

## **Charge to Optics and Photonics Subcommittee of the Mathematics and Physical Sciences Advisory Committee**

### **Background**

In 2012, the National Research Council published its draft report on Optics and Photonics, *Optics and Photonics: Essential Technologies for Our Nation*. This report, which was a follow-on to its 1998 report, *Harnessing Light: Optical Science and Engineering for the 21<sup>st</sup> Century*, details the many contributions that optics and photonics have made to the nation, and called upon U.S. Federal Agencies to coordinate and increase efforts in this critical area. The *Optics and Photonics* report has provided a number of findings and recommendations in areas such as communications, national security, energy, health and medicine, advanced manufacturing, measurement, materials, and displays, all of which have underlying basic research challenges that, if addressed, would enable ground-breaking technological advances in the future. To inspire and frame the recommendations, the report has also identified five overarching technological grand challenges for optical networking, photonics-electronics integration, surveillance and other defense applications, solar power, and optical sources and imaging tools in advanced manufacturing.

The Mathematical & Physical Sciences Directorate supports activities in experimental, computational and theoretical aspects of optics and photonics research across all its Divisions, including Astronomy, Physics, Materials Research, Chemistry and Mathematics. In addition, it supports user facilities and institutes through various initiatives such as the LIGO Laboratory, the National High Magnetic Field Laboratory and PHY Frontiers Centers, for example.

To meet the grand challenges and enable the vision articulated by the NRC report, a coordinated program of basic research is needed in and among all MPS disciplines. This program should be articulated as a set of basic research grand challenges and as a balanced portfolio in basic research that would support technological opportunities in optics and photonics.

### **Charge to the subcommittee**

The subcommittee is charged with advising MPS on its role, vision, and scientific and educational program of work in support of optics and photonics basic research. In developing this advice, the subcommittee should be cognizant of the current NSF investments in optics and photonics research and education, the most recent NRC report described above (and its recommendations to the NSF), as well as other background material from the optics and photonics research community.

The subcommittee should consider the capabilities, capacity, potential for advancing optics and photonics science, and opportunities that may arise. The subcommittee should include research that results in the development of new experimental tools, materials, and

models, as well as advancing the scientific and education mission of the NSF. The subcommittee is asked, at a minimum, to address the adequacy of the current MPS portfolio in optics and photonics, and to identify a set of basic research grand challenges that would enable new technological advances. In addition, the subcommittee should identify basic research opportunities as well as the need, if any, for investments in the development of research infrastructure to support optics and photonics. The report should also address education-related research efforts needed to support the professional development of the next generation of the U.S. optics and photonics workforce. Lastly, the report should identify, insofar as possible, optics and photonics scientific priorities within each discipline.

### **Timeline**

Charge to the Subcommittee – Feb 2013

Interim Report and Draft Findings (briefing) to MPS AC – April 2013

Interim Report to MPS AC – November 2013

Draft Final Report to MPS AC – January 2014

Final Report delivered to MPS – February 3, 2014

These reports will detail progress and interim (draft) findings, and will bring to the attention of the MPSAC any major opportunities and challenges. The report can be delivered virtually, and will be coordinated by the MPSAC.

The Chair of the subcommittee should coordinate delivery of materials with the MPS AC Chair in advance of scheduled MPS AC meetings.

The final written report will be due no later than Feb 3, 2014 with a presentation to the MPSAC at its January 2014 meeting. This final report should be 25-50 pages, suitable for publication and wide distribution, and should treat the five MPS disciplines (Astronomy, Materials Science, Mathematics, Physics and Chemistry) in a balanced manner.

Presentations to the MPSAC may be delivered remotely or in person.

### **Resources**

NSF will arrange for and host virtual meetings of the subcommittee as required by the Chair.