DOE High Energy Physics Program
Status and Funding Opportunities

DPF Meeting
August 4, 2015

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Research and Technology Division Director
Office of High Energy Physics
Office of Science, U.S. Department of Energy
IMPLEMENTING THE HEP PROGRAM
The High Energy Physics Program Mission

...is to understand how the universe works at its most fundamental level:
• Discover the most 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

Our program is formally advised by:
• High Energy Physics Advisory Panel (HEPAP)
  – Jointly chartered by DOE and NSF to advise both agencies
• Astronomy and Astrophysics Advisory Committee (AAAC)
  – Advises DOE, NASA, and NSF on selected issues in astronomy & astrophysics of mutual interest and concern
• National Academy of Sciences (NAS)
  – Established by Congress in 1863 to advise the government and any department thereof on the arts and sciences
Science Drivers identify the scientific motivation while Research Frontiers provide a useful categorization of experimental techniques.

HEP Research program support reflects the science priorities of P5.
The U.S. HEP Program

U.S. particle physics research involves over 150 universities and laboratories in 43 states (plus Washington DC and Puerto Rico)

In 2013 DOE HEP supported:

- Major activities at 5 U.S. national laboratories, involving ~2,600 FTEs
- University research program of ~250 active grants to >100 institutions, involving ~1,700 FTEs
University Research

- University research is supported by a competitive, proposal-driven process
  - Grants issued after peer review of proposals submitted to Funding Opportunity Announcements (FOAs)
- Program alignment is built into proposal review process:
  - Relevance to HEP mission is explicit in review criteria
  - HEP programmatic priorities inform the peer review process
  - Program Managers consider reviewer feedback and program priority when determining awards

Laboratory Research

- Laboratory research is mission driven and funded through Field Work Proposals
  - HEP holds comparative reviews of the Laboratory research programs every 3 years
    - e.g., Energy Frontier review last week
- Program guidance to the Laboratories is provided by HEP with input from a variety of sources, including:
  - The Laboratories themselves
    - Local strengths and resources
  - Advisory committees
  - Institutional reviews
HEP is implementing the strategy detailed in the May 2014 report of the Particle Physics Project Prioritization Panel (P5), formulated in the context of a global vision for the field

- **Energy Frontier:** Continue LHC program with higher collision energy (13+ TeV)
  - The U.S. will continue to play a leadership role in LHC discoveries by remaining actively engaged in LHC data analysis and the initial upgrades to the ATLAS and CMS detectors

- **Intensity Frontier:** Develop a world-class U.S.-hosted Long Baseline Neutrino Facility
  - Continue the design process for an internationalized LBNF and development of a Short-Baseline Neutrino Program that will support the science and R&D required to ensure LBNF success
  - Fermilab will continue to send world’s highest intensity neutrino beam to NOvA, 500 miles away to Ash River, MN

- **Cosmic Frontier:** Advance our understanding of dark matter and dark energy
  - Immediate development of new capabilities in dark matter detection by continuing development of 2nd generation experiments; and in dark energy exploration with baselining of DESI and fabrication of LSST camera
HEP FY 2016 Request Funding by Subprogram

- Energy Frontier: 20%
- Intensity Frontier: 32%
- Cosmic Frontier: 16%
- Theoretical and Comp.: 8%
- Advanced Technology R&D: 2%
- Accelerator Stewardship: 7%
- Construction: 2%

HEP FY 2016 Request Funding by Activity

- Research: 44%
- Facilities: 34%
- Energy Frontier Projects: 3%
- Intensity Frontier Projects: 4%
- Cosmic Frontier Projects: 8%
- Other Projects: 0.3%
- Construction: 7%
- Construction (Line Item): 9%
• P5 report recommendation suggests increasing the project budget fraction to 20%–25%
  – “Addressing the [science] Drivers in the coming and subsequent decades requires renewed investment in projects.”
• P5 report strategy has informed the HEP request in the FY 2016 DOE budget
• P5 was charged to consider three 10-year budget scenarios for HEP within the context of a 20-year vision for the global field
  – **Scenario A** was the lowest constrained budget scenario
  – **Scenario B** was a slightly higher constrained budget scenario
  – **Scenario C** was “unconstrained,” but not considered unlimited

*Budget Request and Appropriations do not include SBIR/STTR*
## FY 2016 HEP Funding by Activity

<table>
<thead>
<tr>
<th>HEP Funding Category ($ in K)</th>
<th>FY 2014 Current</th>
<th>FY 2015 Enacted</th>
<th>FY 2016 Request</th>
<th>Explanation of Changes (FY16 vs. FY15)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research</td>
<td>373,932</td>
<td>337,383</td>
<td>334,703</td>
<td>Research reductions support project investments</td>
</tr>
<tr>
<td>Facilities</td>
<td>278,683</td>
<td>265,125</td>
<td>262,658</td>
<td>Maintain efficient operations of facilities and ongoing experiments</td>
</tr>
<tr>
<td>Projects</td>
<td>71,305</td>
<td>105,698</td>
<td>113,401</td>
<td></td>
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</tbody>
</table>

**Energy Frontier Projects**
- FY 2014: 0
- FY 2015: 15,000
- FY 2016: 19,000
- **Explanation**: Ramp up in LHC detector upgrades fabrication

**Intensity Frontier Projects**
- FY 2014: 37,400
- FY 2015: 43,970
- FY 2016: 33,700
- **Explanation**: Continue g-2 and FNAL acc. upgrade profiles; some LBNE efforts move to construction

**Cosmic Frontier Projects**
- FY 2014: 30,705
- FY 2015: 45,728
- FY 2016: 58,701
- **Explanation**: Increase supports LSSTcam, DESI and second generation dark matter experiments

**Other Projects**
- FY 2014: 3,200
- FY 2015: 1,000
- FY 2016: 2,000
- **Explanation**: Planned Lattice QCD hardware acquisition

**Construction (Line Item)**
- FY 2014: 51,000
- FY 2015: 37,000
- FY 2016: 56,100
- **Explanation**: Planned profile for Mu2e; engineering and design for LBNE

**SBIR/STTR**
- FY 2014: 21,601*
- FY 2015: 20,794
- FY 2016: 21,138

**Total**
- FY 2014: 796,521*
- FY 2015: 766,000
- FY 2016: 788,000

* SBIR/STTR added to FY 2014 for comparison to FY 2015/2016

House mark: $776 M; Senate mark: $788.1 M

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* U.S. DEPARTMENT OF ENERGY
  Office of Science

* DOE HEP Status and FOAs -- August 4, 2015
HEP FUNDING OPPORTUNITIES
Summary of DOE/HEP-based Solicitations

“FY 2015 Continuation of Solicitation for the Office of Science Financial Assistance Program” [DE-FOA-0001204]
- Also known as the “general or open annual DOE/SC solicitation”
  - SC-wide FOA that invites applications in support of work in any of six SC offices, incl. HEP research
- Published annually, typically at beginning of FY (October), remains open until successive issuance

“FY 2016 Research Opportunities in High Energy Physics” [DE-FOA-0001358]
- Issued for new or renewing grant applications, evaluated through comparative review (CR) process
  - Letter of Intent (LOI) requested for CR planning purposes, due August 13, 2015, 5 PM Eastern Time
  - Final application due September 17, 2015, 5 PM Eastern Time

- Research that aligns with the goals of the Intensity Frontier program to investigate the properties and interactions of the known neutrinos and search for new types of neutrinos
  - Letter of Intent (LOI) required, due by July 29, 2015. Encourage/discourage responses have been sent
  - Final application due date is September 2, 2015, at 5 PM Eastern Time

“Early Career Research Program” [DE-FOA-0001386; LAB 15-1386]
- SC-wide invitation for junior investigators (within 10-years post PhD) from labs or universities
  - Early career development of outstanding scientist’s research programs in areas supported by DOE/SC
  - Required pre-application due Sep. 10, 2015 @ 5 PM ET, final applications due Nov. 19, 2015 @ 5 PM ET

Upcoming: “Research Opportunities in Accelerator Stewardship”
- Specifically for accelerator R&D which predominantly impacts non-HEP applications
  - LOI will be required, resulting in encourage/discourage response
  - Eligibility will include academia, national labs, and industry
Purpose of DOE/HEP-based Solicitations

Annual Solicitation for the Office of Science [DE-FOA-0001204] is for:
- Conferences and Workshops
- Experimental operations support at non-DOE facilities, with no DOE lab involvement (e.g., T2K)
- Supplemental awards and other invited or special-purpose applications

NOTE: SC Annual Solicitation generally has lower programmatic priority in HEP

FY 2016 Research Opportunities in High Energy Physics [DE-FOA-0001358] is for:
- HEP Research and Technology R&D grants
  (HEP experimental frontiers, HEP Theory, Accelerator R&D, Detector R&D)

Supports Research in highest programmatic priority areas

Intermediate Neutrino Research Program [DE-FOA-0001381; LAB-15-1381] is for:
- Support of new neutrino experiments that are modest in scale and ready for fabrication
  - Includes final design, fabrication, installation, operations; should produce physics data in 5 years or less
  - Less than $2M in capital equipment costs
  - Technology R&D and Neutrino Theory proposals also accepted but generally lower priority

Early Career Research Program” [DE-FOA-0001386; LAB 15-1386] is for:
- Outstanding junior investigators from labs or universities
  - Establish new research programs with potential for high impact and future leadership in HEP
  - All junior faculty/lab staff are encouraged to apply

“Upcoming: “Research Opportunities in Accelerator Stewardship”
- Specifically for accelerator R&D which predominantly impacts non-HEP applications
  - Specific technical topics TBA
  - Collaborative teams strongly encouraged
Data Management Plans (DMPs)

- All Research proposals to DOE/SC must have a data management plan
  - Includes HEP comparative review, Early Career
  - Does not include conferences, workshops, operations, projects
- Please make sure applicants know that the requirement for a data management plan will be strictly enforced. Any research thrust in a proposal without a DMP will be declined without review.

All Renewal proposals will need to also submit “proposal products” (essentially recent publications and other records of science outcomes from DOE-supported research) after the application is submitted

- PIs will be notified by PAMS and have 5 days to respond
- We cannot review incoming proposals until this step is completed
- In the future, these will be captured with your annual Progress Report, but during the transition phase, you will need to enter them by-hand
HEP Proposal Review and Award Process

Pre-review

• **August**: Letter of Intent (LOI) received from PI (if required). Program planning at DOE/HEP.

• **September**: Proposal received. FOA compliance checks at DOE/HEP: PI qualifications, scope, page limits, budget pages, etc.

Panel Review

• **Sept-October**: Proposals assigned to at least three reviewers via DOE’s Portfolio Analysis and Management System (PAMS);

• **October-November**: Reviewers input written reviews in PAMS.

• **November**: Panel discussion of all proposals and all senior personnel. Add additional reviews and make comparative reviews & evaluations.

Post-review and award

• **December**: Assessment of each proposal and each PI by DOE/HEP using merit review, grant monitor input, programmatic priorities, budget constraints.

• **Early-to-mid January**: Prioritized budget guidance sent to PIs and requests for revised budgets and budget justifications using proper DOE forms.

• **End-January - March**: Route proposal’s procurement packages through DOE/SC and DOE Chicago Operations Office for approval.

• **March-April**: Awards to university from DOE Chicago Operations Office.
Comparative Merit Review Criteria

(In descending order of importance. First 4 criteria are common to all SC FOAs. 5th is typical for HEP)

• Scientific and/or Technical Merit of the Project
  – *e.g.*, How might the results of the proposed research impact the direction, progress, and thinking in relevant scientific fields of research?

• Appropriateness of the Proposed Method or Approach
  – *e.g.*, How logical and feasible is the research approach of each senior investigator? Does the proposed research employ innovative concepts or methods?

• Competency of Research Team and Adequacy of Available Resources
  – *e.g.*, How well qualified is the research team to carry out the proposed research?

• Reasonableness and Appropriateness of the Proposed Budget
  – *e.g.*, Is the budget reasonable and appropriate for the scope?

• Relevance to the mission of the DOE Office of High Energy Physics (HEP) program
  – *e.g.*, How likely is the research to impact the mission or direction of the overall HEP program?

• General Comments and Overall Impression
DOE HEP Research Priorities: Snapshot

- **Energy Frontier**
  - Analysis of LHC Run 2 data
  - Contribute to operational responsibilities and complete “Phase I” upgrades
  - Prepare for leading roles in HL-LHC upgrades

- **Intensity Frontier**
  - Neutrino Program
    - NOvA, T2K/SK, Minerva, MINOS+ data analysis
    - Develop near-future short-baseline program
    - Prepare to host LBNF/DUNE and PIP-II
  - Muon Program: complete Mu2e and g-2 and take data
  - Heavy Flavor Program: complete Belle-II and take data

- **Cosmic Frontier**
  - Dark Matter: Complete G1 analysis, construct G2 experiments, modest R&D
  - Dark Energy: Complete BOSS, DES analysis; construct LSST and DESI
  - Begin planning for CMB-S4

- **Accelerator R&D**
  - Hosting workshops to work through R&D plan following P5 and GARD panels

- **Detector R&D**
  - Seeking community input to identify highest priority R&D activities in wake of P5

- **HEP Theory**
  - Maintain an overall “thriving” program as per P5
1. Talk to your grant monitor and HEP program manager. Many are here this week. Many are scheduling time for 1-on-1’s

2. Attend one of the “DOE breakout” sessions this week
   - DOE PMs will give overview of their program, address programmatic priorities, and take questions
   - All DOE sessions in Alumni Center

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<tr>
<th>Day/Time</th>
<th>Topic</th>
<th>HEP PM(s)</th>
</tr>
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<tbody>
<tr>
<td>Wed 1400-1600</td>
<td>Intensity Frontier and Detector R&amp;D</td>
<td>Alan Stone, GC</td>
</tr>
<tr>
<td>Thu 1400-1600</td>
<td>Energy Frontier</td>
<td>Abid Patwa</td>
</tr>
<tr>
<td>Thu 1600-1800</td>
<td>Cosmic Frontier</td>
<td>Kathy Turner</td>
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<tr>
<td>Fri 1700-1830</td>
<td>Theory</td>
<td>Simona Rolli</td>
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Other Opportunities at DOE

• (Lots of) Comings and Goings
  – Dave Boehnlein (Energy Frontier IPA, FNAL) departed Jan 2015
  – Keith Dienes (Theory IPA, Arizona/NSF) departed Jan 2015
  – Peter Kim (Detector R&D Detee, SLAC) departed Feb 2015
  – Larry Price (Computing Detee, ANL) departed Mar 2015
  – Tina Kaarsberg (Detee, DOE EERE) arrived Nov 2014 → SBIR, Stewardship, infrastructure
  – Eric Linder (Cosmic IPA, LBNL) arrived Jan 2015 → Operations, data management
  – Steve Peggs (Detee, BNL) arrived Mar 2015 → PIP-II
  – Bill Wisniewski (Detee, SLAC) arrived April 2015 → LBNF
  – Intensity Frontier Detee TBA coming June 2015

• New Assignments and Opportunities
  – Helmut Marsiske now assisting >half-time with Detector R&D program
  – Michael Salamon ~full-time on International agreements
  – Abid Patwa managing LHC Operations Program and Phase-2 detector upgrades
  – Alan Stone taking on budgets and strategic planning
  – Michael Cooke taking on strategic communications and program planning
  – Approval for 4 new Fed staff positions
    • Two offers made; one accepted and one in final approval stages
    • Physicist (Intensity Frontier) closed; reviewing candidates
    • One other position TBA
    • Interested parties should contact HEP management

Fermilab Users Meeting - June 11, 2015
DOE HEP is executing its Research mission by supporting and implementing the P5 plan
  - Priority is given to specific projects or efforts recommended

There are several opportunities for investigators in U.S. program to get better informed and involved
  - Specific funding opportunities, discussions with HEP PMs
  - Opportunities at funding agencies

Particle physics has a long history of leading successful efforts to “internationalize” science
  - Tevatron, BaBar, LHC just the most recent examples
  - LBNF/DUNE gives the U.S. the opportunity to set a strong example in hosting its first international “megascience” facility
Another Promising Start