

PROJECT ABSTRACT/ SUMMARY

We propose a five-year effort to develop a new class of emergent ferromagnetic materials that will enable us (i) to demonstrate the generation of spin currents in an emergent material for the first time, (ii) to understand the role of the interface in spin current generation, (iii) to provide model systems for the realization of energy efficient spin current based devices for applications of interest to DOD and (iv) to educate and train the next generation of scientists and engineers for the defense and national security workforce.

More specifically, we will develop a fundamental understanding of the physics of spin current generation and spin transfer without charge flow through our clean model systems based on spinel structure materials. We will also develop an understanding of emergent interfacial phenomena in these materials by shedding light on the role of band structure, electron densities and interaction length imbalances on charge redistribution and magnetic and orbital order at interfaces of epitaxial spinel oxide based heterostructures. Such a program will have significant intellectual impact on materials physics but also provide the foundation for a truly energy efficient spin current based electronics platform. With our extensive experience in oxide film growth, in particular spinels, we believe that we are particularly well positioned to carry out the proposed research.