



U.S. DEPARTMENT OF
ENERGY

Office of
Science

HEP Research Program Status

HEPAP Meeting
December 8, 2022

Glen Crawford
Research & Technology Division Director
Office of High Energy Physics
Office of Science, U.S. Department of Energy

Outline

Disclaimer: This is sort of a “rapporteur” talk, briefly covering many things that have gone on during the past ~6 months, and crowdsourced. Like all such talks, there is not enough time to cover everything, my apologies in advance to the many contributors (and to those who prefer a consistent slide style...)

Topics:

- ▶ Codes of Conduct
- ▶ Selected Research Highlights
- ▶ Funding Opportunities FY22/23
 - ▶ Outcome and prospectus
- ▶ DEIA Activities
- ▶ Office Comings and Goings
- ▶ Awards and Recognition

SC Statement of Commitment

“The DOE Office of Science (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.... SC’s effective stewardship and promotion of safe, accessible, diverse, and inclusive workplaces that value and celebrate the diversity of people, ideas, cultures, and educational backgrounds across the country and that foster a sense of belonging in our scientific community is foundational to delivering on our mission. We are committed to promoting people from all backgrounds, including individuals and communities that were historically underrepresented and minoritized in STEM fields and the activities we sponsor in recognition of our responsibility to serve the public...

Discrimination and harassment undermine SC’s ability to achieve its mission by reducing productivity, discouraging or inhibiting talent recruitment, retention, and career advancement, and weakening the integrity of the SC enterprise overall. **SC does not tolerate discrimination or harassment of any kind...**

Beyond issues that may rise to the level of legal action, SC expects the scientific community, particularly those engaging in SC-sponsored activities, to always conduct themselves in a manner that is respectful, ethical, professional, and inclusive. **SC reserves the right to take appropriate action at SC-hosted events** should participants not adhere to these expectations for responsible workplace behavior. **SC also strongly encourages recipient and partner institutions to adopt and implement their own codes of conduct...**”



Potential Consequences for Unprofessional Behavior at SC Meetings

The Office of Science (SC) expects the scientific community participating in SC-sponsored events to conduct themselves in a manner that is respectful, ethical, professional, inclusive, and non-disruptive. By attending such events, participants agree to conduct themselves according to these expectations. If a participant does not adhere to such expectations, SC reserves the right to take appropriate action.

Such action may include:

- A verbal reprimand and reminder of the expectations,
- Being asked to leave the event,
- Removal by security personnel,
- Temporary or permanent suspension from receiving invitations to future non-public SC events, and,
- Reporting of individual(s) responsible for exclusionary and/or disruptive workplace behavior through appropriate channels.

Inappropriate behavior can be reported by an attendee to the senior most SC federal manager present at the event or the senior federal manager of the SC host office for the event. Retaliation against individuals who report inappropriate behavior will not be tolerated.

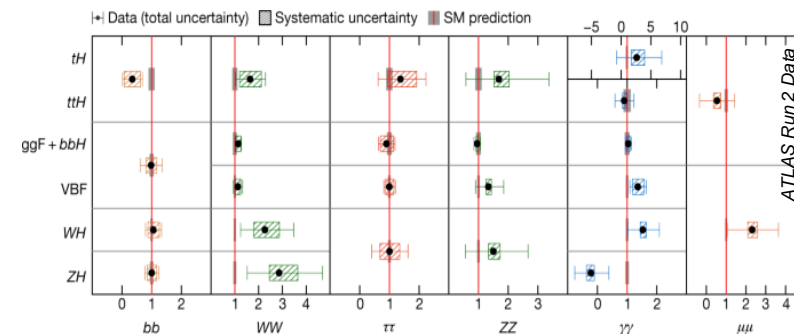


Energy Frontier: LHC Highlights

- ▶ Congratulations to the LHC and ATLAS & CMS on the successful start of Run 3 on July 5th, now operating at 13.6 TeV, the highest energy particle collisions in the world
 - ▶ And commend the program for delivering $\sim 40 \text{ fb}^{-1}$ of data, surpassing the 25 fb^{-1} goal originally set for calendar year 2022
- ▶ At the 10th anniversary of the Higgs boson discovery this year, ATLAS and CMS published comprehensive measurements of the Higgs properties in journal *Nature*
 - ▶ Results include application of AI/ML methods to increase purity and efficiency of identified and reconstructed final state decay particles
- ▶ Run 3 results already streaming towards publications
 - ▶ Includes CMS first measurement of $\sigma(\text{tt})$ at 13.6 TeV with 8.8 fb^{-1} of data: Measured: $\sigma_{t\bar{t}} = 887_{-41}^{+43}(\text{stat} + \text{syst}) \pm 53(\text{lumi}) \text{ pb}$
Theo. pred: $\sigma(t\bar{t}) = 921_{-37}^{+29} \text{ pb}$
- ▶ Look forward to more results with Run 3 data and thereby add to the rich suite of 2,300+ publications, overall by ATLAS and CMS, since the start of LHC running in 2009



Observed Rate to Predicted SM Event Rate for Different Higgs Production and Decay Processes



November 2021

HEP Research Program - HEPAP

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LZ – First Results

Berkeley Lab Researchers Record Successful Startup of LUX-ZEPLIN Dark Matter Detector at Sanford Underground Research Facility (lbl.gov)

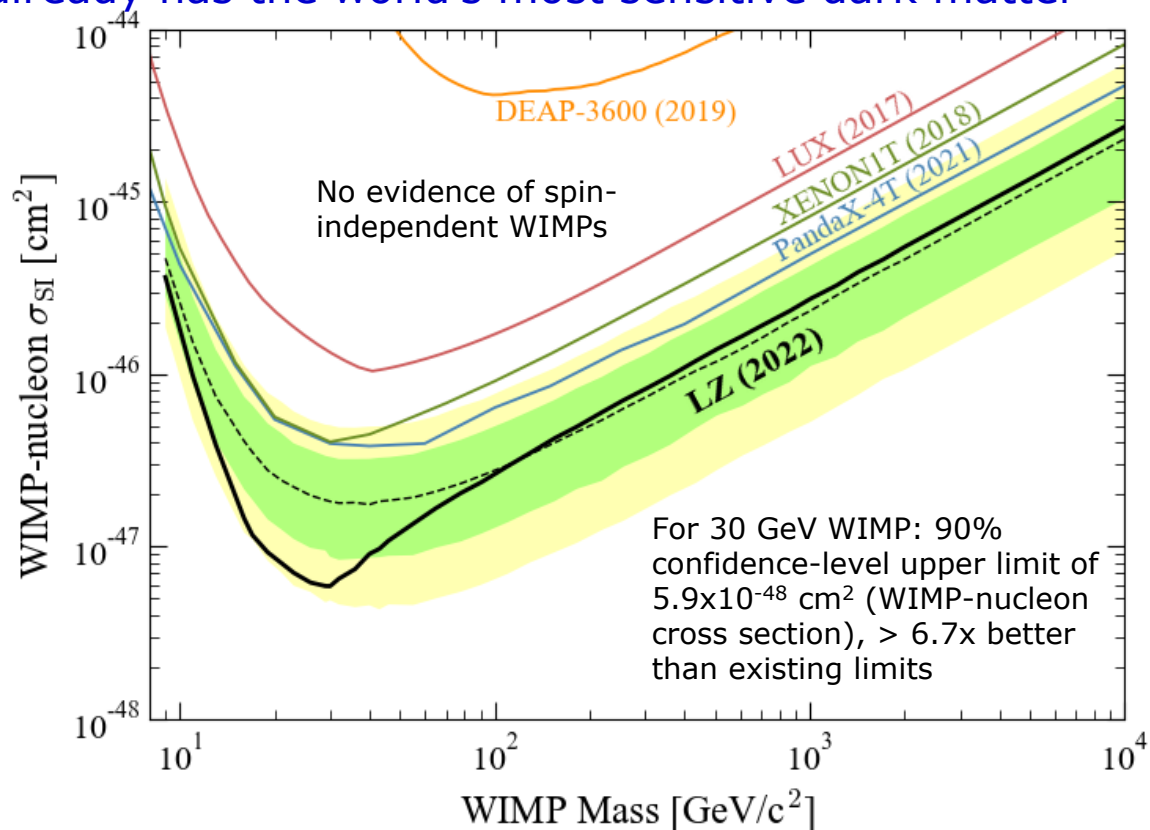


Gen-2 Direct Detection WIMP Dark Matter search

- Time Projection Chamber with 7 tonnes liquid Xenon
- Located nearly 1 mile underground at SURF in Lead, SD.
- HEP MIE Project completed Sept. 2020; 4 countries & > 35 institutions

→ **July 7, 2022: First science results released!**

With only 60 days of data, LZ already has the world's most sensitive dark matter results (1000 days planned)



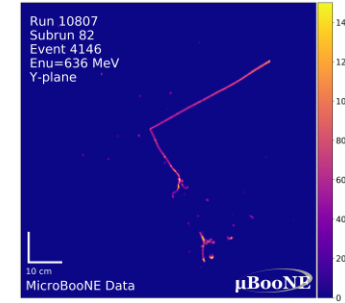
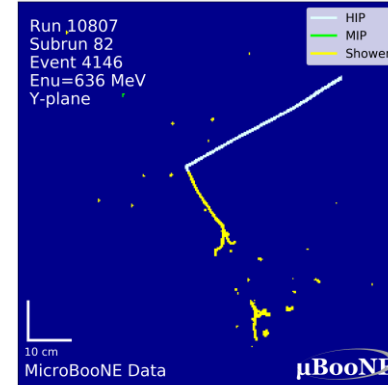
Theory Highlights

- ▶ HEP Theory supports over 200 university theorists on ~100 grants
 - ▶ Hot topics include:
 - ▶ Dark Matter (Light DM, Wimp DM, Wave DM, Cosmic DM, ...)
 - ▶ Inflation, Cosmic Acceleration, the h_0 controversy, ...
 - ▶ Custom EFTs for SM, BSM, Gravity Waves, Inflation, ...
 - ▶ Quantum information and QFT, Quantum Gravity, AdS/CFT, ...
 - ▶ Lattice for $g-2$, flavor, BSM, ...
- ▶ Topic of the day: Traversable wormholes in Quantum Gravity:
 - ▶ Collaboration between HEP theorists and experimentalists with quantum computing experts. (Nature, V. 612 Issue 7938, 1 December 2022)
 - ▶ Experimental realization of features of wormhole dynamics on a quantum computer: “a step towards a program for studying quantum gravity in the laboratory”



Computational HEP Highlights

- ▶ HEP has a long track record of successful AI/ML research and development across many experiments and decades
 - ▶ One recent example is the Deep Learning low energy excess analysis by MicroBooNE
 - ▶ Using semantic segmentation to identify the detector hits caused by protons, muons, or electrons based on the unique signatures left in the detector.

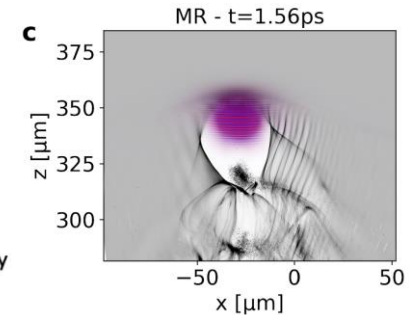
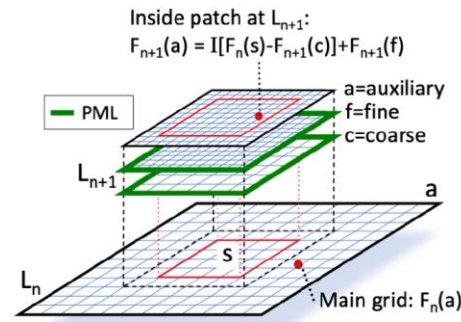


Raw Detector Hits

Deep Learning Prediction

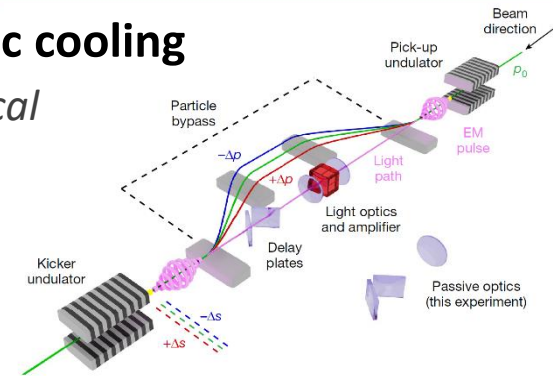
- ▶ HEP PIs supported through the Exascale Computing Project [WarpX](#) won the [ACM 2022 Gordon Bell Prize](#)
 - ▶ For "Pushing the Frontier in the Design of Laser-Based Electron Accelerators With Groundbreaking Mesh-Refined Particle-In-Cell Simulations on Exascale-Class Supercomputers"

Mesh-Refinement in Electromagnetic PIC



GARD R&D Highlights: Beam Physics

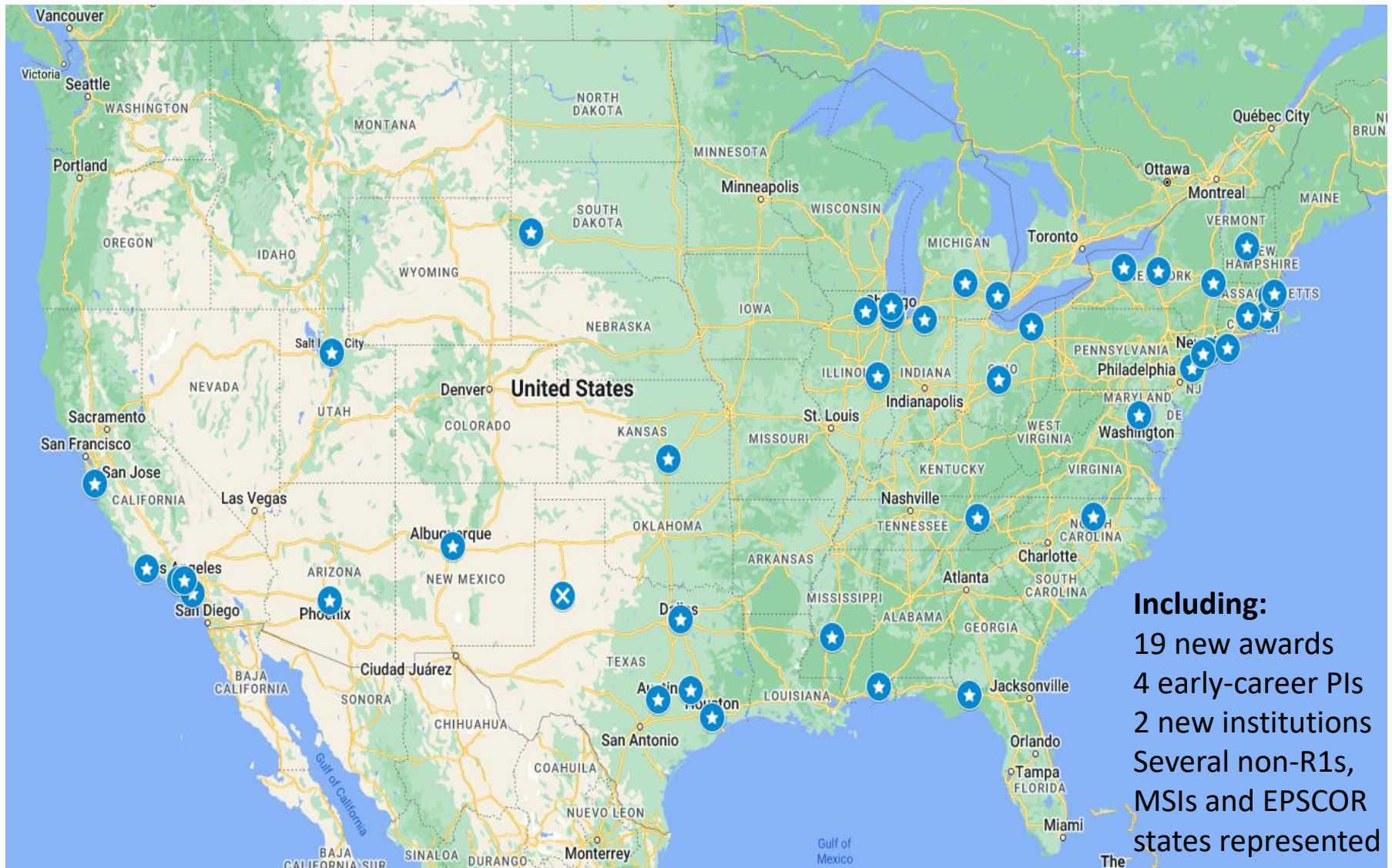
- **First-ever experimental demonstration of optical stochastic cooling**
 - J. Jarvis (ECA) et al., *First Experimental Demonstration of Optical Stochastic Cooling*, **Nature** Vol:608, PP 287–292 (2022)
- **The IOTA test accelerator at Fermilab:**
 - Running electrons to complete the nonlinear integrable optics research and support ongoing research;
 - The Proton Injector received safety approvals recently and to begin commissioning of the proton source and commenced high-voltage testing.
- **SLAC team has developed 2D CSR tracking package with transient effects**
 - CSR is an important limiting factor for short bunches and could be studied at FACET-II. The new simulation code on one GPU is $\sim 100x$ faster than the equivalent calculation on a multi-core (64) CPU.
- **HEP GARD ABP roadmap was held in Sept 2022**
 - Identified four grand challenges for future accelerators and colliders: (1) Beam intensity; (2) Beam quality; (3) Beam control and (4) Beam predictions;
 - developed future R&D roadmap;
 - First complete draft will be ready for distributing for feedback next week and final report will be completed in early January of 2023.



FY 2022 HEP Funding Opportunities Recap

Funding Opportunity	Timeline	Outcomes
FY 2022 Research Opportunities in High Energy Physics	Released 8/2/21 Proposals due 10/5/21	119 proposals, 60 funded. Univ only
U.S.-Japan Science and Technology Cooperation Program In High Energy Physics	Released 10/29/21 Proposals due 12/15/21	21 proposals, 14 funded. Lab only
FY 2022 SC Early Career Research (ECR) Program (SC-wide)	Released 9/9/21 Pre-apps due 12/1/21 Full Proposals due 1/20/22	79 HEP proposals, 11 funded. Univ + Lab
Scientific Discovery Through Advanced Computing : HEP (SciDAC-5)	Released 11/3/21 Proposals due 2/9/22	10 proposals, 5 funded. Lab only. See also backup.
AIML for HEP (New in 2022)	Released 3/4/22 Proposals due 5/25/22	75 proposals, 19 funded. Univ + Lab
HEP Traineeships in Computation (new Topical area)	Released 4/28/22 Proposals due 6/30/22	5 proposals, 3 funded. Univ only. See also backup.
RENEW-HEP (New in 2022)	Released 5/25/22 Proposals due 8/15/22	30 proposals, TBA funded. Univ + Lab.

Map of FY 2022 HEP Comparative Review Awards



Including:
19 new awards
4 early-career PIs
2 new institutions
Several non-R1s,
MSIs and EPSCOR
states represented

▶ **General HEP FOA to support the SC AI/ML Initiative**

- ▶ Previously supported through FOAs for targeted applications, programmatic comparative review, and Early Career Research Program. More details: [HEP Artificial Intelligence \(AI\)](#)
- ▶ Universities & DOE laboratories were both eligible to apply through two distinct paths:
 - ▶ Multi-institution Team proposals led by DOE Labs
 - ▶ Single-institution Seed proposals led by universities/colleges
- ▶ **This was the first FOA of this type and HEP received a strong response from the community**
 - ▶ Extremely competitive FOA with a success rate of 33% for university Seed Awards and 11% for lab led Team Awards
- ▶ Support for [three Team](#) and [16 Seed](#) for three-year projects that span the AI topic areas and the HEP research program
 - ▶ Many awards include diverse partnerships with private for-profit and nonprofit organizations and/or with co-PIs from non-HEP backgrounds

RENEW in Context of HEP

SC RENEW Goals:

- ▶ RENEW aims to build foundations for the Office of Science (SC) research at institutions historically underrepresented in the SC research portfolio.
- ▶ RENEW aims to provide the hands-on experiment gained through the initiative will open new career avenues for a future pool of talented scientists, engineers, and technicians with critical skills and expertise needed for the full breadth of SC research activities.

• RENEW-HEP:

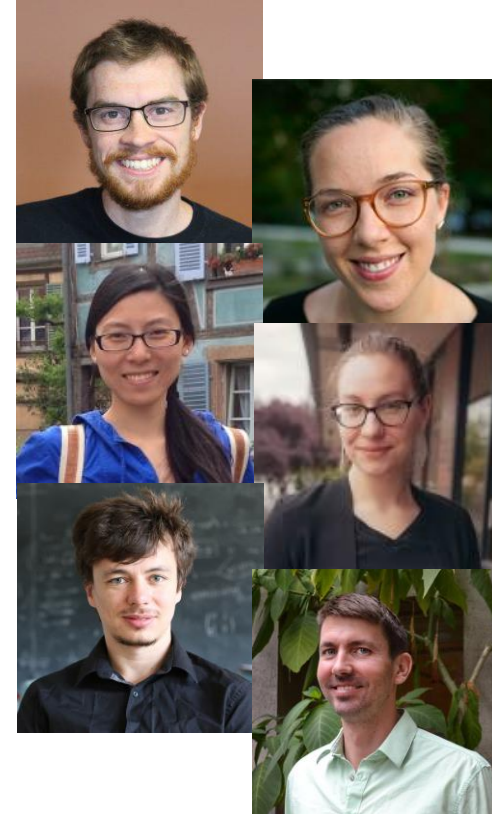
- ▶ **HEP seeks to broaden and diversify the high energy physics community.**
- ▶ Some of the barriers identified in improving diversity and equity in HEP include: lack of sufficient mentoring, support networks, or recruitment, outreach and professional culture of inclusion at “traditional” HEP research institutions; lack of research infrastructure and support at institutions that have not traditionally received HEP funding, possibly disadvantaging them in the competitive review process; the need for additional support for faculty at institutions with large teaching loads; and general financial barriers to students pursuing degrees in STEM fields. T
- ▶ **This program is informed and influenced by the recommendations reports including the American Institute of Physics TEAM-UP report.**

• RENEW-HEP programmatic goals:

- **1) Supporting investigators and building research infrastructure at institutions which have not traditionally been part of the particle physics HEP portfolio.**
- **2) Encouraging underrepresented populations to pursue STEM careers by providing traineeships and/or support for undergraduate and graduate students, postdoctoral researchers, and faculty at academic institutions not well represented in the HEP research portfolio.**

FY 2022 HEP Early Career Awards: University

- ▶ **Keith Bechtol, U. Wisconsin**
 - ▶ Vera C. Rubin Observatory: from Commissioning to Cosmology
- ▶ **Tova Holmes, U. Tennessee**
 - ▶ Expanding Sensitivity to New Physics at the LHC Through Unconventional Track Signatures
- ▶ **Xiao Luo, U. California, Santa Barbara**
 - ▶ Searching for New Physics with Advanced Liquid Argon Detector Capabilities at Neutrino Experiments
- ▶ **Natalie Paquette, U. Washington**
 - ▶ The Mathematical Foundations of Holography
- ▶ **Geoff Penington, U. California, Berkeley**
 - ▶ Spacetime from Information
- ▶ **Matthew Pyle, U. California, Berkeley**
 - ▶ Developing TES with Sensitivity to meV Scale Excitations for Light Mass Dark Matter Searches and other Applications



FY 2022 HEP Early Career Awards: Laboratory

- ▶ **Kavin Ammigan, FNAL**
 - ▶ Advanced Materials to Enable Next-Generation High-Power Accelerators
- ▶ **Andrew Hearin, ANL**
 - ▶ AI-Accelerated Discovery of Dark Energy Physics with LSST, DESI, and CMB-S4 Cross-Correlations
- ▶ **Noah Kurinsky, SLAC**
 - ▶ Superconducting Qubit-Based Sensors for meV-Scale Particle Detection
- ▶ **Ben Nachman, LBNL**
 - ▶ Allowing Collider Data to Tell Their Own Story with Deep Learning
- ▶ **Marlene Turner, LBNL**
 - ▶ Energy Recycling for a Green Plasma Based Collider



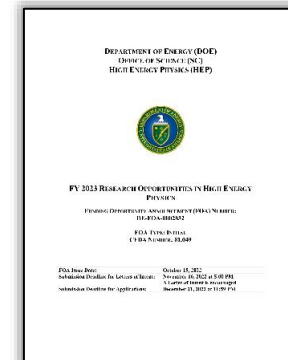
FY 2023 Planned Funding Opportunities

Funding Opportunity	Timeline	Notes
FY 2023 Research Opportunities in High Energy Physics	Released 10/19/22 Proposals due 12/21/22	Univ only. New features in FY23. FAQ and Webinar recording available. See following slide.
U.S.-Japan Science and Technology Cooperation Program In High Energy Physics	Released 10/17/22 Proposals due 12/15/22	Lab only
FY 2023 SC Early Career Research (ECR) Program (SC-wide)	Released 11/16/22 Pre-apps due 1/5/23 Proposals due 3/23/23	Univ + Lab. FAQ and Webinar recording available.
HEP Traineeships in Accelerator Science and Engineering (re-compet)	Release ~early 2023 Proposals due TBD	Univ only. See backup slide.
RENEW-HEP	Release ~early 2023 Proposals due TBD	Univ + Lab. Traineeships + Research Infrastructure. Partnerships encouraged.
FAIR (SC-wide, New in 2023)	Release ~soon Proposals due TBD	Univ only. Webinar planned. See following slide



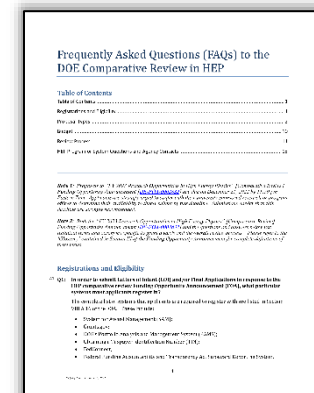
FY 2023 HEP Comparative Review FOA and FAQ

- ▶ **DE-FOA-0002832** issued: **October 19, 2022**
- ▶ **Six core HEP research subprograms**
 - ▶ Energy, Intensity, and Cosmic Frontiers
 - ▶ HEP Theory, Accelerator Science and Technology R&D, and Detector R&D
- ▶ **Letter of Intent (strongly encouraged) due: November 16, 2022**
- ▶ **Final Proposal deadline: December 21, 2022**
- ▶ **Review process: January – March 2023**



PIs and university SROs should read the FOA carefully to comply with all requirements prior to submitting a proposal.

- ▶ **In addition to the FOA, an FAQ is available to address topics:**
 - ▶ Registration and eligibility requirements
 - ▶ Proposal types and requirements;
 - ▶ Guidance for new faculty and those without current grants
 - ▶ Guidance for PIs with existing HEP grants
 - ▶ Budget information and guidance on scope of request(s)
 - ▶ Letter of Intent
 - ▶ Information on overall scientific merit review process
 - ▶ Contacts for program- or system-related questions



The FOA, FAQ, and a recording of an informational webinar are available at: <https://science.osti.gov/grants/FOAs/Open>

Funding for Accelerated, Inclusive Research (FAIR)

- ▶ FAIR is a new initiative spanning the research scope of the Office of Science aiming to support research at institutions historically underrepresented in the Office of Science portfolio
 - ▶ This includes minority serving institutions (MSIs) and emerging research institutions (ERIs).
 - ▶ FAIR supports mutually beneficial relationships between MSIs and ERIs with partnering institutions to perform basic research
- ▶ FAIR compliments the scope of RENEW by supporting research
 - ▶ That research may take advantage of the infrastructure and training developed through RENEW-HEP
- ▶ In FY23 HEP will participate in the cross Office of Science FOA
 - ▶ A public webinar is being scheduled to discuss more details of the SC FOA
 - ▶ Details are expected at the time of the FOA release

Expanded SC Outreach to Potential Applicants

In 2022, SC expanded its outreach efforts to broaden participation in SC-sponsored program opportunities. This included:

- Public webinars associated with the release of new funding opportunity announcements, e.g.:
 - FY 2022 Reaching a New Energy Sciences Workforce [FOA webinars](#)
 - FY 2022 Energy Frontier Research Centers [FOA webinar](#)
 - FY 2023 SC Early Career Research Program [FOA webinar](#)
- Increase Office of Science engagement at national professional society meetings (e.g., NOBCChE, NSBP)
- Increased outreach webinar and career fair webinars for internship programs sponsored through the SC [Office of Workforce Development for Teachers and Scientists \(WDTs\)](#)

SC intends to build on these efforts in the coming year.

[Sign-up to receive Office of Science announcements!](#)



Promoting Inclusive and Equitable Research (PIER) Plans

Beginning in FY 2023, Office of Science solicitations require applicants to submit a plan for **Promoting Inclusive and Equitable Research, or PIER Plan**, along with their research proposals.

- This is a requirement for proposals submitted to all Office of Science solicitations, as well as invited proposals from the DOE national laboratories.

PIER Plans are limited to 3 pages and should describe the activities and strategies that investigators and research personnel will incorporate to promote diversity, equity, inclusion, and accessibility in their research projects.

- The complexity and detail of a PIER Plan is expected to increase with the size of the research team and the number of personnel to be supported.
- The PIER Plans will be evaluated under a new merit review criterion as part of the peer review process.

Additional information and FAQs: <https://science.osti.gov/grants/Applicant-and-Awardee-Resources/PIER-Plans>



New Conference Proposals Policy in FY 2023

Beginning in FY 2023, all proposals to SC requesting support for conferences:

1. Require that the host organization of the conference/meeting have a **code of conduct** (or equivalent policy) that addresses:
 - Discrimination and harassment of all kinds,
 - Defines how issues can be reported and how complaints will be addressed,
 - Describes how all attendees will be informed of the policies and procedures.
2. Require a **recruitment and accessibility plan** that describes plan for recruiting speakers and attendees, including discussion of recruitment of individuals from groups underrepresented in the research/professional community associated with the technical focus.
 - Applies to all applications to the DOE Office of Science requesting funding to support conferences or conference activities. (*Non-SC hosted conferences, meetings, or workshops*)
 - Conference proposals requirements are listed in the [FY 2023 Continuation of Solicitation for the Office of Science Financial Assistance Program](#) and available on the [SC website](#).

<https://science.osti.gov/grants/Applicant-and-Awardee-Resources/Conference-Proposals>



Promoting a Living Wage for Graduate Students

- The DOE Office of Science is committed to ensuring that students, trainees, and postdoctoral fellows are paid a fair and equitable wage sufficient to allow a reasonable standard of living.
- Applicant institutions are strongly encouraged to examine their institutional pay scales to ensure that all personnel earn a living wage.
- The provision of fellowships, traineeships, stipends, honoraria, subsistence allowances, and other similar payments may be allowable expenses on SC financial assistance awards (per 2 CFR 200.430, § 200.431, and § 200.466).
- For graduate students, SC considers a reasonable living wage to be an annual income of \$45,000, excluding benefits.

All Office of Science solicitations now include language encouraging institutions to support graduate students with an appropriate living wage.



HEP Office Comings & Goings

▶ Incoming:

- ▶ New GARD Program Manager, Derun Li
- ▶ New Cosmic Frontier PM, Bryan Field
- +New Detailees in Cosmic Frontier, Detector R&D, Energy, GARD!

▶ Outgoing:

- ▶ IPA/detailees: David Cinabro (April) → NP
- ▶ AAAS Fellows: Adam Iaizzi, Mike Tennenbaum (Sep)
- ▶ DOE Federal Positions for Cosmic Frontier, QIS PMs
 - ▶ Re-advertising in 2023
- ▶ DOE Federal Positions for Facilities, Projects
 - ▶ Re-advertising in 2023
- ▶ Always looking for candidates to help with critical tasks
 - ▶ Interested parties should contact HEP Management!
 - ▶ Investigating alternate hiring opportunities beyond IPAs and Detailees



Office of Science Distinguished Scientist Fellow: Marcela Carena

- ▶ The **Office of Science Distinguished Scientist Fellows** program honors particularly eminent and accomplished DOE National Laboratory Scientists with an award of \$1,000,000 over three years to support activities that develop, sustain, and promote scientific and academic excellence in SC research through collaborations between institutions of higher education and national laboratories.
- ▶ **Dr. Marcela Carena**, Head of the Theory Division at Fermilab is one of two Distinguished Scientist Fellows honored in 2022.
- ▶ **Award Ceremony and Public Lecture: January 25, 2023, 1:30-3:00 PM ET.** Proceedings will include an award ceremony, technical talk covering Dr. Carena's science and career, and a Q&A session.

Register at: <https://science.osti.gov/fellows/Ceremony-Lecture-Series>

- ▶ **Citation:** *For leadership and influential contributions to particle physics, including novel theoretical ideas and strategies for HEP experiments related to the Higgs boson, dark matter and electroweak baryogenesis, and promoting Latin American participation in DOE-hosted experiments.*





U.S. DEPARTMENT OF
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SC Commitment to Diversity, Equity, Inclusion, and Accessibility

As a steward of public funding, the Office of Science has a responsibility to ensure that we are serving the public.

SC is deeply committed to:

- Supporting diverse, equitable, inclusive, and accessible work, research, and funding environments that value mutual respect and personal integrity;
- Promoting people of all backgrounds, including individuals from groups and communities historically underrepresented in STEM fields;
- Advancing scientific discovery by harnessing a diverse range of views, expertise, and experiences to drive scientific and technological innovation.

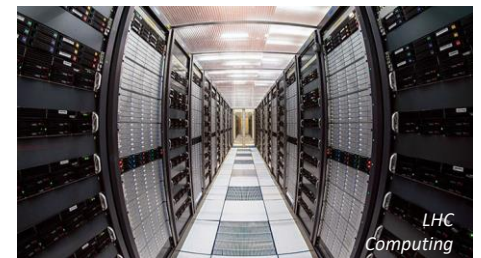
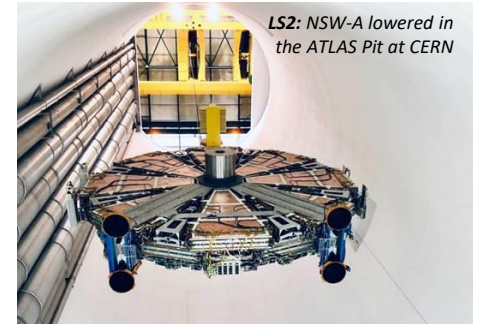
The FY 2023 new proposal requirements are a reflection of this responsibility and of this commitment. [“Everyone has a Role to Play in Making Science More Equitable and Inclusive”](#)

SC Statement of Commitment: <https://science.osti.gov/SW-DEI/SC-Statement-of-Commitment>



Energy Frontier: LHC/HL-LHC Highlights (II)

- ▶ US CMS and US ATLAS detector operations programs successfully achieved all of the US work objectives during the LHC Long Shutdown 2
 - ▶ Includes CMS installation and testing of the Forward Pixel (FPix) system
 - ▶ ATLAS installation of both end-sides of the Muon New Small Wheels (NSWs)
- ▶ In collaboration with DOE-HEP CCE and NSF IRIS-HEP, experiments are actively pursuing R&D to reduce the CPU/storage requirements and scale the future software and computing capabilities for the HL-LHC era
- ▶ HL-LHC accelerator and detector upgrades progressing well
 - ▶ Accelerator upgrade DOE re-baseline project review scheduled next week to accommodate the updated LHC/Long Shutdown 3 schedule + COVID impacts
 - ▶ US ATLAS DOE CD-2/3 (incl. baseline) project review held in October 2022; US CMS CD-2/3 review scheduled for mid-January 2023
 - ▶ DOE coordinating with the experiments and CERN to help mitigate risks of potential shortfall of contributions originally planned by the Russian and Belarusian institutes to the HL-LHC detector upgrades
- ▶ Look forward to the next P5's assessment for the science reach and near- and longer-term ambitions of the future Energy Frontier program



November 2021

HEP Research Program - HEPAP

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Dark Energy Spectroscopic Instrument (DESI) Experiment



DOE's DESI started its 2nd year of operations in May.

- World's premier multi-object spectrograph w/5,000 fibers, positioned robotically
 First **Stage IV dark energy**; Will measure spectra of > 40 million galaxies

→ DESI was down from mid-June to mid-Sept due to the fire that went through Kitt Peak. DOE helped get air support for fire-fighting. DESI is now successfully back up!

Amazing data-taking: takes ~ 100,000 spectra per night; Running ahead of schedule with 16.3 Million extra-galactic redshifts recorded (significantly more than all other surveys combined) + 5M stars

- Collaboration has submitted 8 papers on science goals and experiment features from the data validation phase. They plan a public data release in early 2023.

Bureau of Land Management video:
https://fb.watch/dKzbQM_YPg/?fs=e&s=cl



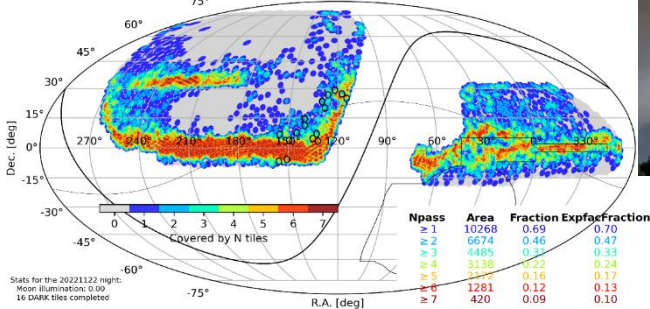
Z 16
 2022-06-16 18:37:15
 KPNO Mayall 4m



Back on sky

Credit: KPNO/NOIRLab/NSF/AURA/T. Slovinsky

Main/DARK : 3266/9929 (=33%) completed tiles up to 20221122



Sats for the 20221122 night:
 Moon illumination: 0.09
 16 DARK tiles completed

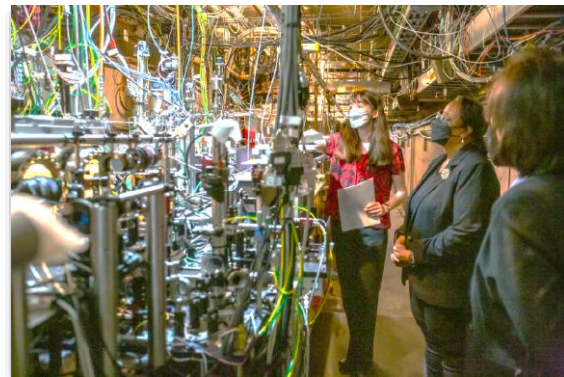
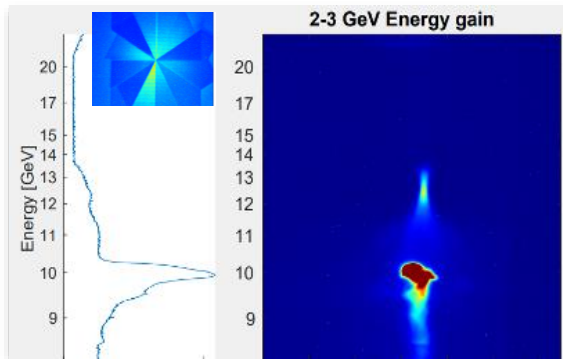
GARD R&D Highlights: Advanced Concepts

- **FACET-II: A National User Facility Based on High-Energy Beams and Their Interaction with Plasmas and lasers**

- New Experimental Area developed with strong engagement from User Community and beam time focused on:

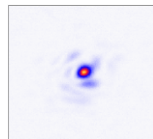
- ML/AI diagnostics;
- Plasma wakefield acceleration;
- Bright gamma-ray bursts;
- SFQED.

Single bunch driving 10GeV/m wakefield with large energy transfer to wake. Meeting all requirements for two-bunch PWFA in FY23 focused on beam quality.



- **Berkeley Lab's BELLA Second Beamline completed and started operations**

- Will power multi-GeV staging, advanced guiding, higher energies;
- Extend plasma-based accelerators towards potential future e+e- colliders
- First experiment: collaboration with U. Maryland, increased energy via guiding



High quality focus with staging plasma mirror



- **Berkeley Lab's AMP team awarded Leading Exascale Computing and SciDAC-5 Accelerator Projects**

SCIENTIFIC DISCOVERY THROUGH ADVANCED COMPUTING: HIGH ENERGY PHYSICS

- ▶ The 5th cycle of the SciDAC joint solicitation HEP and ASCR was issued in FY22
 - ▶ Partner HEP and ASCR scientists to deliver high impact science that would not be possible without new innovative development to make use of DOE SC High Performance Computing User Facilities
 - ▶ Successful program to support leading application of DOE HPCs to HEP
- ▶ Applications were sought that would advance the [P5 science drivers](#) through HPC usage in three topic areas:
 - ▶ Integrated end-to-end simulation of conventional, hybrid, or “virtual” **particle accelerators**
 - ▶ Novel **detector simulation** and tracking models and data driven analysis techniques for HEP experiments
 - ▶ Innovative **theoretical**, computational, and simulation techniques to explore the unknown, including new particles, interactions and physical principles
- ▶ Even partnership between ASCR and HEP to provide \$30M of support for up to 5 years
 - ▶ [Five awards](#) made across the three topic areas for lab led research teams partnering with the SciDAC Institutes
 - ▶ LBNL led [Collaboration for Advanced Modeling of Particle Accelerators \(CAMPA\)](#)
 - ▶ ORNL led [Celeritas: GPU-accelerated particle transport for detector simulation in high energy physics experiments](#)
 - ▶ FNAL led [Next Generation Precision for Neutrino and Collider Computations](#)
 - ▶ ANL led [Enabling Cosmic Discoveries in the Exascale Era](#)
 - ▶ BNL led [Multiscale acceleration: Powering future discoveries in High Energy Physics](#)

Computational HEP Funding Opportunity Announcement

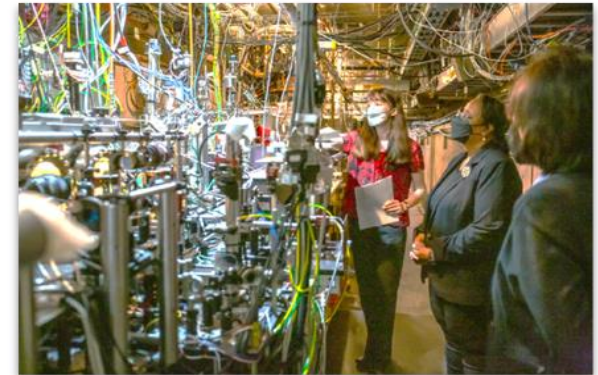
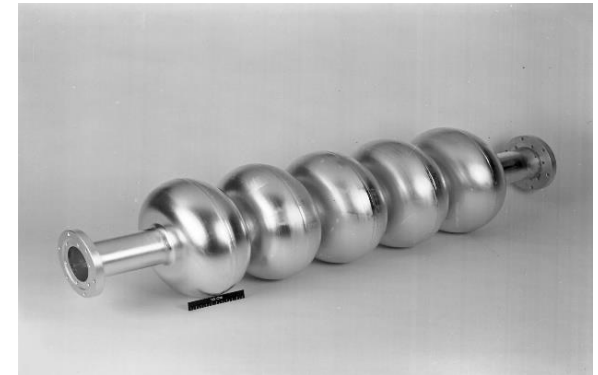
DOE TRAINEESHIPS IN COMPUTATIONAL HIGH ENERGY PHYSICS

DE-FOA-0002743

- ▶ This FOA seeks to support training of a domestic pool of technically competent computationally expert scientists and engineers capable of designing, developing, deploying, and maintaining the software and computing infrastructure needed to deliver the next generation of HEP discoveries
 - ▶ All science drivers identified by the [P5 Report](#) require increasingly complex software and computing systems
 - ▶ The lack of necessary computing expertise needed to realize these scientific drivers was viewed as a risk across the HEP program
- ▶ The scope of the Computing Traineeships were determined by:
 - ▶ [Computing in High Energy Physics: Report from the Topical Panel Meeting on Computing and Simulations in High Energy Physics](#) March 2014
 - ▶ [National Strategic Computing Initiative \(NSCI\)](#) NITRD report July 2015
 - ▶ [Snowmass Computing Frontier: Software Development, Staffing, and Training](#) November 2013
 - ▶ [HEP Workforce Development Needs](#) report of the HEPAP subcommittee, June 30th, 2014
- ▶ Applications were sought from domestic accredited universities/colleges offering graduate degrees in Physics and/or Computer science, and with at least one faculty member working in HEP
 - ▶ Awards provide tuition support for 4-10 new graduate students per year for two academic years each
 - ▶ Partnerships with a DOE-focused Program Element to conduct the computational research for student's Master's or PhD thesis in one of three training categories:
 - ▶ **Hardware-Software co-design** – Software development that requires detailed knowledge and understanding of computing hardware systems
 - ▶ **Collaborative Software Infrastructure** – Collaborative software environments used to share tools and datasets in a coherent and efficient manner across heterogeneous computing platforms for hundreds or thousands of scientific users.
 - ▶ **High Performance Software and Algorithms** – Software and algorithms that can take advantage of increasingly parallel computing platforms either synchronously or asynchronously.
- ▶ [Three awards](#) made to diverse collaborations of universities partnering with DOE National Labs
 - ▶ Expect to support more than 80 students over the five-year programs

HEP Accelerator Traineeship Program

- **A number of studies indicate a shortfall in the number of domestically trained accelerator physicists and engineers employed at DOE labs (including HEPAP study in 2014)**
- Shortfalls are expected to occur in four major areas:
 - Physics of large accelerators and systems engineering
 - Superconducting RF accelerator physics and engineering
 - Radiofrequency power system engineering
 - Cryogenics systems engineering
- Graduate-level traineeship program created to address these needs
- **First FOA published in 2017, 4 awards to date**
 - FY17: MSU, provided supplemental funds for FY22, expect renewal proposal in FY23
 - FY19: 2 awards, SBU and IIT
 - FY21: ODU
- **FY23 FOA expected issue date: early 2023**
 - Both new and renewal applications will be accepted



PIER Plans Should be Tailored to the Research Project

Because PIER Plans should be intrinsic to the proposed research, SC expects to receive a wide range of ideas and approaches. In developing tailored PIER Plans, applicants are encouraged consider one or more of the following areas:

- **The composition of the project team, including project personnel and partnering institutions.** Could include: recruitment and inclusion of individuals from diverse backgrounds on the research project, individuals from groups [historically underrepresented in the proposed research area](#); partnering with individuals from institutions historically underrepresented in Federal research, including but not limited to [minority serving institutions](#), [non-R1 institutions of higher education](#); and/or institutions of higher education in [EPSCoR states](#).
- **The research environment.** Could include: establishing and cultivating research and work environments that promote mutual respect and professionalism, where all project personnel feel welcome, safe, and supported; development and/or adoption of laboratory-, community-, or collaboration-specific codes of professional conduct; practices and protocols for ensuring safe conduct of research and personnel safety, including in isolated environments; and/or providing equitable access to research tools and making reasonable accommodations for researchers with disabilities.
- **The implementation of the research project, and scholarly and professional growth of project personnel.** Could include: distribution of leadership responsibilities among project key personnel; mentoring and/or training opportunities for project personnel; equitable access of project personnel to professional development opportunities; inclusive and equitable plans for recognition on publications and presentations; and/or inclusive practices for community engagement.

<https://science.osti.gov/grants/Applicant-and-Awardee-Resources/PIER-Plans/Things-to-Consider-When-Developing-a-PIER-Plan>

