The Abdus Salam
International Centre
for Theoretical Physics

International Conference on Multi-Condensate Superconductivity and Superfluidity in Solids and Ultra-Cold Gases

14 - 18 May 2018 (Trieste, Italy)

Quantum Interference Assisted Spin Filtering in Graphene Nanoflakes

Angelo VALLI
SISSA, Trieste, Italy

Abstract:

We demonstrate that hexagonal graphene nanoflakes with zigzag edges display quantum interference (QI) patterns analogous to benzene molecular junctions. In contrast with graphene sheets, these nanoflakes also host magnetism. The cooperative effect of QI and magnetism enables spin-dependent quantum interference effects that result in a nearly complete spin polarization of the current and holds a huge potential for spintronic applications. We understand the origin of QI in terms of symmetry arguments, which show the robustness and generality of the effect. This also allows us to devise a concrete protocol for the electrostatic control of the spin polarization of the current by breaking the sublattice symmetry of graphene, by deposition on hexagonal boron nitride, paving the way to switchable spin filters. Such a system benefits from all of the extraordinary conduction properties of graphene, and at the same time, it does not require any external magnetic field to select the spin polarization, as magnetism emerges spontaneously at the edges of the nanoflake.