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Infrared study of carrier scattering in graphene field effect device 2h0'

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We determined carrier scattering rate (Γ) of grapheme from Far-IR transmission measurement on CVD-graphene/SiO2/p-Si field effect device. As carrier density (n) is varied by applying the gate voltage exhibits distinct n-dependent change which is represented by two polynomial scatterings as Γ(n) = A/n + B·√n. The A/n-scattering and B·√n-scattering plays dominant role in the low-n and high-n regime respectively, whereas they have equal strength at n = nc = 2×10^12 cm-2 . We calculated dc-conductivity (σ0(n)) from Γ(n) finding that σ0(n) exhibits the linear-to-sublinear crossover at n = nc due to that Γ(n) switches from A/n to B·√n at this density. It accounts for the sub-linear behavior of I-V curve, long-standing puzzle in graphene physics. We discuss possible origin of the A/n and B·√n scattering in terms of the charged-impurity, phonon, and short-range adatom scattering.

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