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Studies of limitations on the mobility and mean free paths in graphene devices.[1] XU DU, IVAN SKACHKO, EVA Y. ANDREI, Department of Physics and Astronomy, Rutgers University, Piscataway, New Jersey 08854, USA — The Dirac Fermion nature of the quasiparticles in graphene has led to many predictions for novel phenomena such as specular Andreev reflections at graphene-superconductor interfaces and a negative index of refraction for transmission of charge across graphene p-n junctions. These predictions presuppose ballistic transport, which requires long mean free paths compared to the distance between leads. However, within current fabrication techniques, the mean free paths of charge carriers in graphene devices are often too short for ballistic transport. The reduced mean free path is primarily due to excess scattering introduced by extrinsic factors such as material imperfections, substrate contamination, e-beam resist residue, chemical doping, contact potential and contact geometry. We will discuss the results of systematic studies of extrinsic factors, highlighting the case of graphene SNS weak links, and will propose strategies to increase the mean free path.

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