Emerging new 2D materials: Silicene and Phosphorene

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Silicene, resembles graphene in many aspects: it is ordered in a honeycomb lattice and expected to present a Dirac cone band structure in the vicinity of the Fermi energy. Electronically, the main difference between carbon and silicon is a stronger preference of sp3 over sp2 in silicon, favoring a tetrahedral atomic arrangement. Until now, silicene synthesis has so far been achieved by epitaxial growth mainly on silver surfaces, but the interaction with the substrate has a detrimental effect on its electronic properties. This has challenged research groups to explore other potential substrates having weaker interactions with silicene, to probe its intrinsic electronic properties and to make silicene based electronic devices.

In parallel, phosphorene presents both an intrinsic tunable direct band gap and high carrier mobility values, which make it suitable for a large variety of optical and electronic devices. However, the synthesis of single-layer phosphorene is a major challenge because the principal process currently used to produce phosphorene is exfoliation, which prevents any reproducible measurements or implementation into larger scale electronic circuits. To this end, the use of molecular beam epitaxy (MBE) process to achieve a fully controlled synthesis of phosphorene is mandatory.

In this presentation, I will show the state of the art of these two bidimensional materials and I will highlight some of our recent results in this field.

References:

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