Abstract Submitted
for the DAMOP18 Meeting of
The American Physical Society

Bridging the thermoelectric and superfluid fountain effects with ultracold fermions MARTIN LEBRAT, DOMINIK HUSMANN, SAMUEL HÄUSLER, PHILIPP FABRITIUS, LAURA CORMAN, ETH Zurich, JEAN-PHILIPPE BRANTUT, EPFL, TILMAN ESSLINGER, ETH Zurich — An out-of-equilibrium system with temperature and chemical potential gradients needs both heat and matter currents to relax to thermodynamical equilibrium. The relaxation dynamics illuminates the microscopic mechanisms responsible for transport and energy conversion between heat and work, which is of great technological importance for cooling (Peltier effect) or power generation (Seebeck effect). Using two reservoirs of fermionic lithium-6 atoms connected by an optically-shaped constriction, we demonstrate such thermoelectric effects and investigate the influence of interactions and constriction properties. With weak interactions and a 2D constriction, thermoelectric coupling can be optimized by controlling the geometry or introducing disorder. With strongly interacting fermions close to the superfluid transition and a quasi-1D constriction, the system evolves towards a non-equilibrium steady state, associated with a reduced heat diffusion and a strong violation of the Wiedemann-Franz law. Measuring thermoelectric transport coefficients as a function of constriction anisotropy and degeneracy, we underline the analogies and differences between our observations and the celebrated fountain effect shown with superfluid helium-4.

Martin Lebrat
ETH Zurich

Date submitted: 24 Jan 2018 Electronic form version 1.4