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 2025/2026

AR5 – Cavity spectroscopy for correlated systems

Title of PhD Project	**Cavity spectroscopy for correlated systems**
Type	Theory
Supervisor(s)	Prof. Angel Rubio Dr. Emil Viñas Boström
Affiliation(s):	Max Planck Institute for the Structure and Dynamics of Matter
Number of positions:	1
Abstract:	The recently established field of cavity material engineering attempts to modify a material's thermal state through the coupling to a cavity's electromagnetic vacuum fluctuations. Due to the strong light-matter interactions, it is expected that non-trivial information about the material state, such that its correlation and entanglement structure, is encoded in the cavity field. However, a key challenge for the field is how to probe the effects of the cavity, and how to extract such information about the embedded material. This project will develop a framework to describe open cavity systems, building on recent work using the input-output formalism. In particular, it will involve relating photonic correlation functions of the field emitted from the cavity to correlation functions of the embedded material. This framework will be applied to investigate correlated two-dimensional materials with unconventional electronic and magnetic orders, to understand what information can be learned and how to extract it. We will also consider the dynamics of open cavity systems, and how dynamical material engineering schemes like Floquet engineering and non-linear phononics can be enhanced in a cavity. [1] Cavity Spectroscopy for Strongly Correlated Polaritonic Systems. L. Grunwald et al., Phys. Rev. Lett. 134, 246901 (2025). https://doi.org/10.1103/1lpw-22np
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