



Directorate for Mathematical and Physical Sciences (MPS) Advisory Committee Meeting  
October 25 – 26, 2022 (all times EDT)  
National Science Foundation  
2415 Eisenhower Ave, Alexandria, VA  
Virtual Meeting

## Summary Minutes

**Tuesday, October 25, 2022**

### Advisory Committee Members in Attendance:

*Members listed in italics participated virtually.*

*Dr. David Awschalom*

*Dr. Anna Balazs*

*Dr. Tabbetha Dobbins*

*Dr. Miguel Garcia-Garibay*

*Dr. Lynne Hillenbrand*

*Dr. Catherine Hunt*

*Dr. Dan Jaffe*

*Dr. Cornelia Lang*

*Dr. Herbert Levine*

*Dr. Jennifer Lewis*

*Dr. Jill Pipher*

*Dr. Ed Thomas, Jr.*

*Dr. William Tolman*

*Dr. Roldolfo Torres*

*Dr. Suzanne Weekes*

*Dr. Eva Halkiadakis*

*Dr. Yuri Tshinkel*

**Call to order and official opening of meeting, FACA Briefing** – *Dr. Cornelia Lang, MPSAC Chair; Dr. Sean L. Jones, Assistant Director, MPS; Dr. Michelle Bushey, Staff Associate, MPS*

Immediately prior to the meeting being called to order, Dr. Michelle Bushey briefed members on the policies of the Federal Advisory Committee Act regarding conflicts of interest for AC members, as well as a reminder that the meeting was open to the public and occurring under the guidelines of FACA. The meeting was officially opened at 10:05 am by Dr. Cornelia Lang. Dr. Lang asked for introductions around the room. The minutes from the previous meeting, held in March 2022, were unanimously approved by a motion introduced by Dr. Lang.

**Update: MPS** – *Dr. Sean L. Jones, Assistant Director, MPS*

Dr. Sean L. Jones, Assistant Director for Mathematical and Physical Sciences, provided an update on the state of the MPS directorate. Sean Jones covered the following topics.

- A welcome to Cornelia Lang as the new AC Chair
- Announcement of changes in NSF leadership, upcoming departure of Linda Sapochak, new AC members as well as departures.
- A review of MPS by the numbers of people supported, proposals, awards, and dollars.
- MPS and the American Rescue Plan (ARP) investments from FY21-22
- CHIPS and Science Act impact on NSF and the MPS Directorate
- ExpandQISE: notable awards in Quantum Information Science
- Update on FY 22 MPS investments in LEAPS and Ascend.
- Review of Partnerships for Research and Education in MPS
- Updates on facilities construction and operations.
- Overview of MPS supported conferences and workshops.



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**Science Highlight – Event Horizon Telescope Sgr A\***

*NSF: Dr. Nigel Sharp, AST Program Director*

Dr. Sharp discussed some of the recent scientific highlights from the Event Horizon Telescope, including the first images of Sagittarius A\*, the black hole at the center of the Milky Way. The Event Horizon Telescope uses Planetary Scale Very Long Baseline Interferometry (VLBI) at short wavelengths to directly observe the immediate environment of a black hole.

- VLBI collects signals from multiple radio telescopes seeing the same source. This allows the network to emulate a telescope with a size equal to the maximum separation between individual telescopes.
- EHT provides consistent and additional receivers to each telescope site as well as dual polarization ability, an enhanced correlator, data transfer and pipelines
- NSF contributed to funding many of the telescopes within EHT network and supports surface metrology and active control, improvements that help all users plus prepare for a 345GHz enhanced EHT.
- EHT looking to expand and improve image quality (resolution, color), telescope accuracy.

**GRANTED Presentation**

*NSF: Dr. Alicia Knoedler, Head of the Office of Integrative Activities*

Dr. Knoedler gave a presentation on *Granted: Growing Research Access for Nationally Transformative Equity and Diversity*, a new program to engage a larger part of the nation's research enterprise and promote inclusivity and research engagement. Dr. Knoedler noted that the traditional mechanisms used by NSF to engage with its community are not sufficient to reach the goal of inclusive, diverse research engagement.

- Proposal submissions to NSF have dropped in recent years. Institutions in EPSCoR jurisdictions account for 15% of proposals evaluated by NSF while MSIs account for approximately 16% of proposals evaluated by NSF.
- Institutions in EPSCoR jurisdictions account for 14% of new awards funded while MSIs account for approximately 15% of new awards funded.

Dr. Knoedler provided an overview of Emerging Research Institutions (ERIs), which are a pathway to improving NSF engagement diversity and inclusivity. Granted aims to mitigate the barriers to competitiveness and enhance research capacity at emerging and underserved research institutions. FY 2023 funding focuses on growing research enterprise support at minority-serving institutions as a part of the NSF has an Agency Priority Goal (APG) to increase the number of proposals from underrepresented investigators and underserved institutions by 10% by the end of September of 2023.



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**Articulating Impacts of Basic Research**

*AC: Dr. Dan Jaffe, moderator, University of Texas at Austin*

*NSF: Dr. Saul Gonzalez, MPS Senior Science Advisor*

*Panelists: Dr. Tabbetha Dobbins, Rowan University; Dr. Jill Pipher, Brown University; Dr. Ed Thomas Jr., Auburn University; Dr. Rodolfo Torres, University of California, Riverside*

Dr. Jaffe introduced panel and gave an overview of its significance. Panel started off with short introductions and discussions of the importance of basic research. Panelists provided examples on why basic research is fundamental to a variety of disciplines and problem solving. Dr. Lang then opened the floor to questions and comments.

Topics discussed include the following:

- Communication of the science and impact
- Measurement of research quality
- Methods for improving the delivery of science education
- The financial implications of basic research

Dr. Jaffe stressed the importance of engagement from active participants of basic research.

**MPS Facilities Portfolio Overview and Discussion**

*NSF: Dr. Chris Smith, Senior Advisor for Facilities, MPS OAD; Dr. Denise Caldwell, PHY DD; Dr. Linda Sapochak, DMR DD; Dr. Debra Fischer, AST DD*

In this session the NSF presenters provided an overview of the MPS facilities portfolio, describing the major facilities within each division. Dr. Chris Smith ended the session by transitioning into the following agenda topics with facilities on the horizon.

**Update on MPS Response to Astro2020**

*NSF: Dr. Sean Jones, MPS Assistant Director; Dr. Debra Fischer, AST Division Director; Dr. Chris Smith, MPS Senior Advisor for Facilities*

Dr. Debra Fischer provided an update on Astro 2020 and its recommendations. She noted that Astro 2020 recommends starting with funding people and developing the workforce. Dr. Fischer indicated that NSF's response to this recommendation consists of a combination of old and new programs, including PAARE, REU, GRFP, ASCEND and LEAPS. Dr. Fischer then discussed the Astro 2020 midscale recommendations: sustain instrumentation; laboratory astrophysics; data science and archives. In this context Dr. Fischer noted that The Center for Computational Astrophysics (CCA) at the Flatiron Institute, in collaboration with the National Science Foundation, is organizing a Future of Astrophysical Data Infrastructure Workshop. Dr. Fischer also gave updates on the Arecibo Observatory, Green Bank Observatory, and ngVLA.



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**AC Subcommittee, Study 1 - Report: Recap and Next Steps**

*AC: Dr. Katie Hunt, University of Virginia, Dr. Cornelia C. Lang, University of Iowa, Dr. Jill Pipher, Brown University, Subcommittee Chair*

Dr. Cornelia Lang noted that the report was unanimously accepted by the subcommittee. Dr. Lang and Dr. Katie Hunt composed a letter of support for MPS' facilities and major research infrastructure programs. They noted that NSF has an exceptional ability to invest in facilities and infrastructure, which is critical to advancing research.

**AC Subcommittee, Study 2 - Kickoff: Review and Update**

*NSF: Dr. Chris Smith, MPS Senior Advisor*

*AC: Dr. Jill Pipher, Brown University, Subcommittee Chair*

Dr. Jill Pipher opened with a recap of the key issues for research infrastructure, a review of the charge for the subcommittee, and the instructions for the first interim report. She noted the following:

- Research infrastructure investments are strategic, large, long-term, cross-cutting, and multi-scale.
- We do not have the luxury a “one-at-a-time” approach for major facilities; we are looking at several competing demands.
- The subcommittee is charged to look at long-term, large-scale strategic issues involved in MPS investments in Major Research Infrastructure.
- The anticipated demand for investments across a broad spectrum of instruments will produce extraordinary challenges for setting priorities, managing construction, and constraining costs.

**Next Generation Gravitational Waves Subcommittee**

*NSF: Dr. Denise Caldwell, PHY Division Director*

Dr. Caldwell described plans for a Next Generation U.S. Gravitational Wave Observatory. She presented a brief history of LIGO, and a forward look beyond the 20–25-year lifetime of AdvLIGO. Dr. Caldwell noted that the Astro 2020 committee “strongly endorses gravitational wave observations as central to many crucial science objectives.”

Dr. Caldwell asked the MPSAC to establish a new committee to assess and recommend a set of concepts for new GW observatories in the U.S. The overarching goal is to identify configurations that can operate at approximately an order of magnitude the sensitivity of LIGO A+ by the mid-2030s.



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### Preparation for Meeting with NSF Director and Chief Operating Officer

MPS AC Chair Dr. Cornelia Lang led the discussion with the MPS AC members. The topics discussed include:

- Dedicating time to facilities and research infrastructure
- Strategies and best practices for articulating the value of basic research.
- Critical role that MPS plays in the major priorities of the Biden Administration, including the CHIPS and Science Act.

### Closing remarks and adjourning for the day

At 4:56 pm MPS AC Chair Dr. Cornelia Lang thanked the AC members and NSF for a wonderful first day and adjourned for the day.

### Wednesday, October 26<sup>th</sup>, 2022

#### Advisory Committee Members in Attendance:

*Members listed in italics participated virtually.*

*Dr. Anna Balazs*

Dr. Tabbetha Dobbins

Dr. Miguel Garcia-Garibay

Dr. Lynne Hillenbrand

Dr. Catherine Hunt

Dr. Dan Jaffe

*Dr. Yuri Tshinkel*

Dr. Cornelia Lang

*Dr. Herbert Levine*

Dr. Jill Pipher

Dr. Ed Thomas, Jr.

Dr. William Tolman

Dr. Roldolfo Torres

Dr. Suzanne Weekes

Dr. Eva Halkiadakis

*Dr. Jennifer Lewis*

### Call to Order, FACA Briefing, and Official Opening of the Second Day

The meeting was opened at 8:25 am by Dr. Cornelia Lang and began with a reminder from Dr. Michelle Bushey on the policies of the Federal Advisory Committee Act from the previous day's briefing.



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### **Science Highlight- CAS Innovative Solutions in Sustainable Chemistry**

*NSF: Dr. David Berkowitz, CHE Division Director*

Dr. Berkowitz provided an overview of sustainable chemistry and sustainable chemical economy research within MPS Directorate. He noted that Congress asked the agencies to stand-up a sustainable strategy team and report back to Congress about the federal landscape regarding sustainable chemistry.

Dr. Berkowitz highlighted MPS centers and facilities conduct research in sustainable chemistry. He described the metaprogram, Critical Aspects of Sustainability (CAS), and displayed a wheel figure derived from the CAS Dear Colleague Letter (DCL) entitled “Innovative Solutions to Sustainable Chemistry” (CAS-SC) that guided the following science highlights:

- Research on sustainable building blocks funded by DMR.
- Research on sustainable products from alternative sustainable products from CHE.
- Research on industrial and manufacturing advances from PHY.

### **Waterman Canvassing Group**

*NSF: Dr. Alicia Knoedler, Office of Integrative Activities*

*AC: Dr. William Tolman, University of St. Thomas*

Dr. Tolman described the primary purpose of the working group as ensuring a diverse pool of candidates and nominations for the Waterman Award, as well as encouraging nominations for underrepresented groups in the respective scientific fields. Dr. Alicia Knoedler provided an overview of the Waterman Award, including a brief history.

### **Quantum Information Science**

*NSF: Dr. Denise Caldwell, PHY Division Director*

Dr. Caldwell gave a presentation on Quantum Information Science on behalf of the Quantum Stewardship Steering Committee.

The topics covered in the presentation included the following:

- The US National Strategy for QIS from the National Quantum Initiative (NQI) Act
- NSF’s role in the NQI Act regarding research and education such as investments
- Transformational Advances in Quantum systems (TAQS)
- Quantum Leap Challenge Institutes and their impact (QLCI)
- Workforce Development in Quantum Information Science
- MPS’s Expand-QISE Program which focuses on small- medium teams, especially for non-traditional QIS participants



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Dr. Caldwell concluded the presentation with three questions directed to the AC members for further engagement in QISE.

- What applications for QISE do you see in your discipline?
- What instrumentation/resources are needed for your community to participate in QISE research?
- What training would be needed to connect members of your community to utilization of QISE?

### **Introduction to Climate Change and Clean Energy**

*NSF: Dr. Sean Liam Jones, MPS Assistant Director*

Dr. Lang introduced the next section on climate change and clean energy. Dr. Jones highlighted that the Biden-Harris administration has made climate change and clean energy an administrative priority and noted that MPS has much to offer to help advance clean energy and climate change/solutions.

### **Climate Solutions and Sustainable Chemistry**

*NSF: Dr. Amanda Haes, CHE Program Director, Dr. Lin He, CHE Deputy Division Director*

Dr. He noted that NSF promotes fundamental research in climate change and solutions. She outlined that MPS has major contributions in climate solutions, sustainable chemistry, and clean energy, which have components that overlap and contribute to each other. She discussed two climate research highlights, one from CHE and one from DMS. Dr. He then discussed the NSF's investment in climate solutions, including a mention of the Climate Change Coordinating Committee.

Dr. Haes then discussed the CAS metaprogram, which has crossed multiple directorates and issued several DCLs, including the Innovative Solutions to Climate Change DCL (CAS-Climate) which focuses on solutions relevant to mitigation, sequestration, and adaptation. She noted that the funded awards under the DCL include a variety of mechanisms, including standard grants, workshops, and EAGERS. Dr. Haes explained that MPS also funds centers, facilities, and partnerships that conduct research on climate solutions. She highlighted Astro2020's guidance to reduce greenhouse gas emissions from their observatories.

Dr. Haes then presented an historical overview of MPS' past and current activities and investment in sustainable chemistry. She highlighted the CAS-SC DCL, as mentioned by Dr. Berkowitz in the Science Highlight presentation earlier in the day. Dr. Haes shared two highlights, one from DMR and one from PHY.



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### **Clean Energy**

*NSF: Dr. Birgit Schwenzer, DMR Program Director; Dr. Linda Sapochak, DMR Division Director*

Dr. Sean Jones introduced the clean energy session and highlighted that MPS has a big impact on advancing clean energy. Dr. Sapochak discussed the historic role of the AC in clean energy, including a joint working group between MPS and ENG. She discussed how NSF differentiates itself from DOE, and noted that one strategy from the earlier MPS AC working group was to look at energy from a sustainability perspective. Dr. Sapochak went over the FY22 clean energy budget, which included fundamental research, clean energy infrastructure, and workforce development and listed research topics under the umbrella of clean energy (included, but not limited to, energy storage/transmission, energy efficiency and end use). Both DMR and CHE have large investments in clean energy, but overall, there is very little investment in some renewable energy areas such as biomass and wind. She asked the AC is there is an opportunity there.

Dr. Schwenzer defined energy efficiency to include power efficiency and provided a broader view that encompasses research that enables lower energy consumption including developing building materials. She highlighted research in multiferroics, as well as current programs, facilities, and partnerships that facilitate clean energy research. Both Dr. Sapochak and Dr. Schwenzer noted that the MRI program may a great tool for leveraging clean energy research. Dr. Sapochak discussed the need for equity, networking, and partnerships within clean energy research, including a highlight on training teachers about clean energy topics. Dr. Schwenzer posed a question of how NSF and DOE can coexist in the clean energy space. NSF can play a role in making existing technologies more sustainable, addressing the use of critical minerals in batteries, and providing fundamental research on scaling technologies. She highlighted a partnership with DOE EERE to foster collaboration between research communities.

### **ERE AC follow-up**

*NSF: Dr. Dave Berkowitz, CHE DD, Dr. Amanda Haes CHE PD*

*ERE AC: Dr. Kimberly Jones, Howard University; Dr. Vicki Grassian, University of California, San Diego; Dr. Lora Billings, Montclair State University*

*MPS AC: Dr. Rodolfo Torres, University of California, Riverside; Dr. Katie Hunt, University of Virginia, Charlottesville*

Dr. Kimberly Jones provided a brief overview of the Advisory Committee for Environmental Research and Education (ERE) and its objectives. AC ERE created an environmental equity subcommittee in Fall of 2022 to provide advice to NSF and the research community on strategies to center equity in environmental research.

The AC ERE and the MPS AC are working to identify shared interests for future workshops. The goal is to have the workshops facilitate interactions among researchers who may not otherwise





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attend the same conferences or publish in the same journals. The panel discussed methods on how to diversify the environmental research community.

**Preparation for Meeting with NSF Director, Chief Operating Officer, and Chief of Staff**

Members reviewed questions document prepped for meeting with NSF Director, Chief Operation and Chief of Staff Officer to ensure accuracy.

**Meeting and Discussion with NSF Director and Chief Operating Officer - Dr. Sethuraman Panchanathan, Dr. Karen Marrongelle and Dr. Brian Stone**

The MPS AC Chair introduced new AC members, Suzanne Weeks, Yuri Tshinkel and Eva Hiladakis to the NSF Director, COO, and Chief of Staff. The MPS AC briefed the Director, COO, and Chief of Staff on several themes that emerged across the 2-day meeting.

**Closing Remarks and Adjournment**

*AC: Dr. Cornelia C. Lang, MPSAC Chair*

*NSF: Dr. Sean Liam Jones, MPS Assistant Director*

At 3:05 pm MPS AC Chair Cornelia Lang thanked everyone for joining the MPS AC meeting. She claimed that this was a wonderful AC meeting and hoped everyone will join the next AC meeting in the spring.