Conductance of a quantum wire in the Wigner crystal regime.
Author: K. A. Matveev

And

Non-unitary spin-charge separation in a one-dimensional fermion gas.
Authors: V. V.Cheianov and M. B. Zvonarev

Recommended with a commentary by Bertrand I. Halperin, Harvard University

Theoretical analyses of interacting one-dimensional electron systems commonly focus on the Lut-tinger liquid behavior expected in the limit of low temperatures and low energies. For a system where the short distance repulsion is sufficiently strong, however, it is difficult for adjacent electrons to change places, and the spin exchange energy E_{spin} can be much smaller than the Fermi energy E_F for non-interacting electrons. Then there is an interesting regime, where the temperature T is small compared to the energy for short wavelength charge excitations, but large compared to E_{spin}, and hence larger than the energy of any pure spin excitations.

In a recent preprint, Cheianov and Zvonarev obtained interesting results for the one-electron Green function G(x, t) in this limit. The Green function can be factored into a non-propagating spin sector and a propagating charge sector with anomalous dimensions that are described by a non-unitary conformal field theory. The tunneling density of states is found to diverge at low energies, as $\omega^{-1/2}$,provided that $h\omega$ is still large compared to T and E_{spin}.

More recently, Matveev considered transport through a one-dimensional channel with a smoothly varying electron density, such that there is a central region where the density is low and Espinis much smaller than T, while the reverse is true in the outer regions. Matveev argues that the electrical conductance through the wire is then e^2/h, which is half of the zero-temperature value for an open channel with two spin states. This results from the fact that excitations in the spin sector are totally reflected near the points where the local E_{spin} decreases below T, whereas the bosonic charge excitations pass through unimpeded. It will be interesting to see how closely this may be related to observed anomalies in transport through a quantum point contact at finite temperatures, near pinch-off, and more generally, how well one can realize an experimental regime with $E_{spin} << T << E_F$ in a 1-D wire.