By David Harris

HEPAP REDUX

A newly structured High Energy Physics Advisory Panel met in Washington, DC, to provide advice to the Department of Energy and National Science Foundation and to hear science policy-makers' responses to the President's budget request.

A changed High Energy Physics Advisory Panel (HEPAP) met in Washington, DC, on March 3–4, 2006, to set a fresh agenda for high-energy physics policy advice. A roll call of senior policy figures provided context for the panel's discussions, including response to the recent US President's budget request.

HEPAP was founded in 1967 to provide advice on the national high-energy physics program. Originally established by the Atomic Energy Commission, it now reports to the US Department of Energy Office of Science's Office of High Energy Physics and the National Science Foundation's Mathematical & Physical Sciences Directorate. HEPAP has played a major role in setting the direction of high-energy physics research in the United States.

Mel Shochet, new chair of HEPAP and professor of physics at the University of Chicago, enthused, "We're at an extraordinary moment and scientific opportunities are really ripe for discovery, greater than at least the last three decades."

HEPAP itself has much to do, as seen at the two-day meeting. Four subpanel reports were presented, one task force presented an interim report, and another three new charges were set to subpanels.

Office of Science associate director for high-energy physics Robin Staffin said, "I'm extremely pleased to see this new HEPAP ready to go. The larger size of HEPAP, now up to 20 members, reflects the sense that the field has gone in broader directions."

One change in HEPAP is its increased international constituency. "There are full voting members from outside the US in order to reflect what is going on in the rest of the world. What we are striving for is a balanced portfolio, not just something in our own backyard," Staffin said.

A less obvious change in HEPAP operations, and the reason for the delay between the finishing of the previous HEPAP's term last year and its reconstitution, is that members are no longer acting as representatives of various organizations but as individual experts, and are sworn in as Special Government Employees for their service on HEPAP. This change is applicable to advisory panels across the Office of Science.

Budget proposal responses

The room was suffused with wary excitement as the HEPAP panel met in front of an audience of about 50. US administration and agency representatives spoke to the panel about the

Members and guests of HEPAP listen to Raymond Orbach talk about the Office of Science budget and plans. Other speakers presenting to HEPAP included (left photo, left to right) John Marburger, Robin Staffin, Mel Shochet, Arden Bement, and Joseph Dehmer.

President's budget request, which included the first proposed significant increase in physical science budgets in recent years.

Director of the President's Office of Science and Technology Policy John Marburger, director of the Department of Energy's Office of Science Raymond Orbach, and director of the National Science Foundation Arden Bement, all talked about how the President's budget request was a very positive step for physical sciences in general and how high-energy physics would reap benefits from that increase.

Orbach repeatedly asked the community to support the President's budget, saying that it "will allow the US an order of magnitude dominance in the areas we support." In an analogy he also used earlier in the week before the Fusion Energy Sciences Advisory Committee, Orbach said that "we will right the ship," with regard to funding for the physical sciences.

Using an example from the fusion community, Orbach explained that he was able to ask the President to support rejoining the ITER fusion project because he had in hand a set of four reports supporting the move, implying that a similar strategy would be wise when considering efforts to fund an International Linear Collider (ILC).

"The Linear Collider is the future of HEP in this country," Orbach declared. But he warned, "this committee has a tremendous responsibility. It either will or it won't help us get the Linear Collider built in this country. If we don't have the community with all of the spectrum behind us, we will not be successful."

Quoting from a press release issued that morning by an *ad hoc* committee of senior Japanese science policy figures, he recognized Japan's interest in hosting the ILC. In response, Orbach said, "Gentlemen, start your engines… We need your leadership…You have our full backing, we are working to make this happen… It's now time, if we are serious about a linear collider on our shores, to get going."

As part of the Office of Science's (SC) commitment to this goal, Orbach said it is doubling ILC funding to $60 million in FY07. Since that meeting, Orbach has also indicated his commitment to the project by raising the possibility of requesting within the next year a Presidential Initiative to fund the ILC.

Orbach listed other highlights of the SC budget and program including the Linac Coherent Light Source at Stanford Linear Accelerator Center, the Spallation Neutron Source at Oak Ridge National Laboratory, a Petaflop computing initiative for FY08, four or five nanotechnology research centers coming online, the CEBAF upgrade at Thomas Jefferson National Laboratory, full funding of RHIC experiments at Brookhaven National Laboratory with some money for RHIC II and eRHIC, and the start of R&D and project engineering for the NSLS-II synchrotron in FY07.

However, given the 8.1 percent increase over the enacted SC FY06 funding levels, Orbach warned that the budget is "a sitting duck" and that "this will not happen unless the President's budget is supported by the public at large."

Physical science is a likely target because the SC increase is occurring in the context of reductions in other agencies. Budget analysis by the American Advancement for the Association of Science says that "increases for some physical sciences and related research programs would be more than offset by cuts in other agencies' research," leading to a net decrease in overall federal research and development spending

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Raymond Orbach, director of the DOE Office of Science.

once weapons development and space vehicles development are excluded from consideration.

Following on from Orbach, in a more cautious tone, Marburger placed funding for physical sciences in a historical context. He pointed out that significant physical science funding was driven via defense justifications during the Cold War. Marburger indicated that the substantial body of reports over the past few years has made much clearer the economic rationale for funding physical sciences, and that that is a reason for renewed interest. In this context, Marburger warned, "particle physics and space science have many interesting [science goals] but they are not emphasized in the ACI [American Competitiveness Initiative]," introduced in the President's State of the Union address in January.

"Although this will reduce some of the pressure in HEP, the ACI is more directed to research in BES [Basic Energy Sciences] that has more obviously direct economic consequences," he continued.

Marburger stated that the reason for explaining this distinction was as encouragement to particle physicists: "The community must not rest in gaining public support… You've got the goods…now it's a question of keeping [the effort] up over a number of years."

As examples of effective messages, Marburger praised HEPAP's *Quantum Universe* reports, stating that he likes them because, "they put the emphasis where it belongs—on the excitement of the science." He also commented on what tactics don't work: "It's dangerous for basic science to oversell itself on the basis of spinoffs. I cringe every time I hear particle physicists claim responsibility for MRI [Magnetic Resonance Imaging]."

Marburger entreated the HEP community to consider the bigger picture and what must happen for it to achieve its goals of increased funding: "We are asking people to give something up to do this."

During a break in the proceedings, Shochet responded to Marburger's comments: "I thought it was sobering, but I had read the [ACI] report and read the same things in it. There is now a realization of the importance of training in the physical sciences. Now we have to make the case for increased federal support."

Bement was enthusiastic about the budget and the increases for the National Science Foundation. He said, "Our economy is driven by investment in research and development and investment in education and investment in infrastructure."

In particle physics, Bement noted the US leadership in the community, especially the involvement in the LHC collaboration and the role the United States is playing in the ILC.

The NSF's physics division director Joseph Dehmer spoke about joint efforts between NSF and DOE, highlighting a $15 million increase for elementary particle physics (EPP) research, including a 34.7 percent increase ($4.64 million) for LHC involvement. He also spoke about priorities within the physics program such as increasing the strong, flexible core of university principal investigators to more than 50 percent of the physics budget, and a 10 percent per year budget increase for EPP research.

HEPAP's subpanel reports

During the meeting, four HEPAP subpanels offered reports for acceptance. Though generating some discussion, all four reports were accepted by HEPAP for transmission to the Department of Energy.

The Particle Physics Project Prioritization Panel (P5) had been charged with determining how and when to make a decision about the time to end the runs of Fermilab's Tevatron and SLAC's PEP-II colliders, currently slated to conclude at the ends of FY09 and FY08 respectively.

P5 praised both collider programs and recommended the running of the Tevatron through FY08 and PEP-II though FY07 in any long-term scenario for a roadmap, and that they currently see no reason for terminating either program before the original end dates. However, they state that they have not yet considered the last year of running of the programs in the context of a full roadmap, informed by other HEPAP subpanels.

The Neutrino Scientific Assessment Group (NuSAG) had been charged to study three recommendations coming from the American Physical Society's "The Neutrino Matrix" (2004)

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report. NuSAG recommended US leadership in neutrino oscillation experiments. Specifically, they called for participation in both accelerator- and reactor-based experiments including Fermilab's NOvA; the B280 part of the Japanese T2K neutrino oscillation experiment; R&D in liquid argon time-projection chamber technology; either the Braidwood (United States) or Daya Bay (China) reactor experiments, depending on cost sharing; and, as a lower priority, relatively inexpensive participation in the Double Chooz (France) reactor experiment.

The HEPAP Task Force on Physicist Resources concluded that maximizing the physics return from running experiments and preparing for LHC might tax the resources of the US HEP community. It stressed that unprecedented coordination will be required among labs, universities, funding agencies, and experimental collaborations. A Fermilab group tasked with considering the same issue concluded that there will be enough physicist resources but that steps must be taken to mitigate potential risks. They made several specific recommendations to Fermilab management, some of which are already in process.

The Dark Energy Task Force (DETF) was charged with advising DOE, NSF, and NASA on a program in dark energy exploration. In their interim report, the DETF showed fifteen tentative findings summarizing their assessments of the four major observational techniques for studying dark energy. Perhaps the most significant finding is that the best understanding of dark energy will come from a combination of techniques rather than concentrating on improving the capabilities of a single technique. The optimal mix of techniques is not yet clear, however.

Future investigations

With much new information, HEPAP is now overseeing the next phase of study and advice, with three new charges going to subpanels.

The P5 panel was asked to continue its work and prepare a full roadmap for US high-energy physics by the end of 2006, considering realistic budget constraints and the international context. The NuSAG group was charged with studying a next-generation neutrino beam and detector, assuming a megawatt class proton accelerator as a neutrino source. Its report will be due August 2006.

The DOE requested that HEPAP and the Astronomy and Astrophysics Advisory Committee (AAAC) form a joint subpanel to provide advice on priorities and strategies for the direct detection and study of dark matter. The new Dark Matter Scientific Assessment Group (DMSAG) will advise NSF and DOE on matters concerning the US dark matter research program in a final report due February 1, 2007.

There is much on HEPAP's plate, but Shochet sees it as an exciting opportunity for discovery, especially at the future colliders: "We are guaranteed to see phenomena we have never seen before. We'll see them first at the LHC and then later at the ILC. We don't know what those phenomena will be, but they will surely change our understanding of the natural world."

Now it is up to Shochet's HEPAP to work with the physics community, funding agencies, the public, and the government, to steer high-energy physics toward that new understanding he and many others seek.