Topologically protected states in 1D and 2D lattices of microwave resonators.

In recent years, concepts of symmetry have been extended to optical systems with loss and gain, giving rise to the field of PT symmetric systems with a multitude of possible applications. At the same time, there is a great deal of interest to transfer topological band theory from electronic to photonic systems, leading, e.g., to optical analogs of the quantum Hall effect and the quantum spin Hall effect.
These investigations are driven to a large extent by the desire to find new concepts for robust wave guiding, lasing, unidirectional transmission, nonlinear switching, and perfect absorption. In our work we combine these concepts in a microwave experiment to demonstrate that topological robustness extends to optical properties that do not have an electronic counterpart. For this we exploit a unique feature of topologically protected interface states, namely, that these states break a sublattice symmetry. This property isolates the state from PT- symmetric losses, which affect all other states in the system. In our experiments, this enhances the visibility of the topological state both in the frequency and in the time domain. Depending on time, I will present properties of other topological states experimentally obtained in strained artificial ribbons of graphene, and in a 2D Lieb lattice.