Opportunity Title: Novel Control and Readout Schemes for Gate-Based Quantum Computing
Opportunity Reference Code: ICPD-2023-18

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 2/28/2023 6:00:00 PM Eastern Time Zone

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

State-of-the-art qubits for quantum computing continue to push the boundaries with-respect-to minimizing control and readout errors. Many of the leading approaches such as superconducting circuits, silicon quantum dots and trapped ions are now no longer limited by errors in the qubits themselves but are reaching the limits imposed by classical control electronics and readout schemes. Furthermore, once calibrated, high fidelity operations often tend to drift over time either due to device or control-electronics-based variations. Finally, readout is often much slower when compared to gate operations and with much lower fidelity. However, quantum error correction relies on both high fidelity operations and fast feedback of syndrome measurements in a multi-qubit environment.

This topic aims to reduce these error sources by developing novel control and readout schemes. The main focus is on high fidelity control and/or readout in a multi-qubit environment.

Example Approaches:

Examples of novel control techniques to be considered in this topic include (but not limited to):

1. In-situ sensing of control signals and/or device variations with feedback for stabilization
2. Autonomous control techniques where errors are corrected without user and/or control electronics interjection
3. Quantized control signals to minimize fluctuations

Examples of novel readout techniques to be considered in this topic include (but not limited to):

1. Tighter integration of readout amplifiers with quantum devices to reduce

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signal loss
2. Reduction of measurement back-action during fast readout
3. Development of readout schemes compatible with multi-qubit arrays
4. Transduction to aid in low noise readout

Relevance to the Intelligence Community (IC):

All known major applications for quantum computing require fault-tolerant quantum error correction codes. These codes require fast and high fidelity control and readout in multi-qubit environments. Due to recent advances in leading qubit technologies, these fidelities are becoming limited by standard qubit control and readout electronics. Furthermore, often control and readout in multi-qubit environments is limited by crosstalk and poor signal-to-noise. This call aims to overcome these limitations by developing novel approaches to qubit control and readout. This directly aligns with "computing" category of the identified IC wide S&T needs.

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

Key Words: #Quantum Computing, #Qubits, #Readout, Noise, #Multi-Qubit Devices, #Superconducting Qubits, #Spin Qubits, #Trapped Ions

Eligibility Requirements

- **Citizenship:** U.S. Citizen Only
- **Degree:** Doctoral Degree.
- **Discipline(s):**
  - **Chemistry and Materials Sciences** (12 👁)
  - **Communications and Graphics Design** (5 👁)
  - **Computer, Information, and Data Sciences** (17 👁)
  - **Earth and Geosciences** (21 👁)
  - **Engineering** (27 👁)
  - **Environmental and Marine Sciences** (14 👁)
  - **Life Health and Medical Sciences** (48 👁)
  - **Mathematics and Statistics** (11 👁)
  - **Other Non-Science & Engineering** (2 👁)
  - **Physics** (16 👁)
  - **Science & Engineering-related** (1 👁)
  - **Social and Behavioral Sciences** (29 👁)

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