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Local spin manipulation of quantized atomic currents LAURA CORMAN, MARTIN LEBRAT, SAMUEL HÄUSLER, PHILIPP FABRITIUS, DOMINIK HUSMANN, TILMAN ESSLINGER, ETH Zurich — Controlling the internal state of a particle in an ultracold atom experiment is instrumental for studying spinor phases and most prominently to emulate spin transport and artificial gauge fields. This control can be implemented using magnetic fields — acting on the full cloud — or using light fields — which can be spatially varied. The latter method was successfully used in several experiments to couple the spin and motional degrees of freedom of quantum gases, although the experiment time was strongly constrained by the heating induced by the laser beams.
Here, we report on the control of spin transport of fermionic lithium atoms at a quantum point contact thanks to the spatial shaping of a near-resonant laser. Spin-dependent transport was observed over several seconds with reduced heating thanks to the localized spin potential. We were able to lift the spin degeneracy for weak interactions while retaining conductance plateaus. The observed conductances match a Landauer theory adapted to take losses into account. We were finally able to distinguish small changes in the interaction strength by monitoring the separation between the two spin conductance curves.

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