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Effects of optical and surface polar phonons on the optical conductivity of doped graphene VASILI PEREBEINOS, IBM - Watson, BENEDIKT SCHARF, JAROSLAV FABIAN, Institute for Theoretical Physics, University of Regensburg, Germany, PHAEDON AVOURIS, IBM - Watson — During the past decade, graphene has attracted immense interest, mainly due to its excellent transport and optical properties, which make it an attractive candidate for possible applications in nanoscale electronics and optoelectronics. Using the Kubo linear response formalism, we study the effects of intrinsic graphene optical and surface polar phonons (SPPs) on the optical conductivity of doped graphene. We find that inelastic electron-phonon scattering contributes significantly to the phonon-assisted absorption in the optical gap. At room temperature, this midgap absorption can be as large as about 20-25% of the universal ac conductivity for graphene on polar substrates (such as Al_2O_3 or HfO_2) due to strong electron-SPP coupling. The midgap absorption, moreover, strongly depends on the substrates and doping levels used. We predict that with increasing temperature, the midgap absorption increases, while the Drude weight decreases. These predictions can serve as an experimental signature for the role of SPPs on transport and optical properties of graphene, which have important implications for the performance of graphene-based electronic devices and broadband modulators.

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