Low-frequency noise in graphene

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The most common source of low-frequency *1/f* noise in transistor structures is the tunneling of carriers between a conductive channel and surrounding impurities [1]. The scattering of carriers is highly sensitive to the distribution of these impurities. As a result, *1/f* noise can be used as a tool to investigate the mechanisms of scattering.

Carrier scattering in graphene is unusual and not fully understood. We have studied *1/f* noise in monolayer graphene structures on Si/SiO_2 substrates in the frequency range from 10 to 400Hz at room temperature. In conventional Si MOSFET structures the normalised noise power S_R/R^2 diverges at the conductance threshold. In contrast, *1/f* noise in graphene is seen to exhibit a pronounced dip at the Dirac point where a maximum in resistance occurs (Figure, a) [2].

The *1/f* noise in graphene has been observed to change in the presence of water. We show that water acts as an acceptor of electrons. The normalised noise power increases after doping, indicating that water molecules are a significant source of scattering (Figure, b). The mechanism of scattering by water can be understood from the change in the shape of the noise dependence on gate voltage.

We discuss possible reasons for the suppression of *1/f* noise at the Dirac point in monolayer graphene, and the origin of *1/f* noise in the presence of water molecules.

References

[1] S. Kogan, Electronic Noise and Fluctuations in Solids (Cambridge University Press, 1996)

[2] Y.-M. Lin and P. Avouris, Nano Letters **8**, (2008) 2119.

Figures

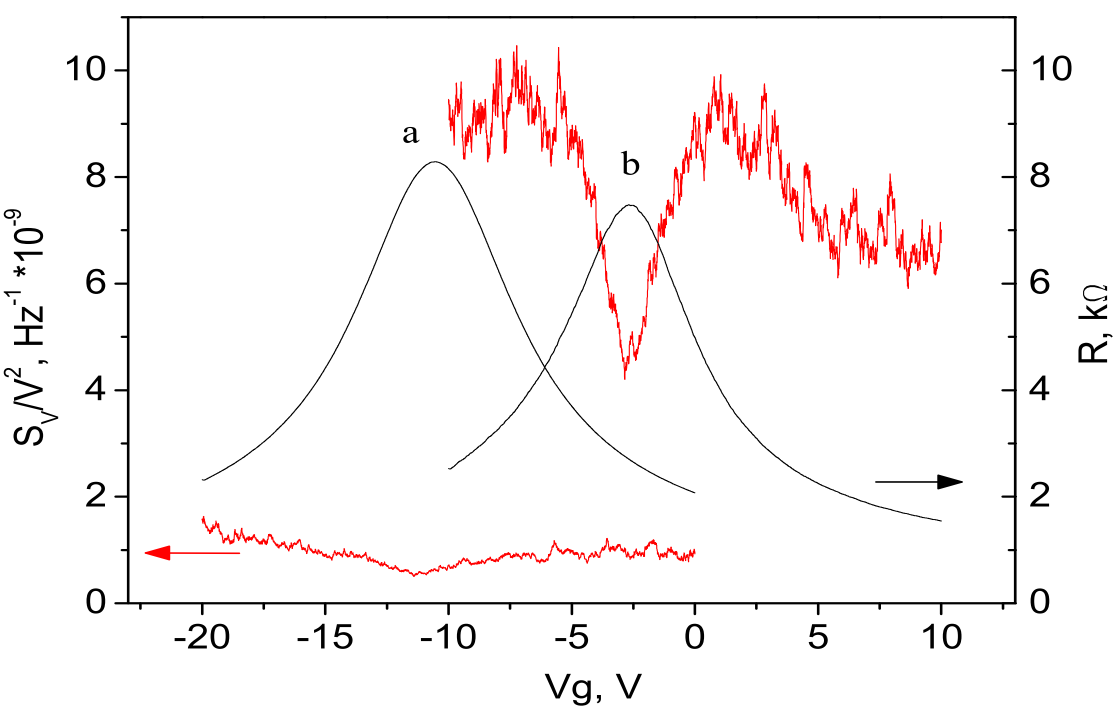

Figure. Peak in the resistance as a function of V_g accompanied by a dip in the noise power: a) before doping and b) after doping with H_2O.