

**Mathematisch – Naturwissenschaftliche Fakultät**  
der Universität zu Köln  
- Der Dekan -

# Einladung

zu der am Dienstag, den 06. Dezember 2016, um 16:45 Uhr  
im Hörsaal III der Physikalischen Institute,  
Zülpicher Straße 77  
stattfindenden öffentlichen

## Antrittsvorlesung

von Herrn

### **Prof. Dr. Sebastian Diehl**

(Institut für Theoretische Physik)

über das Thema

#### **Driven Open Quantum Systems: From Micro- to Macrophysics**

Recent developments in diverse areas - ranging from cold atomic gases over light-driven semiconductors to microcavity arrays - move systems into the focus, which are located on the interface of quantum optics, many-body physics and statistical mechanics. They share in common that coherent and driven-dissipative quantum dynamics occur on an equal footing, placing these systems far away from thermodynamic equilibrium. Harnessing the control and manipulation tools of ultracold atoms, it is possible to design controlled driven dissipative dynamics. This allows for counter-intuitive effects such as dissipatively induced long-range phase coherence. We sketch a microscopic implementation scheme, and show how this concept may open up an arena for many-body physics, realizing novel types of phase transitions resulting from competing Hamiltonian and dissipative dynamics, or dissipatively induced topological order. We then address aspects of many-body physics and statistical mechanics of driven open quantum systems, where light is strongly coupled to matter, such as realized in exciton-polariton condensates. In particular, we argue that two dimensional driven systems cannot support superfluidity and quasi-long range order, in stark contrast to thermodynamic equilibrium. Furthermore, we show that driven Bose criticality lies beyond the equilibrium classification of dynamical critical phenomena, in particular highlighting that the microscopic drive conditions bear observable though fully universal consequences even at the largest scales.

A. Büschges  
Dekan