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Electron Localization in the Inhomogeneous Electron Gas: Quantum Point Contacts ABHIJIT C. MEHTA, Duke University, CYRUS J. UMRIGAR, Cornell University, A. DEVRIM GUCLU, National Research Council of Canada, HAROLD U. BARANGER, Duke University — We use Quantum Monte Carlo (QMC) techniques to investigate the behavior of electrons in an inhomogeneous quasi-one-dimensional wire as a model of quantum point contact geometries. Previous QMC work by Guclu et al. demonstrated that electrons can be strongly localized in quantum point contacts, and this result was reproduced by Welander et al. using LSDA calculations. We model a quantum point contact as a constriction in a quantum ring, and we use variational and diffusion Monte Carlo to investigate the effects of different point contact lengths and geometries on the electronic properties of the QPC. A key issue is how robust the previous results are to the length of the constriction, the depth and steepness of the confining potential, and to increasing the density of the electrons in the high-density lead region.

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