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The cold-atom elevator: From edge-state injection to the preparation of fractional Chern insulators

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Optical box traps offer new possibilities for quantum-gas experiments. Building on their exquisite spatial and temporal control, we propose to engineer system-reservoir configurations using box traps, in view of preparing and manipulating topological atomic states in optical lattices. First, we consider the injection of particles from the reservoir to the system: this scenario is shown to be particularly well suited to activating energy-selective chiral edge currents, but also, to prepare fractional Chern insulating ground states. Then, we devise a practical evaporative-cooling scheme to effectively cool down atomic gases into topological ground states. Our open-system approach to optical-lattice settings provides a new path for the investigation of ultracold quantum matter, including strongly-correlated and topological phases.

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Primary author: GOLDMAN, Nathan (ULB)

Co-authors: ECKARDT, André (Technische Universitat Berlin); Dr WANG, Botao (ULB); DALIBARD, Jean (College de France); AIDELSBURGER, Monika

Presenter: GOLDMAN, Nathan (ULB)

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