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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 October 12-13. We heard status reports on a number of studies currently being carried out as well as the Large Hadron Collider (LHC) accelerator and detectors. Most importantly, we acted upon the final report on the particle physics roadmap from the Particle Physics Project Prioritization Panel (P5).

At the beginning of the meeting, I congratulated George Smoot and John Mather, recipients of the 2006 Nobel Prize in Physics for the study of the spectrum and anisotropy in the cosmic microwave background radiation using the COBE satellite. This landmark experiment helped usher in the era of precision experimental cosmology. The Department of Energy is also to be congratulated since it provided the exploratory funding that allowed Smoot to develop his ideas. Small amounts of discretionary funds have in the past enabled the development of important new techniques and areas of research. If DOE and NSF funding continues to increase as part of the focus on the physical sciences, we hope that the agencies enhance the funding available for developing new, promising ideas.

Robin Staffin presented news from the Department of Energy. The House of Representatives' energy and water appropriations bill has passed, but the Senate bill awaits action by the full body. Passage in the Senate and Conference Committee negotiations are not likely before the November election. In the meantime, expenditures are governed by a continuing resolution. At a meeting of senior officials from DOE, NASA, and OSTP, it was decided that a National Research Council panel would be asked to recommend the next Beyond Einstein mission from those that have been proposed, including the Joint Dark Energy Mission (JDEM). Robin noted that there is now broad appreciation in Washington that we are nearing a decision point on the future of high-energy physics. The International Linear Collider (ILC) is important, but so is breadth in the program.

Joe Dehmer presented news from the National Science Foundation. The budget outlook for fiscal year 2007 looks bright; the mark-ups in both the House and Senate are close to the President's request, which is approximately 6.6% above the FY06 level. The S1 site-independent study of the

science scope of the Deep Underground Science and Engineering Laboratory (DUSEL) is now complete. DUSEL is the NSF's portion of a joint vision of advancing tools for future experiments, along with the ILC in the DOE Office of High Energy Physics (OHEP) and the Rare Isotope Accelerator (RIA) in the DOE Office of Nuclear Physics. HEPAP is concerned about how DUSEL operating costs will be covered. We encourage the NSF to plan on increased funding for the Foundation units that will be responsible for operating DUSEL and sharing the operating costs among the divisions with experiments in the laboratory.

There were three presentations on projects that are central to the long-range assessment of the DOE Office of High Energy Physics. Young-Kee Kim gave a status report on Run-II at the Fermilab Tevatron. The physics highlight of the past year was the observation and precision measurement of the very rapid oscillation between B_s and anti- B_s mesons. This is an extremely important result that was the highlight of the recent international conference on high-energy physics. The accelerator is performing extremely well, with peak luminosity exceeding $2 \times 10^{32} \text{ cm}^{-2} \text{ sec}^{-1}$ and a total delivered integrated luminosity of 1.8 inverse femtobarns. The laboratory and the collaborations continue to address the problem of adequate personnel for the remainder of the physics run. Young-Kee requested modest help from the funding agencies to support key personnel and some graduate students.

Persis Drell reported on the status of the PEP-II/BaBar program at the Stanford Linear Accelerator Center (SLAC). Prior to the shutdown for the last major accelerator and detector upgrades, the accelerator reached a luminosity above $1 \times 10^{34} \text{ cm}^{-2} \text{ sec}^{-1}$. During the year, there were two major vacuum problems, both now fixed. The physics productivity of the BaBar collaboration continues to be very high. They are searching for new sources of CP violation by greatly overconstraining the CKM triangle with multiple measurements of all three angles as well as the length of some of the sides. The channels studied include many with large penguin contributions.

Rob Plunkett presented a status report on the NuMI/MINOS neutrino program at Fermilab. Despite a number of beamline component problems that required significant downtime, the total number of protons on target exceeded 1×10^{20} , which was the DOE performance measure. The MINOS near detector has collected a large number of events with which to understand both the beam and the detector. With far detector data, MINOS has produced its first measurement of neutrino oscillations, determining the atmospheric mixing angle and mass difference to $\pm 15\%$. Rob described the plan to increase the number of booster batches from 5 to 9, thereby increasing the beam power to 400 kilowatts.

Bill Molzon then reported on the midterm assessment of the OHEP long range goals. The metrics were carefully selected in 2004 to measure the performance of the major HEP facilities independent of nature's answers to our questions. The assessment so far is very positive. Most of the measures are on target for timely completion. For at least one, the precision of the measured top quark mass, the 2014 target has already been reached. It is too soon to know whether two of the goals will be met: the Higgs sensitivity at the Tevatron and the MiniBooNE sensitivity to a very short wavelength neutrino oscillation. The assessment will be completed and forwarded to the DOE before the end of the year.

HEPAP is grateful to Mike Salamon for informing us about the NASA Science Mission Directorate. There are serious budget problems at NASA, with the five-year budget plans now significantly lower than they were a year ago. This has serious impact on the science program, in particular the Beyond

Einstein program, which contains JDEM as one of the proposals along with two other “probes” and two “great observatories”. Since the earliest dates for the first two missions now appear to be 2016 and 2021, the priority of the proposals is being reconsidered. A National Research Council committee will recommend the first mission by late summer. In August, three concept studies for JDEM were approved, with reports due early in FY09. However a joint DOE/NASA announcement of opportunity for JDEM could be issued as early as FY08. HEPAP is concerned that an excellent proposed NASA science program is being so adversely affected by the budget. If the study of dark energy with JDEM is selected as the first Beyond Einstein mission, it could be delayed by further budget erosion. If another project is selected, then a different approach to the JDEM mission will have to be found.

Bernard Sadoulet presented the report of the DUSEL Site Independent Study (S1) of the science case for a new underground scientific laboratory. He described physics, geology, and biology questions that require a deep underground site to be answered. In particle physics, the initial program would include large dark matter and neutrinoless double-beta decay experiments, both rated as high priority by P5. Bernard noted that although there are other deep underground facilities around the world, the increasing importance of doing experiments with a large overburden has resulted in the need for additional underground laboratories. HEPAP is pleased by the breadth of the DUSEL science program and the opportunity DUSEL would present for important particle physics experiments.

The major item on the agenda was Abe Seiden’s presentation of the report of the Particle Physics Project Prioritization Panel (P5). As envisioned by the 2001 HEPAP Subpanel on Long Range Planning for U.S. High-Energy Physics, P5 should be the guardian of the roadmap for future projects. Since its establishment four years ago, P5 has been asked to prioritize a number of individual proposals. This time it was asked to establish the roadmap by looking broadly at the program, setting priorities, and recommending a set of projects that could be carried out under reasonable budget assumptions. P5 drew on the work of other HEPAP subpanels and the National Academy’s EPP2010 committee. Budget guidelines were provided by the DOE and NSF. The report first describes the major scientific questions particle physics is addressing and then discusses each proposed major project, its scientific potential, cost, timescale, and its place in the international context. The panel then established planning guidelines based on the scientific opportunities and budget realities. Based on these, P5 made priority recommendations for construction and review of individual projects. HEPAP is pleased with both the process and the report, which presents a plan stressing the most important scientific problems, yet retaining needed breadth for the field. The report also makes clear what more could be done with additional funding. Future P5 reviews will have to be scheduled based on physics advances, project R&D, and budget status. It is also important that an international forum be developed so that the three regions can discuss and coordinate long-term plans. HEPAP unanimously and enthusiastically approved the P5 report.

Homer Neal gave a status report on the work of the University Research Program Subpanel. He reviewed the subpanel’s charge and the topics discussed at their first two meetings. They are collecting data from the community and the agencies. Additional input will come from town meetings that are planned at Fermilab, SLAC, and the meeting of the APS Division of Particles and Fields. HEPAP looks forward to receiving the subpanel’s report at the summer meeting.

Guy Wormser completed the report on the CERN Council Strategy Group he gave at the July meeting. He reviewed the final strategy document and the European priorities, which are remarkably similar to those in the EPP2010 report. There are some ordering differences that reflect local needs. They place advanced accelerator R&D ahead of the ILC, reflecting their desire for a post-LHC

accelerator at CERN. Another difference is the reversed order of the neutrino initiatives and astrophysics. HEPAP feels that such a planning group is important and we should cooperate with them in the planning of an international HEP program.

Henry Sobel gave a status report on the work of the Dark Matter Scientific Assessment Group (DMSAG). He reviewed the importance of research into the identification of the dark matter particles and the current state of the various experimental efforts. Recent advances in detector technology could increase sensitivity by as much as three orders of magnitude in the coming years. HEPAP looks forward to the final report on this rapidly expanding area of research.

The final three presentations at the meeting were on the status of the LHC accelerator and the two large general-purpose detectors that will take data there. Lyn Evans described the accelerator status. The quality of the delivered magnets is excellent, and the remaining dipoles will be installed by the end of March. The cryogenic line is now in excellent shape; the problems of last year have all been solved. The machine is on target for a run in November at low luminosity and a center-of-mass energy of 900 GeV. The detectors should have at least two weeks of colliding beams. Running at the full machine energy of 14 TeV will start in the spring of 2008. HEPAP was very impressed by the speed at which the CERN accelerator division solved the machine problems.

Mike Tuts reported on the status of the ATLAS detector. The collaboration is on track for first collisions in the fall of 2007, but the schedule is tight. The endcap muon toroid supports were six months behind schedule, which delays installation of the muon chambers. There are also problems with some low-voltage power supplies. On the other hand, many systems have now been tested with cosmic rays, and the pixel system is now a month ahead of schedule.

Dan Green gave the CMS status report. The collaboration has decided to install a slice of the pixel system before the 2007 run to get operational experience. Many of the CMS subsystems have also been tested with cosmic rays, and a computing, software, and analysis challenge is now underway. Dan stressed that funding for upgrade R&D activities are needed now.

The next HEPAP meeting will occur on February 22-23. At that time we expect to have the reports from DMSAG and the Neutrino Scientific Assessment Group (NuSAG). We will also hear a status report from the University Research Program Subpanel as well as the presentation of the Reference Design Report of the ILC Global Design Effort (GDE).

Sincerely,



Melvyn J. Shochet
Chair, High Energy Physics Advisory Panel