## O 1: Focus Session: Topological Phenomena in Synthetic Matter I (joint session DS/O)

Topological insulators are a striking example of materials in which topological invariants are manifested in robustness against perturbations. Topology has emerged as an abstract, yet surprisingly powerful, new paradigm for controlling the flow of an excitation, e.g. the flow of electrons or light. This interdisciplinary Focus Session aims at discussing the latest experimental and theoretical results in the fast developing field of topological phenomena in synthetic matter. The recent merging of topology and cold atoms, photonics, mechanics and many more fields promises a considerable impact on these disciplines. We bring together leading theoretical and experimental experts from the fields of topological phenomena in synthetic matter to discuss recent progress and interdisciplinary synergy emerging at the interface of these fields. Furthermore, we give an overview to young scientists of exciting possibilities of interdisciplinary research in these fields with the special focus on the practical applications of fundamental science.

**Organizers:** S. Klembt, R. Thomale, S. Höfling (Uni Würzburg) and A. Szameit (Uni Rostock)

Time: Monday 9:30–11:00 Location: CHE 89

**Invited Talk** O 1.1 Mon 9:30 CHE 89

**In situ fabrication of (Bi,Sb)-based topological insulator - superconductor hybrid devices** — •Peter Schüffelgen — Forschungszentrum Jülich, Peter Grünberg Institute 9, Jülich, Germany

With their experimental verification in 2007, topological insulators render a new and fascinating material class. A band inversion in the bulk of a 3D topological insulator creates a 2D metallic Dirac system at the physical surface of those 3D crystals. The surface Dirac states are topologically protected and have their spin locked to their momentum. This intrinsic quantum spin texture enables the realization of novel technologies, such as elusive Majorana quantum bits. In this talk, I will introduce the material class of (Bi,Sb)-based topological insulators and discuss experimental challenges. I will present an in situ process that makes it possible to construct hybrid devices comprised of topological and superconductive nanostructures fully under ultra-high vacuum conditions via molecular beam epitaxy. A combination of stencil lithography and selective area growth allows for the realization of a variety of superconductor-topological insulator hybrid devices and solves the associated fabrication challenges.

**Invited Talk** O 1.2 Mon 10:00 CHE 89

**Atomic monolayers as two-dimensional topological insulators** — •Ralph Claessen — Physikalisches Institut and Würzburg-Dresden Cluster of Excellence ct.qmat, Universität Würzburg, Germany

Two-dimensional topological insulators (2D-TIs) are characterized by hosting spin-polarized conducting band states at their one-dimensional (1D) edges, giving rise to the quantum spin Hall (QSH) effect. As pointed out in the seminal work of Kane and Mele, graphene would constitute the most simple realization of a QSH insulator if it were not for its almost negligible spin-orbit interaction. It has been suggested that going to heavier group IV monolayers (such as Sn-derived "stanene") could remedy this problem, but a convincing demonstration of such 2D TIs is still lacking. Recently it has been found that going to the neighboring groups III and V in the Periodic Table provides a promising alternative approach. Here I will discuss our recent photoemission (ARPES) and scanning tunneling microscopy (STM) studies of such monolayer systems. Particular focus will be on the case of bismuthene deposited on a SiC(0001) substrate, which is identified as a large band-gap QSH insulator with almost atomically confined 1D edge states. Time permitting I will also address our recent discovery of possible topological behavior in triangular In monolayers on SiC.

**Invited Talk** O 1.3 Mon 10:30 CHE 89

**Exceptional Topology of Non-Hermitian Systems** — •Jan Carl Budich — Institute of Theoretical Physics, Technische Universität Dresden, 01062 Dresden, Germany

In a broad variety of physical situations ranging from classical settings to open quantum systems, non-Hermitian (NH) Hamiltonians have proven to be a powerful and conceptually simple tool for effectively describing dissipation. Motivated by recent experimental discoveries in synthetic materials, a major focus of research has developed on investigating the topological properties of such NH systems. In this talk, we present our latest results in this rapidly growing field. Specifically, we discuss the occurrence of novel gapless topological phases unique to NH systems. There, the role of spectral degeneracies familiar from Hermitian systems such as Weyl semimetals is played by exceptional points at which the effective NH Hamiltonian becomes non-diagonalizable. Furthermore, we show how guiding principles of topological matter such as the bulk boundary correspondence are qualitatively changed in the NH realm.