

Abstract Submitted
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Observation of spin-charge separation and localization in a one-dimensional quantum wire OPHIR M. AUSLAENDER¹, HADAR STEINBERG, AMIR YACOBY, Department of Condensed Matter Physics, Weizmann Institute of Science, Israel, YAROSLAV TSERKOVNYAK, BERTRAND I. HALPERIN, Lyman Laboratory of Physics, Harvard University, KIRK W. BALDWIN, LOREN N. PFEIFFER, KENNETH W. WEST, Bell Labs, Lucent Technologies — We report on measurements of quantum many-body modes in ballistic wires and their dependence on Coulomb interactions. To this end we measure tunneling between two parallel wires in an AlGaAs/GaAs heterostructure as a function of electron density. When the density is high we clearly observe two spin modes and one charge mode of the coupled wire system. Mapping the dispersion velocities of these modes as a function of decreasing density, we find good agreement between the data and theoretical calculations of the charge velocity, although theory also predicts an additional charge mode that is not observed. We also find that, within experimental precision, the measured spin velocity is smaller than predicted theoretically. Decreasing density further, we observe spontaneous localization at a critical density. A simultaneous measurement of the two terminal conductance, which exhibits typical conductance steps, shows localization transitions concurrent with each conductance drop.

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