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August 18, 2006

Dr. Robin Staffin  
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Office of Science  
Department of Energy

Dr. Judith Sunley  
Acting Assistant Director  
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Dear Robin and Judith:

I am writing to summarize the meeting of the High Energy Physics Advisory Panel (HEPAP) held in Washington on July 6-7. On the first day, we heard reports from a number of HEPAP subpanels as well as external committees. On the second day, we focused on the status of International Linear Collider research and development.

The meeting began with a presentation by Harold Shapiro on behalf of the National Academies' Committee on Elementary Particle Physics in the 21<sup>st</sup> Century (EPP2010). Its report, "Revealing the Hidden Nature of Space and Time: Charting the Course for Elementary Particle Physics", presents a compelling scientific case with a clear set of priorities. It sees the danger that the United States will cease to be among the world leaders in the field when the Tevatron and B-Factory programs come to an end toward the end of this decade. It proposes a strategy to advance the field and maintain a leadership position for the U.S. This includes full participation in the LHC program, which will first explore the Terascale. Central to the plan is vigorous R&D toward the International Linear Collider and preparation for a bid to host it in the United States. The report also stresses the importance of a diverse program that would include studies of dark energy, dark matter, and neutrinos. HEPAP is grateful to the members of the Committee, especially those not from the particle physics community, for this vital report. The EPP2010 vision is exciting, one that HEPAP strongly supports.

Robin Staffin described the status of the FY07 budget process. HEPAP is very disappointed with the action taken in the Senate Energy and Water Appropriations Subcommittee with regard to both ILC R&D and HEP theory. We support the President's DOE OHEP budget, which is consistent with the recommendations of the EPP2010 committee. The requested ILC R&D funds are needed to develop, within the international context, a reliable cost estimate that is as low as possible as well as to advance industrialization within the U.S. This would permit a construction decision following the discovery of exciting new phenomena at the LHC. HEPAP is shocked by the 15% reduction in funds for elementary particle theory. This would seriously disrupt important theoretical research being carried out at universities and national laboratories across the U.S. just when additional theoretical work will be needed to understand the experimental results from the LHC.

Robin Staffin also noted the recent Senate confirmation of Ray Orbach as the first DOE Under Secretary for Science. This is recognition of the importance of scientific research in the Department of Energy portfolio. HEPAP is very pleased that Ray will oversee the scientific enterprise across the DOE.

In response to a question, Robin said that support for the Double Chooz reactor neutrino experiment is possible if the Daya Bay project in China gets off to a good start.

Joe Dehmer gave an update on the Deep Underground Science and Engineering Laboratory (DUSEL). DUSEL would provide a new facility for large experiments that must be deep underground in order to reduce sources of background. In elementary particle physics, DUSEL would be a natural location for experiments to search for neutrinoless double-beta decay and the interaction of dark-matter particles. Both of these are important projects that will be part of the roadmap that the Particle Physics Project Prioritization Panel (P5) will present at the October HEPAP meeting. HEPAP is pleased that DUSEL is on schedule for site selection in April, 2007, and a baseline-reviewed package for the Major Research Equipment and Facilities Construction (MREFC) panel in early 2008.

Jay Marx presented the final report of the Advanced Accelerator Research and Development subpanel. It assessed the needs for sustaining and strengthening accelerator science for the benefit of particle physics, other sciences, and the nation. To make future very high energy accelerators possible, new technologies must be developed that significantly decrease the cost per GeV of energy. Short-, medium-, and long-term R&D require stable funding, modernization of infrastructure, and well-trained new researchers. The report makes recommendations for improving all of these as well as agency management of the program. Of particular concern for the subpanel is the state of long-term, fundamental R&D on superconducting RF, an important technology that will likely have many applications in the future. For a healthy program, funding in this area should be increased. HEPAP unanimously approved the report, recognizing that effective accelerator R&D is essential to the future of particle physics. We look forward to hearing an implementation plan in the future.

Rocky Kolb presented the report of the Dark Energy Task Force (DETF). The observation that the universe is accelerating is arguably the most important physics discovery in the past decade. At present there is no convincing explanation of this phenomenon. Progress towards its understanding must come from experimental observations. Multiple techniques should be employed to reduce the effect of systematic uncertainties and the dependence on cosmological parameters. DETF recommends an aggressive program to explore dark energy including one or more near-term Stage III projects as well as one or more Stage IV projects to get a factor of ten more sensitivity than current experiments. The former will provide early important information about dark energy and help guide the execution of later experiments. The latter would be major scientific undertakings that require significant R&D prior to a construction decision. HEPAP, which is excited by this science, unanimously approved the DETF report.

Abe Seiden presented an interim report of the Particle Physics Project Prioritization Panel (P5). P5 is charged with producing a prioritized roadmap for the field to cover the next decade, which HEPAP looks forward to seeing at its October meeting. The interim report gives a recommendation on the FY08 running of the SLAC B-Factory. To put this decision into context, P5 looked broadly at the FY08 DOE OHEP program. The subpanel recommends operating the B-Factory. It also strongly supports the physics program at the energy frontier, the LHC and ILC R&D. It recommended starts

for the Dark Energy Survey (DES), the 25-kilogram Cold Dark Matter Search (CDMS) experiment, and the Daya Bay reactor neutrino experiment once it passes scientific and technical reviews. It also recommends a construction start for the NOvA neutrino oscillation experiment at Fermilab and moving the Large Synoptic Survey Telescope (LSST) and the SuperNova/Acceleration Probe (SNAP) to Preliminary Design Stage and CD2 status respectively. These initiatives are consistent with the EPP2010 priorities and desired diversity. The interim report was approved by HEPAP without dissent.

Eugene Beier gave a status report on the work of the Neutrino Scientific Assessment Group (NuSAG) toward its latest charge, assessing within the international context next-generation neutrino detector configurations that could be used with a megawatt-class proton accelerator. There is underway a Workshop on Long Baseline Neutrino Experiments organized by Brookhaven National Laboratory and Fermilab. NuSAG sent the Workshop a set of questions whose answers would provide quantitative input for addressing the NuSAG charge. The use of a consistent set of assumptions and methodologies will provide meaningful comparisons of wide- vs. narrow-band beams and different detector technologies. The next meeting of NuSAG should be in early autumn, after the Workshop report is written. HEPAP expects to get the NuSAG report for its winter meeting.

Guy Wormser reported on the recent work of the CERN Council Planning Group. He described the complex European political and financial structures for elementary particle physics and astrophysics. The CERN Council has two roles, responsibility for CERN and the broad strategy for European particle physics. The relation and differentiation of these functions are currently being discussed. Important for the future is further developing the cooperative relationship between Europe and the U.S. To enhance the probability of a significant European contribution to a major new accelerator in the U.S., Guy suggested that the U.S. participate in the relatively inexpensive upgrade of the LHC to higher luminosity (SLHC). HEPAP is grateful for Guy's insight into the European planning process and looks forward to his report at the October HEPAP meeting on the CERN Council Planning Group's final prioritization of future projects.

Jonathan Bagger informed HEPAP of a proposal to create a prestigious fellowship program for postdocs, graduate students, and perhaps junior faculty doing important theoretical work in preparation for LHC data. It would be similar to the Hubble and SSC Fellowship programs. Fellows could work together through a virtual institute using collaborative tools. Comments and suggestions are welcome by the steering committee chaired by Paul Langacker.

There were four presentations on the International Linear Collider (ILC). Barry Barish gave an overview of the Global Design Effort (GDE). He expects the draft Reference Design Report (RDR) to be ready by the end of 2006, with the final document distributed roughly six months later. The GDE created an ideal ILC R&D program, prioritized the approximately 400 items, and found most of the critical items are being done at present. This list is being used to develop the US R&D program.

Gerry Dugan described the GDE effort within the Americas. The work is broken down into work packages documented in Memoranda of Understanding. This year the expenditures total \$30M with additional infrastructure support from the laboratories. Most of the Office of Science and NSF laboratories are participating in ILC R&D. Requests for FY07 total \$105M, compared to \$60M in the President's budget. Prioritization is being done so that the most critical projects are carried out within the available resources. HEPAP is pleased by the commitment to both the RDR and R&D as well as the effort to align U.S. R&D to the overall GDE R&D goals.

Paul Grannis spoke about U.S. activities in preparation for a possible bid to host the ILC. This includes developing industrial capabilities, setting up test facilities, and investigating site geology. The plan is being developed by the Linear Collider Steering Group for the Americas (LCSGA) and the Americas Regional Team. Anticipating a question from HEPAP, Paul noted that the total ILC R&D expenditures in the three regions of the world (the Americas, Europe, and Asia) are the same to within a few percent when a common costing procedure is applied.

Paul also described the status of ILC detector R&D in the U.S. During FY06, \$1.3M were distributed to universities. The request for FY07 from the American Linear Collider Physics Group is approximately \$3M. To date, the U.S. detector R&D effort significantly lags behind that in Europe. In response to a concern that was expressed prior to the HEPAP meeting, Paul reported that both the DOE and NSF welcome proposals for which ILC detector or accelerator R&D is the whole or a component of the effort.

Jonathan Bagger reported on the work of the ILC Communications Group, which was set up by the LCSGA to develop a clear message for a variety of constituencies. It is utilizing existing worldwide communications tools such as Interactions.org. It is also developing the Particle Physics Envoy Program, which will train envoys representing the entire field to develop relationships with policymakers in Washington. A steering committee is being formed with representatives from the American Physical Society Division of Particles and Fields, the Fermilab and SLAC users organizations, the LHC experiments, and professional communicators.

Overall, HEPAP is pleased with the progress being made toward the ILC, which is crucial to the future of elementary particle physics. But we stress the importance of adequate U.S. funding for both accelerator and detector R&D and strengthened international planning.

The final agenda item was a presentation of charges for two new HEPAP studies. The first is the University Grant Program Subpanel which is charged with a comprehensive review of the university grant programs in both the Department of Energy Office of High Energy Physics and the National Science Foundation Physics Division. In the second, a small group of HEPAP members are carrying out a midterm assessment of the DOE OHEP's long-term research goals that were established two years ago under the federal government's Program Assessment Rating Tool (PART) program.

The next HEPAP meeting is scheduled for October. At that time we expect to have the draft P5 report on the roadmap for elementary particle physics. We will also hear status reports from the Dark Matter and University Research subpanels as well as the OHEP long-term assessment group.

Sincerely,



Melvyn J. Shochet  
Chair, High Energy Physics Advisory Panel