

## DAGSI RESEARCH TOPIC

1. **Research Title:** Spin-Based Qubits for Quantum Sensing
2. **Individual Sponsor:**

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

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

4. **Objectives:**

- Investigate and characterize the dynamic interactions between spin-based qubit candidates (such as molecules and point defects) and targeted external stimuli, including magnons, phonons, and coherent light.
- Identify and develop novel mechanisms for spin modulation, read-out, and information transduction to enable advanced quantum sensing protocols.
- Evaluate practical pathways for the material scaling and functional integration of these hybrid spin systems into solid-state architectures.

5. **Description:** There is a critical need for highly sensitive, next-generation quantum sensing platforms capable of operating in dynamic, real-world environments to support advanced navigation, timing, and electromagnetic field detection. Spin-based qubits, specifically solid-state point defects and molecular materials, are leading candidates to meet this need due to their atomic scale, robust coherence properties, and potential for room-temperature operation. However, a significant materials and engineering challenge remains in efficiently scaling and interfacing these isolated spin systems with practical device architectures.

This research aims to bridge the gap between fundamental spin properties and functional solid-state integration. By systematically exploring how individual spins couple with tailored external stimuli (magnons, phonons, or coherent optical fields), the project will uncover new methods for efficient spin state preparation, manipulation, and readout. Understanding these hybrid interactions is essential for developing the novel transduction mechanisms and advanced quantum sensing protocols required to transition these materials from the laboratory to robust quantum information technologies supporting the DAF mission.

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