

Opportunity Title: Entangled Two-Photon Absorption Filters for Communications

Opportunity Reference Code: ICPD-2022-29

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.

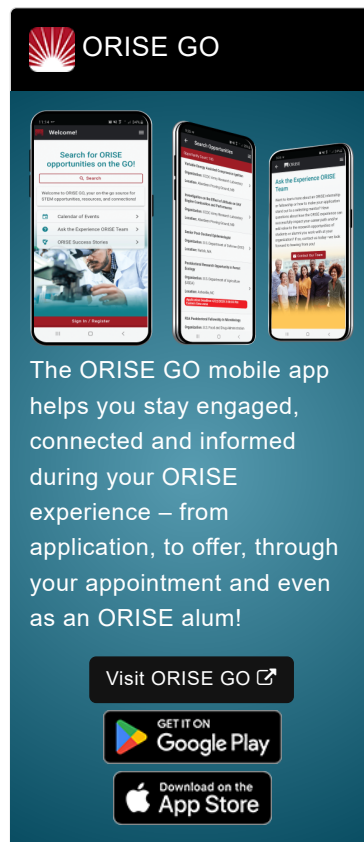
Application Deadline 2/28/2022 6:00:00 PM Eastern Time Zone

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

Traditional telecommunications relies on RF technology for the transmission of information. Despite the age of this technology high data transfer rates and secure communications have been realized through clever technological innovation. With congestion of the frequency spectrum, increases in computing power, and materials science advancements these methods for secure communications are becoming less secure and one day may present a liability for the users. Progress in optical communication offers a solution to this problem through the use of non-linear optical (NLO) materials. When contrasted with classical absorption where, the absorption coefficient is independent of the light intensity, NLO materials absorption is described by higher order functions. Beyond the systems level, selection of materials that would allow for higher data transfer rates and more secure communications is essential for this technology to be successful. Recent advances in entangled two-photon absorption (ETPA) have shown organic materials possess high entanglement cross sections amenable to secure communication and are sensitive enough to be feasible to low light intensity. A significant advantage of these materials with respect to inorganic NLO materials is their ability to be tuned with atomic precision for the desired application. With the current technology, prototyping of proof-of-concept devices for ETPA should be carried out to further advance the field. This research topic will investigate materials and device designs for a filter that is transparent to entangled photons but absorptive to classical coherent photons.


Example Approaches:


- Guzman, A.R.; Harpham, M.R.; Süzer, Ö.; Goodson III, T.; J. Am. Chem. Soc. 2010, 132, 7840-7841
- Goodson III, T., Makiuchi N., Ogawa K., Kobuke, Y.; J. Am. Chem. Soc. 2008, 130, 17212-17213


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- Wasilewski R. M., Forbes D.E.M., et. al.; Nat. Rev. Chem. 2020, 4, 490-504

Relevance to the Intelligence Community:

Prototyping an ETPA filter would set the Intelligence Community on a path towards better communications. If successful, it should provide a proof of concept device, which may advance current technologies.

Key Words: Entangled Photons, Nonlinear Optics, Organic Materials, Two-Photon Absorption, Quantum Chemistry, ETPA

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** ([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](#))