U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
SUBCOMMITTEE ON ENERGY

A Review of the P5: The U.S. Vision for Particle Physics After Discovery of the Higgs Boson

CHARTER

Tuesday, June 10, 2014
10:00 a.m. – 12:00 p.m.
2318 Rayburn House Office Building

Purpose

The Subcommittee on Energy of the House Committee on Science, Space, and Technology will hold a hearing entitled, *A Review of the P5: The U.S. Vision for Particle Physics After Discovery of the Higgs Boson*, at 10:00 a.m. on Tuesday, June 10^{th}. This hearing will examine the Particle Physics Project Prioritization Panel's (P5's) strategic plan for United States' particle physics vis-à-vis other countries just released last month. The P5 report presents a strategy for the next decade and beyond that enables discovery and maintains the United States' position as a global leader in physical sciences through specific investments by the Department of Energy's (DOE's) Office of Science and the National Science Foundation (NSF). The full report and summaries are available at http://usparticlephysics.org/p5/.

Witnesses

- **Dr. Steve Ritz,** *P5 Chair and Professor, University of California, Santa Cruz*
- **Dr. Persis Drell,** *Director Emerita, SLAC National Accelerator Laboratory*
- **Dr. Nigel Lockyer,** *Director, Fermi National Accelerator Laboratory*
- **Dr. Natalie Roe,** *Director, Physics Division, Lawrence Berkley National Laboratory*

Background

Particle physics is discovery-driven science that explores the fundamentals of matter and energy and reveals the profound connections underlying everything in existence, including the smallest and largest structures in the known universe. On the smallest scale, quarks are the most fundamental forms of matter known. Hadrons are composed of various combinations of quarks, and hadrons then form atomic particles like protons, electrons, and neutrons. On the largest scale, the current hypothesis using the standard model of cosmology is that only 5% of the known physical universe is comprised of such ordinary matter. The rest of the universe is comprised of dark matter and dark energy.

This fundamental, scientific research requires state-of-the-art, world-class facilities. Much has changed in this field since the previous P5 strategic planning report in 2008, including the discovery of the Higgs boson in 2012. Therefore, DOE and NSF charged a new P5 to provide "an updated strategic plan for the U.S. that can be executed over a ten-year timescale, in the context of a twenty-year global vision for the field."

After a comprehensive study, the P5 report has identified five intertwined Scientific Drivers that show promise over the next 20 years:

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

The P5 developed two sets of criteria for its prioritization process, one for optimization of the U.S. particle physics program and the other for the evaluation of individual projects.[1] The program optimization criteria focus on the scientific goals, opportunities for the U.S. to host leading international facilities, and sustained productivity. The individual project criteria focus on the following: (1) science; (2) timing; (3) uniqueness; (4) cost vs. value; (5) historic context; (6) feasibility; and (7) potential for U.S. particle physics leadership.

The P5 recommends the following levels of engagements:

- Large projects, in time order, include: 1) the Muon g-2 and Muon-to-electron Conversion (Mu2e) experiments at Fermilab (for more information, see: http://mu2e.fnal.gov/); 2) strong collaboration in the high-luminosity upgrades to the Large Hadron Collider (for more information, see: http://home.web.cern.ch/topics/large-hadron-collider); and 3) U.S.-hosted Long Baseline Neutrino Facility (LBNF) that receives the world's highest intensity neutrino beam from an improved accelerator complex (PIP-II) at Fermilab (for more information, see: http://lbne.fnal.gov/).
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- U.S. involvement in a Japanese-hosted International Linear Collider (ILC), should it proceed, with stronger participation in more favorable budget scenarios. For more information, see: http://www.linearcollider.org/ILC/What-is-the-ILC/The-project.

- Areas with clear U.S. leadership in which investments in medium and small-scale experiments have great promise for near-term discovery of direct detection of dark matter and dark energy, including the NSF's Large Synoptic Survey Telescope (LSST) (see http://www.lsst.org/lsst/), DoE Office of Science Dark Energy Spectroscopic Instrument (see http://desi.lbl.gov/), cosmic microwave background experiments, and a portfolio of small projects that includes short-baseline neutrino experiments.

- Specific investments in particle accelerator, instrumentation, and computing research and development are required to support the program and to ensure the long-term productivity of the field.

Funding

The funding for High Energy Physics is coordinated through DOE's Office of Science (SC). The FY 2015 Administration's proposal calls for a net decrease of (-6.6%) from the FY2014 enacted level of $797 million.

Additional Reading

1. *Building for Discovery*, Strategic Plan for U.S. Particle Physics in the Global Context, Report of the Particle Physics Project Prioritization Panel May 2014. See http://usparticlephysics.org/p5/.

2. *Together to the Next Frontier*, by Nigel Lockyer, Director of Fermi Laboratories, Nature, December 2013. See: http://www.nature.com/news/particle-physics-together-to-the-next-frontier-1.14364