



Department of Energy  
Office of Science  
Washington, DC 20585

Office of the Director

February 28, 2011

Dr. Jay Marx  
Executive Director, LIGO Laboratory  
California Institute of Technology  
Pasadena, California 91125

Mr. Mark Reichanadter  
Deputy Chief Operating Officer  
Deputy ALD for Laboratory Operations  
SLAC National Accelerator Laboratory  
2575 Sand Hill Road  
Menlo Park, California 94025

Dear Dr. Marx and Mr. Reichanadter:

I request that you organize and lead a review to help define cost-effective options for utilizing the planned Deep Underground Science and Engineering Laboratory (DUSEL) at the Homestake Mine in Lead, South Dakota, for future particle and nuclear physics experiments of interest to DOE. The purpose of the review is to assess cost and schedule estimates for deploying experiments described below, using existing studies and available information.

The Department of Energy (DOE) Office of Science (SC) High Energy Physics (HEP) and Nuclear Physics (NP) programs are planning investments in underground science to study CP violation in the neutrino sector, the origin of Dark Matter, and the neutrino mass and mass hierarchy. Following the Nuclear Science Advisory Committee (NSAC) Long Range Plan in 2007 and the High Energy Physics Advisory Panel (HEPAP) Particle Physics Project Prioritization Panel roadmap in 2008, DOE and the National Science Foundation (NSF) jointly pursued the concept for DUSEL. However, in December 2010, the National Science Board declined a proposal to provide further NSF support for development of DUSEL under the existing DOE/NSF stewardship model. In light of this development, DOE intends to review cost and schedule information, as well as setting and staging alternatives to consider cost-effective options for implementing a world-class program of underground science assuming only DOE resources. The findings of the review are needed to inform DOE budget planning for FY 2013 and beyond. For that reason and because of the urgent need to determine the future of activities already in progress, the focus of the review will be confined to experiments and associated underground infrastructure already within the envelope of current DOE planning for the DUSEL research program.



In carrying-out this charge, the review committee is requested to review input solicited by DOE HEP and NP program offices from the Long Baseline Neutrino Experiment; from representative dark matter and neutrino-less double beta decay experiments which bracket the range of expected costs; from the NSF supported DUSEL Project Team; from the Sanford Laboratory and the Sudbury Neutrino Observatory. DOE HEP and NP programs will request, from each entity, information such as location, science objectives, cost and schedule estimate ranges, construction duration, and annual operating costs. Based on this input and additional information that may be required, the committee is asked to assess and comment on the options, encompassing design, construction, and operations costs, for the following scenarios:

**At the Homestake Mine:**

1. A long baseline neutrino experiment using water Cerenkov detectors located on the 4850 ft. level near the existing Sanford Laboratory's Davis Campus;
2. A long baseline neutrino experiment using LAr detectors located at a shallow campus (800 ft. level ), including the resources need to carry out a program of R&D necessary to prove the scalability of LAr technology to 17 kilotons;
3. A third generation dark matter experiment located on the 4850 ft. level.
4. A ton-scale neutrino-less double beta decay experiment located on the 4850 ft. level.
5. A third generation dark matter experiment located on the 7400 ft. level.
6. A ton-scale neutrino-less double beta decay experiment located on the 7400 ft. level.

**At the Sudbury Neutrino Observatory:**

7. A third generation dark matter experiment located at the Sudbury Neutrino Observatory
8. A ton-scale neutrino-less double beta decay experiment located at the Sudbury Neutrino Observatory

An example of the desired cost and schedule table for each option is attached. In carrying out this assessment, please indicate, by experiment, which facility is both viable and provides the most cost-effective option taking into account economies that may be lost by utilizing more than one site.

Dr. Timothy Hallman, Associate Director of the Office of Science for Nuclear Physics will serve as the primary DOE point of contact and will work closely with you as necessary to plan and carry out this review. I would appreciate receiving your committee's report by May 25, 2011.

Sincerely,



W. F. Brinkman  
Director, Office of Science

Enclosure

cc:

S. Koonin, S-4  
P. Dehmer, SC-2  
P. Oddone, FNAL  
S. Vigdor, BNL  
NSF staff (TBD)  
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N. Smith, SNO  
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B. Harlan, Sanford Lab  
Tony Venhuizen, Ofc. of Gov. SD  
J. Strait, Fermilab

**Example Cost and Schedule Table:**

**Review of DUSEL Cost Effective Options**

**Experiment**

**Location**

**Science Goal**

**Cost Range (\$2011)**

**Construction Duration (years)**

**Annual Operating Costs (\$2011)**

**Comments on Cost and Schedule**

**Discussion**