U.S. DEPARTMENT OF ENERGY | Office of Science

HEP and Early Career Primer

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- I hope you are all in good health, physically and mentally. And that your families are also doing well.
- My sincere condolences if you have lost a friend of loved one during this pandemic.
- Be informed. Be prepared. Be smart. Be safe.

Hatch Act of 1939

- The Hatch Act, officially, **An Act to Prevent Pernicious Political Activities**, is a United States federal law, enacted by Congress in 1939. The main provision **prohibits employees in the executive branch of the federal government**, except the president, vice-president, and certain designated high-level officials, **from engaging in some forms of political activity.**
- **Sen. Carl Hatch, D-N.M., introduced the act** after learning that New Deal–era government programs, specifically the Works Progress Administration, were **using federal funds overtly to support Democratic Party candidates in the 1938 elections**.
- The law was an attempt to **regulate corruption and possible intimidation of federal employees in the civil service by their elected supervisors.** The act banned the use of federal funds for electoral purposes and forbade federal officials from coercing political support with the promise of public jobs or funds.

- Federal employees are still **forbidden to use their authority to affect the results of an election.**
- In general, executive branch federal employees may not:
  - **Use official authority or influence to interfere with an election**
  - Solicit or discourage political activity of anyone with business before their agency
  - **Engage in political activity while: on duty**, in a government office, wearing an official uniform, or using a government vehicle

Federal Support of Science and Engineering

Congress shall have Power… to promote the Progress of Science and useful Arts, by securing for limited Time to Authors and Inventors the exclusive Right to their respective Writings and Discoveries.

- **The Founders understood the importance of science and technology in the long-term future of the United States.** Without science and engineering advancement, in the face of advancement by others, the US could not compete with ideological and economic challengers.
- **Scientific and technological advancement funded by the Federal Government has a strong constitutional foundation** in the Preamble's mandated promotion of the *"common Defence and general Welfare."* Specifically, **the Congress has enumerated powers in this regard in Article I, Section 8. Implementation of those powers logically requires federal involvement in science and engineering research**, as follows:
  - Clause 5 – fixing of *"the Standard of Weights and Measures."*
  - Clause 6 – detection and prevention *"of counterfeiting."*
  - Clause 7 – establishment and implied improvement of *"post Roads"* and, by logical extension, more modern means of delivering communications.
  - **Clause 8 – evaluation of *"Discoveries"* in *"Science and the useful Arts"*** for the purpose of *"securing…exclusive rights"* for *"Inventors."*
  - Clause 12 and 13 – *"support"* of *"Armies"* and maintenance of *"a Navy"* and, by logical extension, future forces necessary to the *"common Defence."*
  - Clause 15 and 16 – support of the *"Militia"* and their use to *"repel Invasions."*
  - **Clause 18 of Section 8** further gives Congress the power ***"to make all laws necessary and proper for carrying into Execution the foregoing Powers**, and all other Powers vested by this Constitution **in the Government of the United States, or in any Department or Officer thereof."***

Science Policy and the Constitution

- **Under Clause 2 of Article II, Section 2**, **Presidents have the power to appoint** *"…by and with Advice and Consent of the Senate…all other Officers of the United States…whose Appointments… shall be established by Law…"* **including individuals responsible for federally supported research in science and technology**
- The President, with funding concurrence by the Congress, has **significant discretion in assigning science and technology research duties to federal Departments and Agencies** so long as Congress can constitutionally fund their implementation.
  - Federal support of science and technology research in medicine, agriculture, energy, and natural resources based on the specific applicability to national security of research projects in these arenas.
- **Since the nation's founding, federally supported or managed big science and engineering efforts have contributed to national defense or to treaty enforcement**. Examples include:
  - Canals, locks, dams, and levees beginning in the early 1800s;
  - **Agricultural research through Land Grant academic institutions (1860s and 1890s);**
  - The Transcontinental Railroad in the late 1860s;
  - Aeronautical research that began early in the 1910s;
  - **The Manhattan Project of the 1940s;**
  - Nuclear Navy and related power systems, and communication satellites in the 1950s;
  - **The Apollo Moon-landing Program of the 1960s.**

- The **constitutional rationale for selective support of pure scientific research lies primarily in the stimulation of educational initiatives that train the scientists and engineers** that serve more direct constitutional functions, particularly national security.

https://www.americasuncommonsense.com/

Mission of the Department of Energy

- The mission of the Energy Department is to ensure America’s security and prosperity by addressing its energy, environmental and nuclear challenges through transformative science and technology solutions.
  - Catalyze the timely, material, and efficient transformation of the nation’s energy system and secure U.S. leadership in clean energy technologies.
  - **Maintain a vibrant U.S. effort in science and engineering as a cornerstone of our economic prosperity with clear leadership in strategic areas.**
  - Enhance nuclear security through defense, nonproliferation, and environmental efforts.
  - Establish an operational and adaptable framework that combines the best wisdom of all Department stakeholders to maximize mission success.

What is the Office of Science?

ACTIVITY/AGENCY	YEARS	AUTHORIZATION	
Manhattan Project	1942 – 1946	none	
Atomic Energy Commission	1946 – 1974	P.L. 79-585	
Energy Research and Development Administration	1974 – 1977	P.L. 93-438	
Office of Energy Research	1977 – 1998	P.L. 95-91	DOE
Office of Science	1998 – present	P.L. 105-245	DOE

Today the DOE Office of Science is

- The nation's largest supporter of basic research in the physical sciences
- The steward of 10 national laboratories
- The lead agency supporting fundamental research for energy production and security

DOE Office of Science Research Programs

Basic Energy Sciences (BES)	• **Understanding, predicting, and ultimately controlling matter and energy flow at the electronic, atomic, and molecular levels**
Advanced Scientific Computing Research (ASCR)	• **Delivering world leading computational and networking capabilities to extend the frontiers of science and technology**
Biological and Environmental Research (BER)	• **Understanding complex biological, climatic, and environmental systems**
Fusion Energy Sciences (FES)	• **Building the scientific foundations for a fusion energy source**
High Energy Physics (HEP)	• **Understanding how the universe works at its most fundamental level through research, projects, and facilities**
Nuclear Physics (NP)	• **Discovering, exploring, and understanding all forms of nuclear matter**

https://www.energy.gov/science/office-science

Stewardship of DOE National Laboratories

- Together, the 17 DOE laboratories comprise a preeminent federal research system, providing the Nation with strategic scientific and technological capabilities. The laboratories:
  - **Execute long-term government scientific and technological missions**, often with complex security, safety, project management, or other operational challenges;
  - **Develop unique, often multidisciplinary, scientific capabilities** beyond the scope of academic and industrial institutions, to benefit the Nation's researchers and national strategic priorities; and
  - **Develop and sustain critical scientific and technical capabilities** to which the government requires assured access.

Fermilab

Location: Batavia, Illinois
Type: Single-program laboratory
Contractor: Fermi Research Alliance, LLC
Responsible Site Office: Fermi Site Office
Website: https://www.fnal.gov

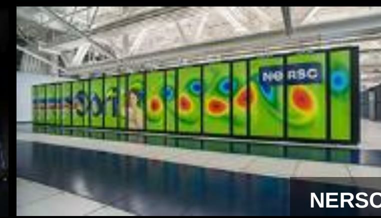
Physical Assets:
6,800 acres and 365 buildings
2.4 million GSF in buildings
Replacement Plant Value: $2.44B
28,913 GSF in 10 Excess Facilities
22,155 GSF in Leased Facilities

Human Capital:
1,810 Full Time Equivalent Employees (FTEs)
22 Joint faculty
95 Postdoctoral Researchers
65 Undergraduate Students
30 Graduate Students
3,746 Facility Users
7 Visiting Scientists

FY 2019 Costs by Funding Source:
(Cost Data in $M):

Lab Operating Costs: $491.64M
DOE Costs: $490.12M
SPP (Non-DOE/Non-DHS) Costs: $1.51M
SPP as % Total Lab Operating Costs: 0.3%

28 scientific user facilities



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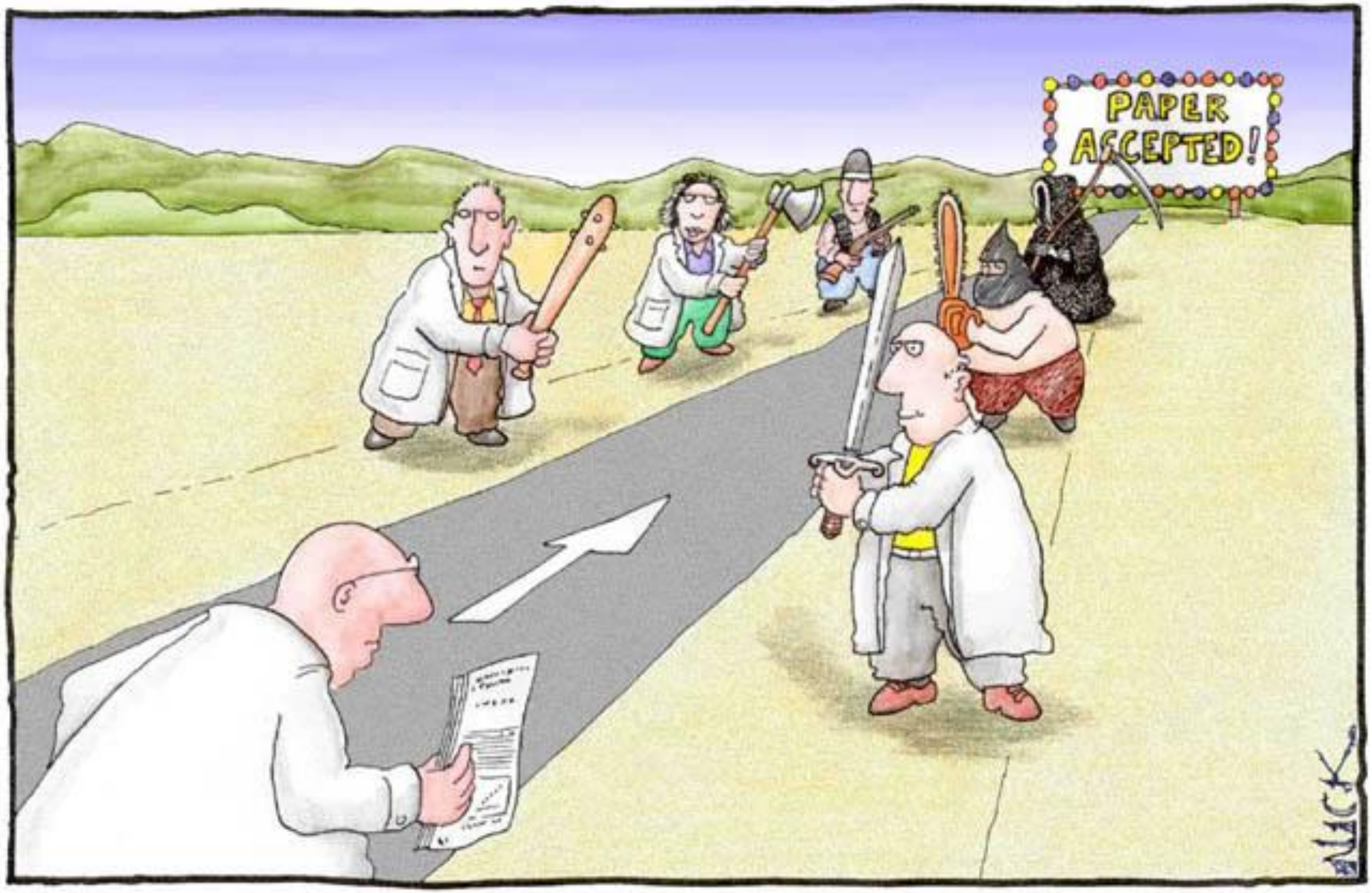


Most scientists regarded the new streamlined
peer-review process as 'quite an improvement.'

HEP: A Mission-Driven Agency

- The mission of the HEP program is to **understand how the universe works** at its most fundamental level by discovering the elementary constituents of matter and energy, probing the interactions between them, and exploring the basic nature of space and time.
- Experimental program is "mission-driven":
  - HEP develops and supports a specific portfolio of projects and emphasis is placed on conducting experiments and obtaining results.
  - HEP makes significant, coherent contributions to facilities/experiments selected for the program, including project management.
  - HEP supports science collaborations in all stages, seeking the best possible science results.
  - HEP supports R&D that will advance the state-of-the-art in particle accelerators and detectors, which will lead to new, more capable facilities.
- Theory program seeks to support theoretical activities that **provide the vision** and the mathematical framework for understanding and **extending our knowledge** of particles, forces, space-time, and the universe.
- **DOE supports ~85% of the U.S. HEP (in $)**, incl. **~all national labs**

HEP FOAs & New Initiatives

- There is one "continual" FOA (DOE/SC Open Solicitation) and these annual FOAs:
  - Research Opportunities in HEP (a.k.a. Comparative Review FOA)
    - **In FY 2020, expanded to include Detector R&D Consortiums**
  - Early Career Research Program
  - Research Opportunities in Accelerator Stewardship
    - **In FY 2021, will relocate to Office of Accelerator R&D and Production (SC-24.2)**
  - Quantum Information Science
  - Traineeship in Accelerator Science & Technology
    - **In FY 2021, will expand to include Detector R&D**
  - U.S.-Japan Science and Technology Cooperation Program
- FOAs that launch new initiatives are informed through:
  - Strategic plans (HEPAP P5, AAAC Decadal Survey)
  - Whitepapers
  - Roundtables
  - Workshops or working groups (Basic Research Needs)

Core Research vs. Early Career

- All proposals are subject to scientific/technical merit and program policy factors, and a comparative review is used to enhance the validity of the written evaluations
- Many factors weigh the selection process (and funding recommendations)
  - ***Compelling research proposal*** for next ~3-5 years
    - ✓ **Interesting? Novel? Significant? Plausibly achievable?**
    - ✗ **Incremental? Implausibly ambitious? Poorly presented?**
  - ***Significant recent contributions*** in last 3-5 years
    - Synergy and collaboration within group (as appropriate)
    - Contributions to the research infrastructure of experiments
  - ***Alignment with HEP*** programmatic priorities
  - ***Balanced program*** of R&D/design, support of construction or operations, data analysis
    - This may span multiple experiments over the proposal's project period
- For the Early Career Research Award, the proposal success rate is much lower than for proposals submitted to the "Comparative Review" FOA
  - Select the most outstanding proposals.
  - Did the PI lay out a robust five-year program?
  - Are there novel elements? High-risk, high reward is a factor
  - **Has the PI demonstrated leadership?**

Develop a Personal Roadmap

- Timescales for HEP projects from conception to first data will only get longer in the continued pursuit of discovery science **due to cost, size and complexity**
- HEP academic research track (Univ. or Lab) will benefit from developing a near-, mid- and long-term research plan
  - Balance research between ongoing experiment, upgrades and R&D with future experiment
- New Univ. tenured-track faculty or lab scientist is likely to **"hit the ground running"** by continuing the research conducted during their most recent post-doc position
  - This is perfectly normal. Most people are hired with this consideration.
  - A rising trajectory, clear leadership positions, track record of accomplishments, mentoring, etc.

- **Before preparing that first proposal, map out your long-term strategic goals (10+ years)**
- Will you be working on that same experiment in 5 years? How about 10 years? In 20 years?!
- Optimize your start-up or LDRD funds by expanding your research portfolio and seeding a future looking project/experiment
- With your strong participation, major projects like Mu2e, LBNF/DUNE, Vera Rubin Observatory, and HL-LHC CMS and ATLAS will complete on time and be poised to reap the physics data on Day 1
- **Can you envision you (and your colleagues) shepherding the "post-P5" projects?**

Early Career Research Program

- ERCP Launched in 2009 across all Office of Science.
  - Successor to and replacement of highly successful DOE-HEP-OJI program (1978-2009), upon which it is modelled.
- Open to university tenure-track professors and laboratory scientists holding equivalent appointments who are within ten years of receiving their PhD.
  - FY 2020 cycle closed. Awards announced June 23, 2020.
  - FY 2021 cycle begins TBD. Open to candidates obtaining Ph.D. in year 2010 or later
- Common Office of Science criteria:
  - Mandatory five-year program.
  - ≥$750K for university PIs, ≥$2,500K for lab PIs.
  - Funding can be front (or back) loaded
- Program designed to be highly competitive with high impact.
  - Identify and support the future HEP research leaders
  - Over 11 years, 120 awards made from 1035 submitted proposals = 11.6%

Overall Process (HEP)

Typically, the process runs from October – June. FY 2020 schedule was highly compressed.

Pre-review

- **<u>January</u>: Mandatory Pre-proposals due. Eligibility checks. Program planning.**
- **<u>February</u>: Encouragement/discouragement to develop full proposals.**
- **<u>March</u>: Proposals received.**

Review Process

- **<u>April</u>: Mail-in review of all proposals via PAMS (at least three reviews each).**
- **<u>April</u>: HEP selection of proposals for subprogram panel review, based on mail-in reviews (or sub-panel).**
- **<u>May</u>: Super-panel discussion and ranking of selected proposals.**

Post-review and award

- **<u>May</u>: HEP selection of candidate awardees, nominations to Office of Science.**
- **<u>June</u>: Office of Science selection and announcement of awardees.**
- **<u>September:</u> Awards begin.**

HEP Review Procedure

- Three-step merit review process:
  - Stage 1: Three to six mail-in reviews collected for each candidate in each research subprogram*.
    - *Advanced Accelerator R&D, Cosmic Frontier, Detector R&D, Energy Frontier, Intensity Frontier, Theoretical and Computational HEP.
  - Stage 2: Finalists selected based on mail-in reviews, programmatic priorities, and panel discussions.
  - Stage 3: Panel review of 21 proposals selected by subprogram panels, with a super-panel evaluating all proposals together.
- "Super Panel" approach:
  - Lab and university proposals are reviewed together.
  - All six subprogram Accelerator R&D, Cosmic, Detector R&D, Energy, Intensity and Theory are reviewed together.
    - We do not expect panelists to be experts in all proposal topics, but take a "big picture" view of which proposals/PIs are most likely to impact HEP.

ECRP Merit Review Criteria

- Six criteria for all proposals across Office of Science:
    1. Scientific and/or Technical Merit of the Project
    2. Appropriateness of the Proposed Method or Approach
    3. Competency of Research Team and Adequacy of Available Resources
    4. Reasonableness and Appropriateness of the Proposed Budget
    5. Relevance to the mission of the DOE Office of High Energy Physics (HEP) program
    6. Potential for leadership in the scientific community
- All are important; the blue ones typically provide more differentiation between proposals.
- "Mission relevance" is important; HEP does not like to use the Early Career award to launch a new Project.

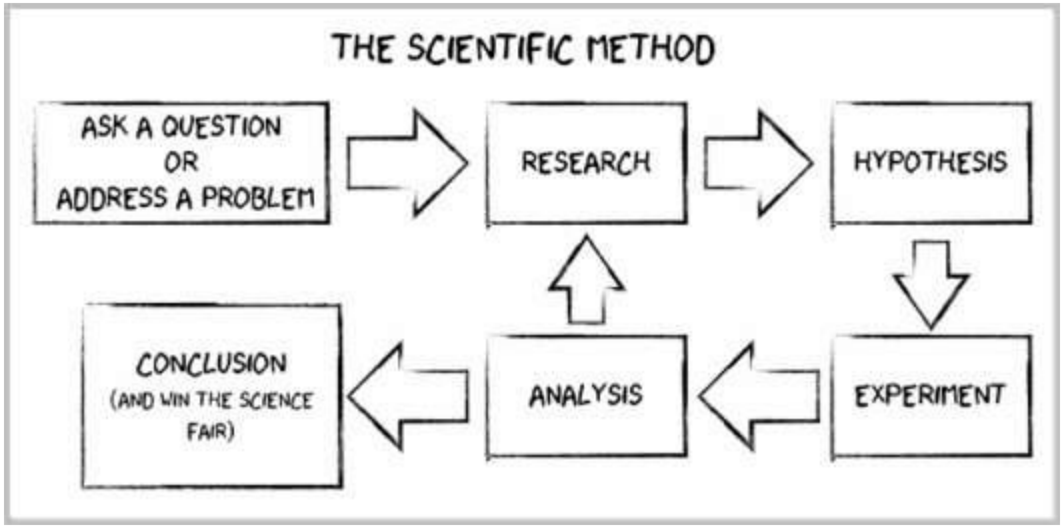
Implicit Bias in Scientific Peer Review

- **How does implicit bias influence your evaluations?**
- **A few key characteristics of implicit biases**
  - **Implicit biases are pervasive and robust. Everyone possesses them**
  - **Implicit and explicit biases are generally regarded as related but distinct mental constructs**
  - **The implicit associations we hold arise outside of conscious awareness**
  - **We generally tend to hold implicit biases that favor our own in-group**
  - **The implicit associations that we have formed can be gradually unlearned and replaced with new mental associations**
  - **http://kirwaninstitute.osu.edu/research/understanding-implicit-bias/**
- **In a perfect world, peer review would require scientific research to pass a uniformly high bar based solely on its merit**
  - **Physicists, like all people, will find it difficult to set aside all of their biases**
  - **Single-blind peer review allows conscious and unconscious biases regarding the author's professional reputation, age, gender, race, or institutional affiliation to influence reviews**
  - **In theory, concealing the identity of the PI(s) would remove these biases**
  - **However, the high degree of specialization in particle physics makes the preservation of anonymity very challenging**
- **Test yourself for implicit bias**
  - **https://implicit.harvard.edu/implicit/selectatest.html**

Early Career Proposal Framework

1. What are the problems you are trying to solve?
2. Isn't someone else doing it? Alternatively isn't that already being funded?
3. How does this research exploit/engage the unique capabilities of your institution?
4. What are the resources you need to do this project?
5. Outline a five year timeline, with key deliverables and personnel.
6. Why you are a future leader in high energy physics?

Identify The Problem

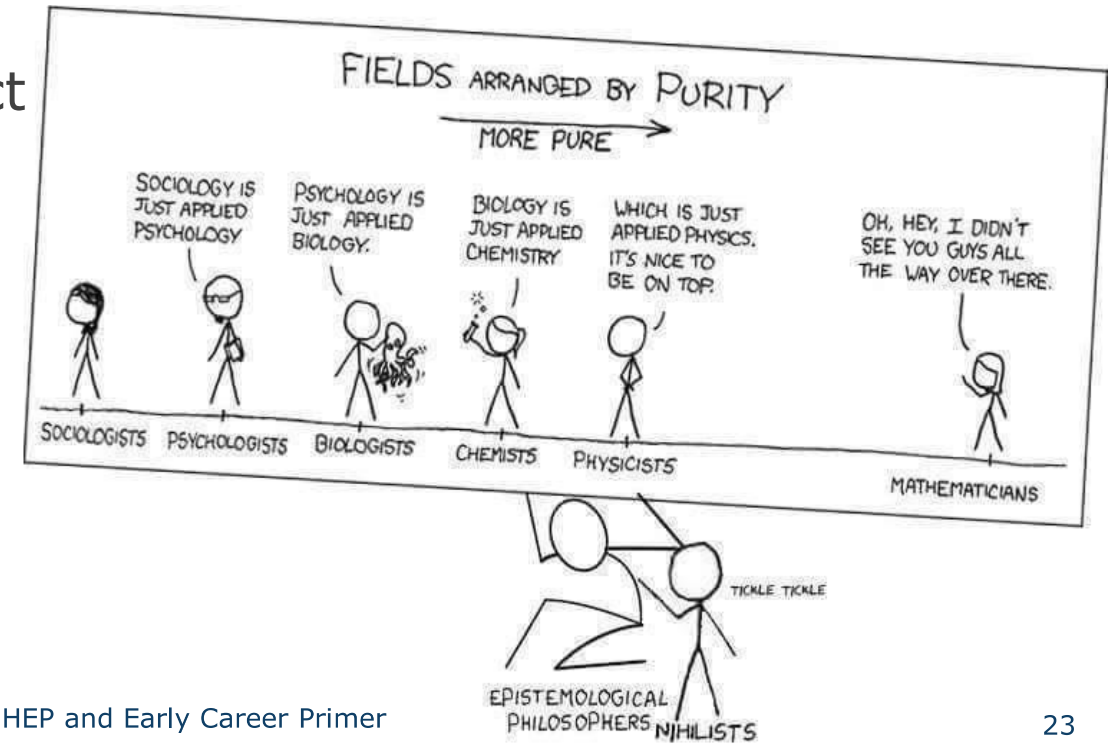


- Always start with the **big** question.
  - What are the major obstacles?
  - Is this an interesting challenge?
  - Can you articulate the problem to a general audience?
  - Can you tell a story? [More later…]

- Are you creating a new tool or capability for a larger audience?
- Will you reduce the risk/cost to a project?
- Can you substantially increase the sensitivity of the experiment?
- Are you advancing the knowledge of the field in a significant way?

Justify that You can solve the Problem

- There are two key takeaways
  1. Provide compelling argument backed up with evidence: simulation, LDRD, startup, letters of support, track record
  2. Explain how the proposed research:
     - Is above and beyond currently supported effort
     - Is not supported by baseline project
     - Is not duplicative (Federal funding)



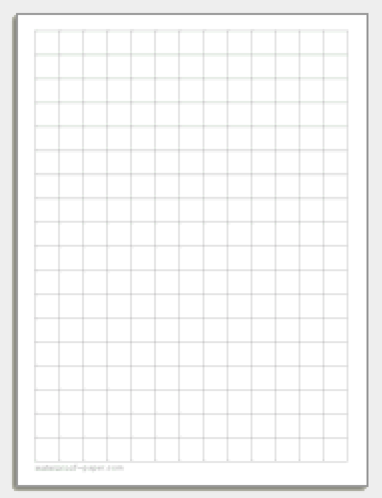
What Is Your "Unfair Competitive Advantage?"

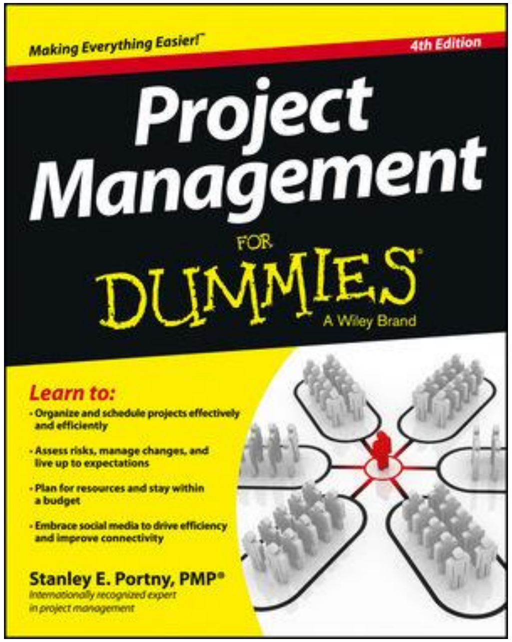
- This has greater weight for the proposals submitted from the DOE National Laboratories
  - In particular, we are interested in how the proposals leverage a lab's unique facilities and capabilities.
  - If this is not called out, a lab proposal has a lower chance in getting funded.

- For the experimental and technology proposals submitted from the Universities
  - We are also interested in how the proposals leverage the Universities facilities and resources
  - Reminder: Grants are financial assistance agreements and do not cover all costs

Validate: Costs, Resources, Schedule

- Outline a five year timeline, with yearly key deliverables, all personnel, roles and responsibilities
  - Consider month by month plan
  - What is a credible hiring plan?
  - Do you need to front-load funding to support engineering and equipment?
    - For example: 200/200/150/100/100
  - Can you delay the hire of a post-doc?
  - Do you have external dependences, and if so, does your schedule and deliverables make sense?
    - For example: Will the widget arrive too late for the project baseline decision?
  - Have you validated all expenses?





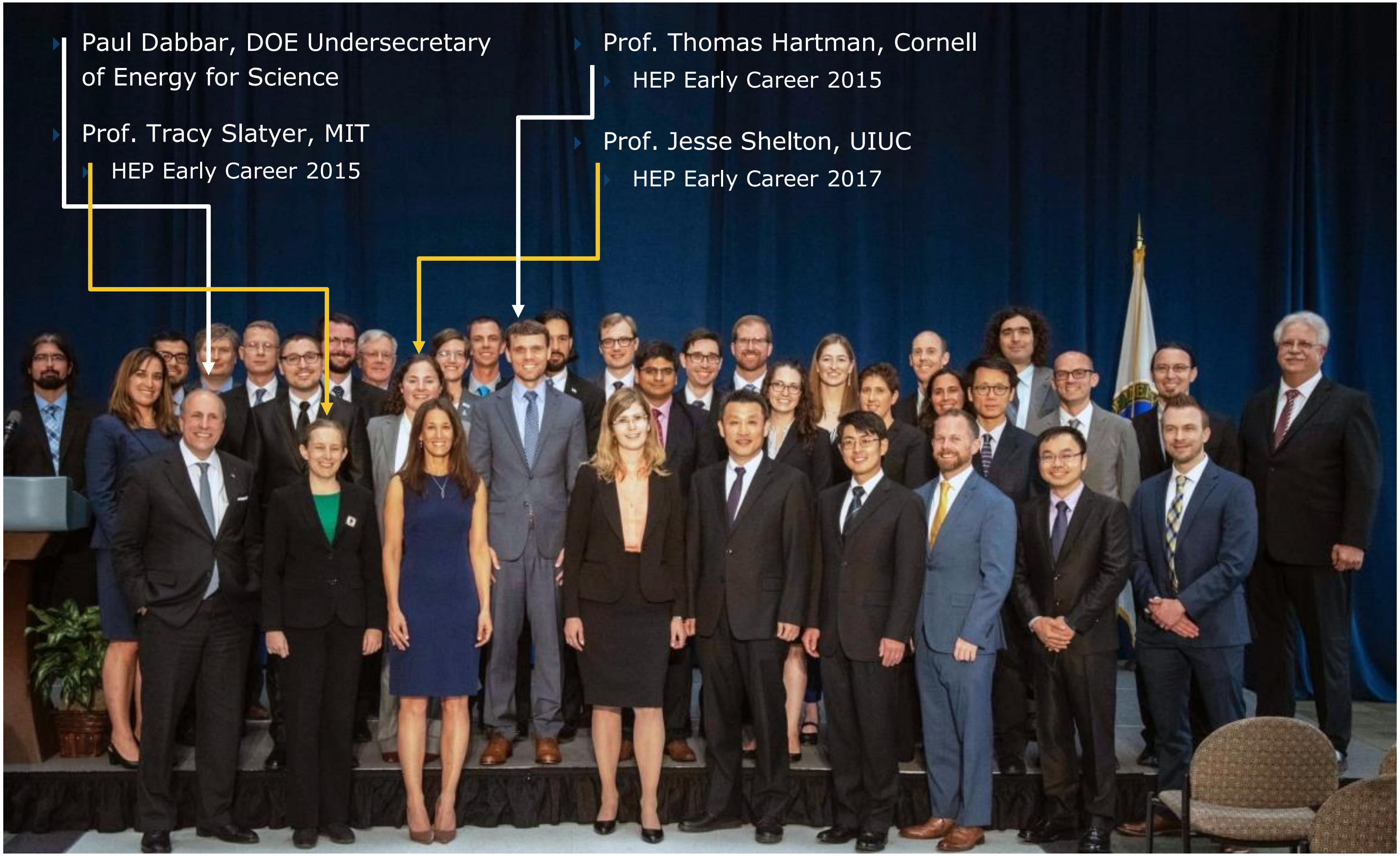
Demonstrate Leadership

- Presidential Early Career Awards for Scientists and Engineers (PECASE)
  - PECASE-eligible candidates are selected from the pool of Early Career awardees

    http://science.energy.gov/about/honors-and-awards/pecase/

- Scientific leadership can be defined very broadly and can include direct research contributions
  - How has the PI demonstrated the potential for scientific leadership and creative vision?
  - How has the PI been recognized as a leader (collaboration, institution, community service)?
  - Does the PI have a track record for mentoring students and post-docs?
- Ensure the CV is correct and current
- Polish up your public-facing online presence
  - Do you have a professional, PR-friendly photo posted on your institution's web site?

2019 PECASE Award Ceremony



Beware of Red Herrings

- A red herring is something that misleads or distracts from a relevant or important issue.

- Examples include:
  - Vague narrative descriptions, poorly described tables and figures, or dubious budget requests will lead reviewers/panel to make their own interpretations
  - Other (funded) research that is not crisply delineated from the proposed research
  - Unclear explanations of supported personnel, required resources, and timeline for deliverables
  - Grammar

Speaker's Pet Peeves

- Avoid starting sentences – and especially paragraphs – with "**It is…**"
  - You can confuse the reader. What exactly does "it" refer to?
- Constrain the usage of conjunctive adverbs (see table below)
  - Use Search and count. I've read proposals with >20 uses "finally". Trimming these "filler" words down will free up space for constructive narrative.
- Be precise – eliminate the usage of significantly, substantially, very, really, etc.
  - Instead, try "increase signal by a factor of 2" or "reduce background by 20%"
- Single spaces between sentences. Use the Oxford comma.
- Expressing what you **WILL** do is much more important than what you can or may do
  - Search/replace usages: can, could, may, might
- Jargon, Acronyms, and Initializations
  - Always define. Not every reader is an expert in your sub-field
  - If only used once or twice, can you drop it entirely?
  - Keep in mind that each instance of an unfamiliar word, phrase, or term will interrupt the reader's comprehension

A conjunctive adverb connects two independent clauses.

Cause or effect	Sequence	Time	Contrast
Therefore	Next	Before	However
Hence	Furthermore	Meanwhile	Instead
Accordingly	In addition	Now	Rather
Then	Finally	Since	In spite of
Thus	Moreover	Lately	

Emphasis	Summarize	Illustrate	Comparison
Indeed	Finally	For example	Also
Of course	In conclusion	Namely	Likewise
Certainly	In summary	For instance	Similarly

Tell a Story

- The best compliment that you can get from a reviewer: **"This was a pleasure to read."**
  - Avoid the trap of "narrow casting." Readers of your proposal will come from many disciplines within particle physics, accelerator science, and related fields
- Intersperse graphics to stimulate and illustrate
  - A single high-resolution photo is often more impactful than a few paragraphs of narrative
  - Avoid using: a copy of a copy; a collage of tiny plots; a graphic that is outdated
- Begin with "Why?"
  - **Why** tends to **reach an emotional chord with audiences** that can inspire the actions you desire. When communicating about vision, values, broad concepts, start with the why
  - **What** – once inspired, **adults have a strong desire to know** more about the what
  - **Who** refers to the breakdown of your research team as you pose your questions. Be mindful to think cross functionally
  - **Where** needs a thoughtful, detailed analysis for your efforts to be most successful
  - **When** will give you a sense of direction and sometimes urgency
  - **How** is usually the "work horse" of your planning team and guides your project planning with tasks and tactics

Start with the Answer

- **Grab the attention of the reader**, by providing the **Why** within a few sentences in the very first paragraph using Plain English
  - Do not bury the lead with X paragraphs on the history of Y physics and Z experiment
  - The context to the thesis of your project should be deferred to the narrative section, and in some cases, the appendix.
  - Ask non-physicists to read it, and see if they can paraphrase your opening paragraph. **Does it pass the "Mom test"?**
- Drawing an analogy to films, TV, and novels. Starting with the answer builds **Suspense**
  - **Readers feel suspense when they are deeply curious** about what will happen next, or when they know what is likely to happen **but don't know how it will happen**. Even in historical fiction, with characters whose life stories are well known, the why usually brings suspense to the novel.
  - Every film needs suspense. At the foundational level, a story poses a question in the beginning and answers it by the end. The suspense is the anticipation for that answer. A filmmaker who puts the **ending at the beginning** is hoping to entertain us with **HOW events unfold**



Proposals: What To Do

Do Follow Instructions	Do seek out advice & support from trusted colleagues & mentors	Do learn the rules, regulations, and costs of your institution	Do follow through on reviewer feedback	Do follow proper English grammar and composition	Do ask for what you reasonably need
Read the current FOA thoroughly, as well as any supporting materials, e.g. FAQ	Your institution has invested a lot of time and money hiring you. They want you to succeed. Let them help you	Funds are awarded to the institution. Understand direct and indirect rates, benefits, and restrictions	Give weight to the critical reviews Arguing with HEP that 3 out of 5 reviewers thought your proposal was excellent does not address the 2 reviewers who had a different opinion	Careless editing will annoy or confuse reviewers	Standard research requests • Salary and travel • Other Personnel including post-docs, students, Engineer, etc. • Equipment, M&S, Tuition remission
SC rules & procedures and HEP program requirements are regularly updated	Request a review of the proposal. There are resources at most institutions	Establish a relationship with your budget office or sponsored research office		Hire someone to proof-read your proposal	Realistic funding expectations • Early Career >$150k Univ & >$500k Lab • 50% FTE to proposal • Stagger personnel

Proposals: What **Not** To Do

Do Not submit a proposal late

You should assume that applications received after the deadline will not be reviewed or considered for award

Use the weeks or months after the FOA is made public to prepare and then submit your proposal early

Do Not brag or exaggerate

Be professional and objective.

Fully list your accomplishments in the bio. Include your mentoring.

Accurately and reasonably describe research plan

Do Not bury the message

The narrative should be accessible to a review panel with a wide range of expertise

Avoid jargon when possible. Same with acronyms.

Describe in clear and concise language. Tell a story.

Do Not dwell on the past

General rule of thumb (1/3:2/3).

No more than one-third of proposal devoted to past efforts

Majority of proposal narrative should be forward looking

Do Not submit a sloppy budget

The budget sheets and justification should be prepared with the same care as the narrative

Reviewers will call out any:

- Excessive or inappropriate requests
- Arithmetic errors
- Poorly justified expenses

Do Not be discouraged

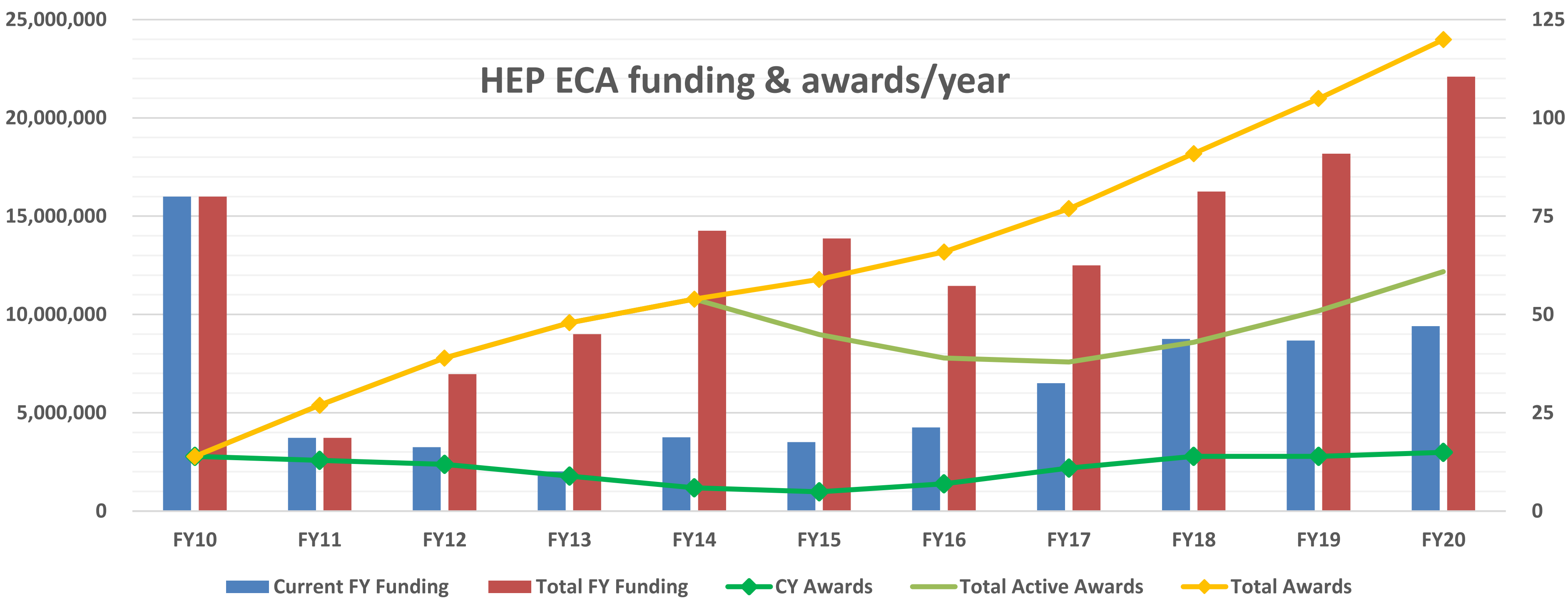
Competition is strong.

Some very good proposals are declined due to limited resources.

That first feedback is so valuable.

Increasing Investments to Early Career Research Program

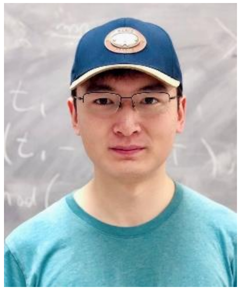
- Launched in FY 2010 with ARRA funding https://science.osti.gov/early-career
- Established Program to Stimulate Competitive Research (EPSCoR) supported 1 Theory ECA in FY 2011, 1 Intensity ECA in FY 2013, and 1 Cosmic in FY 2020
- Funding nadir was FY 2013, the first year impacted by sequestration
- Full-funding requirement took affect in FY 2014 (awards < $1M)
- **120 total HEP awards to date**: 71 University and 49 National Labs
  - In FY 2020, 15 awards (10 Univ, 5 Lab) is the largest cohort in a single year



FY 2020 HEP Early Career Awards: Univ.

- Jonathan Asaadi, U. Texas Arlington^
  - Discovery Science with New Multi-modal Pixel-based Noble Element Time Projection Chambers
- Javier Duarte, U. California San Diego*
  - Real-Time Artificial Intelligence for Particle Reconstruction and Higgs Physics
- Heather Gray, U. California Berkeley*
  - Probing the Flavor Dependence of Higgs Couplings with Charm Tagging
- Luchang Jin, U. Connecticut*
  - Lattice Calculation of the QED Corrections to Meson Leptonic Decay
- Hugh Lippincott, U. California Santa Barbara
  - HydroX: Using Hydrogen Doped in Liquid Xenon to Search for Dark Matter




*** First HEP Early Career Awards at these Institutions**

*** First HEP Early Career Award in Detector R&D at a University**

FY 2020 HEP Early Career Awards: Univ.

- Michael Mooney, Colorado State U.*
  - Constraining the Electromagnetic Shower Energy Scale at LArTPC Neutrino Detectors Near and Far
- Lado Samushia, Kansas State U.#
  - Robust Dark Energy Constraints with Dark Energy Spectroscopic Survey
- Louise Skinnari, Northeastern U.
  - Exploring the Energy Frontier through Precision Tests and Fast Tracking with the CMS Detector
- Douglas Stanford, Stanford U.
  - Quantum Black Holes and Wormholes
- Michael Troxel, Duke U.
  - Accurate Dark Energy Constraints via the Precise Characterization of Galaxy Intrinsic Alignment Coupled with Shear and Redshift Interference

*** First HEP Early Career Awards at these Institutions**

 # Also funded by DOE Established Program to Stimulate Competitive Research

FY 2020 HEP Early Career Awards: Labs

- Robert Ainsworth, FNAL
  - Ensuring Bunch Stability in Multi-MW Beams
- Laura Fields, FNAL
  - Precision Neutrino Fluxes for LBNF/DUNE
- Jonathan Jarvis, FNAL
  - Next-Generation Beam Cooling and Control with Optical Stochastic Cooling
- Brendan O’Shea, SLAC
  - Improving Accelerators with Diagnostics Optimized for Artificial Intelligence
- Tong Zhou, LBNL
  - Multi-kHz Laser-plasma Accelerator Driven by Spectrally Combined Fiber Laser



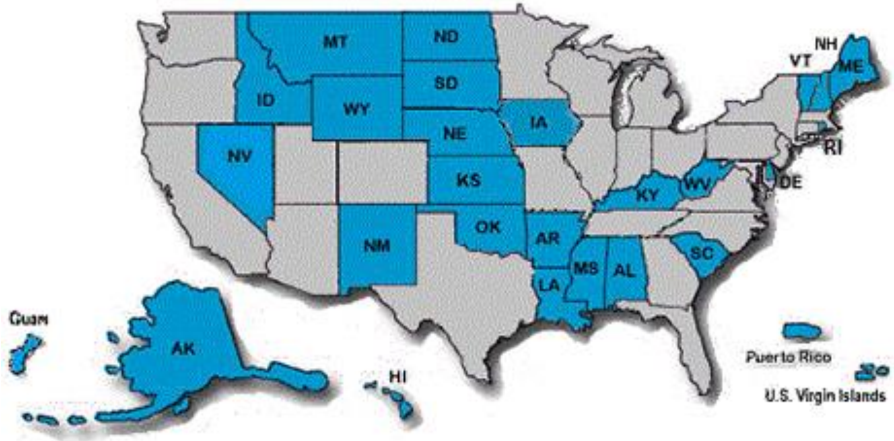


SC Workforce Development for Teachers and Scientists (WDTS)

- Science Undergraduate Laboratory Internships (SULI)
  - Summer 2020 SULI just closed (Applications due May 28, 2020)
- Community College Internships (CCI)
  - Fall 2020 CCI just closed (Applications due May 28, 2020)
- Visiting Faculty Program (VFP)
  - Summer 2020 VFP closed Jan. 2020, notifications in April
- Office of Science Graduate Student Research Program (SCGSR)
  - Two annual solicitations with May and November deadlines **(backup slide)**
- Albert Einstein Distinguished Educator Fellowship
  - 2020-2021 cycle closed on November 14, 2019
- More information and key dates for all programs at:
  - https://science.osti.gov/wdts

DOE Experimental Program to Stimulate Competitive Research (EPSCoR)

- 42 USC13503 [Title 42 U.S. Code Chapter 134, Subchapter X, section (§) 13503. Supporting research and technical analysis]:
  - EPSCoR shall assist those States that-
    - Historically have received relatively little Federal research and development funding
    - Demonstrated a commitment to develop their research bases and improve science and engine ering research and education programs at their universities and colleges.



- Program Priorities:
  - DOE EPSCoR is a science-driven, merit-based program that supports early stage research activities spanning the broad range of science and technology programs
  - In addition, the program places high priority on increasing the number of scientists and engineers in energy-related areas.
  - The program places particular emphasis and importance of collaboration among young faculty, postdoctoral associates, graduate/undergraduate students supported by EPSCoR with scientists from the DOE national laboratories where unique scientific and technical capabilities are present.

Laboratory Directed Research and Development (LDRD)

- LDRD serves a number of important purposes.
  - **Enables high risk R&D** at the Department's laboratories in areas of potential value to national R&D programs.
  - Flexibility allows the laboratories to assemble experts from different fields into teams whose collaboration uncovers synergies and multidisciplinary solutions not otherwise evident without the freedom to reach across traditional technical boundaries.
  - **LDRD serves as a proving ground for advanced R&D concepts that are often subsequently pursued by DOE programs** and, at the same time, helps the Government identify more creative approaches to fulfilling future mission needs.
- LDRD projects are selected on a competitive basis through rigorous management and peer review processes.
- Among the most valuable aspects of the LDRD program is its **role as an excellent professional development tool**.
  - The LDRD program is instrumental in the laboratories' ability to **attract promising young scientists and engineers**, providing the basis for continually refreshing the laboratory research staff, as well as for the education and training of the next generation of scientists.
  - **Includes support for both undergraduate and graduate students working on LDRD projects**, technical staff retention associated with opportunities to retain and hone scientific skills via LDRD, and a **range of university collaborations stimulated via LDRD projects.**

ORISE

- Whether you are an **undergraduate, graduate student, postdoc, or early-career professional**, ORISE provides various resources to address the **career planning and professional development** needs of all research and non-research participants.
  - What STEM Careers are in High Demand?
  - Internship or Entry-Level Position?
  - Find a Recruiting Event
  - How to Write a Cover Letter
  - Is a Resume the Same as a CV?
  - Personal and Professional Recommendations: What's the Difference?
  - What is a Virtual Career Fair?
  - How to Boost Your Visibility through Networking
  - What to Expect During an Interview
  - Learn about ORISE-Managed STEM Programs
- Resources for K-12 Teachers and Students

Final Word: Engagement

- Review criteria for HEP Comparative Review and Early Career includes "leader within the proposed effort and/or potential future leader in the field"
  - Important to seek out and/or volunteer for roles and responsibilities which increase visibility and provide career advancement opportunities
  - Editorial Boards, Sub-detector systems, Physics Working Groups, Run Coordinator, Analysis Coordinator, etc.
  - Service work for community is also valued, e.g. co-chairing a conference committee; serving on a DOE or NSF review panel; running DEI program at your institution
- When asked to review, co-chair, attend, speak, etc. **try NOT to say no!**
  - You need the experience
  - Ask for feedback (if possible)
  - Respond promptly to all communication

- Talk to your community representatives
- HEPAP: High Energy Physics Advisory Panel
  - http://science.energy.gov/hep/hepap/
- AAAC: Astronomy and Astrophysics Advisory Committee
  - https://www.nsf.gov/mps/ast/aaac.jsp
- APS Division of Particles and Fields
  - https://www.aps.org/units/dpf/
- HEP Organization
  - Introduce yourself to the DOE Program Managers
- Ask questions

U.S. DEPARTMENT OF
ENERGY

Office of
Science

Office of High Energy Physics

James Siegrist, Director

Carol Atherly (Contractor)

HEP Budget and Planning
Alan Stone
Erin Cruz
Michelle Bandy
Michael Cooke

International Agreements Program
Abid Patwa

International Quantum Information Science
Altaf Carim

Accelerator Stewardship
Eric Colby

HEP Operations
Kathy Yarmas

HEP Connections
Lali Chatterjee

Research & Technology Division

Glen Crawford, Director

Janice Hannan
Debora Monteiro (Contractor)
Christie Ashton
David Bogley

Physics Research

Energy Frontier
Abid Patwa

Intensity Frontier
Glen Crawford (Acting)
Michael Cooke
Laurence Littenberg (Detailee)
David Cinabro (IPA)

Cosmic Frontier
Kathy Turner
Drew Baden (IPA)
Eric Linder (IPA)
Karen Byrum (Detailee)

Theoretical Physics
William Kilgore

Research Technology

General Accelerator R&D
L.K. Len
John Boger
Eric Colby
Ken Marken

Detector R&D
Helmut Marsiske

Computational HEP & QIS
Lali Chatterjee
Eric Church (Detailee)

SBIR/STTR
Ken Marken

Facilities Division

Mike Procario, Director

Facility Operations

Fermilab Complex
John Kogut

LHC Operations
Abid Patwa

Other Operations [SLAC/Other Labs]
John Kogut

SURF (Lead, SD)
Clayton Hollowell

Instrumentation & Major Systems

DESI – Kathy Turner
FACET-II – Ted Lavine
HL-LHC AUP – Simona Rolli
HL-LHC ATLAS – Simona Rolli
HL-LHC CMS – Simona Rolli
LBNF-DUNE – David Lissauer (Detailee)
LSSTcam – Helmut Marsiske
LZ – Ted Lavine
Mu2e – Ted Lavine
PIP-II – Mike Harrison (Detailee)
SuperCDMS-SNOLAB – Simona Rolli
CMB - S4 – Drew Baden (IPA)
Kathy Turner

High Energy Physics Advisory Panel

- Jointly chartered since October 2000 by the Department of Energy (DOE) and the National Science Foundation (NSF), HEPAP **reports both to DOE's Office of High Energy Physics and the NSF's Mathematical & Physical Sciences directorate** under the guidelines established by the Federal Advisory Committee Act (FACA) of 1972.
- DOE and NSF continue to work together to enhance ongoing U.S. leadership in the three frontiers of high energy physics.
- HEPAP's activities include:
  - Periodic reviews of existing high energy physics programs
  - Providing advice on the formulation of long-range plans, priorities, and strategies for the nation's high energy physics program, e.g. P5
  - Recommending appropriate levels of funding to assure a world leadership position
  - Making recommendations to help maintain appropriate balance between competing elements of the program
- Special attention is paid by both NSF and DOE to obtain a diverse membership with a balance of disciplines, interests, experiences, points of view, and geography.

https://science.osti.gov/hep/hepap

- **Prof. Alan Bolton**
- Kansas State University
- March 2022

- **Dr. John Byrd**
- Argonne National Laboratory
- March 2023

- **Prof. Janet Conrad**
- Massachusetts Institute of Technology
- March 2021

- **Prof. Rohini Godbole**
- Indian Institute of Science
- March 2021

- **Prof. Jordan Goodman**
- University of Maryland
- March 2021

- **Dr. Anna Grassellino**
- Fermi National Accelerator Laboratory
- March 2023

- **Prof. JoAnne Hewett, Chair**
- SLAC National Accelerator Laboratory

- **Prof. Michael Hildreth**
- Notre Dame University
- March 2022

- **Prof. Kent Irwin**
- Stanford University
- March 2021

- **Prof. Young-Kee Kim**
- University of Chicago
- March 2021

- **Prof. Donatella Lucchesi**
- University of Padova
- March 2021

- **Prof. Rachel Mandelbaum**
- Carnegie Mellon University
- March 2023

- **Prof. Alysia Marino**
- University of Colorado
- March 2022

- **Prof. Meenakshi Narain**
- Brown University
- March 2021

- **Dr. Soren Prestemon**
- Lawrence Berkeley National Laboratory
- March 2022

- **Dr. Patrizia Rossi**
- Thomas Jefferson National Accelerator Facility
- March 2022

- **Prof. Mark Wise**
- California Institute of Technology
- March 2023

HEP Early Career FY10-20 Lab vs. Univ Awards

L = National Laboratory Proposal U = University Proposal

Subprogram Awards (L/U)	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	Total
Energy	3 (1/2)	3 (1/2)	1 (0/1)	2 (0/2)	2 (1/1)	0 (0/0)	2 (0/2)	2 (1/1)	3 (2/1)	3 (2/1)	3 (0/3)	24 (8/16)
Intensity	2 (1/1)	1 (0/1)	3 (2/1)	1 (0/1*)	1 (1/0)	2 (1/1)	1 (1/0)	2 (2/0)	2 (2/0)	1 (0/1)	2 (1/1)	18 (11/7)
Cosmic	2 (0/2)	3 (2/1)	3 (1/2)	2 (1/1)	1 (0/1)	0 (0/0)	1 (0/1)	2 (1/1)	2 (0/2)	3 (0/3)	3 (0/3*)	22 (5/17)
HEP Theory	6 (1/5)	4 (0/4*)	3 (0/3)	3 (1/2)	1 (0/1)	3 (0/3)	1 (1/0)	2 (0/2)	3 (0/3)	3 (1/2)	2 (0/2)	31 (4/27)
Detector	0 (0/0)	0 (0/0)	0 (0/0)	0 (0/0)	0 (0/0)	0 (0/0)	0 (0/0)	1 (1/0)	2 (2/0)	2 (2/0)	1 (0/1)	6 (5/1)
Accelerator	1 (1/0)	2 (2/0)	2 (1/1)	1 (0/1)	1 (1/0)	0 (0/0)	2 (2/0)	2 (2/0)	1 (0/1)	2 (2/0)	4 (4/0)	18 (15/3)
QIS	NA	NA	NA	NA	NA	NA	NA	NA	1 (1/0)	0 (0/0)	0 (0/0)	1 (1/0)
HEP Awards	14 (4/10)	13 (5/8)	12 (4/8)	9 (2/7)	6 (3/3)	5 (1/4)	7 (4/3)	11 (7/4)	14 (7/7)	14 (7/7)	15 (5/10)	120 (49/71)
Proposals	154 (47/107)	128 (43/85)	89 (34/55)	78 (29/49)	77 (36/41)	73 (27/46)	84 (27/47)	83 (26/57)	92 (35/57)	92 (28/64)	85 (26/59)	1035 (358/677)

*** Three awards funded by DOE Office of Basic Energy Sciences (BES) as an EPSCoR [Experimental Program to Stimulate Competitive Research] award with grant monitored by DOE Office of High Energy Physics (HEP).**

HEP Early Career FY10-20 Demographics

M= Male F= Female

Subprogram Awards (M/F)	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	Total
Energy	3 (2/1)	3 (2/1)	1 (1/0)	2 (1/1)	2 (1/1)	0 (0/0)	2 (2/0)	2 (2/0)	3 (2/1)	3 (1/2)	3 (1/2)	24 (15/8)
Intensity	2 (1/1)	1 (1/0)	3 (1/2)	1 (0/1*)	1 (1/0)	2 (2/0)	1 (0/1)	2 (2/0)	2 (2/0)	1 (0/1)	2 (1/1)	18 (11/7)
Cosmic	2 (2/0)	3 (3/0)	3 (2/1)	2 (2/0)	1 (1/0)	0 (0/0)	1 (1/0)	2 (1/1)	2 (0/2)	3 (2/1)	3 (3*/0)	22 (17/5)
HEP Theory	6 (6/0)	4 (3/1*)	3 (3/0)	3 (3/0)	1 (1/0)	3 (2/1)	1 (1/0)	2 (0/2)	3 (3/0)	3 (2/1)	2 (2/0)	31 (26/5)
Detector	0 (0/0)	0 (0/0)	0 (0/0)	0 (0/0)	0 (0/0)	0 (0/0)	0 (0/0)	1 (1/0)	2 (2/0)	2 (2/0)	1 (1/0)	6 (6/0)
Accelerator	1 (0/1)	2 (2/0)	2 (2/0)	1 (1/0)	1 (0/1)	0 (0/0)	2 (2/0)	2 (2/0)	1 (1/0)	2 (1/1)	4 (4/0)	18 (15/3)
QIS	NA	NA	NA	NA	NA	NA	NA	NA	1 (1/0)	0 (0/0)	0 (0/0)	1 (1/0)
HEP Awards	14 (11/3)	13 (11/2)	12 (9/3)	9 (7/2)	6 (4/2)	5 (4/1)	7 (6/1)	11 (8/3)	14 (11/3)	14 (8/6)	15 (12/3)	120 (91/29)
Proposals	154 (131/23)	128 (110/18)	89 (75/14)	78 (64/14)	77 (62/15)	73 (57/16)	84 (65/19)	83 (59/24)	92 (72/20)	92 (67/25)	85 (63/22)	1035 (825/210)

* Three awards funded by DOE Office of Basic Energy Sciences (BES) as an EPSCoR [Experimental Program to Stimulate Competitive Research] award with grant monitored by DOE Office of High Energy Physics (HEP).

11-year average (women): 20.3% submitted proposals. 24.2% awards.

HEP Early Career FY10-19 Proposal Details

L = National Laboratory Proposal
U = University Proposal

Subprogram Proposals	FY10 (L/U)	FY11 (L/U)	FY12 (L/U)	FY13 (L/U)	FY14 (L/U)	FY15 (L/U)	FY16 (L/U)	FY17 (L/U)	FY18 (L/U)	FY19 (L/U)	Total (L/U)
Energy	47 (7/40)	32 (5/27)	18 (2/16)	15 (4/11)	14 (4/10)	10 (3/7)	18 (4/14)	15 (3/12)	16 (8/8)	23 (6/17)	208 (46/162)
Intensity	16 (6/10)	21 (10/11)	17 (9/8)	7 (4/3)	14 (9/5)	15 (8/7)	19 (7/12)	14 (7/7)	15 (8/7)	10 (3/7)	148 (71/77)
Cosmic	20 (8/12)	12 (5/7)	17 (5/12)	22 (9/13)	13 (7/6)	14 (6/8)	14 (6/8)	13 (5/8)	16 (5/11)	16 (4/12)	157 (60/97)
HEP Theory	49 (6/43)	45 (7/38)	23 (5/18)	20 (3/17)	23 (3/20)	25 (3/22)	21 (1/20)	29 (2/27)	31 (3/28)	29 (2/27)	295 (35/260)
Accelerator	19 (18/1)	18 (16/2)	10 (9/1)	8 (6/2)	11 (11/0)	7 (6/1)	10 (9/1)	8 (6/2)	6 (4/2)	10 (10/0)	107 (95/12)
Detector	3 (2/1)	0 (0/0)	4 (4/0)	6 (3/3)	2 (2/0)	2 (1/1)	2 (0/2)	4 (3/1)	8 (7/1)	4 (3/1)	35 (25/10)
Total Proposals	154 (47/107)	128 (43/85)	89 (34/55)	78 (29/49)	77 (36/41)	73 (27/46)	84 (27/57)	83 (26/57)	92 (35/57)	92 (35/57)	950 (332/618)

Ten-Year Average University: 65% submitted proposals. 58% awards.

To be updated to include FY 2020: 85 proposals

FY 2019 HEP Early Career Awards: Univ.

- Thomas Dumitrescu, UCLA
  - New Tools for Strongly Coupled Quantum Field Theories
- Cora Dvorkin, Harvard U.
  - Discovering Dark Matter Clumps and Primordial Particles with Galaxies
- Tim Eifler, U. Arizona
  - Multi-Probe Cosmology with DES and LSST
- Sowjanya Gollapinni, U. Tennessee
  - Development of a Laser Calibration System for the DUNE Far Detector
- Scott Hertel, U. Massachusetts, Amherst
  - Optimization and Calibration of a 4He-based Detector for Low-Mass Dark Matter
- Laura Jeanty, U. Oregon
  - Searches for New Long-Lived Particles and Upgrades to the ATLAS Inner Detector
- Elisabeth Krause, U. Arizona
  - Joint Analyses of Lensing, Clustering, and Galaxy Clusters with DES and LSST







FY 2019 HEP Early Career Awards: Labs

- Viviana Cavaliere, BNL
  - Boosting New Physics Searches with Higgs Differential Cross-Section Measurements
- Diana Gamzina, SLAC
  - Mechanics of Materials' Interaction with Electromagnetic Waves in Accelerator Cavities
- Pedro Machado, FNAL
  - The Next Revolution in Neutrino Physics
- Peter Sorensen, LBNL
  - Tagging Radon Daughter Backgrounds in a Crystalline Xenon TPC: A Solid Future for the LZ Dark Matter Search Experiment
- Nhan V. Tran, FNAL
  - Deep Learning Acceleration of the Boosted Higgs Program and HEP Computing
- Jingke Xu, LLNL
  - Pursuing the Ultimate Power of Xenon Dark Matter Detectors
- Xingchen Xu, FNAL
  - Development of Next-Generation Nb_3Sn Superconductors for Energy-Frontier Circular Colliders



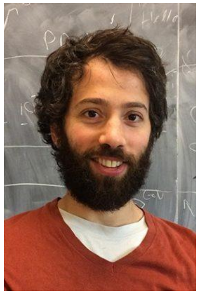




FY 2018 HEP Early Career Awards: Univ.

- Thomas Faulkner, University of Illinois
  - New perspectives on QFT and gravity from quantum entanglement
- Alexie Leauthaud-Harnett, University of California, Santa Cruz
  - Exploiting Synergies Between Lensing and BAO Surveys for Improved Cosmological Constraints
- Themis Mastoridis, California Polytechnic State University
  - Optimal Design of Radio Frequency Algorithms and Models for Next Generation Accelerators
- Benjamin Safdi, University of Michigan
  - Particle Dark Matter Across Scales
- Hee-Jong Seo, Ohio University
  - Optimal and robust reconstruction of BAO, redshift-space distortions and the Alcock-Paczynski effect
- David Simmons-Duffin, Caltech
  - Precision Computations in Strongly Coupled Conformal Field Theories
- Rachel P. Yohay, Florida State University
  - Probing New Physics with Tau Leptons using the CMS Detector




FY 2018 HEP Early Career Awards: Labs

- Artur Apresyan, FNAL
  - Exploring the Lifetime Frontier with New Detectors and New Searches
- Daniel Bowring, FNAL
  - Microwave Single-Photon Sensors for Dark Matter Searches and Precision Neutrino Measurements
- Daniel A. Dwyer, LBNL
  - Improving Neutrino Detection in DUNE with Pixel Sensors
- Michael Kagan, SLAC
  - Exploring the Higgs Sector at the Energy Frontier with Bottom Quarks, Machine Learning, and the Upgraded ATLAS Pixel Detector
- Aritoki Suzuki, LBNL
  - Development of high throughput techniques for SC microfabrication, assembly and deployment for future high energy physics experiments
- Kazuhiro Terao, SLAC
  - GPU/FPGA Accelerated Deep Learning Technique Development for Discovering Physics in Liquid Argon Time Projection Chambers
- Javier Tiffenberg, FNAL
  - Towards table-top neutrino detectors: A 10 kg Skipper-CCD experiment

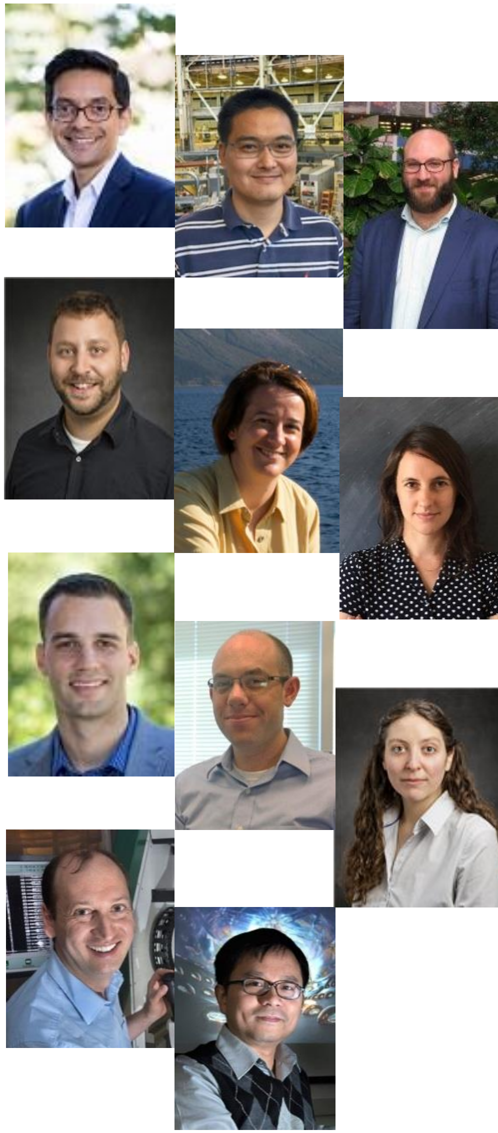






FY 2017 HEP Early Career Awards

- **Zeeshan Ahmed (Detector, SLAC)** Development of High-density Microwave-multiplexed Transition Edge Sensor Bolometers for next-generation CMB Cameras
- **Qiang Du (Accelerator, LBNL)** Scalable Control of Multidimensional Coherent Pulse Addition for High Average Power Ultrafast Lasers
- **Alexander Himmel (Intensity, FNAL)** Seeing Neutrinos: The Physics Potential of Photon Signals in DUNE
- **Ben Hooberman (Energy, UIUC)** Probing Naturalness with Searches for Supersymmetric Higgs Partners at the LHC
- **Anja von der Linden (Cosmic, SUNY SB)** Towards Precision Cluster Cosmology with LSST
- **Marilena Loverde (Theory, SUNY SB)** Discovering dark energy, dark matter and neutrino properties with cosmic structure
- **Emilio Nanni (Accelerator, SLAC)** High-Gradient Accelerators at THz Frequencies
- **Michael Schneider (Cosmic, LLNL)** Dark Energy Constraints from Weak Gravitational Lensing in the Large Synoptic Survey Telescope (LSST)
- **Jessie Shelton (Theory, UIUC)** Hidden sectors from cosmos to colliders
- **Alessandro Tricoli (Energy, BNL)** Unveiling the electroweak symmetry breaking mechanism at ATLAS and at future experiments with novel silicon detectors
- **Chao Zhang (Intensity, BNL)** Optimization of Liquid Argon TPCs for Nucleon Decay and Neutrino Physics



FY 2016 HEP Early Career Awards

- Kristian Hahn (Northwestern University) *"Dark matter and Track Triggering with the CMS Experiment"*
- Shih-Chieh Hsu (University of Washington) *"Search for Dark Matter using mono-Higgs and the ATLAS Pixel Detector"*
- Christoph Lehner (BNL) *"New methods enabling a precise first principles computation of the muon anomalous magnetic moment"*
- Chad Mitchell (LBNL) *"Compensation of Nonlinear Space Charge Effects for Intense Beams in Accelerator Lattices"*
- Sam Posen (Fermilab) *"Developing the Next Generation of Superconducting RF Cavities with Nb3Sn"*
- Jen Raaf (Fermilab) *"Coming in from the Cold: A High-Pressure Gaseous Argon Time Projection Chamber as an Option for the DUNE Near Detector"*
- Eduardo Rozo (Arizona) *"Constraining Dark Energy with Galaxy Clusters and Baryon Acoustic Oscillations"*





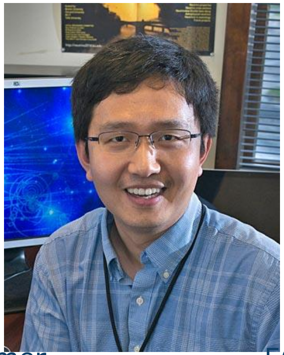


FY 2015 HEP Early Career Awards

- Phillip Barbeau (Duke University) "*Coherent Neutrino-Nucleus Scattering: A Tool to Search for New Physics*"
- Nathaniel Craig (University of California, Santa Barbara) "*Leveraging the Higgs to Discover Physics Beyond the Standard Model*"
- Thomas Hartman (Cornell University) "*Universality in Quantum Gravity*"
- Tracy Slatyer (Massachusetts Institute of Technology) "*Confronting Dark Matter with the Multiwavelength Sky*"
- Peter Winter (ANL) "*Muon g-2: Precision Determination of the Magnetic Field and Enhanced Trolley Features*"

FY 2014 HEP Early Career Awards

- Eric Dahl. Northwestern. *"A Scintillating Xenon Bubble Chamber for Dark Matter Detection"*
- Peter Graham. Stanford. *"New Searches for Ultralight Particles"*
- Anna Grassellino. Fermilab. *"Impurity Doping of Niobium for Ultra Efficient Superconducting RF Cavities"*
- James Hirschauer. Fermilab. *"Search for new phenomena at the 13 TeV LHC: Fast start and strong finish"*
- Stephanie Majewski. University of Oregon. *"Search for New Physics with Top Quarks and Upgrade to the ATLAS Liquid Argon Calorimeter"*
- Xin Qian. Brookhaven National Laboratory. *"Detector Development towards Precision Measurements of Neutrino Mixing"*



FY 2013 HEP Early Career Awards

- Adam Bolton (University of Utah) *"Integrating Advanced Software and Statistical Methods for Spectroscopic Dark-Energy Surveys"*
- Clarence Chang (ANL) *"Exploring Fundamental Physics through New Measurements of the Cosmic Microwave Background Polarization"*
- Clifford Cheung (California Institute of Technology) *"The Higgs Frontier"*
- Stefan Hoeche (SLAC) *"High Precision Event Simulation for the LHC"*
- Andrew Ivanov (Kansas State University) *"Quest for a Top Quark Partner and Upgrade of the Pixel Detector Readout Chain at the CMS"*
- Matthew Jewell (University of Wisconsin Eau Claire) *"Mechanical Performance of HTS Superconductor for HEP Applications"*
- Jelena Maricic (University of Hawaii) *"Resolving Reactor Antineutrino Anomaly with Strong Antineutrino Source" #*
- Toyoko Orimoto (Northeastern University) *"Search for the Higgs and Physics Beyond the Standard Model with the CMS Electromagnetic Calorimeter"*
- Andrew Tolley (Case Western Reserve University) *"Exploring the Fundamental Origin of Cosmic Acceleration"*

 # Also funded by DOE Established Program to Stimulate Competitive Research

FY 2012 HEP Early Career Awards

PI		Institution	Year PhD	Thrust
Carosi	Gianpaolo	LLNL	2006	Cosmic
Casey	Brendan	Fermilab	2001	Intensity
Essig	Rouven	SUNY Stony Brook	2008	Theory
Hartnoll	Sean	Stanford	2005	Theory
Mandelbaum	Rachel	Carnegie Mellon	2006	Cosmic
Padmanabhan	Nikhil	Yale	2006	Cosmic
Senatore	Leonardo	Stanford	2006	Theory
Shen	Tengming	Fermilab	2010	Acceler.
Snopok	Pavel	IIT	2007	Acceler.
Whitehead	Lisa	Houston	2007	Intensity
Zeller	Geralyn	Fermilab	2002	Intensity
Zhu	Junjie	Michigan	2004	Energy

FY 2011 HEP Early Career Awards

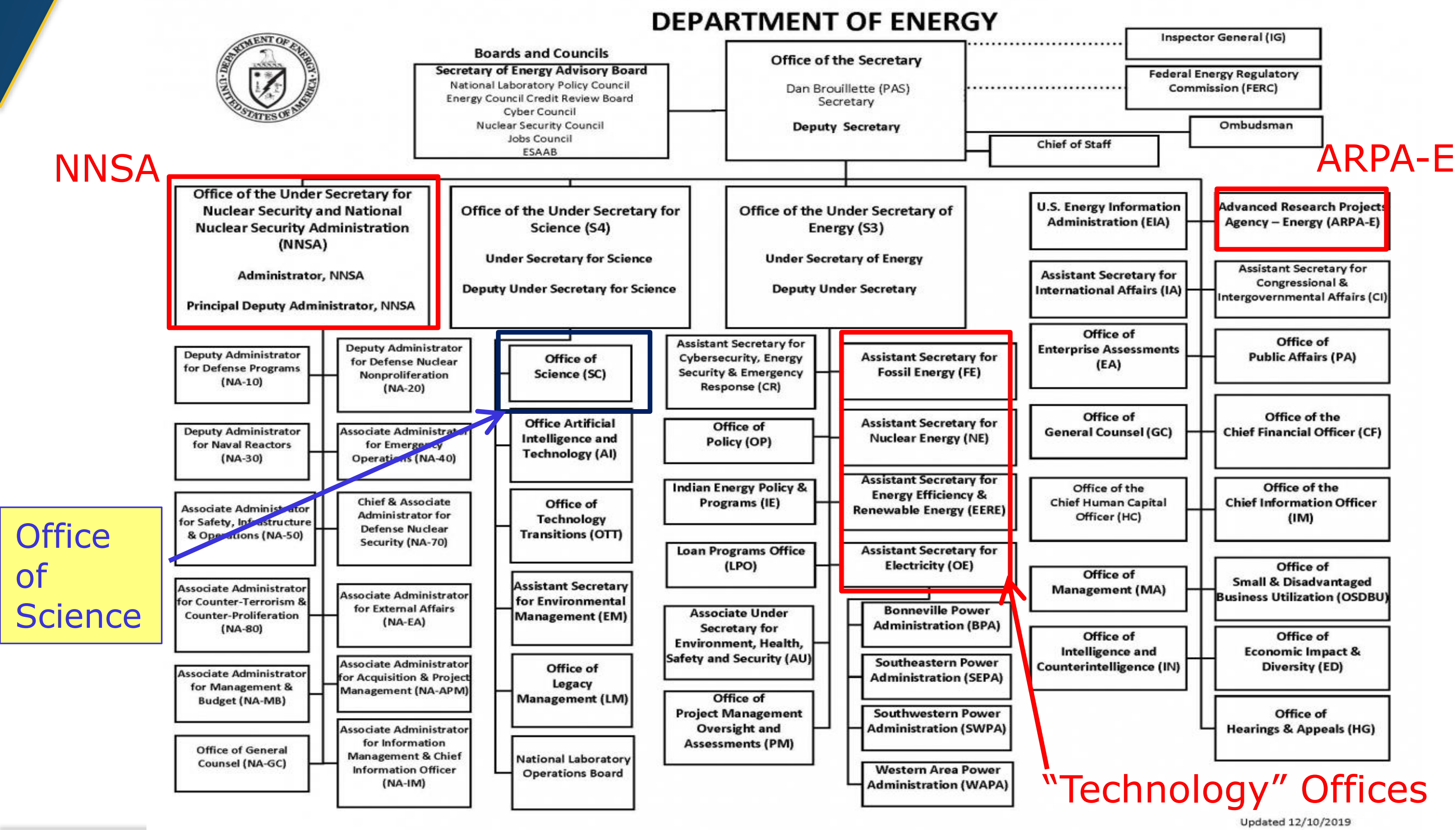
PI	Institution	Subprogram	Proposed Research
Aaron S. Chou	FNAL	Cosmic	Search for Holographic Noise from the Planck Scale
Sarah Demers	Yale	Energy	Taus and the Trigger for Discovery at ATLAS
Aran Garcia-Bellido	Rochester	Energy	Precision Physics and Searches with Top and Bottom Quarks
Carter Hall	Maryland	Cosmic	The search for weakly interacting dark matter with liquid xenon
Christopher Hirata	Caltech	Theory	Cosmological Probes of Fundamental Physics
Alberto Nicolis	Columbia	Theory	Quantum Field Theories for Cosmology
Ryan B. Patterson	Caltech	Intensity	Developing novel techniques for readout, calibration, and event selection in the NO A long-baseline neutrino experiment
Thomas Proslier	ANL	Accelerator	Atomic Layer Deposition: An innovative approach to improve the performance of high energy physics accelerators
Anze Slosar	BNL	Cosmic	Cosmology with the Lyman-alpha forest
Jesse Thaler	MIT	Theory	Interpreting New Data from the High Energy Frontier
Anastasia Volovich	Brown#	Theory	Miracles in Scattering Amplitudes: from QCD to Gravity
Faya Wang	SLAC	Accelerator	RF Breakdown Dependence on Electric and Magnetic Fields and Pulsed Heating
Jinlong Zhang	ANL	Energy	Enhancement of the Trigger Capability for New Physics at the Large Hadron Collider

 # Also funded by DOE Established Program to Stimulate Competitive Research

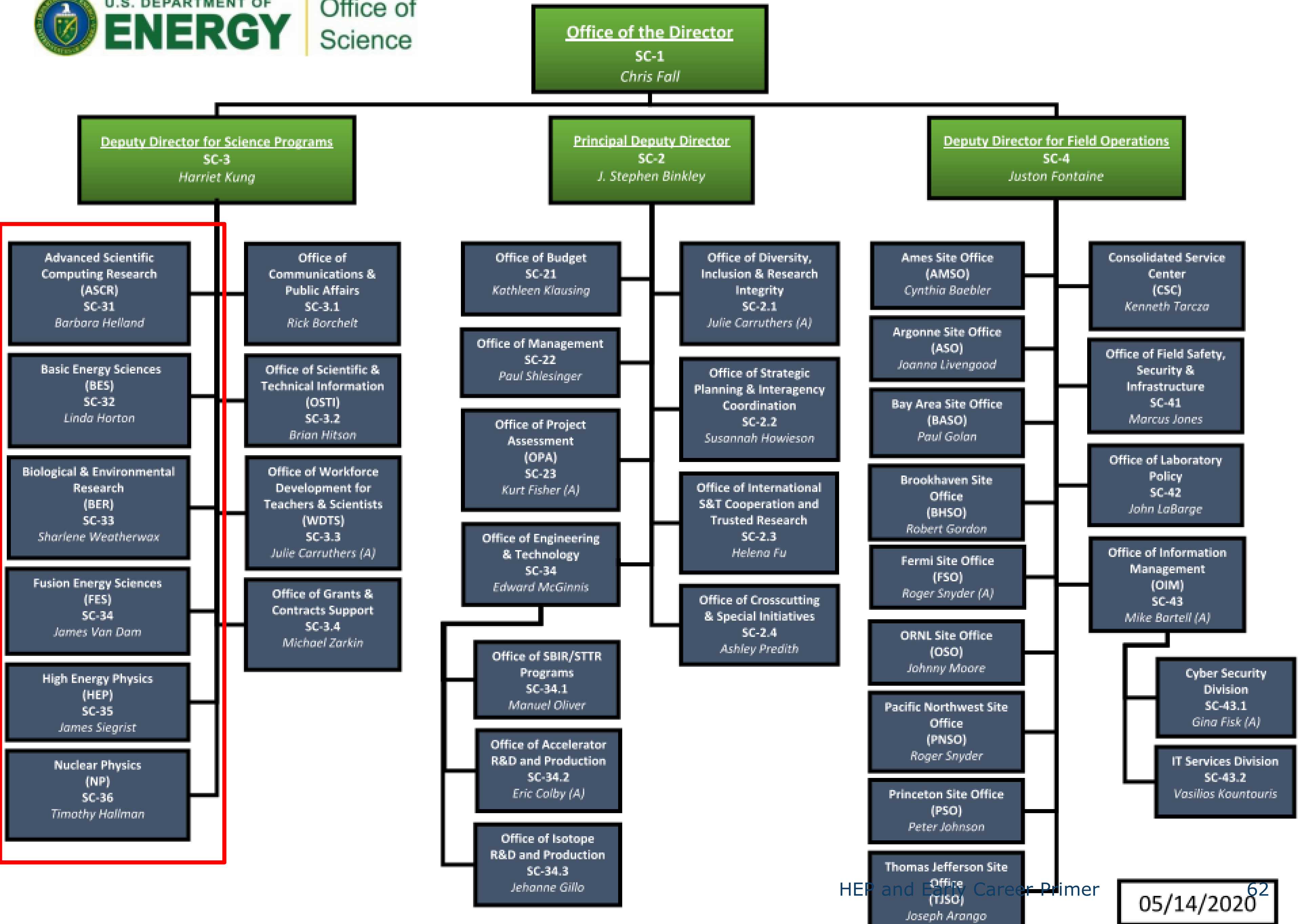
FY 2010 HEP Early Career Awards

PI		Institution	PhD	Thrust
Marino	Alysia	Colorado	2004	Intensity
Schwartz	Matthew	Harvard	2003	Theory
Mauger	Christopher	LANL	2002	Intensity
Smirova	Evgenya	LANL	2005	ACC
Bauer	Christian	LBNL	2000	Theory
Newman	Jeffrey	Pittsburgh	2000	Cosmic
Halyo	Valerie	Princeton	2001	Energy
Wang	Lian-Tao	Princeton	2002	Theory
Schwartzman	Ariel	SLAC	2004	Energy
Shih	David	Rutgers	2006	Theory
Nadolsky	Pavel	SMU	2001	Theory
Mahapatra	Rupak	Texas A&M	2000	Cosmic
Farbin	Amir	Texas Arlington	2003	Energy
Huber	Patrick	Virginia Polytechnic	2003	Theory

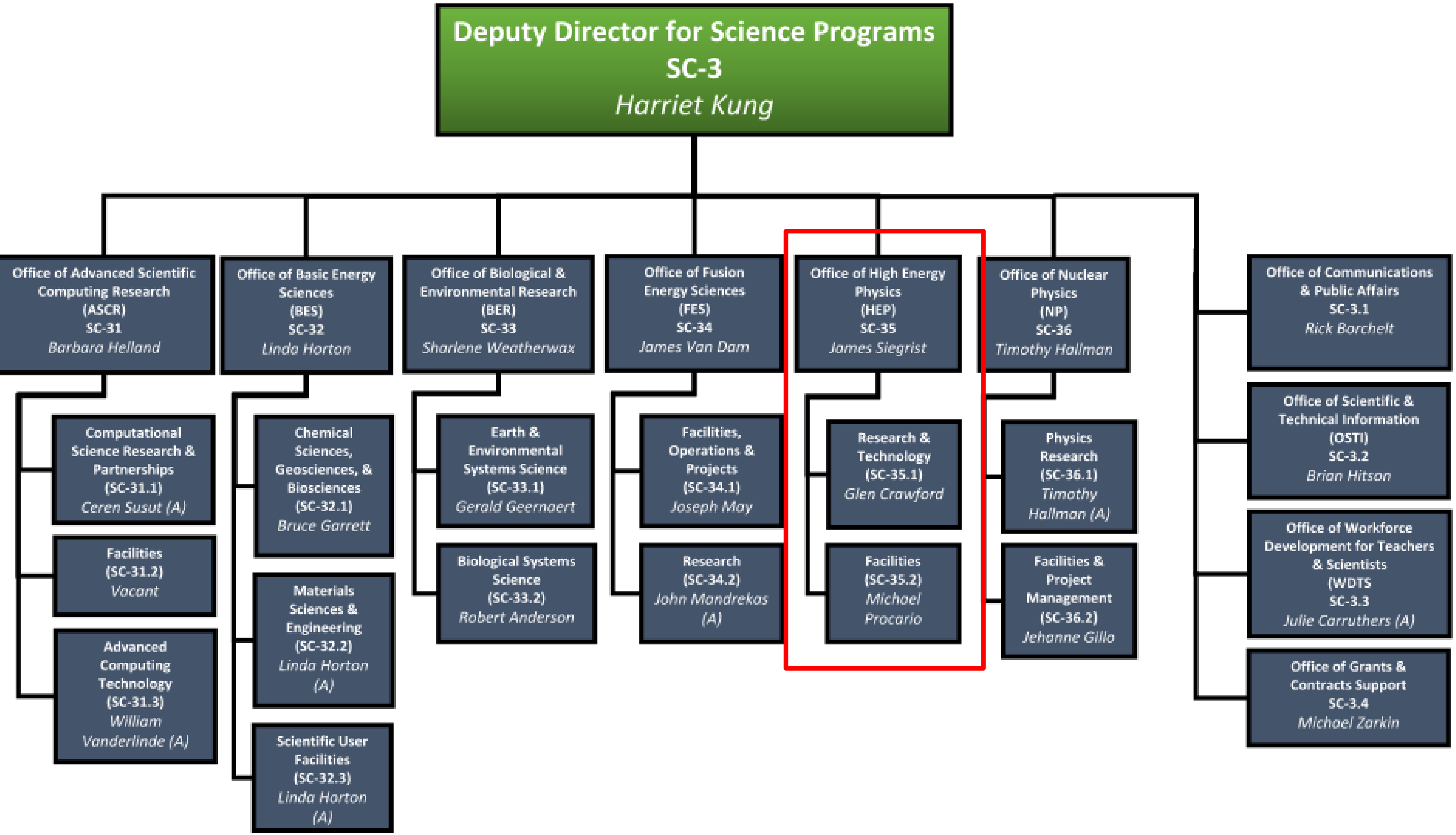
Department of Energy Organization



U.S. DEPARTMENT OF ENERGY | Office of Science



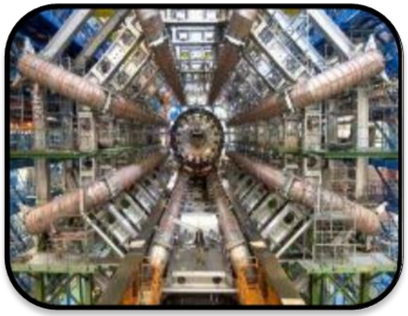
U.S. DEPARTMENT OF ENERGY | Office of Science



DOE Office of Science

A research funding agency and a steward of national research infrastructure.

- The mission of DOE's Office of Science is to 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.



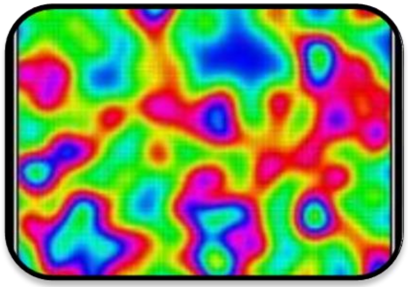
Largest Supporter of Physical Sciences in the U.S.

Funding at >300 Institutions, including 17 DOE Labs

Over 23,000 Researchers Supported

Over 33,000 Users of 28 SC Scientific Facilities

~38% of Research to Universities



Research: 41.7%

Facility Operations: 40.3%

Projects/Other: 18.0%

Seventeen DOE National Laboratories

Office of Science Laboratories

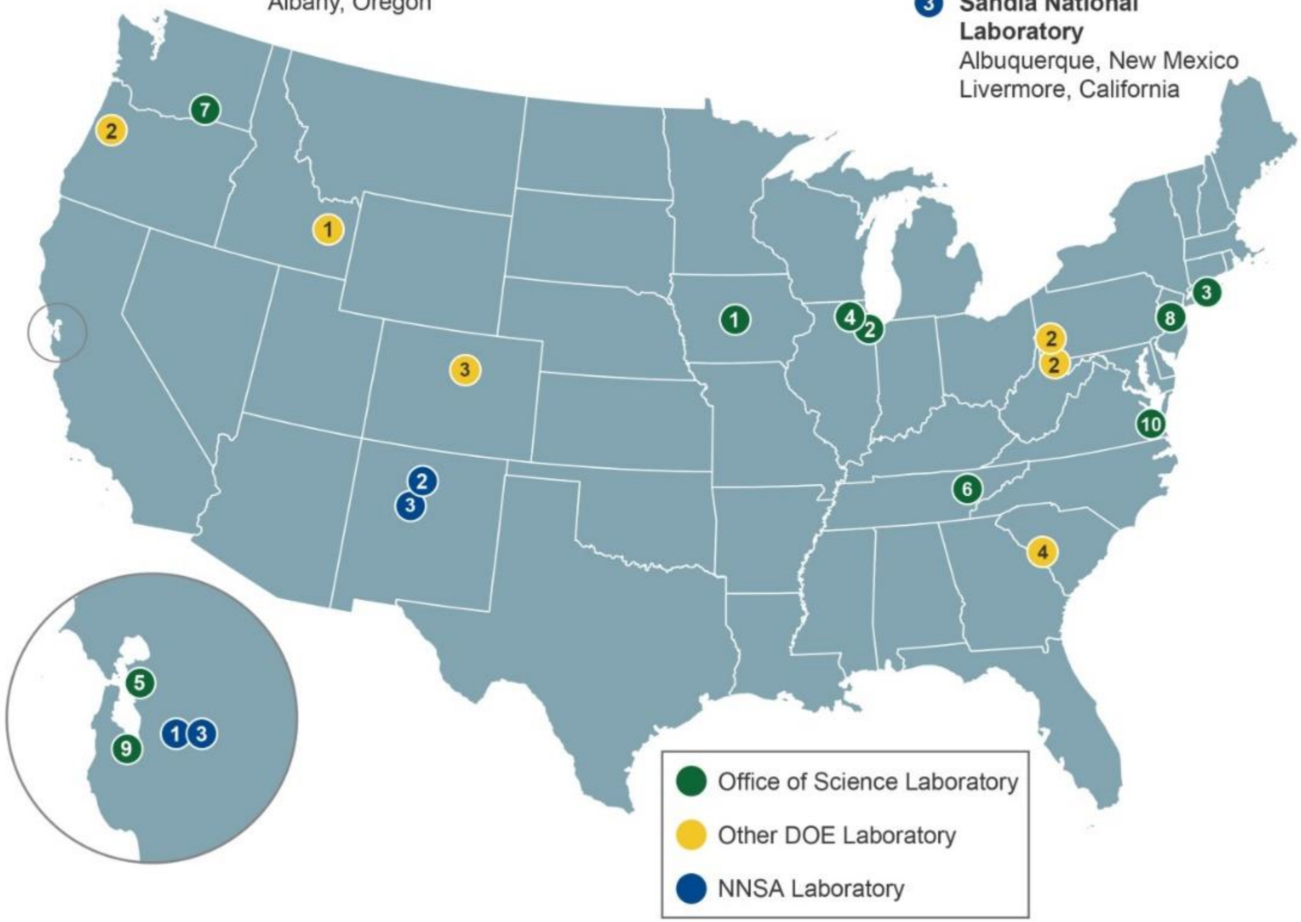
1. **Ames Laboratory**
   Ames, Iowa
2. **Argonne National Laboratory**
   Argonne, Illinois
3. **Brookhaven National Laboratory**
   Upton, New York
4. **Fermi National Accelerator Laboratory**
   Batavia, Illinois
5. **Lawrence Berkeley National Laboratory**
   Berkeley, California
6. **Oak Ridge National Laboratory**
   Oak Ridge, Tennessee
7. **Pacific Northwest National Laboratory**
   Richland, Washington
8. **Princeton Plasma Physics Laboratory**
   Princeton, New Jersey
9. **SLAC National Accelerator Laboratory**
   Menlo Park, California
10. **Thomas Jefferson National Accelerator Facility**
    Newport News, Virginia

Other DOE Laboratories

1. **Idaho National Laboratory**
   Idaho Falls, Idaho
2. **National Energy Technology Laboratory**
   Morgantown, West Virginia
   Pittsburgh, Pennsylvania
   Albany, Oregon
3. **National Renewable Energy Laboratory**
   Golden, Colorado
4. **Savannah River National Laboratory**
   Aiken, South Carolina

NNSA Laboratories

1. **Lawrence Livermore National Laboratory**
   Livermore, California
2. **Los Alamos National Laboratory**
   Los Alamos, New Mexico
3. **Sandia National Laboratory**
   Albuquerque, New Mexico
   Livermore, California



Office of Science oversees 10 of 17 DOE National

BERKELEY LAB

$898M in FY 2019

- Founded 1931
- 202 acres, 97 buildings
- 3,129 FTEs, including: 428 post-docs, 441 students, and 239 joint faculty
- 2,043 visiting scientists
- 12,763 facility users

Pacific Northwest NATIONAL LABORATORY

$939M in FY 2019

- Founded 1965
- 781 acres, 77 buildings
- 4,177 FTEs, including: 223 post-docs, 737 students, and 112 joint faculty
- 60 visiting scientists
- 1,734 facility users

The Ames Laboratory

$54M in FY 2019

- Founded 1947 (1942)
- 10 acres, 13 buildings
- 307 FTEs, including: 44 post-docs, 180 students, and 45 joint faculty
- 120 visiting scientists

Fermilab

$491M in FY 2019

- Founded 1967
- 6,800 acres, 366 buildings
- 1,782 FTEs, including: 95 post-docs, 103 students, and 21 joint faculty
- 8 visiting scientists
- 3,635 facility users

Argonne NATIONAL LABORATORY

$837M in FY 2019

- Founded 1946 (1942)
- 1,517 acres, 154 buildings
- 3,237 FTEs, including: 260 post-docs, 595 students, and 2343 joint faculty
- 790 visiting scientists
- 7,921 facility users

SLAC NATIONAL ACCELERATOR LABORATORY

$542M in FY 2019

- Founded 1962
- 426 acres, 150 buildings
- 1,602 FTEs, including: 145 post-docs, 327 students, and 32 joint faculty
- 22 visiting scientists
- 2,931 facility users

OAK RIDGE National Laboratory

$1,825M in FY 2019

- Founded 1943
- 4,421 acres, 272 buildings
- 4,708 FTEs, including: 281 post-docs, 936 students, and 196 joint faculty
- 1,533 visiting scientists
- 3,289 facility users

Jefferson Lab

$160M in FY 2019

- Founded 1962
- 169 acres, 69 buildings
- 693 FTEs, including: 33 post-docs, 62 students, and 28 joint faculty
- 1,491 visiting scientists
- 1,630 facility users

PPPL PRINCETON PLASMA PHYSICS LABORATORY

$97M in FY 2019

- Founded 1961 (1951)
- 91 acres, 30 buildings
- 447 FTEs, including: 21 post-docs, 43 students, and 7 joint faculty
- 50 visiting scientists
- 292 facility users

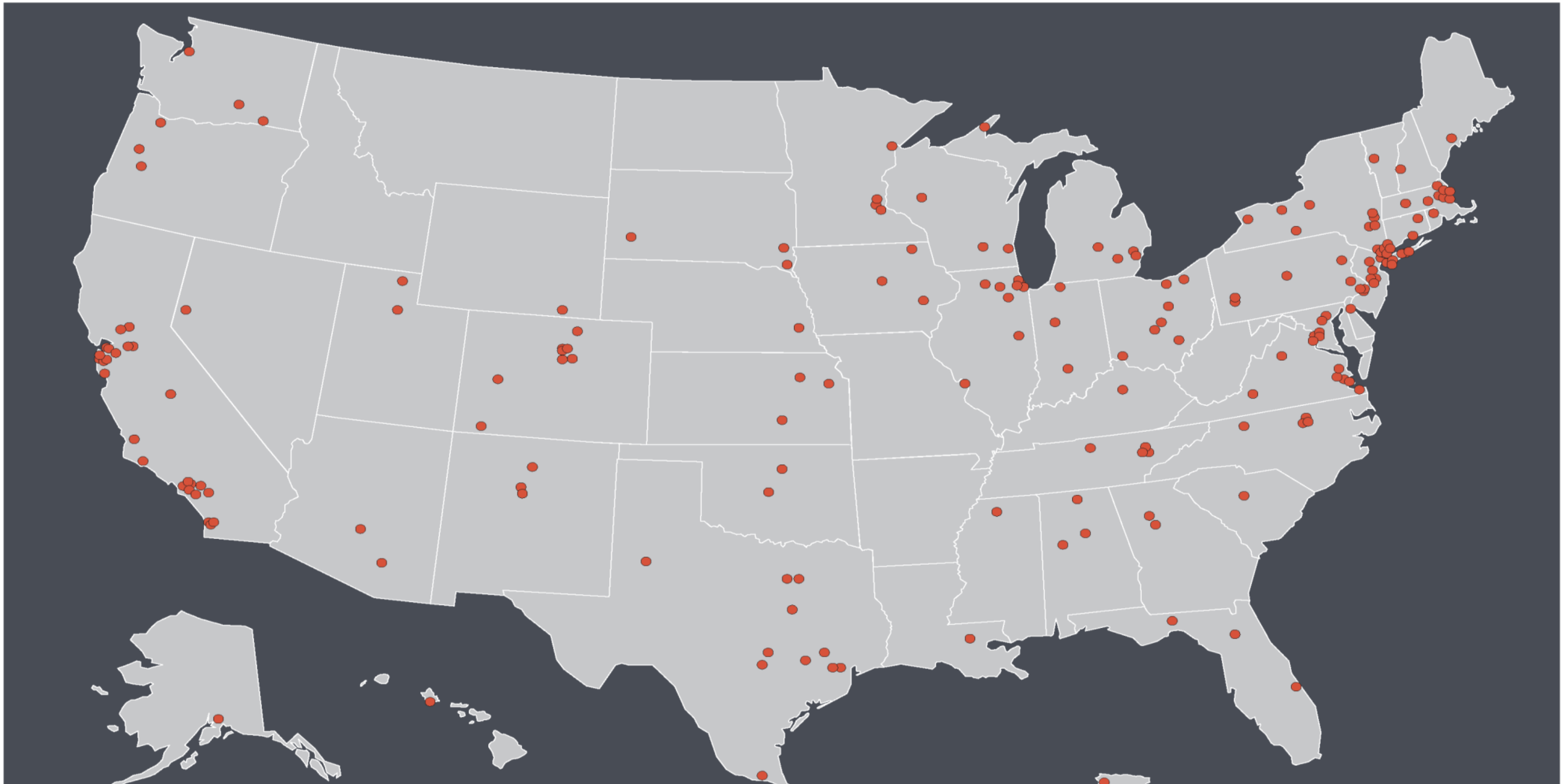
BROOKHAVEN NATIONAL LABORATORY

$588M in FY 2019

- Founded 1947
- 5,322 acres, 315 buildings
- 2,379 FTEs, including: 121 post-docs, 448 students, and 139 joint faculty
- 2,176 visiting scientists
- 3,198 facility users

Particle Physics in the United States

Scientists, engineers, and technicians at more than 180 universities, institutes, and laboratories throughout the U.S. are working in partnership with their international colleagues to build high-tech tools and components, conduct scientific research, and train and educate the next generation of innovators. Particle physics activities in the U.S. attract some of the best scientists from around the world.

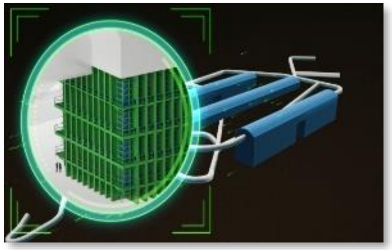


Dots represent Laboratories and Universities receiving funding in 2019 for particle physics from DOE or NSF

U.S. Long-Term Particle Physics Strategy

- The global vision presented in the 2014 Particle Physics Project Prioritization Panel (P5) report was the culmination of years of effort by the U.S. particle physics community
  - 2012 – 2013: Scientific community organized year-long planning exercise ("Snowmass")
  - 2013 – 2014: U.S. High Energy Physics Advisory Panel convened P5 to develop a plan to be executed over a ten-year timescale in the context of a 20-year global vision for the field

- P5 report enables discovery science with a balanced program that deeply intertwines U.S. efforts with international partners
  - **U.S. particle physics community** strongly supports strategy
  - **U.S. Administration** has supported implementing the P5 strategy through each President's Budget Request
  - **U.S. Congress** has supported implementing the P5 strategy through the language and funding levels in appropriations bills
  - **International community** recognizes strategy through global partnerships



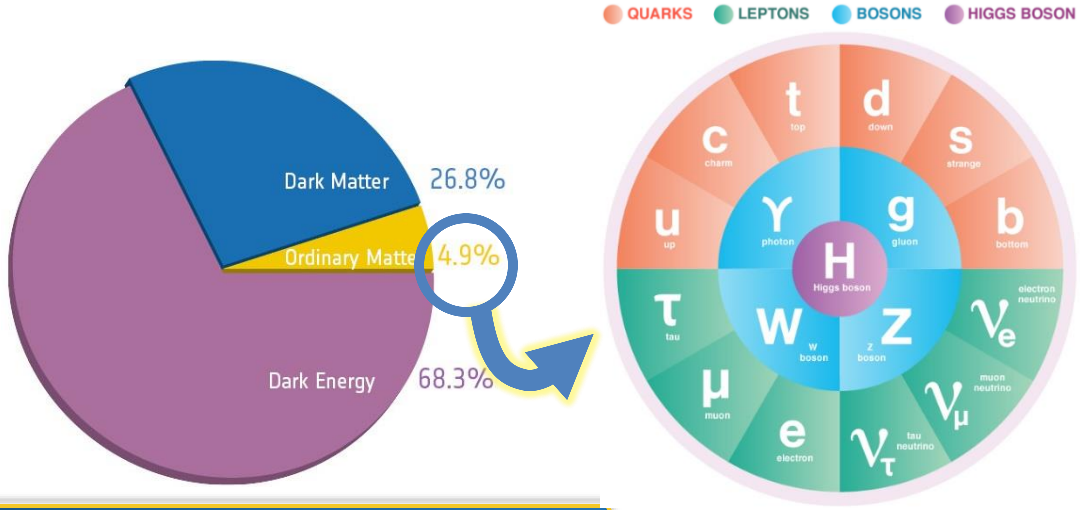
The High Energy Physics Program Mission

…is to understand how the universe works at its most fundamental level:

- Discover the elementary constituents of matter and energy
- Probe the interactions between them
- Explore the basic nature of space and time

The Office of High Energy Physics fulfills its mission by:

- Building **projects** that enable discovery science
- Operating **facilities** that provide the capability to perform discovery science
- Supporting a balanced **research** program that produces discovery science



P5: Science Drivers of Particle Physics

The P5 report identified five **intertwined science drivers**, compelling lines of inquiry that show great promise for discovery:

- Use the **Higgs boson** as a new tool for discovery **2013*
- Pursue the physics associated with **neutrino mass** **2015*
- Identify the new physics of **dark matter**
- Understand **cosmic acceleration**: dark energy and inflation **2011*
- **Explore the unknown**: new particles, interactions, and physical principles

** Since 2011, three of the five science drivers have been lines of inquiry recognized with Nobel Prizes*

DOE Supports Mission-Driven Science

- All proposals requesting Office of Science support must be written in the context of the agency mission
- Proposals responding to the *FY20XX Research Opportunities in High Energy Physics* and *Early Career Research Program [HEP]* Funding Opportunity Announcements (FOAs) need to align with at least one of the P5 science drivers

Funding Vehicles for Federal Funds

- DOE National Laboratories
  - Most are Government Owned/Contractor Operated (GOCO) Federally Funded Research and Development Centers (FFRDCs) and operate under Management and Operating (M&O) contracts
  - Laboratory research is mission driven and funded through **Field Work Proposals** (FWPs)
    - Comparative reviews of the Lab Research programs held every 4-5 years
  - **Laboratories propose yearly financial plans based on DOE guidance**
    - Mechanisms exist to tune funding each month
- Universities
  - **Submit grant proposals in response to a Funding Opportunity Announcement (FOA)**
    - Independent peer review informs the selection of awards
  - Award is ~fixed once made, with **funding cycle of 1-5 years**
    - **Funding adjustments (downward) are possible if circumstances change**
    - **Changes are also possible through submission of supplementary proposals**

Grant Process

- **Grant applications must be submitted through Grants.gov**
- Instructions for preparing and submitting grant applications are contained in the **Funding Opportunity Announcements posted** on Office of Science web pages, at www.grants.gov, and at www.FedConnect.net
- The rules governing SC's grants and cooperative agreements are regulations codified in the Code of Federal Regulations (CFR).
- Acquisition and contracting services are provided by the DOE Office of Science Consolidated Support Center (CSC).
  - The ISC is a virtual organization comprised of the combined support capabilities of offices in Lemont, Illinois, and Oak Ridge, Tennessee.

- More info: SC Grants & Contracts support: **science.energy.gov/grants/**

Step 1: Registration

- Obtain a DUNS number
- Obtain an EIN number
- Register with the System for Award Management
- Register with FedConnect
- Register with the Federal Funding Accountability and Transparency Act Subaward Reporting System
- Register with grants.gov

Step 2: Application

Use Grants.gov to find open SC Funding Opportunity Announcements (FOAs). The FOAs contain the required application forms and instructions. Complete the forms and submit all required information through Grants.gov. Only applications submitted through Grants.gov will be accepted by SC.

Step 3: Receipt

Applications are received by SC and undergo an initial review for completeness and responsiveness.

Step 4: Referral

Applications are assigned to SC Program Managers who conduct the merit reviews.

Step 5: Review

Technical experts (Federal and non-Federal) review the applications and provide their assessments to the SC Program Manager.

Step 6: Preaward

The SC Program Manager recommends funding an application. The recommendation is concurred by a series of senior officials, and the entire package is reviewed by Grants and Contracts Support. After final concurrence, the Integrated Service Center reviews the file, negotiates with the applicant, and prepares the award documents.

Step 7: Award

The Integrated Service Center releases the binding award documents. The Notice of Financial Assistance Award contains an assistance agreement, terms and conditions of award, and other items incorporated by reference.

Step 8: Performance

The applicant, which is now an awardee, performs the project for which support was received, by complying with all terms and conditions of award. Changes that require prior approval may be made only after official SC approval of the official request by the awardee.

Step 9: Reporting

Performance and financial reports are required as indicated in the terms and conditions in the award.

Step 10: Closeout

When the project ends, the awardee prepares and submits its final reports as indicated in the terms and conditions in the award.

Step 11: Public Access

DOE supported research projects provides their results of research through scholarly publications and announcing their scientific and technical information to the Office of Scientific and Technical Information.

DOE SC Graduate Student Research Fellowships

- DOE SC Graduate Fellowship program has **2 calls per year**, supporting student internships with DOE lab mentors in the summer (deadline previous Fall) and during the school year (deadline previous Spring).
- Spring 2020 solicitation closed, next solicitation opens August 2020 for interns starting June 2021 or later. Internship period is flexible: 3-12 months
- This program has **supported 15-20 HEP graduate students per year and has a high success rate for eligible applications**. You can view the solicitation at https://science.osti.gov/wdts/scgsr/
- **New in 2019 solicitation are Convergence Research Topical Areas**, for research of interest to 2 or more SC offices and are treated somewhat differently in review. Please encourage likely candidates.
- Convergence Research Topical Areas

  (a)Microelectronics (ASCR, BES, HEP)

  (b)Data Science (ASCR, BES, BER, FES, HEP, NP)

  (c)Fundamental Symmetries (BES, HEP, NP)

  (d)Accelerator Science (ASCR, BES, BER, FES, HEP, NP)

- Program aims to strengthen the US-Japan scientific collaboration by facilitating greater cooperation in projects of mutual benefit to Japan and the United States in the areas of accelerator and particle physics
- Each year, up to five proposals will be selected in the U.S. and up to five in Japan
  - Graduate students enrolled in US Physics Ph.D. programs are eligible to submit a proposal to conduct HEP research or technology R&D in Japan
  - The duration of the award is for a three- to twelve- month period
  - The award will provide travel, housing and cost of living expenses stipend for the stay in Japan. Tuition will be the responsibility of the students and their home institution
- **Application deadline December 20, 2019 - CLOSED**
  - The selection results were given by March 1 2020. Exchanges start as early as June 1 2020
  - Next application opens in November 2020 for exchanges starting in June 2021
  - Web address and further info: https://www.bnl.gov/ozaki/

Small Business Innovation Research (**SBIR**) & Small Business Technology Transfer (**STTR**)

- The SBIR Program was established by Congress in 1982 [Public Law 97-219]. Major goals are:
  - Stimulate technological innovation and use small business to meet Federal R&D needs
  - Foster and **encourage participation by the socially and economically disadvantaged small businesses**, and those that are **51 percent owned and controlled by women**, in technological innovation
  - Increase private sector commercialization of innovations derived from Federal R/R&D, thereby increasing competition, productivity, and economic growth
- **SBIR and STTR Have Three Distinct Phases**
  - Phase I explores the feasibility of innovative concepts with awards up to $225,000 and 12 months.
  - Phase II is the principal R&D effort, with awards up to $1,500,000 and 2 years.
  - Phase III offers opportunities to small businesses to continue their Phase I and II R&D work to pursue commercial applications of their R&D with non-SBIR/STTR funding.
- **Differences between SBIR and STTR**
  - STTR project requires the small business (applicant) to be teamed with a non-profit research institution, typically a university or Federal Laboratory.
  - STTR program is focused on the transfer of technology from the Research Institution to the small business and ultimately to the marketplace through a Phase I-II-III sequence.
  - **STTR: PI could be primarily employed at either the Research Institution or the small business**.
    - SBIR: PI must be primarily employed at the proposing small business, meaning that he or she cannot work full time elsewhere during the project period.
  - **Up to 60% of the research effort for an STTR project can be subcontracted**
    - There is a 33% limit on Phase I SBIR subcontracting (increases to 50% in Phase II)
- For FY 2019-2022: SBIR rate = 3.2%, STTR = 0.45%
  - Construction funding is exempted.

DOE Particle Physics Agency Partnerships

NSF

- Proposal driven program
- Funds facilities and equipment, such as telescopes, through cooperative agreements with research consortia

Department of Energy

- Mission driven program
- National Laboratory enterprise and National User Facilities provide important capabilities & expertise

NASA

- Mission driven program
- Expertise in human spaceflight, aeronautics, space science, and space applications
- Partnership enables unique science opportunities

HEPAP Coordination

AAAC Coordination

NSF	DOE	NASA / Other agencies
Strong connections	Energy Frontier	
Modest ties	Intensity Frontier	
Strong connections	Cosmic Frontier	*Space-based experiments*
Strong connections	Theoretical Physics	
Modest ties	Technology R&D	DoD, NIST, DHS, NIH

NIST National Institute of Standards and Technology U.S. Department of Commerce

NIH National Institutes of Health

Program Advice and Coordination

- Formal advice (Federal Advisory Committee Act)
  - High Energy Physics Advisory Panel (HEPAP)
    - Jointly serves DOE and National Science Foundation (NSF)
    - 2014: P5 long-term strategy report
    - 2015: Accelerator R&D Subpanel report
  - Astronomy and Astrophysics Advisory Committee (AAAC)
    - Advises DOE, NSF, and NASA on selected issues of mutual interest within the fields of astronomy and astrophysics (*e.g. CMB-S4 Conceptual Design Team*)

- Community input
  - National Academies of Science: Astronomy and Astrophysics Decadal Survey (*New Worlds, New Horizons*)
  - DOE Workshop reports, including Quantum Sensors, Accelerator R&D Roadmaps, Technology Connections, Basic Research Needs, etc.

- International coordination
  - CERN Council (LHC)
    - Governs CERN by defining its strategic programs, setting and following up its annual goals, and approving its budget
  - International Neutrino Council (LBNF/PIP-II)
    - International consulting body for DOE that facilitates high-level global coordination across the LBNF/PIP-II enterprise
  - Resources Review Board (DUNE)
    - Facilitates Fermilab's coordination of resource-related matters for DUNE

DOE Roles and Responsibilities

- Certain functions are considered "inherently governmental" and reserved for Federal staff, including:
  - Determination of agency policy, such as determining the content and application of regulations, among other things
  - Determination of Federal program priorities for budget requests
  - Determination of budget policy, guidance, and strategy
  - Approving, awarding and administering government prime contracts
    - Including determining what supplies or services are to be acquired with government funds
- Moreover, since Federal staff are normally hired following civil service laws, there is a strong precept that contractors must not act as Federal staff and vice versa, e.g.:
  - Government employees do not directly supervise contractors
  - Federal staff are generally not involved in contractor personnel decisions
- For all intents and purposes, DOE labs are *prime contractors* and lab employees are *contractor employees*

DOE Lab Roles and Responsibilities

- Facility Operations and Construction
  - Performance judged against specified metrics (e.g. *pb*$^{-1}$; EVMS)
  - Includes maintenance, upgrades, planning for new facilities
  - User support
- HEP Research and Technology R&D
  - Nurture and support HEP research collaborations to enable discovery science
  - Participation in all phases – from design, construction, operations & analysis
  - Particular emphasis on:
    - Management, design, construction and operation of HEP experiments
    - Integration of cross-cutting activities, *e.g.*: computation, simulation and theoretical research, in support of HEP program
    - Exploiting lab infrastructure and resources to develop next-generation particle accelerator and detector technologies for the advancement of HEP and science more broadly

University Roles and Responsibilities (DOE Perspective)

HEP Research and Technology R&D

- Contribute significantly to HEP research collaborations to enable discovery science
- Participation in all phases – from design, construction, operations & analysis
- Particular emphasis on:
  - Advanced training of students and postdocs
  - Data analysis and comparison with theoretical models
  - Vision and theoretical framework for understanding the Standard Model and beyond
  - Novel and innovative concepts and approaches
  - Design of future HEP experiments

Starting Notes

- A faculty position does not guarantee anyone a DOE grant
- A laboratory position does not guarantee new resources
- All proposals are subject to peer-review
- Review process is comparative and competitive
- A grant is financial assistance funded by taxpayer dollars
- A contract is the purchase of a product or service for federal use

Early Career Merit Review

- 1. Scientific and/or Technical Merit of the Project
  - What is the scientific innovation of proposed research? How does the proposed research compare with other research in its field, both in terms of scientific and/or technical merit and originality? How might the results of the proposed research impact the direction, progress, and thinking in relevant scientific fields of research? What is the likelihood of achieving influential results? Is the Data Management Plan suitable for the proposed research and to what extent does it support the validation of research results?
- 2. Appropriateness of the Proposed Method or Approach
  - Does the proposed research employ innovative concepts or methods? How logical and feasible are the research approaches? Are the conceptual framework, methods, and analyses well justified, adequately developed, and likely to lead to scientifically valid conclusions? Does the applicant recognize significant potential problems and consider alternative strategies?
- 3. Competency of Applicant's Personnel and Adequacy of Proposed Resources
  - Does the proposed work take advantage of unique facilities and capabilities? What are the past performance and potential of the Principal Investigator (PI)? How well qualified is the research team to carry out the proposed research? Are the research environment and facilities adequate for performing the research?
- 4. Reasonableness and Appropriateness of the Proposed Budget
  - Are the proposed budget and staffing levels adequate to carry out the proposed research? Is the budget reasonable and appropriate for the scope?
- 5. Relevance to the Mission of the Specific Program (e.g., ASCR, BER, BES, FES, HEP, or NP) to which the Application is Submitted
  - How does the proposed research contribute to the mission of the program in which the application is being evaluated?
- 6. Potential for Leadership within the Scientific Community
  - Scientific leadership can be defined very broadly and can include direct research contributions. How has the PI demonstrated the potential for scientific leadership and creative vision? How has the PI been recognized as a leader?

Grants and Contracts

- A grant is a form of financial assistance to a designated class of recipients authorized by statute to meet recognized needs, while a contract involves the purchase of a product or service for federal use or, as stated in the Federal Grant and Cooperative Agreements Act, for the direct benefit of the government.
- Contracts are subject to the Federal Acquisition Regulation at Title 48 of the Code of Federal Regulations.
  - Grants are governed by "common rules" in the OMB Circulars as incorporated into grantor agency regulations.

GRANTS
• **Flexible instrument designed to provide money to support a public purpose.**
• Governed by the terms of the grant agreement
• Flexible as to scope of work, budget, and other changes
• Diligent efforts are used in completing research and the delivery of results
• Payment awarded in annual lump sum
• Annual reporting requirements
• Principal Investigator has more freedom to adapt the project and less responsibility to produce results

CONTRACTS
• **Binding agreement between a buyer & a seller to provide goods/services in return for consideration.**
• Governed by Federal Acquisition Regulations
• **Relatively inflexible as to scope of work, budget, and other changes**
• Significant emphasis placed on delivery of results, product, or performance
• Payment based on deliverables & milestones
• Frequent reporting requirements
• High level of responsibility to the sponsor for the conduct of the project and production of results