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Energy Relaxation of Hot Dirac Fermions in Graphene[1] WANG-KONG TSE, University of Texas, Austin; University of Maryland, College Park, SANKAR DAS SARMA, University of Maryland, College Park — We develop a theory for the energy relaxation of hot Dirac fermions in graphene. We obtain a generic expression for the energy relaxation rate of hot Dirac fermions in graphene due to electron-phonon interaction and calculate the power loss due to both optical and acoustic phonon emission as a function of electron temperature $T_{\rm e}$ and density n. We find an intrinsic power loss weakly dependent on carrier density and non-vanishing at $n = 0$, originating from interband electron-optical phonon scattering from the intrinsic electrons in the graphene valence band. We also obtain the total power loss per carrier to be $\sim 10^{-12} - 10^{-7}\,\mathrm{W}$ within the range of electron temperatures $\sim 20 - 1000\,\mathrm{K}$, finding that the temperature for the optical phonon emission to overtake acoustic phonon emission as the dominant energy loss mechanism ranges $\sim 200 - 300\,\mathrm{K}$ for $n = 10^{11} - 10^{13}\,\mathrm{cm}^{-2}$.

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