

Max-Planck-Institut für Struktur und Dynamik der Materie

Max Planck Institute for the Structure and Dynamics of Matter

IMPRS UFAST Call for PhD applications 2023/2024

Project Title: Cavity light-matter engineering of superconductivity



Title of PhD Project	Cavity light-matter engineering of superconductivity
Type	Theory
Supervisor(s)	Prof. Michael Sentef
Affiliation(s):	Max Planck Institute for the Structure and Dynamics of Matter University of Bremen
Number of positions:	1
Abstract:	<p>One of the key frontiers in condensed matter physics is the theoretical understanding of far-from-equilibrium many-body states of matter. The external stimulation of quantum materials with short and strong light pulses has allowed researchers to gain control over their emergent properties (structural, electronic) on ultrashort (femtosecond) time scales [1]. On a different note, the vacuum fluctuations of light in cavities or on plasmonic surfaces can also be used to trigger changes in the materials properties through excitations that couple to the quantum-electrodynamical (QED) fields, opening up the field of cavity quantum materials [2]. Together, these novel light-matter control paradigms have led to exciting prospects: Can one induce superconductivity — the property of a collection of electrons to conduct electricity without losses — far above the equilibrium superconducting transition temperature? In this project, we will study new avenues towards inducing superconductivity with light, by exploiting both laser driving and cavity settings, employing nonequilibrium Green's functions and/or many-body wavefunction simulations.</p> <p>[1] A. de la Torre et al., Rev. Mod. Phys. 93, 041002 (2021) [2] F. Schlawin et al., Applied Physics Reviews 9, 011312 (2022)</p>
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