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Microscopic Current Flow Patterns in Nanoscale Quantum Point
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California, San Diego — Transport in nanoscale conductors has been studied ex-
tensively mainly using the stationary scattering approach. However, the dynamical
nature of transport, and in particular, the flow patterns of the microscopic current
through a nanoscale junction, have remained poorly understood. We apply a novel
time-dependent transport approach [1], which combines closed and finite geome-
tries with time-dependent density functional theory, to study current flow patterns
in nanoscale quantum point contacts [2]. The results of both atomistic and jellium
calculations show that surface charges form dynamically at the junction-electrode
interfaces in both abrupt and adiabatic junctions. The current exhibits some charac-
teristics of a classical hydrodynamic liquid but also displays unique patterns arising
from the interaction with the surface charges. We also investigate the effect of the
flow velocity, charge density, and lattice structures on the electron dynamics. If time
permits we also discuss the effects of the viscosity of the electron liquid [3]. Work
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