Coulomb correlations in ultrathin wires

MICHAEL FOGLER, UCSD

— We compute the ground-state energy and the density-density correlation function of electron liquid in a thin one-dimensional wire. The calculation is based on an approximate mapping of the problem with a realistic Coulomb interaction law onto exactly solvable models of mathematical physics. This approach becomes asymptotically exact in the limit of small wire radius but remains numerically accurate even for modestly thin wires. Possible experimental realizations of the model include semiconducting carbon nanotubes on high-kappa dielectric substrates and quantum wires near metallic gates.