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Quasi-ballistic and diffusive electron transport in inhomogeneous semiconductor nanostructures[1] DAN CSONTOS, SERGIO E. ULLOA, Department of Physics and Astronomy, Nanoscale and Quantum Phenomena Institute, Ohio University — We study nonequilibrium electron transport in inhomogeneous, nondegenerate semiconductor nanostructures using a computational approach based on the self-consistent, direct solution of the semiclassical, steady-state Boltzmann transport equation and the Poisson equation. We show that, in general, large applied and built-in fields in these systems give rise to strongly out-of-equilibrium electron velocity distributions that display interesting structure in the high-energy tail of the distribution, caused by the interplay between quasi-ballistic and diffusive contributions to the electron transport. The observed characteristics have a strong spatial dependence, related to the large inhomogeneous electric field variations in these systems, as well as a strong dependence on temperature and the detailed nature of the electron scattering where we find that the impact of a phonon threshold-energy scattering mechanism on the nonequilibrium distribution is considerable.

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