Opportunity Title: Trapped Ion Systems with Reduced Noise and Faster Gates
Opportunity Reference Code: ICPD-2020-21

Organization Office of the Director of National Intelligence (ODNI)

Reference Code ICPD-2020-21

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 2/28/2020 6:00:00 PM Eastern Time Zone

Description

Research Topic Description, including Problem Statement:

Arrays of coupled ions, trapped using electromagnetic fields generated from nearby electrodes, constitute a leading approach to implement quantum bits, or qubits, in future quantum computers. They are leading the quantum computing community in terms of achieving the lowest 1 and 2 qubit gate errors. This is a result of the ability to isolate ions from environmental noise, a precise knowledge of their reproducible energy level structure, and precise control of these states using laser and microwave systems. However, gate speeds are typically slow compared with competing technologies and when ions are trapped closer to surfaces or transported through arrays, gate performance can become limited by noise causing heating in the ions motion.

The goal of this topic is to work towards faster, lower error and lower noise trapped ion systems. This could be achieved by either developing novel gate schemes or novel ion encoding schemes which are immune to typical sources of noise, or by identifying the source of the noise itself and eliminating it.

Example Approaches:

There are multiple possible paths one could take to achieve the program goals:

- Identify and remove surface noise sources via a combination of surface science and improved fabrication schemes.
- Develop gate and transport schemes immune to typical sources of noise and/or with enhanced speed.
- Identify sources of noise and drift present or induced during the operation of trapped ion systems.
- Implement novel quantum information encoding schemes immune to typical sources of noise.
- Develop novel entanglement generation schemes using driven systems.

Relevance to the Intelligence Community:

Quantum information processing with trapped ion qubits constitutes a leading approach towards building a quantum computer. However, qubit gates are typically slow and the best gate performances are achieved in systems with limited potential to scale beyond small qubit arrays. Furthermore, when brought close to trapping electrodes, as is typically required in multi-qubit devices, gate performance becomes limited by anomalous heating noise. This call aims to overcome these limitations by developing novel fast, noise resilient gate schemes and by reducing or eliminating common noise sources.

Key Words: Quantum Computing, Trapped Ions, Photons, Qubits, Noise, Heating, Lasers

Qualifications

Postdoc Eligibility

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- 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 👁)