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Correlated Topological Quantum States in Ultracold Atoms

Ultracold atoms in optical lattices are powerful quantum simulators for strongly correlated systems. With synthetic gauge fields, induced by time-periodic driving, they can simulate interacting topological states of matter. I will address open challenges:

Quantum gases are mesoscopic and have soft boundaries. We propose an interacting topological interface that allows to experimentally observe edge modes via quantum gas microscopy. We also show that the topology of an interacting Chern insulator is approximately encoded in the single-particle density matrix, which can be measured in time-of-flight experiments.

Disorder usually impedes coherent transport. Together with gauge fields it can remarkably *induce* a topological phase with quantized transport. We show that strong correlations can even enhance this effect.