

Abstract Submitted
for the MAR08 Meeting of
The American Physical Society

Effects of Confinement Potential and Screening on a Quasi One Dimensional Electron Gas¹ LUKE SHULENBURGER, MICHELE CASULA, University of Illinois at Urbana-Champaign, GAETANO SENATORE, Università di Trieste, and INFM-CNR Democritos, RICHARD M. MARTIN, University of Illinois at Urbana-Champaign — We study a quasi one dimensional system of electrons for different densities and strengths of the transverse confining potential. By means of exact quantum Monte Carlo techniques, we analyze the behavior of electrons interacting via an unscreened potential with a long range $1/r$ tail. We also study the effect of screening due to a metallic gate, which allows a more direct comparison with experiments.

While the high density regime is well described by the RPA, we find that the charge compressibility χ_c is reduced due to electronic correlation as the density decreases. In the absence of screening, this corresponds to the onset of a quasi Wigner crystal, as shown by the finite size scaling of the static structure factor at $4k_f$. As the density decreases further, the electrons behave as spinless fermions which is evidenced by the energetics and exponentially small spin velocities. The spinless fermion features persist also in the strongly screened system, and the RPA to Wigner crystal crossover is shifted to higher densities for a thinner wire.

¹Supported by NSF DMR 04-04853

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Date submitted: 27 Nov 2007

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