DOE HEP Perspectives

DPF 2013 – UC Santa Cruz
August 14, 2013

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Program Manager
Office of High Energy Physics
Office of Science, U.S. Department of Energy

Message from "The Funding Frontier"

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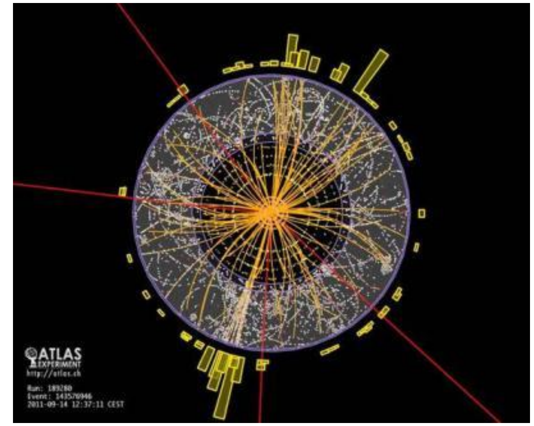
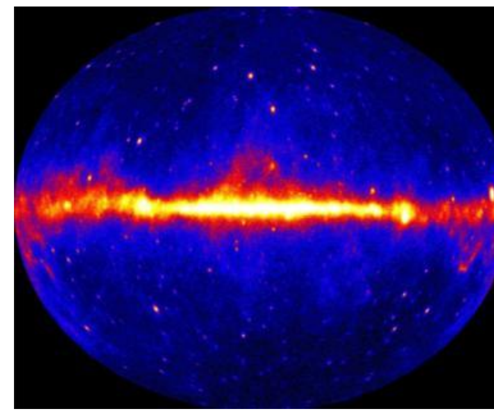
PROGRAM OVERVIEW

From Deep Underground to the Tops of Mountains, HEP pushes the Frontiers of Research



RESEARCH AT THE ENERGY FRONTIER — HEP supports research where powerful accelerators such as the LHC are used to create new particles, reveal their interactions, and investigate fundamental forces, and where experiments such as ATLAS and CMS explore these phenomena.

RESEARCH AT INTENSITY FRONTIER — Reactor and beam-based neutrino physics experiments such as Daya Bay, NOvA and LBNE may ultimately answer some of the fundamental questions of our time: why does the Universe seem to be composed of matter and not anti-matter?



RESEARCH AT THE COSMIC FRONTIER — Through ground-based telescopes, space missions, and deep underground detectors, research at the cosmic frontier aims to explore dark energy and dark matter, which together comprise approximately 95% of the universe.

THEORY AND COMPUTATION — The interplay between theory, computation, and experiment is essential to the lifeblood of High Energy Physics. Computational sciences and resources enhance theory and enable data analysis, detector and accelerator development.

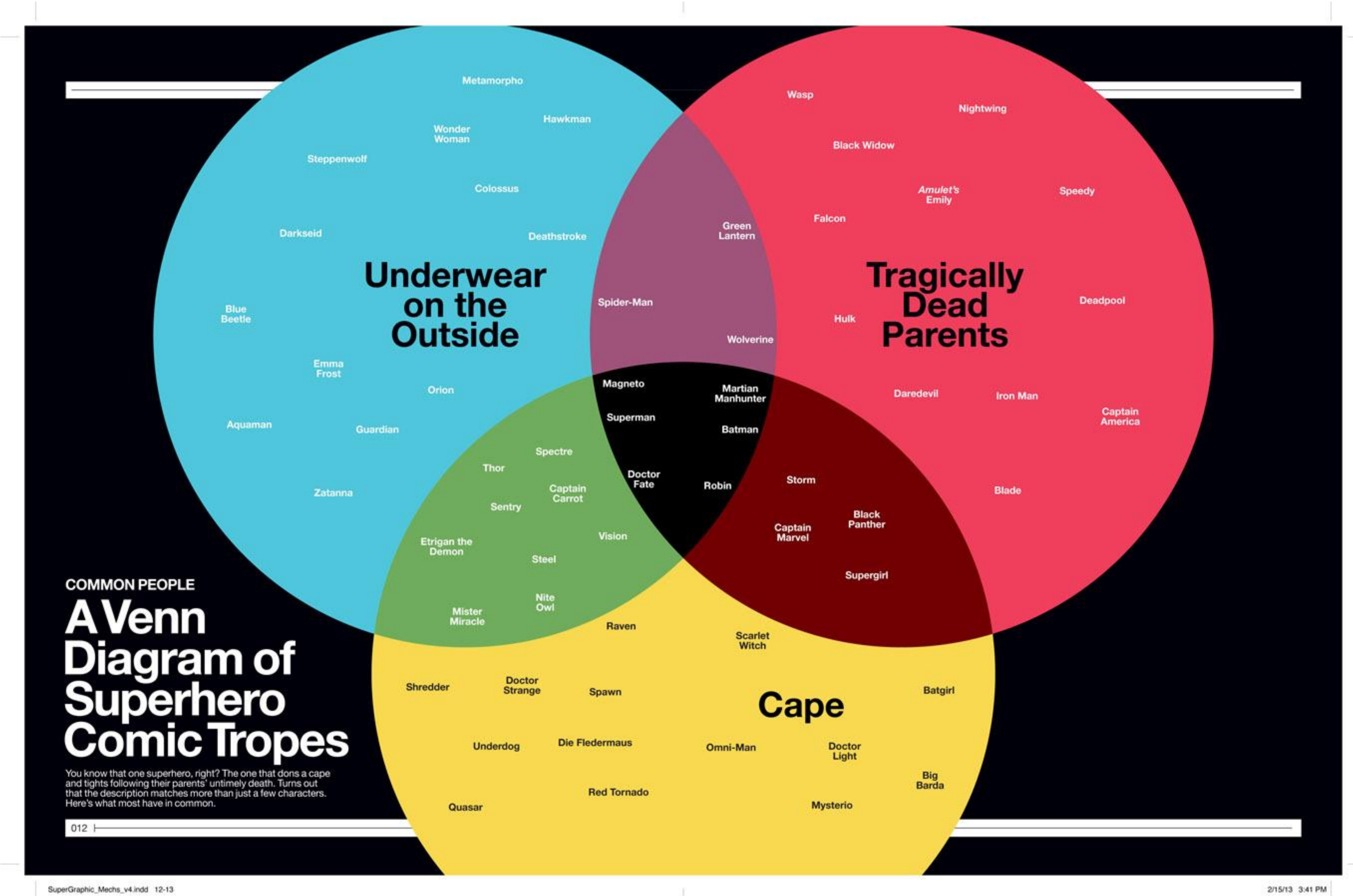
ACCELERATOR SCIENCE — Supports R&D at national labs and universities in beam physics, novel acceleration concepts, beam instrumentation and control, high gradient research, particle and RF sources, superconducting magnets and materials, and superconducting RF technology.

The Common Goal

A realistic, coherent, shared plan for US HEP:

- Enabling world-leading facilities and experiments in the US while recognizing the global context and the priorities of other regions
- Recognizing the centrality of Fermilab while maintaining a healthy US research ecosystem that has essential roles for both universities and multi-purpose labs
- Articulating both the value of basic research and the broader impacts of HEP
- Maintaining a balanced and diverse program that can deliver research results consistently

A Venn Diagram



Well-attended sessions, high quality presentations, lively discussions and panels!

Congratulations to the American Physical Society Division of Particles and Fields, Chair Jonathan Rosner, past and future chairs, and the too-many-to-name committee members and conveners.

Kudos to the University of Minnesota for hosting Snowmass, and to Dan, Marvin, and a small army of energetic students who were central to a successful workshop.

SNOWMASS

or How I Spent My Summer Vacation

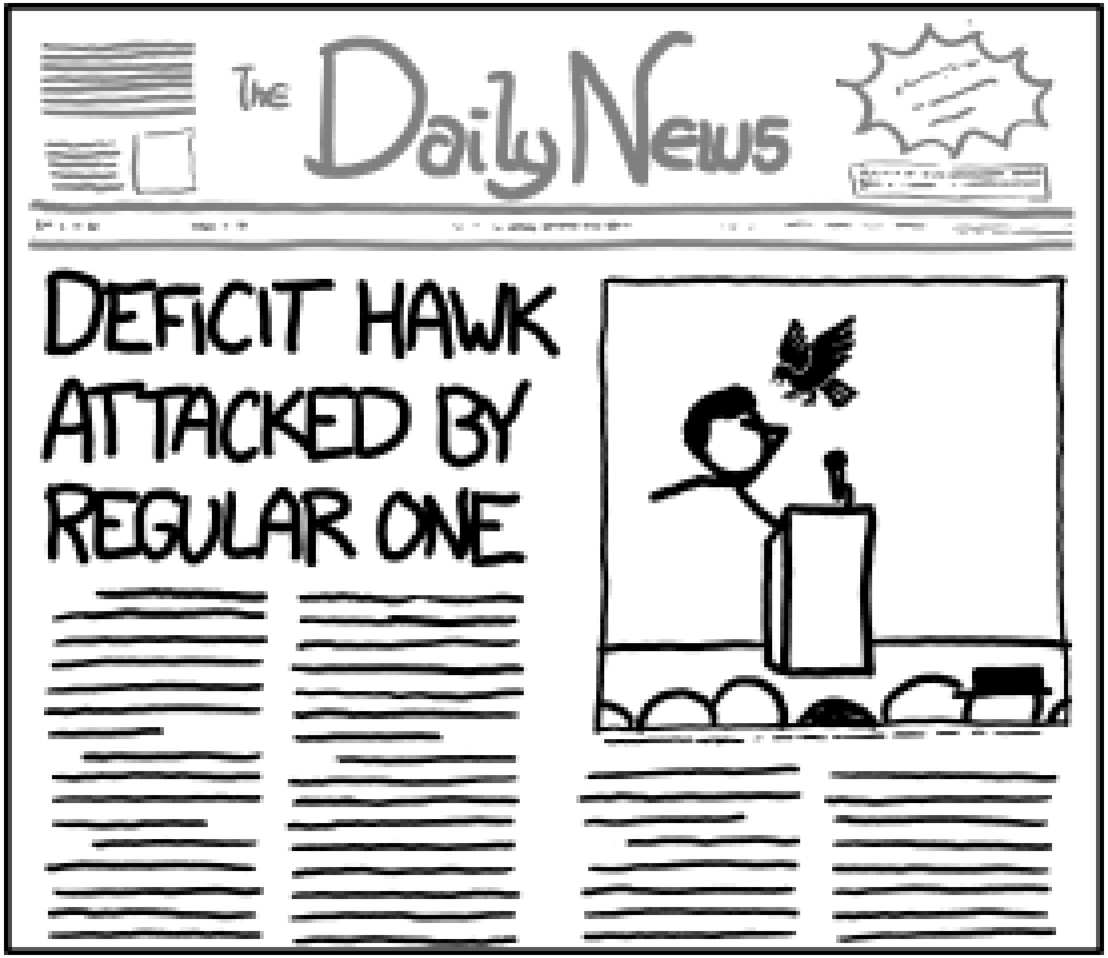
The 17 Physicists with Legible Handwriting

SNOWMASS OBSERVATIONS (I)

- Conference travel rules are onerous, but are unlikely to be relaxed
  - Which headline would you rather see make the news?
    - "DOE spending millions of dollars on a three-week conference at a ski resort."
    - "600 particle physicists came together at the University of Minnesota."
  - Take a proactive approach. Task Force?
    - Submit VERY early for conference approval & funding support
    - Coordinate with international hosts in setting registration deadlines
- Construction around University of Minnesota
  - Third trip since 2010. When are they going to finish the light rail?
- Program managers need to get out of Germantown more often
  - PI Meetings: Energy, Cosmic, Theory, Computing, Detector R&D
  - University site visits are rare due to shrinking DOE travel budgets
  - Ad-hoc meetings, lunch and dinner discussions
  - Young Snowmass presentation, Q&A
  - And trips to Ash River to inspect NOvA construction!
- Aisle seats are a commodity
  - Charge a premium?

SNOWMASS OBSERVATIONS (II)

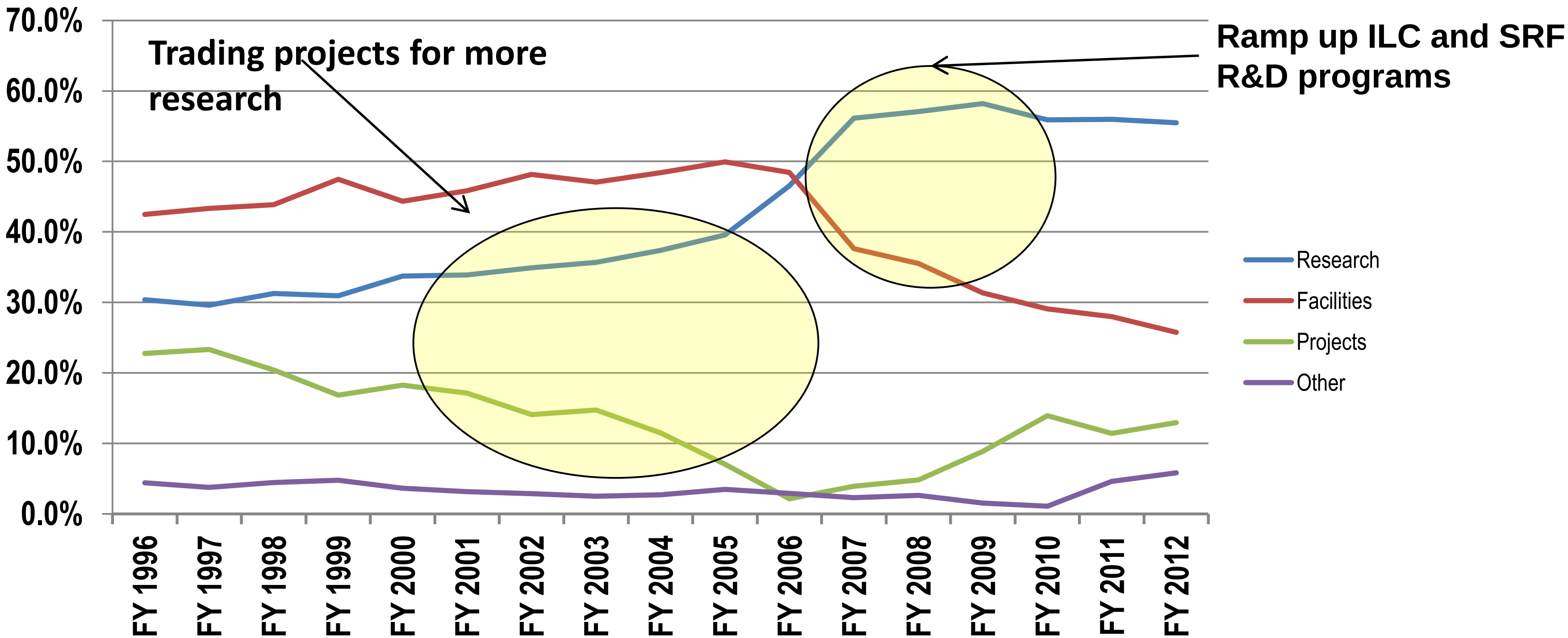
- The Frontier depiction of the HEP experimental research program
  - ✓ We have established a recognized brand & aligned the budget to the brand
  - – Program managers responsible for defending their budgets
  - – The voices of dissatisfaction are hard to quantify or qualify
    - Correlated with reduction (loss) in funding?
    - What alternatives are being suggested that would bring more money to HEP?
    - What opportunities are lost due to the “restrictions” of the Frontiers?
  - – Silent majority do not have many complaints
    - Correlated with satisfaction with funding?
    - Overwhelming majority of HEP research falls within a single thrust or frontier
    - For Cosmic or Intensity, physicists may be on multiple experiments, e.g. dark energy or neutrinos, but they are usually staged and complementary
  - – HEP does not discourage work or proposal to work in more than one research area
    - Uncommon: Research with shared software or technology development is a good example, e.g. Dark Matter/LAr R&D
    - Rare: Researchers working on orthogonal efforts, e.g. LHC and X
    - Many of the current post-docs in Intensity Frontier experiments did their thesis on a Tevatron or LHC experiment
    - Theory is not a frontier.
  - – Peer review provides input on who is or who is not active or credible
- Healthy interaction between Frontiers
  - ✓ Plenary and joint sessions; Tough Questions; Panel Discussions
  - x Parallel sessions



xkcd.com/1062/

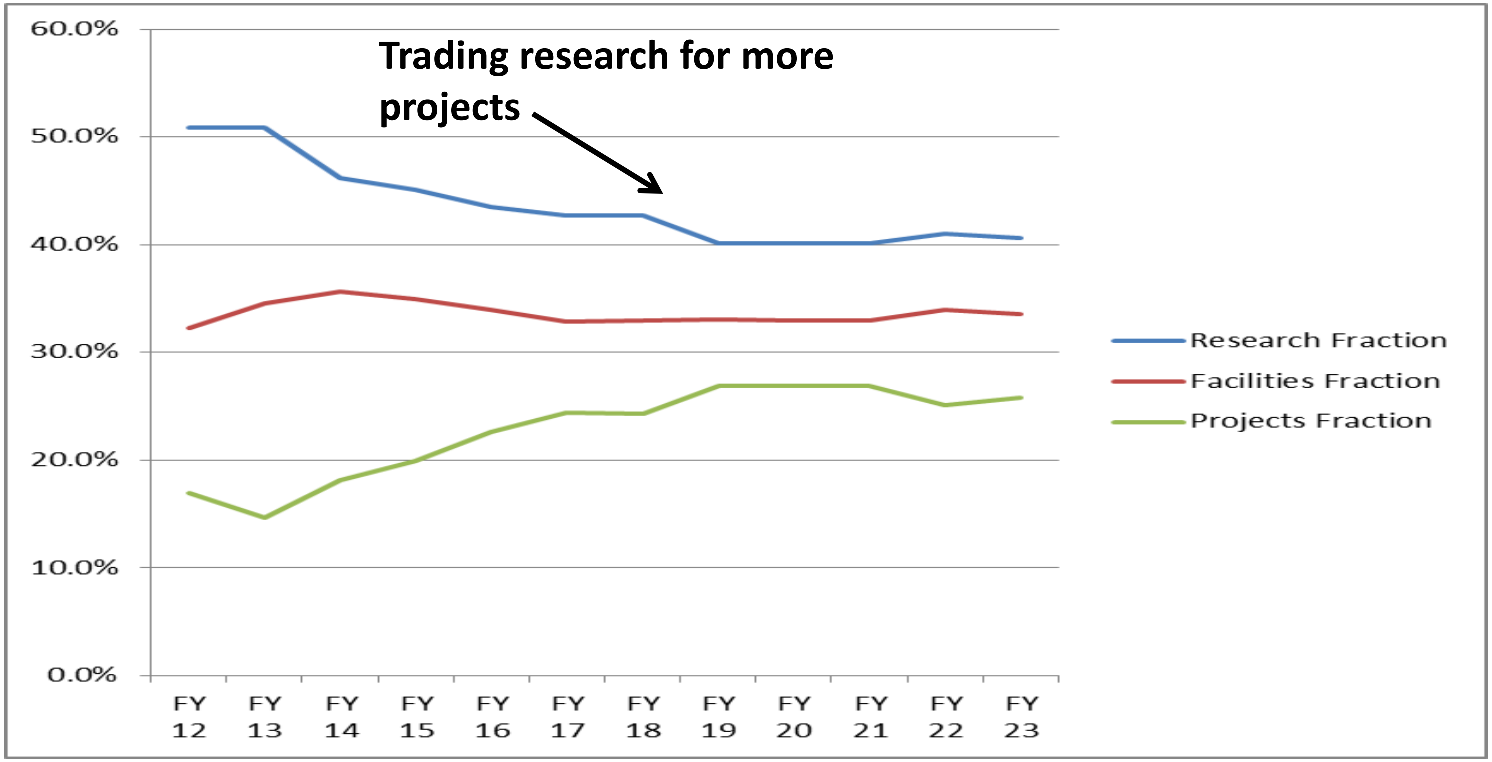
HEP Budget

Recent Funding Trends



- In the late 90's the fraction of the budget devoted to projects was about 20%.
- Progress in many fields require new investments to produce new capabilities.
- The projects started in 2006 are coming to completion.
- New investments are needed to continue US leadership in well defined research areas.
- Possibilities for future funding growth are weak. Must make do with what we have.

One Possible Future Scenario



- **About 20% (relative) reduction in Research fraction over ~5 years.**
  - ***In order to address priorities, this will not be applied equally across Frontiers.***
- **This necessarily implies reductions in scientific staffing.**
  - **Some can migrate to Projects but other transitions are more difficult.**
- **We have requested labs to help manage this transition as gracefully as possible.**

FY 2014 High Energy Physics Budget
(Dollars in thousands)

Description	FY 2012 Actual	FY 2013 July Plan	FY 2014 Request	Explanation of Change [FY14 Request vs. FY12 Actual]
Energy Frontier Exp. Physics	159,997	148,164	154,687	Tevatron ramp-down offset by R&D for LHC detector upgrades
Intensity Frontier Exp. Physics	283,675	287,220	271,043	Completion of NOνA (MIE), partially offset by Fermi Ops
Cosmic Frontier Exp. Physics	71,940	78,943	99,080	Ramp-up of LSST-Camera
Theoretical and Computational Physics	66,965	66,398	62,870	Continuing reductions in Research
Advanced Technology R&D	157,106	131,885	122,453	Completion of ILC R&D
Accelerator Stewardship	2,850	3,132	9,931	FY14 includes Stewardship-related Research
SBIR/STTR	0	0	21,457	
Construction (Line Item)	28,000	11,781	35,000	Mostly Mu2e; no LBNE ramp-up
Total, High Energy Physics:	**770,533**[a]	**727,523**[b,c]	**776,521**	**wrt FY13: Up +3.6% after SBIR correction wrt FY12: Down -2% after SBIR correction**
***Ref:* Office of Science (SC):**	**4,873,634**	**4,621,075**[c]	**5,152,752**	

[a] The FY 2012 Actual is reduced by $20,327,000 for SBIR/STTR.
[b] The FY 2013 July Plan is reduced by $20,791,000 for SBIR/STTR.
[c] Reflects sequestration.

SBIR = Small Business Innovation Research
STTR = Small Business Technology Transfer

Note on HEP Research Funding

- The FY 2014 Request for HEP Research was $384M, about a 6% increase compared to FY 2013, but $26 million of this is planned to go to R&D for Dark Matter G2, MS-DESI, and LHC upgrades.
- Our current FY 2014 planning is based on the House markup of the Energy and Water Appropriation which is overall slightly below the Request
  - The House mark directed HEP to move $8 million to LBNE PED, $2 million to SURF, and lower the overall HEP budget by $4 million. The choice was made to take all of these reductions from Research due to our priority to increase Project spending.
- These two effects reduce Research to $343M, about a 5% reduction w.r.t. FY 2013
- At the beginning of the year it is necessary to hold back funds for decisions to be made later in the year, such as the Early Career Program and other needs.
  - This results in an approximately 6% reduction relative to FY 2013 for the initial distribution of funds. This is the average effect on initial HEP research funding.
- There is some small variation in the impact to individual HEP subprograms, and program managers have the authority to provide more or less than the average reduction based on program priorities and the results of merit review.
- The House mark is a budget indicator but not the final word on FY 2014. When Congress passes a budget, there could be either an increase or a decrease in HEP research funding.

Major Item of Equipment (MIE) Issues

- We were not able to implement [most] new MIE-fabrication starts in the FY14 request
  - Muon g-2 experiment is the <u>only new start</u> in HEP that was not requested in FY13
  - LSST-Camera and Belle II, which did not receive approval in FY13, are requested again in FY14

- This upsets at least 2 major features of our budget strategy:
  - Strategic plan: “Trading Research for Projects”
  - Implementation of facilities balanced across Frontiers

Current LBNE Strategy

- We are trying to follow the reconfiguration [phased] plan for LBNE, though it has hit some snags
  - Out-year budgets are challenging
  - Some members of the community objected that the phased LBNE was not what the previous P5 (or they) had in mind
- The plan, as it currently stands:
  - Use time before baselining to recruit partners (international and domestic) that expand scope and science reach
- We also take note of the House language on LBNE:

"The Committee recognizes the importance of this project to maintaining American leadership in the intensity frontier and to basic science discovery of neutrino and standard model physics. However, the Committee also recognizes that LBNE construction must be affordable under a flat budget scenario. As such, the Committee supports the Office of Science's challenge to the High Energy Physics community to identify an LBNE construction approach that avoids large out-year funding spikes or to identify viable alternatives with similar scientific benefits at significantly lower cost."

HEP Project Status

Subprogram	TPC ($M)	CD Status	CD Date
INTENSITY FRONTIER			
Long Baseline Neutrino Experiment (LBNE)	TBD	CD-1	December 10, 2012
Muon g-2	40	CD-0	September 18, 2012
Muon to Electron Conversion Experiment (Mu2e)	249	CD-1	July 11, 2012
Next Generation B-Factory Detector Systems (Belle II)	16	CD-3a	November 8, 2012
NuMI Off-Axis Electron Neutrino Appearance Exp't (NOνA)	278	CD-3b	October 29, 2009
Micro Booster Neutrino Experiment (MicroBooNE)	19.9	CD-3b	March 29, 2012
Main INjector ExpeRiment for ν-A (MINERνA)	16.8	CD-4	June 28, 2010 [Finished]
Daya Bay Reactor Neutrino Experiment	35.5	CD-4b	August 20, 2012 [Finished]
ENERGY FRONTIER			
LHC ATLAS Detector (Phase-1) Upgrade	TBD	CD-0	September 18, 2012
LHC CMS Detector (Phase-1) Upgrade	TBD	CD-0	September 18, 2012
COSMIC FRONTIER			
Dark Matter (DM-G2)	TBD	CD-0	September 18, 2012
Mid-Scale Dark Energy Spectroscopic Instrument (MS-DESI)	TBD	CD-0	September 18, 2012
Large Synoptic Survey Telescope (LSST)	173	CD-1	April 12, 2012
Dark Energy Survey (DES)	35.1	CD-4	June 4, 2012 [Finished]
ADVANCED TECHNOLOGY R&D			
Accelerator Project for the Upgrade of the LHC (APUL)	11.5	CD-2/3	July 29, 2011
Berkeley Lab Laser Accelerator (BELLA)	27.2	CD-4	January 17, 2013 [Finished]
Facility for Advanced Accelerator Experimental Tests (FACET)	14.5	CD-4	January 31, 2012 [Finished]

Calvin & Hobbes. 1995

Strategic Planning

Implementation of 2008 Advisory Panel (P5)

- The HEP budget puts in place a comprehensive program across the three frontiers.
  - In five years:
    - NOvA, Belle II, Muon g-2 will be running on the Intensity Frontier
    - Mu2e will be commissioning for first data taking
    - The CMS and ATLAS detector upgrades will be installed at CERN
    - DES will have completed its science program and new mid-scale spectroscopic instrument and DM-G2 should begin operation
    - The two big initiatives, LSST and LBNE, will be well underway
- Need to start planning now for what comes next.
  - We have been engaging with the DPF community planning process starting at Fermilab in Oct 2012 and culminating in Minneapolis just last week
  - Will set up a prioritization process (a new P5) using that input.

Customized Implementation Strategies

- Energy Frontier
  - US has a leading role in LHC physics collaborations but does not own the facility
    - The issue is the scope and scale of US involvement. Requires US-CERN negotiation.
    - Could also be true for Japanese-hosted Linear Collider
- Intensity Frontier
  - US is the world leader and needs new facilities and/or upgrades of existing facilities to maintain its position
    - Has the potential to attract new partners to US-led projects
    - Portfolio of experiments and science case is diverse. This complicates the case. The scale of the projected investments is a big challenge
- Cosmic Frontier
  - US HEP has a leading role in a competitive, multidisciplinary environment
    - HEP component of the physics case is simple and compelling. Key issues are what levels of precision and sensitivity can be achieved and scientifically justified
    - DOE is a technology enabler, not a facilities provider (see NSF, NASA)
      - Analogous to LHC but the HEP physics goals are not those of the facility owners
    - DOE supports particle physics goals and HEP-style collaborations
      - Astronomy and astrophysics is not in our mission nor our *modus operandi*

Snowmass / P5 Interface

Some of what we heard at Snowmass:

- What are the most compelling science questions in HEP that can be addressed in the next 10 to 20 years and why
- What are the primary experimental approaches that can be used to address them? Are they likely to answer the question(s) in a "definitive" manner or will follow-on experiments be needed?
- What are the "hard questions" (science, technical,...) that a given experiment or facility needs to answer to respond to perceived limitations in its proposal?

These topics (and more) will be covered in the Snowmass reports and white papers. P5 will use these reports and white papers as its starting point.

- We expect to have the P5 panel selected and a formal charge issued by the time of the September 5-6 HEPAP meeting at NSF

Goals For The P5 Process

DOE/NSF agree on the goals:

- The P5 process will use the science goals of the community to construct a plan that is feasible and executable over a 10-20 year timescale.
- HEP MUST have a planning and prioritization process that the community can stand behind and support once the P5 report is complete.
- We also need a process that repeats at more less regular intervals (5 years?)
  - We also want to allow for less comprehensive updates and modest course corrections to the plan along the way (a la P5 updates in 2009, 2010)
- Key elements and outcomes envisioned for the P5 process:
  - Revisit the questions we use to describe the field (e.g. *Quantum Universe*, updated and corrected)
  - Decide on the science and project priorities within budget guidance (in detail for the next 10 years, in broad outline beyond that)
  - Crisply describe the *impact* of HEP research on other sciences and society
  - Build on the investment in Snowmass process and outcomes

What P5 Is

P5 will articulate the vision for U.S. particle physics in a global context.

It will prioritize HEP projects over a 10-20 year timeframe within reasonable budget assumptions.

- **Discussion will include such issues as: The role of domestic HEP facilities in the context of the worldwide particle physics program; and US leadership roles and their importance.**
- **Prioritization will necessarily involve consideration of technical feasibility as well as plausible timescales and resources for future projects.**

Fundamental questions for the field and how to unify/connect the Frontiers framework will also be discussed.

- **Input from the Theory community will be especially important in this area.**

What P5 Is Not

Technology support will NOT be a main focus of P5, but the panel will benefit from wisdom in the community in this area.

- **E.g., Do we have a coherent technology R&D plan that dovetails with the science opportunities? If not, how do we get there?**
- **Note that ‘Accelerator Stewardship’ is an Office of Science wide initiative managed by the HEP office, so should be discussed for information, but will not be modified by P5.**

Other issues will be addressed by HEPAP in the future, such as:

- **Agency review processes**
- **Roles, responsibilities and funding of labs versus universities**

Working with HEPAP Chair to identify the key topics to review

- **We welcome input and discussion on what you think are the pressing structural issues for HEP**

Moving Forward With The P5 Process

P5 composition:

- P5 will be chaired by Steve Ritz (UC Santa Cruz).
- The target size for P5 will be approximately same as in past, *i.e.* ~20+
  - Chosen after considerable input and discussion
- Nominations have been sought from HEP and related communities through a "Dear Colleague" letter.

Community input:

- P5 will build on the investment in the Snowmass process and output,
  - But P5 may solicit additional material as needed.
- Community input and interaction will not stop with Snowmass.
- Process will include public presentations and town hall meetings.
  - Including inputs on prioritization criteria and other issues
  - Including open discussion of issues so the community can better understand the consideration and constraints, and hopefully reach broader agreement.
- Send input by email to sritz@ucsc.edu & andrew.lankford@uci.edu

More About The P5 Process

- Publicizing and explaining the outcome is an important function.
- We are considering breaking out important “supporting” work:
  - Two separate (non-P5) working groups:
    - Science Connections, highlighting the scientific areas where HEP advances, informs, and benefits from other DOE/SC programs. See e.g., 1998 National Academy EPP Decadal Survey (Winstein)
      - Co-chairs Shamit Kachru (Stanford/SLAC) & Curt Callan (Princeton)
    - HEP Impact, developing a potential list of messages for the U.S. HEP community to use in communicating the broad impact of HEP in technology, workforce development, and other societal benefits
      - Interested parties are strongly encouraged to engage with the Education and Outreach group at Snowmass
    - These groups would produce short reports to HEPAP/P5 by the end of the calendar year in order to provide timely input that can be integrated by P5

Evolving P5 Timeline

✓**May 2013:** DOE and NSF agree on outlines of P5 process and inform community via presentations and "Dear Colleague" letter

✓**Jun 2013:** Call for nominations to P5

✓**Jul 2013:** Agencies draft P5 charge. HEPAP Chair reviews P5 nominations and begins selection process

✓**Aug 2013:** Snowmass meeting. P5 charge sent to HEPAP Chair. (The budget guidance to P5 will be public as part of its charge.)

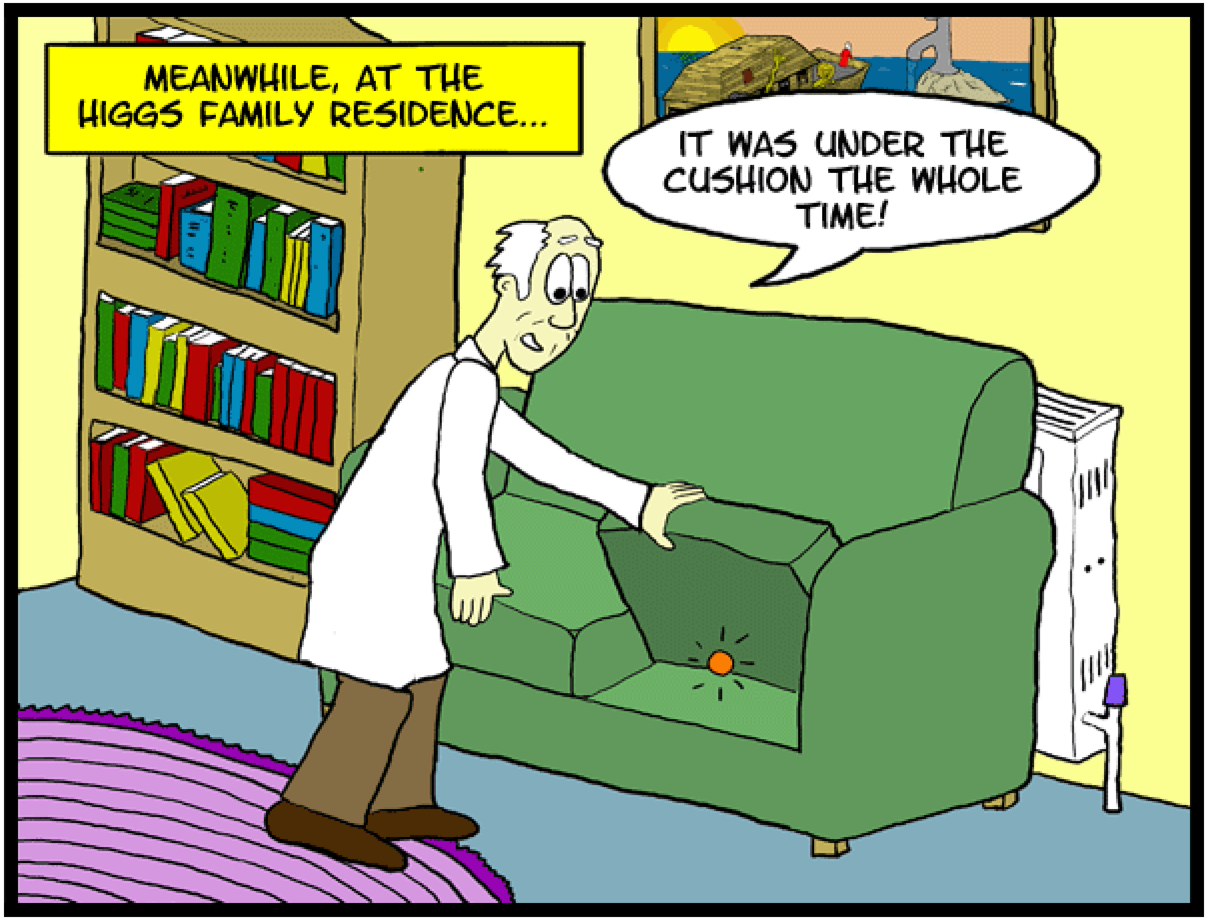
❖**Sep 2013:** HEPAP Meeting (Sep 5-6 at NSF). Snowmass reports issued. P5 charge and membership formally announced. Timeline for P5 meetings announced.

❖**Fall 2013:** Public Meetings (number, venues and topics TBD)

- ❖Planning of meetings to derive from the charge

❖**Fall 2013 to Spring 2014:** P5 meetings (phone in and face to face)

❖**Spring/Summer 2014:** P5 report(s) due. Exact dates and deliverables to be spelled out in P5 charge.



Lukesurl.com. 2008

SUMMARY

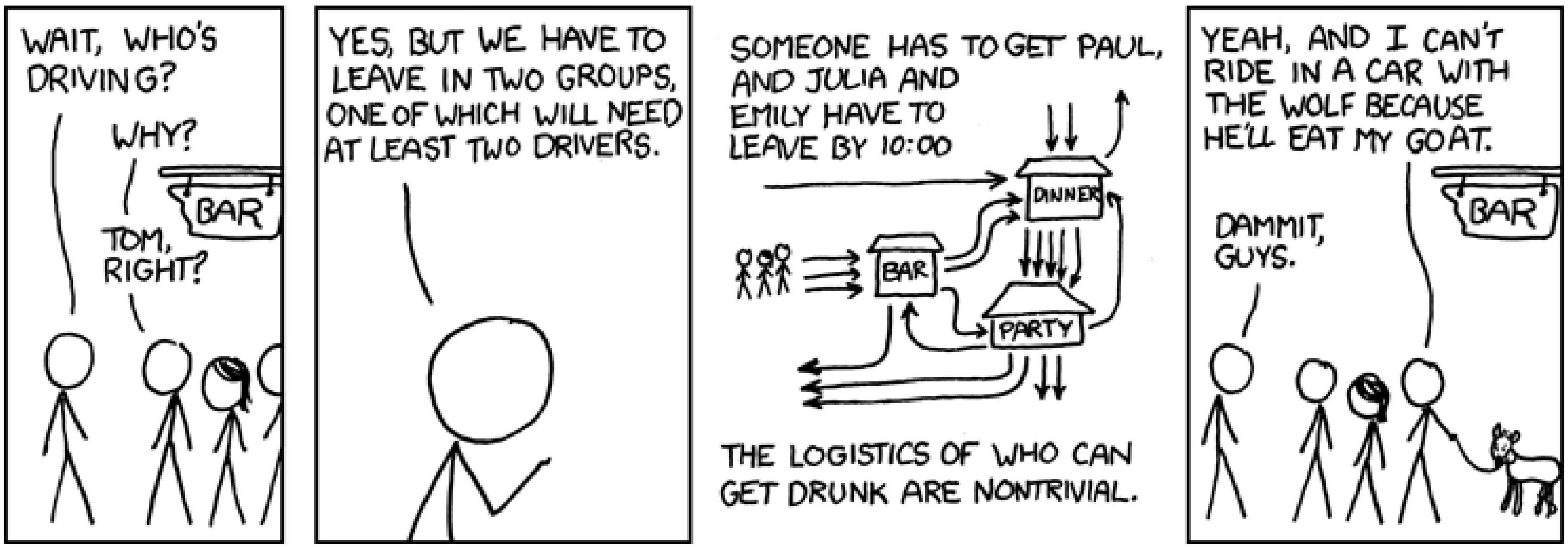
Take-Away Messages

- The U.S. HEP program is following the strategic plan laid out by the previous HEPAP/P5 studies
- Though some of the boundary conditions have changed, we are still trying to implement that plan within the current constraints
  - FY2014 request generally supports this, though funding constraints have led to delays in some key projects
  - Need to maintain progress with projects currently "on the books"
  - Working to attract partnerships that will extend the science impact
- Actively engaged with community in developing new strategic plan
- Increased emphasis on broader impacts via accelerator stewardship
- Leadership in the long-term will be through excellence in innovation and unique capabilities
  - Focus on areas where U.S. can have leadership
  - "High-risk, high-impact" as opposed to incremental advances
  - Note this is not an either/or proposition, we need both with appropriate balance

Thank you.

Questions?

Food and Drink!



xkcd.com/589/

Lukesurl.com. 2010

BACKUP

Office of

High Energy Physics

Fundamental

to the

Frontiers of

Discovery

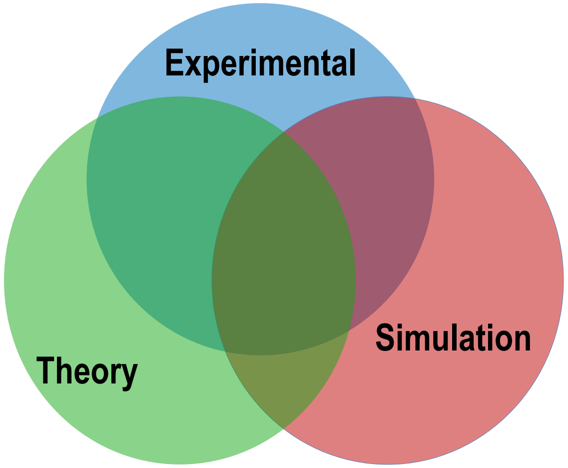
HEP's Mission: To explore the most fundamental questions about the nature of the universe at the Cosmic, Intensity, and Energy Frontiers of scientific discovery, and to develop the tools and instrumentation that expand that research.

HEP seeks answers to Big Questions:

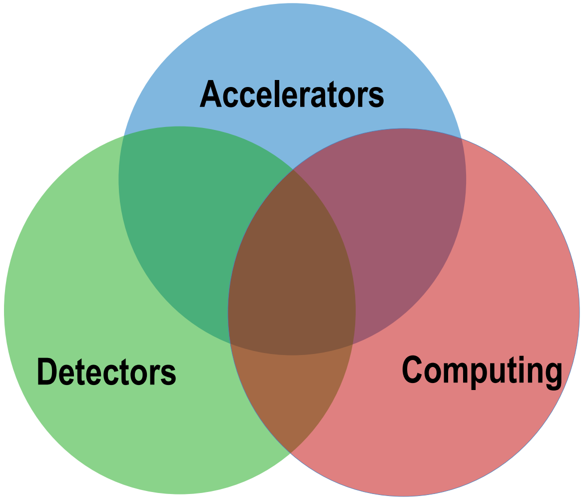
How does mass originate?
Why is the world matter and not anti-matter?
What is dark energy? Dark matter?
Do all the forces become one and on what scale?
What are the origins of the Universe?

HEP offers high-impact research opportunities for small-scale collaborations at the Cosmic and Intensity Frontiers to full-blown international collaborations at the Energy Frontier. More than 20 physicists supported by the Office of High Energy Physics have received the Nobel Prize.

HEP Physics and Technology



Along Three Paths



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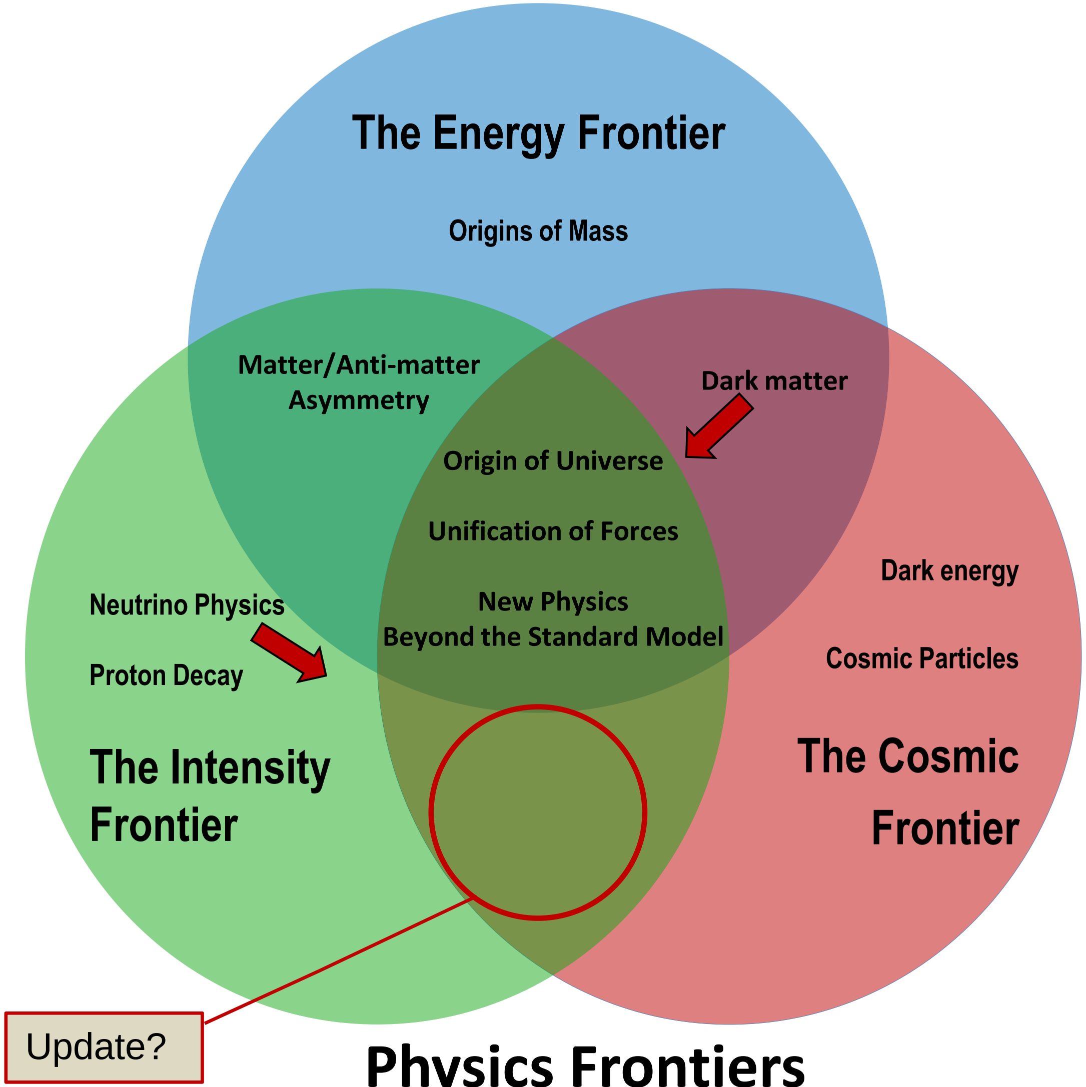


Physics Frontiers

Issues and Questions

Issues and questions we need to deal with when laying out longer term plan – and to be able to execute & defend the program

- **Which are the most important science areas &/or projects that need to be emphasized to make significant advances towards HEP goals? Which areas of phase space do we emphasize? Are there efforts that need to be ramped down or terminated?**
- **In addition to looking for next steps following current program, are there gaps in the current program or other projects that need to be done in the future to fully exploit our program?**
- **Are there branch points where we choose a certain direction?**
- **How far do we need to go in precision &/or setting limits in each area, i.e. when do we stop going in a certain direction?**
- **What are other theory, computational resources and simulations needed?**
- **Need to build case with other Frontiers for the importance and priority of funding**

HEP Energy Frontier Experiments

Experiment	Location	CM Energy; Status	Description	# Institutions; # Countries	#US Institutions	#US Coll.
DZero	Fermilab Tevatron Collider [Batavia, Illinois, USA]	1.96 TeV; Operations ended: Sept. 30, 2011	Higgs, Top, Electroweak, SUSY, New Physics, QCD, B-physics	74 Institutions; 18 Countries	33 Univ., 1 National Lab	192
CDF (Collider Detector at Fermilab)	Fermilab Tevatron Collider [Batavia, Illinois, USA]	1.96 TeV; Operations ended: Sept. 30, 2011	Higgs, Top, Electroweak, SUSY, New Physics, QCD, B-physics	55 Institutions; 14 Countries	26 Univ., 1 National Lab	224
ATLAS (A Toroidal LHC ApparatuS)	CERN, Large Hadron Collider [Geneva, Switzerland / Meyrin, Switzerland]	7-8 TeV; 13-14 TeV Run 1 ended: Dec. 2012 Run 2 start: 2015	Higgs, Top, Electroweak, SUSY, New Physics, QCD, B-physics, and Heavy-Ion	174 Institutions; 38 Countries	40 Univ., 4 National Labs	556
CMS (Compact Muon Solenoid)	CERN, Large Hadron Collider [Geneva, Switzerland / Cessy, France]	7-8 TeV; 13-14 TeV Run 1 ended: Dec. 2012 Run 2 start: 2015	Higgs, Top, Electroweak, SUSY, New Physics, QCD, B-physics, and Heavy-Ion	179 Institutions; 41 Countries	46 Univ., 1 National Lab	676

Collaboration data as of May 2013.

- **US-ATLAS comprises ~21% of the international ATLAS Collaboration**
- **US-CMS comprises ~33% of the international CMS Collaboration**

Energy Frontier Issues

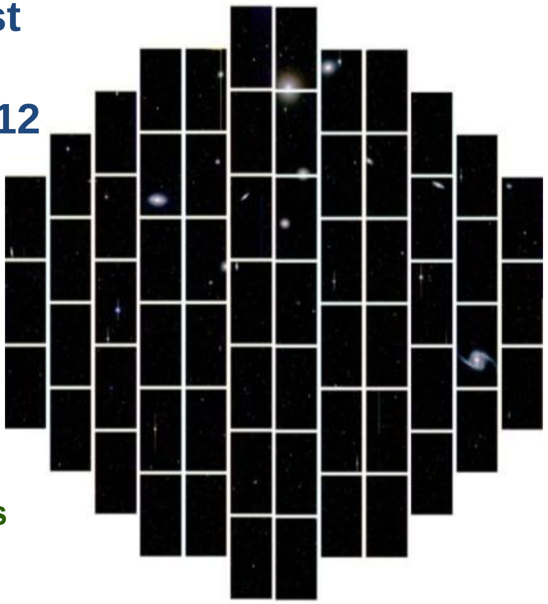
- Discussions with CERN about follow-on to LHC Agreement proceeding
  - Necessary precursor to planning for “Phase-II” upgrades; US scope for “Phase-II” TBD
- Energy Frontier science plan will require high-energy, high-luminosity LHC running
  - What is the real physics of the TeV scale?
    - This will likely take a few years to sort itself out
  - US Snowmass/P5 process is an important element, along with European and Asian HEP strategies
- Significant collaborations with other regions on future colliders will require a high-level approach between governments
  - Modest ground-level R&D efforts can continue as funding allows
  - We support an international process to discuss future HEP facilities that respects the interests of major national and regional partners as well as realistic schedule and fiscal constraints
  - Once Snowmass/P5 studies and the community input are complete, we will be in a better position to evaluate future US priorities for the HEP program in detail
  - We encourage active engagement by all interested parties

HEP Cosmic Frontier Experiments

Current program

- Several operating experiments studying high-energy cosmic & gamma rays:
  - Fermi/GLAST, VERITAS, Auger, AMS
- Several 1st generation (G1) dark matter direct detection experiments operating:
  - ADMX, LUX, CDMS-Soudan, DarkSide
  - High Altitude Water Cherenkov (HAWC) starts operations in 2014
- Several dark energy experiments are operating:
  - BOSS, Supernova surveys; Dark Energy Survey (DES) is starting 5-year survey in Sept. 2013
- Other areas: SPTpol (CMB), Holometer

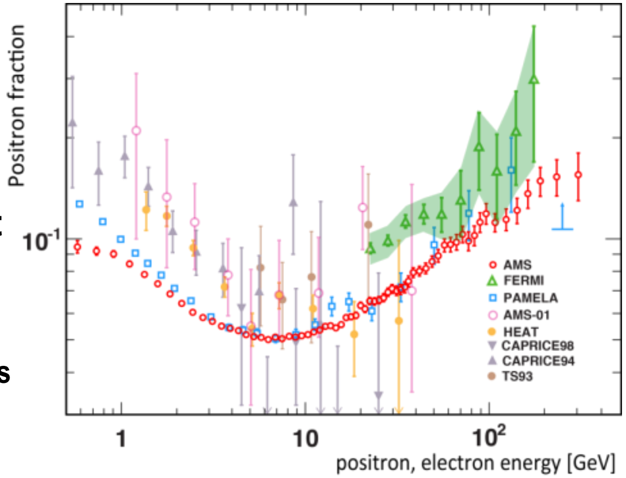
DES First Light – Sept. 2012



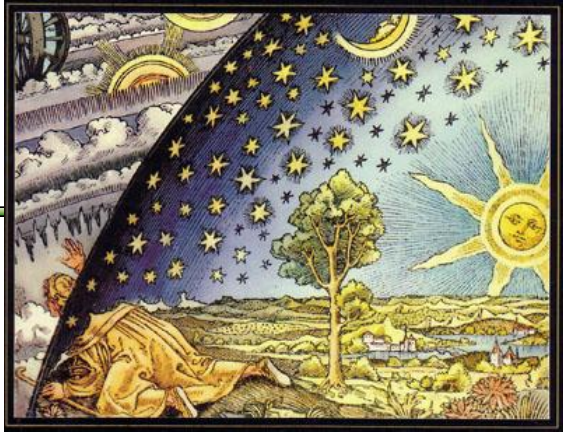
Planned program

- Large Synoptic Survey Telescope will make definitive ground-based Stage IV DE measurements
  - CD-1 for LSST-camera approved in April 2012
  - HEP requested an MIE fabrication start for LSST-camera in FY2014 President's Request budget
- Dark Matter 2nd-Generation (DM-G2) experiments to probe most of preferred phase space
  - CD-0 approved in September 2012
  - FY13 R&D awards announced at March HEPAP meeting:
    - ADMX-Gen2, LZ, SuperCDMS-SNOLab, DarkSide-G2, COUPP-500
  - Down-selection for expt's to move into fabrication phase expected to occur in late 2013
  - FY14 President's Request - R&D continues; planning to request an FY15 start
- Mid-scale Dark Energy Spectroscopic instrument to complement DES/LSST
  - CD-0 approved in September 2012
  - FY13: HEP is working with NSF-AST to determine if preferred site to host the instrument is available in the timescale needed
  - FY14 President's Request - R&D continues; planning to request an FY15 start

AMS First Results



Cosmic Frontier Issues



- The HEP component of the physics case is simple & compelling

→Key issues are what levels of precision and sensitivity can be achieved and scientifically justified

- HEP has a leading role in a competitive, multidisciplinary environment:
  - Make significant, coherent contributions to facilities/experiments selected for the program, including instrumentation, computing, and bring the tradition of science collaborations to all stages of the experiment
  - Form partnerships or use other agency's facilities when needed (e.g. we don't build telescopes); our science goals are often a subset of those of the facility owners

Program Guidance:

- FACA panels – official advice to the government:
  - High Energy Physics Advisory Panel (HEPAP): PASAG subpanel 2009 has been the main guidance for planning the program
  - Astronomy and Astrophysics Advisory Committee (AAAC): Reports to NASA, NSF and DOE on areas of overlap
- Other Input:
  - National Academies of Science - Astronomy & Astrophysics Decadal survey (New Worlds New Horizons 2010)
  - Specific studies, e.g. Dark Energy science group in summer 2012→ Science case for a HEP dark energy program developed by a task force at HEP request (Rocky Kolb, chair). This was seen as a good model for the different science areas

Future Directions

- Dark Matter & Dark Energy – We have a path forward for next steps
- Science case and role of other particle astrophysics areas needs to be better articulated
- Will further develop and optimize program starting with input from the Snowmass → P5 process

HEP Intensity Frontier Experiments

Experiment	Location	Status	# Institutions	#Collaborators	#US Inst.	#US Coll.
Belle II	KEK, Tsukuba, Japan	Physics run 2016	70	508+	10 Univ, 1 Lab	55
BES III	IHEP, Beijing, Ching	Running	50	363	6 Univ	26
CAPTAIN	Los Alamos, NM, USA	R&D; Neutron run 2015	6+	20+	5 Univ, 1 Lab	20+
Daya Bay	Dapeng Penisula, China	Running	38	229	13 Univ, 2 Lab	76
Heavy Photon Search	Jefferson Lab, Newport News, VA, USA	Physics run 2015	17	63+	8 Univ, 2 Lab	47
K0TO	J-PARC, Tokai , Japan	Running	16	66	3 Univ	12
LArIAT	Fermilab, Batavia, IL	R&D; Phase I 2013	18	45+	11 Univ, 3 Lab	38
LBNE	Fermilab, Batavia, IL & Homestake Mine, SD, USA	CD1 Dec 2012; First data 2023	65	366+	48 Univ, 6 Lab	336
MicroBooNE	Fermilab, Batavia, IL, USA	Physics run 2014	19	108	15 Univ, 2 Lab	101
MINERvA	Fermilab, Batavia, IL, USA	Med. Energy Run 2013	21	65	13 Univ, 1 Lab	48
MINOS+	Fermilab, Batavia, IL & Soudain Mine, MN, USA	NuMI start-up 2013	27	75	15 Univ, 3 Lab	53
Mu2e	Fermilab, Batavia, IL, USA	First data 2019	26	139+	15 Univ, 4 Lab	106
Muon g-2	Fermilab, Batavia, IL, USA	First data 2016	27	100+	13 Univ, 3 Lab, 1 SBIR	75+
NOvA	Fermilab, Batavia, IL & Ash River, MN, USA	Physics run 2014	34	144	18 Univ, 2 Lab	114
ORKA	Fermilab, Batavia, IL, USA	R&D; CD0 2017+	17	48+	6 Univ, 2 Lab	26
Super-K	Mozumi Mine, Gifu, Japan	Running	35	121	7 Univ	29
T2K	J-PARC, Tokai & Mozumi Mine, Gifu, Japan	Running; Linac upgrade 2014	56	500+	10 Univ	70
US-NA61	CERN, Geneva, Switzerland	Target runs 2014-15	27 (NA61/SHINE)	144 (NA61/SHINE)	4 Univ, 1 Lab	15
US Short-Baseline Reactor	Site(s) TBD	R&D; First data 2016	11	28+	6 Univ, 5 Lab	28

Intensity Frontier Research & Development

- Intensity Frontier R&D activities reviewed case by case
  - Target of opportunities: fast, cheap and compelling (discovery potential)
- What constitutes Intensity Frontier R&D?
  - Perform simulations and physics studies in support of the conceptual and preliminary design of a future experiment or project
  - Develop and demonstrate the technical feasibility of novel detectors or systems
  - Design, construct, commission, and operate a prototype experiment
- What are the ground rules?
  - Start at home. Seed support from Univ. start-up, LDRD, private foundation, etc.
  - There is not a separate pot of money. All funding comes out of research. Be thrifty. Be reasonable. R&D proposals should be mainly for technical support.
  - Form a strong & credible collaboration. Partnerships with labs and universities are preferred. International participation is encouraged.
  - Socialize with the funding agencies AND lab management at the earliest opportunity.
    - Briefings to DOE (or NSF). PAC(s) should have a voice.
    - How and when does this activity fit within the HEP mission and Intensity Frontier portfolio?
  - Technical proposal will be reviewed. Research will be reviewed. Separately.

Current Intensity Frontier R&D Efforts

Experiment	Location	Status	Description	#US Inst.	#US Coll.
CAPTAIN	Los Alamos, NM, USA	R&D; Neutron run 2015	Cryogenic apparatus for precision tests of argon interactions with neutrinos	5 Univ., 1 Lab	20
Heavy Photon Search	Jefferson Lab, Newport News, VA, USA	Physics run 2015	Search for massive vector gauge bosons which may be evidence of dark matter or explain g-2 anomaly	8 Univ., 2 Lab	47
LArIAT	Fermilab, Batavia, IL	R&D; Phase I 2013	LArTPC in a test beam; develop particle ID & reconstruction	11 Univ., 3 Lab	38
ORKA	Fermilab, Batavia, IL, USA	R&D; CD0 2017+	Precision measurement of $K^+ \to \pi^+ \nu\nu$ to search for new physics	6 Univ., 2 Lab	26
US-NA61	CERN, Geneva, Switzerland	Target runs 2014-15	Measure hadrons production cross sections crucial for neutrino beam flux estimations needed for NOvA, LBNE	4 Univ., 1 Lab	15
US Short-Baseline Reactor	Site(s) TBD	R&D; First data 2016	Short-baseline sterile neutrino oscillation search	6 Univ., 5 Lab	28

- Heavy Photon Search: Feb 2013 DOE Briefing; July 11, 2013 DOE Panel Review
  - Determine whether to fund the design, construction, commissioning, and operation of the first phase of the experiment for period of FY14-FY16
- nEXO R&D: Monthly DOE HEP/NP Phone Calls; July 12, 2013 DOE Panel Review
  - Determine whether to fund the 5 ton LXe TPC R&D program for period of FY13-FY16
- US Short-Baseline Reactor: Monthly DOE Phone Calls; Apr 2013 DOE Briefing
- LArIAT: Monthly DOE Phone Calls; Apr 2013 DOE Briefing; Jul 2013 NSF Briefing
- ORKA: May 2012 DOE Briefing; FNAL Stage 1
- CAPTAIN: Feb 2013 LANL Review (DOE Observer); Monthly DOE Phone Calls
- nuSTORM: Monthly DOE Phone Calls; Proposal to FNAL PAC in Jun 2013; FNAL Stage 1
- US-NA61: Aug 2013 DOE Briefing
- And more in pipeline to be considered: OscSNS, CHIPS, LAr1 Phase 1…

➢ Planning a LBNE-related R&D review in Spring 2014

Detector R&D Program

- **Develop the next generation of detectors for particle physics and supports research leading to fundamental advances in the science of particle detection and instrumentation.**
  - "Generic" research on the physics of particle detection that has potential for wide applicability and/or high impact.
  - Provide graduate and postdoctoral research training, equipment for experiments and related computational efforts
  - Support for engineering and other technical efforts and equipment required for experimental detector R&D and fabrication

- **Establish Detector R&D Test Facilities at National Labs**
  - Fermilab: ASIC Development and Testing Facility, Cryogenics and Vacuum Instrumentation Facility, Fixed Target Test Beams, Thin Film Support Facility, etc.
  - SLAC: ESTB Test Beam Facility
- **Innovation through Partnerships**
  - Fruitful collaboration already seen at Laboratories and Universities
- **Many Suggestions from the HEP Community**
  - Grand Challenges – Focused R&D; LAPPD as an example
  - Plans for better education of students and post-docs
  - EF/IF/CF support for the technical staff between Projects
  - Improved access to Lab engineering facilities
  - Work will continue via Coordinating Panel for Advanced Detectors (CPAD)

Instrumentation Summary Strategic Themes

Instrumentation Area	Possible Technology	Energy F.	Intensity F.	Cosmic F.	Nucl. Phys.	BES	Applied
Photodetectors	LAPPD or SiPM	✓	✓	✓	✓	✓	✓
Spectral Sensitive Pixels	MKID or Tiered Silicon			✓		✓	✓
Calorimetry	Crystal EM calorimetry, compensating	✓	✓		✓	✓	
Low Background Techniques	Neutron veto detectors Photodetectors, materials			✓	✓		✓
Intelligent Tracking	3D Silicon	✓	✓		✓		
Custom Electronics	Waveform sampling ASIC Cold electronics	✓	✓	✓	✓	✓	✓
Low-mass tracking	Carbon, G-pixel Si, power delivery	✓	✓		✓		
DAQ	ATCA, high-speed optical links	✓	✓	✓	✓		
	... more this week ...						

Snowmass 2013 (CSS), Minneapolis, July 29 2013 - Marcel Demarteau (Instrumentation Frontier)

HEP Theory Program

- Topics studied in theoretical high energy physics research *include, but are not limited* to: phenomenological and theoretical studies that support experimental HEP research at the three frontiers, both in understanding the data and in finding new directions for experimental exploration; development of analytical and numerical computational techniques for these studies; and construction and exploration of theoretical frameworks for understanding fundamental particles and forces at the deepest level possible.
- The program is centered across several research areas:
  1. Standard Model Phenomenology, which involves high precision calculations of Standard Model predictions such as Monte Carlo simulation, higher order calculations of particle production rates and distributions, radiative corrections, and extraction of parton distribution functions;
  2. Beyond the Standard Model Phenomenology, which studies the experimental consequences of extensions of the Standard Model as well as the search for new particles given their signatures in collider and astrophysical sources, and in rare processes;
  3. Cosmology and Astroparticle theory, which studies the early universe, inflation scenarios, large scale structure formation, particle models for Dark Matter and prospects for its detection, Dark Energy and its theoretical consequences, quantum gravity and black holes;
  4. Lattice Field Theory, which involves the study and simulation of lattice models of quantum field theory and its phenomenology;
  5. Theoretical and phenomenological studies of neutrino physics; and
  6. Formal and mathematical aspects of quantum field theory, including string theory.

HEP Theory Issues

Role of theory in DOE-supported research

- HEP mission at the frontiers
  - Intensity Frontier leadership → is the theory effort adequate?
  - Energy Frontier co-leadership → is the US effort comparable and competitive with the European one?
  - Cosmic Frontier co-leadership → DM and DE, relationship with astrophysics, active role of theorists in experimental collaborations

- Relationship with other sectors/agencies and fitting it within our budget envelope
  - Nuclear Physics→ neutrino physics at low/medium energy; Heavy Ions Physics (holography applications); IF synergies
  - BES and Condensed Matter → the re-branding of String Theory?
  - Computational aspects of HEP theory →Cosmology initiatives; Lattice (HEP vs. NP); Monte Carlo simulation

Computational HEP Program

HEP SciDAC focuses on partnership projects:

- SciDAC 3 Projects – (part of the Office of Science SciDAC Program)
  – In partnership with Office of Advanced Scientific & Computing Research (ASCR), DOE
- Transforming GEANT 4 to multicore systems –
  – A pilot project in partnership with ASCR Research Division
- Open Science Grid (OSG)
  – In partnership with National Science Foundation and Office of Nuclear Physics
- Other Pilot Projects with various partnerships including ASCR Facilities
- Scientific Computing: Community Data Tools, codes, Frameworks, Distributed Computing, Networks, Software, data workflow and analytics portals. Includes pilot projects to help kick off specific activities like transitioning LHC software to HPC machines and data initiatives

Computing HEP Issues

- Computing in the DOE program is organized and funded largely through large projects (ATLAS, CMS…) and labs (FNAL, SLAC…), with a modest "Computational" HEP program.
  - Most of computing is not managed as a whole
  - Are "cross-cutting" solutions or efficiencies missed through this organization?
- Would HEP benefit from a computing R&D program aimed at our specific needs? If so:
  - What initial topics could be addressed?
  - Why would they not be addressed as well within individual projects?
- Does HEP support and develop common tools (used across the field) appropriately?
  - What are the common tools that are most important to the field?
  - Are there tools that are needed but somehow not being developed?
- Would some of these issues be addressed by establishing a Virtual Center for HEP Computing, consisting of distributed experts in different aspects of computing made available broadly to the HEP community?
- How long must data be preserved and what are the technical and intellectual challenges involved?
- How do we best make use of "new" technology (and what happens if we don't)?
  - Highly parallel supercomputers, Highly parallel processor chips (multicore), GPUs, Cloud computing
- Is there a software strategy to handle any (likely) computing architecture of the next several years.
  - Cannot rewrite software for each hardware change.

Lattice Gauge Theory teams have been at the forefront of evolving computing architectures for years and continue to work with industry and advanced prototypes

HEP Accelerator R&D Mission

- Support world-leading research in the physics of particle beams and in accelerator R&D
- Mapped into three broad categories:
  - **Near- to mid-term directed R&D** for specific facilities or technologies in support of DOE projects (sometimes captured in project TPC)
  - **Mid-term, facility-inspired R&D** focused on specific concepts or technologies to demonstrate feasibility and engineering readiness
  - **Long-term, proposal-driven research** on the fundamental science underlying particle accelerators and beams to enable breakthroughs in size, cost, beam intensity, beam energy, and control
- The HEP Accelerator Stewardship Program will spin off from the third category

Accelerator R & D – Classification

Accelerator Research

- Explore concepts for future accelerators
  - Applies to both HEP and non-HEP
- Support generic accelerator science of highest quality
  - Understand limitations of present accelerators
    - Investigate how to circumvent or mitigate these
- Develop next generation of accelerator scientists

Accelerator R&D Stewardship

- Support accelerator research that benefits a broader community:
  - Discovery science, industry, medicine, defense and security, energy and environment

Accelerator Development

- Improve facility performance;
- Develop accelerator technology for use at HEP facilities
  - Magnets, RF devices, feedback systems, diagnostics,…

Program specific/directed R&D

- SRF Technology/Infrastructure;
- Muon Accelerator Program
- LHC Accelerator Research Program

Accelerator Facilities

- ATF; AWA; BELLA, FACET, HBESL
  - Test beds for new concepts

Stewardship Recent Activities and Plan

- Workshops organized to assess needs in identified target areas
  - Ion Beam Therapy Workshop (co-sponsored by NIH/NCI)
    - January 9-11, 2013 in Bethesda, MD
  - Laser Technology for Accelerators Workshop
    - January 23-25, 2013 in Napa, CA (Organized by LBNL)
- Both meetings were small and tightly focused
  - Attendance by invitation only
    - Limited number of industrial “observers” accommodated
- FY2014 Request identified a modest “start-up” program that redirects or relabels existing efforts that have broader impacts beyond HEP
- HEP Program managers generating proposals for new stewardship programs based on 2013 workshop outcomes
  - These would be vetted with SC partners and then (if successful) put into FY2015 Request

SBIR/STTR Program

- Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs
  - Established in 1982 to award federal research grants to small businesses
    - To spur technological innovation in the small business sector
    - To meet the research and development needs of the federal government
    - To commercialize federally funded investments
- Success stories: Symantec, Qualcomm, Genentech, ...
  - Qualcomm (Market Cap: $115 B) in SBIR Hall of Fame;
    - 10 SBIR awards (7 Phase I and 3 Phase II) between 1987 to 1990 for a total of $1.3 M
- Reauthorization in 2011 for 5 more years; $2B /year
- Office of SBIR and STTR Program at DOE (http://science.energy.gov/sbir/)
  - Section, Preparing a DOE SBIR/STTR Phase I Grant Application
- SBIR/STTR Program in Office of HEP ($21.5 M in FY2014)
  - Project Officer (K. Marken)
  - Technical Topic Managers: Computing (L.Price), Accelerator (E.Colby, K.Marken), Detector (P. Kim)
- FY13 SBIR/STTR/TTO Grants Awarded:
  - SBIR Phase I ($150K – one year) : 5
  - SBIR Phase II ($500K/year – two years): 2 new + 3 old continuing from last year
  - TTO Phase I ($450K – one year): 1 - LAPPD Technology Transfer

SBIR/STTR Review Process - FY14

- Phase I Topics released by DOE SBIR/STTR Office (July 15, 2013)
  http://science.energy.gov/sbir/funding-opportunities/
  Topics are chosen by HEP TTMs after consulting with HEP community

"All grant applications must clearly and specifically indicate their relevance to present or future programmatic activities as described in the Energy, Intensity, and Cosmic Frontiers."

- Funding Opportunity Announcement: August 12, 2013
  - Must submit both Letter of Intent (LOI) and Application
  - LOI Due Date: September 3, 2013
  - Application Due Date: October 15, 2013

- Each application is reviewed by 3 or 4 reviewers in respective area of expertise
- HEP SBIR Project Manager submits recommendations to the DOE SBIR/STTR Office

- Awards notified: Early January, 2014.
- Award Start Date: Late February, 2014.

- FY14 Phase II has a slightly later timeline (See the above FOA web page).

Digital Data Management

Effective with all solicitations and invitations for research funding issued on or after October 1, 2013.

The DOE Office of Science Statement on Digital Data Management will require a Data Management Plan with all proposals submitted for Office of Science research funding.

See March 12, 2013 HEPAP presentation by Laura Biven:
http://science.energy.gov/~/media/hep/hepap/pdf/march-2013/2013_Spring_HEPAPBriefing_v3_NoBackup_LBiven.pdf

More information will also be available in the FOAs, via the DOE Office of Science website, and on the High Energy Physics webpage.

Note: Proposals submitted to the FY14 HEP Comparative Review FOA [DE-FOA-0000948] or to the FY14 Early Career Research Program FOA [DE-FOA-0000958] that have already been posted will not require Data Management Plans.

Budget Reference Slides

HEP Budget – FY14

- The President's Request (PR) budget usually comes out ~ February each year
  - HEP FY14 PR budget submitted ~ November 2012; released ~ April 2013
  - The ACTUAL budget that we get for the FY is usually different – following the House, Senate process & budget approval.
  - Our budget that we plan to at the beginning of each FY is usually lower than the PR; if we get increased funds after the budget is approved, we can make changes to the program.
- In developing the FY2014 PR budget, HEP philosophy was to enable new world-leading HEP capabilities in the U.S. through investments on all three frontiers

HEP Budget Overview

- FY2014 budget philosophy was to enable new world-leading HEP capabilities in the U.S. through investments on all three frontiers
  - Accomplished through ramp-down of existing Projects and Research
  - When we were not able to fully implement this approach, converted planned project funds to R&D: Research → ~~Projects~~ → Research
  - Therefore the FY14 Request shows *increases* for Research which are driven by this R&D "bump", while Construction/MIE funding is only slightly increased
- Impact of these actions:
  - Several new efforts are delayed:
    - LBNE, LHC detector upgrades, 2nd Generation Dark Matter detectors, MS-DESI
  - US leadership/partnership capabilities will be challenged by others
  - Workforce reductions at universities and labs
- Key areas in FY2014 Request
  - Maintaining forward progress on new projects via funding lines for Construction and Research (including R&D for projects)

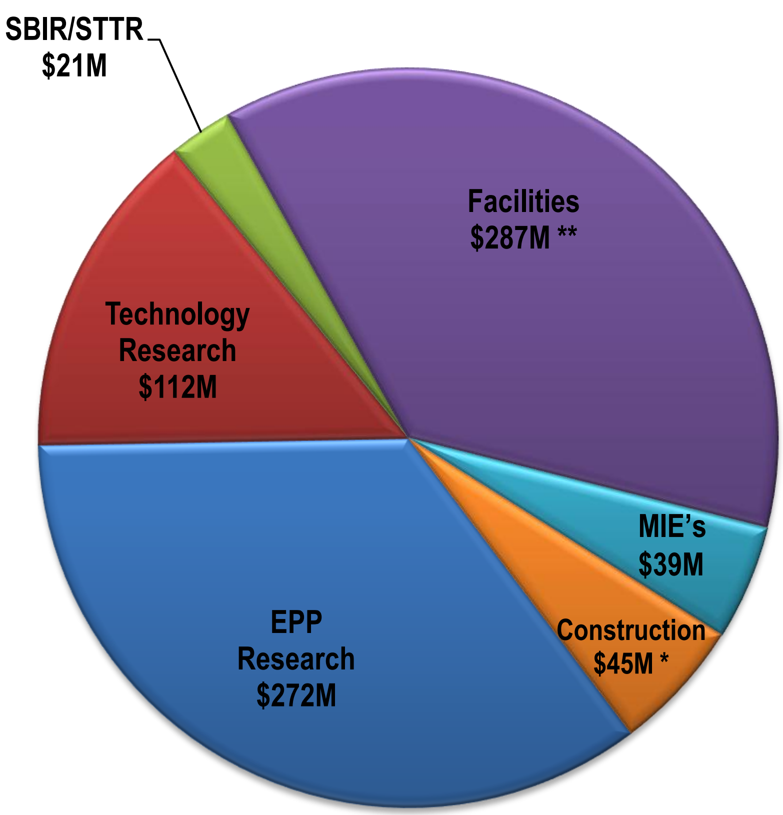
HEP Physics Funding by Activity

Funding (in $K)	FY 2012 Actual	FY 2013 July Plan	FY 2014 Request	Explanation of Change wrt FY12
Research	**391,329**	**362,284**	**383,609**	Reduction mostly ILC R&D
Facility Operations and Exp't Support	**249,241**	**265,305**	**271,561**[a]	NOνA ops start-up and Infrastructure improvements
Projects	**129,963**	**99,934**	**99,894**	
Energy Frontier	0	3,000	0	Phase-1 LHC detector upgrades
Intensity Frontier	86,570	62,794	37,000	NOνA ramp-down, start Muon g-2
Cosmic Frontier	12,893	19,159	24,694	LSST
Other	2,500	3,200	3,200	LQCD hardware
Construction (Line Item)	28,000	11,781	35,000	Mostly Mu2e; no LBNE ramp-up
SBIR/STTR	**0**	**0**	**21,457**	
TOTAL, HEP	**770,533**	**727,523**[b]	**776,521**	

[a] **Includes $1,563K GPE.**
[b] **Reflects sequestration.**

FY 2014 Request Crosscuts

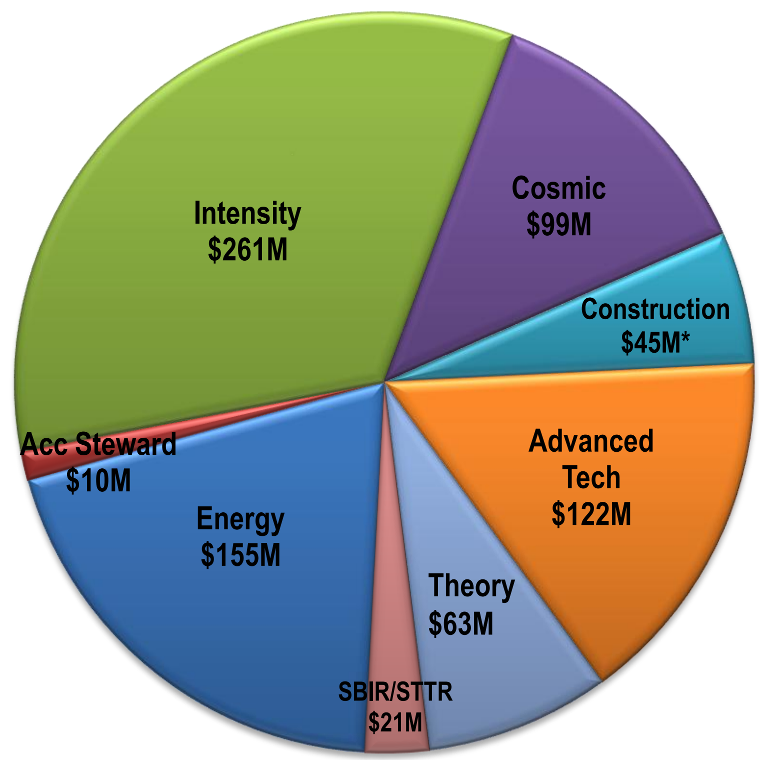
By Function



*Includes Other Project Costs (R&D) for LBNE

**Includes $15.9M Other Facility Support

By Frontier



*Includes Other Project Costs (R&D) for LBNE

HEP Physics MIE Funding

Funding (in $K)	FY 2012 Actual	FY 2013 July	FY 2014 Request	Description
MIE's	**55,770**	**45,687**	**39,000**	
Intensity Frontier	41,240	19,480	0	NOνA ramp-down
Intensity Frontier	6,000	5,857	0	MicroBooNE
Intensity Frontier	500	0	0	Reactor Neutrino Detector at Daya Bay
Intensity Frontier	1,030	5,000	8,000	Belle II
Intensity Frontier	0	5,850	9,000	Muon g-2 Experiment
Cosmic Frontier	1,500	1,500	0	HAWC
Cosmic Frontier	5,500	8,000	22,000	Large Synoptic Survey Telescope (LSST) Camera
TOTAL MIE's	**55,770**	**45,687**	**39,000**	

HEP Physics Construction Funding

Funding (in $K)	FY 2012 Actual	FY 2013 July	FY 2014 Request
Construction - TPC	**53,000**	**28,388**	**45,000**
Long Baseline Neutrino Experiment	**21,000**	**17,888**	**10,000**
TEC	4,000	3,781	0
OPC	17,000	14,107	10,000
TPC	21,000	17,888	10,000
Muon to Electron Conversion Experiment	**32,000**	**10,500**	**35,000**
TEC	24,000	8,000	35,000
OPC	8,000	2,500	0
TPC	32,000	10,500	35,000

TEC = Total Estimated Cost (refers to Capital Equipment expenses)
OPC = Other Project Costs
TPC = Total Project Cost

HEP Energy Frontier

Funding (in $K)	FY 2012 Actual	FY 2013 July Plan	FY 2014 Request	Comment
Research	**91,757**	**86,172**	**96,129**[a]	Tevatron ramp-down offset by R&D for LHC detector upgrades
Facilities	**68,240**	**61,992**	**58,558**	
LHC Detector Ops	64,846[b]	56,912	56,774	LHC down for maintenance
LHC Upgrade Project	0	3,000	0	LHC detector upgrades (OPC)
Other	3,394	2,080	1,784	IPAs, Detailees, Reviews
TOTAL, Energy Frontier:	**159,997**	**148,164**	**154,687**	

OPC = Other Project Costs

[a] **Includes $12M (= $6M CMS + $6M ATLAS) Phase-1 detector upgrades [R&D]; Therefore, Energy Frontier Core Research FY14 Request = 84,129k**

[b] **Per interagency MOU, HEP provided LHC Detector Ops funding during FY12 CR to offset NSF contributions to Homestake de-watering activities.**

HEP Intensity Frontier

Funding (in $K)	FY 2012 Actual	FY 2013 July Plan	FY 2014 Request	Comment
Research	**53,261**	**52,108**	**53,562**	Ramp-down of B-factory research offset by increased support for new initiatives
Facilities	**143,844**	**172,318**	**180,481**	
Expt Ops	6,615	7,354	7,245	Offshore and Offsite Ops
Fermi Ops	119,544	143,128	156,438	Accelerator and Infrastructure improvements
B-factory Ops	10,031	5,654	4,600	Completion of BaBar D&D
*Homestake**	5,478	14,000	10,000	
Other	2,176	2,182	2,198	GPE and Waste Mgmt
Projects	**86,750**	**62,794**	**37,000**	
Current	73,770	52,794	27,000	NOνA + MicroBooNE ramp-down
Future R&D	12,880	10,000	10,000	
TOTAL, Intensity Frontier	**283,675**	**287,220**	**271,043**	

***Per interagency MOU, HEP provided LHC Detector Ops funding during FY12 CR to offset NSF contributions to Homestake dewatering activities.**

HEP Cosmic Frontier

Funding (in $K)	FY 2012 Actual	FY 2013 July Plan	FY 2014 Request	Comment
Research	**47,840**	**48,836**	**62,364**	R&D for G2 Dark Matter
Facilities	**11,207**	**10,948**	**12,022**	Offshore and offsite Ops
Projects	**12,893**	**19,159**	**24,694**	
Current	9,153	9,500	23,200	LSSTcam fabrication begins
Future R&D	3,380	9,659	1,484	Dark energy and dark matter projects move to conceptual design
TOTAL, Cosmic Frontier	**71,940**	**78,943**	**99,080**	

HEP Theory and Computation

Funding (in $K)	FY 2012 Actual	FY 2013 July Plan	FY 2014 Request	Comment
Research	**64,465**	**63,198**	**59,670**	
HEP Theory	55,929	54,621	51,196	Follows programmatic reductions in Research
Computational HEP	8,536	8,577	8,474	
Projects	**2,500**	**3,200**	**3,200**	Lattice QCD hardware
TOTAL, Theory and Comp.	**66,965**	**66,398**	**62,870**	

HEP Advanced Technology R&D

Funding (in $K)	FY 2012 Actual	FY 2013 July Plan	FY 2014 Request	Comment
Research	**134,006**	**111,888**	**105,303**	
General Accel. R&D	59,280	61,791	57,856	Selected long-term R&D moves to Accelerator Stewardship
Directed Accel. R&D	46,587	22,692	23,500	Completion of ILC R&D
Detector R&D	28,139	27,405	23,947	Funding for liquid argon R&D is reduced
Facility Operations	**23,100**	**19,997**	**17,150**	Completing SRF infrastructure at Fermilab
TOTAL, Advanced Technology R&D	**157,106**	**131,885**	**122,453**	

- **$24M originally set aside for Generic Detector R&D**
- **FY10-FY13 higher with infusion from ARRA, CDRD, Liquid Ar R&D**
- **Fraction of the University grants = ~1/8 of Det R&D over recent years**
  - **Plan is to try keeping it near last year's level of $3.2M.**

Accelerator Stewardship

Funding (in $K)	FY 2012 Actual	FY 2013 July Plan	FY 2014 Request	Comment
Research	0	82	6,581	Recast of Accelerator R&D activities relevant to broader impacts
Facility Operations	2,850	3,050	3,350	Incremental FACET ops for stewardship research
TOTAL, Accel. Stewardship	2,850	3,132	9,931	

DOE HEP Organization

Office of High Energy Physics

James Siegrist (IPA)
Sherry Pepper-Roby

Eric Colby (IPA)

HEP Budget and Planning

Donna Gilbert
Dean Oyler
John Boger
Larry Price (Detailee)

HEP Operations

Kathy Yarmas

Research & Technology Division

Glen Crawford
Janice Hannan
Kristi Naehr
Christie Ashton
Wanda Morris

Physics Research

- Energy Frontier – **Abid Patwa**, **David Boehnlein (IPA)**, **James Stone (IPA)**
- Intensity Frontier – **Alan Stone**, **Tim Bolton (IPA)**
- Cosmic Frontier – **Kathy Turner**, **Michael Salamon**
- Theoretical Physics – **Simona Rolli**

Research Technology

- General Accelerator R&D – **L.K. Len**, **John Boger**, **Eric Colby (IPA)**, **Ken Marken**, **Michael Zisman (Detailee)**
- Detector R&D – **Glen Crawford (Acting)**, **Peter Kim (Detailee)**
- Computational HEP – **Lali Chatterjee**, **Larry Price (Detailee)**
- SBIR/STTR – **Ken Marken**

Facilities Division

Mike Procario
Vera Bibbs

Facility Operations

- Fermilab Complex – **John Kogut**
- LHC Operations – **Simona Rolli**, **James Stone (IPA)**
- Other Operations (SLAC/Other Labs) – **John Kogut**

Facilities Development

- LARP – **Bruce Strauss**
- Muon Accelerator (MAP) – **Bruce Strauss**

Instrumentation & Major Systems

- NOvA – **Ted Lavine**
- MicroBooNE – **Ted Lavine**
- Mu2e – **Ted Lavine**
- LSSTcam – **Helmut Marsiske**
- APUL – **Bruce Strauss**
- LBNE – **Mike Procario**
- Belle-II – **Helmut Marsiske**
- CMS Upgrade – **Simona Rolli**
- ATLAS Upgrade – **Simona Rolli**
- DESI – **Kathy Turner**
- Muon g-2 – **Ted Lavine**
- Dark Matter G2 – **Helmut Marsiske**

FY14 HEP Comparative Review FOA

- **DE-FOA-0000948**
  - Issued June 14, 2013
- **Six HEP research subprograms**
  - Energy, Intensity, and Cosmic Frontiers
  - HEP Theory
  - Accelerator Science and Technology R&D
  - Particle Detector R&D

☑ **Letter of Intent due July 15, 2013 by 5 PM Eastern Time**
  - Strongly encouraged
- **Final Proposal (*i.e.,* Application) deadline Sept. 9, 2013 by 11:59 PM Eastern Time**

FINANCIAL ASSISTANCE
FUNDING OPPORTUNITY ANNOUNCEMENT

U. S. Department of Energy
Office of Science
Office of High Energy Physics

FY2014 Research Opportunities in High Energy Physics

Funding Opportunity Number: DE-FOA-0000948
Announcement Type: Initial
CFDA Number: 81.049

Issue Date:	June 14, 2013
Letter of Intent Due Date:	July 15, 2013, at 5 PM Eastern Time (A Letter of Intent is encouraged)
Application Due Date:	September 9, 2013, at 11:59 PM Eastern Time

http://science.energy.gov/hep/funding-opportunities/

Early Career: Next Round in FY14

- **FY14 FOA [DE-FOA-0000958] posted on July 23, 2013 at the Early Career website:**
  - http://science.energy.gov/early-career/
- **Read the FY14 FAQ, also on above web site**
  - Addresses most of the common Q&A collected over the last 4 years
- **Features of FY14**
  - Entering 5th year
    - Some population of candidates will no longer be eligible due to the "3-strikes rule"
  - Mandatory Pre-application requirement. Two pages.
    - Deadline: September 5, 2013, 5 PM Eastern
    - All interested PIs encouraged to register as soon as possible in DOE SC Portfolio Analysis and Management System (PAMS) for submission [link provided in EC website]
  - Full proposals due: November 19, 2013, 5 PM Eastern
    - Candidates will have more than 3 months to develop a plan, write a narrative, and submit an application
- **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/

FY13 HEP Early Career Awards

Theory

- Stefan Hoeche (SLAC) "High Precision Event Simulation for the LHC"
- Clifford Cheung (California Institute of Technology) "The Higgs Frontier"
- Andrew Tolley (Case Western Reserve University) "Exploring the Fundamental Origin of Cosmic Acceleration"

Cosmic

- Clarence Chang (ANL) "Exploring Fundamental Physics through New Measurements of the Cosmic Microwave Background Polarization"
- Adam Bolton (University of Utah) "Integrating Advanced Software and Statistical Methods for Spectroscopic Dark-Energy Surveys"

Accelerator

- Matthew Jewell (University of Wisconsin Eau Claire) "Mechanical Performance of HTS Superconductor for HEP Applications"

Energy

- Toyoko Orimoto (Northeastern University) "Search for the Higgs and Physics Beyond the Standard Model with the CMS Electromagnetic Calorimeter"
- Andrew Ivanov (Kansas State University) "Quest for a Top Quark Partner and Upgrade of the Pixel Detector Readout Chain at the CMS"

Intensity

- Jelena Maricic (University of Hawaii) "Resolving Reactor Antineutrino Anomaly with Strong Antineutrino Source" *[funded by HEP and DOE Experimental Program to Stimulate Competitive Research (EPSCoR)]*

Snowmass Young: Redux (I)

- 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, etc.
  - Service work for community is also valued, e.g. co-chairing a conference committee or serving on an NSF review panel
- 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
- HEPAP: High Energy Physics Advisory Panel
  - Meets ~3 times/year
  - Open meeting in DC area
    - Sept 5-6 2013 @ NSF
  - Prof. Andy Lankford (Chair)
  - Know your reps!
- P5. Particle Physics Project Prioritization Panel
  - Nomination period ended and selection process begins
  - Stay informed. Follow the town halls. Learn the membership. Ask questions. Provide feedback.
- Demographics.
- HEP Organization

Snowmass Young: Redux (II)

- 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) would benefit from developing a short-, mid- and long-term research plan
  - Balance research between ongoing experiment, upgrades and R&D with future experiment
- Starting Assistant Prof. at University will most likely continue research from most recent post-doc position
  - Will you be working on that same experiment in 5 years? How about 10 years?
  - Optimize your start-up funds by expanding your research portfolio
- Are you up to the challenge to get involved early and help deliver projects like LBNE and LSST to successful completion?
  - Don't expect people to come knocking on your door.
  - Sometimes it is about showing up.
  - Often you have to earn trust and gain credibility.
- This is HARD work!
  - You are doing cutting edge high energy particle physics
  - The competition for jobs at all levels in HEP is still very high.
  - It is not about the money.
  - It's about the SCIENCE!

Major Recommendations of 2008 Advisory Panel (P5)

- The panel recommends that the US maintain a leadership role in world-wide particle physics. The panel recommends a strong, integrated research program at the three frontiers of the field: the Energy Frontier, the Intensity Frontier and the Cosmic Frontier.
- The panel recommends support for the US LHC program, including US involvement in the planned detector and accelerator upgrades (highest priority)
- The panel recommends a world-class neutrino program as a core component of the US program, with the long-term vision of a large detector in the proposed DUSEL and a high-intensity neutrino source at Fermilab.
  - LBNE CD-0 received Jan 2010, and CD-1 received Dec 2012.
- The panel recommends funding for measurements of rare processes to an extent depending on the funding levels available… (Mu2e at FNAL, U.S. Belle II detector upgrade).
  - Mu2e CD-0 received Nov 2009, and CD-1 received July 2012.
  - Belle II CD-0 received Aug 2011, and CD-1 received July 2012.
- The panel recommends support for the study of dark matter and dark energy as an integral part of the US particle physics program.
- The panel recommends a broad strategic program in accelerator R&D, including work …, along with support of basic accelerator science.
- These are still relevant, and this is still the plan.

Joint Agency Letter to the Community

- Fundamentally…[planning] is a multi-step process with several important milestones over the coming year, and each step will inform and prepare for the next.
  1. HEP Facilities Subpanel: Advise DOE/SC mgmt. on the scientific impact and technical maturity of planned and proposed SC Facilities, in order to develop a coherent 10-yr SC facilities plan
     - Subpanel can add or subtract from initial facilities list
     - Does not exclude/pre-empt later additions
  2. DPF/CSS2013 "Snowmass": identify compelling HEP science opportunities over an approximately 20 year time frame.
     - Not a prioritization but can make scientific judgments
  3. HEPAP/P5: Develop new strategic plan and priorities for US HEP in various funding scenarios, using input from #1 and 2 above (among others)

Public Policy Priorities for 2013

Public's Policy Priorities for 2013

% saying each is a "top priority" for president and Congress this year	4 years ago Jan 2009 %	1 year ago Jan 2012 %	Now Jan 2013 %	4-year chg
Strengthening economy	85	86	86	+1
Improving job situation	82	82	79	-3
Reducing budget deficit	53	69	72	**+19**
Defending against terrorism	76	69	71	-5
Making Social Security financially sound	63	68	70	**+7**
Improving education	61	65	70	**+9**
Making Medicare financially sound	60	61	65	+5
Reducing health costs	59	60	63	+4
Helping poor and needy	50	52	57	**+7**
Reducing crime	46	48	55	**+9**
Reforming tax system	--	--	52	--
Protecting environment	41	43	52	**+11**
Dealing w/ energy problem	60	52	45	**-15**
Reducing influence of lobbyists	36	40	44	**+8**
Strengthening the military	44	39	41	-3
Dealing w/moral breakdown	45	44	40	-5
Dealing w/ illegal immigration	41	39	39	-2
Strengthening gun laws	--	--	37	--
Dealing w/ global trade	31	38	31	0
Improving infrastructure	--	30	30	--
Dealing w/ global warming	30	25	28	-2

PEW RESEARCH CENTER Jan. 9-13, 2013. Significant differences in **bold**.

Widest Partisan Gaps Over Environment, Gun Control, Health Care

% considering each as a "top priority"	Rep %	Dem %	Ind %	R-D diff
Protecting the environment	32	69	49	**-37**
Strengthening gun control laws	22	56	32	**-34**
Reducing health care costs	46	79	63	**-33**
Dealing with problems of the poor	46	71	53	**-25**
Dealing with global warming	13	38	31	**-25**
Reducing crime	44	63	55	**-19**
Improving educational system	64	80	68	**-16**
Improving roads, bridges, transportation	24	36	29	**-12**
Making Medicare financially sound	62	73	61	**-11**
Reducing the influence of lobbyists	39	49	43	-10
Reforming nation's tax system	48	57	51	-9
Improving job situation	77	84	75	-7
Dealing with global trade	30	33	30	-3
Strengthening nation's economy	89	89	84	0
Dealing with nation's energy problem	45	45	46	0
Making Social Security financially sound	74	72	67	+2
Defending against terrorism	80	72	64	+8
Dealing with illegal immigration	44	35	40	+9
Dealing with moral breakdown	50	34	40	**+16**
Reducing budget deficit	84	67	71	**+17**
Strengthening the military	58	31	38	**+27**

PEW RESEARCH CENTER Jan. 9-13, 2013. Q30. Significant differences in **bold**.

Peanuts. Nov 1956.