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Current-Controlled Spin Flip in Magnetically-Substituted Graphene Nanoribbons: Toward the Realization of Graphene-Based Spintronic Devices[1] J.T. HARALDSEN, Department of Physics, University of North Florida, G. HOUCHINS, C.B. CROOK, Department of Physics and Astronomy, James Madison University, JIAN-XIN ZHU, Theoretical Division and Center for Integrated Nanotechnologies, Los Alamos National Laboratory, A.V. BALATSKY, Institute for Materials Science, Los Alamos National Laboratory — We examine the possibility of using graphene nanoribbons with directly substituted chromium atoms as spintronic device. Using density functional theory, we simulate a voltage bias across a constructed graphene nanoribbon in a device setup, where a magnetic dimer has been substituted into the lattice. Using a first principles approach, we calculate the electronic and magnetic properties as a function of Hubbard U, voltage, and magnetic configuration. Through a calculation of the energy of each magnetic configuration, we can determine that initial antiferromagnetic ground state flips to a ferromagnetic state with applied bias. Mapping this transition point to the calculated conductance for the system reveals that there is a distinct change in conductance through the graphene nanoribbon, which indicates the possibility of a spin valve. We also show that this corresponds to a distinct change in the induced magnetization within the graphene. Our goal is to show that graphene, while already being used in electronic, may also have spintronic capabilities as well.

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