Opportunity Title: Noise Characterization of Superconducting Qubit Systems
Opportunity Reference Code: ICPD-2021-35

Organization Office of the Director of National Intelligence (ODNI)

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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 2/26/2021 6:00:00 PM Eastern Time Zone

Description **Research Topic Description, including Problem Statement:**

Recording devices including smart assistants, such as Google Home and Amazon Echo, are often installed in places that are not ideal for capturing intelligible audio. This can be due to a variety of factors including room design, device design, other noise sources, and obstructions. Understanding the factors internal and external to recording devices that affect audio intelligibility could help optimize these devices' performance. Research on this topic could focus on the physical design principles of these devices, methods to better assess and utilize the microphone's environment, or methods for quantifying their performance in untested locations.

Superconducting qubits are reaching new levels of performance due to a combination of novel device design, material optimization, and noise reduction. As a result, superconducting qubits are now regularly exceeding 100 microsecond lifetimes and coherence times. Reexamining the effect of noise sources on qubit performance can shed light on issues that may have been previously hidden by poor qubit performance levels.

The goal is to characterize deleterious external noise sources, develop methods for reducing these noise levels, and demonstrate resulting enhanced qubit performance levels.

Example Approaches:

Examples of noise types to be considered in this topic include, but are not limited to:

- Thermal noise causing excess qubit excitation;
- Thermal noise causing qubit decoherence;
- Excess quasi-particle generation;
- Excess infrared (IR) radiation in the qubit environment;
- Noise-causing correlated errors in qubit arrays.

Possible characterization techniques include, but are not limited to:

- Inclusion of sensors in the qubit environment to target specific noise sources;
- Use of spectator qubits to directly measure various noise types;
- Injection of well-characterized artificial noise;

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- Controlled variation of the qubit's environment.

Possible methods for reducing the noise characterized include, but are not limited to:

- Qubit design optimization to reduce noise sensitivity;
- Novel filtering schemes;
- Improved qubit shielding and packaging schemes;
- Co-located sensors with feedback.

Relevance to the Intelligence Community:

Qubit performance is highly sensitive to external perturbations. This research aims to overcome these limitations by identifying limiting noise sources, developing noise characterization techniques, and reducing qubit sensitivity to these noise sources.

Key Words: Quantum Computing, Superconducting Qubits, Qubits, Noise, Quasiparticles, Decoherence

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** (17 👁)
  - **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 👁)