



U.S. DEPARTMENT OF
ENERGY

Office of
Science

DOE Neutrino Program Plans

Glen Crawford

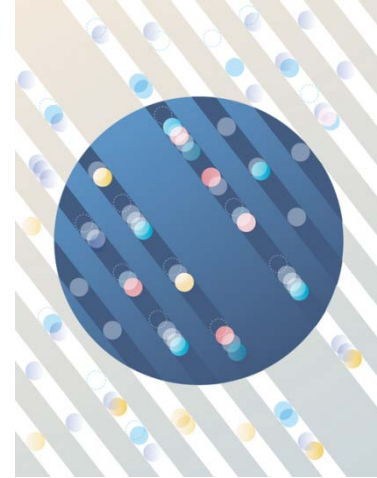
Director, Research and Technology R&D

Office of High Energy Physics

Office of Science, U.S. Department of Energy

P5 Neutrino Program Recommendations

- Pursue the physics associated with neutrino mass
- Several significant changes in direction are recommended:
 - Reformulate the long-baseline neutrino program as an internationally designed, coordinated, and funded program with Fermilab as host.
 - Redirect specific activities and efforts at Fermilab to the PIP-II program of improvements to the accelerator complex, which will provide proton beams with power greater than one megawatt by the time of first operation of the new long-baseline neutrino facility.
- **Recommendation 12: In collaboration with international partners, develop a coherent short- and long-baseline neutrino program hosted at Fermilab.**
 - **Fermilab has started this process, with our encouragement**



P5 Short-Baseline Neutrino Recommendations

- **Recommendation 15: Select and perform in the short term a set of small-scale short baseline experiments that can conclusively address experimental hints of physics beyond the three-neutrino paradigm. Some of these experiments should use liquid argon to advance the technology and build the international community for LBNF at Fermilab.**
 - A large fraction of the world's neutrino program will move to the U.S.
 - The worldwide neutrino community will see the U.S. as the place to do their physics



DOE Process for Intermediate Neutrino Program

- **P5 recommended both:**
 - LBNF as top midterm priority major project
 - A balanced and coherent program of short baseline neutrino experiments including small projects
- **Plans for LBNF are moving along well and are described in the Fermilab talk immediately preceding**
 - This talk will focus on the latter, near-term item above
- **The FNAL short baseline program using the Booster Neutrino Beam is well advanced in planning stages and will be evaluated by the FNAL PAC in January**
- **However, there are many other possible short baseline neutrino experiments using other facilities, with and without accelerator beams**
 - Many R&D efforts underway at various stages of development
- **DOE is interested in understanding these various options and plans in more detail**
 - Community workshop February 4-6, 2015 at Brookhaven
 - Followed by a possible call for proposals



Workshop Info.

- **Workshop on the Intermediate Neutrino Program**
 - February 4-6, 2015
 - Brookhaven National Laboratory
 - www.bnl.gov/winp
- **Agenda will include:**
 - Talks from agencies
 - Lots of physics working groups on various neutrino topics
- **Early registration deadline January 9**



WINP2015

Workshop on
the Intermediate
Neutrino Program

February 4-6, 2015

Brookhaven National Laboratory

www.bnl.gov/winp

Scientific Advisory Committee

Ed Blucher (Chicago), Bonnie Fleming (Yale), Alberto Guglielmi (INFN), Karsten Heeger (Yale), Steve Kettell (BNL), Josh Klein (U. Penn), Jonathan Link (Virginia Tech), David Lissauer (BNL), Joe Lykken (FNAL), Marzio Nessi (CERN), Gina Ramelka (FNAL), Kate Schoenberg (Duke), Mike Shaevitz (Columbia), Greg Sullivan (UMD), Bob Svoboda (UC Davis), Mark Thomson (Cambridge), Peter Wilson (FNAL)

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Topics

Sterile Neutrinos
Neutrino Mixing
Neutrino Interactions
Neutrino Properties
Precision SM Tests
Astrophysical Neutrinos
Research & Development

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DOE Process for Short-baseline Neutrinos

- Planning for the workshop includes input from NSF and DOE NP as well including PIs supported by those programs
 - See www.bnl.gov/winp for more info
- The workshop gives us the opportunity, in particular, to hear community ideas for other near term (less than 5 year) small projects (less than ~\$10M) that are:
 - Scientifically compelling
 - Competitive in the world program
 - Small enough in scope and technically ready
- Based on the information gleaned from the workshop and available funds we may announce a new funding opportunity (FOA) for such small projects later in 2015
 - Specific objectives and requirements would be called out in the FOA



Other Elements of DOE Neutrino program

- There will be many good ideas that do not fit into the funding or schedule constraints discussed above and we are interested in those, as well
 - For example, there are also important issues to address in technology R&D for future experiments and theory support for the broad neutrino program
 - Reports from the working groups will be helpful in addressing these issues
- Possible funding for such efforts will be dealt with through the usual proposal process. There may be additional opportunities for partnerships or other collaborative funding.

BACKUP



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Measuring Neutrino Properties

- **Neutrinos are neutral and only interact via the weak force**
 - Experiments need to generate a huge number of neutrinos
 - Nuclear power plants produce antineutrinos in all directions
 - Powerful accelerators can produce copious amounts of neutrinos and antineutrinos in a directed beam to a neutrino detector
 - Experiments need very large and sensitive detectors
 - Hundreds to thousands of tons of mass help allow a neutrino interaction
 - High detector sensitivity helps record rare interactions, when they occur
- **Neutrinos are known to change types as they travel and it is not clear if there is a difference in the way neutrinos and antineutrinos interact**
 - It takes some time (distance) for neutrinos to change types (oscillate)
 - Optimal distance depends on the properties of the neutrino source
 - Some measurements require hundreds of miles between source and detector
 - Accelerators required to study difference between neutrino & antineutrino
- **Understanding the complex physics of neutrinos requires a complementary set of experiments with different sources and detectors**

