November 22, 2021 10:00 AM
QED & Materials seminar
Jose Pizarro

Title
"Many-body phenomena in moiré superlattices"

Abstract
Twisted Van der Waals materials have appeared as a tunable testing ground to investigate the conspiracy of strong electronic correlations, (flat) band structures with non-trivial topologies, and lattice degrees of freedom to yield exotic quantum many-body ground states in a 2D Dirac material framework. The appealing on studying these materials comes from the fact that the degree of electronic correlations can be tuned by the twist angle or by changing the dielectric environment, and that they can be non-invasively doped when a gate voltage is applied. These unprecedent possibilities allow to systematically explore their phase diagrams. The "boom" of twisted materials started in 2018 when the group of Pablo Jarillo-Herrero in the MIT discovered in twisted bilayer graphene a set of correlated insulators at certain integer doping levels and superconductivity next to them. These experiments were later confirmed and improved to show a plethora of other many-body states, as well as extended to other twisted Van der Waals materials.

My goal through this talk is to give a brief overview on the projects I have been working on during the last years. First, I will give a basic introduction on electronic correlation phenomena and twisted materials. Then I will talk about the projects [1]-[3]. Finally, I will comment my current collaboration with Michael Sentef and the McIver lab.

[1] J.M. Pizarro et al., Internal screening and dielectric engineering in magic-angle twisted bilayer graphene, PRB 100 (16), 161102(R), 2019

[2] J.M. Pizarro et al., Deconfinement of Mott localized electrons into topological and spin-orbit-coupled Dirac fermions, npj Quantum Materials 5 (1), 1-7, 2020

[3] N. Witt, J.M. Pizarro et al., Doping fingerprints of spin and lattice fluctuations in moiré superlattice systems, arXiv: 2108.01121, 2021