MAX PLANCK INSTITUTE
FOR THE STRUCTURE AND DYNAMICS OF MATTER

ANNOUNCEMENT - TALK

Title: Anomalous transport and hidden collective modes in clean quantum materials

Habib Rostami

Assistant Professor of Physics at the University of Bath, UK
Email: hr745@bath.ac.uk

Abstract

Clean quantum materials can host transport regimes and collective excitations that are not captured by ordinary Drude, ballistic, or conventional hydrodynamic descriptions. In this talk I will discuss how electron–electron interactions, conservation laws, and long-lived Fermi-surface deformations produce anomalous transport signatures in low-dimensional systems. I will begin with tomographic electron transport, where odd-parity deformations of the Fermi surface acquire anomalously long lifetimes, and show how weak magnetic fields suppress this regime by mixing angular harmonics. I will then discuss how nonlinear thermoelectric response can probe these hidden long-lived modes in topological Fermi liquids. I will also briefly connect this transport perspective to plasmon-assisted photodetection in graphene, where nonlinear optical response generates pseudo-Euler dynamics for collective electronic variables beyond the regime of conventional hydrodynamics. As an outlook, I will discuss a Fermi-liquid model of d-wave altermagnets that predicts spin-carrying anisotropic demon modes and their hybridization into Fano-demon states. The common theme is the use of transport, optical response, and nonlinear spectroscopy to reveal hidden many-body structure in clean quantum materials, from anomalously long-lived Fermi-surface modes to dark collective excitations and beyond-hydrodynamic

Short biography:
Habib Rostami is an Assistant Professor of Physics at the University of Bath, UK, where he leads a group working on condensed matter and quantum materials. He obtained his PhD in theoretical condensed matter physics from the Institute for Research in Fundamental Sciences (IPM) in Iran in 2015. He then held postdoctoral positions at Scuola Normale Superiore in Pisa and IIT Genoa from 2015 to 2017, followed by fellowship-supported research in Sweden from 2017 to 2022, including a Nordita Assistant Professorship at Nordita/Stockholm University. Since November 2022, he has held a permanent academic position at the University of Bath. His research has been supported by external fellowships and grants, and focuses on quantum transport, nonlinear optical and phononic responses, and collective excitations in low-dimensional quantum materials.

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Location:	**MPSD 900.EG.136**
Speaker:	Habib Rostami
Affiliate:	University of Bath, UK