High Energy Physics
Broadening Engagement in STEM

Dr. Jacqueline D. Smith

American Association for the Advancement of Science (AAAS) Science & Technology Policy Fellow (2023 -2025)

8th Annual African School of Physics Conference

July 10th, 2024

Marrakech, Morocco

U.S. DEPARTMENT OF ENERGY | Office of Science

Energy.gov/science

Introductions

Previous Experience

- Criminology
- Police officer/Investigator/Instructor/Supervisor
- International Police Advisor
- Policy – "the foundation for any organization"

Education

- Undergraduate
- Graduate
- Faculty Member (ERI and HBCU)
- Doctoral
- Research and Policy

Current Status

- AAAS S & T Policy Fellow
- Assist in Supervising MEISPP Intern (Fostering Great Minds)
- Mentor: Alan Stone

Future

- AAAS S & T Policy Fellow (2nd year)
- Mentoring fellow Policy Fellows
- Change Agent (Policy, STEM, Education, & Justice)

High Energy Physics – Broadening Engagements

U.S. DEPARTMENT OF ENERGY | Office of Science

The nation's largest supporter of basic research in the physical sciences

Principal roles:

- Direct support of scientific research
- Direct support of the development, construction, and operation of unique, open-access scientific user facilities available for use by external researchers

U.S. DEPARTMENT OF ENERGY | Office of Science

High Energy Physics' Mission:

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)

U.S. DEPARTMENT OF ENERGY | Office of Science

Driving Discovery Science for the Nation

Discovery science supported by the Office of Science builds the foundation for ensuring America's future prosperity and competitiveness by addressing its energy, environment, and national security challenges.

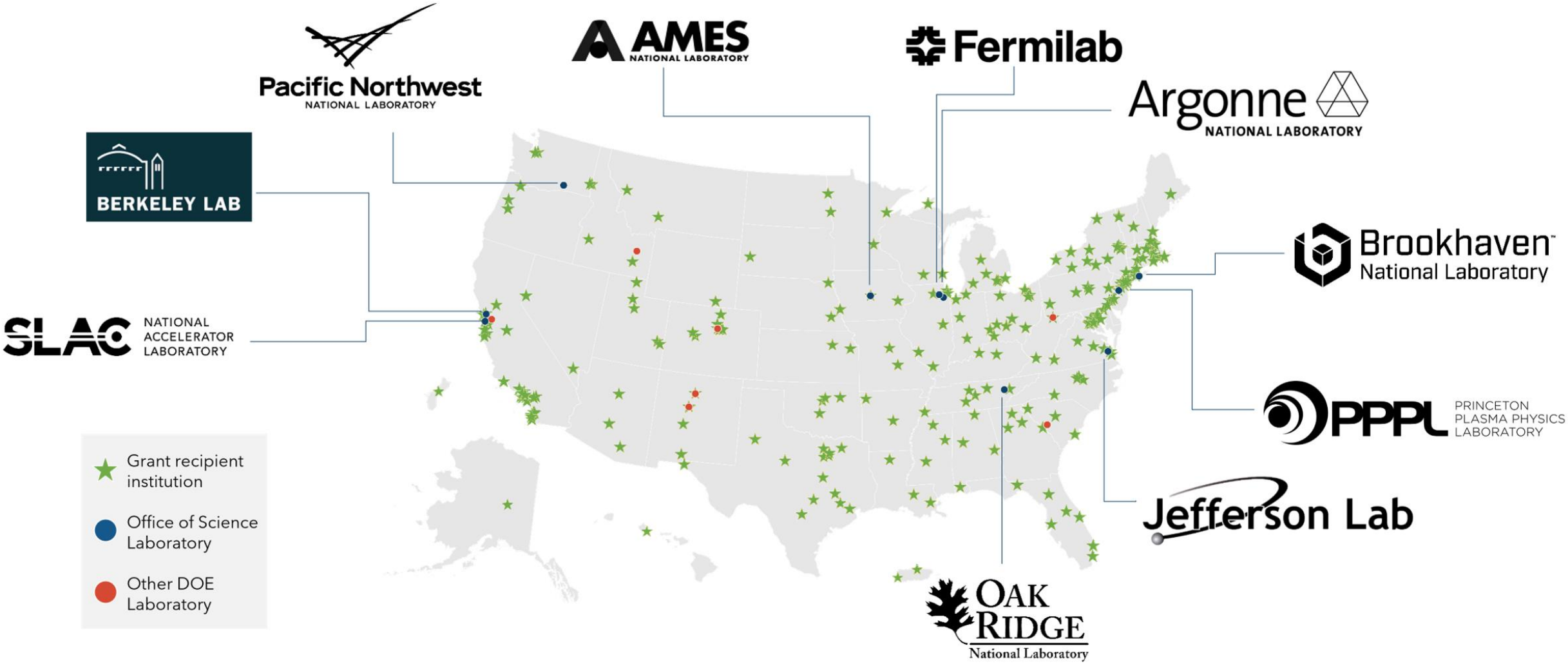
Fostering Great Minds and Great Ideas

The Office of Science addresses the world's most challenging scientific problems, supporting innovation from America's brightest minds, across multiple disciplines, and at universities, DOE's national laboratories, and other research institutions.

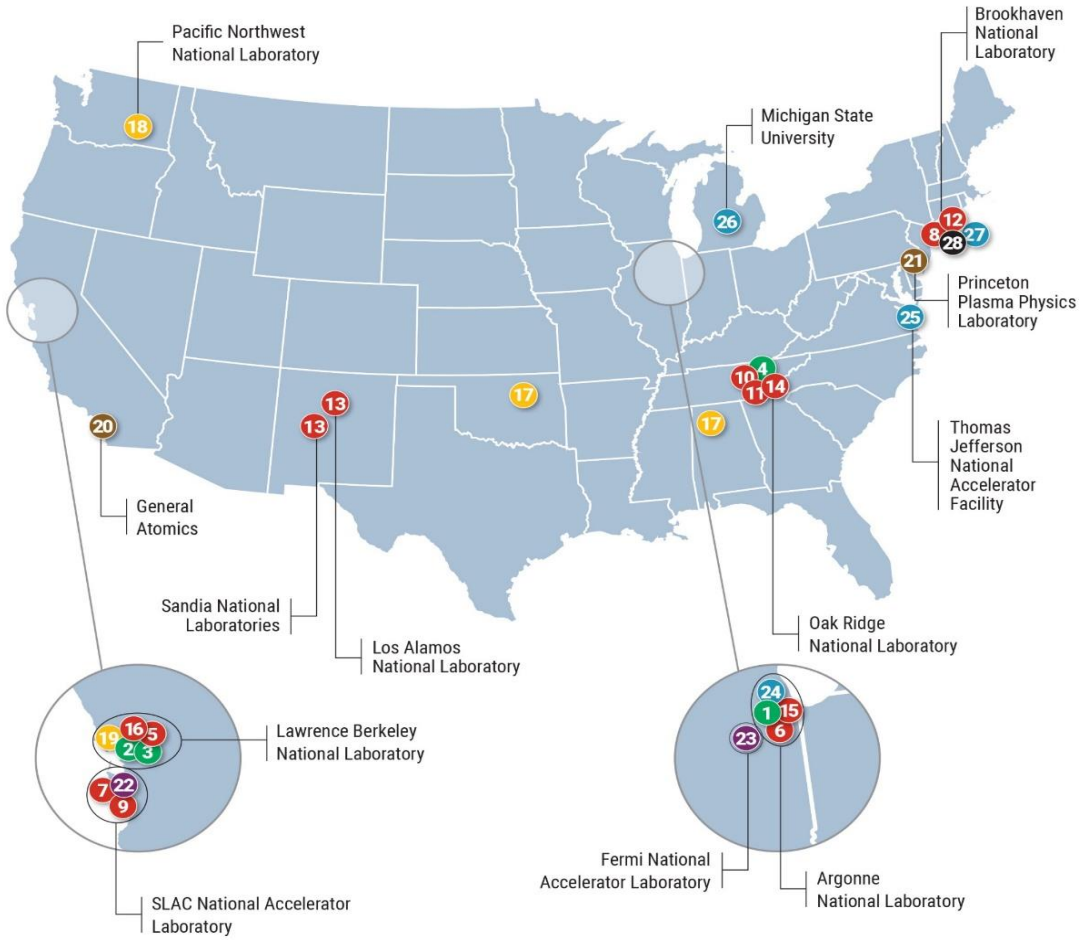
Providing Unique, World-Class Facilities

The Office of Science stewards a suite of scientific user facilities that provide the broad scientific community with world-leading capabilities for research - from physics, materials science, and chemistry to genomics and medicine.

Where we are, who we support



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

Building a New Energy Workforce

One that looks like America -- One that serves all Americans

SC Internship Programs and Opportunities

- Science Undergraduate Laboratory Internships Program
- The Community College Internships Program
- Office of Science Graduate Student Research
- Visiting Faculty Program

science.osti.gov/wdts

Diversity, Equity, Inclusion, and Accessibility

The Office of Science is deeply committed to:

- Supporting diverse, equitable, inclusive, and accessible environments
- Promoting people of all backgrounds
- Harnessing a diverse range of views, expertise, and experiences

Justice40

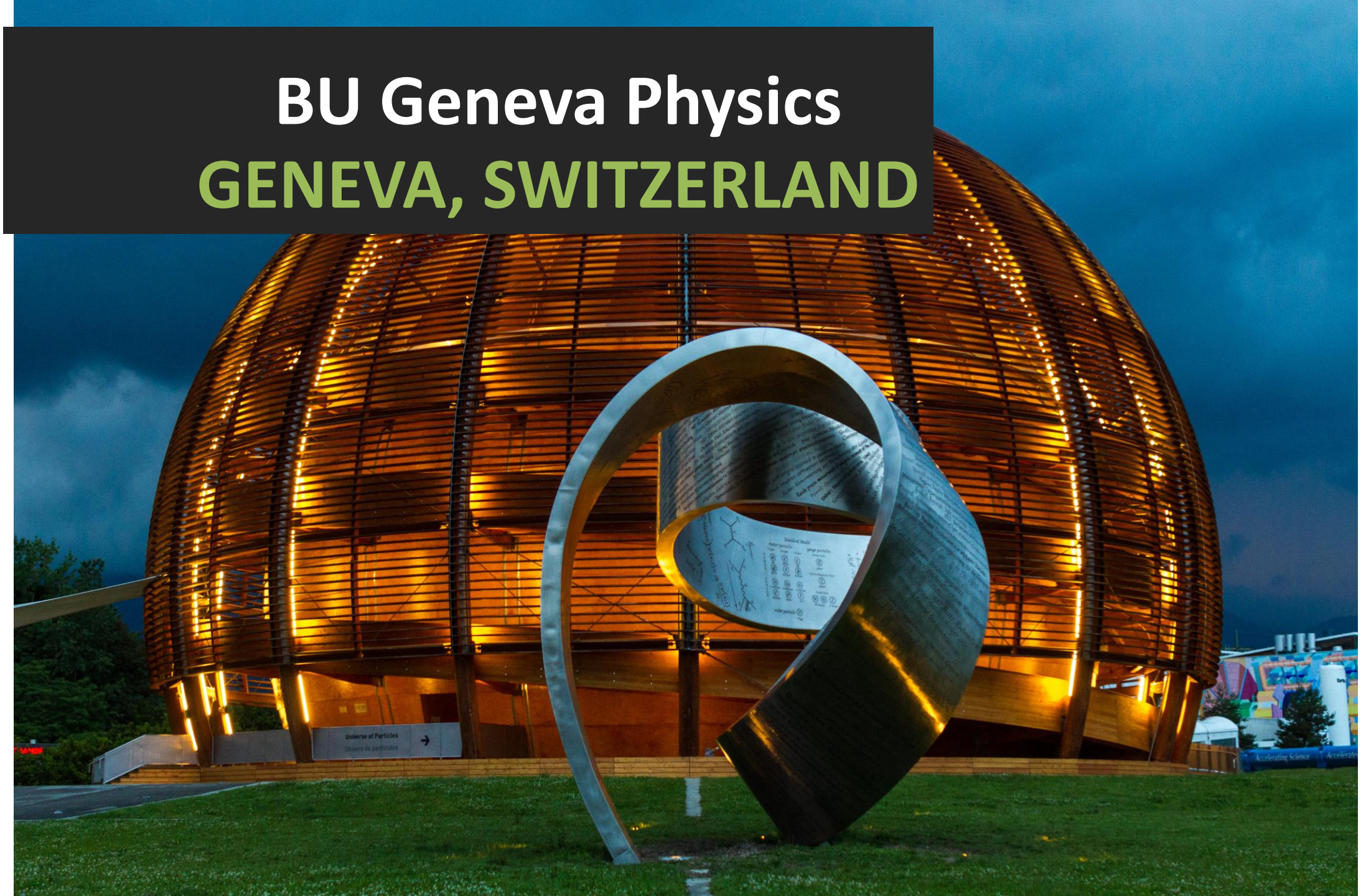
The Biden-Harris Administration created the Justice40 Initiative to confront and address decades of underinvestment in disadvantaged communities.

The initiative will bring resources to communities most impacted by:

- Climate change
- Pollution
- Environmental hazards

BU Geneva Physics

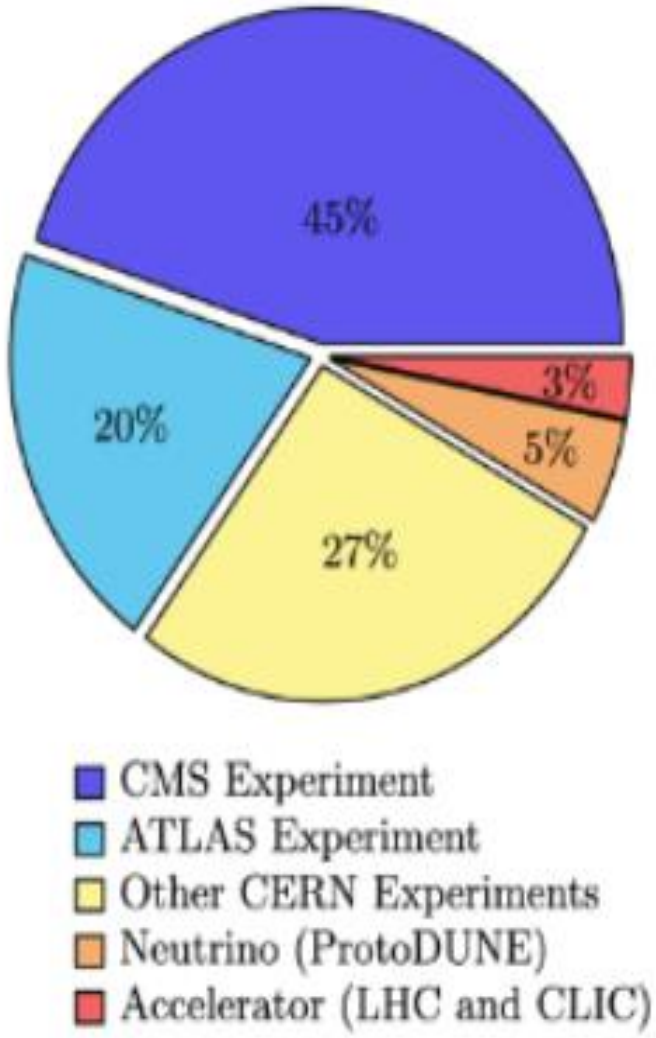
GENEVA, SWITZERLAND

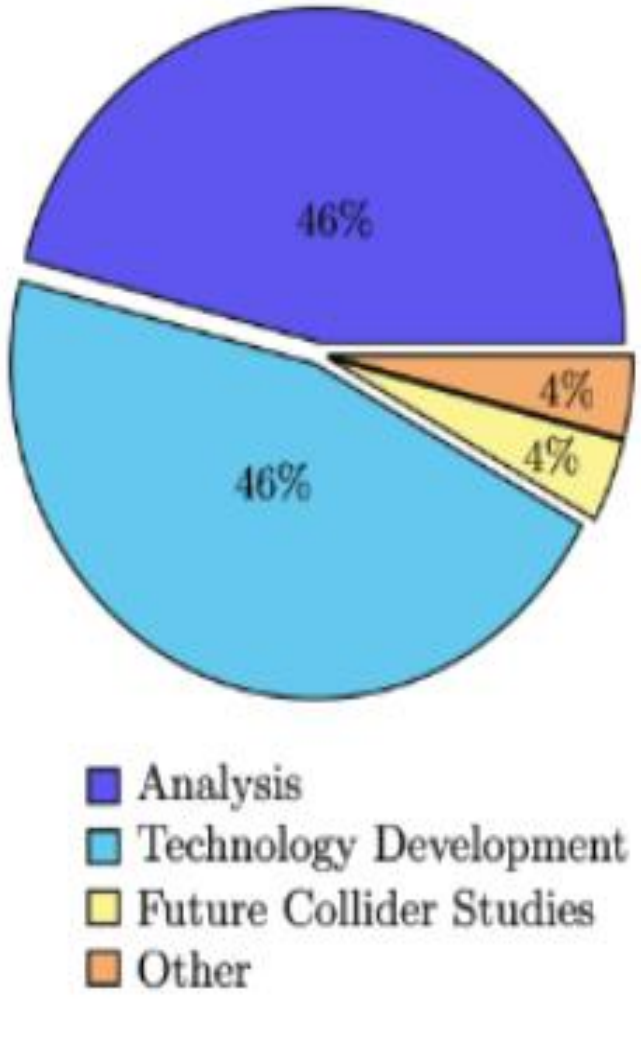


Overview

- Study Abroad :
  - Junior year, second semester for Physics/Astronomy/Math majors
  - 6 Months stay in Geneva
  - Guided research at CERN
  - Get immersed at the University of Geneva
- Summer Extension :
  - 6 weeks extended stay in Geneva
  - Full-time research at CERN with a CERN mentor
- Live just a short walk from Geneva's most famous landmarks and attractions
- Cultural exchanges & excursions!

Summer Extension: Research Focus!





A large variety of research projects from data analysis to technology development across multiple experiments and accelerator projects!

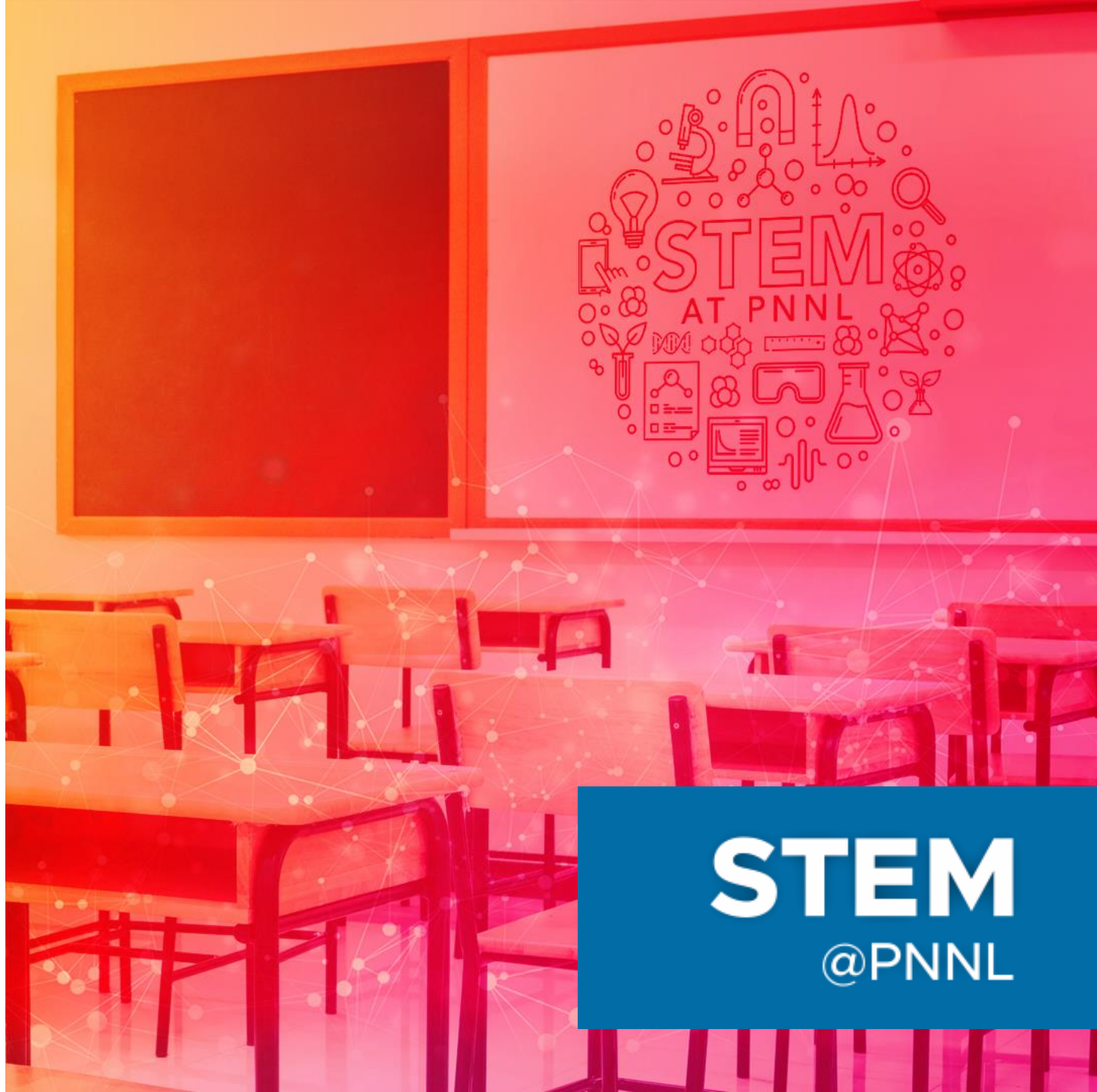
Pacific Northwest
NATIONAL LABORATORY

Building the Diverse STEM Workforce of the Future: High Energy Physics at PNNL

Evangelina Galvan Shreeve

Chief Diversity Officer & STEM Education Director

June 2024



U.S. DEPARTMENT OF ENERGY BATTELLE

PNNL is operated by Battelle for the U.S. Department of Energy

PNNL-SA-193234

HEP Outreach at PNNL

- **PNNL prioritizes diversity,** equity, inclusion, and accessibility in our HEP efforts.
- **PNNL conducts strategic HEP outreach** by leveraging our STEM Ambassadors. We also develop partnerships with Minority Serving Institutions and Emerging Research Institutions.
- **PNNL engages faculty and students** who are from underrepresented groups to develop interest and awareness of DOE-SC HEP research and workforce development opportunities.

Pacific Northwest
NATIONAL LABORATORY

STEM Education Capabilities at PNNL

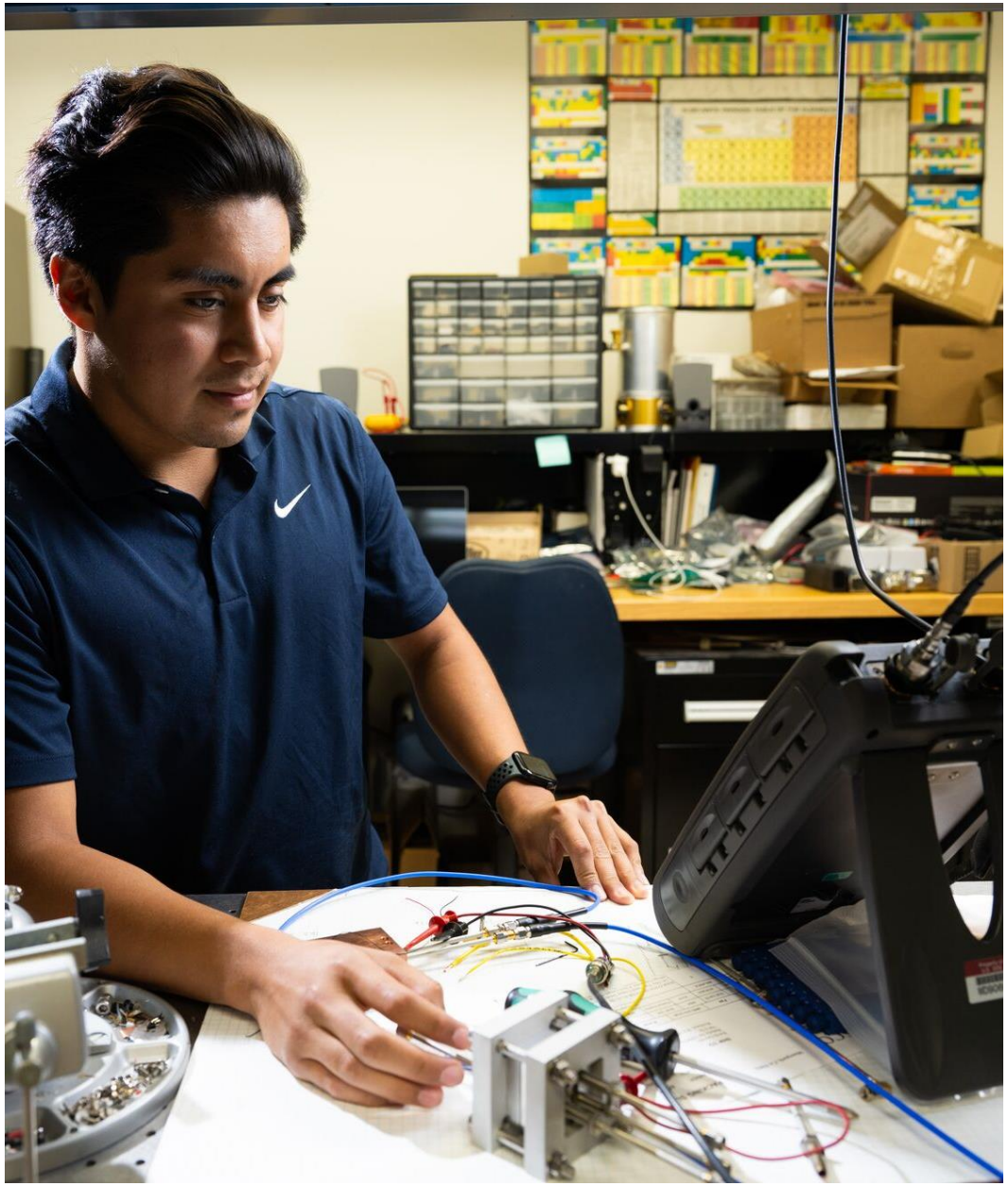
STEM OUTREACH

STEM WORKFORCE DEVELOPMENT

Pacific Northwest
NATIONAL LABORATORY

HEP Workforce Development at PNNL

- **Early STEM pathway project:** Engages underrepresented students from two community colleges that are Hispanic Serving Institutions (HSI) in remote and onsite HEP research internships at PNNL.
- **Undergraduate STEM pathway project:** Engages underrepresented undergraduate students from a non-R1, HSI in onsite HEP research internships at PNNL and immersive HEP learning at their college campus. Provides HEP-focused professional development for faculty.



SLAC Returning Citizens Pilot Program

Project Plan FY24

Natalie Holder, Chief Diversity Officer

SLAC NATIONAL ACCELERATOR LABORATORY

Stanford University | U.S. DEPARTMENT OF ENERGY

Background: The Pilot and a Potential Solution

For FY24 and FY25,

SLAC received a total of $500k in funding from the DOE to launch a pilot program to determine whether returning citizens could be a talent pipeline for our lab

The pilot would target technicians' roles

New York State's Clean Slate Law automatically seals misdemeanor offenses after three years, making it advantageous to work with a NY-based organization to source the talent

Key Facts about Returning Citizens

- Over **2 million** people are incarcerated in the U.S.
- According to the National Reentry Resource Center, about **70 million** adults in the United States have a criminal record, and some of them do **pursue higher education**, including obtaining **college degrees**.
- Hiring formerly incarcerated individuals **helps reduce** their chances of returning to jail or prison.
- Employees with a record are loyal and offer a unique perspective in the workplace.
- Companies can help **strengthen the economy** by hiring formerly incarcerated individuals.

Companies that have successful Returning Citizens Programs

1. **IBM (launched in 2020)**: IBM's "New Collar" program doesn't focus on a candidate's educational background or traditional qualifications but rather on their skills and potential. They've been open to hiring individuals with non-traditional backgrounds, including those with criminal records.

2. **Google (launched 2016)**: Google has taken steps to support individuals with criminal records by signing the Obama administration's Fair Chance Pledge. They've committed to considering individuals with criminal records for job opportunities.

3. **Microsoft (launched 2015)**: Microsoft is known for its initiatives to provide employment opportunities to individuals with criminal backgrounds. They've worked on several programs focusing on skills training and hiring individuals who have been formerly incarcerated.

4. **Amazon (launched 2022)**: Amazon has a program called "Career Choice" that provides training and education for employees, including those with criminal records, to gain skills for in-demand jobs, both within and outside of Amazon.

5. **Biogen (launched 2015)**: Biogen, a biotechnology company, has supported programs focusing on workforce development and providing opportunities for individuals with criminal records. They've been involved in initiatives aimed at increasing diversity and inclusivity in the workforce.

Roadmap: Overall Program Framework

Statement of Recruitment, Retention & Promotion Strategy to Increase DEI+, Particularly in S&T

1

Build

- Work with external partners to source, support and hire the pilot participants
- Internally partner with Talent Acquisition and the directorate to identify critical and difficult to hire roles

2

Work

- Select Returning Citizens to participate in the program through the interview and hiring process

3

Assess

- Determine the efficacy of the program and lessons learned
- Determine whether to extend offers of full-time employment

SAGE Journey Program (founded at SLAC is now run in many other national laboratories)

2024 Stanford President's Award for Excellence in Diversity

www.mySAGEjourney.org

SAGE Journey Program (founded at SLAC is now run in 6 other national labs)

At SLAC, in 2023, out of 809 Technical Research Staff, 148 (18%) were women

Supported by the Gordon and Betty Moore Foundation 2018-2024

SAGE Journey is a program that guides students from high-school through college and into their first jobs in the Department of Energy (DOE) National Laboratory network.
Mission: to engage curious and passionate students of genders historically underrepresented in STEM, and empower them to explore a wide range of possibilities for their future.

SAGE CAMP
Encourage college bound students with a passion for discovery and innovation to join the DOE community

- Allow students to meet women at DOE at various career stages
  - Undergraduate and graduate students
  - Early and mid career professionals and senior leadership

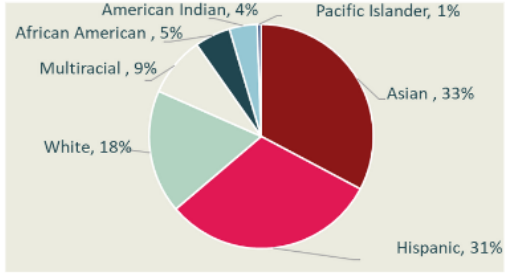
SAGE Camp Goals

- Students with diverse socio-economic background
- Create the feeling of awe
- Develop professional skills
- Show impact of science and engineering on our communities and the world
- Grow SAGE Community
- Imagine themselves as scientists and engineers

METRICS

- Evaluate impact by tracking students for 5 years
- Use data to improve program

Summer Camp participants ethnic diversity:

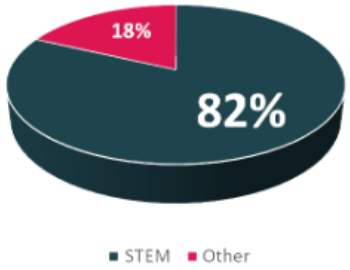


Student impact:

745	Cumulative students attended SAGE Camps
25	SAGE Live events with an average of 27 attendees
9	SAGEx School Clubs with an average of 20 members

Choice of STEM major:

Based on 181 SAGE alumni annual survey responses



SAGE Internship:

- advertising existing national lab internship programs within the SAGE community
- connecting SAGE participants with mentors at National Laboratories and guiding them through the application and selection processes
- developing skills relevant and/or unique to National Laboratories
- tracking of skill proficiency level increase

Strongly supported by HEP

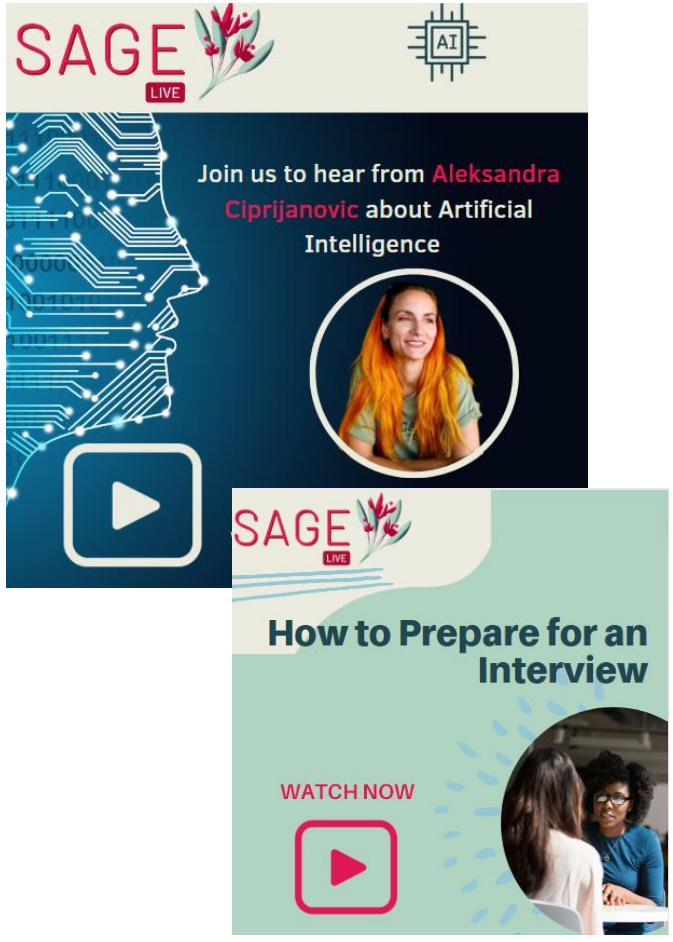
Internships	2022	2023
SAGE HEP funded	7	21
DOE and Lab funded	14	25
Total	21	46

www.mySAGEjourney.org

Mission: to engage curious and passionate students, and empower them to explore a wide range of possibilities for their future.

SAGE Live

Keep a connection with the students' community



SAGEx Clubs

High school clubs that enlarge the SAGE community and give opportunities to our students to apply their leadership skills

12 clubs

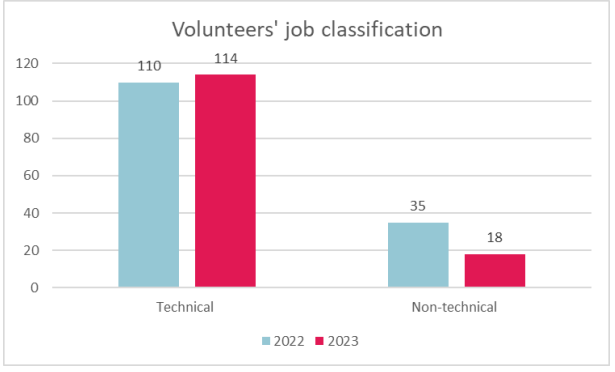
8 career talks

2 SLAC tours

~12 members per club

SAGE Volunteers

Bring the SLAC community together



SAGE

Fermilab Initiatives – TECHS and IDEAS

21 June 2024

New Fermilab Initiatives for Engineers and Technicians

Purpose: Foster innovation and growth in the engineering and technical communities

- Provide support to engineers to pursue innovations that lead them into the research and development arena and technology transfer while advancing the lab's strategic priorities
  - Improve mission operations, such as safety, sustainability, advanced manufacturing and fabrication processes, materials, advanced tools and new technology
  - Pursue ideas within emerging capabilities such as quantum, microelectronics, and artificial intelligence / machine learning
- Create a program to develop the technical skills in high school students desired in technicians
  - Also, introduce high schoolers to careers at the lab beyond scientists and engineering

<u>Solution: DOE Office of Science funding of $2M over the next 5 years</u>

Two New Initiatives: TECHS and IDEAS

Technician Education for Careers out of High School (TECHS)

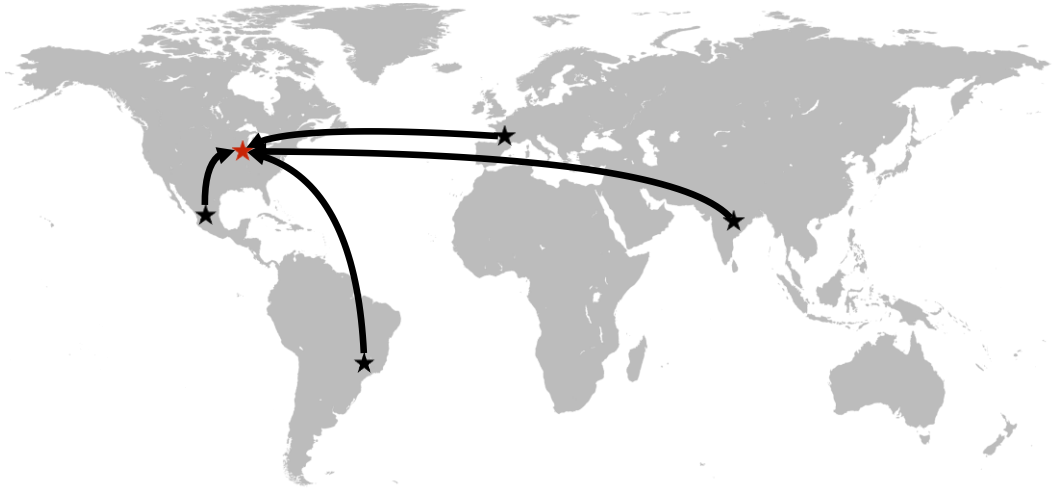
- Pilot apprenticeship for high school students
- Talent incubator to nurture future technicians
- Two-summer commitment starting 2025
  - Mentored by lab technicians and program instructors
  - First summer for rising high school seniors to receive instruction on basic electrical and mechanical skills and work on lab room projects
  - Second summer for the summer after students graduate from high school to work within technician groups
  - Upon completion of program, opportunity for qualified students to apply for permanent positions

Innovative Design Engineering to Accelerate Solutions (IDEAS)

The suite of initiatives to support engineering innovations

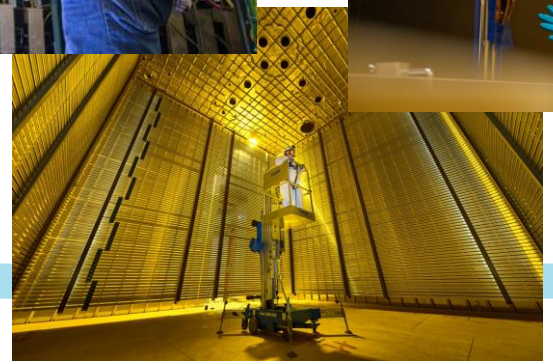
- Disclosure Drive Funding – “What would you do with 30 hours and $5000?”
  - Pursue an idea that could lead to an invention disclosure or patent
- Microgrants
  - For the development of ideas or applications towards proof-of-concept small-scale prototypes
  - $25,000 microgrant – 1 award
  - $5000 microgrants – 3 awards
- Applying for a DOE Early Career Award
  - Up to 300 hours of effort to write a proposal, seek out guidance, and incorporate feedback

Fermilab Intensity Frontier International Student Program



- Enable students to come to Fermilab to conduct research under the supervision of laboratory staff
- Short-term: < 6 months stay at Fermilab, undergraduates through Ph.D. students
- Long-term: > 6 months stay at Fermilab to work on Masters or Ph.D. thesis research

- Students conduct research on a Fermilab-based neutrino experiment (eg, MicroBooNE, ICARUS, SBND, NOvA, DUNE, EMPHATIC, ANNIE).



Fermilab Intensity Frontier International Student Program

- A huge success!
  - >90% of participants of the long-term program who chose to continue in the field were hired as postdoctoral scholars.
  - Participants have made life-long friendships and professional connections
  - Participants are highly visible within the experimental collaborations
- Details:
  - Home institution provides airfare and some level of per-diem
  - Fermilab provides housing, additional per-diem and a shared vehicle for local transportation
  - International PIs are responsible for arranging research project and Fermilab supervisor
  - Participation in the program requires agreements between the institution and Fermilab. Please contact Hema Ramamoorthi (hema@fnal.gov) for more information.

VALOR: (Veteran Applied Laboratory Occupational Retraining) Program

Investment (DOE Office of Science)

- $4M over 5 years (2022 – 2026)

Goal

- Opportunity for military veterans reentering civilian life.
- Build a rich workforce pipeline of trained technicians, and computing and procurement professionals, to fill critical roles as incumbents retire.

Multiple entry points for learning and training

- Short-term **paid** learning opportunities
- Long-term employment security
- Visibility to post-high-school pathways (may or may not include college)

Opportunities

- fabricate, assemble, calibrate, operate, test, repair or modify electronic/mechanical equipment, systems, devices or databases.
- information technology, procurement, ESH environmental, wastewater disposal, radiological surveys

JROTC Summer Internship

- JROTC - local high schools
- 6 weeks

VetTech Summer Internship

- Military veterans
- 10 weeks

Apprenticeship

- Military vets / JROTC students
- 6-months, FT, (held 2x per year)

From Service to Science – VALOR Profiles (a few…)

Small Business Liaison Officer
Finance and Procurement
Hired 2023

Cybersecurity Specialist
Accelerator Directorate
Hired 2023

Financial Analyst
Finance and Procurement
Hired 2023

Area Facilities Manager
Infrastructure Services Division
Hired 2023

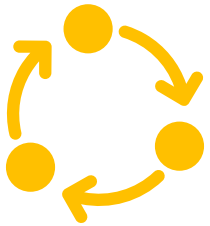
STEM Ambassador: Primary Responsibilities

FY24 RENEW Proposals:

Coordinate efforts with academic institutions to submit full proposals to DOE for the Reaching a New Energy Workforce (RENEW) Funding Opportunity Announcements (FOAs).

Establish Partnerships:

Connect collaborators from institutions not historically represented in the Office of Science Research Proposal with Fermilab researchers and program opportunities.



PIER Plans:

Review and approve Promoting Inclusive and Equitable Research (PIER) plans for FOAs.

Funded Programs:

Lead and coordinate funded program efforts and administer post-award activities and reporting.

Funded Program

Fermilab and Brookhaven Summer School Exchange Program:

A university freshman undergraduate summer school exchange experience at two national laboratories focused on the DOE mission-critical areas of neutrino research, artificial intelligence/machine learning, and quantum information science. Climate science has been added for the second year of the summer school.

Funded Programs

Fermilab QIS Summer Institute for K-12 STEM Educators:

Selected STEM educators learn about Quantum Information Science (QIS) and create age-appropriate instructional materials for primary through secondary school students.

Educators receive:

- weekly stipend
- professional development credits
- budget to support the development of instructional materials

Funded Program

Particle Accelerator Capabilities Enhancement and Modernization Apprenticeship Program (PACEMAP):
A multi-year training program to develop electrical technicians for Department of Energy laboratory workforce needs. The funding provides student tuition for required courses, stipend while taking courses, wrap around support, wages for on-the-job training at Fermilab, and equipment for collaborating academic institution.

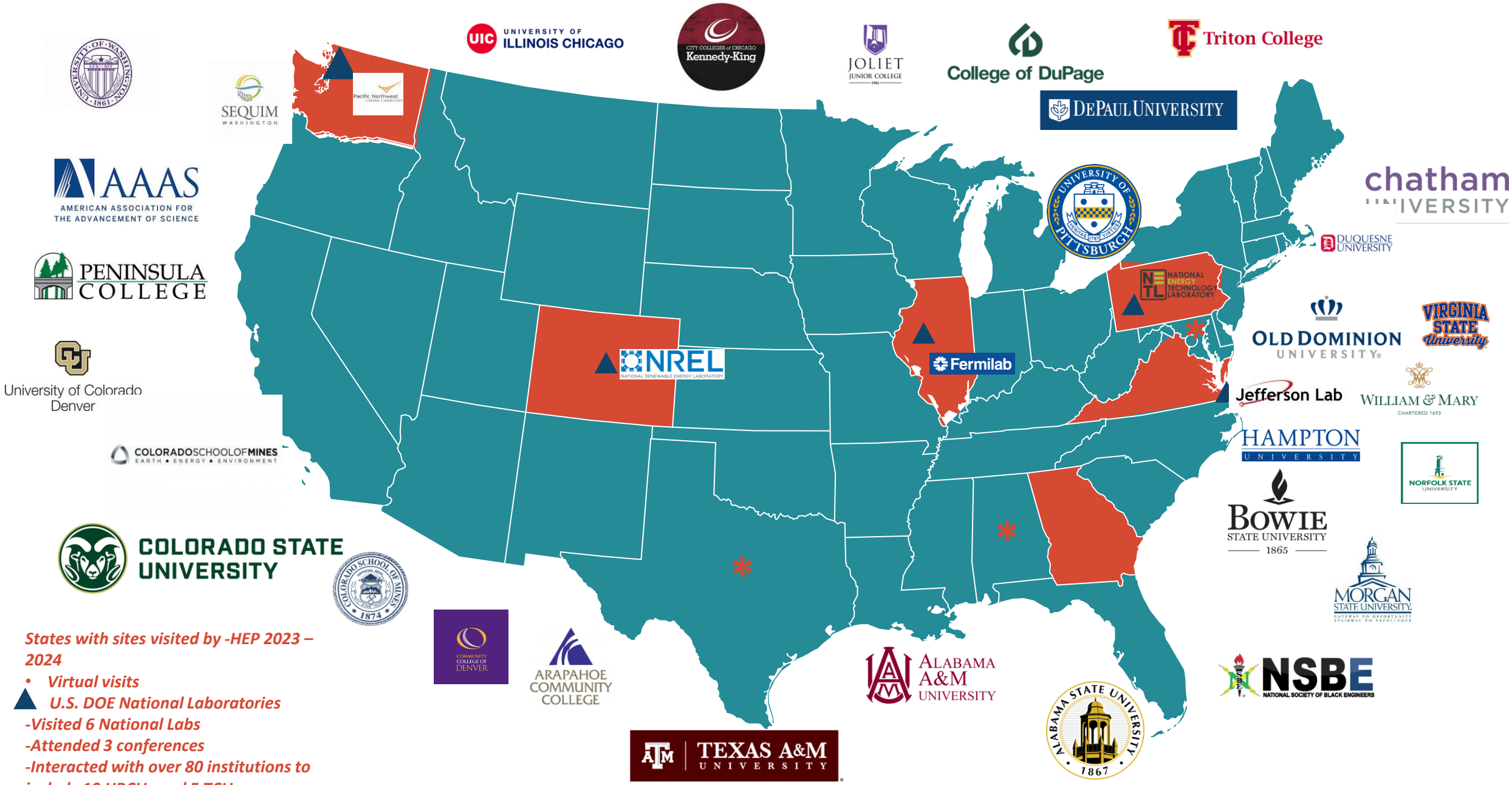
Funded Programs

Training through research in quantum information science and engineering at the SQMS Center:

The funded program supports investigators and students at their institutions through investments in their education and infrastructure and includes funding to purchase equipment at partnering institutions, investigators become part of the SQMS collaboration, and internships will be offered at Fermilab to their students.

On-the-Ground Visits

- Implementation of EDIA with writing policy
- Seeking out personnel from MSIs that have the Knowledge Skills and Abilities (KSA)
- Incorporating personnel that have the KSA and background
- Employ personal so that they can impart knowledge, continue the work, and thrive.



States with sites visited by -HEP 2023 – 2024

- *Virtual visits*
- ▲ *U.S. DOE National Laboratories*

-Visited 6 National Labs
-Attended 3 conferences
-Interacted with over 80 institutions to include 10 HBCUs and 5 TCU

Ozaki Exchange Program

The goals of this program are to strengthen U.S.-Japan scientific collaboration and in particular facilitate greater cooperation in the areas of accelerator and particle physics in projects of mutual benefit to Japan and the United States.

The program was launched in 2018, in honor of Satoshi Ozaki, to support US university students to go to Japanese HEP labs and Japanese university students to US DOE Labs

All graduate students enrolled, or undergraduate students already accepted for enrollment in accredited Japanese or U.S. physics Ph.D. programs are eligible to submit a proposal.

Call for application annually, reviewed by committees and approved by KEK and DOE

The duration of the award is for a three- to twelve-month period.

The award will provide for travel, housing, and cost-of-living expenses for the stay overseas.

There was a pause in 2021 and 2022 due to COVID pandemic.

Ozaki Exchange Program (II)

The exchange program has attracted students for a variety of research opportunities

- 15 US Students and 9 Japanese students have been selected to participate in the program on High Energy Physics experiments and accelerator R&D
  - Belle II, T2K, SuperK, KOTO, neutrino physics and detector, accelerator R&D, Cosmic Microwave Background, silicon detector R&D

The selected students gain research experience at leading particle physics facilities

The program strengthens the US-Japan collaboration in high energy physics

Lessons Learned

- Meeting people where they are and forging trustworthy and longstanding relationships between SC/HEP and Emerging Research Institutions and Minority Serving Institutions
- Important to visit both labs/R1s and ERIs/MSIs on trips. SC initiatives emphasize partnerships between former & latter
- Follow up after visit, encouraging further communication

Frequent Observations

- Resilience
- Strong work ethics
- Sense of community
- Small research enterprises with out-sized impact
- Relationship builders

- Do not know about FOA, are eligible to apply, etc.
- Research grant infrastructure
- Faculty overburden
- Outdated equipment

Additional Information to connect:

Science.osti.gov/wdts

Jacqueline.smith@science.doe.gov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