Seminar announcement

Tuesday, February 13, 2024
1:30 pm
WSI, Seminar room S 101
<u>Exclusively in person</u>

"Topolectrics – Topology and non-hermiticity studied in electric circuit networks"

Topological materials are realizations of novel states of matter that are characterized by a topological invariant. This characterization implies that the state is robust against perturbations that preserve the underlying symmetry of the system, as long as these perturbations do not close the gap of the corresponding band structure. While this is conceptually particularly powerful in fermionic systems, for which Kramer's doubling provides a very robust topological protection, this notion has also been successfully transferred to bosonic and even classical systems in recent years.

I will introduce how electric circuit networks can be designed to harbor topological properties and serve as a versatile platform to study a wide range of physical models of lattice regularizations. Starting from a nodal analysis of a circuit lattice in terms of currents and voltages, I will first show the correspondence to tight binding models in traditional solid-state physics. This correspondence is next used to engineer and measure band structures in a synthetic crystal composed of electric circuit elements, and I demonstrate how different topological phases can be realized in such a setting.

I will continue to demonstrate how the inclusion of features like gain, loss or periodic driving allow us to study open systems in electric circuit networks. For these types of non-Hermitian systems, we encounter a dramatic modification of the bulk-boundary correspondence, which is one of the most relied upon topological principles in Hermitian systems. We find the previously predicted non-Hermitian Skin effect, displaying an extensive mode localization despite a translationally invariant bulk.

I shall close by providing an outlook of future research directions, and in particular, highlight the connection to research in contemporary photonic systems.

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