SEMINAIRE ISMO

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Atomic and electronic structure of graphene ribbons and perspectives for ultrafast dynamics

Methods for producing semiconducting–metallic graphene networks suffer from scalability problems, stringent lithographic demands and process-induced disorder in the graphene. These problems can be overcome by taking advantage of graphene grown on patterned SiC steps, without relying on chemical functionalization or finite-size patterning.

This scalable bottom-up approach produces graphene in the form of a strip, at the edge of which, a semiconductor, is bonded to metallic graphene. This semiconductor ribbon is only a few nanometers wide and the semiconducting graphene strip width is defined to within a few graphene lattice constants, a level of precision beyond modern lithographic limits, and which is robust enough that there is little variation in the electronic band structure across thousands of ribbons. The energy gap is greater than 0.5 eV in an otherwise continuous metallic graphene sheet along the short direction of the ribbon while it exhibits ballistic transport along the long direction of the ribbon. One of our aims is to address the unknown origin of this gap, which can be driven for instance by an sp^3 hybridization or by strain at the curved edge of the ribbon. Our current structural studies by STM and cross-sectional TEM allow us to shed light on the electronic properties, especially on the origin of the gap.

These fundamental studies provide a deep knowledge on graphene and graphene nanoribbons necessary for applications, either in electronics or in optoelectronics. Optoelectronics applications rely on the study of the optical absorption and the desexcitation dynamics, phenomena that can be studied by time-resolved photoemission.

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