Large Scale Pseudomagnetic Field on Graphene

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Abstract

Spatially tailored pseudo-magnetic fields (PMF) can be potentially used to achieve quantized conductance and the valley hall effect in graphene, but this remains the realm of theory because at a practical level, it is highly challenging to create the specific strain texture that can generate a uniform PMF over a large area. [1,2]. We report a strategy to engineer large scale pseudomagnetic field (PMF) on graphene by shear-straining it on a hetero-substrate. We show that the PMF can be tuned in terms of strength and spatial distribution by rotation angle of graphene on a hetero-substrate. Importantly, our work suggests that interfacing graphene with substrates that are mismatched in terms of symmetry and crystal lattice, allied with anisotropic van der Waals interactions, provide a strategy to generate non-uniform strain texture on graphene that is intertwined with PMF. We further show that electron-phonon coupling between graphene and a hetero-substrate can be exploited to create giant magnetoresistance effects [3].

References

[1] Jiong Lu, Antonio C. Neto, Kian Ping Loh*, *Nature Communications,* 8;3: (2012) 823.(2012)

[2] Yan Peng Liu, N. B. Rodrigues Antonio C. Neto, Adam Shaffique, Jiong Lu*, Kian Ping Loh*, *Nature Nanotechnology* (submitted).

[3] Yan Peng Liu, Adam Shaffique, Kian Ping Loh* Nanoletters (submitted).

Figures

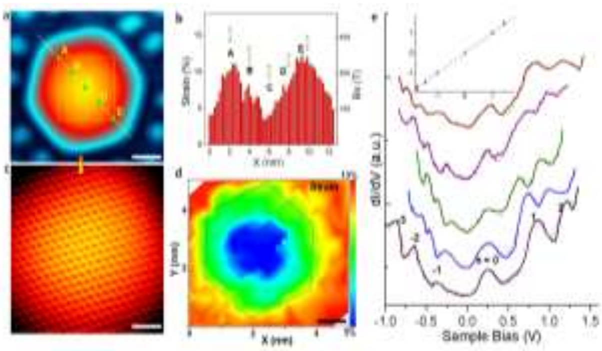

Figure 1: STM images and strain mapping of a hexagonal GNB. a, STM image of a hexagonal GNB. **b**, A histogram of experimentally-determined local strains along the dashed-line in **a** and the corresponding pseudo-magnetic field derived from the energy levels in *dI*/*dV* spectra shown in **e**. **c**, Magnified view of the area marked by the square in **a** with its corresponding strain map shown in **d**. e, Sequence of five dI/dV spectra (*T* ~ 100 K, modulation voltage = 20 mV) taken at A-E points.

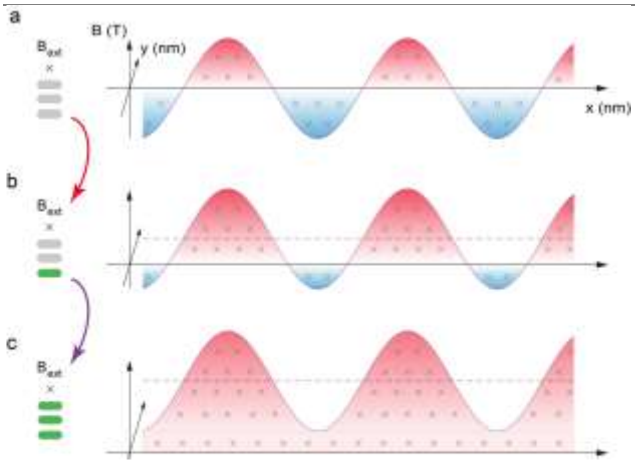

Figure 2: Schematic evolution of the spatially alternating distribution of PMFs as function of the external magnetic field strength.