

Graz Advanced School of Science  
PHYSICS COLLOQUIUM OF THE UNIVERSITY OF GRAZ AND  
THE GRAZ UNIVERSITY OF TECHNOLOGY

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**Topological physics with light:  
Topological edge and corner modes in polariton lattices**

Topological Photonics is an emerging field of research, adapting concepts from condensed matter physics to photonic systems adding new degrees of freedom. After the first demonstrations of topological photonic insulators, the field has moved on to study and exploit the inherent non-hermiticity of photonic systems and the interplay with their topological nature. I will attempt to give an overview about the quickly emerging field of topological photonics, discussing topological lasers as a prime example of using topological concepts potentially for new technologies in the broad context of synthetic (photonic) matter. Examples will be given from novel photonic lattice devices resulting from the coupling of individual vertical III-V semiconductor microresonators. Here, the so-called exciton-polaritons – hybrid states of light and matter – can emerge in the strong-coupling regime. The specific geometries as well as the hybrid light-matter nature allow for ways to break time-reversal symmetry and implement topologically non-trivial systems. We were able to experimentally demonstrate the first exciton-polariton topological insulator, manifesting in chiral, topologically protected edge modes. In order to study topological effects in combination with optical non-linearities, so-called topological lasers have been envisaged and realized. We have presented the first experimental demonstration of a topological insulator vertical cavity laser array, using the crystalline topological insulator model. Following this works, recent advances towards electrical operation and lasing from a topological defect are discussed. In addition, so-called corner modes, fully localized topological defects in a two-dimensional lattices are discussed.

Date: Tuesday, 16th January 2024, 4:15 p.m.

Location: HS 05.01 EG, Universitätsplatz 5, 8010 Graz

meet the speaker coffee 3:45 p.m. library Experimental Physics, 1. floor

Host: Prof. Thomas Weiss

