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Quantum transport of massless Dirac fermions in graphene KENTARO NOMURA, ALLAN MACDONALD, Department of Physics, University of Texas — Graphene is a two-dimensional carbon material with a honeycomb lattice and Dirac-like low-energy excitations. Motivated by recent graphene transport experiments, we have undertaken a numerical study of the conductivity of disordered two-dimensional massless Dirac fermions. It has been found that in the long-range Coulombic scattering case the conductivity depends linearly on the carrier density and that the minimum conductivity $\sigma_{\min} \approxeq e^{2/h}$, consistent with experiments if intervalley scattering is assumed to be negligible. We study the transport properties of graphene in the presence of a perpendicular magnetic field. In a strong field the conductivity reveals the massless Dirac fermion Landau level structure and quantized Hall conductivities. On the other hand, in the strongly disordered (weak field) regime in which Landau level maxing is important, the conductivity closes to $e^{2/h}$ for the long-range scattering case. K. Nomura, A. H. MacDonaold, cond-mat/0606589.

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