113. Title: Drude conductivity of Dirac fermions in graphene

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Abstract: Electrons moving in graphene behave as massless Dirac fermions, and they exhibit fascinating low-frequency electrical transport phenomena. Their dynamic response, however, is little known at frequencies above one terahertz (THz). Such knowledge is important not only for a deeper understanding of the Dirac electron quantum transport, but also for graphene applications in ultrahigh-speed THz electronics and infrared (IR) optoelectronics. In this paper, we report measurements of high-frequency conductivity of graphene from THz to mid-IR at different carrier concentrations. The conductivity exhibits Drude-like frequency dependence and increases dramatically at THz frequencies, but its absolute strength is lower than theoretical predictions. This anomalous reduction of free-electron oscillator strength is corroborated by corresponding changes in graphene interband transitions, as required by the sum rule.