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High electric-field quantum transport for Bloch electrons in a single band scattering from a random distribution of impurities JOSEPH B. KRIEGER, Dept. of Physics, Brooklyn College (CUNY), B'klyn, NY 11210, ANDREY A. KISELEV, ILKI KIM, GERALD J. IAFRATE[1], Dept. of Electrical and Computer Eng., NC State Univ., Raleigh, NC 27695 — The quantum Boltzmann equation for a Bloch electron in a single band under the influence of a homogeneous and inhomogeneous electric field subject to scattering from a random, spatially inhomogeneous distribution of impurities will be presented. The analysis assumes the use of a single band effective Hamiltonian to describe the Bloch dynamics, and makes use of the vector potential to define the homogeneous electric field. After developing an *interaction picture* transformed Liouville equation for the Bloch electron based on the Wigner function, and then taking the limit of slowly varying inhomogeneous electric field and slowly varying scatterer density distribution, a novel quantum generalization of the Boltzmann equation is obtained which includes a collision term with impurity-related intra-collisional field effects correct to second order in the impurity potential, and a drift term which includes the total force based on the homogeneous and inhomogeneous fields.

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