Opportunity Title: Specific roles of materials and defects in quantum device noise
Opportunity Reference Code: IC-16-34

Organization	Office of the Director of National Intelligence (ODNI)
Reference Code	IC-16-34
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.
Application Deadline	4/15/2016 6:00:00 PM Eastern Time Zone
Description	The goal of this effort is to address one of the key limitations to creating a quantum computer, which is the difficulty of turning materials into reliable qubit devices. Instead of focusing on the characteristics of the quantum state decoherence/dephasing time or quantum state lifetime, this effort is intended to focus on identifying and quantifying specific physical sources of noise relevant to quantum devices as measured through isolated device metrics such as microwave loss tangent, 1/f noise, or quantum state signatures of defects. Of interest to this effort is a specific focus on detailed materials analysis in order to advance the connections between materials, defects, and quantum device noise. The primary aim of this research is to address the current limitations of engineering knowledge to understand the chemical and physical interactions that cause poor devices for quantum devices. Attention should be placed to expand the existing correlations in literature by correlating variations in device performance with physical and chemical characteristics of the fabricated devices. Proposals should lay out plans of defining optimization metrics related to measurable device defects with respect to measured variations in qubit performance. **Example Approaches:** Experimentally focused proposals should seek to address correlations in qubit device performance and sources of noise that are measured at appropriately low temperatures, with conventional spectroscopic measurements that quantify the elemental, physical and chemical characteristics of the tested qubit device. Collaboration between an existing quantum computing groups and an engineering group with experience fabricating high technology devices and methods of failure

Opportunity Title: Specific roles of materials and defects in quantum device noise
Opportunity Reference Code: IC-16-34

analysis is strongly encouraged.

- A successful proposal might address one or more of the following questions or goals with respect to a clearly defined metric of quantum device performance:
- Experimental verification of a predicted origin of noise (e.g. isolate specific point defects that create two-level systems).
- Identify correlations between the relative abundance of certain chemical bonds and variations in qubit performance.
- Explore the efficacy of quantitative comparisons between room temperature physical properties and low-temperature qubit performance that can act as screening protocols.
- Detailed failure analysis of highly performing and poorly performing quantum devices fabricated with the same fabrication procedure and toolset.
- Computationally or theoretically develop descriptions of specific defects and their role as origins of quantum device noise.

Eligibility Requirements

- **Citizenship:** U.S. Citizen Only
- **Degree:** Doctoral Degree.
- **Discipline(s):**
  - **Business** (11 👁)
  - **Chemistry and Materials Sciences** (12 👁)
  - **Communications and Graphics Design** (6 👁)
  - **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** (13 👁)
  - **Physics** (16 👁)
  - **Science & Engineering-related** (1 👁)
  - **Social and Behavioral Sciences** (28 👁)