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Proximity-Induced Anomalous Hall Effect in Graphene[1] ZHIYONG WANG, CHI TANG, RAYMOND SACHS, YAFIS BARLAS, JING SHI, University of California - Riverside — Pre-patterned graphene devices are transferred from SiO_2/Si to atomically flat magnetic insulator thin films, yttrium iron garnet (YIG) deposited by a laser molecular beam epitaxial system on gadolinium gallium garnet (GGG) substrate. Room temperature Raman spectroscopy reveals both single-layer graphene and YIG characteristic peaks. In addition to the ordinary Hall effect, there is a clear non-linear Hall component correlated with the magnetization of the YIG films, which we attribute to the anomalous Hall effect (AHE). The magnitude of AHE in graphene/YIG devices decreases as temperature increases. With device-to-device variations, in some devices, AHE persists to room temperature, indicating a strong proximity-induced exchange interaction. By sweeping top gate voltages, one can tune the carrier density across the Dirac point. We also find that the carrier mobility is not significantly different in graphene/YIG. As the graphene is tuned from the electron- to hole-type, the ordinary Hall changes the sign as expected, but the sign of the AHE contribution remains the same. It suggests that AHE does not simply originate from the carrier density change which is responsible for the ordinary Hall effect, but is related to the spin-orbit interaction in the system.

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Zhiyong Wang
University of California - Riverside

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