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Hydrodynamical approach to transport in nanostructures
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University of California - San Diego — The electrical resistance induced by the viscous properties of the electron liquid has been recently derived.[1] In addition, it is known that the geometric constriction experienced by electrons flowing in a nanostructure gives rise to a fast "collisional" process.[2] These facts allow us to derive Navier-Stokes-type of equations, and therefore describe the electron flow on a par with a viscous and compressible liquid. By using this hydrodynamical approach we study electron transport in nanoscale systems and derive the conditions for the transition from laminar to turbulent flow in quantum point contacts. We also discuss possible experimental tests of these predictions.

[1] N. Sai, M. Zwolak, G. Vignale, and M. Di Ventra, Phys. Rev. Lett. **94**, 186810 (2005).

[2] M. Di Ventra and T.N. Todorov, J. Phys. Cond. Matt. **16**, 8025 (2004); N. Bushong, N. Sai and, M. Di Ventra, Nano Lett. (in press).

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