RX20-16

1. **Research Title:** Studies of Topological Insulator – Ferromagnet Structures for Radio Frequency Applications

2. **Individual Sponsor:**

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3. **Academic Area/Field and Education Level:** Electrical Engineering, Physics, Materials Science and Engineering (M.S. or Ph.D. Level)

4. **Objectives:** Study the electronic and spin properties of topological insulators and their ability to manipulate ferromagnets for RF applications

5. **Description:**
Topological insulators, first observed experimentally in 2008, and whose theoretical development in the 1970's and 1980's was the subject of the 2016 Nobel Prize in Physics, are unique materials which are insulating in the bulk, but have intrinsic metallic topological states on their surface. These topological surface states result from the very large spin-orbit coupling in topological insulators, and they are intrinsic to the material, existing at any surface regardless of its orientation relative to the underlying crystal structure. Due to the large spin-orbit coupling, topological insulators have been used to generate spin-polarized currents and spin-torques in ferromagnets to which they are closely coupled. The goal of this project is to evaluate the spin-torque properties of topological insulators coupled to ferromagnets through electrical characterization techniques in order to develop topological insulator – ferromagnet structures for radio frequency applications. Candidates should characterize topological insulator materials coupled to ferromagnets via techniques including but not limited to electrical transport measurements such as angle dependent anomalous Hall effect and/or Ferromagnetic Resonance (FMR) measurements.

6. **Research Classification/Restrictions:** Unclassified and without ITAR restrictions.

7. **Eligible Research Institutions**: Ohio State University, Wright State University, University of Dayton, Miami University, University of Cincinnati, Air Force Institute of Technology