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**Magnetoresistance and Anti-Ferromagnetic Coupling in FM-Graphene-FM Trilayers** ENRIQUE D. COBAS, OLAF M. J. VAN 'T ERVE, SHU-FAN CHENG, BEREND T. JONKER, US Naval Research Laboratory — Both high-magnetoresistance(MR) minority spin filtering[1] and anti-ferromagnetic (AFM) coupling[2-3] have been predicted for FM|Graphene|FM vertical heterostructures. Our previous experiments[4-5] demonstrated ordinary magnetoresistance in NiFe-Graphene-Co heterostructures and no evident AFM coupling. Here we present experimental results that confirm both MR minority spin filtering and AFM coupling in high-quality FM|Graphene|FM heterostructures. The heterostructures were fabricated by a combination of sputtering, chemical vapor deposition and electron beam evaporation. The stack was patterned into symmetric cross-bar structures using Ar ion milling. Measurements show negative magnetoresistance in excess of 10 percent, confirming spin-filtering, and weak anti-ferromagnetic coupling throughout the temperature range 15K to 300K. The temperature dependence of the MR was studied and found consistent with thermal excitation of spin waves in the ferromagnetic electrodes. Junction resistance-area products are in the range of 10 $\Omega$cm$^2$. These heterostructures provide a fast and low-power magnetic field sensor in the sub-100 Oe range and are a step towards high-MR low RA-product MRAM junctions. [1] Karpan, et al. Phys. Rev. Lett 99, 176602, 2007. [2] Li et al., App. Phys. Lett 98 (13), 133111, 2011. [3] Kim, D. et al., App. Phys. Lett 102 (11), 112403, 2013 [4] Cobas et al., Nano Lett. 12, 3000, 2012. [5] Cobas et al., IEEE Trans. Mag., 49 (7), 4343, 2013.

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