LMU LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN | ARNOLD SOMMERFELD CENTER FOR THEORETICAL PHYSICS

Sommerfeld Theory Colloquium

Prof. Angel Rubio

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Quantum fluctuations alter materials functionalities: cavity and floquet materials Engineering

One of the principal challenges in computational physics is to formulate an accurate yet computationally viable theory that can address non-equilibrium light-driven phenomena in molecules and quantum materials. Additionally, there is a need to simulate spatially and temporally resolved spectroscopies, ultrafast events, and newly emerging states of matter. In pursuit of this goal, TDDFT has emerged as the cutting-edge ab initio theoretical framework, enabling reliable and precise simulations of light-induced alterations in the physical and chemical characteristics of intricate systems. In this context, I will also introduce the recently developed framework of Quantum Electrodynamics Density-Functional Formalism (QEDFT). This framework offers a first-principles approach to predict, characterize, and manipulate the spontaneous emergence of ordered phases in strongly interacting light-matter hybrids, referred to as polaritons These phases manifest both as ground states, resulting in novel states of matter, as well as metastable states. Noteworthy examples include photon-mediated superconductivity, cavity fractional quantum Hall physics, and optically driven topological phenomena in low dimensions. This exploration brings to light a burgeoning field, which we term "Cavity Materials Engineering" or the science of strongly correlated electron-photon interactions. We will conclude with the great challenges ahead in this captivating field of research.

Wednesday, 8 January 2025, 16:15h, Room A348, Theresienstr. 37/III

Dr. Christian Schilling