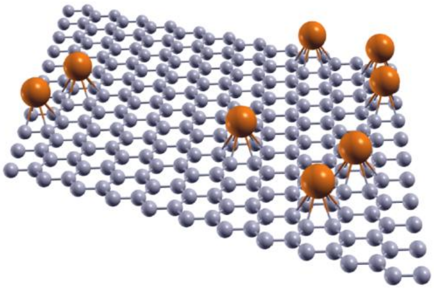
Quantum Transport in Disordered Graphene :

Scaling Properties and Spin relaxation Mechanisms



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Abstract:

This talk will focus on the presentation of transport properties in graphene-based-materials containing disorder or specific structural morphologies such as grain boundaries in polycrystalline samples. The used multiscale quantum transport methodologies combine state-of-the-art first-principles with real space order N tight-binding approaches, will be shown to enable in-depth analysis of charge (and spin) transport fingerprints of realistic models of defected graphene of interest for industrial applications. Here, we will explore the effect of grain boundaries in polycrystalline graphene limiting charge mobilities in large-scale materials used in transparent electrodes applications. We will also discuss the origin of spin relaxation in graphene which is currently a highly debated issue, with reported spin diffusion times about 1 nanosecond, that is three orders of magnitude lower than expected, whereas the nature of relaxation fluctuates between Elliot-Yaffet and Dyakonov Perel mechanism with no consensus and puzzling experimental features. All these issues also point towards revisiting the way such fundamental length scales are usually extracted in experiments (Hanle Measurements, two-terminal magnetoresistance), prior to the development of spin manipulation and revolutionary spin devices.