

**Plenary Talk**

PV IV Tue 9:00 U Audimax

**Light and cavity induced new states of matter: Quantum Electrodynamical Density Functional Theory (QEDFT) —**

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Computer simulations that predict the light-induced change in the physical and chemical properties of complex systems usually ignore the quantum nature of light. Recent experiments at the interface between materials science and quantum optics have uncovered situations where both the molecular system and the photon field have to be treated in

detail. In this talk, we show how the effects of quantum-photons can be properly included in the newly developed quantum electrodynamics density-functional formalism (QEDFT). We provide an overview of how well-established concepts in the fields of quantum chemistry and material sciences have to be adapted when the quantum nature of light becomes important. We identify fundamental changes in Born-Oppenheimer surfaces, conical intersections, spectroscopic quantities, and quantum control efficiency. We also show how periodic driving of many-body systems allow to design Floquet states of matter with tunable electronic properties on ultrafast time scales (and cavity induced-topology). This work paves the road for the development of two new fields, namely QED-materials and QED-chemistry.

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