Max-Planck-Institut für
Struktur und Dynamik der Materie

Max Planck Institute for the Structure and Dynamics of Matter

IMPRS UFAST Call for PhD applications 2020/2021

Cavity engineering of 2D twisted materials
A. Rubio-6

Title of PhD Project	**Cavity engineering of 2D twisted materials**
Type	Theory
Supervisor(s)	Prof. Dante Kennes Prof. Angel Rubio and Dr. Lede Xian
Affiliation(s):	Max Planck Institute for the Structure and Dynamics of Matter RWTH Aachen University CAS Songshan Lake Materials Laboratory
Number of positions:	2
Abstract:	The goal of this project is to explore the potential of Floquet and cavity engineering in twisted van der Waals heterostructures. The sensitivity of correlated phases to meV changes of the dispersion of the Moire bands in these materials suggests that rich effects can be achieved already via dressing the electronic bands by weak light fields in the Floquet engineering paradigm. In the presence of an optical pump, a photon-mediated renormalization of the hopping matrix elements between Moire unit cells might allow to selectively modify the low-energy band further and engineer exotic correlated phases with light. In a second step cavity engineering can be used to allow for strong light-matter coupling and even more pronounced changes to electronic phases. The comparatively low energy scales of Moire bands and correlated phases in twisted materials suggests that coupling to a cavity photon mode can induce an outsized effect on the interacting electronic state. One such application is in photo-induced and cavity-induced superconductivity. In sum, this project aims at adding non-equilibrium control as a tuning knob to steer electronic phases of matter beyond the many possibilities already offered by twisting.
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