Organization	Office of the Director of National Intelligence (ODNI)
Reference Code	ICPD-2024-33
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 3 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** | 2/28/2024 6:00:00 PM Eastern Time Zone |
| **Description** | **Research Topic Description, including Problem Statement:**

One of the main challenges in quantum information science is the development of applications for quantum computers that can surpass the performance of classical computing. An area of research where this has shown promise is in the field of material science and quantum chemistry. This topic seeks proposals to develop quantum algorithm for quantum sensors (simulating and optimizing) with a focus on material development and configuration design.

Multi-level quantum systems, so called qudits, offers a larger state space for quantum information processing compared to 2-level qubit systems. This can potentially improve the efficiency of quantum algorithms by reducing the resource required for quantum computation. We are seeking proposals for novel development of quantum algorithms based on qudit systems, as well as implementations of qubit computation on physical platforms. Novel proposals regarding qudit systems in general to inform algorithm development insights are also invited.

Example Approaches:

A literature review could inform a theoretical or experimental approach. As the topic is intended to inform medium to long term insight into quantum algorithm development, a wide range of approaches to explore fundamental knowledge is welcomed.

Relevance to the Intelligence Community: |

Quantum computing stands to significantly enable and or disrupt the work of the NIC. Insights into potential software developments will assist the NIC to understand global technological change, plan for the future of NIC enterprise and prepare for emerging capabilities.

Reference:

- Yannick Deller, Sebastian Schmitt, Maciej Lewenstein, Steve Lenk, Marika Federer, Fred Jendrzejewski, Philipp Hauke, and Valentin Kasper, (2023) 'Quantum approximate optimization algorithm for qudit systems'. Physical Review A. https://doi.org/10.1103/PhysRevA.107.062410.
- Chi, Y., Huang, J., Zhang, Z. et al. (2022) A programmable qudit-based quantum processor. Nature Communications. https://doi.org/10.1038/s41467-022-28767-x.
- Nikolaeva, A.S., Kiktenko, E.O. and Fedorov, A.K., (2021) Efficient realization of quantum algorithms with qudits. arXiv preprint arXiv:2111.04384 https://arxiv.org/abs/2111.04384.

Key Words: Material science; quantum chemistry; quantum algorithm; qudits; quantum information science; quantum sensors.

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 appointment start date
- 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** (3 👁)
  - **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** (11 👁)
- **Other Non-Science & Engineering** (2 👁)
- **Physics** (16 👁)
- **Science & Engineering-related** (1 👁)
- **Social and Behavioral Sciences** (30 👁)