

2.8 ViennaWD - Applications

P. Ellinghaus¹, J. Weinbub¹, M. Nedjalkov^{1,2}, S. Selberherr¹

¹TU Wien, Austria

²Bulgarian Academy of Sciences, Bulgaria

weinbub@iue.tuwien.ac.at

The Wigner Monte Carlo simulator - part of the free open source ViennaWD project - implements the signed-particle method, which has been matured to the point where two-dimensional numerical experiments can be performed accurately and with a reasonable computational effort. The capability of the Wigner simulator to investigate time-dependent quantum transport is demonstrated by examples investigating the evolution of wave packets. The propagation of a wave packet in a mesoscopic ring-like structure reveals the quantum phenomena of interference and also entanglement, which can be clearly identified using the phase-space perspective. Furthermore, the use of electrostatic lenses to manipulate electron wave packets will be discussed along with a demonstration on how focusing can be used to increase the drive-current in nanoscale channels. An outline of envisioned simulation experiments, which consider decoherence effects and magnetic fields, will be given to highlight the associated theoretical and computational challenges for the Wigner signed-particle model.