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Dr. Tony Chan  
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Dear Robin and Tony:

I am writing to summarize the meeting of the High Energy Physics Advisory Panel (HEPAP) held in Washington on July 13-14. The major items on the agenda were final reports from four HEPAP subpanels: the Neutrino Scientific Assessment Group (NUSAG), the Dark Matter Scientific Assessment Group (DMSAG), the University Grant Program Subpanel (UGPS), and the Particle Physics Project Prioritization Panel (P5).

At the beginning of the meeting, I noted the importance of our planning process for developing the strongest science program for the field. P5 and HEPAP set priorities based on input from specialized subpanels as well as National Academy studies such as the Committee on Elementary Particle Physics in the 21<sup>st</sup> Century (EPP2010). This open planning process is essential for maintaining a cohesive community of scientists. It was stressed that members of the community must be careful not to go around or evade this process explicitly or implicitly.

The first report was from Robin Staffin on the budgets and program within the Department of Energy's Office of High Energy Physics (OHEP). He noted that the budget numbers in the House and Senate markups are good. OHEP will be doing a lot next year, operating the Tevatron and PEP-II as well as building new projects. Of 32 dark energy R&D proposals, 21 were funded. OHEP plans to repeat this solicitation next year. Robin noted that there has been progress on internationalization of the ILC; the Funding Agencies for Large Colliders (FALC) group and its resource board will be more directly involved in ILC oversight. Robin received a letter from the CERN Director General inviting non-member-states to participate in future LHC accelerator upgrades. HEPAP welcomes this initiative and feels it could also be an opportunity for advancing the internationalization needed for the ILC.

Joe Dehmer reported on activities in the National Science Foundation's Physics Division. Site selection was completed for DUSEL, an underground laboratory that will serve the international science and engineering communities. HEPAP sees the successful completion of the down-select process as an important step toward realizing DUSEL and fully supports the plan to open the laboratory to proposals from U.S. and international scientists. Joe noted that the proposed FY08 budget, with the Physics Division up 8%, is a promising start toward the goal of doubling the NSF budget. HEPAP is pleased with the increase and the plan to have in FY08 the first open competition

for Physics Frontier Centers in a number of years. The upper funding limit for a Major Research Initiative (MRI) is being increased from \$2M to \$4M. HEPAP supports this change and encourages the NSF to establish a program to cover projects that fall between the MRI and Major Research Equipment and Facilities Construction (MREFC) ranges.

Young-Kee Kim presented a status report on the work of the Fermilab Steering Group, which is addressing the issue raised by Ray Orbach at the previous HEPAP meeting. It is working toward a roadmap with branch points for the Fermilab accelerator-based physics program. The goal is to keep the LHC and ILC at the highest priority but adds R&D for a synergistic program that could provide opportunities in neutrino physics and charged lepton and quark precision measurements if the ILC construction schedule is delayed. They favor an 8 GeV proton linac that uses ILC cavities for most of the acceleration. Before the report is completed next month, they will look more closely at the physics case and estimate the needed resources. The report will be carefully reviewed by the Fermilab Accelerator and Physics Advisory Committees, P5 and HEPAP.

Peter Meyers presented the latest report from NUSAG. They assessed detector and beam configurations for a large neutrino experiment, fed by a megawatt proton source, that would determine the neutrino mass ordering and measure the CP violation phase. If the detector were deep underground, it could also do other important science such as the search for proton decay. Because of the significance of the science and the cost of the experiments, NUSAG demanded  $5\sigma$  coverage for the measurements. They recommend that R&D be carried out so that technology decisions can be made when the size of  $\theta_{13}$  is known, which could be as early as 2012. Any decision to proceed should be made within the international context. R&D must encompass the beam as well as both liquid-argon and water-Cerenkov detectors. HEPAP was impressed by the thorough report and approved it unanimously.

Hank Sobel summarized the changes to the DMSAG report since the last HEPAP meeting. These resulted from comments of the outside reviewers requested by the Astronomy and Astrophysics Advisory Committee (AAAC). The changes did not significantly alter the recommendations of DMSAG on experiments to directly detect cosmic dark matter. They call for increased funding for this program so that operating experiments can be improved and R&D can be carried out on new promising technologies such as noble liquids, which might be more easily scalable to very large detectors. HEPAP unanimously approved the DMSAG report.

Homer Neal presented the report of the UGPS which assessed the DOE and NSF university grant programs. He reviewed the charge and the broad input they received from the high-energy physics community. The UGPS recommends strengthening the university program with a funding increase corresponding to approximately 1% of the HEP budget. This is needed as a result of structural changes in the field: an increased diversity of scientific approaches which is well matched to the diversity of the university program, and the increased focus abroad, especially at CERN's Large Hadron Collider (LHC). They noted the importance of research scientists, technical personnel, computing, communications tools, and travel funds for offshore research. On the theory side, additional support for students and postdocs doing calculations related to upcoming experiments is needed.

The UGPS also recommended some changes in the advisory structure to enhance the health of the program. These include a University Grants Program Committee that would consult with agency managers on issues facing the university grants program and a set of standing Scientific Advisory Groups that would more broadly and more regularly prioritize proposed experiments. HEPAP

unanimously approved the report and looks forward to working with the agencies in implementing UGPS recommendations.

Jon Kotcher gave an update on the proposed Deep Underground Science and Engineering Laboratory (DUSEL). He reviewed the interdisciplinary science program of this centerpiece in the Physics Division's investment in underground science. He reported on the site selection process which was recently completed. DUSEL will be proposed for the Homestake Mine in South Dakota. A new solicitation will call for proposals to develop the initial suite of experiments. HEPAP is pleased that focus can now move from site selection to the detailed design of the facility.

Bill Carithers presented the report from P5 which made a recommendation on the running of the Fermilab Tevatron in FY09. They asked whether the accelerator could deliver adequate luminosity, whether the CDF and D0 detectors could handle that luminosity, and whether the collaborations have the personnel to run the detectors and analyze the data. P5 concluded that the answers to all of these questions are yes and so they enthusiastically recommend running the Tevatron in FY09. At the P5 meeting in September, they will consider what factors might lead to additional running. HEPAP unanimously approved the P5 report.

Mike Harrison reported on the ILC engineering design program. He noted that recently there was an international review of the Reference Design Report cost estimate, with the conclusion that the estimate is conservative. The GDE is now restructuring itself for the engineering design phase. They will complete an overall design by 2010 so that construction could start three years after that. There will be full project management with a focus on maintaining or reducing the cost by value engineering and industrialization worldwide. They will establish a project management organization with prioritized work packages within a WBS work structure and Memoranda of Understanding (MOU) with participating institutions. There are project managers to lead the technical efforts and regional directors to seek funding and authorization for the work. They plan on having draft MOUs ready within the next nine months. In response to a question, Mike noted that the lack of a selected site complicates the process.

Guy Wormser summarized the reaction in Europe to Ray Orbach's remarks at the previous HEPAP meeting. Some typical reactions have been that the U.S. has definitely delayed the ILC, that it is not a reliable partner, and that CERN is now back in the running for the next lepton collider. The latter is due to a recent decision by the CERN Council to provide a 240 MCHF supplement, which will allow CERN to complete the Super-LHC and then start a new machine in 2016. Many in Europe will look at the Fermilab Steering Group's report to gain further insight on U.S. intentions toward the ILC. Guy feels a balanced worldwide program is being put in jeopardy. To help repair the international situation, he suggests making use of the LHC upgrade discussions to form an ILC-like political prototype. He also noted that FALC's commitment to support the ILC engineering design phase is a positive step.

Frank Wuerthwein described the Open Science Grid (OSG) in which common middleware tools allow a variety of scientific communities to share large quantities of distributed computing resources. It is less than a year old and already has some impressive successes. Noteworthy is D0's recent reprocessing of almost 300,000,000 events on the OSG. The OSG will be crucial for the analysis of the LHC data.

Joel Butler gave a status report on the ATLAS and CMS detectors. Both have made great progress, although challenges remain before full data taking begins. HEPAP is very impressed by the near

completion of these two enormous and complex detectors and looks forward to the excitement of the LHC physics program.

Alan Bross summarized the R&D work being done by the Neutrino Factory and Muon Collider Collaboration. This group of 19 U.S. universities and national laboratories, with corporate partners, is part of a large international effort. Their goal is to develop the accelerator techniques necessary to build a very high intensity neutrino source or a very high energy lepton collider. At present they are working on targeting through the MERIT experiment, muon phase-space cooling through the MuCool work for the MICE experiment, and accelerator design and simulation. This is important R&D for future accelerators that might be needed to solve high-priority questions in elementary particle physics.

Lyn Evans gave a status report on LHC installation and commissioning. All magnets and RF cavities are installed, with sector interconnections nearing completion. The last remaining production problem is the collimators, which are now back up to full production and should be all delivered by the end of the year. There was a successful pressure test of the repaired inner triplet. HEPAP congratulates Fermilab, CERN, LBNL, and BNL on a rapid and successful solution to the problem. The LHC schedule has all systems tested to 7 TeV and beam testing commencing by May, 2008. First collisions at 14TeV are planned two months later.

This meeting had the second set of educational presentations on possible future dark energy projects. At the previous meeting, we heard about the three JDEM mission concepts. This time we learned about two ground-based proposals. These experiments would address a number of astronomy issues in addition to dark energy. The interdisciplinary nature of experiments studying dark energy, dark matter, and neutrinos make the upcoming Astronomy Decadal Survey of great importance to the elementary particle physics community.

Tony Tyson gave HEPAP a primer on the Large Synoptic Survey Telescope (LSST), a very large ground-based telescope that would study dark energy using weak lensing, baryon acoustic oscillations, supernovae, and galaxy clusters. The 3 gigapixel camera would sit on an 8.4-meter telescope with a 10 square-degree field.

Nick Kaiser gave us an overview of the Panoramic Survey Telescope and Rapid Response System (Pan-STARRS), which could study dark energy from the ground using weak lensing, galaxy clusters, and supernovae. They propose four 1.8 meter large-aperture telescopes with a 7 square-degree field of view. The first of the telescopes starts its science mission this summer.

The next HEPAP meeting will occur on November 29-30. At that time we will hear the conclusions of the Beyond Einstein Program Assessment Committee, the report of the Committee of Visitors to the DOE's Office of High Energy Physics, and final reports from P5 and the Fermilab Steering Group.

Sincerely,



Melvyn J. Shochet  
Chair, High Energy Physics Advisory Panel