Opportunity Title: Integrated Nanophotonics
Opportunity Reference Code: IC-16-24

Organization Office of the Director of National Intelligence (ODNI)

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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 With the continued advancement of silicon microelectronics to ever more advanced nodes, the power and speed constraints have shifted to the interconnect technologies. Additionally, beyond the processors, themselves, the networking layer within the data centers have become impediments to fielding future capabilities. Without innovative solutions, routers and switches will grow to consume megawatts of prime power and expand to require herculean thermal management, thus preventing the realization of next-generation data centers. The development and application of integrated nanophotonics is expected to mitigate this capability gap. The use of photonics based signaling enables significant reduction of energy per bit per millimeter since the charge is not transported via the modulation of the transmission medium. For example, integrated photonics is predicted to enable switches and interconnects operating at greater than 100 Gbps while requiring significantly less power than traditional 10-Gbps solutions. Further, the use of innovative integration approaches, such as silicon-based photonics and advanced heterogeneous integration, could enable affordable solutions. Therefore, integrated nanophotonics will enable revolutionary solutions to the data crunch that confronts the future intelligence community.

Example Approaches

This research topic may be pursued in many different manners spanning individual perspectives from devices to systems. Proposed investigations could explore the development of integratable nanophotonic components, subsystem architectures, and integration technologies as they relate to revolutionary communication and routing capabilities.

Examples of various approaches that would be of interest are:

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- Modeling and fabricating advanced nanophotonic components to correlate material and device properties;
- Exploring novel silicon-based nanophotonic devices compatible with advanced silicon microelectronics fabrication for monolithic integration;
- Investigation of the limits of heterogeneous integration of photonic and electronic devices optimized for their native material systems;
- Design, simulation, fabrication, and characterization of nanophotonic devices harnessing novel phenomena, such as surface plasmons, suitable for highly integrated subsystems.

Investigations of approaches enabling at least 100X future reduction of overall energy per bit as compared to current state of the practice in either inter- or intra-chip signaling are highly desired.

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 👁)