



PHYSIKALISCHES KOLLOQUIUM

Vortrag: **Prof. Dr. Stefan Kaiser**
Institute of Solid State and Materials Physics,
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Thema: **Ultrafast Optical Control of Complex Quantum Materials**
(Antrittsvorlesung)

Zeit und Ort: Dienstag, 14.12.2021, 16:40 Uhr / Online-Kolloquium in Zoom

Zoom-Meeting: Meeting-ID: 812 3860 4187 / Kenncode: PK-21!-SK
<https://tu-dresden.zoom.us/j/81238604187?pwd=TjNic2VzdWczSE56SDI1NFJqN2d1QT09>

Leitung: Dekan Prof. Dr. Carsten Timm

Kurzfassung: It is well known fact that various phase transitions in condensed matter can be triggered by external parameters such as temperature, pressure, electric field or magnetic field. Finding systems that show phase transitions triggered by external stimulation of light became a particularly interesting field of research. Advanced nonlinear optical methods such as ultra-broad band pump-probe spectroscopy open new ways of controlling ultrafast dynamics in complex solid-state materials on unprecedented timescales. In quantum materials, finding new ways of manipulating the complex interplay of electronic phases opens new avenues in controlling physical properties and designing new functionalities.

I will show how we investigate different scenarios like the balancing between competing phases triggered by ultrashort light pulses or possibilities of dynamical stabilization of new states of matter in periodically driven light fields. In particular I will review the remarkable possibilities to induce superconductivity in high temperature cuprate superconductors or controlling effective interactions in molecular crystals. As a novel method I will discuss the avenues of Higgs-Spectroscopy that became possible through phase-resolved high-field non-linear THz spectroscopy. Tracing collective coherent order parameter oscillations we gain insight into the ground states and the dynamics of condensates like high T_c superconductors or excitonic insulators and I will present first results and future ideas for this exciting technique.

Biographie: Stefan studied Physics at the RWTH Aachen and received his Diploma in 2005. Then he worked with Martin Dressel at the University of Stuttgart receiving his PhD in 2010 on organic superconductors and investigating their interplay with charge order. As a Post-Doc and later

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group leader he joined Andrea Cavalleri in 2009 at the Max Planck Institute for the Structure and Dynamics of Matter and the Center for Free Electron Laser Science at the University of Hamburg. The research focus in Hamburg was on pioneering experiments in the area of Light Induced Superconductivity, a topic he carried on with since then. In December 2014 Stefan became head of the independent Ultrafast Solid-State Spectroscopy group at the Max Planck Institute for Solid State Research in Stuttgart and was appointed Juniorprofessor at the University of Stuttgart. Here Stefan developed the new method of Higgs Spectroscopy and studied aspects of collective excitations in quantum materials. In March 2021 Stefan became Professor at the Institute of Solid State and Materials Physics at the TU Dresden.