Nanoscale control of new properties added to graphene: Superconductivity Magnetism and Electronic Gap

Ivan Brihuega
UAM, Spain
ivan.brihuega@uam.es

At present, we have a very high level of understanding of the inherent properties of graphene. This means that we are now in a position to go one-step further and try to add and take advantage of some of the few properties not naturally found in graphene, such as the existence of magnetic moments, gaps in the band structure or superconducting properties. In this talk I will show how we incorporate those properties to graphene, and how we control them at the nanoscale by using STM as main experimental tool. More specifically, we use quantum confinement to selectively introduce gaps in graphene's electronic band structure [1], atomic H as building blocks to incorporate magnetic moments [2] and Pb islands to induce superconductivity by the proximity effect [3]. In addition, I will show how we use quasiparticle interference patterns to probe graphene topological properties [4].

References

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Figures

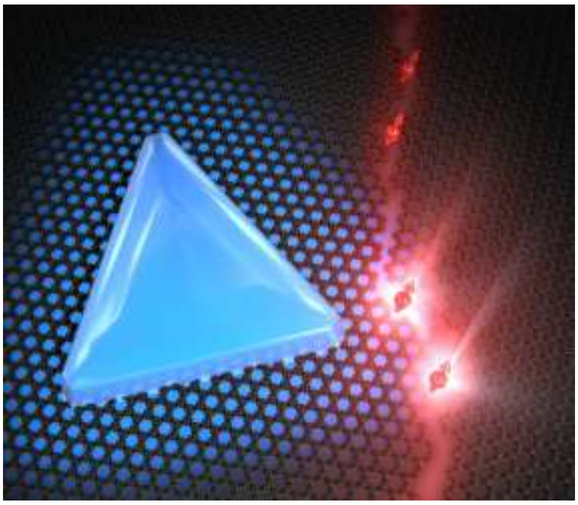

Figure 1: Graphene is made superconducting with Pb islands. At the same time, magnetic moments are introduced using naturally existing graphene grain boundaries. We show that both superconductivity and magnetism can coexist in graphene, generating exotic Yu-Shiba-Rusinov states. Those states provide a starting point to ultimately create graphene topological qubits, putting forward graphene as a potential platform for topological quantum computing