CISE Overview

Dilma Da Silva
Acting Lead

Now: CISE Organization and Core Programs

Katie Antypas
Office Director

Office of Advanced Cyberinfrastructure (OAC)

- Data/Software
- Leadership and Advanced Computing
- Networking/Cybersecurity
- Learning and Workforce

Amy Walton
Deputy Office Director

Computing & Communication Foundations (CCF)

- Algorithmic Foundations
- Communications and Information Foundations
- Software and Hardware Foundations
- Foundations of Emerging Technologies

Irina Dolinskaya, Acting Division Director

Siddiq Qidwaj, Acting Deputy Division Director

CISE Leadership

Dilma Da Silva,
Acting Assistant Director

Joydip Kundu,
Deputy Assistant Director

Ellen Zegura, Division Director

Behrooz, Shirazi, Deputy Division Director

- Computer Systems Research Networking Technology and Systems
- Education and Workforce Development

Computer & Network Systems (CNS)

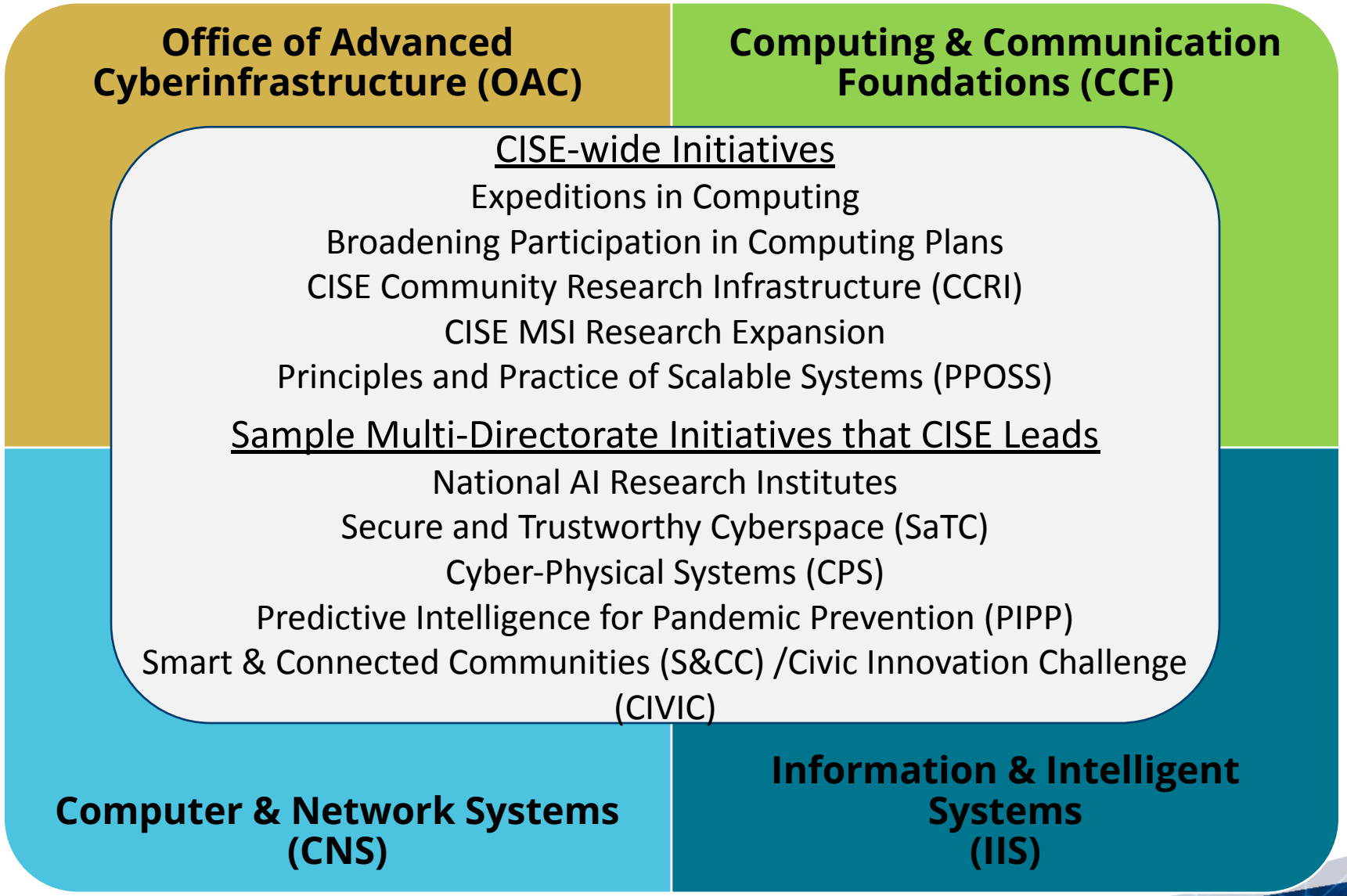
- Human-Centered Computing
- Information Integration and Informatics
- Robust Intelligence

Information & Intelligent Systems (IIS)

Michael Littman, Division Director

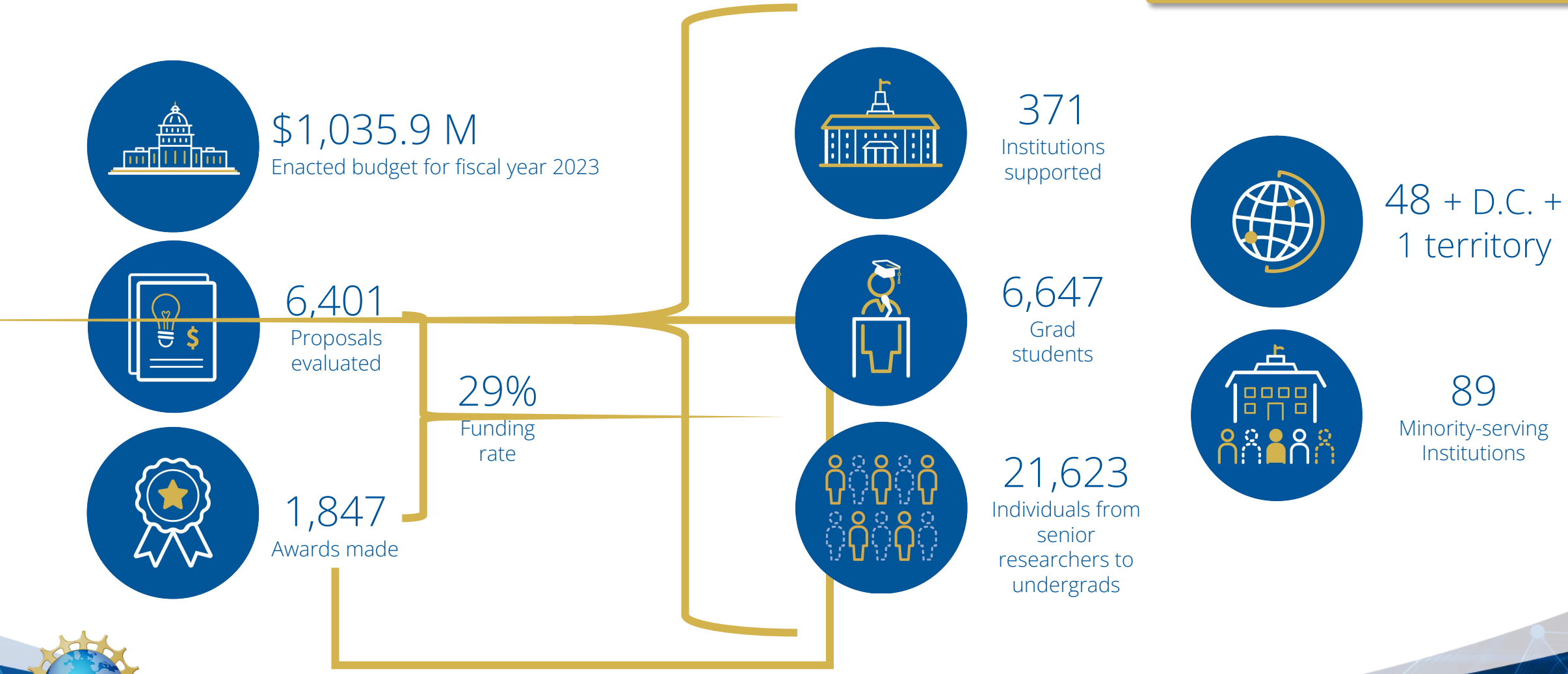
Wendy Nilsen, Deputy Division Director

Major CISE-wide and Multi-Directorate Initiatives



CISE by the Numbers

NSF funds **80%** of federally-funded CS in the US at academic institutions.



All data depicted is for fiscal year 2023.

Technical Themes

CISE Overarching Technical Themes

CISE in a Post-Moore's Law World: Seismic Shift

Core: AF, SHF, FET, CSR, NetS, ...
FuSe
PPoSS
DESC
...

Transcendence of Artificial Intelligence: AI for Everyone

Designing Beneficial Sociotechnical Systems

CISE Overarching Technical Themes

CISE in a Post-Moore's Law World: Seismic Shift

Core: AF, SHF, FET, CSR, NetS, ...
FuSe
PPoSS
DESC
...

Transcendence of Artificial Intelligence: AI for Everyone

Core: RI, IIS, HCC, AF, CIF, SHF, CSR ...
SLES
AI Institutes
...

Designing Beneficial Sociotechnical Systems

National AI Research Institutes

- NSF has funded **25 multi-organization AI Institutes**
- **~$500 million** investment to advance fundamental and use-inspired AI

LEAD ORGANIZATION

SUBAWARD

FEDERAL AGENCY AND INDUSTRY PARTNERS

amazon accenture Google intel IBM NIST USDA

Expand AI Program

- Program promotes
  - Capacity development for new AI programs at MSIs
  - Partnerships between MSIs and AI Institutes
- Flexible Approach, Recurring Contiguous Submission Windows (no single date deadline)

Capacity

Build AI capacity

MSI-specific goals
Institution support
Path to partnership

Partnership

Leverage AI Institutes

MSI-led awards
Institute subawards
Shared vision and goals
Institute integration plans

Approach

Lower barriers to success

Concept outlines
Submission windows
Flexible submissions

CISE Overarching Technical Themes

CISE in a Post-Moore's Law World: Seismic Shift

Core: AF, SHF, FET, CSR, NetS, ...
FuSe
PPoSS
DESC
...

Transcendence of Artificial Intelligence: AI for Everyone

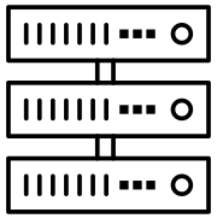
Core: RI, IIS, HCC, AF, CIF, SHF, CSR ...
SLES
AI Institutes
...

Designing Beneficial Sociotechnical Systems

Core: HCC, SHF
DASS
SCH
CIVIC Innovation Challenge

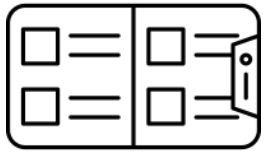
Vision for the National AI Research Resource

A widely-accessible, national research infrastructure that will advance the U.S. AI R&D environment, discovery, and innovation by empowering a diverse set of users through access to:



Secure, high-performance, privacy-preserving **computing**

High-quality **datasets**



Catalogs of **testbeds** and **educational materials**

Training tools and **user support** mechanisms

Goals:

Spur **innovation**

Increase the **diversity** of talent in AI

Improve U.S. **capacity** for AI R&D

Advance **trustworthy AI**

Initial NAIRR Pilot AI Research Thrusts

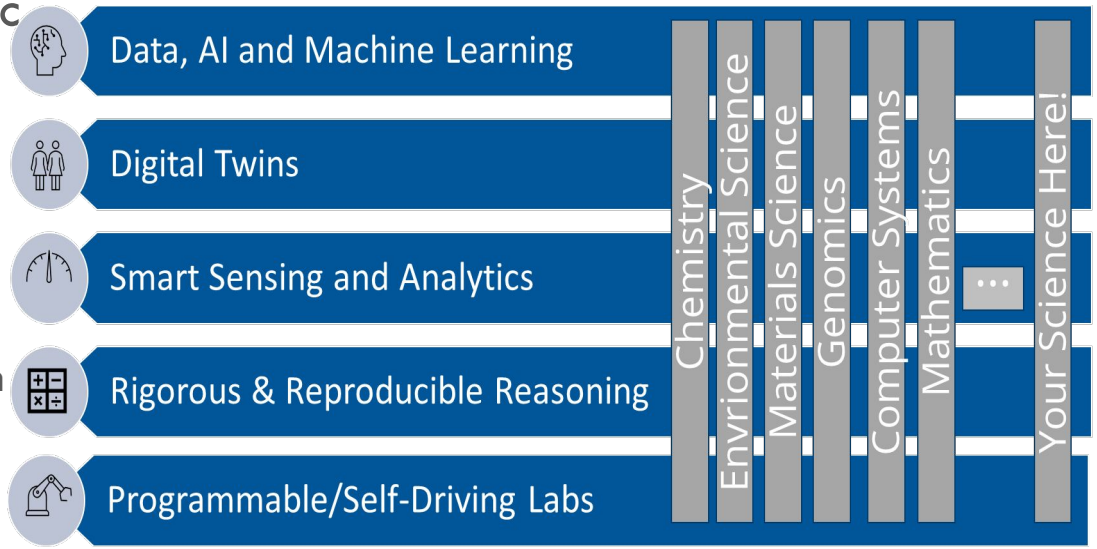
- Accelerate societally-relevant research on **AI safety, reliability, security, and privacy**.
- Empower advances in **cancer treatment and individual health outcomes.**
- Support resilience and optimization of **agricultural, water, and grid infrastructure.**
- Improve design, control, and quality of **advanced manufacturing systems.**
- Address **earth, environmental, and climate challenges** via integration of diverse data and models.

Funding opportunities

- Solicitations
- Dear Colleague Letters (DCLs)
- Program Descriptions

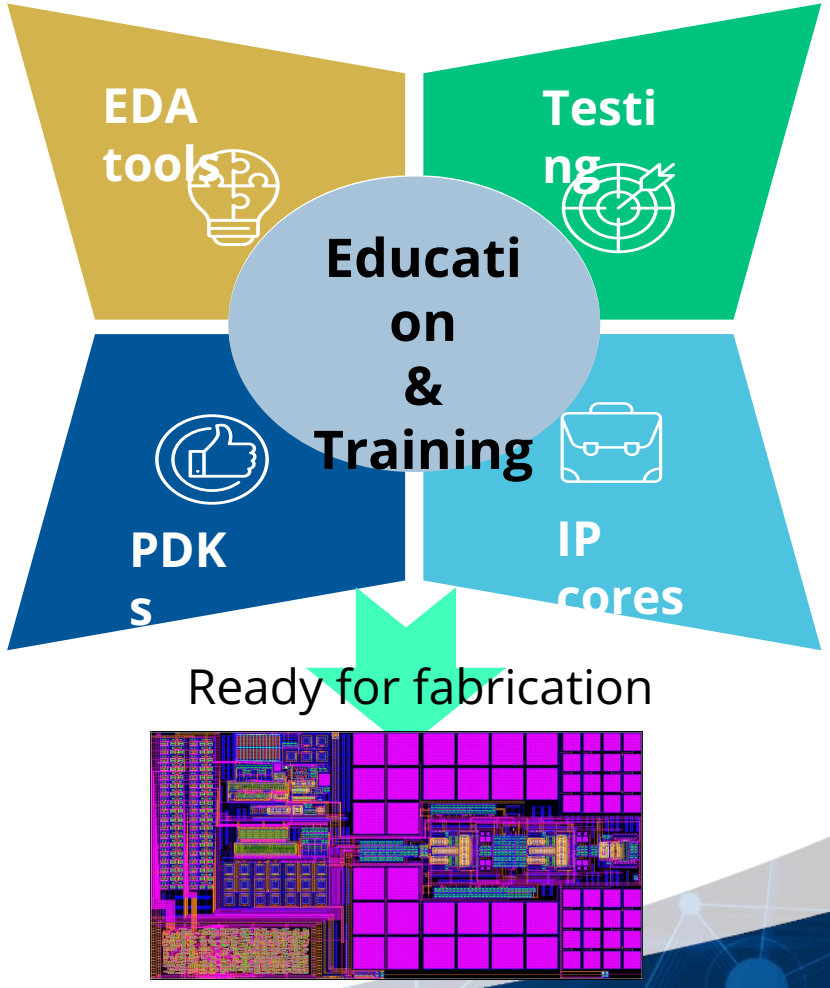
ACED: Accelerating Computing-Enabled Scientific Discovery (NSF 24-541)

- New solicitation designed to harness computing in a virtuous cycle that: (a) benefits scientific disciplines through computational technologies and (b) fosters novel computing technologies that will enable advances beyond the specific use cases/domain.
- Requires collaborations between researchers in computing and another scientific or engineering discipline.
- The ACED program solicits proposals in two tracks:
  - Track I: Emerging Ideas Proposals: Support speculative multidisciplinary projects that explore bold new research directions. Projects are limited to $500,000 in total budget, with durations of up to 18-24 months. Proposals due May 13, 2024.
  - Track II: Discovery Proposals: The objective of this track is to support transformative interdisciplinary research that will significantly advance both computing and the scientific discipline(s). Projects are up to 4 years with a total budget of up to $3,000,000. Proposals due January 14, 2025-2026.
- ACED supports NSF Priority Areas: Emerging Industries, Resilient planet and Research Infrastructure with CISE, BIO, ENG, MPS, and TIP



Chip Design Hub: Enabling Access to the Semiconductor Chip Ecosystem for Design, Fabrication, and Training (NSF 24-522)

- Provide cloud-based design enablement to IHEs and beyond
  - Dramatically lower the barriers for students to access
    - State-of-the-art electronic design automation (EDA) tools
    - Process design kits (PDKs), and
    - Design intellectual property (IP) cores
  - Enable students at various levels to design and test IC chips
- Solicitation: NSF 24-522
  - Industry participation highly encouraged



EducateAI

EducateAI enables *educators* to make high-quality, audience-appropriate artificial intelligence educational experiences available nationwide to **K-12**, **community college, four-year college** and graduate students, as well as adults interested in formal training in AI.

Emerging Industries:
Advancing inclusive computing education to prepare <u>all</u> learners for the AI workforce.

Creating Opportunities Everywhere:
Focus on broadening participation of groups who are historically underrepresented and underserved by existing computing courses and careers

Research Infrastructure:
Leveraging the NAIRR Pilot to support AI-related computational, data, model or other resources, and associated workforce training through NAIRR Classroom.

PHASE 1: EducateAI DCL (24-025)

Invites submission of proposals that advance inclusive AI education for preK-12 and undergraduate students through **CSforAll** and **IUSE: Computing in Undergraduate Education**

Questions and Discussion

Advanced Scientific Computing Research (ASCR)

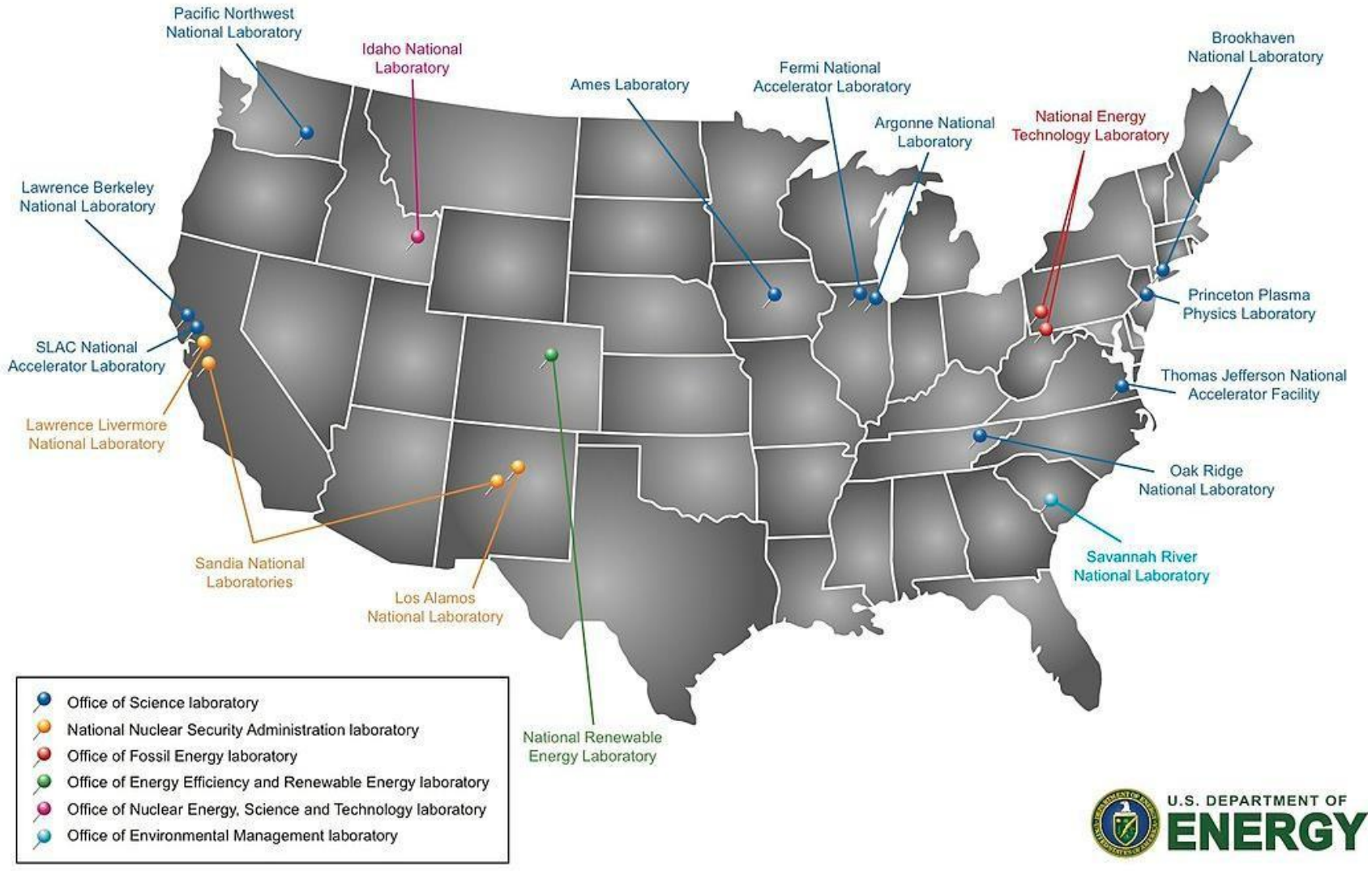
Margaret R. Lentz, PhD

https://science.osti.gov/ascr/

U.S. DEPARTMENT OF ENERGY | Office of Science

Energy.gov/science

DOE's National Laboratories



U.S. DEPARTMENT OF ENERGY

https://www.energy.gov/maps/doe-national-laboratories

U.S. DEPARTMENT OF ENERGY | Office of Science

Our Mission:

Deliver scientific discoveries and major scientific tools to transform our understanding of nature and advance the energy, economic, and national security of the United States.

More than **34,000 r**esearchers supported at more than **300** institutions and **17** DOE national laboratories

Steward **10** of the 17 DOE national laboratories

More than **37,000** users of **28** Office of Science scientific user facilities

$8.1B
(FY 23 enacted)

OFFICE OF SCIENCE BY THE NUMBERS

Delivering scientific discoveries and major scientific tools to transform our understanding of nature and advance the energy, economic, and national security of the United States

FY23

6 CORE SCIENCE PROGRAMS

- Advanced Scientific Computing Research
- Basic Energy Sciences
- Biological and Environmental Research
- Fusion Energy Sciences
- High Energy Physics
- Nuclear Physics

3 ENGINEERING AND TECHNOLOGY OFFICES

- Accelerator Research and Development and Production
- Isotope Research and Development and Production
- Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR)

5 NATIONAL QUANTUM INFORMATION SCIENCE RESEARCH CENTERS

ACROSS ITS 10 NATIONAL LABS, OFFICE OF SCIENCE MAINTAINS APPROXIMATELY

24 MILLION SQUARE FEET OF SPACE

1,600 BUILDINGS

38,000 ACRES OF LAND OWNED

SUPPORTS RESEARCH SPANNING

16 DOE NATIONAL LABS

50 STATES, GUAM, PUERTO RICO, AND WASHINGTON, D.C.

>310 UNIVERSITIES AND HIGHER-LEARNING INSTITUTIONS

4 BIOENERGY RESEARCH CENTERS

2 ENERGY INNOVATION HUB PROGRAMS

51 ENERGY FRONTIER RESEARCH CENTERS

STEWARDS 10 DOE NATIONAL LABORATORIES

3 World-Leading Supercomputers

ESTIMATED RESEARCHERS SUPPORTED

- 11,100 Permanent PhDs
- 3,400 Postdoctoral Associates
- 5,200 Graduate Students
- 9,700 Other Scientific Personnel

OVER 39,500 USERS AT 28 OFFICE OF SCIENCE FACILITIES

10 SITE OFFICES

1 CONSOLIDATED SERVICE CENTER

OVER 100 NOBEL PRIZES

$8.1 BILLION OVERALL OFFICE OF SCIENCE BUDGET

$918 MILLION USER FACILITY CONSTRUCTION

$281 MILLION SCIENCE LABORATORIES INFRASTRUCTURE

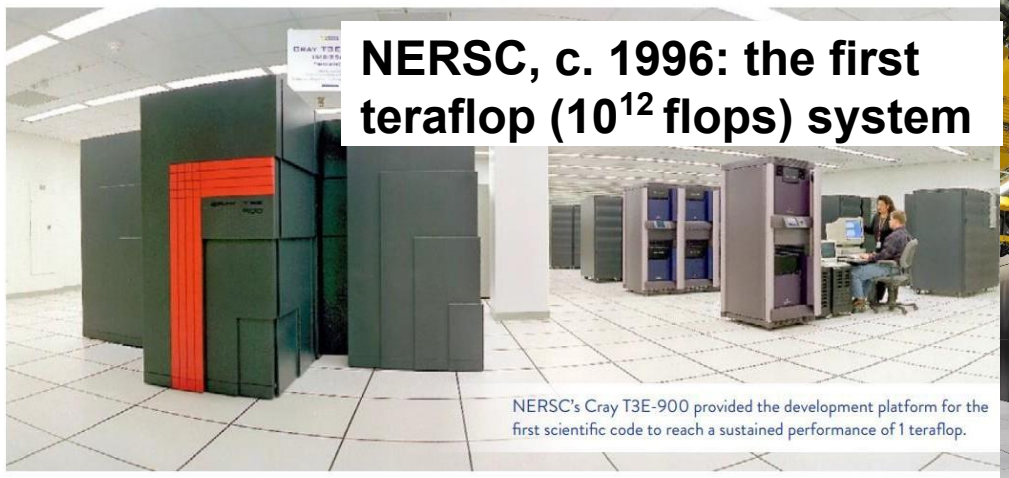
The Office of Science Research Portfolio

Advanced Scientific Computing Research	• Delivering world leading computational and networking capabilities to extend the frontiers of science and technology
Basic Energy Sciences	• Understanding, predicting, and ultimately controlling matter and energy flow at the electronic, atomic, and molecular levels
Biological and Environmental Research	• Understanding complex biological, earth, and environmental systems
Fusion Energy Sciences	• Supporting the development of a fusion energy source and supporting research in plasma science
High Energy Physics	• Understanding how the universe works at its most fundamental level
Nuclear Physics	• Discovering, exploring, and understanding all forms of nuclear matter
Isotope R&D and Production	• Supporting isotope research, development, production, processing and distribution to meet the needs of the Nation
Accelerator R&D and Production	• Supporting new technologies for use in SC's scientific facilities and in commercial products

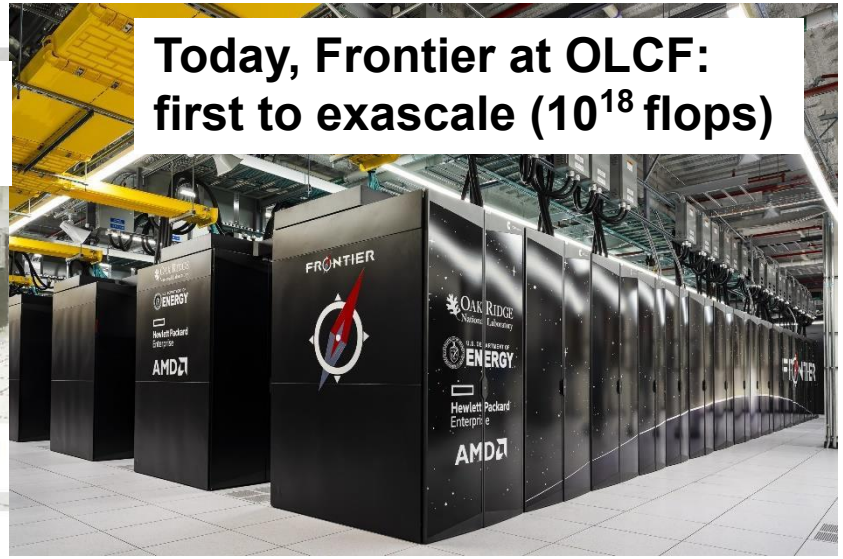
ASCR – over 70 years of Advancing Computational Science

Beginnings: During the Manhattan Project, John Von Neumann advocated for the creation of a Mathematics program to support the continued development of applications of digital computing

Over 40+ years, ASCR has a rich history of investment in computational science and applied mathematics research, and revolutionary computational and network infrastructure.



NERSC, c. 1996: the first teraflop (10^{12} flops) system



Today, Frontier at OLCF: first to exascale (10^{18} flops)

WHY COMPUTATIONAL SCIENCE?

- Computational science adds a third pillar to researcher's toolkit along side theory and experiments
- Computational science is essential when experiments are too expensive, dangerous, time-consuming or impossible
- Computational science facilitates idea-to-discovery that leads from equations to algorithms
- Virtually every discipline in science and engineering has benefited from DOE's sustained investments in computational science

The ASCR Facilities mission: Research infrastructure for the nation

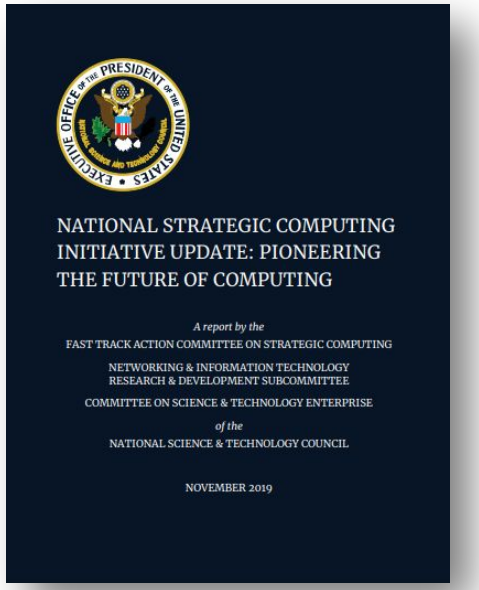
Our mission is to achieve the greatest impact for science and the nation by delivering

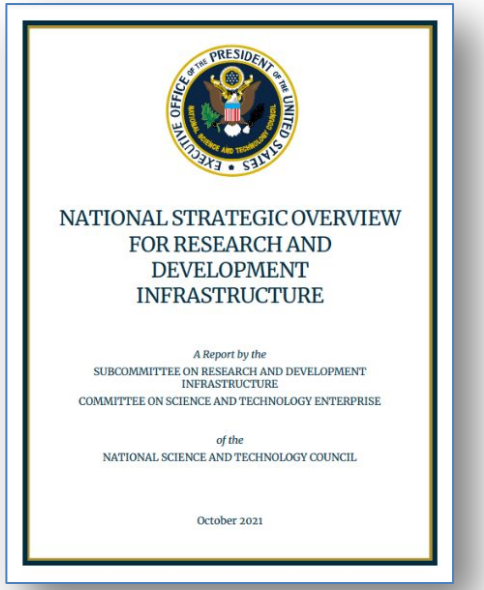
first-of-a-kind high-uptime high performance computing, data, and networking infrastructure

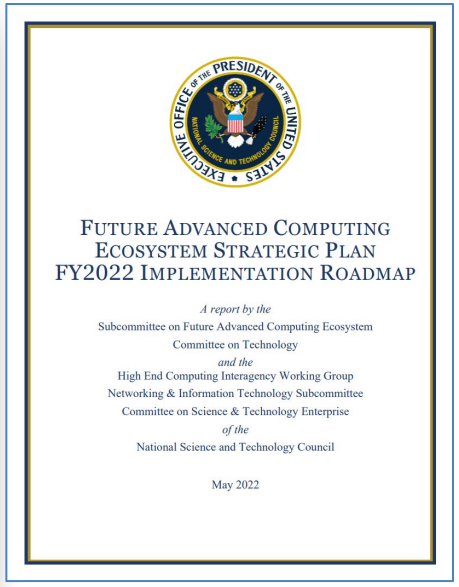
capable of meeting the requirements of extreme scale science.

We seek to influence the trajectory of computing, data, and networking technology to benefit U.S. competitiveness and the national research enterprise, and

We seek to influence how researchers use computing, data, and networking to benefit the practice of science.







DOE is an apex provider of national research infrastructure (RI). Other USG agencies and industry rely on DOE RI.

DOE's extreme scale RI is unique in the national advanced computing ecosystem.

Exascale Computing Project (ECP)

DOE's Exascale Computing Initiative: A partnership between SC and NNSA/ASC to accelerate R&D, acquisition, and deployment to deliver exascale computing capability to DOE national labs by the early- to mid-2020s

6 Core DOE Labs 100 R&D Teams 1000 Researchers

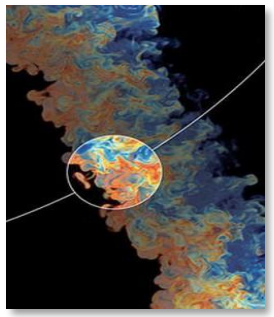
Exascale System deployment Frontier, Aurora, El Capitan

APPLICATION DEVELOPMENT

Develop and enhance the predictive capability of applications critical to DOE

National security

- Stockpile Stewardship
- Reentry-vehicles
- High-energy density physics



Energy security

- Wind farms
- Small Modular Reactors
- Nuclear materials
- Subsurface Science
- Combustion
- Clean fossil fuels
- Biofuel catalysts

Economic security

- Additive manufacturing
- Power grid
- Seismic risk

Scientific discovery

- Astrophysics
- Lattice QCD
- Accelerators
- Materials
- Chemistry
- Fusion
- Standard Model

SOFTWARE TECHNOLOGY

Expanded & vertically integrated software stack for capable exascale computing

HARDWARE AND INTEGRATION

Integrated delivery of ECP products on targeted systems at leading DOE HPC facilities

Earth system

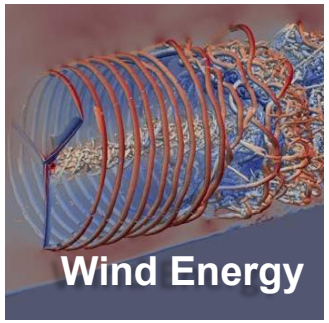
- Earth system models
- Biomass
- Metagenomics (DOE applications)

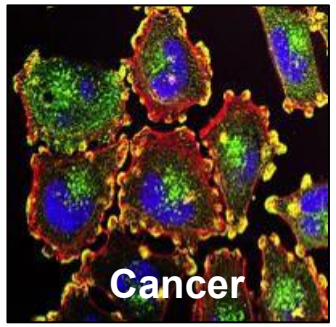
Health care

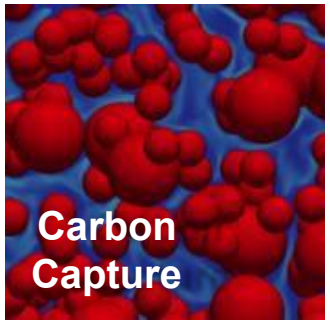
- Cancer

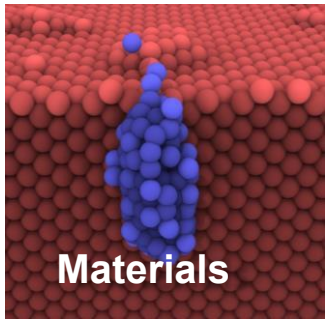
On track for CD-4 in FY24

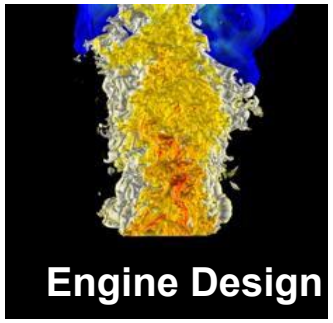
The breadth of exascale-ready applications is remarkable; indicative of a sea change in computing abilities for DOE and the nation

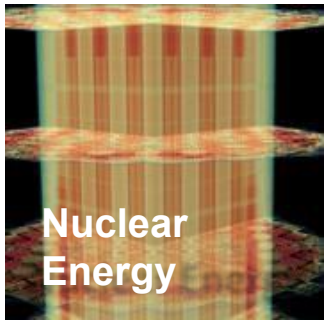


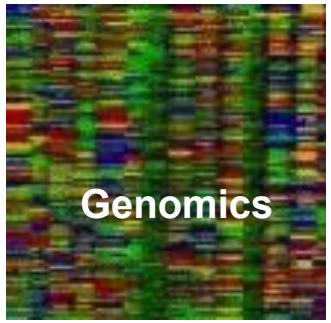


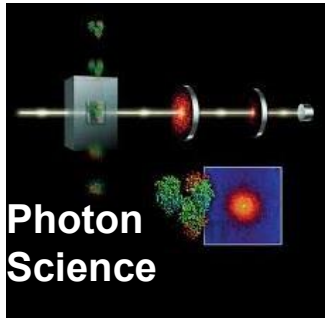


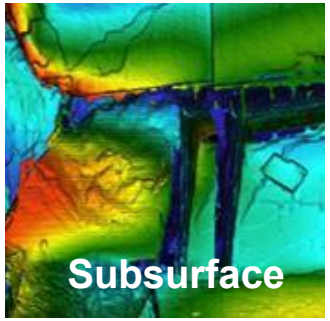


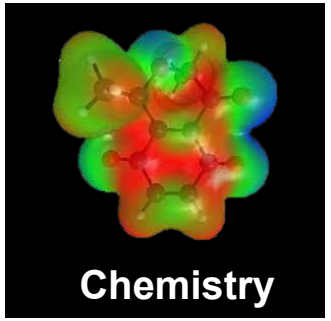


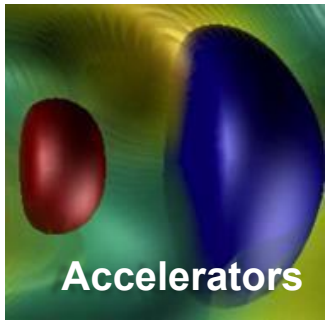


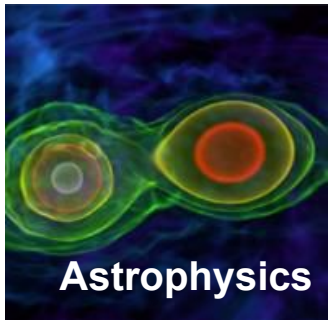


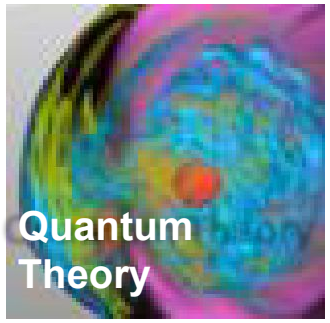


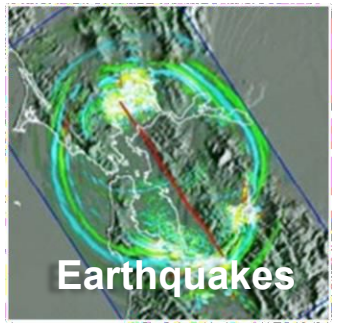


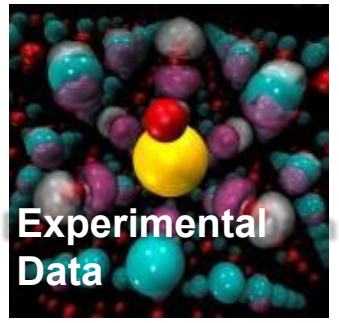


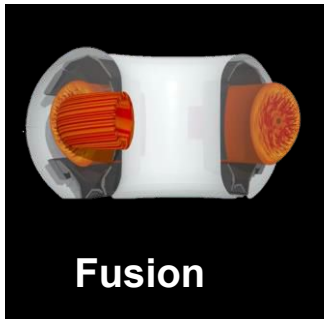


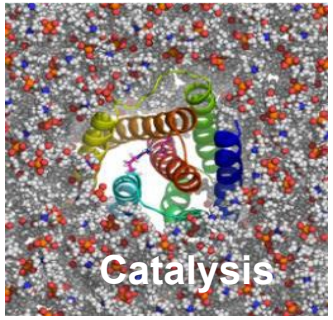












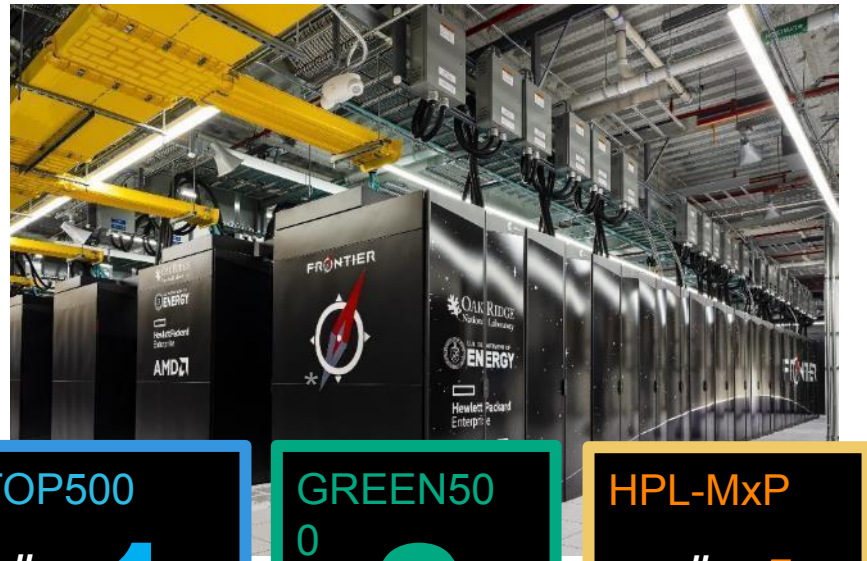
Exascale Today Enables the AI of Tomorrow

Long-term investments in applied mathematics and computer science enabled exascale.

MPICH2

R&D 100

2005



TOP500 # 1

GREEN500 # 2

HPL-MxP # 1

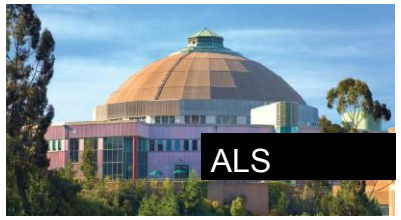
Frontier, #1 on the Top500, **leads the world in computational capability**, and is also **#2 in the world in energy efficiency**, and is **#1 in the world for AI capability**.

The exascale and AI-enabled science era will lead to dramatic capabilities to predict extreme events and their impacts on the electric grid across weather and climate time scales…

and will accelerate the design and deployment of clean-energy technologies to create a better future.

The ASCR Facilities are Scientific User Facilities

FY 2023
28 scientific user facilities



U.S. DEPARTMENT OF ENERGY
Office of Science

DOE's Integrated Research Infrastructure (IRI) Vision:

To empower researchers to meld DOE's world-class research tools, infrastructure, and user facilities seamlessly and securely in novel ways to radically accelerate discovery and innovation

Experimental and Observational User Facilities

Advanced Networking

Edge Sensors

Advanced Computing

Local Campus Computing

Computing Testbeds

Cloud Computing

Researchers

Data Management

- High Performance Data Facility
- Data Repositories PuRE Data Assets

Rapid data analysis and steering of experiments

Software

- Software and Applications
- AI Tools Digital Twins

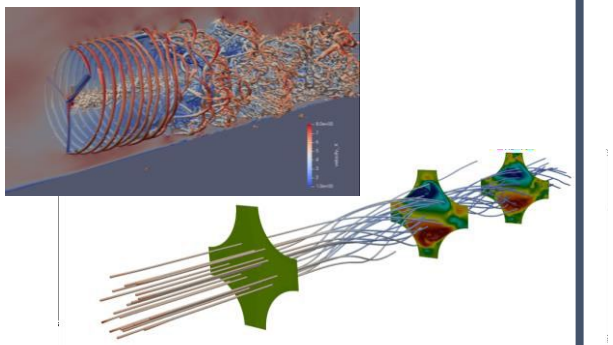
Novel workflows using multiple user facilities

AI-enabled insight from integrating vast data sources

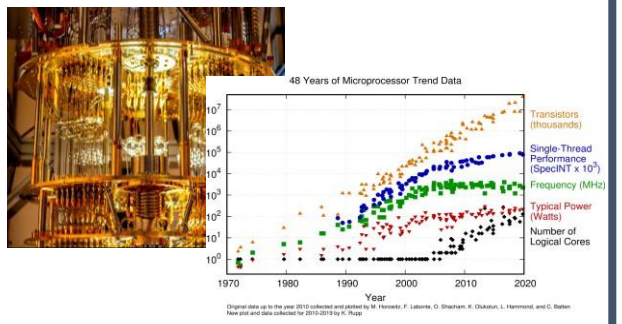
New modes of integrated science

Emerging Technology Trends for Scientific Computing

Advanced Modeling, Simulation, and Visualization

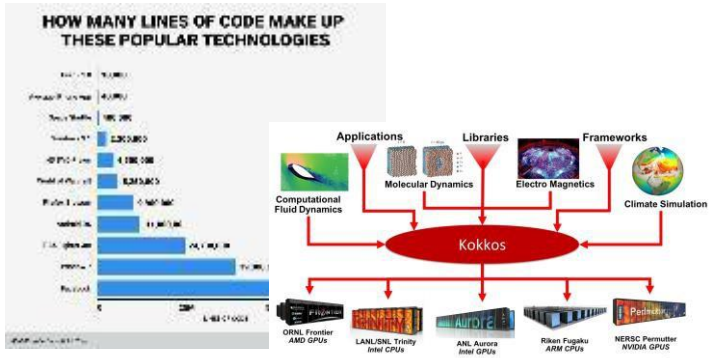


Trustworthy Artificial Intelligence and Data



Heterogeneous, Distributed, Co-Designed, Energy-Efficient Computing and Algorithms

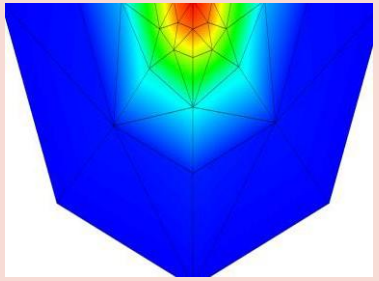
Software Complexity for Increased Versatility



High-Performance Computing and Networking across Experiments, Exascale, and the Edge

ASCR Research: Key To Enabling DOE and SC Scientific Enterprise

Simulation, modeling and data-driven discovery combined with testbeds and prototypes equip the ASCR community, big and small, to tackle scientific and societal crises.

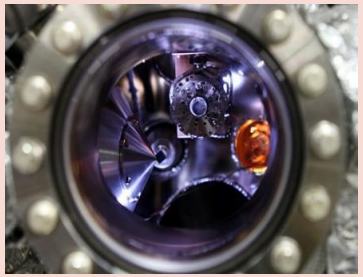


Discovery Science

ASCR's SciDAC partnership with Fusion Energy Sciences uses exascale-ready software to understand plasma motion.

Lowering Energy Costs

Multi-scale mathematics algorithms and models led to insights to reduce energy in industrial coating by nearly a third.

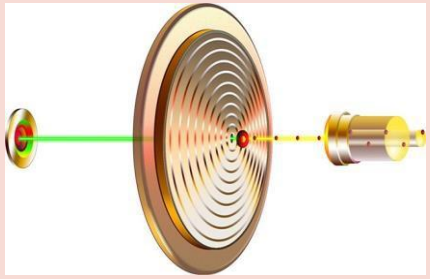


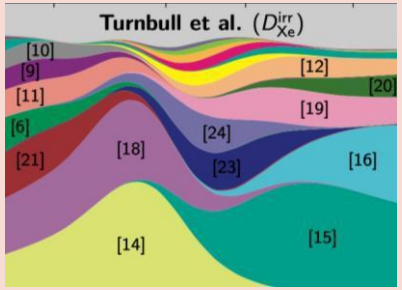
Optimizing Experiments

Optimization and AI methods provided real-time experiment steering at beamlines and microscopes.

Foundations For the Future

Design and demonstration of a deterministic single-photon source for quantum networking and computing.





Partnerships for Energy

ASCR's SciDAC partnership with Nuclear Energy predicts diffusion of xenon under irradiation conditions.

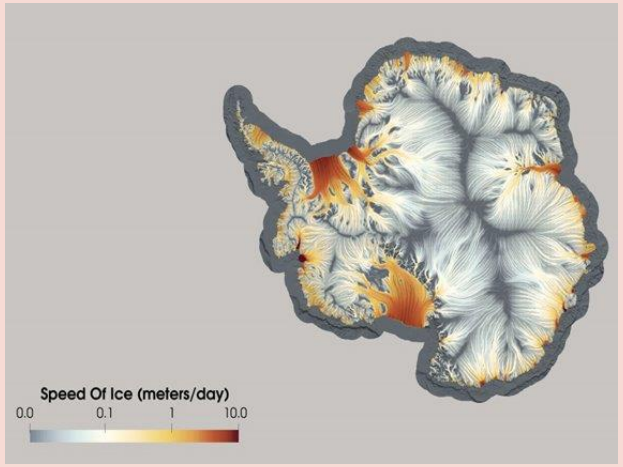
Insights Unlocking Technologies

AI models predict the 3D grain structures of cooling metals to enable new advanced-manufacturing technologies.

Understanding Changing Environmental Conditions: Sea & Fire

State-of-the-art research in simulation, modeling and data-driven discovery help us improve our understanding of fundamental processes and our projections for the changing global

Projected Land Ice Contribution to 21st Century Sea Level Rise



By simulating the flow of ice across Antarctica using an improved ice-sheet model, the researchers projected 2015-2100 land ice contribution to sea level for a range of emissions scenarios.

- The most comprehensive projections of sea-level rise from land ice to date.
- Antarctica remains a critical focus for reducing future sea level uncertainty.
- Limiting global warming to 1.5°C reduces 21st century land ice contribution to sea- level rise from 25 to 13 cm.

An ASCR-BER SciDAC Partnership

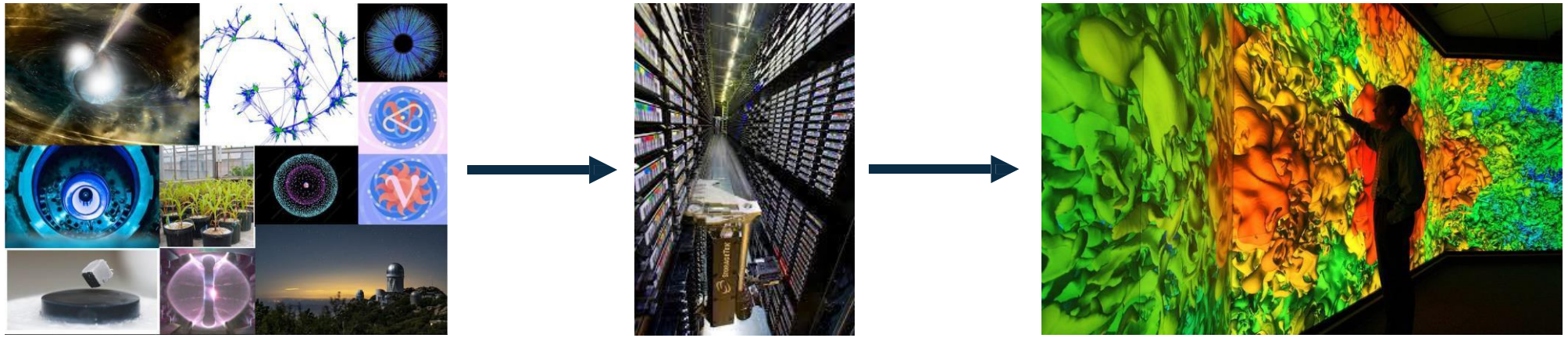
5G Drones: Real Time Data Assimilation to Transform Wildfire Predictability

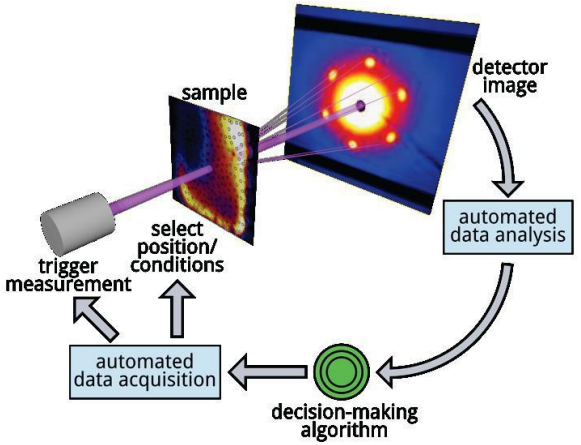
5G drone data will lead to better predictions of smoke and fire spread.

- Use 5G drones to assess changes in fire behavior and smoke characteristics.
- Leverage data gathered via various sources such as citizen scientists.
- Coordinate with partners to integrate fire modeling into fire master plans.

The time evolution of the Rio Medio (NM) fire was captured by citizen images and videos from multiple angles and distances. The researchers are harnessing this unique data set to inform their simulations and improve their models to enable better forecasts.

Scientific Data at Extreme Scale





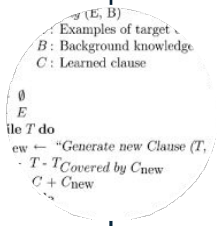
- Scientific computations and experiments produce terabytes or petabytes of data that must be efficiently stored.
- That data is stored on collections of disk drives and archive systems at ASCR computing facilities.
- As with ASCR's computing capabilities, high-performance data management requires performing many operations in parallel.
- ASCR invests in innovative ways to store, compress, search, and analyze data that maximizes parallelism and performance.
- ASCR also invests in advancements in streaming data and federated learning, allowing data in geographically-separated places to contribute to scientific modeling without needing to store all of the data in once place.

A Rough Evolution of Artificial Intelligence

1960s

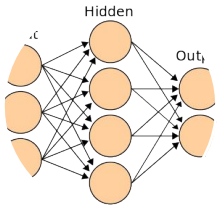
AI

Any technique that enables computers to mimic human intelligence.



Classic AI

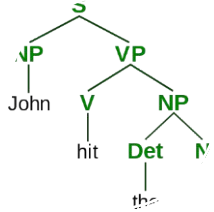
Human-provided logic + some statistics



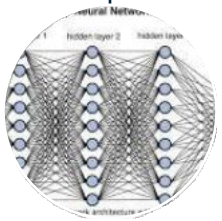
Machine Learning

Techniques that enable machines to improve at tasks with experience. Need some human-provided structure and lots of data.

(Rule-Based) Expert Systems



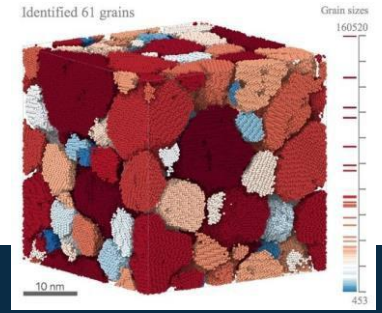
Natural Language Processing



Deep Learning

Based on neural networks that permit a machine to train itself to perform a task.

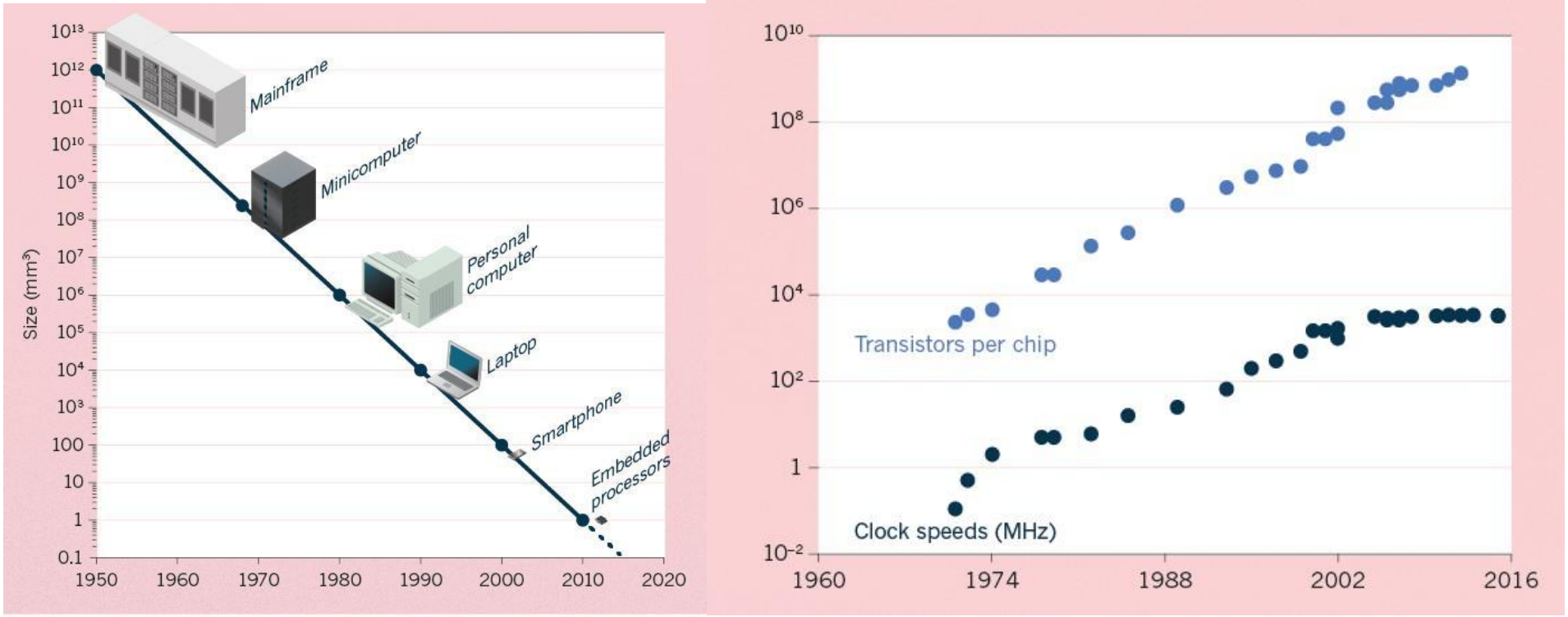
Today



AI and Machine Learning R&D

AI & Machine Learning for predictive models from large-scale data
Federated Learning for broader insights via collectively shared datasets
Privacy-preserving algorithms for cybersecurity and AI at the edge
AI hardware co-design for energy-efficient **hybrid algorithms** & computing
Tools for ensuring **FAIR data for AI**
AI/ML for **autonomous experiments**

Moore’s Law



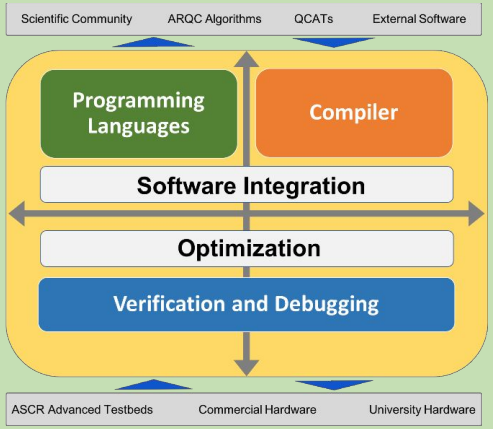
https://www.nature.com/news/the-chips-are-down-for-moore-s-law-1.19338

- Moore's law is the observation that the number of transistors in an integrated circuit (IC) doubles about every two years.
- As Moore’s law has continued computers have continued to shrink *and* become more capable.
- However, the clock speed of energy-efficient computers stopped increasing some time ago – this is why parallel computing, doing more simultaneously, is critical to modern computing including ASCR’s supercomputers.

Quantum Computing in ASCR

Fundamental Science

Programs support core basic research for quantum algorithms, quantum computer science and quantum networking.



AIDE-QC, an ARQC team, explores five thrusts to program emerging QC platforms and support the broader DOE quantum community.

National QIS Research Centers

Support for the Centers, the first large-scale QIS effort that crosses the technical breadth of Office of Science.

SQMS

QUANTUM SCIENCE CENTER

C²QA Co-Design Center for Quantum Advantage

Q-NEXT NEXT GENERATION QUANTUM SCIENCE AND ENGINEERING

Five National QIS Research Centers address major cross-cutting challenges in broad ranging topics in QIS including computing, communications and sensing.

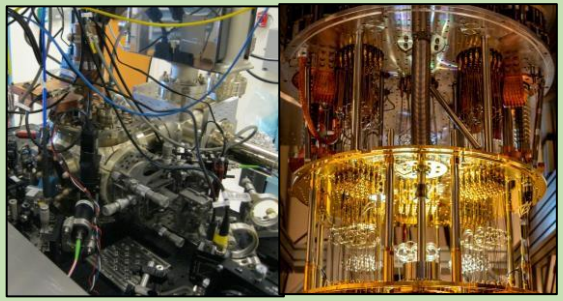
Quantum Internet Testbeds

Research and development for the deployment of regional testbeds to provide early proof of concepts.

In FY21 ASCR awarded two projects, led by LBNL and ORNL to design, develop and demonstrate regional-scale quantum internet testbeds.

Quantum Computing Testbeds

Provide the research community with fully transparent access to novel quantum computing hardware.

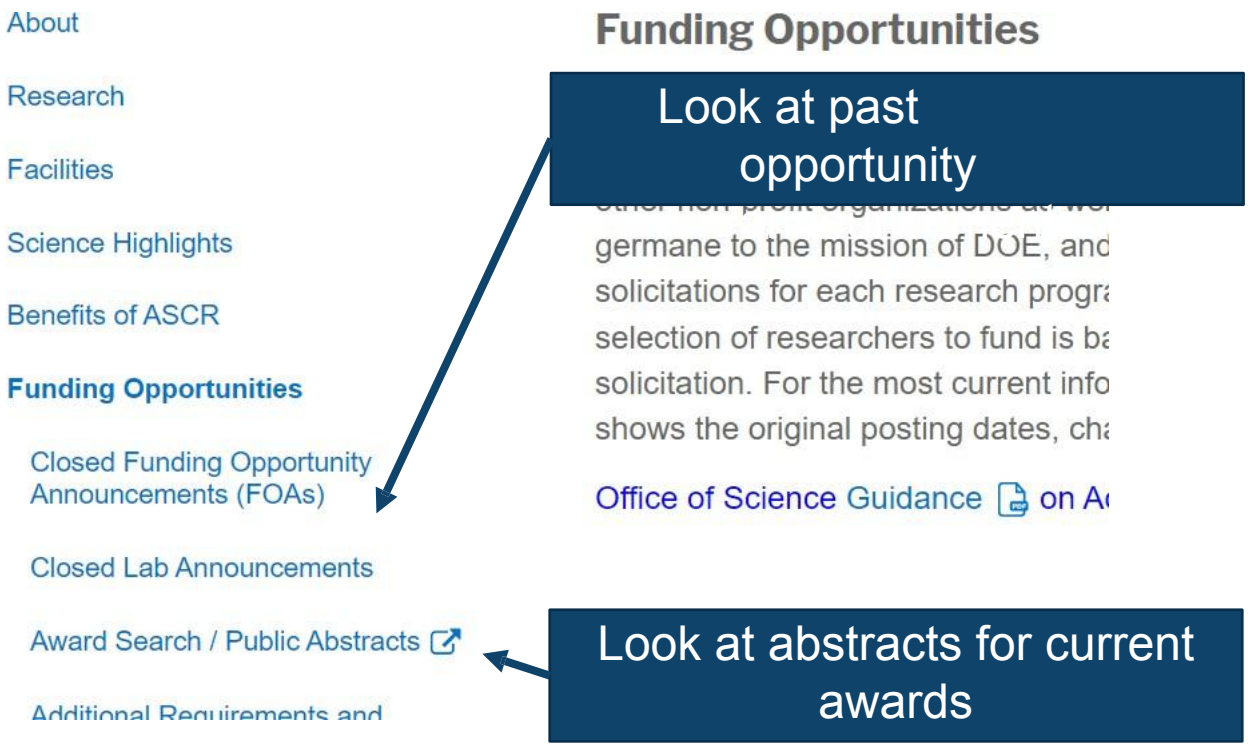


SNL's QSCOUT (left) is the world's first publicly-available trapped ion quantum computer. LBNL's AQT (right) offers access to a unique superconducting platform.

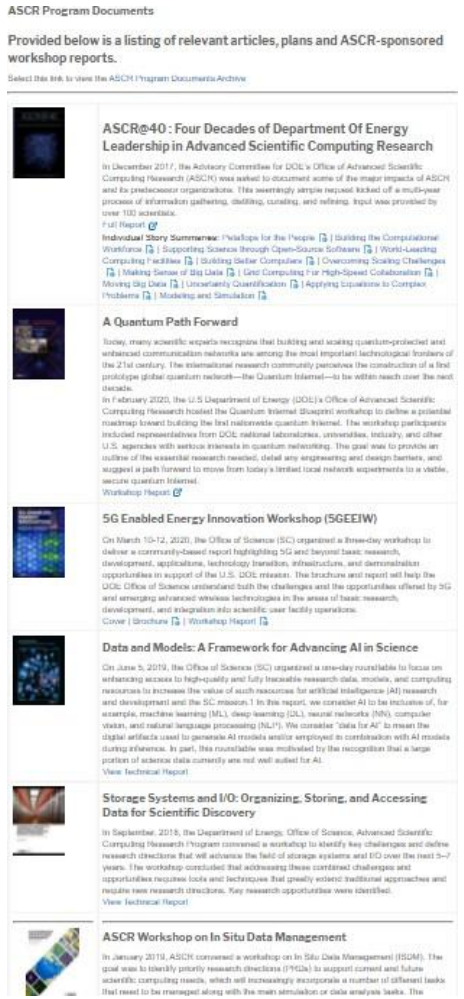
Additional Information on ASCR's Website

https://science.osti.gov/ascr/Funding-Opportunities

https://science.osti.gov/ascr/Community-Resources/Program-Documents



Look at recent reports from ASCR-sponsored workshops. These discuss priority research directions, as identified by the research community, along with relevant background information, in



Partnerships to Deliver Future Leaders

DOE Computational Science Graduate Fellowship (CSGF)

- Started in 1991 to broadly train advanced computational scientists
- Funded by both DOE-SC/ASCR and NNSA/ASC
  - Currently, CSGF supports 99 students at 41 universities in 22 states.
  - More than 500 students at 65 U.S. universities have trained as fellows.
- Requires that fellows
  - plan and follow a plan of study that transcends the bounds of traditional academic disciplines
  - participate in 12-week research experience at DOE lab
- Benefits
  - Up to four years of support, including full tuition/ required fees paid
  - Yearly stipend of $45,000 plus an Academic allowance
  - Annual program review with peers, Alumni and DOE/Lab scientists

https://www.krellinst.org/csgf/

2019 incoming class of Computational Science Graduate Fellows

CSGF alumni work in DOE laboratories, industry and educational institutions

Office of Science Graduate Student Research (SCGSR) Program

The SCGSR Program provides supplemental awards to outstanding graduate students to spend 3 to 12 months conducting part of their doctoral thesis/dissertation research at a host DOE national laboratory/facility in collaboration with a DOE laboratory scientist.

- ❑ Graduate students must apply online through the online application system.
- ❑ The application requires a research proposal and letters of support from both the graduate student's thesis advisor and the collaborating DOE laboratory scientist.
- ❑ Student's research and proposed SCGSR project must be aligned with one of the identified SCGSR priority research areas defined by the SC Program Offices and specified in the solicitation.
- ❑ Applications proposing to use an SC user facility must apply for user facility time separately.

Award Benefits:

- A monthly stipend of up to $3,600/month for general living expenses.
- Reimbursement of inbound/outbound traveling expenses to/from the host DOE laboratory/facility of up to $2,000.
- (Award payments are provided directly to the student)

Eligibility:

- U.S. Citizen or Lawful Permanent Resident
- Qualified graduate program & Ph.D. Candidacy
- Graduate research aligned with an SCGSR priority research area.
- Establishment of a collaborating DOE laboratory scientist at the time of application.

Active awards cohorts include 2022 S1 and S2, and 2023 S1

2023 Solicitation 2 applications under review, upcoming 2024 S1 application to open in February 2024

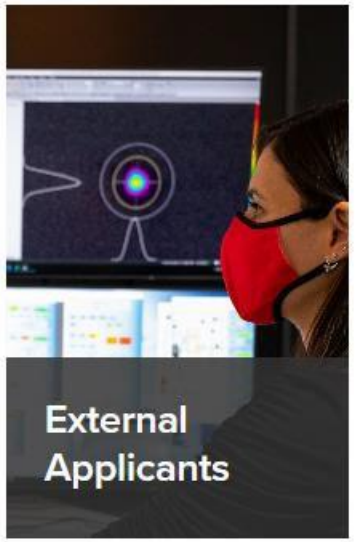
Application Assistance Workshops, Program requirements, FAQs, and link to online application at:

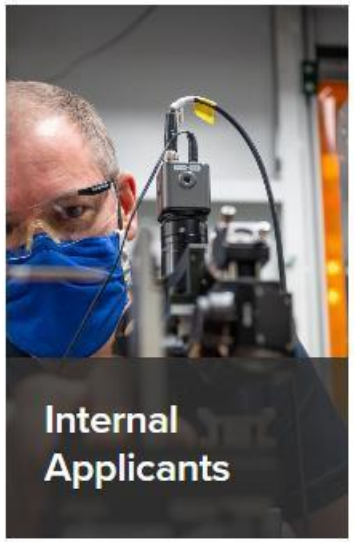
https://science.osti.gov/wdts/scgsr/

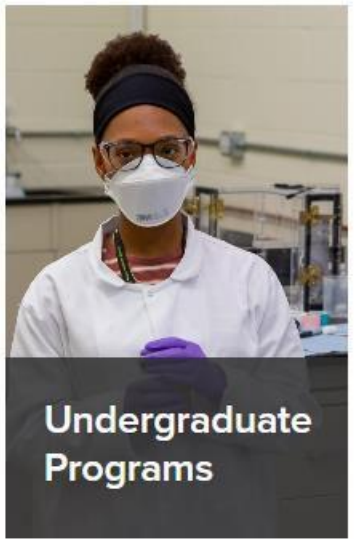
Looking for More Opportunities?

https://science.osti.gov/wdts

Explore Job Opportunities at DOE's National Laboratories







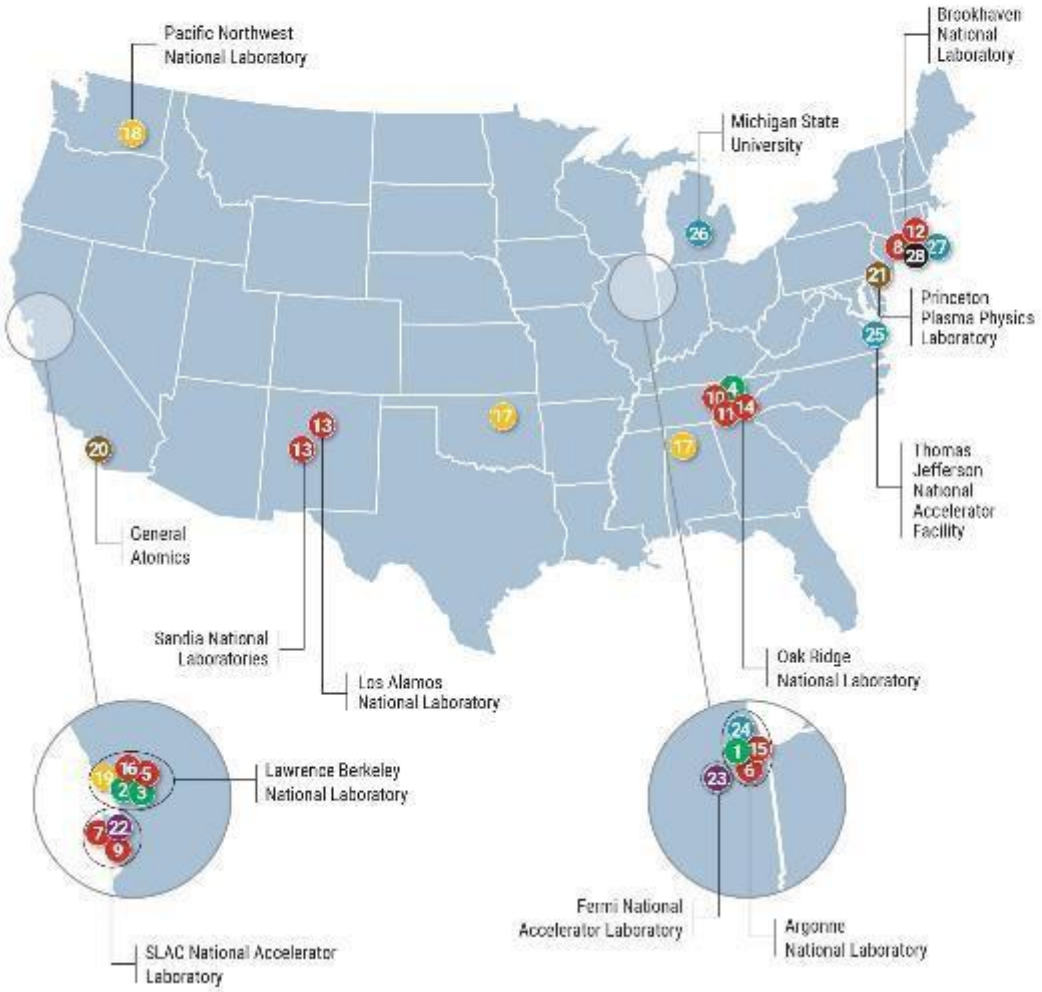
https://nationallabs.org/work-here/careers/

Backup and More Information

Office of Science Statement of Commitment & Other Guidance

- **SC Statement of Commitment** – SC is fully and unconditionally committed to fostering safe, diverse, equitable, inclusive, and accessible work, research, and funding environments that value mutual respect and personal integrity. https://science.osti.gov/SW-DEI/SC-Statement-of- Commitment
- **Expectations for Professional Behaviors** –SC's expectations of all participants to positively contribute to a professional, inclusive meeting that fosters a safe and welcoming environment for conducting scientific business, as well as outlines behaviors that are unacceptable and potential ramifications for unprofessional behavior. https://science.osti.gov/SW-DEI/DOE-Diversity-Equity-and-Inclusion-Policies/Harassment
- **How to Address or Report Behaviors of Concern**– Process on how and who to report issues, including the distinction between reporting on unprofessional, disrespectful, or disruptive behaviors, and behaviors that constitute a violation of Federal civil rights statutes. https://science.osti.gov/SW-DEI/DOE-Diversity-Equity-and-Inclusion-Policies/How-to-Report-a-Complaint
- **Implicit Bias** – Be aware of implicit bias, understand its nature – everyone has them - and implicit bias if not mitigated can negatively impact the quality and inclusiveness of scientific discussions that contribute to a successful meeting. https://kirwaninstitute.osu.edu/article/understanding-implicit-bias

U.S. Department of Energy Office of Science User Facilities



Advanced Scientific Computing Research (ASCR)

1. **Argonne Leadership Computing Facility (ALCF)**
   Argonne National Laboratory
2. **Energy Sciences Network (ESnet)**
   Lawrence Berkeley National Laboratory
3. **National Energy Research Scientific Computing Center (NERSC)**
   Lawrence Berkeley National Laboratory
4. **Oak Ridge Leadership Computing Facility (OLCF)**
   Oak Ridge National Laboratory

Basic Energy Sciences (BES)

LIGHT SOURCES

5. **Advanced Light Source (ALS)**
   Lawrence Berkeley National Laboratory
6. **Advanced Photon Source (APS)**
   Argonne National Laboratory
7. **Linac Coherent Light Source (LCLS)**
   SLAC National Accelerator Laboratory
8. **National Synchrotron Light Source II (NSLS-II)**
   Brookhaven National Laboratory
9. **Stanford Synchrotron Radiation Lightsource (SSRL)**
   SLAC National Accelerator Laboratory

NEUTRON SOURCES

10. **High Flux Isotope Reactor (HFIR)**
    Oak Ridge National Laboratory
11. **Spallation Neutron Source (SNS)**
    Oak Ridge National Laboratory

NANOSCALE SCIENCE RESEARCH CENTERS

12. **Center for Functional Nanomaterials (CFN)**
    Brookhaven National Laboratory
13. **Center for Integrated Nanotechnologies (CINT)**
    Sandia National Laboratories and Los Alamos National Laboratory
14. **Center for Nanophase Materials Sciences (CNMS)**
    Oak Ridge National Laboratory
15. **Center for Nanoscale Materials (CNM)**
    Argonne National Laboratory
16. **The Molecular Foundry (TMF)**
    Lawrence Berkeley National Laboratory

Biological and Environmental Research (BER)

17. **Atmospheric Radiation Measurement (ARM) User Facility**
    Fixed and Mobile Sites Across the Globe
18. **Environmental Molecular Sciences Laboratory (EMSL)**
    Pacific Northwest National Laboratory
19. **Joint Genome Institute (JGI)**
    Lawrence Berkeley National Laboratory

Fusion Energy Sciences (FES)

20. **DIII-D National Fusion Facility**
    General Atomics
21. **National Spherical Torus Experiment Upgrade (NSTX-U)**
    Princeton Plasma Physics Laboratory

High Energy Physics (HEP)

22. **Facility for Advanced Accelerator Experimental Tests (FACET)**
    SLAC National Accelerator Laboratory
23. **Fermilab Accelerator Complex**
    Fermi National Accelerator Laboratory

Nuclear Physics (NP)

24. **Argonne Tandem Linac Accelerator System (ATLAS)**
    Argonne National Laboratory
25. **Continuous Electron Beam Accelerator Facility (CEBAF)**
    Thomas Jefferson National Accelerator Facility
26. **Facility for Rare Isotope Beams (FRIB)**
    Michigan State University
27. **Relativistic Heavy Ion Collider (RHIC)**
    Brookhaven National Laboratory

Accelerator R&D and Production (ARDAP)

28. **Accelerator Test Facility (ATF)**
    Brookhaven National Laboratory

ASCR R&D Funding (**)

Funding Opportunity Announcements (FOAs)

- https://science.osti.gov/ascr/Funding-Opportunities
- Announced on grants.gov (hint: sign up for email notifications for 'ASCR')
- Read each announcement carefully to understand who can apply and other restrictions/requirements
- Depending on the announcement, supports 2–5-year projects
- University researchers can apply directly (please coordinate with your organization's sponsored-research office)
- Subcontracting is often permitted, and sometimes collaborative applications are permitted

Early Career Research Program

- https://science.osti.gov/early-career
- Research grants for five years
- Stays with PI if PI changes institutions
- Eligible within 10 years of Ph.D. (can apply up to three times)
- University-based researchers receive about $175,000/year
- Topics released in the summer, pre-applications generally due in the fall

DOE National Laboratory Announcements

- https://science.osti.gov/ascr/Funding-Opportunities (bottom of the page)
- Open only to DOE Laboratories
- Often allow subcontracts to support collaborators at other organizations

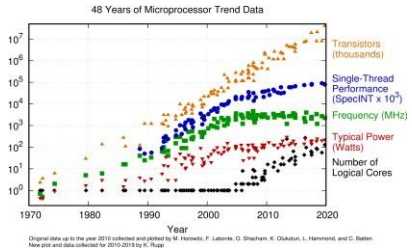
Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR)

- https://science.osti.gov/sbir
- Grants to for-profit US businesses with 500 or fewer employees (including affiliates)
- Phase I: ~$200k for 6-12 months, Phase II: ~$1M for 2 years
- Subcontracting is permitted, STTR: requires collaboration with a research Institution
- Topics released in the summer, pre-applications generally due in the fall

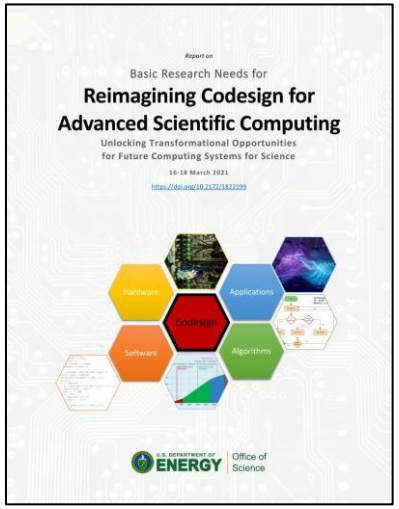
Computational Science Graduate Fellowship (CSGF)

http://www.krellinst.org/csgf/

Transforming the Fundamentals of Computing



Heterogeneous, Distributed, Co-Designed, Energy-Efficient Computing and Algorithms



ASCR Workshop on Reimagining Codesign, March 2021: https://doi.org/10.2172/1822199

Quantum Computing for Biomedical Computational and Data Sciences Joint DOE NIH Quantum Roundtable March 2023: https://doi.org/10.2172/2228574

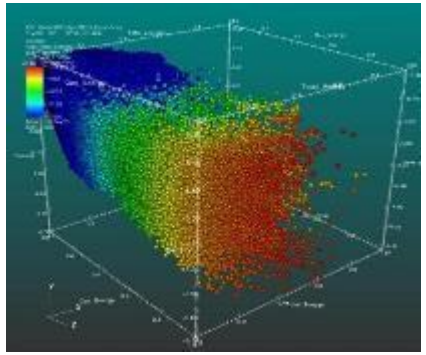
FY 2023

FY 2023

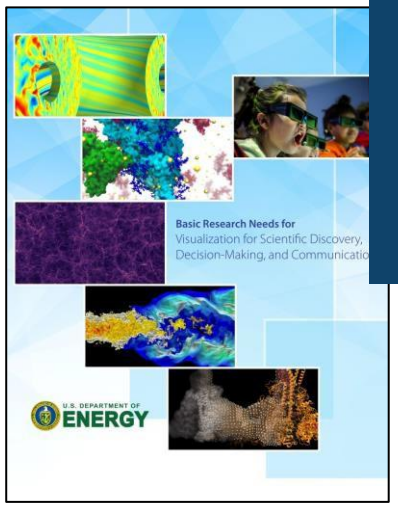
ASCR Basic Research Needs in Quantum Computing and Networking, July 2023: https://doi.org/10.2172/2001044 (brochure; report forthcoming)

Empowering Science Through Data Innovations

Data, Privacy, and Scientific Integrity



ASCR Workshop on Basic Research Needs for Management and Storage of Scientific Data, January 2022: https://doi.org/10.2172/1845707



ASCR Basic Research Needs Visualization for Scientific Discovery, Decision-Making, and Communication, January 2022: https://doi.org/10.2172/1845708

AI4SES Report

- AI for Science, Energy, and Security Report, released May 2023: https://www.anl.gov/ai-for-science-report

- Created by a confederation of laboratories, informed by a series of workshops held in 2022.

- Covers AI approaches:
  - AI and Surrogate Models for Scientific Computing
  - AI Foundation Models for Scientific Knowledge Discovery, Integration, and Synthesis
  - AI for Advanced Property Inference and Inverse Design
  - AI-Based Design, Prediction, and Control of Complex Engineered Systems
  - AI and Robotics for Autonomous Discovery
  - AI for Programming and Software Engineering
- Also covers crosscuts, including workflows, data, AI hardware, computing infrastructure, and workforce

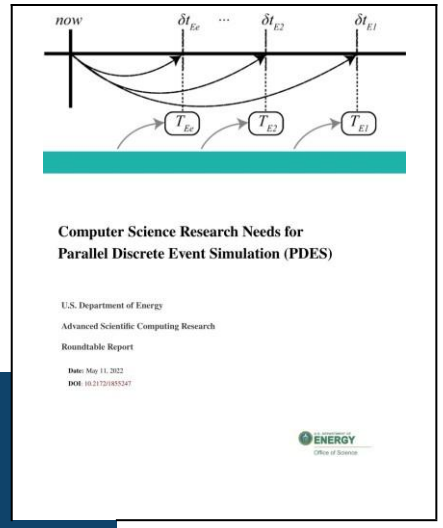
Accelerating Science from Exascale to the Edge

Scientific Computing and Networking: from Exascale to the Edge

Integrated Research Infrastructure Architecture Blueprint Activity, 2023: https://doi.org/10.2172/1984466

FY 2023

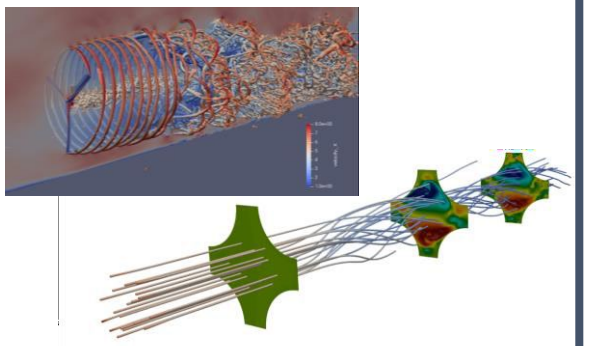
Roundtable on Foundational Science for Biopreparedness and Response, March 2022: Report available from https://science.osti.gov/ascr/Community-Resources/Program-Documents

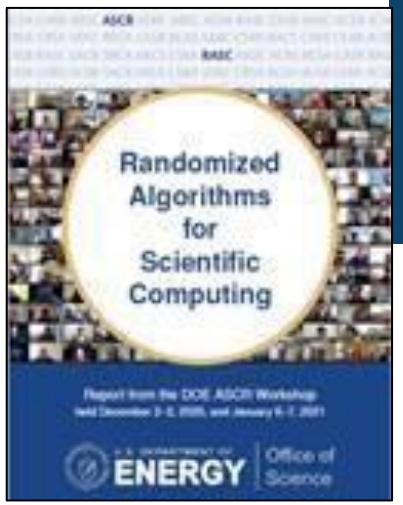


Roundtable on Computer Science Research Needs for Parallel Discrete Event Simulation, 2022: https://doi.org/10.2172/1855247

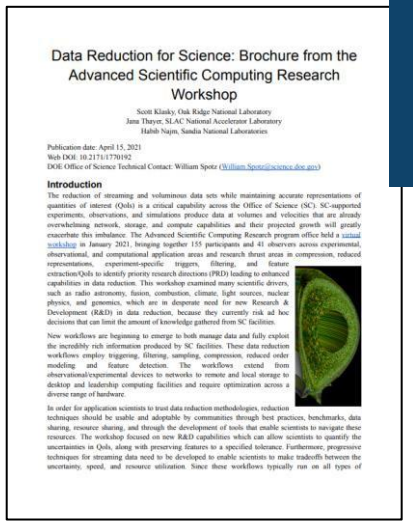
Innovating in Algorithms and Mathematics

Advanced Modeling, Simulation, and Visualization





ASCR Workshop on Randomized Algorithms for Scientific Computing, January 2021: https://doi.org/10.2172/1807223



Data Reduction for Science: Brochure from the Advanced Scientific Computing Research Workshop

Scott Klasky, Oak Ridge National Laboratory
Jana Thayer, SLAC National Accelerator Laboratory
Habib Najm, Sandia National Laboratories

Publication date: April 15, 2021
Web DOI: 10.2171/1770192
DOE Office of Science Technical Contact: William Spotz (William.Spotz@science.doe.gov)

Introduction

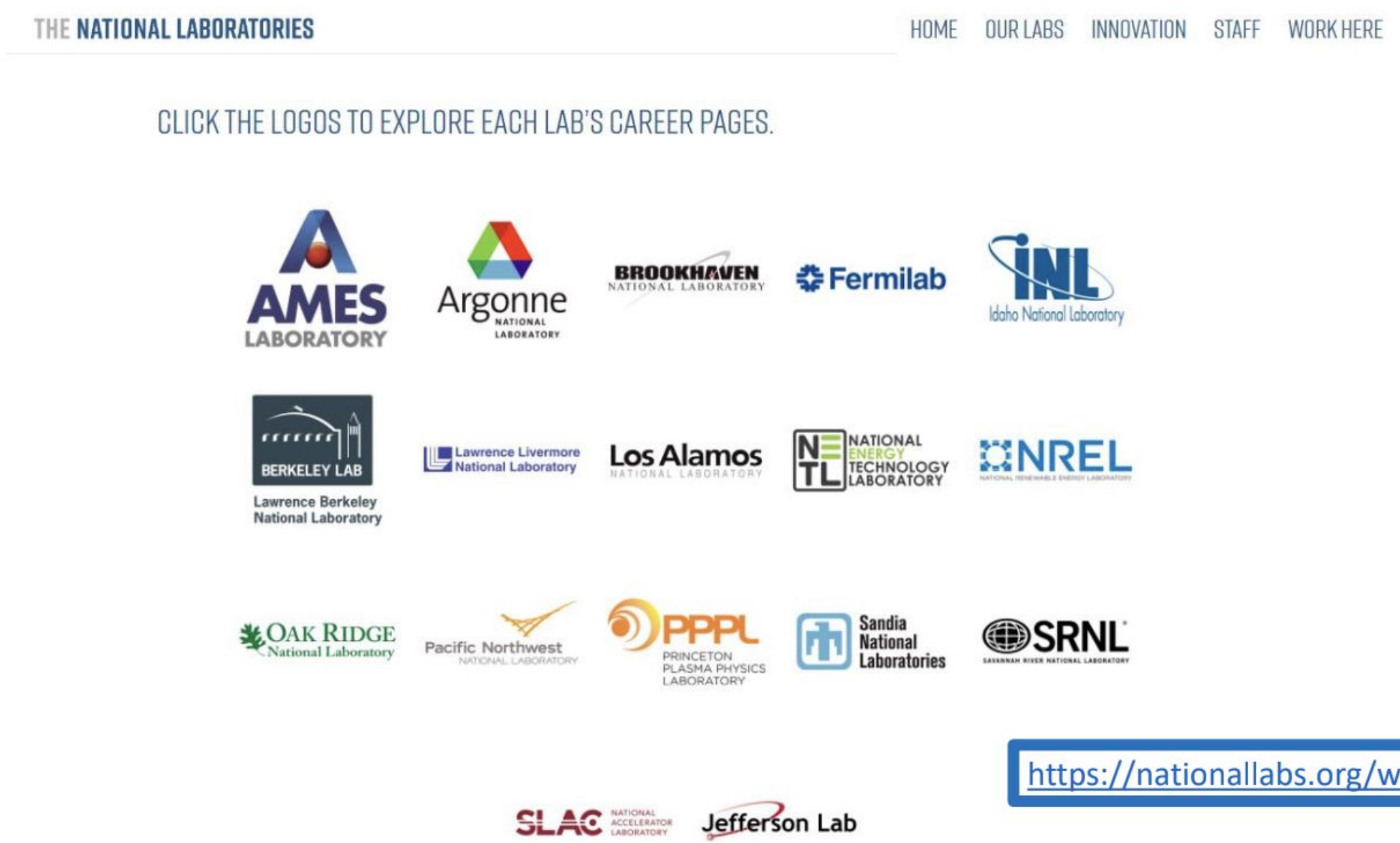
The reduction of streaming and voluminous data sets while maintaining accurate representations of quantities of interest (QoIs) is a critical capability across the Office of Science (SC). SC-supported experiments, observations, and simulations produce data at volumes and velocities that are already overwhelming network, storage, and compute capabilities and their projected growth will greatly exacerbate this imbalance. The Advanced Scientific Computing Research program office held a virtual workshop in January 2021, bringing together 155 participants and 41 observers across experimental, observational, and computational application areas and research thrust areas in compression, reduced representations, experiment-specific triggers, filtering, and feature extraction/QoIs to identify priority research directions (PRD) leading to enhanced capabilities in data reduction. This workshop examined many scientific drivers, such as radio astronomy, fusion, combustion, climate, light sources, nuclear physics, and genomics, which are in desperate need for new Research & Development (R&D) in data reduction, because they currently risk ad hoc decisions that can limit the amount of knowledge gathered from SC facilities.

New workflows are beginning to emerge to both manage data and fully exploit the incredibly rich information produced by SC facilities. These data reduction workflows employ triggering, filtering, sampling, compression, reduced order modeling and feature detection. The workflows extend from observational/experimental devices to networks to remote and local storage to desktop and leadership computing facilities and require optimization across a diverse range of hardware.

In order for application scientists to trust data reduction methodologies, reduction techniques should be usable and adoptable by communities through best practices, benchmarks, data sharing, resource sharing, and through the development of tools that enable scientists to navigate these resources. The workshop focused on new R&D capabilities which can allow scientists to quantify the uncertainties in QoIs, along with preserving features to a specified tolerance. Furthermore, progressive techniques for streaming data need to be developed to enable scientists to make tradeoffs between the uncertainty, speed, and resource utilization. Since these workflows typically run on all types of

Data Reduction for Science, January 2021: https://doi.org/10.2172/1770192

Explore Job Opportunities at DOE's National Laboratories



https://nationallabs.org/work-here/careers/