Keynote

Graphene as an integrated platform for molecular-scale devices.

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Graphene can be considered as the ultimately thin and high mobility platform that offers a unique opportunity to adiabatically bridge the mesoscopic and molecular electronic properties within a single, one-atom thick 2D material. The corollary experimental challenge is to bring together all production, patterning and contacting techniques that will make it possible to tailor graphene from typically 1 μm down to 1 nm and eventually to individual carbon atoms.

In this context, we propose to combine low energy electron beam and chemical etching to design arbitrary graphene patterns over multiple length scale down to sub-10 nm feature size. Our approach is compatible with ultra-high vacuum (UHV) environment and applicable to connected device fabrication. Structural characterization of cut edges and graphene nanoribbons shows crystalline and atomically smooth edges. Next, we have adapted our approach to device configuration. The etching procedure has been successfully adapted to partially suspended graphene leading to connected and gated graphene nanoribbons devices with width below 50 nm. Preliminary transport measurements performed on suspended graphene nanoribbons with crystalline edges will be discussed.

The second part will be dedicated to the fine tuning of the electronic properties of graphene. Indeed prospective molecular-scale graphene devices will have to be actuated. Electrostatically gated transport is only one in several options. In particular, we will discuss the prospects of reversibly tuning the charge carrier density of graphene by optical or chemical means.