Spin Transport through Multilayer Graphene

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NNIN Facilities utilized: Nanofabrication Center & Characterization Facility

- Description of Work
  - Graphene spin valves were fabricated to investigate spin transport through multilayer graphene (MLG).
  - Electron beam lithography, optical photolithography, e-beam evaporator and reactive ion etching in NFC were used for the fabrication of the main part of the device.
  - Raman microscopy, atomic force microscopy and scanning electron microscopy in CharFac were used for the characterization of graphene.
  - Transport studies were done using a Quantum Design PPMS®.

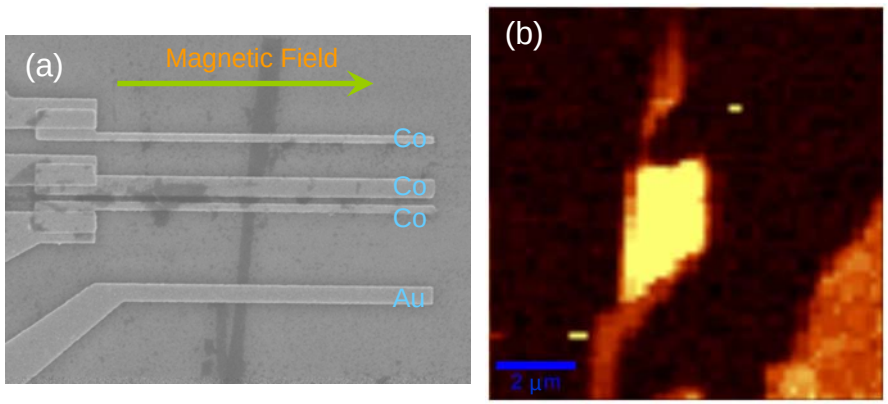

Figure. 1 (a) A SEM picture of the device. (b) A Raman microscope image of a graphene flake. The peak height of *D*' peak (~2700 cm^{-1}) was used.

- Major Observations
  - Spin valve devices with two Co contacts of different widths (100 nm and 300 nm) and a 100 nm gap between the two contacts were successfully fabricated.
  - Raman *D*' spectra show that the graphene had six layers.
  - A positive magnetoresistance (MR) of up to 0.39 % at 2 K with switching at magnetic fields that is consistent with magnetization orientations inferred from anisotropic MR data obtained for the Co contacts was observed.

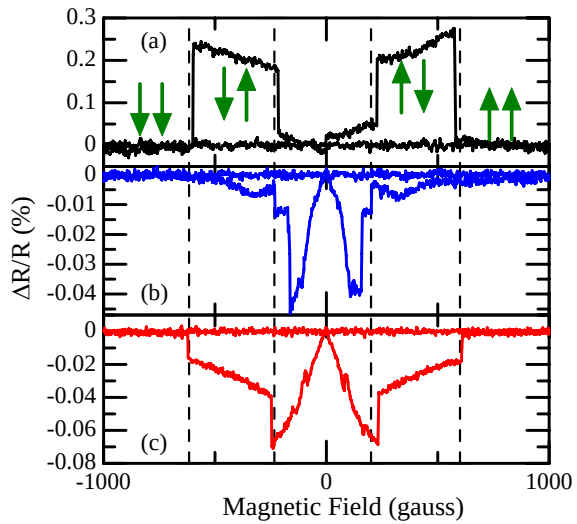

Figure. 2 (a) MR of a MLG spin valve device at 2 K. (b) and (c) Anisotropic MR of the 300 and 100 nm wide Co electrodes at 10 K, respectively.

- **Publications**
  - Masaya Nishioka and A. M. Goldman, Appl. Phys. Lett. **90**, 252505 (2007).