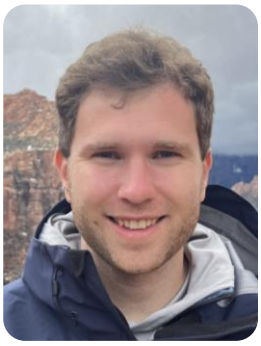
Sonderforschungsbereich 1277

Emergent Relativistic Effects in Condensed Matter -
From Fundamental Aspects to Electronic Functionality

SFB – Colloquium



Speaker: **Ludwig Holleis**

UC Santa Barbara, US

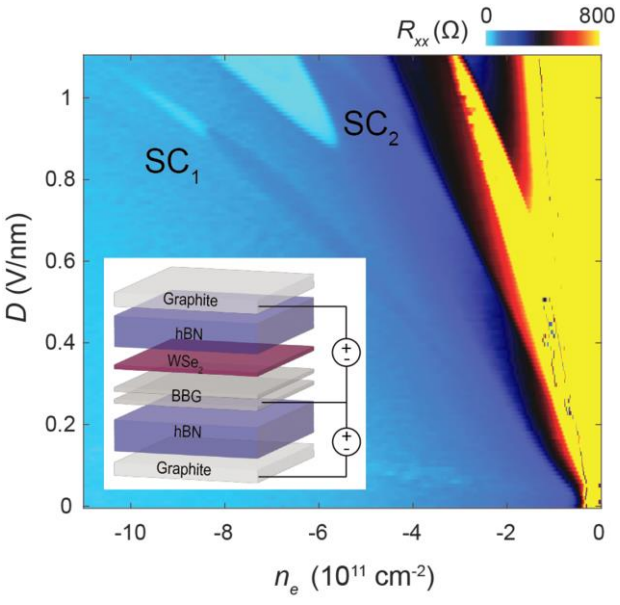
Date: Tuesday, 16 May 2023, 14:15, H34

Topic: Ising Superconductivity in Bernal Bilayer Graphene with Strong Spin-Orbit Coupling

Abstract:

Superconductivity is an almost ubiquitous feature in the low temperature phase diagram of multilayer graphene allotropes – moire or crystalline. While the microscopic electronic structures of these systems differ, supporting devices with monolayer WSe_2 has been shown to increase superconductivity along many axes of the phase space like density, magnetic field and temperature. Here, we study two superconducting domes (SC_1 and SC_2) in Bernal Bilayer graphene on WSe_2 as prototypical example of the enhancement of superconductivity. While SC_1 appears in a symmetry unbroken phase, quantum oscillation measurements show that the normal state of SC_2 is nematic, breaking C_3 symmetry. Despite this difference, both superconductors violate the Pauli limit consistent with spin singlet pairing between opposite valleys protected from de-pairing by Ising SOC. Our results suggest that the induced SOC is central to the observed enhancement of superconductivity in many graphene multilayer systems - favoring pairing between time reversal symmetric partners.

Host: Prof. Dr. Jaroslav Fabian



Density and displacement field dependent phase diagram of Bernal Bilayer Graphene proximitized to WSe_2 which hosts two superconducting domains. The inset shows the dual gated sample architecture. (from: arXiv:2303.00742).