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Simulating electron transport and devices on liquid helium[1] PASCAL BUGNION, STEPHEN LYON, FORREST BRADBURY, Princeton University — Manipulation of the spin of electrons in surface states on superfluid helium is a promising method for the implementation of a quantum computer. The electrons can be transported around a substrate along channels in a manner analogous to charge-coupled devices. These devices operate on one or a few electrons, which are sufficiently isolated to be treated as classical point charges. The model must therefore incorporate the discreteness of the charges and their interactions, as well as their response to external potentials. These constraints lead towards considering a "molecular" dynamics, multi-electron simulation. The calculation of the electron-electron interactions are complicated by the presence of nearby metallic gates and insulating layers. The concepts necessary for a fast, accurate dynamic simulation of a large collection of individual electrons are elaborated. A computationally cheap approximation of the electrostatic potential due to substrate polarisation for an electron above a channel is proposed. The approximation is compared to an analytic solution. Other substrate geometries which might be used in a quantum computer are also discussed, concentrating on approximations of the potential.

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