

SPECIAL CONDENSED MATTER THEORY SEMINAR

Subject: **Superconductivity, Charge Density Wave, and Supersolidity in Flat Bands with a Tunable Quantum Metric**

Speaker: **Dr. Johannes-Stephan Hofmann (Weizmann Institute of Science, Israel)**

Date & time: **Monday, 10th of July 2023 at 4:15 p.m.**

Venue: **Room 01.114**

Abstract:

Predicting the fate of an interacting system in the limit where the electronic bandwidth is quenched is often highly non-trivial. The complex interplay between interactions and quantum fluctuations driven by the band geometry can drive a competition between various ground states, such as charge density wave order and superconductivity. In this work, we study an electronic model of topologically-trivial flat bands with a continuously tunable Fubini-Study metric in the presence of on-site attraction and nearest-neighbor repulsion, using numerically exact quantum Monte Carlo simulations. By varying the electron filling and the spatial extent of the localized flat-band Wannier wavefunctions, we obtain a number of intertwined orders. These include a phase with coexisting charge density wave order and superconductivity, i.e., a supersolid. In spite of the non-perturbative nature of the problem, we identify an analytically tractable limit associated with a 'small' spatial extent of the Wannier functions, and derive a low-energy effective Hamiltonian that can well describe our numerical results.