Kolloquium

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Coherent Control of Quantum Materials Phases

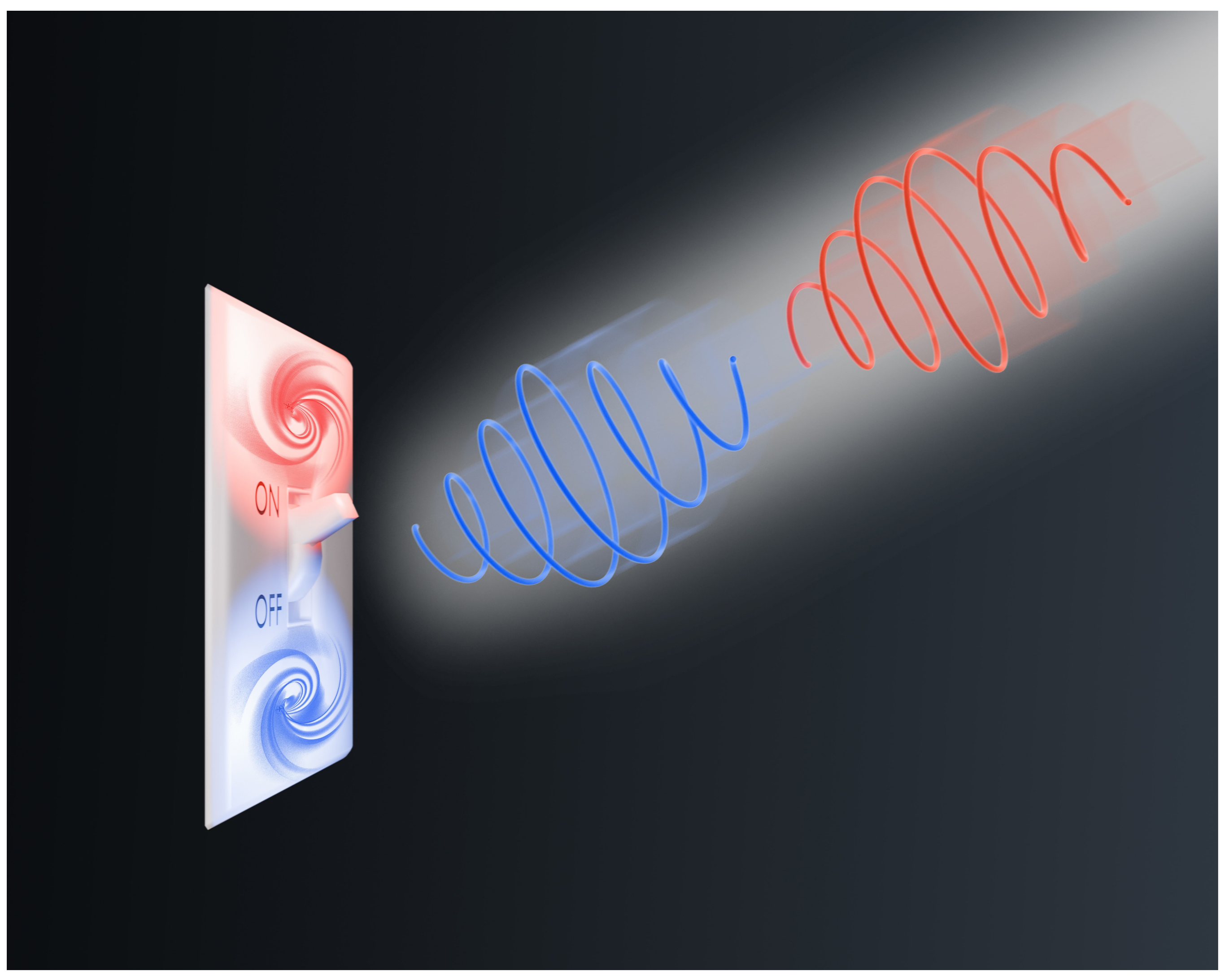
physikalisches

Mo. 24.11.25
16:00 Uhr
Ort: H34

Much of modern research in condensed matter physics focuses on the tuning and optimization of electronic, structural and magnetic phases of solids, with a significant effort devoted to Quantum Materials. These solids, in which quantum mechanical responses are observed on macroscopic lengthscales, are expected to form the backbone for future quantum technologies, in sensing, information storage and processing applications. New physics in these materials is generally pursued through materials discovery, and by tuning materials in equilibrium with pressure, strain and magnetic fields.

On the other hand, recent trends have channelled these efforts toward the physics of electromagnetically driven Quantum Materials, in search of new physical phenomena that exist only in these out-of-equilibrium conditions. I will discuss how coherent electromagnetic radiation, when tuned to drive collective modes in quantum materials, can be used to induce unexpected dynamical phases. The core idea is that when uncoupled normal modes are driven nonlinearly, interactions that are subdominant in equilibrium become progressively larger.

Induced interactions give rise to new collective properties, and forms of order that do not occur in equilibrium. An illustrative set of examples will be discussed for the nonlinear control of the crystal lattice, which is used to induce magnetic order in paramagnetic materials, ferroelectricity in paraelectrics and non-equilibrium superconductivity at high temperatures.



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