NUCLEAR SCIENCE ADVISORY COMMITTEE
to the
US DEPARTMENT OF ENERGY and NATIONAL SCIENCE FOUNDATION

PUBLIC MEETING MINUTES

Hybrid Meeting
April 26, 2024
NUCLEAR SCIENCE ADVISORY COMMITTEE
SUMMARY OF MEETING

The U.S. Department of Energy (DOE) and National Science Foundation (NSF) Nuclear Science Advisory Committee (NSAC) meeting was convened at 9:00 a.m. Eastern Time (ET) on Friday, April 26, 2024, at the Hilton Arlington National Landing and via Zoom® by Committee Chair **Gail Dodge**. The meeting was open to the public and conducted in accordance with Federal Advisory Committee Act (FACA) requirements. Visit https://science.osti.gov/np/nsac for more information about NSAC.

NSAC Members Present

Gail Dodge (Chair)
Christine Aidala
Paulo Bedaque
Kelly Chipps
Ian Cloet
Andre Luiz de Gouvea
Romualdo deSouza
Austin Harton
Calvin Howell
Yordanka Ilieva
Dean Lee (*APS ex-officio*)
Jorge Lopez
Cecilia Lunardini
Rosi Reed
Lijuan Ruan
Carol Scarlett
Daniel Tapia Takaki
Derek Teaney
Justin Walensky (*ACS ex-officio*)
Fred Wietfeldt

Committee Manager
Brenda May, DOE SC Office of Nuclear Physics (NP)

DOE Presenters
Linda Horton, NSAC Designated Federal Officer, DOE Office of Science (SC), NP, Acting Associate Director
Harriet Kung, DOE SC, Acting Director
Paul Mantica, DOE SC, NP, Facilities and Project Management Division, Director
Geraldine Richmond, DOE, Under Secretary for Science and Innovation
Sharon Stephenson, DOE SC, NP, Physics Research Division Director

NSF Presenters
Denise Caldwell, NSF, Mathematical & Physical Sciences , Acting Assistant Director
Souleymane Omar Diallo, NSF, Division of Materials Research , Program Director
Allena Opper, NSF, Division of Physics, Program Director

High Energy Physics Advisory Panel (HEPAP) Presenter
Sally Seidel, HEPAP Chair

American Physical Society (APS) Division of Nuclear Physics (DNP) Presenter
Haiyan Gao, APS/DNP Past Chair

April 26, 2024

Welcome and Introduction, Gail Dodge, NSAC Chair, welcomed attendees and asked committee members, NSF representatives, DOE representatives, and in-person attendees to introduce themselves.

Opening Remarks (pre-recorded), Geraldine (Geri) Richmond, DOE, Under Secretary for Science and Innovation

Richmond thanked NSAC members for their service and expressed appreciation to former SC Director Dr. Asmeret Berhe. Acting Director Dr. Harriet Kung is well positioned to continue leadership of SC and, along with Dr. Timothy Hallman, in his detail as Special Advisor, advance diversity, equity, and inclusion (DEI) efforts across SC programs.

Nuclear physics plays a vital role in the nation's science ecosystem. To address the wide breadth of nuclear physics research, NP supports four world-leading accelerator microscopes with complementary resolving power capabilities. Fundamental research conducted across the 28 SC user facilities, including the recently completed Facility for Rare Isotope Beams (FRIB), provides the scientific foundation for addressing climate, clean energy, and fusion energy challenges. Building on recent advances will require new knowledge in nuclear physics and material science. Hosting world-class facilities and joining facilities partnerships are essential components of the global nuclear physics enterprise.

The 2023 NSAC Long Range Plan (LRP) identified construction of the Electron-Ion Collider (EIC) as the highest priority for new facility construction. The world's most advanced collider, the EIC, is dedicated to understanding how proton properties are dynamically generated by quarks and gluons. With international contributions already being made, the EIC promises to unlock scientific discoveries and technical advances for the global scientific

community.

Neutrinoless double beta decay (NLDBD) was identified in the LRP as the highest priority for new experiment construction. NLDBD experiments and other LRP projects are important considerations to SC's charge to characterize the scientific merit and technical readiness for facilities and projects for the next decade. NSAC's input is essential to optimize SC's strategy for supporting forefront research in the physical sciences. In addition, the knowledge and skills required to execute these projects will produce pioneering advances in quantum information science (QIS), artificial intelligence/machine learning (AI/ML), and more.

Office of Science Update, Harriet Kung, DOE SC, Acting Director

Kung expressed gratitude to Dr. Berhe, whose accomplishments include driving efforts related to Urban Integrated Field Labs, fusion energy sciences public-private partnerships, exascale computing, and SC Energy Earthshots. Dr. Berhe served as the Head of Delegation to the International Thermonuclear Experimental Reactor (ITER), deepened relationships with international partners, broadened community outreach efforts, strengthened participation in inclusive research and capacity building programs, and brought increased rigor and a robust DEI effort to SC.

Dr. Berhe led SC realignment efforts and streamlined leadership structure to two Deputy Directorships: the Deputy Director for Science Programs (DDSP) and the Deputy Director for Operations. Leadership changes include Dr. Linda Horton, Associate DDSP and Acting Associate Director for NP; Dr. Timothy Hallman, Special Advisor on Equity, Inclusion, and Accessibility; and Dr. Andrew Schwartz, Acting Associate Director for Basic Energy Sciences (BES).Two new SC divisions were created effective April 12, 2024. The Fusion Energy Sciences (FES) Enabling Science and Partnerships (ESP) Division will address the expanded FES mission, established in the Energy Act of 2020, to develop a competitive U.S. fusion power industry, support enabling science programs, and grow partnerships with the private sector and international fusion ecosystem. The High Energy Physics (HEP) Accelerator and Technology (AT) Division will consolidate capabilities and expertise in accelerator research and deployment, steward the Accelerator Research and Development and Production (ARDAP) subprogram, and improve effectiveness of SC investments in critical technologies such as QIS, AI, and microelectronics.

Dr. Berhe was a proponent of making SC accessible to the general public. To make its mission more publicly accessible, SC reorganized its mission statement into three pillars: Driving Discovery Science for the Nation, Fostering Great Minds and Great Ideas, and Providing Unique World-Class Facilities. SC connects people with tools to unleash discovery and advance scientific innovation to drive energy and national security priorities.

SC stewards six core science programs and ten national laboratories, serves over 39,500 users across 28 facilities, and maintains ~24M ft^2 of facility space. These responsibilities are critical considerations for budget formulation.

The SC FY 2024 Enacted Budget of ~$8.24B represents an increase of ~$140M over that of FY 2023. The increased funding will be used to initiate Microelectronics Science Research Centers (MSRCs) at $30M and Fusion Innovation Research Engine (FIRE) Collaboratives at $45M. The Energy Earthshots Initiative was reduced to $20M, and SC is working to address challenges from the reduced funding. User facilities remain a high priority and will be funded on average at 89% optimal operation. Congress enacted a requirement to progressively move to fully funding research awards of $2.5M or less (raised from $1M). Additionally, the FY 2024 Funding for Accelerated, Inclusive Research (FAIR) and Reaching a New Energy Sciences

Workforce (RENEW) Funding Opportunity Announcements (FOAs) have pre applications due April 23 and 30, respectively.

The FY 2025 Budget Request is ~$8.58B and is balanced to provide support to cutting edge research and development (R&D) for discovery, support for optimal operations, and upgrade the infrastructure at the scientific user facilities and national laboratories. Budget highlights for research include funding AI research at $259M (+$93.1M); Microelectronics at $94.7M (+$22M), including $45M for MSRCs; U.S. Fusion Acceleration at an increase of +$18.8M, including the FIRE collaboratives; Climate Initiative at $20M; SC Energy Earthshots at $115M (+$95M); RENEW at $120M (+$68.6M); and FAIR at $64M (+$31.6M). Operations and construction highlights include funding scientific user facility operations on average at 88% of optimal operations (+$189.1M); core laboratory infrastructure upgrades at $50M (+$31.7M), including scientific laboratory infrastructure (SLI) projects and General Plant Projects; line-item construction and Major Items of Equipment (MIE) projects; National Laboratories deferred maintenance and obsolete infrastructure backlog; Laboratory Operations Apprentice Program at $5M (+$2M); and full funding of Oak Ridge Nuclear Operations.

President Biden released an executive order for federal agencies to address the benefits and threats of AI/ML. All six SC program offices will contribute to the DOE Frontiers in Artificial Intelligence for Science, Security, and Technology (FASST) initiative. There are five initiative pillars: AI for Science, including scientific AI foundation models and models trained on supercomputers; AI Hardware Innovation, to improve energy efficiency by greater than 100-fold; AI for User Facilities and Advanced Instrumentation or Technology; AI Tools for Design and Evaluation of Trustworthy AI Systems; and a diverse AI workforce.

SC Energy Earthshots accelerate clean energy breakthroughs in eight topic areas. The two new shots announced in 2023 are Affordable Home Energy and Clean Fuels and Products.

The LRP provides a clear roadmap for SC and NSF to execute a new era of discovery. NSAC's highest priority for facility construction is the EIC and the highest priority for experiment construction is the NLDBD campaign.

Facilities for the Future of Science, published in 2003, established best practices of long-term planning and prioritization and drove 20 years of investment in U.S. scientific excellence. Presently, many of the projects identified as priorities in the 2003 report have been completed or are near completion, including facilities such as ITER, Frontier, Linac Coherent Light Source-II (LCLS-II), National Synchrotron Light Source-II (NSLS-II), Majorana Demonstrator, and FRIB. The facilities represent significant advances across many disciplines relevant to SC.

NSAC is charged to consider new or upgraded facility projects which advance U.S. science and innovation leadership. NP projects considered by the NSAC Facilities Subcommittee are: the EIC; the EIC Detector II, the High Rigidity Spectrometer (HRS); Project 8; the FRIB Energy Upgrade (FRIB400); the Solenoid Large Intensity Device (SoLID); and, under the Ton Scale NLDBD (TS-NLDBD) program, the Large Enriched Germanium Experiment for NLDBD (LEGEND-1000), the next Enriched Xenon Observatory (nEXO), and the Cryogenic Underground Observatory for Rare Events with Particle Identification (CUPID).

Discussion

Dodge inquired how the FY 2025 Budget Request was constructed and incorporated the LRP's prioritization of research. **Kung** responded research is NP's top priority due to NP's research budget erosion compared to other SC programs. SC made a concerted effort to move available resources and argue for increased resources for NP research. Additionally, the FY 2025

Budget Request accounted for NP's major construction projects, including the EIC and NLDBD efforts. NP Leadership will form an implementable plan to critically evaluate the balance of research funding, facility operations, and construction priorities. Under federal budget austerity, increasing research while facing other high demands is a challenge.

Lee asked how AI/ML funding will be dispersed throughout the various programs. **Kung** noted each program has an allocation of new AI/ML funding which will be added to already actively funded AI activities. Additionally, Dr. Horton will lead a crosscutting strategic planning effort for implementing AI/ML initiatives.

Howell inquired if two-thirds of the ~$340M difference between the FY 2025 and FY 2024 Budgets is allocated to facilities to ensure 89% of optimal operations. **Kung** responded construction project roll-offs could increase other parts of the portfolio. Many construction projects, such as the EIC, are ramping up and require resources. New initiatives such as AI/ML impose additional requirements on the funding received.

Cloet asked about SC's vision for QIS. **Kung** said SC maintains an investment in QIS of over $250M and it remains SC's highest priority for critical emerging technologies. In addition, ASCR is proposing a modest funding increase for QIS in FY 2025.

Ruan questioned if DOE would assist the Science Accelerating Girls' Engagement in STEM (SAGE) program at SLAC National Accelerator Laboratory due to the program's loss of private sector support. **Kung** replied SC stays closely connected to national laboratory-led activities and has launched a longitudinal evaluation process to ensure investments are impactful. SC addresses prioritized needs across the national laboratories and will take a closer look at SAGE's loss of private funding.

Tapia Takaki asked if SC plans to review the Established Program to Stimulate Competitive Research (EPSCoR) program. **Kung** said SC's EPSCoR program is very successful, although smaller than NSF. BES manages the EPSCoR program and conducts a review every three or four years. In addition to the dedicated EPSCoR program, all programs fund EPSCoR states and institutions. The Creating Helpful Incentives to Produce Semiconductors (CHIPS) and Science Act provides guidance on EPSCoR funding, and SC is expanding investment in EPSCoR states. Recent SC initiatives consider EPSCoR state status as a program policy factor.

Dodge raised DEI aspects of the cost-of-living increases for graduate students. **Kung** responded this is a key priority to broadening participation, which NP made clear in the LRP. Although graduate student stipends are set at the institutional level, SC has language encouraging principal investigators (PIs) to fund graduate students at close to a living wage. With the combined efforts of the six programs, SC hopes to advocate for increased resources for core research which will benefit graduate students. **Wietfeldt** emphasized funding for graduate students is reaching a crisis level for small grants. **Tapia Takaki** noted the language in new DOE solicitations regarding expectations for graduate student stipends could be improved to better encourage PIs.

Perspectives from the National Science Foundation, Dr. Denise Caldwell, NSF MPS, Acting Assistant Director

Caldwell presented NSF MPS personnel changes: Dr. Denise Caldwell is Acting Assistant Director effective October 2023; Dr. Saul Gonzalez is Division Director (DD) of Physics; Dr. Michael Cavagnero is Acting Deputy DD of Physics; Dr. Chris Smith is Interim DD of Astronomy; and DD of Chemistry Dr. David Berkowitz will step down May 2024. Open positions include the DD of Chemistry and the DD of Astronomy.

MPS is reorganizing its structure to better focus on key MPS facilities and crosscutting

initiatives. The Office of Multidisciplinary Activities became the Office of Strategic Initiatives, now charged with identifying and funding areas poised for significant impact at the MPS level.

FY 2024 NSF Budget was reduced by ~5% to $9.06B. The decrease in funding will impact all NSF activities. NSF is currently developing the funding allocation plan.

The FY 2025 NSF Budget Request is $10.18B, with $1.68B requested for MPS. The 2022- 2026 NSF Strategic Plan has three pillars: advancing the frontiers of research and innovation, ensuring accessibility and inclusivity, and being a leader in the global science and engineering enterprise. The FY 2025 Budget Request reinterpreted the NSF pillars into three main investment opportunities: Strengthening Established NSF; Inspiring Missing Millions, aiming to expand workforce capacity and inclusion; and Accelerating Technology and Innovation, a growing area of the NSF portfolio. Within the three NSF pillars, the FY 2025 Budget Request identified Four Major Themes: Advance Emerging Industries for National and Economic Security, A Resilient Planet, Create Opportunities Everywhere, and Strengthen Research Infrastructure. Key emerging industries relevant to MPS include QIS, AI, and biotechnology.

MPS is impacted by the guidance of advisory committees, including: NSAC; HEPAP; National Academies of Sciences, Engineering, and Medicine (NASEM) Decadal Surveys; and MPS Advisory Committee (MPSAC) subcommittees. The MPS Facilities and Major Research Infrastructure Subcommittee was established to advise on how to prioritize facilities investments. Following the advice of the Subcommittee, MPS recently established a process using NSF's panel review system to assess investment priorities and make recommendations. The MPSAC Subcommittee on Next-Generational Gravitational Wave (GW) Detector Concepts recently released a report planning next steps beyond Laser Interferometer GW Observatories (LIGO). The Astro2020 Decadal Survey informed NSF's decision to review a possible contribution to the construction of two large optical telescopes, ensuring US leadership in optical astronomy for the next decade.

Additionally, NSAC's LRP established clear priorities and directions useful to MPS. In partnership with DOE and NP, MPS will strive to maintain a strong research program that capitalizes on talent and maximizes the impact of NSF resources.

The NSF Large Facilities Construction Project is conducted through a series phases: a conceptual design phase, a preliminary design phase, and the final design stage. Each project is expected to submit a proposal and go through each phase successfully. Commitment for construction is only made at the conclusion of the final design phase.

The Mid-scale Research Infrastructure (MSRI)-1 and MSRI-2 programs are effectively utilized by the nuclear science community, because many of the capabilities needed by the community are in the smaller or mid-size funding range. An example from this program is the recently constructed Zettawatt Equivalent Ultrashort pulse laser System (ZEUS) Laser User Facility at the University of Michigan.

MPS is the steward of QIS within NSF. The Expanding Capacity in QIS and Engineering (ExpandQISE) program targets institutions which have not had a major investment in QIS. The Quantum Sensing Challenges for Transformational Advances in Quantum Systems (QuSeC-TAQS) invests in areas such as sensors and quantum interconnects. The National Quantum Initiative (NQI) Reauthorization Act is currently going through Congress and would support NQI for another five years.

NSF has recently launched the National Quantum Virtual Laboratory (NQVL), which focuses on areas in which QIS can demonstrate an advantage for a key problem. The program is structured to advance projects from basic science conception to commercial development.

AI is an area of focus via the MPS AI Institutes. There is currently a competition for AI for Astronomical Sciences and an upcoming competition for AI for Discovery and Materials Research. Partnerships with the private sector, foundations, and international organizations are key to enhancing these initiatives.

MPS has implemented two requirements identified by the CHIPS and Science Act, namely, to establish a sustainable chemistry program and support research and workshops that address the potential impact of satellite constellations on astronomy systems used by NSF programs. Additionally, the CHIPS and Science Act requested NASEM evaluate the QIS workforce on behalf of MPS. This effort is challenged by the lack of data about the nascent QIS workforce.

The Missing Millions programs are key methods by which MPS broadens participation to underrepresented groups, emerging research institutions (ERIs), and minority serving institutions (MSIs). Programs include: MPS Ascending Postdoctoral Research Fellowships (MPS-ASCEND), MPS Ascending Faculty Catalyst Awards (MPS-AFCA), Launching Early-Career Academic Pathways in MPS (LEAPS-MPS), and five divisional MPS Partnership Programs.

Recent science highlights include detection of primordial gravitational waves by North American Nanohertz Observatory for Gravitational Waves (NANOGrav) and the successful application of AI to the IceCube detector to image the Milky Way in neutrinos.

Discussion

Ruan asked for more information about the national quantum virtual laboratory. **Caldwell** explained the concept is a geographically distributed laboratory. Instead of the laboratory as a physical space, the virtual laboratory is a coordination mechanism involving groups to make effective contributions. Benefits include forgoing facility construction and opening participation across geography.

Tapia Takaki inquired about the three phases of facility construction for joint construction efforts with DOE. **Caldwell** noted one group will submit a proposal for each stage of the facility development. The process is similar to the DOE Critical Decision (CD) process with a different schedule. For example: a group will submit a proposal for conceptual design. Pending a favorable review, the group can submit a proposal for preliminary design. Then, if the proposal passes the preliminary design review, the same group can write a proposal for final design. When construction is carried out in partnership with DOE, roles are defined, and every step is jointly coordinated. MPS aims to focus NSF contributions to well-defined deliverables that contribute to the overall project.

DOE Office of Nuclear Physics Overview, Linda Horton, DOE SC, NP, Acting Associate Director; Paul Mantica, DOE SC, NP, Facilities and Project Management Division Director; Sharon Stephenson, DOE SC, NP, Physics Research Division Director

Horton presented NP personnel updates: Dr. Linda Horton is Acting Associate Director, Dr. Sharon Stephenson is Director of the Physics Research Division, Dr. Tasia Bryson is an AAAS Fellow and is responsible for NP's diversity programs, and the Nuclear Structure and Nuclear Astrophysics position is open.

The NP program funds research and facilities across the breadth of the field. Areas of investment include quantum chromodynamics, fundamental symmetries, nuclei and nuclear astrophysics, NLDBD, nuclear theory, and nuclear data.

Horton discussed the trend in DOE-NP appropriations. The FY 2024 Enacted Budget (~$804M) is approximately the same as FY 2023. Research was prioritized as suggested by the

LRP, and research initiative support focuses on QIS, AI/ML, RENEW, and FAIR. The CHIPS and Science Act is an authorization bill that allows NP to request progressive funding as proposed by the LRP. The FY 2025 Budget Request is ~$833M.

Stephenson reviewed Physics Research Division appropriations. The FY 2024 Enacted Budget allocates ~$256M for research with the following distribution: 29% for low energy core research, including nuclear structure, nuclear astrophysics, and fundamental symmetries; 24% for theory core research, 19% for medium energy core research, 17% for heavy ion core research, and 11% for Initiatives including Microelectronics, AI/ML, QIS, ACCELERATE, RENEW and FAIR. The FY 2025 Budget Request of ~$251M allocates 26% for low energy core research, 22% for theory core research, 20% for NP Initiatives, 17% for medium energy core research, and 15% for heavy ion core research. The Initiatives increase of ~$23M focuses on AI/ML, RENEW, and FAIR. FY 2025 Budget Request core research is ~$17M less than FY 2024.

FY 2024 SC FOAs relevant to NP include the Early Career Research Program (~$8M), EPSCoR State-Lab Grants (~$2M+), Nuclear Data Interagency Working Group Research Program (~$12M), Research and Development for Next Generation Nuclear Physics Accelerator Facilities (~$4M+ for FY 2024 and ~$4M for FY 2025), FAIR (~$2M), and RENEW (~$6M).

Recent research highlights include the precision mass measurement for the lightest bound Al isotope at FRIB, the creation of five heavy metal isotopes for the first time on Earth at FRIB, and the observation of the electromagnetic field effect via charge-dependent directed flow in heavy-ion collisions at the Relativistic Heavy Ion Collider (RHIC).

Mantica presented an update on NP user facilities. The FY 2024 Enacted Budget funds the four NP-supported user facilities at ~90% of optimal budget. RHIC plans to operate for 25 weeks and focus on proton-proton collision data relevant to the super Pioneering High Energy Nuclear Interaction Experiment (sPHENIX) and the Solenoidal Tracker at RHIC (STAR) detector. Continuous Electron Beam Accelerator Facility (CEBAF) plans to run for 30 weeks and aims to complete experiments scheduled in Hall A before scheduled accelerator downtime in the summer. Argonne Tandem Linac Accelerator System (ATLAS) plans to run 39 weeks and is readying the arrival of the Gamma-Ray Energy Tracking In-beam Nuclear Array (GRETINA) spectrometer and commission of the neutron generator based Californium Rare Isotope Breeder Upgrade (nuCARIBU) driver cyclotron. FRIB is planning to operate for 24 weeks at 10kW and at the end of the current scientific run will prepare operations for 20kW.

The LRP identified the EIC as a top new construction priority and urged expedited completion. In March 2024, the EIC received CD-3A approval to execute ~$90M of long lead procurements to reduce technical risk. The EIC has an international user group of ~1,500 users representing ~290 institutions across 40 countries. The EIC Project envisions international in-kind contributions of ~$100M to the EIC detector and ~$50M to the accelerator. The EIC Advisory Board and EIC Resource Review Board (RRB) facilitate international collaboration and coordinate in-kind contributions.

The TS-NLDBD Program was identified by the LRP as a top priority for new experimental construction. There are three proposed technologies to realize discovery of NLDBD decay: CUPID, LEGEND-1000, and nEXO. NP has made investments in the three technologies to develop their conceptual design towards critical decision 1 (CD-1), Approve Alternative Selection and Cost Range. A working group has been established and charged with defining an organizational framework for a Virtual Global DBD Observatory. Significant investment and collaboration from international partners are critical for success.

Other MIE updates include Gamma Ray Energy Tracking Array (GRETA), with CD-4A

forecast in Q3 FY 2025; Measurement of Lepton-Lepton Electroweak Reactions (MOLLER), with CD-2/3 forecast in Q3 FY 2024; High Rigidity Spectrometer (HRS), with CD-2/3 for the High Transmission Beam Line forecast in Q1 FY 2025.

NP has actively engaged the international community. A recent highlight is United Kingdom Research and Innovation (UKRI) announcement of £58.8M (~$74M) to support EIC construction. The EIC RRB will meet in Rome, Italy, May 6-7, 2024.

Horton thanked NSAC for the development of the LRP. NP is working to deliver on the LRP while prioritizing available resources.

Discussion

Chipps expressed concern that research budget pressures may limit the opportunities available for RENEW, FAIR, and EPSCoR participants to join the field and asked how agencies can help to bridge the gap. **Horton** agreed this is a necessary challenge of flat/inflationary growth but noted the success of EPSCoR. Ten percent of the non-EPSCoR SC research budget goes to EPSCoR states. Ideally, SC can realize similar success for emerging research institutions (ERIs) and minority serving institutions (MSIs) through RENEW and FAIR.

Cloet inquired what factors contributed to the 3.6% increase in FY 2025 Budget Request from the FY 2024 Enacted Budget and how this increase compares to other program offices. **Horton** said a major factor was the administration's initiatives and priorities. For example, the increased budget for AI is concentrated in ASCR. Program-specific funding information can be found in the FY 2025 Request Budget on the SC website.

Tapia Takaki asked for clarification regarding what is meant by "research" in the budget, and if "initiatives" refers to LRP initiatives. **Horton** answered the research budget includes funding for SC initiatives and for NP's core research portfolio. Initiatives are specifically SC initiatives, such as QIS, AI/ML, RENEW, and FAIR.

NSF Nuclear Physics Overview, Allena Opper, NSF, Nuclear Physics, Program Director

Opper noted no NSF leadership personnel changes since December 2023. NSF is currently seeking candidates for the Program Director for Particle Astrophysics.

The NSF FY 2024 President's Budget Request is ~$11.31B. The final FY 2024 appropriation is ~$9B. The FY 2024 appropriations were delayed from October 1st, 2023, to March 23rd, 2024. As a result, NSF will not have funding available until about the end of May. Currently, NSF is prioritizing making awards for immediate needs, such as graduate student support for the summer. NSF will endeavor to move quickly once it is able to begin making awards.

The FY 2025 President's Budget Request is ~$10.41B. Highlights include an increase in the request for Research & Related Activities and Major Research Equipment & Facilities Construction. The FY 2025 Requests for MPS (~$1.68B) and Physics ($312.9M) are increases over the FY 2023 Base Plan.

The LRP was developed via a community-led effort, and the prioritization efforts in the LRP help agencies make decisions. NSF has already received proposals responding to the four recommendations in the LRP. From 2021-2023, the NSF NP program received about 40 proposals each year for three-year duration grants. In FY 2024, 55 proposals were received. This indicates the community is growing and research activity is increasing. However, the NSF NP budget will not increase correspondingly.

Highlights include a Faculty Early Career Development Program (CAREER) summer camp for students with autism, an experiment from FRIB advancing nuclear equation-of-state

research, student travel to the Large Hadron Collider (LHC) to perform relativistic heavy-ion collisions, and promising preliminary data from the MUon proton Scattering Experiment (MUSE).

Discussion

Tapia Takaki suggesting mapping NSF and DOE budget categories to the LRP for better clarity in certain areas, such as supporting workforce. **Opper** said the NSF NP program budget maps to both the 2015 LRP and 2023 LRP and consists of three main accounts: nuclear astrophysics and structure, broad quantum chromodynamics, and precision measurements for fundamental symmetries and constants. Additionally, the program directors are able to transfer money from one account to another in response to prioritization from the review process. **Dodge** asked if most of the regular program awards are for research and not operations. **Opper** responded that the majority of NSF NP funding is for research grants, and operations support is only provided for the nuclear physics laboratories at Florida State University and the University of Notre Dame.

Howell asked if NSF foresees graduate student stipends increasing or incorporates stipend increases into budget requests. Equity can be a struggle, especially in cases where a graduate student stipend is locked in at a certain amount over a duration. **Opper** noted the graduate student support requested is set by individual university policies. Additionally, awards are made for specific durations, and adjustments to award scope require re-competing against other NSF proposals. There is no NSF funding line to bring students up to a new stipend rate. Furthermore, the NP program budgets have been flat or with minimal increases, so increasing funding to one area decreases funding to another.

Facilities Report Presentation, Christine Aidala, Chair, Facilities Subcommittee

On December 1, 2023, SC charged the federal advisory committees to consider new or upgraded facility projects over $100M for the next decade that position SC at the forefront of scientific discovery. The Facilities Subcommittee (the Subcommittee) used an (a, b, c, d) rating system to evaluate projects on i. the potential to contribute to world-leading science over the next decade and ii. readiness for construction. NP provided seven projects to consider: EIC, HRS, TS-NLDBD, Project 8, FRIB400, SoLID, and EIC Detector II.

NSAC was well positioned to address the facilities charge with the priorities and scientific vision outlined in the LRP. NSAC formed the Subcommittee from LRP Writing Committee members to address the charge, ensuring project expertise and avoiding conflicts of interest. The Subcommittee requested and received feedback from each project relevant to scientific importance and construction readiness.

For scientific importance, LRP Recommendations #2 and #3 identified the EIC and NLDBD as (a) absolutely central to maintaining US leadership in nuclear science. The Subcommittee's report to NSAC reaffirmed this evaluation. LRP Recommendation #4 highlighted additional projects and strategic opportunities to advance discovery science, which the Subcommittee report to NSAC identified as (b) critically important.

In considering readiness for construction, the Subcommittee was guided by current project status and remaining challenges, including DOE CD level if applicable. The Subcommittee noted a large gap between charge rating categories (a) ready to initiate construction and (b) significant scientific/engineering challenges to resolve before construction. Projects without significant scientific/engineering challenges were rated (a) with an accompanying readiness explanation. Rating (c) was defined in the charge as “mission and

technical requirements not yet fully defined."

The Subcommittee assigned the following ratings for scientific importance and readiness for construction, respectively: EIC (a, a); HRS (b, a); TS-NLDBD (a, a); Project 8 (b, c); FRIB400 (b, a); SoLID (b, a); and EIC Detector II (b; c).

In March 2024, DOE asked the Subcommittee to address cross-cutting opportunities, including the scientific interest of the nuclear science community in facilities under construction by other SC programs. The LRP addressed computing and sensing, accelerator and detector R&D, and nuclear data. In terms of computing, ASCR facilities are key to the EIC, other nuclear science computing needs, and AI/ML use cases.

The EIC addresses unique and compelling science, provides unprecedented abilities, and advances accelerator technology. The EIC is the first accelerator facility designed with a high-level of AI/ML-driven automation. The EIC User Group and multiple foreign agencies have expressed support and interest in providing in-kind contributions. In terms of readiness, CD-3A was achieved in March 2024. The State of New York awarded the EIC $100M, and the Inflation Reduction Act (IRA) allocated $138M to the EIC to be spent by 2027. The R&D performed to date confirms the technical feasibility of the facility.

HRS is a key instrument for substantially increasing FRIB's scientific reach and productivity in the areas of nuclear structure, nuclear reactions, and nuclear astrophysics. The HRS project is divided into two segments: the HTBL and the Spectrometer Section (SPS). HRS achieved CD-1 in September 2021, design finalization for the HTBL is nearing completion, with CD-2 independent project review scheduled for October 2024. CD-2 for the SPS is estimated to take place mid-2025. The IRA allocated ~$30M to HRS.

TS-NLDBD is the highest priority for new experiment construction and would impact multiple scientific fields. As discussed in the LRP, a multi-technology campaign is critical to confirming observation of the phenomenon. The proposed program consists of three experiments: CUPID, nEXO, and LEGEND-1000. Regarding readiness for construction, the three experiments have undergone a rigorous DOE portfolio review and are actively preparing for the CD process. CUPID builds on Cryogenic Underground Observatory for Rare Events (CUORE) infrastructure and has pioneered several technologies. The LEGEND-1000 project was recently invited to prepare a full proposal to the NSF Midscale Research Infrastructure-2 program. The nEXO experiment technology has been well documented, and the nEXO project has successfully completed a series of external reviews for the conceptual design of subsystems. None of the three experimental designs have any significant scientific/engineering challenges to resolve before initiating construction. Isotope acquisition is noted as a significant challenge due to potential geopolitical complexities.

Project 8 would enable high-precision neutrino mass measurements beyond current state-of-the-art capabilities. Additionally, the project offers unique sensitivity to light sterile neutrinos at the eV scale and the potential for major discovery. Project 8 plans to use two new technologies: Cyclotron Radiation Emission Spectroscopy (CRES) and an atomic tritium source. In terms of readiness, the CRES technique has achieved proof-of-principle. The project is in the early stage of pre-conceptual design.

The FRIB400 upgrade will expand FRIB's scientific reach and increase the yield of harvested isotopes. The energy upgrade to 400 MeV will achieve the capabilities envisioned for FRIB in the 2002 LRP and serve a large user base. As for readiness for construction, space is reserved for FRIB400's 11 cryomodules, the technology has been proven and reviewed, and the team to build is in place. However, cost and schedule will remain uncertain until DOE establishes mission need with CD-0 and a CD-1 review is conducted.

SoLID is uniquely important for particle measurements at unprecedented luminosities and rates, as well as for realizing the full potential of the upgraded 12 GeV beam energy and high current capability at the Thomas Jefferson National Accelerator Facility (Jefferson Lab). SoLID will utilize an existing solenoid magnet. A preliminary conceptual design report has been refined over the years and was submitted to DOE in 2020; a full cost exercise was updated in 2023. Additionally, SoLID carried out three Jefferson Lab Director's reviews and received positive science and design feedback. There are no known scientific and engineering challenges to resolve prior to construction. However, cost and schedule will remain uncertain until DOE establishes mission need with CD-0 and a CD-1 review is conducted.

The EIC Detector II's science case overlaps with the scientific motivation for the EIC. A second detector will provide extended and complementary capabilities in selected sectors and enable mutually confirming results. Regarding readiness for construction, the timeline for a second experiment is important, and a delayed timeframe is designed to accommodate advances in detector technologies. A 2022 EIC Detector Proposal Advisory Panel report stated that there is significant community and panel support for the project. The 2nd Detector and Interaction Region (IR8) Working Group is refining the science case and plans to engage with the DOE CD process within the next five years. Hence, the mission and technical requirements are not fully defined.

Discussion

Wietfeldt asked if the decision for the scientific importance grades to align with the LRP was deliberate. **Aidala** confirmed the Subcommittee deliberately followed the recommendations of the LRP.

Howell inquired how the Subcommittee interacted with DOE. **Aidala** answered that all Zoom meetings had DOE observers present to answer questions.

Howell asked if the Subcommittee discussed maximum usable lag time between the first and second EIC detectors. **Aidala** replied while this has been a topic of discussion within the community, it was not a significant discussion within the Subcommittee.

Since the six federal advisory committees each received the facilities charge, **Taipa Takaki** suggested emphasizing NP's role in fundamental research and the importance of current and future NP facilities in discovery science in general. **Aidala** added the last NSAC facilities reports were published in 2013 and 2003, with a joint federal advisory committee report in 2003. Regarding whether the current facilities reports will lead to a joint report, **Horton** said it is unclear whether SC will publish a synthesized report or use the information internally for balancing the budget. The NP facilities report is similar to the recently approved BES facilities report in terms of content and approach.

Lunardini notes the report states there is not significant information to assess the full scope of Project 8's Phase 4. However, the scope appears clearly defined as measuring neutrino mass with unprecedented sensitivity. **Aidala** replied it is unclear whether the design goal of 40 meV can be technically achieved without having completed the Phase 3 R&D. While the scope of the science is clear, the scope of the project and readiness for construction are less so. **Dodge** added language of schedule and cost is used in other cases. **Aidala** agreed but noted preliminary designs of several other projects are well-defined.

DeSouza said the physics case for TS-NLDBD is clear. However, the single readiness recommendation for the three experiments can be clarified. **Aidala** replied that the charge requested one set of scientific importance and construction ratings for the NLDBD campaign, and strong scientific motivations support multiple technologies. The Subcommittee gathered information for the three experiments being discussed regarding science, readiness, procurement, and risks. The report does not make any direct recommendations to pursue all three experiments.

Tapia Takaki noted grading categories such as "absolutely central" or "important" are nuanced by the context of conducting fundamental research. **Dodge** added every project advances the field and helps maintain US leadership, as highlighted in the report and the LRP. **Aidala** commented that the Subcommittee used uniform language throughout the report and articulated the outstanding scientific opportunities of each project.

Dodge thanked the Subcommittee and called for a roll call vote. The report was accepted unanimously.

NSAC Members Ending Terms of Service

Dodge presented certificates of appreciation to NSAC members ending their terms: Paolo Bedaque, Haiyan Gao, Richard Wilson, Cecelia Lunardini, Romualdo deSouza, and Rosi Reed.

Report of the 2023 Particle Physics Project Prioritization Panel (P5): Exploring the Quantum Universe, Pathways to Innovation and Discovery in Particle Physics, Sally Seidel, HEPAP Chair

The definition of particle physics has evolved over time to include many kinds of experiments and facilities. The P5 report considers a wide span of energy scales but excludes particle astrophysics or gravitational wave observatories.

Organized by DOE, NSF, and HEPAP, P5 is charged to provide a 10-year project plan informed by a 20-year vision on issues related to theoretical and experimental particle physics and associated technologies. Once accepted, the report is transmitted to the Office of Management and Budget (OMB), the Office of Science and Technology Policy (OSTP), DOE, and NSF. In addition to reviewing science cases and prioritizing proposals, P5 also offers actionable recommendations.

P5's Prioritization Principles are the following: enabling US leadership in core areas of particle physics; leveraging unique U.S. facilities and capabilities; engaging with core national initiatives to develop key technologies; developing a skilled workforce for the future; and effectively engaging and leading international endeavors. The panel considered cost, risk, and schedule during prioritization. P5 prioritized project portfolios to approximate budget scenarios and to ensure feasible continuation into the second decade. The program is balanced in terms of project size and time scale, on-shore versus off-shore, project versus research, and current versus future investment. The Prioritization Principles differ depending on the size of the experiment: large projects (over $250M) must be unique and world-leading, with paradigm-changing discovery potential; medium projects (between $50M and $250M) must be competitive and world-class, with excellent discovery potential or major tool development; and small projects (under $50M) must be excellent training grounds and world-class, with discovery potential, well-defined measurements, or outstanding technology development. In addition, global considerations show some projects require international collaboration while others are reasonably within a single country's scope.

P5 considered two plausible budget scenarios for U.S. funding: the Baseline budget as specified in the CHIPS and Science Act with a 3% increase per year in nominal dollars, and the Less Favorable budget with no CHIPS and Science Act funding and a 2% increase per year in nominal dollars. The recommended budget breakdown is 30% for projects, 30% for operations, and 40% for research. Due to the needs for demonstration experiments and workforce development, P5 suggested a dedicated fund in DOE for medium-scale projects in all particle physics areas with annual calls for proposals.

P5 established three overarching science themes: Decipher the Quantum Realm, related to neutrinos and the Higgs Boson; Illuminate the Invisible Universe, related to dark matter and cosmic evolution; and Explore New Paradigms in Physics, related to the search for new particles and quantum imprints of new phenomena. The report includes six principal recommendations associated with the science themes and twenty area recommendations where sustained investment can advance the future of science and technology. HEP's portfolio is diversified and more balanced as a result of the recommendations.

To Elucidate the Mysteries of Neutrinos, the P5 recommends prioritizing completing ongoing experiments, including Nova, T2K, and the Fermilab's Short Baseline Neutrino program. Completion of Phase-I of the Long-Baseline Neutrino Facility (LBNF) Deep Underground Neutrino Experiment (DUNE) is key to the neutrino priority. DUNE Phase II is also a major project this decade.

In order to Reveal the Secrets of the Higgs Boson, P5 seeks to advance the Standard Model through completion of the ongoing A Toroidal LHC Apparatus (ATLAS) and Compact Muon Solenoid (CMS) experiments at the LHC. A top priority related to the Higgs Boson is completion of the High Luminosity (HL) LHC, which is currently being developed. In addition, the U.S. should move forward with preparations for a "Higgs Factory," i.e., an electron-positron collider covering the range of collision energies from 90 GeV to 350 GeV. Since a Higgs Factory does not fit into the budget scenarios, P5 suggested construction outside of the US with a design determined later this decade. A long-term recommendation is R&D toward a 10 TeV parton-center-of-momentum (pCM) Collider for precision measurement of the shape of the Higgs potential.

To Determine the Nature of Dark Matter, P5 recommended completing ongoing experiments including Darkside 20k, LUX-ZEPLIN (LZ), the Axion Dark Matter eXperiment (ADMX), and the Super Cryogenic Dark Matter Search (SuperCDMS). A significant recommended project, preferably sited in the U.S., is moving forward with a third generation (G3) direct detection experiment to improve sensitivity to the neutrino floor. P5 also recommends substantial investment in an agile portfolio of mid-scale projects.

Progress has been made to Understand What Drives Cosmic Evolution through a suite of experiments, including the Atacama Cosmology Telescope (ACT), the European Planck Satellite, the South Pole Telescope (SPT), the Background Imaging of Cosmic Extragalactic Polarization (BICEP) experiment, the POLARization of the Background Radiation (POLARBEAR) experiment, and the Rubin Observatory's Dark Energy Science Collaboration (DESC). P5's suggested major project is the Cosmic Microwave Background Stage 4 (CMB-S4) experiment, which will be sensitive to primordial gravitational waves, dark radiation, and gravitational lensing of the CMB. P5 recommends continued operations of the Dark Energy Spectroscopic Instrument (DESI) spectroscopic survey and its upgrade (DESI-II).

To Search for Direct Evidence of New Particles, P5's priority is completing the ongoing ATLAS, CMS, and LHC beauty (LHCb) experiments. The HL-LHC, a Higgs Factory, a 10 TeV pCM collider, and other recommended small projects could contribute to this effort. In addition, P5 proposed engaging in agile projects to seek long-lived particles.

In order to Pursue Quantum Imprints of New Phenomena, a priority is completing ongoing projects searching for these indirect quantum imprints such as the Muon-to-Electron Conversion Experiment (Mu2e), Belle II, LHCb, ATLAS, and CMS projects.

Area recommendations cover topics related to the following: increasing support for theory; implementing a small-project portfolio; improving instrumentation, accelerator development, facilities, and infrastructure; strengthening software, computing,

cyberinfrastructure; and sustainability. Beyond the projects, P5 recognized the importance of the individuals conducting the science and offered recommendations related to workforce development, ethical standards, and broad community engagement.

Discussion

Weitfeldt asked where outside the U.S. a Higgs Factory may be built. **Seidel** said domestic and international groups are actively working towards both the Future Circular Collider for electron-positron collisions (FCC-ee) and the International Linear Collider.

Tapia Takaki inquired if the 30% projects, 30% operations, and 40% research budget allocation is written in the report and is consistent with funding agencies. **Seidel** replied it is included in the report. The previous P5 report also recommended 40% for research, which has not been achieved consistently by funding agencies. Research funding recently spiked to 40% in FY 2023, although this was an anomaly.

Tapia Takaki asked if R&D is broadly defined in the report because QIS was not explicitly discussed in the presentation. **Seidel** responded since QIS is one of the three national initiatives, it was explicitly considered in the context of all the recommendations. Although there was no specific recommendation, QIS can be understood to be incorporated throughout recommendations and experiments.

Dodge wondered how costs and uncertainty were considered. **Seidel** noted these factors were considered by a sub-subcommittee who were well-informed and received private information from all relevant experiments.

Howell asked what informed the two plausible budget scenarios. **Seidel** stated DOE provided P5 with two budget scenarios for HEP derived from realistic near-term budget projections. P5 considered all ideas reported at Snowmass and recommended those that fit within the federal guidelines. **Dodge** added the large difference between the two scenarios is because the CHIPS and Science Act is a large authorization.

NSAC LRP Workforce Development Proposals – Division of Nuclear Physics responses, Haiyan Gao, APS/DNP Chair

Gao presented LRP workforce development proposals and emphasized areas of improvement for the community and funding agencies.

The first recommendation is a national outreach and education center for nuclear science. The nuclear physics community has historically engaged in various outreach initiatives, including the following: summer school programs; podcasts; and community-focused websites. The new chair of DNP is prioritizing communication and outreach for FY 2025. DNP will work with the community to establish a virtual national outreach and education center for nuclear science.

DNP recommends continued investment in NSF Research Experiences for Undergraduates (REU), DOE Science Undergraduate Laboratory Internships (SULI), and Conference Experience for Undergraduates (CEU). The CEU program has been very successful, with a high percentage of participating students continuing to graduate school in nuclear physics or other science, technology, engineering, and mathematics (STEM) disciplines.

Another DNP recommendation is to raise compensation for graduate student researchers commensurate with the cost-of-living without contracting the workforce. This action is aimed towards universities which set stipend levels. Universities are demonstrating increased efforts to raise graduate student support across disciplines. Research support is important for contributing to STEM workforce development. DNP can collaborate with APS and the NP community in

advocacy efforts.

DNP suggests expanding policy and resources to ensure a safe and respectful environment. APS has resources for professional skills development and mentoring workshops for new faculty. DNP efforts include conference chair training, a DNP DEI committee, the DNP Allies Program, and organized workshops on community agreements. Within the last few years, SC conducted a survey of Codes of Conduct at user facilities. DNP will work with APS to help establish and maintain enforceable community agreements.

DNP proposes an emphasis on work-life balance. Work-life balance achieves a harmony between a person's career and personal life, involves the minimization of work-related stress and establishment of sustainable well-being, and reduces the chance of burnout. Work-life balance is important to attracting and retaining talent in the field. DNP can organize panel discussions to discuss work-life balance.

Discussion

Ilieva noted factors contributing to high levels of work-related stress include limited funding combined with competitiveness and asked if the DNP would conduct a long-term study culminating in practical strategies. **Gao** acknowledged work-life balance issues transcend many fields. A small task force could be created in collaboration with APS to investigate these issues and could begin with a limited study in collaboration with DNP.

Dodge inquired if APS could assist DNP with outreach activities. **Gao** said outreach is important, and APS has a video-based science communication program.

Tapia Takaki asked about DNP's plans for the virtual national outreach and education center for nuclear science. **Gao** noted the DNP Chair is in conversation with the DOE national laboratories and APS to create professional videos for distribution. DNP is considering NuclearScienceFuture.org as a potential hub for resources and outreach. **Dodge** noted the website can be a good repository for information.

Supporting the Workforce Proposals in the LRP; DOE, Sharon Stephenson, DOE SC, Physics Research Division, Director

Stephenson presented on how DOE is responding to nine 'Suite of Actions' drawn from LRP Section 8.8.

The first action is for a center where scientists, universities, and laboratories could share resources and best practices. Importantly, the annual FAIR and RENEW FOAs include allowable cost language supporting the professional development, training, and mentoring of students and junior researchers. DOE is open to proposals for such a center.

The second action is for continued investment in, and refinement of, NSF CEU and RENEW. NP-RENEW and NP-FAIR budgets increased to $20M and $6M, respectively, from the FY 2024 Enacted Budget to the FY 2025 Budget Request.

The third action calls to raise graduate researcher compensation. The annual open, FAIR and RENEW FOAs suggest a reasonable living wage for graduate students. This effort has initiated conversations at various universities about how to implement living wages. Fully realizing living wages requires the combined efforts of individual principal investigators (PIs), graduate programs, departments, universities, and agencies. DOE cannot mandate living wages but instead must work with higher education institutions.

The fourth action recommends expanded policy and resources to ensure a safe and respectful environment. The CHIPS and Science Act mandates OSTP to establish an interagency working group coordinating federal research agency efforts to reduce sexual harassment and

develop uniform guidelines.

The fifth action states funding agency policies on medical and family leave should be formalized and clearly communicated. The annual open FOAs include language about supplemental funding for family and medical leave issues, and the Early Career FOA discusses extensions that can be given for family and medical leave.

The sixth action recommends supporting appropriate skills development in workshops and targeted sessions at conferences to effectively cultivate an inclusive environment. DOE can provide funding for efforts proposed on this topic via the annual open FAIR and RENEW FOAs.

The seventh action is for national laboratories to implement a community agreement or code of conduct. The SC Office of Scientific Workforce Diversity, Equity, and Inclusion is devoted to supporting DEI efforts at the DOE national laboratories.

The eighth action calls for federal agencies to consider differing service and teaching burdens when structuring proposal peer review and panel training. This is an area of opportunity SC is actively discussing in various working groups.

The ninth action calls for allocating administrative support funds to reduce service load incurred by researchers who are awarded grants focusing on research and retention activities. MSIs do not usually have a competitive grants office, so this request is important for addressing inequities. To this end, the annual open FAIR and RENEW FOAs designate support for administrative personnel and compensating faculty time as allowable costs.

Since NP represents about 10% of SC's budget, there is an opportunity to leverage all other SC programs at a 10% level. NP currently supports researchers in twelve EPSCoR states. SC would like to expand to all twenty-five EPSCoR states and represent all fifty states. The Office of Workforce Development for Teachers and Scientists (WDTS) Visiting Faculty Program (VFP) is an opportunity currently underutilized by NP faculty. The SC Graduate Student Research (SCGSR) Program funds graduate student opportunities at national laboratories, and NP participation constitutes a 10% average of the program. SULI is a competitive program which has exhibited a trend of 6% of awards allocated to NP. WDTS Community College Internships (CCI) is an untapped resource for NP, which currently represents about 5% of CCIs awarded.

Discussion

Ilieva asked about the success rates of the NP students applying to SULI and SCGSR. **Stephenson** answered WDTS keeps exceptional records of success rate data, and the SCGSR program has a very high success rate for NP students. Applications from NP students demonstrate the results of mentorship.

Chipps inquired if RENEW and FAIR policies could be adjusted to allow for R1 universities or DOE national laboratories to leverage their administrative resources by leading the proposal while the partner MSIs or EPSCoR schools receive the majority of the funding. **Stephenson** said changes to FOA language can be requested and mentioned there are other avenues for universities to garner shared resources. In preparing proposals, NP could support a grants officer helping universities with their proposals.

DeSouza commented that DOE historically supported the National Nuclear Chemistry Summer School (NNCSS). This successful program has helped the nuclear science pipeline.

Howell asked if the CCI program is FOA- or grant-supplement driven. **Stephenson** explained WDTS manages the CCI program. WTDS programs have extensive online resources and information sessions to help students apply.

Tapia Takaki inquired about accessibility of information regarding core NP research activities and community members. **Stephenson** replied that NP must proactively address challenge areas such as public perception to effectively reach the Missing Millions. **Dodge** recalled how NASA serves as the outreach center for astrophysics. **Lopez** suggested NP community members can engage in self-directed outreach, such as podcasting. **Scarlett** invited DOE to consider attending and presenting at National Society of Black Physicists, APS Forum on Diversity and Inclusion, and National Society of Hispanic Physicist events. **Stephenson** noted SC is increasing engagement.

Supporting the Workforce; NSF, Souleymane Diallo, NSF, DMR, Program Director

Diallo presented the commitments of NSF and MPS to broadening participation in STEM through DEI efforts and investment priorities, as outlined in the 2022-2026 NSF Strategic Plan. These efforts include preparing a diverse and global workforce, integrating research with education, broadening participation from underrepresented groups and diverse institutions across geographical regions and improving processes to recruit highly qualified reviews and panelists that reflect the nation's diversity.

NSF has Focused Programs, which explicitly broaden participation; Emphasis Programs, which emphasizes broadening participation among other goals; and the Geographic Diversity program of EPSCoR. NSF funding for MSIs and EPSCoR has steadily increased over the last decade, and funding for Focused Programs has rapidly increased since 2019.

NSF supports a diverse future STEM workforce via the REU program and Research Opportunity Awards (ROA). The ROA program supports faculty at primarily undergraduate institutions (PUI) to work as visiting scientists at research-intensive organizations where they collaborate with NSF-supported investigators.

The Growing Research Assess for Nationally Transformative Equity and Diversity (GRANTED) initiative supports innovative strategies to address challenges and inequities within administrative research support and STEM training infrastructure, particularly MSIs and EIRs. Recent GRANTED investments consist of a $20M investment across eight institutions, $9.2M in research infrastructure awards to support 16 MSIs, and $2M for conferences and workshops at MRIs and ERIs.

MPS efforts to educate the future advanced high-technology workforce involves investing in people throughout the STEM pathway via division-specific, MPS-wide, NSF-wide, partnership activities. A variety of available programs address specific needs at the high school-, undergraduate-, graduate-, postdoctoral-, early career faculty-, and established faculty-levels.

The five MPS divisional Partnerships for Research and Education programs fund MSIs and connect them with MPS-supported facilities to increase research capacity and enable students to explore cutting-edge science.

Three MPS-wide funding opportunities are available for Early Career Researchers, with an emphasis on broadening participation by members from underrepresented groups. The LEAPS-MPS program for pre-tenured faculty has successfully distributed ~168 awards. MPS-ASCEND has distributed ~93 awards. The MPS-AFCA represents a strategic investment to maximize impact by providing additional funding opportunities for MPS-ASCEND fellows.

Support is growing for the MPS Alliance for Graduate Education and the Professoriate (AGEP) Graduate Research Fellows program, which is designed to promote increased representation and enables support of one additional Ph.D.-student per award.

NSF's National Facilities and Instrumentation (NaFI) portfolio provides specialized instrumentation and unique research capabilities to the broad research community, with an

emphasis on training the next generation workforce. Examples of facilities in the portfolio include the National High Magnetic Field Laboratory (NHMFL), the Center for High Energy X-ray Sciences (CHEXS), the Materials Innovation Platform (MIP), and the Center for High Resolution Neutron Scattering (CHRNS), among others.

Discussion

Ilieva asked how much demand can be supported by the Re-entry to Active Research Program (RARE) program for established faculty. **Diallo** shared a website[1] for browsing the history of funded awards.

[1]https://www.nsf.gov/awardsearch/advancedSearchResult?ProgEleCode=076Y00%2C140100%2C140300

Ilieva inquired if NSF plans to specifically engage with economically disadvantaged communities. **Diallo** mentioned NSF's Scholarships in STEM (S-STEM) program for low-income students. Additionally, there are correlations between economically disadvantaged students and institutions NSF targets. NSF is in the process of assessing these programs and may change their engagement strategy accordingly.

Tapia Takaki asked about AFCA, noting it may be prudent for NSF to encourage universities to offer post-doctoral researchers' tenure-track positions. **Diallo** said AFCA succeeds Ascend, and the burden is on the post-doctoral researchers to secure faculty positions before being invited to submit a full award proposal.

Howell asked if NSF is considering a similar program to AFCA-eligible to candidates who have not gone through the Ascend program, such as new faculty members. **Diallo** replied not at this time. The AFCA program is specific to supporting the success of Ascend fellows.

Public Comment

Zohreh Davoudi (Associate Professor, University of Maryland) asked about DOE and NSF plans to expand equitable professional development opportunities for families, particularly female researchers with small children. **Stephenson** noted there is already language about family support, and the support can be requested as a supplemental. **Diallo** added NSF allows requests for supplemental funding for a substitute to manage laboratory work due to a scientist caring for a dependent. **Opper** said the NSF Proposal & Award Policies & Procedures Guide (PAPPG) states proposals requesting conference support may include a description of plans to identify resources for childcare and family care. **Tommy O'Donnell** (Associate Professor, Virginia Tech) added DOE FOAs include dependent care costs due to travel as allowable.

Ron Soltz (Science & Technology Deputy Division Leader, Lawrence Livermore National Laboratory) asked why the FY 2025 Budget Request is significantly below the CHIPS and Science Act authorization and how the community can increase the request. **Horton** stated the budget request is a complicated process of balancing resources. A request from SC is sent to DOE leadership. The FY 2024 Enacted Budget was well balanced across priorities considered. **Dodge** said external factors impact the NP Budget Request.

Paul Souder (Professor, Syracuse University) lamented that five of the seven projects discussed in the Report on Nuclear Physics Facilities for the next decade are rated (b). SoLID could be graded (a) as it is absolutely central as highlighted in LRP Recommendations 1 and 4. **Dodge** said the report attempts to explain the importance of SoLID's physics while also respecting the ordering in the LRP for assigning science ratings.

Dodge *adjourned the meeting at 4:52 p.m. ET.*

The minutes of the U.S. Department of Energy and the National Science Foundation/Nuclear Science Advisory Committee meeting, held on April 26, 2024, via hybrid are certified to be an accurate representation of what occurred.

Gail E Dodge

Gail Dodge
NSAC Chair
Date: Aug 4, 2024