Scattering mechanisms that cause 1/f noise in graphene

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We experimentally study the effect of different scattering potentials on the 1/f noise observed in graphene devices on silica and silicon nitride substrates. The noise in nominally identical devices is seen to behave in two distinct ways as a function of carrier concentration, changing either monotonically or nonmonotonically. We attribute this to the interplay between long- and short-range scattering mechanisms. Water was found to significantly enhance the noise magnitude and change the type of the noise behaviour. By using a simple model, we show that water is a source of long-range scattering. Its presence on the graphene surface was found to increase the noise by an order of magnitude, yet cause a comparatively insignificant change in the resistance, which demonstrates that low-frequency noise and resistance in graphene can be determined by different scattering mechanisms. We have also shown that the 1/f noise at the Dirac point and at finite concentration originates from different sources of scattering and most likely from different fluctuation mechanisms.