

Opportunity Title: Solid-State Quantum Magnetometer Readout and Subsystem Enhancements

Opportunity Reference Code: ICPD-2022-23



Organization Office of the Director of National Intelligence (ODNI)

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How to Apply

Create and release your Profile on Zintellect – Postdoctoral applicants must create an account and complete a profile in the on-line application system. **Please note: your resume/CV may not exceed 2 pages.**

Complete your application – Enter the rest of the information required for the IC Postdoc Program Research Opportunity. The application itself contains detailed instructions for each one of these components: availability, citizenship, transcripts, dissertation abstract, publication and presentation plan, and information about your Research Advisor co-applicant.

Additional information about the IC Postdoctoral Research Fellowship Program is available on the program website located at:
<https://orise.orau.gov/icpostdoc/index.html>.

If you have questions, send an email to ICPostdoc@orau.org. Please include the reference code for this opportunity in your email.

Application Deadline 2/28/2022 6:00:00 PM Eastern Time Zone

Description

Research Topic Description, including Problem Statement:

Quantum systems based on solid-state spins, such as the nitrogen-vacancy (NV) center in diamond, have attracted substantial interest as potential sensor platforms, particularly for magnetometry. These solid-state quantum systems allow measurements tied to fundamental physical constants, in principle producing a calibration and drift-free sensor. Compared to existing alternatives, these quantum sensors can provide a unique combination of state-of-the-art sensitivity; high-bandwidth sensing, and low size, weight, and power (SWaP) requirements. However, improvement of readout fidelity, T2* dephasing time, and sensor initialization efficiency are required for these solid-state spin systems to challenge legacy atomic sensor systems in performance, reliability, and cost. Unlike established legacy sensors such as atomic vapor cells, readout techniques for solid-state spin systems are still in their infancy and typically provide performance far from theoretical limits. Research in this area will focus on assessing current approaches and developing new methods to improve sensor readout fidelity, with an emphasis on techniques well suited for operation in deployed systems outside of a controlled laboratory environment.

Example Approaches:

Research for this topic may include a variety of methods to improve the readout fidelity of these sensors. Non-optical readout approaches, such as the cavity-enhanced microwave readout technique are showing considerable promise.

Relevance to the Intelligence Community:

Navigation in the absence of GPS, especially over featureless terrain such as the ocean, is a serious challenge. One way the Department of Defense (DoD) and the Intelligence Community is looking to address this is via magnetic field aided navigation. The earth's crustal magnetic field is suitable for this purpose because it has significant spatial and negligible temporal variation. We aim to develop a high-sensitivity quantum sensor to measure the vector components of the magnetic field. The envisioned sensor will provide quality data to help Map the Earth's crustal magnetic field globally, to a resolution capable of supporting DoD's Alternative Positioning and Navigation applications.

Key Words: Quantum Sensor, Magnetometer, Readout Fidelity, T2* dephasing time, NV Centers in diamond, Optical Readouts, Atomic Sensors, Solid-State Spin, GPS

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Qualifications

Postdoc Eligibility

- U.S. citizens only
- Ph.D. in a relevant field must be completed before beginning the appointment and within five years of the application deadline
- Proposal must be associated with an accredited U.S. university, college, or U.S. government laboratory
- Eligible candidates may only receive one award from the IC Postdoctoral Research Fellowship Program

Research Advisor Eligibility

- Must be an employee of an accredited U.S. university, college or U.S. government laboratory
- Are not required to be U.S. citizens

Eligibility Requirements

- **Citizenship:** U.S. Citizen Only
- **Degree:** Doctoral Degree.
- **Discipline(s):**
 - **Chemistry and Materials Sciences** (12 )
 - **Communications and Graphics Design** (2 )
 - **Computer, Information, and Data Sciences** (16 )
 - **Earth and Geosciences** (21 )
 - **Engineering** (27 )
 - **Environmental and Marine Sciences** (14 )
 - **Life Health and Medical Sciences** (45 )
 - **Mathematics and Statistics** (10 )
 - **Other Non-Science & Engineering** (2 )
 - **Physics** (16 )
 - **Science & Engineering-related** (1 )
 - **Social and Behavioral Sciences** (27 )