SOME INSIGHTS INTO THE PHYSICS OF GRAPHENE NANORIBBONS

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Much of the interest in graphene, lies on its potential applications in electronic circuitry. As methods of fabrication improve, samples with higher mobilities and better conducting properties are produced, as shown by recent experiments where mobilities of the order of $20 \times 10^4 cm^2/Vs$ were obtained [1] . It is thus reasonable to expect that controlled design of sample sizes as well as of edge terminations will be possible in a near future. Of particular interest for device applications are graphene ribbons where the role of confinement has greater influence on transport properties. In theoretical studies graphene ribbons are modeled with two different edge terminations known as armchair and zigzag edges. While the physics of armchair ribbons shows the phenomena expected from confinement of a graphene sheet, zigzag ribbons possess zero energy modes that are highly localized along the edges of the sample. These modes, with a topological origin, play an important role on the electronic and magnetic properties of the ribbon and have been the subject of extensive analytic and numerical research as well as recent experimental investigations on their stability [2], [3]. In this talk I will review our recent work on graphene nanoribbons that provides insights into various curious properties of these systems. In particular I will discuss the effect of electron-electron and spin-orbit interactions as well as the origin of a puzzling dependence on zigzag ribbon's widths. Our analysis suggest that several of these characteristics are shared by a wide range of two-dimensional models and reveals connections between zigzag ribbons and quantum spin chains.

[1] Bolotin KI, Sikes KJ, Hone J, et al., Phys. Rev. Lett. **101**, 096802, (2008). [2] X. Jia *et. al.* Science **323**, 1701 (2009). [3] C.Ö. Girit *et. al.* Science **323**, 1705 (2009) .