

Personal Account of the HEPAP Meeting of Feb. 14 – 15, 2008
R. Cahn, DPF Chair

HEPAP met in Washington on February 14 and 15, but there were no Valentine's to be handed out. The focus was on the dismal state of funding following passage of the Omnibus Bill in December. The full set of presentations is available at

<http://www.science.doe.gov/hep/HEPAPAagendaFebruary2008.shtml>

Ray Orbach

Ray Orbach, Undersecretary of Energy and Director of the Office of Science, addressed HEPAP presenting both the good news of the proposed FY09 budget and the grim news of the FY08 budget. Ray chooses his words carefully and it is worth quoting from his slides:

- *The goal must be a world-class, vigorous, and productive program, which
 - recognizes the internationalization of particle physics,
 - incorporates recent and likely budget realities, and
 - ensures the vitality of the field for the next 10-20 years.*
- *A robust, scientifically compelling plan for U.S. HEP must be developed that is supported by
 - the scientific community, the Administration, Congress and the public.*
- *The scientific community is critically important:
 - The community, through HEPAP and P5, is developing a science-driven plan. I look forward to their report in May.
 - To assist with the realization of this plan, the just released FY2009 Budget Request maintains future options for HEP. We will use the plan to articulate the case in the FY 2010 Budget Request.
 - The community needs to make the case for the science, and its benefits to the nation, to Congress and the public. It is not an entitlement*
- *The very large percentage increase between the essentially flat funding for the DOE Office of Science in FY2008 and the FY2009 President's Request will be an attractive target.
 - We could easily, again, become a "donor" program. This is true for all three American Competitiveness Initiative agencies.*
- *Compounding the danger is the widespread attitude that the proposed increases for the physical sciences under the ACI and America COMPETES act are "a done deal".*
- *There is the possibility we may see a "three peat" and a perpetuation of flat to declining budget trajectories.*
- *If we are to avoid this scenario we need to actively and publicly make the case for LONG TERM basic research rather than short-term applied research.*

It is now up to us to make the case.

I was particularly impressed by Ray's argument that the approval of the very good FY08 budget in the pertinent House and Senate committees did not mean that we had achieved a durable consensus for doubling the budget for physical sciences. As Ray put it, the support was there when Congress had \$22 billion to spend, but not when they didn't.

The weakening economy will certainly make it difficult to retain the large increase for the Office of Science in the President's FY09 budget. As for the political aspects of the situation it is important to remember that the Democratic Congress controlled the Omnibus Bill. There is no reason to think that changes from the fall elections will work in favor of basic research and high energy physics.

Dennis Kovar

Dennis Kovar, the Acting Associate Director for the Office of High Energy Physics of DOE, has taken "Acting" to mean taking action. Kovar proposing a dramatic change in the way DOE will evaluate the work it supports. The best way to describe the system is simply to present a slide from the talk:

- HEP Office is implementing a new organizational structure
 - Organized according to scientific and technical campaigns
 - Managed by a program manager that is empowered and accountable
 - Programs contain universities and national laboratories
- HEP Office is implementing a new review process for national laboratories
 - Annual S&T Reviews of User Facilities (i.e.; Fermilab and SLAC in FY 2008)
 - Reviews of all national laboratories research groups on a rotating basis
 - Reviews of specific activities/initiatives annually (similar to before but expanded)
 - Institutional reviews on a rotating schedule
- HEP Office has obtained approval to fill/advertise positions in the new organization
 - Positions include Division Director plus 12 permanent federal positions
 - Includes program/project managers; scientific/technical advisors; support positions
 - Positions are in the process of being prepared to be advertised
- Anyone interested should contact me or anyone in the Office to get information
- HEP Office has operated for a number of years with IPAs/Detailees
- These individuals has provided invaluable expertise, experience and wisdom to the Office
- It is envisioned that such appointments are needed in the future
- Anyone interested should contact me or anyone in the Office

In addition to reviews of the individual programs at the labs - Fermilab, SLAC, LBNL, BNL, ANL - there will be reviews across all labs in the individual budget lines: Proton Accelerator Physics, Electron Accelerator Physics, Non-Accelerator Physics, and Theory. Such a review would bring together representatives of all the labs and a single panel at Germantown.

Kovar presented some detailed tables revealing the broad, negative impact of the Omnibus Bill. Comparing the President's FY08 Budget to the FY07 enacted appropriations, the increases would have been: BES (Basic Energy Sciences) +20%, BER (Biological and Environmental Research) +11%, Advanced Computing +20%, HEP +4%, Nuclear Physics +11%, Fusion +34%. What emerged instead with the Omnibus Bill, again relative to the FY07 enacted appropriations were: BES +1.6%, BER +13%, Advanced Computing +24%, HEP -8%, Nuclear Physics +2%, Fusion -10%. The hit in Fusion was the shocking zeroing-out of the 160 M\$ for our international obligation to ITER. These numbers re-enforce the point made by Ray Orbach that we have a long way to go in generating the support we need, since we were favored neither by those who wrote the FY08 budget (dominantly Republicans), nor those who revised it (dominantly Democrats).

In the FY09 budget, the increases relative to the enacted FY07 budget are BES +28%, BER +18%, Advanced Computing +34%, HEP +10%, Nuclear Physics +24%, Fusion +16%. The FY09 budget will be the starting point for discussions, and even there we fare less well than other parts of the Office of Science.

Tony Chen

Tony Chen, Associate Director for Mathematical and Physical Sciences at NSF, mentioned the American Competitiveness Initiative, as did Ray Orbach. It is ACI that is supposed to be the rising water that will lift the boat of high energy physics. However, Dr. John Marburger has indicated at times that some boats aren't going to be lifted so much. Indeed in the very good FY08 budget, which was obviated by the Omnibus Bill, HEP went up 4% while the Office of Science went up 16%.

In addition to Chen, also present were Joe Dehmer, the head of Physics at NSF, and Marv Goldberg, who heads EPP (Elementary Particle Physics). The FY08 budget for Physics is, in round numbers, 250 M\$, essentially unchanged from FY07, while in the FY09 request it is just under 300 M\$, a healthy increase.

Of the 1.16 B\$ MPS budget in FY08, something over 20% goes for operating facilities. OF this, about 110 M\$ is for astronomy, 18 M\$

for LHC, 14 M\$ for CESR, 2 M\$ for IceCube and 29 M\$ for LIGO. However, the CESR line is being phased out. The National High-Field Magnet operating cost is 31 M\$ and that of the cyclotron at MSU is 18 M\$.

Of great interest and importance is MREFC (Major Research Equipment and Facilities Construction). Both LSST and DUSEL are counting heavily on MREFC at levels of perhaps 300 M\$ and 500 M\$ respectively. In FY08 there is estimated to be 102 M\$ for ALMA (Atacama Large Millimeter Array), 26 M\$ for IceCube, and 32 M\$ for Advanced LIGO. Both DUSEL and LSST are moving through the MREFC process, but it is not possible to say at this time when (or if!) they will get funding. There will be competing proposals from other parts of NSF, certainly from astronomy in the form of the Giant Segmented Mirror Telescope. The decadal survey in astronomy may have an impact here.

While the Omnibus Bill did not devastate EPP, Theory, and Nuclear and Particle Astrophysics (NPS) at NSF as much as it did HEP in DOE, especially at SLAC and Fermilab, the consequences are still very painful. This is especially the case for those NSF grants up for renewal while the core program is reduced by 5%. Since one-third of the grants are up each year, there are potential 15% decreases for those with this unlucky lottery number.

Pier Oddone

Pier Oddone described a Fermilab scene with "The Good, the Bad, and the Ugly," but followed it with his recipe for a makeover (recovery). The Good is the strong physics program now in operation. Fermilab is a leader in CMS and the LHC program is just around the corner. The Tevatron Collider is providing intense beams for CDF and D0, which are producing important results in electroweak physics, in meson and baryon spectroscopy, and in particle mixing. At the same time, MINOS is exploring neutrino oscillations in the "atmospheric" region, and may even achieve sensitivity to θ_{13} . MiniBooNE has settled one controversy though creating a new puzzle at low energies. So, too, in astrophysics there is much that is positive: CDMSII, Auger, SDSS, and COUPP (dark matter search with a bubble chamber).

Oddone sees a program built on a triad: the energy frontier, the intensity frontier, and non-accelerator physics. Of these, it is the intensity frontier that poses the most immediate challenges. NOvA, the off-axis experiment to measure ν_{μ} oscillation to ν_e (and similarly for anti-neutrinos) has passed CD-2, but had its funding stripped in the Omnibus Bill.

NOvA represents the beginning of a neutrino program as envisioned by the Steering Group, run by Fermilab but with broad community participation. Project X would provide a powerful driver not just for neutrino physics, but for the study of rare processes (e.g. μ to e conversion, $K \rightarrow \pi\nu\bar{\nu}$). With an ILC-like injector, Project X would provide 2.3 MW of 120-GeV protons and 200 kW of 8-GeV protons.

The ugly news for Fermilab was that its FY08 budget would be 320 M\$, not the 372 M\$ that had been anticipated. As is well known, this has led to the decision to layoff 200 people and furlough all remaining employees for 10% of their time. Despite this, Fermilab will maintain the planned Tevatron run and fulfill its LHC obligations.

The Omnibus Bill reduced the funding for ILC from 60 M\$ to 15 M\$ one-quarter of the way into the fiscal year, thus effectively halting all work. The FY09 budget calls for 35 M\$, but common wisdom has it that the FY09 won't be passed until 12 months from now or even later. Of the 60 M\$, 40% was at Fermilab.

Odone continues work to find financial help through the political process, but certainly we cannot count on any relief before passage of the FY09 budget. Odone declared that Fermilab would “work with the community, P5 and HEPAP to make a compelling roadmap that the DOE, the public and the legislators will support in future years.”

He emphasized the need for the program to maintain in one way or another capital funding, funding that builds. This is just plain absent today. This needs to be restored. The current balance of people and capital resources cannot build and maintain a strong program.

Odone advocated Project X as a way forward. It would build the neutrino program beyond NOvA (whose higher energy beam makes it a complement to T2K in Japan), The more intense beam would boost NOvA's effectiveness and improvements in the detector would dramatically improve its reach. Moreover, Project X would form the foundation for the dream machine: an intense beam aimed at a very large detector at DUSEL.

Persis Drell

Because of SLAC's major involvement in ILC, it was hit with appalling cuts. The 120 M\$ program in HEP in an instant became a 95 M\$ program. A planned reduction of 100 became a reduction of 225. The BaBar-PEPII program seemed terminated without any prior notice. Thanks to quick work by the BaBar Collaboration, support from SLAC, and from DOE, a

new program to study $Y(3S)$ and $Y(2S)$ decays in unprecedented numbers was fashioned and approved. It will continue until April 7, 2008. Of course, much analysis remains to be done with the regular BaBar dataset and this will continue for more than two years.

Having reviewed this situation, which was already generally known, SLAC's Director, Persis Drell, continued her presentation with what was generally acknowledged to be the most dramatic and provocative HEPAP presentation in memory. With great passion, she stated:

- *We have to listen to what we are being told*
- *We must be willing to face very difficult questions*
 - *Do we need an operating HEP accelerator in the US to have a healthy program?*
 - *Do we need more than one national laboratory HEP program based at FNAL?*
 - *Can we, in the US, have a world leading science program at the energy frontier?*
 - *What is the appropriate balance between the accelerator-based program and the non-accelerator-based program?*
 - *What should be our investment strategy for the areas where we are not in a 'world leadership' position?*

Persis continued by saying we need to deliver “transformational or paradigm-altering” science in the 688 M\$ scenario, i.e. in the P5 scenario that starts at the Omnibus Bill level of 688 M\$ and increases by just 3.5% per year. This plan, she said, should show us with leadership in one or two of the highest priority areas for the field and then show leadership in other areas can be gained with incremental resources.

Barry Barish

The most painful consequence of the Omnibus Bill for high energy physics was the curtailment of ILC work. Barry Barish showed how the Global Design Effort was dealing with this setback. Essentially, GDE will focus on the most critical items and rely on outside sources as much as possible. The XFEL at DESY will push the development of superconducting RF, critical to the established design for the ILC. There is commonality with the CLIC effort at CERN on sources, damping rings, beam delivery, conventional facilities, and detectors.

The Technical Design Phase will have two stages, Stage I ending in 2010 and Stage II ending in 2012. Included in Stage II is a test of three cryomodules at KEK. Because of the cutbacks, there will not be a detailed engineering design and there will not be industrialization of

the cryomodule construction.

Mike Harrison

Mike Harrison reviewed the ILC work in the Americas region. For all practical purposes, work in the U.S. on ILC has stopped for FY08. If the President's budget for FY09 were passed, we'd have 35 M\$ for ILC in FY09, about half of what was available in FY07 (excluding SCRF at Fermilab). It is likely this would come late in FY09.

Harrison did some financial projection, concluding that if we are stuck at 35 M\$/y, we will not be in a position to host the ILC. In response to a question (mine), Harrison stated that his estimate for the ILC cost (TEC, doesn't include detector(s)) 14.9 B\$ in FY07-year dollars.

Double Chooz

Bob Svoboda of U.C. Davis give a brief presentation on the Double Chooz reactor neutrino experiment. It is hoped that running will begin in June 2009, with just a far detector, at 195 km. The aim is to reduce the limit on $\sin^2 2 \theta_{13}$ to between 0.05 and 0.06 at 90% CL in about 1.5 years of running. With an additional 3.5 years of running with an additional detector at 400 m, the limit could be reduced to 0.03.

Dennis Kovar had explained to HEPAP that it was to provide advice to DOE only when that advice was requested and thus it was not appropriate to advise at this time on whether Double Chooz should receive DOE support. HEPAP did, however, express its enthusiasm for the experiment.

NSF

Jim Reidy reported on the Elementary Particle Physics program (EPP) at NSF. EPP is embedded within Physics, headed by Joe Dehmer. The FY08 PHY budget is 250 M\$, less than 1% above the FY07 figure. Of that amount, 81 M\$ goes to operating facilities: LIGO, NSCL (MSU cyclotron), LHC, CESR. The FY09 request for PHY is nearly 300 M\$, though CESR support will decline as it becomes CESR-TA (CESR damping ring Test Accelerator).

As a consequence of the Omnibus Bill, in FY08, EPP is down 5%, Theory is down 4%, and Particle and Nuclear Astrophysics (PNA) is down 2%. In FY07 the program funding levels were EPP 19 M\$; PNA 16 M\$; DUSEL 6

M\$; Theory 12 M\$; CESR 15 M\$, LHC ops 18M\$; with others at 14 M\$ for a total of 100 M\$. In addition, IceCube received 24 M\$ in MREFC (Major Research Equipment and Facilities Construction).

P5

Charlie Baltay, chair of the current P5, begin by displaying the three funding scenarios the subpanel is to address.

1. FY08 actual of 688 M\$, increased by 3.5%/y.
2. FY07 actual of 752 M\$, increased by 3.5%/y, except that FY08 is 688 M\$.
3. FY07 actual of 752 M\$, increased by 6.5%/y, except that FY08 is 688 M\$.

P5 met at Fermilab on from Jan. 31 to Feb. 2, with a Town Meeting on Feb. 1. It will meet again at SLAC from Feb. 21 to 23 and at BNL from March 6 to March 8.

Charlie presented his own personal views on the situation, including the proposal:

Can we think of our field as having three Frontier Areas with similar high priority:

- *The Energy Frontier: The Origin of Matter*
- *The Luminosity Frontier: Neutrinos and Leptonic CP Violation*
- *The Cosmic Frontier: Dark Matter and Dark Energy*

Each of these three frontiers seek answers to fundamental questions that we should be able to articulate and everyone should be able to appreciate, and they require different approaches and facilities to pursue

Baltay stressed the importance of coordinating our program with those in Europe and Japan. He listed questions central to the P5 deliberations, including some raised by Persis Drell the day before. For example, one slide showed

How important is it to have an onshore running accelerator program in the US

- *To maintain accelerator expertise and train the next generation of accelerator physicists*
- *Is this important in our hopes to recapture the Energy Frontier*
- *To maintain a level of funding for our field anywhere near what it is now*
- *If there were no accelerator facilities in the US, what would be our fair share of the operating costs at CERN?*

A number of points were raised by HEPAP members in response to Baltay's presentation. Lisa Randall suggested we would do better to have a single, unified theme for the program rather than three

separate ones, an idea seconded by Dennis Kovar. Pat Burchat pointed to the frequent invocation of "world leading" as a standard for elements of the program. This kind of labeling can conflict with the very beneficial practice of the community of working in broad international teams. It may be fine to ask that we have "a world leading program," but not appropriate that we have "the world leading program." I pointed out that the three scenarios lead to enormously different total funding. For example, for the years FY08-FY12, the three have totals of 3.69 B\$, 4.07 B\$, and 4.4 B\$. Over the ten years FY08-FY17, the totals are 8.1 B\$, 9.0 B\$, and 10.7 B\$. It will be hard to draw up consistent plans whose total costs differ by 2.6 B\$. Components of these plans might include Project X (1 B\$??), JDEM (0.4 B\$), LHC upgrades (0.4 B\$?), whose sum is less than the difference between the plans. The lowest scenario considered by the previous P5 would have a total of 4.4 B\$ for the FY08-FY12 interval. In other words, the lowest previous scenario has become the highest for the new P5.

BaBar

Hassan Jawahery, spokesperson for BaBar, reported that the PEP-II machine is running excellently, with luminosity around $1.2 \times 10^{34} \text{ cm}^{-2} \text{ s}^{-1}$. Thanks to support from DOE and the international collaborators, the running was not terminated by the Omnibus Bill, but instead will continue until April 7, 2008 taking data at the Y(3S) and Y(2S). These data and the very large dataset from Y(4S) running (over 500 fb^{-1}) will be analyzed over the next two to three years.

Demography

For a couple of years, Usha Mallik has led a group analyzing the demography of the high energy physics community. In particular, it is tracking the flow of researchers through the various stages: grad school, postdoc, junior faculty, senior faculty, with special attention to the flow in and out of the U.S. Naturally, it is not possible to track down everyone and there is a loss of information on 10-20% of the individuals. Still, a fairly complete picture has been formed and will be refined in the next year.

Lattice QCD

Bob Sugar gave a brief review of recent accomplishments in lattice QCD. For example, for the pseudoscalar coupling f_D , lattice QCD gets $201 \pm 3 \pm 17 \text{ MeV}$ while experiment gives $223 \pm 17 \pm 3 \text{ MeV}$. For f_{D_s}/f_D LQCD get $1.12 \pm 0.01 \pm 0.04$, while experiment gets $1.27 \pm 0.12 \pm 0.03$. For f_B LQCD get $216 \pm 22 \text{ MeV}$ and experiment gets 229

$\pm 36 \pm 24$. Similarly impressive results are found for the momentum-transfer-dependent form factor in $D \rightarrow K l \nu$ and for the strong coupling constant evaluated at M_Z . A particularly important use of LQCD is in reducing the theoretical uncertainties associated with extracting from weak decays (especially those of B mesons) the values of the CKM matrix elements. Here we can regard LQCD as a luminosity booster, or in fact better than that because it will reduce total uncertainties below the values they would have no matter how much we increase statistics.

HEPAP meets again at the end of May.