1/*f* Mobility Fluctuations in Graphene

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The discovery of graphene in 2004 revealed its amazing properties, particularly ultra-high carriers mobility and unusual 1/*f* noise characteristics of graphene field effect transistors (FETs) [1,2]. Contrary to the majority of semiconductor FETs, the low frequency 1/*f* noise in graphene revealed weak dependence on the carriers' concentration (gate voltage). Another unusual behaviour of noise reduction after e-beam irradiation was observed in ref. [3]. Such behaviour complies with the model, which assumes the mobility fluctuations as the main source of the 1/*f* noise [4]. Although this mechanism of noise is discussing for a long time (particularly in metals), the direct proof was obtained only recently for graphene transistors [5].

Here, we report the study of the 1/*f* noise in h-BN encapsulated graphene FETs under the condition of geometrical magnetoresistance. This approach was proposed in ref. [6]. to study the nature of the 1/f noise.

Figures 1a,b show the device structure and transfer current voltage characteristics at different magnetic fields for the rectangular sample with the width to length ratio ~ 4. The approach developed in [6] predicts non-monotonic dependence of noise on the magnetic field and strong reduction of noise at $\mu_0 B \cong 1$ (μ_0 is the mobility and *B* is the magnetic field flux). The experimental dependence of noise on the magnetic field shown in Fig.1c complies well with this prediction. This result proves that fluctuations in the mobility of charge carriers are the dominant mechanism of the 1/*f* noise in graphene.

The importance of this funding goes beyond the graphene proving for the first time that indeed the mobility fluctuation can have relevant amplitude and time constants to dominate the 1/f noise spectrum.

References
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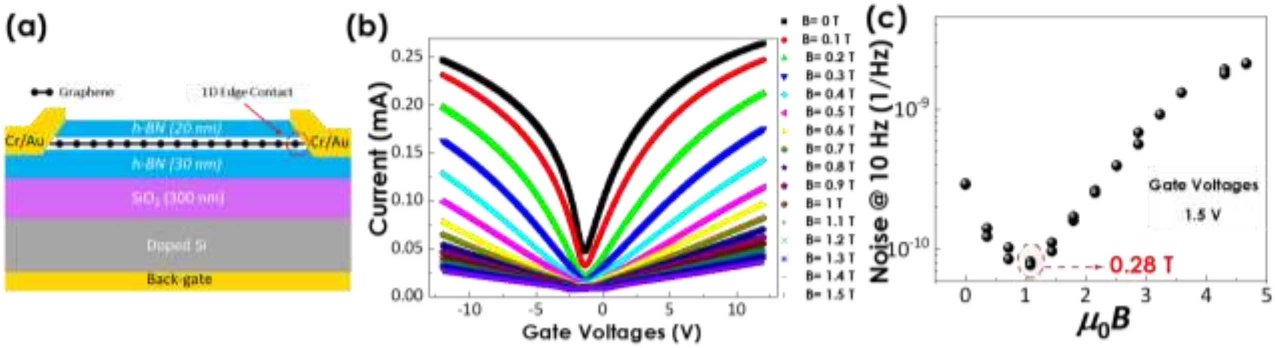

Figure 1: (a) Schematic view of studied back gated graphene device. **(b)** Transfer current-voltage characteristics at various magnetic fields. **(c)** Dependence of the spectral noise density of the drain current fluctuations S_I/I^2 on the magnetic field.