ICFO



INSIGHT SEMINAR: Intertwined entanglement in topological pumps

TILMAN ESSLINGER

November 21, 2024
16:00 to 17:00
Elements Room

BIO:

Tilman Esslinger is Professor of Quantum Optics at the Physics Department of ETH Zurich. He received his PhD from the Ludwig-Maximilians-University of Munich and an honorary degree from Heriot-Watt University. In his work he uses ultracold atoms to synthetically create key models in quantum many-body physics and to explore novel concepts for quantum computing. Major advances were the observations of the superfluid to Mott insulator quantum phase transition, the Dicke phase transition in light-matter interaction and the quantized conductance in neutral matter. He created the first atomic Fermi-Hubbard model and the Haldane model for a topological Chern insulator. He realized a supersolid using long-range cavity mediated interactions and constructed density-dependent gauge fields.

ABSTRACT:

We create spatially separated Bell pairs from double occupancies in a fermionic lattice gas using a bidirectional Thouless pump. By controlling the interaction, exactly one atom of the double occupancy occupies the lower and the other the upper band of the topological pump, each experiencing opposite Chern numbers. Topological pumping therefore transports the two correlated components in opposite directions, further separating them with each pumping cycle. During the pumping we apply (SWAP)a gates, which allow the entangled pairs to pass through each other, giving rise to intertwined entanglement over many lattice sites. As a result, we observe distinctive frequencies and multi-frequency patterns in singlet-triplet oscillations. Perspectives of the scheme for quantum computation, simulation and sensing will be discussed.

Hosted by: Prof. Dr. Leticia Tarruell