



U.S. DEPARTMENT OF  
**ENERGY**

Office of  
Science

# **Basic Energy Sciences Update:**

## **Organization, FY 2023 and FY 2024 Updates**

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Basic Energy Sciences Advisory Committee Meeting

April 25, 2023

Linda Horton, Gail McLean, and Andy Schwartz

Office of Basic Energy Sciences

# Topics for Today's Update

- ▶ Organization and Staffing
- ▶ FY 2023 budget, FOAs, etc.
- ▶ FY 2024 Request
- ▶ Strategic planning and outreach...
- ▶ Nanoscale Science Research Centers -- History

**New Staff**  
**Posted Positions**  
**Vacancies**

**Office of Basic Energy Sciences**  
**Associate Director**  
**Linda Horton**

**BES Budget and Planning**  
 Kara Beles, Financial Management  
 Donetta Herbert, Financial Management  
 Adam Kinney, Senior Technical Advisor  
 (Vacant, Senior Technical Advisor)

**BES Operations**  
 Teresa Crockett, Program Analyst  
 Robin Hayes, Program Manager and Acting EFRC Co-Lead  
 Kerry Hochberger, Program Analyst / BESAC\*  
 (Vacant, Senior Technical Advisor)  
 (Vacant, Program Support Specialist)

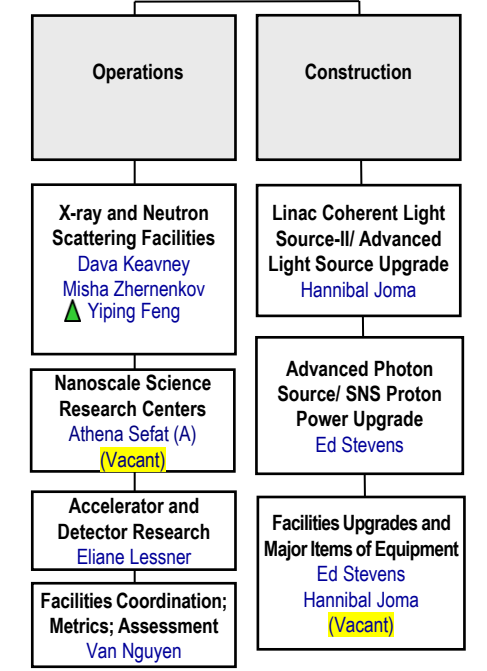
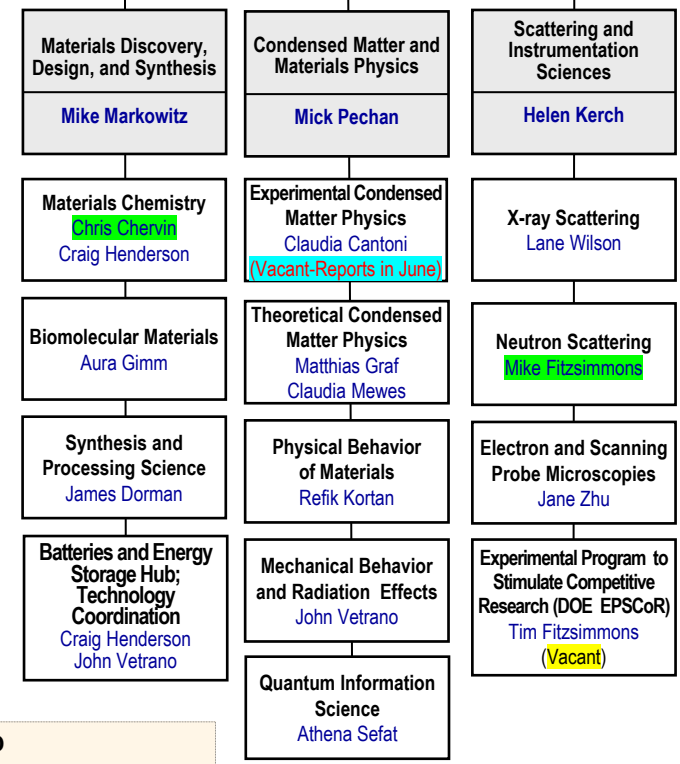
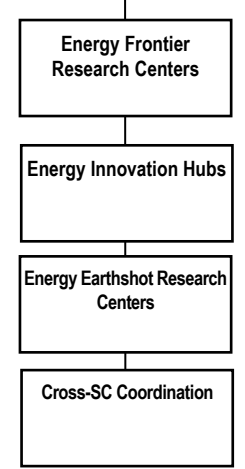
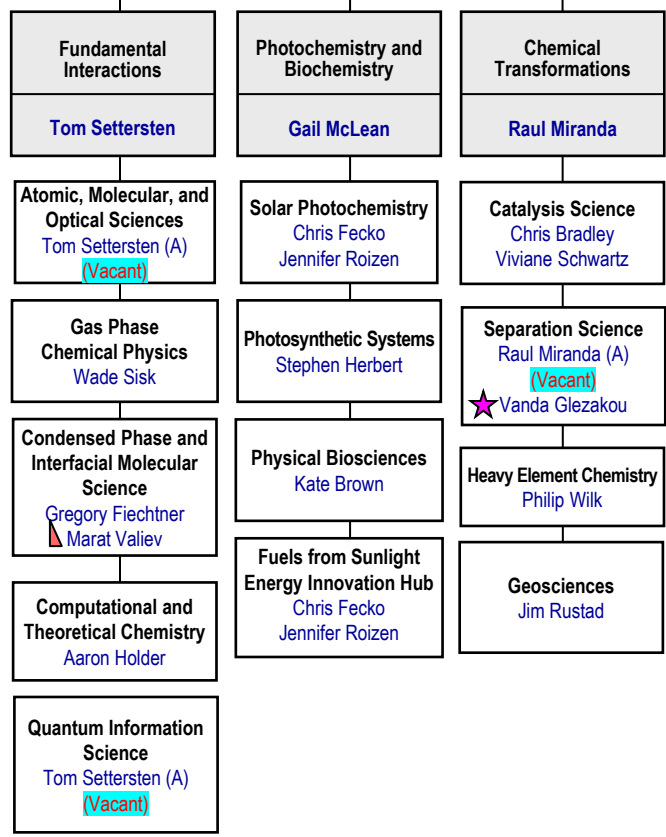
\* Basic Energy Sciences Advisory Committee

**Chemical Sciences, Geosciences, and Biosciences Division**  
**Gail McLean, Acting Director**  
 Gregory Fiechtner, EFRC Team Co-Lead (A)  
 (Vacant)

**Collaborative Research Division**  
**Andy Schwartz, Acting Director**

**Materials Sciences and Engineering Division**  
**Andy Schwartz, Director**  
 John Vetrano, EFRC Team Co-Lead (A)  
 Shawn Chen, AAAS Fellow  
 (Vacant)

**Scientific User Facilities Division**  
**Linda Horton, Acting Director**  
 Rocío Meneses, Program Support Specialist



**LEGEND**

▲ IPA from SLAC

★ Detailee (50%) from ORNL

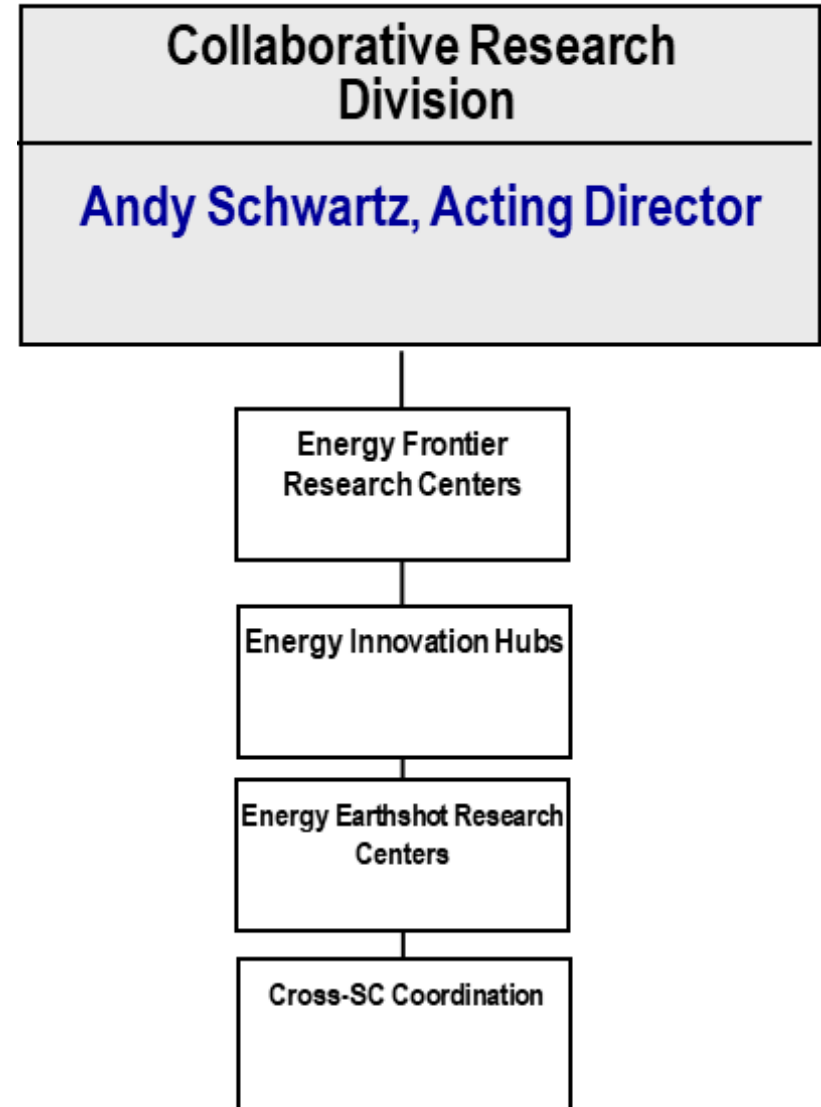
(A) Acting

▲ Detailee (50%) from PNNL

**April 2023**

# SC Realignment added a New BES Research Division

- ▶ Will become the primary organizational home for team research modalities
  - ❖ EFRCs, EERCs, Hubs, etc.
- ▶ Will provide BES leadership for cross-Office of Science activities
  - ❖ Funding opportunities that cross SC Offices
- ▶ Details on overall programmatic scope and staffing plans are underway



# Position Posted – CSGB Division Director! (1/2)

- ▶ <https://www.usajobs.gov/job/720299500>; Open until May 21
- ▶ Open to U.S. Citizens
- ▶ Career position in the Senior Executive Service
- ▶ The Department of Energy's (DOE) Office of Science - Headquarters is looking for a dynamic, innovative, seasoned executive to lead the Office of Chemical Sciences, Geosciences, and Biosciences (CSGB) Division in the Office of Basic Energy Sciences (BES), Office of Science (SC), Department of Energy (DOE).
- ▶ Provide leadership and direction in establishing vision, strategic plans, goals, and objectives for the research activities supported.
- ▶ Plan, develop, and implements vital, productive, forefront research programs conducted in DOE laboratories, universities, and other public and private institutions.
- ▶ Assure adequate financing for the activities in the area of responsibility, set priorities for activities, and apportion available funding among them. Manage the budget in accordance with prescribes practices set forth by the organization and the DOE.

# Position Posted – CSGB Division Director! (2/2)

- ▶ Review and make final approvals on staff recommendations concerning research agreements and individual proposals for research projects.
- ▶ Implement rigorous merit evaluation using independent peer review for all new and ongoing activities supported in accordance with the requirements identified in the Code of Federal Regulations for the grant program and published guidelines for the DOE laboratory programs and facilities.
- ▶ Advise and assist the head of the office in the formulations and management of new programs and policies. Respond to policy questions, resolve management problems, and keep the head of the organization informed of the progress and prospects of activities in the area of responsibility.
- ▶ Maintain strong, collegial relations with other programs within the office, the organization, DOE field offices, DOE laboratories, academic and other institutions both domestic and foreign, and the broad scientific community. Also maintain strong, collegial relations with the DOE technology offices and assess the relevance of research activities to the missions of the DOE as well as the broad national energy agenda. Coordinate research activities with those of other Federal agencies that play roles in the support of chemical, geological, and biological sciences.
- ▶ Represent the division, the office, the organization, and the DOE in matters pertaining to the portfolio of the division to professional societies, coordinating committees, task forces, and various other entities, including national entities.

# New Staff Member – Senior Technical Advisor



## **Dr. Adam Kinney**

Senior Technical Advisor  
Basic Energy Sciences

### **Expertise**

- ▶ Science policy, especially support for SC scientific priorities
- ▶ Advanced electron paramagnetic resonance measurement techniques
- ▶ Chemistries for the catalytic reaction intermediates for solar hydrogen and ammonia production

### **Experience**

- ▶ Scientific and Technical Advisor, Office of Science (including Deputy and Acting Chief of Staff and Acting Director, Office of Strategic Planning and Interagency Coordination)
- ▶ Technical Coordinator, National Coordination Office for the Networking & IT Research & Development (NITRD) Program
- ▶ AAAS Science & Technology Policy Fellow, DOE, Office of Science, Office of the Director
- ▶ Postdoctoral Researcher, Center for Nanoscale Science and Technology, National Institute of Standards and Technology
- ▶ Ph.D., Chemistry, Northwestern University

# New Staff Member – Materials Chemistry



## **Dr. Christopher Chervin**

Program Manager, Materials Chemistry  
Materials Sciences and Engineering Division

### **Expertise**

- ▶ Nanostructured materials and electrode architectures
- ▶ Energy storage, including rechargeable aqueous batteries, oxygen electrocatalysis, solid oxide fuel cells, and pseudocapacitive metal oxides
- ▶ Synthesis of multi-atomic aerogel and xerogel oxides, including perovskites, fluorites, and spinels

### **Experience**

- ▶ Research Chemist and senior Staff Scientist, Naval Research Laboratory
- ▶ NRC Postdoctoral Fellowship, Naval Research Laboratory
- ▶ Graduate Research Fellowship, Lawrence Livermore National Laboratory
- ▶ Ph.D., Inorganic Chemistry, University of California at Davis



# New Staff Member – Neutron Scattering



## **Dr. Michael Fitzsimmons**

Program Manager, Neutron Scattering  
Materials Sciences and Engineering Division

### **Expertise**

- ▶ Innovator of neutron scattering tools and techniques
- ▶ Quantum materials, including interface magnetism of thin film heterostructures
- ▶ Novel technique to observe turbulent flow in cryogenic Helium, with goal of studying vortices in quantum matter

### **Experience**

- ▶ Distinguished R&D Staff Member and Group Leader, ORNL Neutron Science Directorate
- ▶ Joint faculty appointment, Univ. of Tennessee Physics Department
- ▶ Member of the Technical Staff, Los Alamos Neutron Science Center (LANSCE)
- ▶ 2019 President of the Materials Research Society
- ▶ Fellow of American Physical Society and Neutron Scattering Society of America
- ▶ Ph.D., Materials Science and Engineering, Cornell University

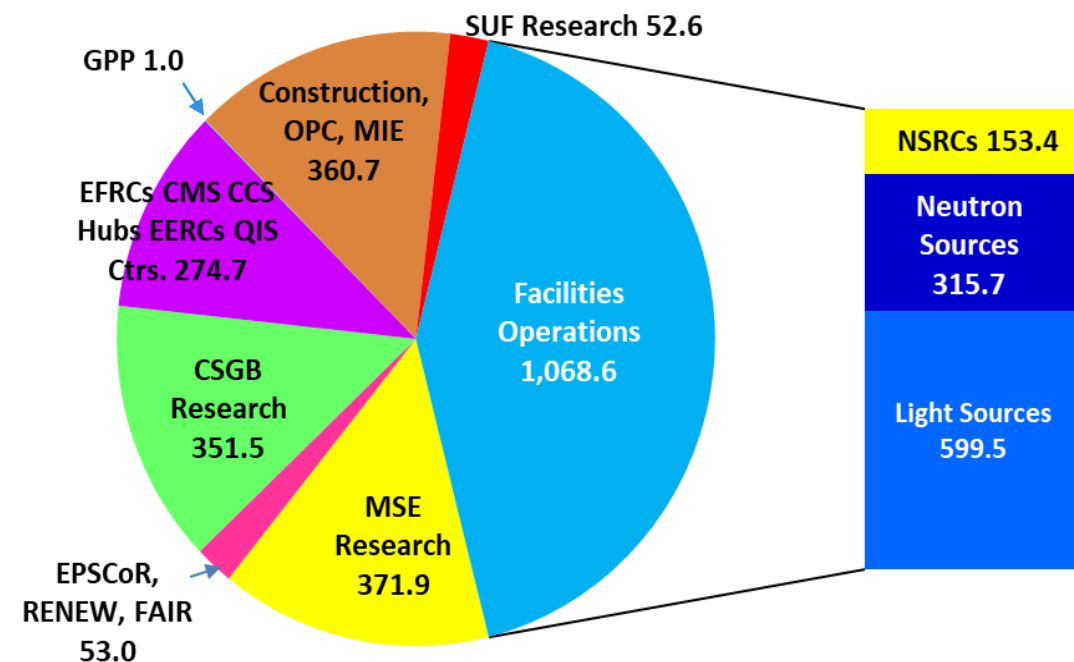
# FY 2023 Enacted: \$2.534B (+\$226M; 9.8% above FY 2022 Enacted)

## Research programs $\Delta = +\$103.6M$

- ▶ Research (\$777.4M, +\$77.7M) includes new and expanded investments in research for Manufacturing, Advanced Computing, AI/ML, FAIR, Accelerate, SC Energy Earthshots, and RENEW
  - ❖ EPSCoR continues (\$25M)
- ▶ Computational Materials and Chemical Sciences, Energy Innovation Hubs, and National QIS Research Centers continue (~\$119M)
- ▶ Energy Frontier Research Centers continue (~\$130M)
- ▶ **Energy Earthshot Research Centers initiated (+\$25M)**

## Scientific user facilities $\Delta = +\$110.2M$

- ▶ **Operations of 12 facilities continue at ~100% of rebaselined budget levels (\$1,068.6M)**
- ▶ Facilities research increases for AI/ML, BRaVE, and accelerator R&D (\$54.6M)



## Construction/MIE\* $\Delta = +\$12.2M$

- ▶ APS-U (\$9.2M); LCLS-II-HE (\$94M); ALS-U (\$135M); PPU (\$17M); STS (\$37M); CRMF (\$10M); **HFIR-PVR (\$2M)**; **NEXT-III (\$1.5M)**
- ▶ MIEs: NSRC Recap (\$25M); NEXT-II (\$25M)

\*includes OPC

# User Facility Operations

- ▶ All BES facilities provided rebaselined operations funding requests that include:
  - ❖ Impacts from inflation and supply chain issues
  - ❖ Staffing for hybrid in-person/remote operations
  - ❖ Bringing upgrades and new capabilities on-line for users
  - ❖ Required maintenance activities
- ▶ New baselines were established through an open process that involved all similar facilities for a “reality” check
  - ❖ Oversight by the Office of Science
  - ❖ Ongoing assessments through facility reviews



# BES User Facilities: Over 15,000 Users from Across the Nation and the World



# Facility Highlights...

- ▶ Stanford Synchrotron Radiation Lightsource (SSRL) celebrated it's 50<sup>th</sup> anniversary!
- ▶ Last week, the Advanced Photon Source entered dark time for installation of the new accelerator
- ▶ The Linac Coherent Light Source (LCLS) and SSRL are recovering from a site-wide power outage that resulted in unexpected downtime. Progress towards restart and completion of LCLS-II upgrade project!
- ▶ High Flux Isotope Reactor restart delayed due to a vacuum leak in the cold source and safety analysis documentation. On track to deliver planned user hours in FY 2023!





# BES FY 2022 RENEW – Five Awards announced in December

Total Funding: \$11.25M for three years; **Five new institutions** for BES support

## ▶ **Controlling Additive Manufacturing Properties of Surfaces (CAMPS)**

- ❖ Navajo Technical University (MSI Type: TCU; ANNH); Lab-Partner: LBNL
- ❖ Goal: Control the effect of reactive gasses on formation of additively manufactured materials for clean energy applications, and training & mentorship tailored for Native American students.

## ▶ **Hydrogen Innovation: Preparing and Obtaining a Workforce in Energy Research (HI POWER)**

- ❖ Florida A&M University; (MSI Type: HBCU); Lab-Partner: Ames
- ❖ Goal: Study the impact of prolonged hydrogen exposure on structural materials performance, design hydrogen-tolerant alloys for the nation's hydrogen storage needs, and training & mentorship tailored for African American students.

## ▶ **Controlling Reaction Pathways under the Non-ideal Conditions of Seawater Electrolysis**

- ❖ University of Guam (MSI Type: ANNH, AANAPISI); Lab-Partner: PNNL
- ❖ Goal: Control the influence of organic matter on the electrochemistry of water splitting by controlling the complex electrode/liquid interface, and training & mentorship tailored for Micronesian and Filipino students.

## ▶ **Nanopore Characterization for Geologic Storage of H<sub>2</sub> and CO<sub>2</sub>**

- ❖ California State University Bakersfield (MSI Type: HSI); Lab-Partner: LBNL
- ❖ Goal: Study of caprock nanopores for long term hydrogen and carbon dioxide capture and clean energy storage, and training & mentorship tailored for Hispanic students.

## ▶ **Partnership to Increase Representation in Energy Research in Puerto Rico (PIRES-PR)**

- ❖ Universidad Ana G Mendez - Gurabo Campus in Puerto Rico (MSI Type: HSI); Lab-Partner: NREL
- ❖ Goal: Study earth-abundant electrocatalysts for oxygen reduction for carbon-neutral hydrogen technologies, and training & mentorship tailored for Puerto Rican students.

# Accelerate Initiative RFI (Q1, FY 2023) drew >50 responses

- ▶ Request for Information requested input on:
  - ❖ Challenges and opportunities associated with transitioning new discoveries to high-value technologies to drive the economy of the future
  - ❖ Identifying approaches that can accelerate the process from scientific discovery to sustainable production of new technologies across the innovation continuum
  - ❖ Opportunities for ensuring a robust workforce for future industries
- ▶ Wide spectrum of responses from national laboratories, businesses (large and small), universities, non-profits, consortia, individuals, and professional societies
- ▶ Frequently mentioned topics include:
  - ❖ Better data, reliable management, availability
  - ❖ Stakeholder involvement from the outset
  - ❖ Holistic, systems approach that considers wide range of potential issues that could impair commercialization (e.g., cost, sustainability, manufacturability, supply chain)
  - ❖ Improved communication of technologies being developed to all sizes of companies
- ▶ Informed FY 2023 Lab Call

# BES Continues to Support Research on Discovery and Use-Inspired Science

- ▶ **Annual Open Solicitation:** Supports grants for research in the topical areas supported by the Office of Science. **Accepts applications continuously**
- ▶ **Annual Early Career FOA:** Supports the development of individual research programs for outstanding scientists early in their careers in areas supported by the Office of Science; all BES core research areas and facilities operations
- ▶ **Accelerate:** New in FY 2023, supports research to accelerate the transition of science advances to technologies, enhances the science foundation for the bridge across the “valley of death” between basic and applied research
- ▶ **Annual SBIR/STTR FOA:** Topics support research that is ready for commercialization, including topics related to accelerators, detectors, and nanoscale instrumentation
- ▶ **FAIR FOA:** Funding for Accelerated, Inclusive Research on topics that cross the Office of Science, supports research at non-R1 minority serving institutions (MSIs) and emerging research institutions, including partnering with DOE National Laboratories and facilities and R1 MSIs
- ▶ **RENEW FOA:** Doubling the FY 2022 investment, the SC-wide Reaching a New Energy Science Workforce initiative leverages SC’s world-unique National Laboratories and user facilities to provide internships for students at academic institutions currently under-represented in the research portfolio
- ▶ **EPSCoR FOA:** Funding for U.S. states and territories that do not have large federally-supported academic research programs. FY 2023 focused on larger-team implementation awards that facilitate development of research infrastructure in the EPSCoR jurisdictions



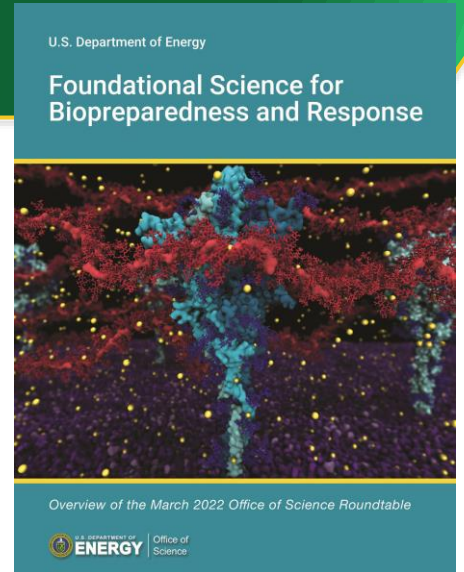
# User Facility Specific FOAs in FY 2023

## ▶ **Biopreparedness Research Virtual Environment**

**(BRaVE):** National Laboratory Funding Announcement – will support development of critical analytical capabilities foundational to responses for future emergencies, focusing on advanced analytics and capabilities for understanding host-pathogen dynamics, molecular interactions at bio-scales, epidemiological models, **materials science for bio-protection and sensing, and advanced user facility instrumentation.** Builds on Report on “Foundational Science for Biopreparedness and Response.” (Supported by ASCR, BES, and BER)

## ▶ **Advanced Scientific Computing Research for DOE User Facilities:**



National Laboratory Funding Announcement – will support development of advanced algorithms and software stacks for new and emerging techniques at DOE light and neutron user facilities to enable on-the-fly data analysis and autonomous experimentation. (**Preproposals due on May 17**; Supported by ASCR and BES)



# SC Energy Earthshots Initiative

- ▶ Addresses key research challenges at the interface between basic research and applied R&D to realize DOE Energy Earthshots stretch goals.
- ▶ BES, ASCR, and BER issued an FY 2023 lab announcement for Energy Earthshot Research Centers (EERCs).
  - ❖ Modeled on EFRCs, EERCs will support large multi-investigator, multi-disciplinary, and multi-institution (academic, national laboratory, industrial) teams to advance foundational knowledge and enabling capabilities in experimental & computational chemical/materials sciences to address Earthshot goals.
  - ❖ Closely coordinated with the Energy Technology Offices and existing research consortia/demonstration projects, to establish teams that span the R&D continuum and accelerate both science and technologies—providing a strong bridge between BES and technology research.
- ▶ EERCs are complemented with foundational science, small group awards.
  - ❖ Focus on use-inspired fundamental research to address knowledge gaps that limit achievement of the Energy Earthshot goals.

**Enhanced Geothermal Shot**





90% Reduction 2035

**Floating Offshore Wind Shot**



>70% Reduction 2035

**Industrial Heat Shot**




85% Reduction 2035

**Hydrogen Shot**



1 Dollar 1 Kilogram 1 Decade

**Long Duration Storage Shot**






Reduce storage costs by 90%\*...  
\*from a 2020 Li-Ion baseline

...in storage systems That deliver 10+ hours of duration

...in 1 decade

**Carbon Negative Shot**



<100 Dollars 1 Ton 1 Decade

<https://www.energy.gov/policy/energy-earthshots-initiative>

# FOA: Science Foundations for Energy Earthshots

- ▶ **Overview:** Team projects to provide scientific foundations DOE Energy Earthshots' goals and address key research challenges at the interface between SC-supported fundamental research and applied R&D supported by DOE technology offices
  - ❖ Emphasis on cross-cutting topics relevant to multiple Energy Earthshots
  - ❖ Lead institution must be a university, but collaboration with National Laboratory and/or industrial team partners encouraged
- ▶ **FOA Issued:** 03/21/2023
- ▶ **Estimated Funding:** Subject to availability of funds, a total of up to \$150 million in current and future fiscal year funds. Support from three SC programs: ASCR, BER, BES
- ▶ **Award size and duration:** \$500K/year to \$2M/year; 3-year awards
- ▶ **Pre-application due date:** 04/25/2023 (Pre-applications required; limit of three per lead institution)
- ▶ **Application due date:** 06/21/2023
- ▶ **Energy Earthshots Initiative:** <https://www.energy.gov/policy/energy-earthshots-initiative>
- ▶ **FOA:** [https://science.osti.gov/bes/-/media/grants/pdf/foas/2023/SC\\_FOA\\_0003003.pdf](https://science.osti.gov/bes/-/media/grants/pdf/foas/2023/SC_FOA_0003003.pdf)

# FY 2023 Batteries and Energy Storage Hub FOA

- ▶ On January 26, 2023, BES issued a Funding Opportunity Announcement to openly recomplete the Batteries and Energy Storage Hub program
  - ❖ Hub-scale projects provide scientific foundations for next-generation energy storage
  - ❖ Supports both grid and mobile electrochemical energy storage
  - ❖ Collaboration among National Laboratory, academic, and/or industrial team partners
- ▶ Key elements of the FOA
  - ❖ Pre-applications were due by April 3; encouraged full applications due by May 18
  - ❖ Subject to appropriations, a total of \$125M in current and future fiscal year funds
  - ❖ DOE anticipates that award sizes will range from an average of \$8M - \$15M/year; up to three 5-year awards expected
- ▶ Program Coordination
  - ❖ Coordination across DOE through the Joint Strategy Team for Batteries, including federal program managers for the Energy Storage Grand Challenge and the Long Duration Storage Shot

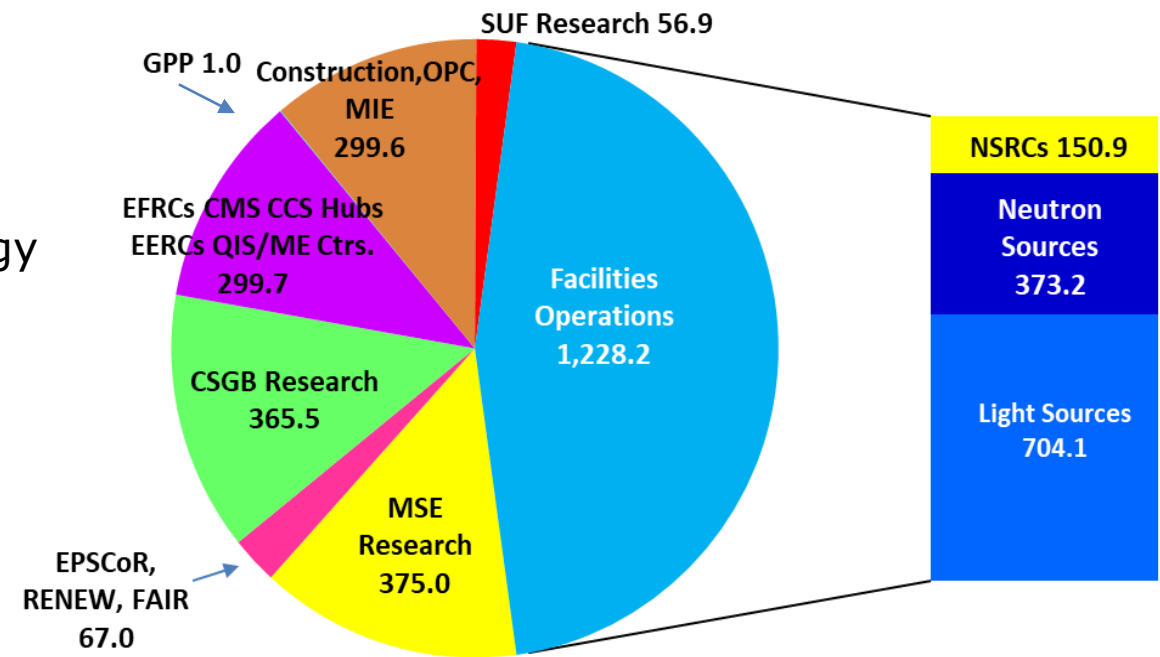
# FY 2024 Request: \$2,693M (+\$159M or 6.3% above FY 2023 Enacted)

## Research programs $\Delta = +\$56.0M$

- ▶ Continued investments in research for clean energy, manufacturing, microelectronics, critical materials and minerals, BRaVE, and RENEW (+\$12M)
- ▶ Computational Materials and Chemical Sciences, Energy Innovation Hubs, and National QIS Research Centers continue (\$119.7M)
- ▶ **Establish Microelectronics Science Research Centers (+\$25M)**
- ▶ Energy Frontier Research Centers continue (\$130M)
- ▶ Expanded investments in SC Energy Earthshots initiative (+\$35M)

## Scientific user facilities $\Delta = +\$165.9M$

- ▶ Operations of 12 facilities supported at ~90% of funding required for re-baselined, normal operations (\$1,228.2M)
- ▶ Facilities research (\$56.9M, +\$7M): Accelerator & Detectors; AI/ML; BRaVE; RENEW



## Construction/MIE\* $\Delta = -\$63.1M$

- ▶ LCLS-II-HE (\$120M); ALS-U (\$57.3M); PPU (\$15.8M); STS (\$52M); CRMF (\$10M)
- ▶ **New starts: HFIR Pressure Vessel Replacement (\$13M); NEXT-III (\$6.6M)**
- ▶ MIEs: NSRC Recap (\$5M); NEXT-II (\$20M)

\*includes OPC



# Microelectronics Science Research Centers

FY 2024 Request: \$60M across SC (\$25M in BES)

- ▶ CHIPS and Science Act (Section 10731, Micro Act) authorizes DOE to establish a crosscutting program of RD&D in microelectronics relevant to DOE missions, including establishing up to four new SC **Microelectronics Science Research Centers** to perform mission-driven research to address foundational challenges in the design, development, characterization, prototyping, demonstration, and fabrication of microelectronics.
  - ❖ Complements existing SC microelectronics awards
- ▶ SC-wide Centers would focus on fundamental science and early-stage research, complementing the investments already made through the CHIPS Act, most relevantly:
  - ❖ Department of Commerce National Semiconductor Technology Center: Focused on later-stage prototyping and applied RD&D; requires external basic research for success
  - ❖ Department of Defense (DOD) Microelectronics Commons: Focused on capabilities required for DOD; unlikely to address most DOE mission areas
- ▶ Centers would leverage the broad infrastructure and expertise at the DOE National Labs as well as in academia and industry.



# Microelectronics Science Research Centers

## FY 2024 Request: \$60M across SC (\$25M in BES)

### ▶ Potential areas of emphasis include:

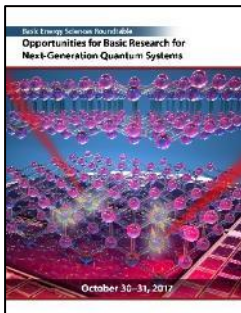
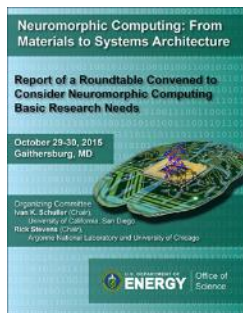
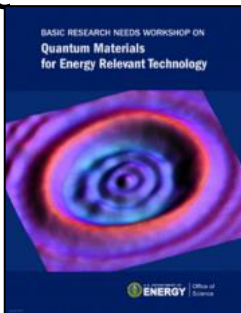
- ❖ Accelerated discovery and development of new microelectronics science and technology
  - ❖ Advanced experimental and computational capabilities, including materials science, chemistry, plasma science, artificial intelligence, and multiscale co-design
  - ❖ Innovative methods for circuits, architectures, systems, modeling, and synthesis
  - ❖ Sustainable and energy-efficient microelectronics devices, including logic, memory, and sensors/detectors
  - ❖ Testbeds for prototyping platforms for validation/verification of new concepts; Prototyping of novel devices to facilitate lab-to-fab transition
  - ❖ Development of advanced cybersecurity capabilities for computing architectures
- ▶ Upcoming – Panel on Fundamental Research and Facilities for Microelectronics



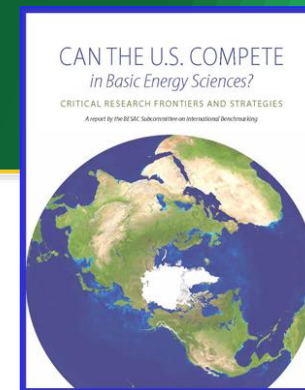
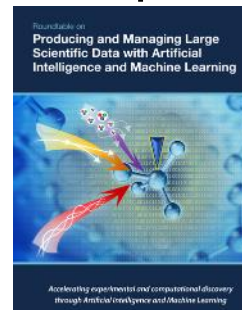
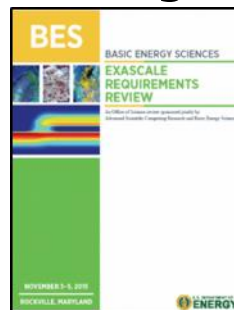
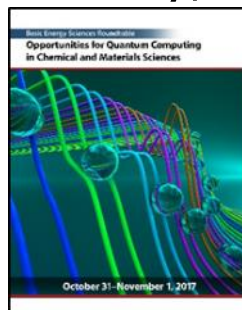


# Defining Research Priorities: Basic Research Needs Strategic Planning Workshops and Roundtables

## Quantum Science

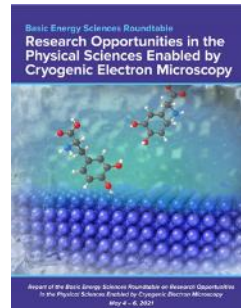


## Theory, Modeling & Computation

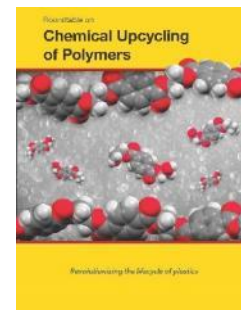


BES Advisory Committee: International Benchmarking

## Characterization

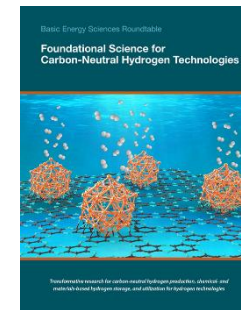
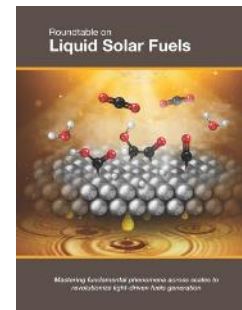
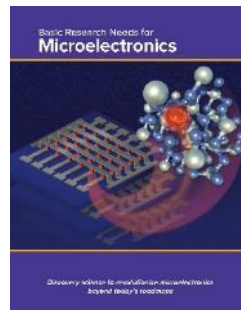
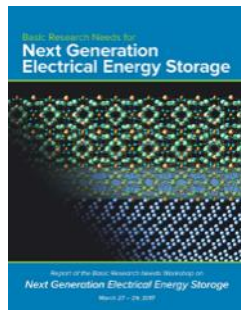
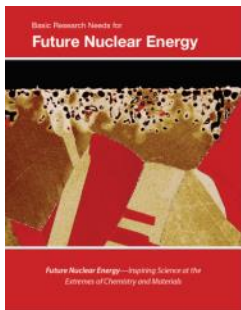
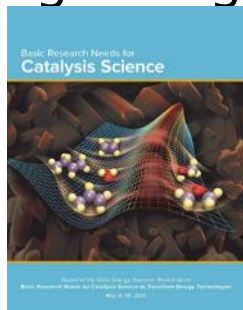
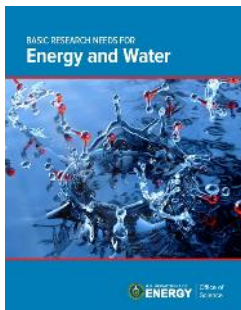


## Synthesis



SC Biopreparedness & Response

## Cross-Cutting Energy





# Launched BES User Facility Science Webinar Series To Celebrate and Communicate User Facility Impact

Public webinar series to enhance communication on BES User Facility science, highlighting contributions to national scientific priorities of Clean Energy, Microelectronics, Advanced Manufacturing, and Biopreparedness

**Kickoff Event: Friday, January 27, 2023**



**Dr. Asmeret Asefaw Berhe**  
Director, Office of Science  
Welcome Remarks



**Prof. Sossina Haile**  
Northwestern University  
Materials for batteries and  
hydrogen



**Prof. Leora  
Dresselhaus-Marais**  
Stanford University  
Low-emissions steel,  
additive  
manufacturing



**Dr. Yong Chu**  
Brookhaven National Lab,  
NSLS-II  
Nanoscale imaging in  
Microelectronics



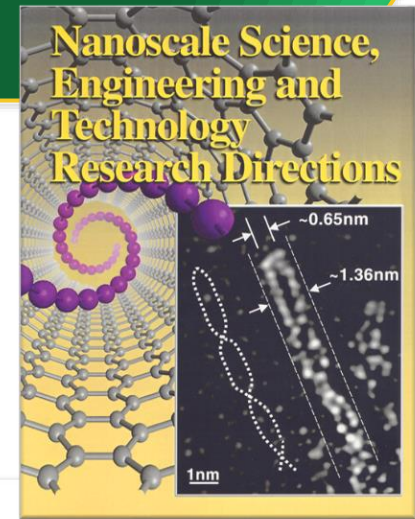
**Dr. Andrey Kovalevsky**  
Oak Ridge National Lab  
Antiviral compounds for  
COVID-19

# Future Topics for User Facility Webinars

- ▶ **World QIS Day** – April 14; included highlights of research on the Quantum Press (CFN, BNL) and x-ray facility research on quantum materials (SSRL, SLAC)
- ▶ **Microelectronics** – Capabilities for advanced lithography and fabrication, 2D and 3D imaging, and characterization of circuits *in situ* and *operando*
- ▶ **Clean Energy** – Facility research for energy storage, photovoltaics, biofuels, carbon capture, etc.
- ▶ **Bio-preparedness** – structural characterization for vaccines and therapeutics, materials for bio-protection, instrumentation and sensing
- ▶ **Advanced Manufacturing** – *in situ* and *operando* understanding of 3D printing and alternate low-carbon processes

# Nanoscale Science Research Center Vision

- ▶ 1999 Report: "Nanoscale Science, Engineering and Technology Research Directions"
  - ❖ "In order to increase the impact of major DOE facilities on the national nanoscience and technology initiative, it is proposed to establish several new Nanomaterials Research Centers."
- ▶ 2001: NSRC Vision (Dehmer, BESAC)
  - ❖ NSRCs will Advance science; Serve the scientific community; Enhance laboratory core competencies; Provide local and national coordination.
  - ❖ NSRCs will provide state-of-the-art nanofabrication and characterization facilities to in-house and visiting researchers and support research for fundamental understanding and control of materials at the nanoscale.



## Nanoscale Science Research Centers will:

- Advance science**
  - Advance fundamental understanding and control of materials at the nanoscale
  - Support investigators and groups working together on problems of a scope, complexity, and disciplinary breadth not possible working separately, with the whole being greater than the sum of the parts
- Serve the scientific community**
  - Provide state-of-the-art nanofabrication and characterization facilities to in-house and visiting researchers at no cost
  - Provide a mechanism for short- and long-term collaborations and partnerships among DOE laboratory, academic, and industrial researchers
  - Provide training for students in interdisciplinary nanoscale research in cooperation with regional or national academic institutions
- Enhance laboratory core competencies**
  - Advance the strategic vision and build on the core competencies of the host laboratory, particularly the BES user facilities and research programs already in place
  - Optimize the use of the BES national user facilities for materials characterization
  - Provide the foundation for the development of nanotechnologies important to DOE
- Provide local & national coordination**
  - Partner with state government and local institutions
  - Complement one another and other-agency centers (e.g., existing components of the NSF National Nanofabrication Users Network)





# Maturing Quintuplets

*Because the five BES NSRCs all will come of age within the next few years, it is important that we now set down a few common principles for these facilities.*



*The light sources and neutron sources have taught us that we need both consistency and individualism among our facilities. One of the purposes of this meeting is to talk about some areas where consistency will be important.*

BESAC, Dehmer  
02/2004



# Nanoscale Science Research Centers Then and Now: Over 15 Years Serving the Nation



**CINT at SNL/LANL**

Start yr. 2006

Users (FY22): 632 on-site; 274 remote



**CNMS at ORNL**

Start yr. 2006

Users (FY22): 509 on-site; 307 remote



**TMF at LBNL**

Start yr. 2006

Users (FY22): 645 on-site; 323 remote



**CNM at ANL**

Start yr. 2007

Users (FY22): 401 on-site; 355 remote

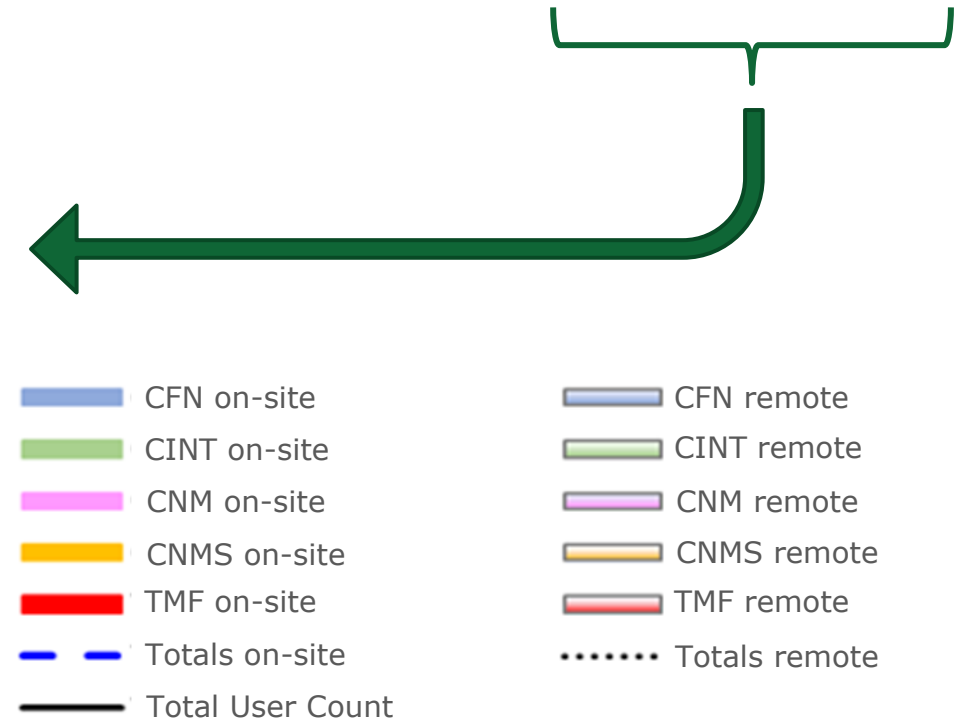
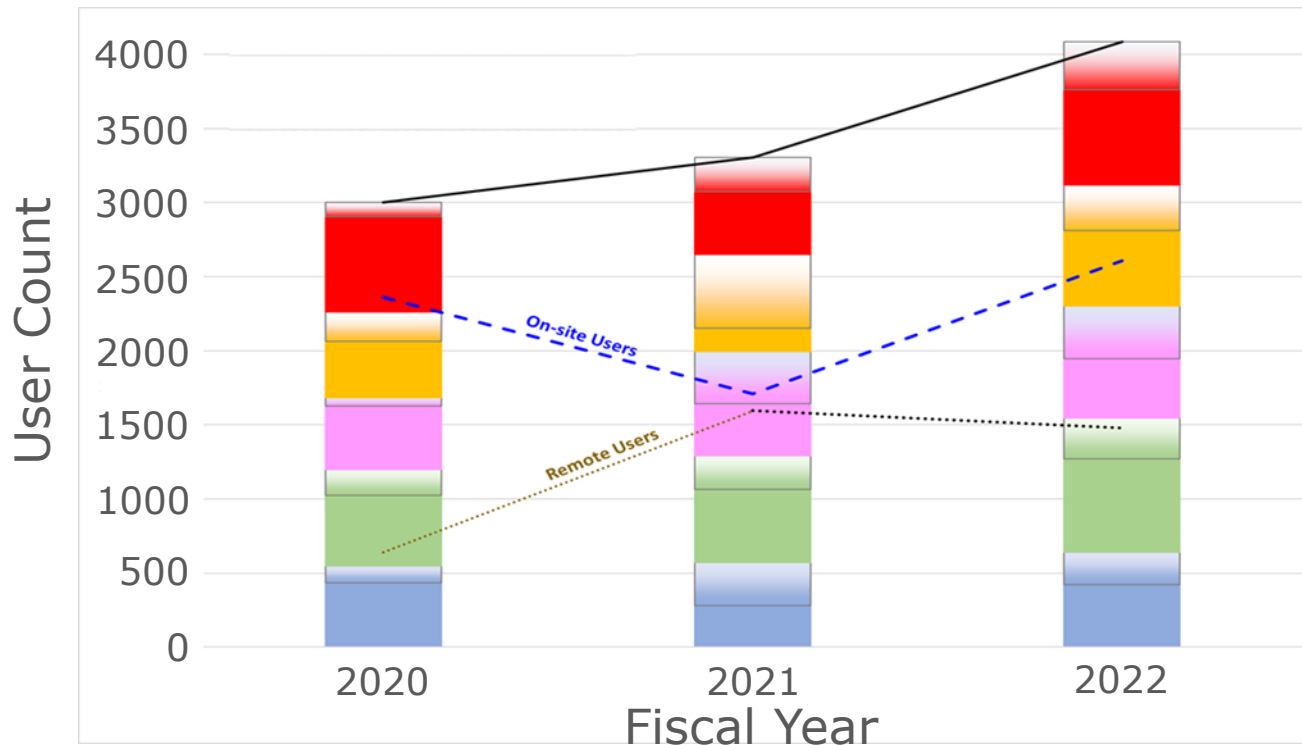
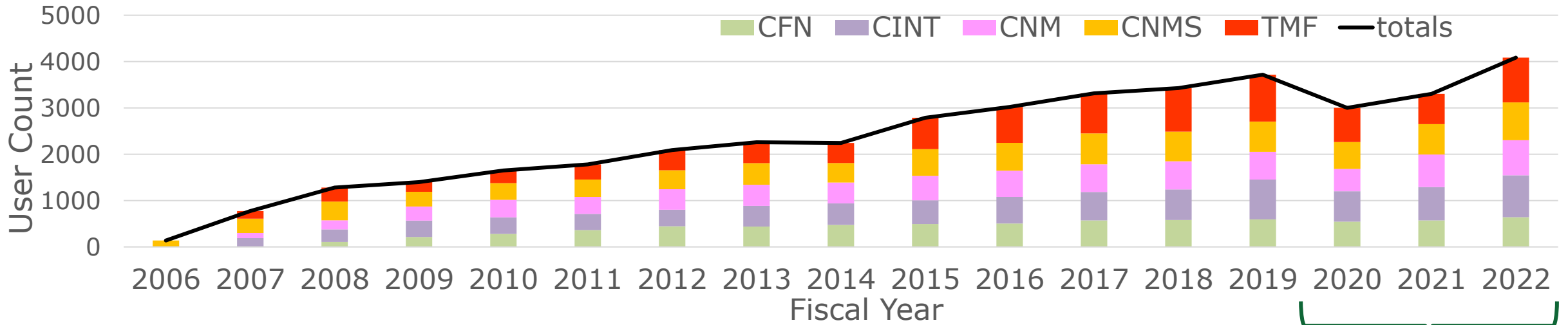


**CFN at BNL**

Start yr. 2008

Users (FY22): 421 on-site; 219 remote

# Impressive Growth of User Community – Including Remote Users!



# Multi-disciplinary NSRCs – Today's Science

- Unique in comparison to BES scattering user facilities, for their **strong basis in materials research: synthesis/fabrication & microscopy**
- **Aligned to respond to important national priorities** with multi-purpose user capabilities and highly-collaborative research environments
- 15 years ago, would you have imagined nanoscience's role in pandemic solutions?
  - ...in QIS? ...manufacturing?
  - ...in AI/ML (and huge data rates)?
  - ...in the national priority for microelectronics?
  - ...or the extraordinary, and growing, role in clean energy?
- Panel discussion will provide more information

**Microelectronics:**  
Research in lithography, materials and device fabrication for power electronics, etc.

**AI/ML:** Research in computer science, data processing, software, and devices, for predictive and transformative science

**Clean Energy:**

Research in energy storage, hydrogen, bioenergy, carbon capture, geothermal, wind, solar and nuclear energy, etc.

**QIS:**

Research on quantum materials/computing/simulation, quantum sensing, etc.

**Pandemic Response:**

Research on biological materials, drug discovery and delivery, viral and protein structures, PPE, clean water, medical isotopes, etc.

**Manufacturing:**

Research in sustainable & supply chains materials, additive manufacturing, decarbonization, critical materials, catalysts, recycling, etc.

# Questions?



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