

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



AR5- Foundations of Pauli-Fierz theory and quantum-electrodynamical density-functional theory

Title of PhD Project	Foundations of Pauli-Fierz theory and quantum-electrodynamical density-functional theory
Type	Theory
Supervisor(s)	Dr. Michael Ruggenthaler Dr. Heiko Appel Prof. Angel Rubio
Affiliation(s):	Max Planck Institute for the Structure and Dynamics of Matter
Number of positions:	1
Abstract:	<p>Recent groundbreaking experiments have demonstrated that the quantized electromagnetic field can have a substantial impact on the dynamics and properties of molecules and solids even at ambient conditions. A detailed description of such situations necessitates the use of quantum electrodynamics (QED) in the non-perturbative low-energy regime. It has been established that the resulting Pauli-Fierz quantum-field theory is mathematically similar to quantum mechanics and can be based on a self-adjoint and bounded-below Hamiltonian.</p> <p>In this project the mathematical structure of the Pauli-Fierz Hamiltonian is to be further investigated and basic mathematical results for quantum-electrodynamical density-functional theory are to be established. A specific focus is on regularity results for the time evolution of the Pauli-Fierz Hamiltonian with external classical fields and the relation between the ultra-violet cutoff and mass renormalization.</p>
Contact person for scientific questions about the project:	Dr. Michael Ruggenthaler: michael.ruggenthaler@mpsd.mpg.de Dr. Heiko Appel: heiko.appel@mpsd.mpg.de Prof. Angel Rubio: angel.rubio@mpsd.mpg.de

