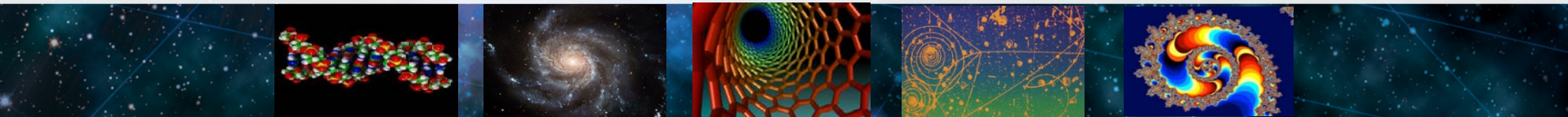
Optics and Photonics Report

Response and Discussion
MPSAC Meeting
November 3, 2014

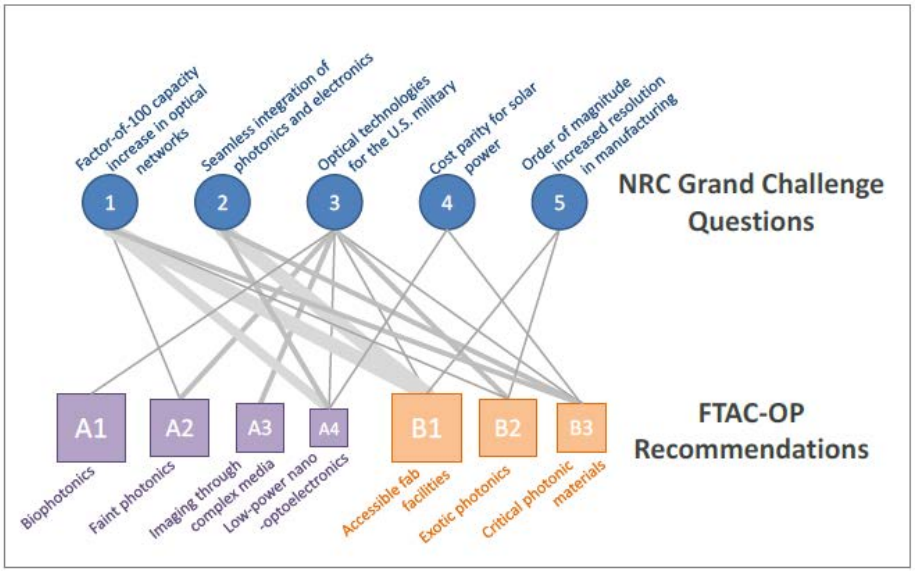


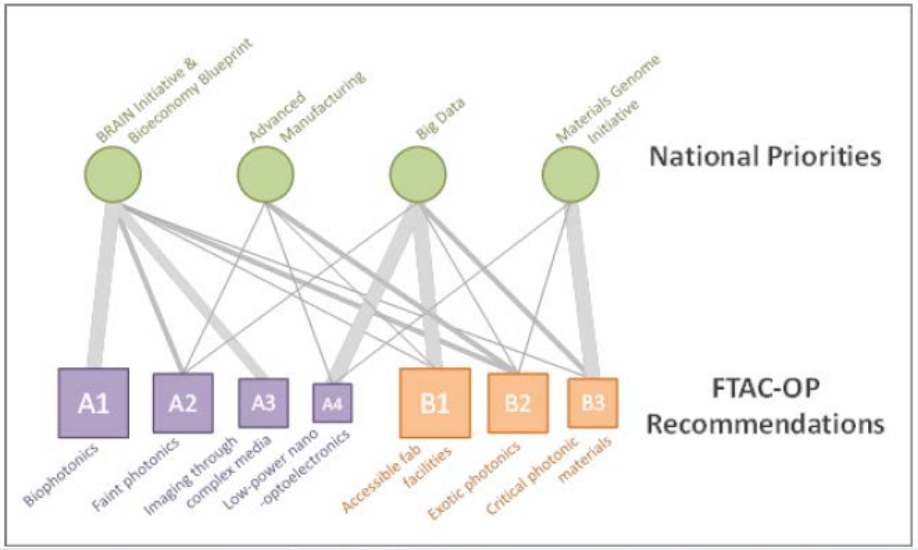
Optics and Photonics: Background

- *Harnessing Light: Optical Science and Engineering for the 21st Century*, published in 1998 (NRC)
- *Optics and Photonics: Essential Technologies for Our Nation* ("Harnessing Light II"), published in 2013 (NRC)
- MPSAC Subcomittee on Optics and Photonics formed and charged in late 2012 / early 2013 (Tony Heinz, Columbia University, subcommittee chair); MPSAC approved and published report in July 2014
- OSTP/NSTC FTAC on O&P chartered in April 2013 report conveyed to OSTP in September 2013; recommendations report published in April 2014
- Joint MPS-ENG-CISE DCL on O&P prepared and published in July 2014

FTAC-OP: Background

- NSTC/CoS/PSSC chartered the FTAC-OP to respond to the National Research Council's (NRC) report, *Optics and Photonics*, specifically "to identify opportunities for Federal investment and interagency cooperation in basic and early applied research."
- FTAC-OP members represented NIST, DOD (many parts), DOE, NASA, HHS (NIH and FDA), and NSF
- FTAC-OP
  - met weekly between May and September
  - hosted subject matter experts within the Federal Government, from academe, and from the private sector
  - final guests were the five sponsoring societies of the National Photonics Initiative (NPI): SPIE, OSA, LIA, IEEE/Photonics, and APS
- Committee recommendations fell into two broad categories:
  - Research Opportunities
  - Capability Opportunities





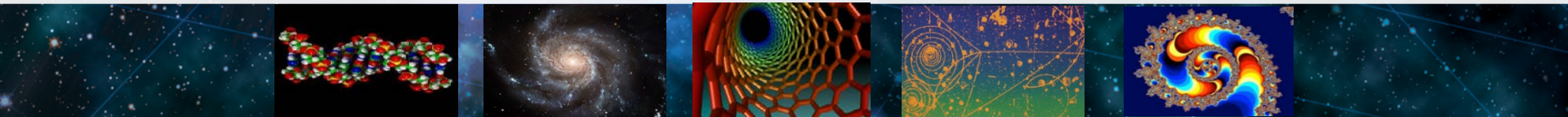
Mapping of the FTAC-OP recommendations the NRC's Grand Challenge Questions (top) and national priorities (bottom). The relative sizes of the boxes indicate the FTAC-OP prioritization, and the relative thickness of the connecting lines indicates the strength of the relationship.

FTAC-OP Prioritized *Research* Recommendations

- (A1) Biophotonics to Advance Understanding of Systems Biology and Disease Progression
  - Support fundamental research in innovative biophotonics to enable advances in quantitative imaging, systems biology, medicine, and neuroscience; *in vivo* validation of biomarkers that advance medical diagnostics, prevention, and treatment; more efficient agricultural production
- (A2) From Faint to Single Photonics
  - Develop optics and photonics technologies that operate at the faintest light levels
- (A3) Imaging through Complex Media
  - Advance the science of light propagation and imaging through scattering, dispersive, and turbulent media
- (A4) Ultra-Low-Power Nano-Optoelectronics
  - Explore the limits of low energy, attojoule-level photonic devices for application to information processing and communications

FTAC-OP Prioritized *Capabilities* Recommendations

- (B1) Accessible Fabrication Facilities for Researchers
  - Determine the need of academic researchers and small business innovators for access to affordable domestic fabrication capabilities to advance the research, development, manufacture, and assembly of complex integrated photonic-electronic devices
- (B2) Exotic Photonics
  - Promote research and development to make compact, user-friendly light sources, detectors, and associated optics at exotic wavelengths accessible to academia, national laboratories, and industry
- (B3) Domestic Sources for Critical Photonic Materials
  - Develop and make available optical and photonic materials critical to our Nation's research programs, such as infrared materials, nonlinear materials, low-dimensional materials, and engineered materials



Subcommittee Membership

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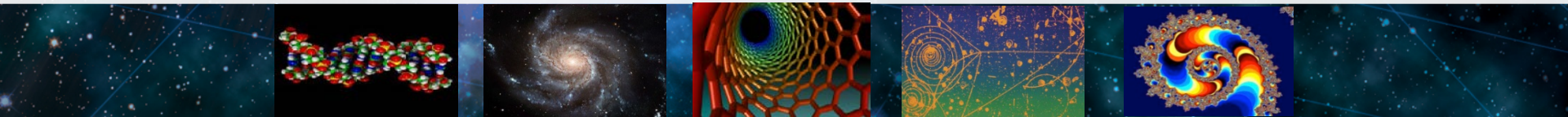

Scientific Frontiers of Optics and Photonics (MPSAC SC) Priorities and Research Directions

1. **Plasmonics and nanophotonics: controlling optical fields and propagation on the nanoscale**
2. **Coherent electromagnetic fields: attosecond time scales and x-ray photon energies electromagnetic**
3. **Optomechanical interactions: from single-molecule mechanics to macroscopic quantum states**
4. **Seeing beyond the diffraction limit and new imaging modalities**
5. **Creating and controlling quantum coherence with light**
6. **Controlling molecules with light and light with molecules**
7. **Observing the universe: optics and photonics for astronomy and astrophysics**

NSF Dear Colleague Letter on Optics and Photonics

- Published on July 16, 2014 (http://www.nsf.gov/pubs/2014/nsf14091/nsf14091.jsp)
- Partnership among MPS, ENG, and CISE
- Identifies two subtopics of special interest to NSF
  - light-matter interaction at the nanoscale…plasmonics, and quantum phenomena
  - novel terabit/second and faster communication systems