# Quantum charged transport and the boundary value problem

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**Abstract:** We consider quantum hydrodynamic models (QHM)-Poisson systems in bounded domains with inflow boundary conditions in the context of charged transport induced by an electric field for a rather general termalization closure. These problems appear in the modeling of nano-scale electronic devices as well as Bose Einstein condensates and other approximations to charged non-linear Schrdinger transport by WKB expansions. We show non-existence of weak solutions to stationary states for a large set of boundary conditions, and, in particular, a blow up in finite time for transient solutions. However the stationary problem is solvable when a nonlinear viscous-friction term is present.

Finally, we present a high order Wigner solver for quantum transport in nanostructures. The main difficulty is that most of the proposed solvers introduce excessive numerical diffusion that overcomes the physical dispersive effects: as a result these solvers have poor agreement with Schrdinger solvers for the pure state simulations under the presence of discontinuous potential. As a consequense, when simulating the steady state distribution using low order Wigner-time-relaxation models, the numerical results sometimes do not represent the modeling dissipation but rather the numerical dissipation (in collaboration with Jing Shi).

We present here a new deterministic solver for Wigner equations. High order numerical discretization is employed in order to minimize the spurious numerical dissipation and dispersion. The correct quantum interference is captured when compared with the corresponding Schrdinger simulation.

Finally we discuss numerical solutions of the Wigner equation and the relation to QHD models.