

# IRTG-Seminar



## Michael Fleischhauer

Department of Physics & Research Center OPTIMAS, University of Kaiserslautern, Germany

### “Topology in finite-temperature and non-equilibrium systems”

Topological states of matter have fascinated physicists since a long time due to the exotic properties of elementary excitations and the topological protection of edge states and currents. The notion of topology is usually associated with ground states of (many-body)-Hamiltonians. I will discuss a classification for topological phases of matter applicable to finite-temperature states as well as non-equilibrium steady states of driven, dissipative systems based on the many-body polarization. In contrast to quantized charge transport and geometric phases, the polarization can be used to probe topological properties of non-interacting and interacting closed and open systems alike and remains a meaningful quantity at finite  $T$ . For non-interacting fermions it defines a topological invariant, the *ensemble topological phase* (ETP) [1], which can be extended to interacting systems. I discuss the physical significance of the ETP visible e.g. in the transfer of topological properties to auxiliary degrees of freedom with zero effective temperature. For bosons it is shown that interactions are required for the existence of non-trivial topological properties of the many-body polarization.

[1] C.E. Bardyn, L. Wawer, A. Altland, M. Fleischhauer, S. Diehl, PRX **8**, 011035 (2018)

**Tuesday, January 8, 2019; 1:00 p.m., HSII  
Physics high rise, Hermann-Herder-Str. 3**