

Conferring the Magnetic Anisotropy of Lanthanide Single-Molecule Magnets to Coupled Magnetic Nanomaterials

PI: K. Randall McClain, Naval Research Laboratory

Co-PI: Benjamin G. Harvey, Naval Research Laboratory

Academic Collaborator: Michael F. Crommie, University of California, Berkeley

Project Summary: This program seeks to transition the design attributes of high-performance lanthanide single-molecule magnets (SMMs) to a new class of pseudo-1D and 2D magnetic nanomaterials in which both magnetic anisotropy and coupling are maximized. The central research theme involves the covalent attachment of suitable organo-lanthanide moieties to nanographene fragments, such as solubilized discrete graphene nanoribbons (GNRs). Selective oxidation of these nanographene constructs is expected to enable magnetic coupling between the organo-lanthanide groups, which individually possess strong magnetic anisotropy. Spin-polarized scanning tunneling microscopy (SP-STM) will be employed to study the magnetic properties of the nanomaterials. Additionally, Inelastic electron tunneling spectroscopy (IETS) will be used to probe exchange couplings and to provide insight into the strength of the magnetic coupling in these systems. Application of these magnetic nanomaterials in next-generation devices may allow for disruptive advances in several fields relevant to the DoD, including: microelectronics, quantum information science and quantum materials.