# グラフェンにおけるショット雑音のナノスケールイメージング

## Nanoscopy of shot noise on graphene

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There have been recently several advanced developments of graphene-based FET devices, such as ultra-high frequency optoelectronic or electron devices [1]. The study of non-equilibrium electron kinetics (e.g. current fluctuation) in graphene devices, especially at the nanoscale, would be an important issue to be tackled at present. So far the vast majority of shot noise measurements have been restricted to the noise integrated in the whole conductor. The detection and the mapping of local shot-noise in real-space has remained to be an attractive and challenging task to be tackled by researchers for decades.

In this study, we present the first shot noise image on bilayer graphene with nanometer resolution, taken by using a passive THz scanning near-field optical microscope [2,3]. A sharp metal tip scatters fluctuating evanescent fields (~20 THz) generated by the current fluctuation of charge carriers, and the scattered waves are detected by a highly-sensitivity THz detector [4]. The bilayer graphene sheet was epitaxially grown on 4H-SiC (000-1) substrate by thermal decomposition in an argon atmosphere. The bilayer graphene is suggested to be of high quality from the Raman spectroscopy, where both *G* and *G'* bands show very sharp one-peak structure, while the *D* peak, due to the defects, is much smaller (intensity ratio of *D*/*G* ~0.2). The graphene is patterned into a device of a narrow constriction with length 1.4 μm and width 0.7 μm (Fig. 1(a)) by using e-beam lithography and reactive ion etching. Figures 1(b) and (c) show, respectively, the 2D image of the fluctuating evanescent fields taken with the current of 0 mA and 1.77 mA. The current density is much higher in the constricted region than the outside region. This is why the shot noise, manifesting itself as the fluctuating evanescent fields, shows up only in the constricted region. In the presentation, the dependence of the shot noise profile on the bias-current and the tip height will be discussed.

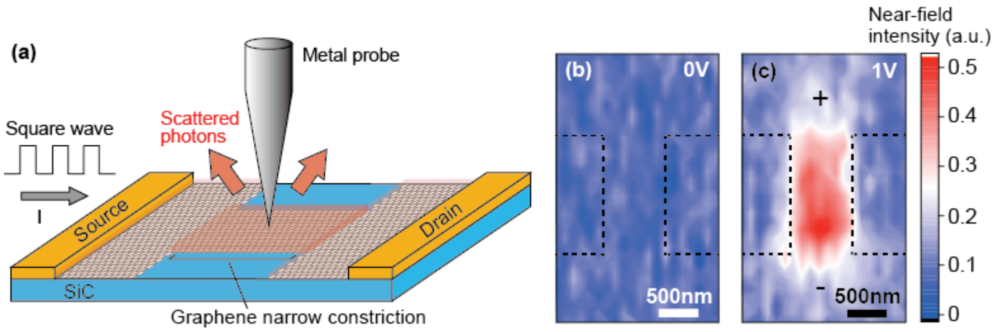


Fig. 1 (a) Schematic illustration of the experimental configuration used to detect current-driven evanescent wave on graphene narrow constriction device. The metallized AFM probe is used to scatter the near-field component to the THz confocal microscope. Near-field images were obtained with the bias of (b) 0 mA and (c) 1.77 mA, respectively.

Reference:

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