Elementary phenomena in hybrid graphene nanoribbons on surfaces

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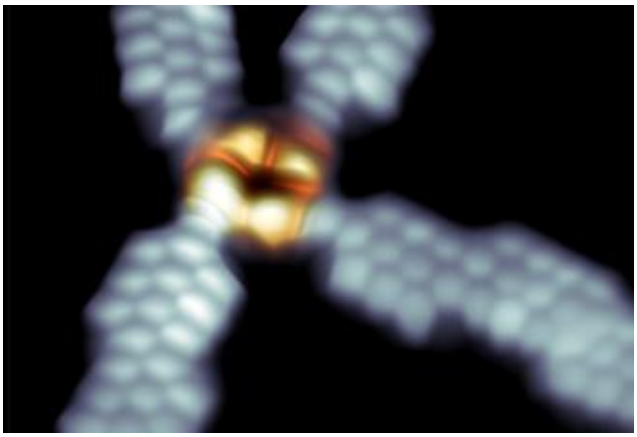
Large aromatic carbon nanostructures are a cornerstone materials due to their increasingly role in functional devices, but their synthesis in solution encounters size and shape limitations. Recently, it has been shown that the production of large graphenoid nanostructures with atomic precision can be realized on a metal surface using strategies of on-surface chemistry [1]. Chemical routes have been established allowing us to steer synthesis by properly selecting the shape of organic precursors and produce large molecular platforms with tunable intrinsic properties such as the electronic band-gap, its magnetic behavior, or its reactivity.

In this presentation, I will summarize results regarding the production of graphene nanoribbons and other carbon nanostructures with interesting electronic phenomenology. We combine high resolution STM imaging (Fig. 1) with local spectroscopy to unveil the success of a reaction pathway and to explore the effect of precursor shape and composition in electronic functionality of the ribbon.

The ribbons studied show rich elementary phenomenology such as band confinement and doping and electron correlations. I will show that these ribbons behave as one-dimensional semiconductors and their band structure can be tuned by modifying their width [2]. Doping can be introduced by incorporating additional species [3]. Furthermore, we developed a method to create quantum dots embedded in hybrid graphene nanoribbon. We found that ribbon bands are confined in them selectively, according to their symmetry [4]. Graphene structures with pores also show localization of image states at pores [5]

Finally, I will show that it is possible to incorporate magnetic molecular species bound to a ribbon [6](see image attached), which endow magnetic character to the ribbon. In particular, we show that the molecular spin of a Iron tetra-phenyl porphyrin survives in the ribbon by using spin-excitation inelastic spectroscopy.



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