GOETHE UNIVERSITÄT
FRANKFURT AM MAIN

Fachbereich Physik
Institut für Theoretische Physik

CONDENSED MATTER THEORY SEMINAR

Subject: **Characterizing and understanding wave-function phenomena by quantum geometry**

Speaker: **Dr. Johannes Mitscherling**
(Department of Physics, University of California, Berkeley, California 94720, USA)

Date & time: **Monday, 30th of October 2023 at 1:00 p.m.**

Venue: **Room Phys _ _.401**

Abstract:

The characterization of the ground state and its excitations is fundamental to the understanding of any quantum material. Until recently, this mostly meant studying the dispersive feature of the band structure and the topological features of the quantum state manifold. In this talk, I will introduce quantum geometry, an emerging field of study with remarkable power to capture the parameter-local properties of the quantum states. By studying the electrical conductivity of non-interacting multiband systems, I will show how quantum geometry emerges naturally in the interband contributions to transport. I will explore the role of the quantum metric, a distance measure between Bloch states, and its importance in flat-band systems, where a non-trivial quantum metric indicates the possibility of finite DC electrical conductivity despite a vanishing quasiparticle velocity. Beyond this particular example, I will discuss the fundamental properties of quantum geometric quantities and highlight some other observables of quantum geometric origin. Given its broad applicability, I will conclude by proposing quantum geometry as a standard tool for characterizing and understanding systems with interesting wave-function phenomena.

Bio: Johannes Mitscherling obtained his PhD in 2021 at the Max Planck Institute for Solid State Research in Stuttgart, Germany, under the supervision of Walter Metzner, where he studied virtual interband effects for electrical transport phenomena in cuprates and topological materials. He then joined the group of Joel Moore at Berkeley in 2022 with a Leopoldina Postdoctoral Fellowship, where he applies quantum geometric concepts to flat band materials, interaction, and disorder effects.