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Talk Title: Transport without charge

Abstract: We study fundamental concepts of particle, spin and heat transport in a model system using ultracold atoms. It consists of a narrow channel connecting two macroscopic reservoirs of fermionic lithium atoms. For example, for non-interacting atoms, we observe quantized conductance and the system finds an ideal description in the Landauer-Büttiker formalism, which views conduction as the transport of carriers from one terminal to another. The concept also offers an avenue to study thermoelectric transport, which is extremely sensitive to quantum confinement and interactions, a feat challenging to study and pin down in real-life materials. We experimentally engineered the thermoelectric response of a two-dimensional system of ultracold fermions using optical potentials, where the absence of defects and phonons also enables direct ab-initio modelling. Upon increasing interactions to the strongly-correlated regime, we can controllably enhance or even reverse the thermoelectric current, smoothly turning our system from a heat engine into a heat pump.