theoretical contributions to understand various scanning tunneling microscopy (STM) experiments [2-5]. The emergence of localized electron spins in such structures appears promising for applications in quantum technologies, provided that the interaction between them as well as with their environment can be controlled. In this regard I will briefly discuss our efforts to quantify hyperfine interactions to spinful ^{13}C and ^{1}H nuclei, an essential ingredient to understand electron spin decoherence [6].

Finally, I will present a theoretical study of electron and spin transport in multi-terminal devices composed of crossed graphene nanoribbons (GNRs) and the proposal to operate them as spin-polarizing electron beam splitters [7].

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Biography: Thomas Frederiksen obtained his PhD in physics in 2007 from the Technical University of Denmark on the topic of inelastic transport theory for nanoscale systems. In 2008 he was awarded a 5-year Gipuzkoa Fellowship to carry out research at the Donostia International Physics Center (DIPC) and abroad. In 2012 he was appointed Ikerbasque Research Professor at the DIPC where he leads a research group on Nanoelectronics – theory and simulation.