

DAGSI RESEARCH TOPIC

1. **Research Title:** Topological Modification of Magneto-Acoustic Interactions
2. **Individual Sponsor:**

Dr. Michael Newburger, AFRL/REEEG
2179 12th Street
Building 652 Room 122
WPAFB, OH 45433
Michael.newburger.1@us.af.mil

3. **Academic Area/Field and Education Level**

Physics, Materials Science and Engineering, or similar (MS or PhD level)

4. **Objectives:** Explore mechanism by which topology can be used to control magnetic or phononic properties in coupled magneto-acoustic materials or heterostructures. Special focus is paid the role topology plays in the frequency of excited phenomena and the ability to induce strong coupling or non-reciprocal behavior.
5. **Description:** Topological physics has introduced entirely new mechanisms for manipulating fundamental excitations in condensed matter platforms. In particular, recent focus has been paid to the role topology can play in systems of magnons, phonons, and photons. Simultaneously, magneto-acoustic materials and heterostructures have emerged in recent years as highly dynamic platforms where magnetic and elastic degrees of freedom naturally interact, leading to new mechanisms for radiofrequency (RF) modulation or high-resolution field sensing. By introducing topological concepts—such as topologically protected edge states, Berry phase effects, and chiral symmetries—into these coupled systems, researchers can fundamentally alter how acoustic and magnetic excitations propagate in the composite platform. This foundational shift provides a robust pathway to overcome the limitations of conventional materials, where inherent scattering, back-reflection, and damping traditionally degrade signal integrity and system performance.

This research topic seeks to explore the mechanisms by which such topological phenomena can be actively harnessed to control or interact with coupled magnetic and phononic properties. Special focus is directed toward understanding the role topology plays in dictating the frequency and propagation direction of excited phenomena, as well as its unique ability to induce strong, coherent coupling or strictly non-reciprocal behavior. Mastering these topological mechanisms is particularly critical for the advancement of next-generation RF technologies. Furthermore, harnessing these tunable protected states provides a foundation for alternative computing architectures—such as magnonic or phononic logic and data processing—where low-power, compact information routing could bypass the physical and thermal limitations of traditional semiconductor electronics.

6. **Research Classification/Restrictions:** Not classified. Only US Citizens will be considered
7. **Eligible Research Institutions:** All