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Observation of quantized conductance in neutral matter DOMINIK HUSMANN, SEBASTIAN KRINNER, MARTIN LEBRAT, CHARLES GRENIER, SHUTA NAKAJIMA, SAMUEL HÄUSLER, JEAN-PHILIPPE BRANTUT, TILMAN ESSLINGER, ETH Zürich — In transport experiments, the quantum nature of matter becomes directly evident when changes in conductance occur only in discrete steps, with a size determined solely by Planck's constant h. Here we report the observation of quantized conductance in the transport of neutral atoms driven by a chemical potential bias. We use high-resolution lithography to shape light potentials that realize either a quantum point contact or a quantum wire for atoms. These constrictions are imprinted on a quasi-two-dimensional ballistic channel connecting the reservoirs. By varying either a gate potential or the transverse confinement of the constrictions, we observe distinct plateaux in the atom conductance. The conductance in the first plateau is found to be equal to the universal conductance quantum, 1/h. We use Landauer's formula to model our results and find good agreement for low gate potentials, with all parameters determined a priori. We eventually explore the behavior of a strongly interacting Fermi gas in the same configuration, and the consequences of the emergence of superfluidity.

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