TAILSPIN: Tailoring spin-interactions in graphene nanoribbons for ballistic fully spin-polarized devices

Main area: Advanced nanofabrication and spintronics
Keywords: graphene nanostructures, spin polarized edge states, spintronic, functionalization, STM, transport, LEEM, ARPES
Duration (months): 36
Total project funding: € 1 019 000

Abstract

We propose here the realization of an "all-graphene" spintronic prototype-device based on ballistic carrier transport in epitaxially grown graphene nanoribbons (GNRs) on appropriately designed SiC templates. Since both room temperature ballistic transport and ferromagnetic states were successfully identified we expect now to realize a new type of quantum device compatible with state of the art process technologies. The GNR-functionality is governed by the details of the atomic structure and environmental effects and in particular by the unique role of the electronic properties of the edges. The unique possibilities of this system generate an entirely new platform for both fundamental and application driven research of quasi one-dimensional carbon based magnetism and spintronics. A concerted action of experts in the fields of growth, spin-resolved and other electron spectroscopies (PEEM, ARPES, RIXS), local probe techniques STM,STS) and transport is mandatory to obtain evidence of the possible origin of the ballistic, spin polarized transport and to explore the options to enhance the spin-orbit interaction to tailor the ferromagnetic behaviour of the nanoribbons. The close collaboration of the partners will bridge the gap between atomic and mesoscopic scales. The targeted sharing into different tasks addresses aspects regarding the precise engineering of nanoribbons with tailored edge states as well as further functionalization by local manipulation, e.g. adsorption and intercalation. This finally allows us to derive a detailed model about the relevant microscopic interactions on various length scales giving rise to the anomalous electronic structure of the edge states.

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