

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

AR1 & DK1- Cavity quantum materials: from ab initio to models



Title of PhD Project	Cavity quantum materials: from ab initio to models
Type	Theory
Supervisor(s)	Prof. Angel Rubio, Dr. Michael Ruggenthaler, Prof. Dante Kennes
Affiliation(s):	Max Planck Institute for the Structure and Dynamics of Matter RWTH Aachen University
Number of positions:	1
Abstract:	<p>Recent experimental and theoretical results suggest [1] that quantum materials can be controlled by changing the mode structure of the electromagnetic environment within optical cavities. While this new control knob is a very promising addition to the control toolkit for quantum materials, it remains unclear to what extent common minimal models need to be adjusted to capture the arising effects. Recent considerations suggest that there can be an interesting interplay between macroscopic and microscopic degrees of freedom at play [2]. In this project we aim at developing problem-adapted models for quantum materials in cavities based on first-principles insights. A focus will be on bridging different energy and lengths scales and a combination of first-principles methods and tensor network approaches applied to these novel minimal models.</p> <p>[1] F. Schlawin, D. M. Kennes, and M. A. Sentef. "Cavity quantum materials." <i>Applied Physics Reviews</i> 9.1 (2022).</p> <p>[2] D. Sidler, T. Schnappinger, A. Obzhairov, M. Ruggenthaler, M. Kowalewski, and A. Rubio. "Unraveling a cavity induced molecular polarization mechanism from collective vibrational strong coupling." <i>arXiv preprint arXiv:2306.06004</i> (2023).</p>
Contact person for scientific questions about the project:	Prof. Angel Rubio: angel.rubio@mpsd.mpg.de Dr. Michael Ruggenthaler: michael.ruggenthaler@mpsd.mpg.de Prof. Dante Kennes: Dante.Kennes@rwth-aachen.de

