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ARNOLD SOMMERFELD
CENTER FOR THEORETICAL PHYSICS



Arnold Sommerfeld Lecture Series

Professor Andrei Bernevig

Princeton University, USA

Sommerfeld Theory Colloquium:

Nano-engineering from a
Theoretical Physics Perspective

Abstract: We will review the beginning of experimental and theoretical studies of moire systems and their evolution up to present. This type of systems represent a new way of "growing" materials, and has tremendous potential both for fundamental physics as well as for applications. Two dimensional periodic crystals, whose separation between atoms is of order angstroms, can be twisted controllably with respect to each other such that they form new "periodicities", called moire periodicities. In the new "unit cell" we find thousands of atoms of the original crystal. These atoms behave in ways that are incredibly counterintuitive. We show how the controlled twisting of graphene and MoTe₂ layers has led to a slew of states of matter not possible in bulk conventional materials. We will show how the collective behavior of thousands of p orbitals in a moire unit cell of graphene can create single Heavy fermion at moire scale, and how the interaction between such fermions can lead to a perfect quantum simulator of an Anderson model. We will then present a catalogue of possible twistable materials and show how a huge variety of strongly interacting models can be realized in twisted homo and hetero twisted bilayers and multilayers of these materials.

Wednesday, May 7, 2025, 16:15 h, Room A348, Theresienstr. 37, LMU

Prof. D. Efetov
Prof. U. Schollwöck