

DPF NEWSLETTER

January 2010

Editor, David Saltzberg, DPF Member-at-Large

Issues and Activities

Boris Kayser, Fermilab, 2009 DPF Chair

This DPF Newsletter conveys the results of the most recent DPF Executive Committee (EC) election, sends you news from the LHC and Fermilab, describes the activities of HEPAP, and tells you about the “DPF 2009” meeting in Detroit and about particle physics at the upcoming APS “April Meeting” to be held February 13-16, 2010 in Washington, DC. I would like to add a report on some of the issues that the EC has been considering in ongoing discussions, and on some of the EC activities during 2009.

Probably the most substantive issue we have been considering is the question of how the DPF can most constructively and effectively contribute to the planning of the future high-energy physics program, and how it can best promote the support of our field. It is recognized that the DPF has a unique role to play — it is the voice of the U.S. particle physics community, and is independent of any direct ties to the federal funding agencies. The EC has discussed a number of possible steps that the DPF could take, and I am sure you will be hearing more about this from the 2010 DPF Chair, Chip Brock.

A related issue is how the American, Asian, and European particle physics communities can help one another, and how the DPF can best make common cause with its European and Asian counterparts, promoting common purposes, issuing joint endorsements, and occasionally having joint conferences. When, late in 2009, a science-funding crisis developed in Japan, the DPF EC helped the APS create a letter to Japan expressing appreciation and admiration of Japanese scientific achievements. The EC also sent its own letter to Japan, written by 2009 Past-Chair Bob Cahn on behalf of the DPF, and encouraged DPF members to send any comments they may have. Since then, the outlook in Japan has brightened. On another front, contact has recently been established between the High Energy Particle Physics Board of the European Physical Society and the DPF EC.

To keep informed on the status of American particle physics funding, and on the political climate for this funding, the DPF EC periodically invites funding-agency officials and observers of the political scene to speak at its meetings.

When a DPF input regarding a matter before Congress appears called for, the DPF EC should act. When the “stimulus

package” was wending its way through Congress, and it appeared that the principal challenge to the inclusion of healthy support for science in this legislation would be in the Senate, the four DPF Chairs (vice chair, chair-elect, chair, and past chair) sent a letter to selected Senators. On behalf of the DPF, this letter argued that a strong investment in scientific research and education would stimulate the U.S. economy now, while empowering the scientific engine that will drive American innovation, technological leadership, competitiveness, and economic strength in the future. We would like to believe that letters such as this one helped to secure the very favorable treatment of science in the stimulus package.

“DPF 2009” was a very successful conference, due in no small part to the dedicated and thoughtful efforts of its organizers, Alexey Petrov and Paul Karchin. In the past, DPF conferences have been held at irregular times. The DPF EC believes that the usefulness and impact of these conferences would be increased by holding them every other year on a regular basis. A subcommittee chaired by Chip Brock is being formed to address this issue.

During a very interesting town-hall-style business meeting at “DPF 2009,” Ben Grinstein noted that APS prizes and awards provide valuable recognition of outstanding accomplishment, and suggested that there be more prizes. In response, the DPF EC has been wondering how outstanding work at the postdoctoral or junior faculty level, presently unrecognized by any special award, might be recognized. A subcommittee chaired by yours truly is being formed to contemplate this issue.

While a newsletter such as this one provides one means of distributing news to DPF members, other means of communication such as a website on which news items would appear whenever they are timely might be very useful. A subcommittee chaired by David Saltzberg has been created to consider the possibilities and recommend the steps to be taken.

As described in Patty McBride’s news item on conferences, there will be a DPF “Business Meeting” at the Washington APS meeting on Monday, February 15 at 5:30 pm. This will indeed be a good place to raise your concerns, voice your opinions, and make suggestions. Please do come to the meeting. Quite apart from this meeting, the DPF EC always welcomes your ideas and any comments you may wish to make. ■

News from the High Energy Physics Advisory Panel

Mel Shochet, University of Chicago, HEPAP Chair

The High Energy Physics Advisory Panel (HEPAP) advises both the Department of Energy and the National Science Foundation on the current and future program in elementary particle physics. Meetings are held three times per year in or around Washington, D.C. The agencies give reports on their activities, often focusing on budgetary issues but also including upcoming projects, recent successes, and current problems. Presentations are also made on topics of importance to the field, including future projects, R&D efforts, and the work of international committees. Following each meeting, I write a letter to the agencies summarizing the meeting and giving HEPAP's comments. Those letters as well as meeting presentations and HEPAP reports are available on the website <http://www.science.doe.gov/hep/panels/hepap.shtml>.

The most important HEPAP task is providing guidance for the future program. This usually takes the form of a report issued by a HEPAP subpanel and approved by HEPAP. Each subpanel is created on an ad hoc basis to address a specific charge from the agencies. It ranges from a narrow focus, like dark matter experiments or advanced accelerator R&D, to a broad charge to develop a ten-year program for the entire field. Recent HEPAP subpanel reports were written by the Neutrino Scientific Assessment Group, the Advanced Accelerator R&D Subpanel, the Dark Energy Task Force, the University Grants Program Subpanel, and the Dark Matter Scientific Assessment Group. For many years there have been periodic broad planning exercises carried out by HEPAP subpanels. In 2002, one chaired by Jon Bagger and Barry Barish recommended that a more regular process be carried out by what they called the Particle Physics Project Prioritization Panel (P5). Since that time there have been three such subpanels, two chaired by Abe Seiden and the most recent one, in 2008, chaired by Charlie Baltay.

The 2008 P5 subpanel was charged with developing ten-year programs under four budget scenarios: less than flat in constant dollars, flat over the decade, an increase of approximately 3% per year in real terms, and an ordered list of important projects requiring additional funding. They heard presentations on current and proposed projects, and they gathered community input through letters and town meetings held at SLAC, Fermilab, and Brookhaven. In their report, they organized the field by the tools we use: the Energy Frontier for experiments requiring high energy colliders, the Intensity Frontier for projects that need intense secondary beams, and the Cosmic Frontier in which particles from the cosmos are studied. Their recommendations have been critical to the development of the DOE and NSF programs.

At the Energy Frontier, the recommended program includes additional running at the Tevatron Collider, strong U.S. participation in the LHC program including upgrades, and broad R&D for a future lepton collider. Since the required energy of such a machine won't be known until new physics is seen at the LHC, P5 recommended R&D not only for the ILC but also for other technologies such as a muon collider. Advanced accelerator R&D and detector R&D were also strongly supported since that is the seed corn for our future.

The centerpiece of P5's Intensity Frontier program is a high intensity proton accelerator at Fermilab directing an intense neutrino beam to a large underground detector in DUSEL to search for ν CP violation, proton decay, and supernova neutrinos. The new accelerator would be a stepping stone to a possible future neutrino factory and eventually a muon collider. Also recommended were reactor neutrino experiments to measure θ_{13} , neutrinoless double beta decay experiments, and a set of precision experiments including a $\mu \rightarrow e$ conversion experiment and possible participation in an overseas super-B factory and rare K decay experiments.

In the Cosmic Frontier, the program includes large dark energy experiments in space and on the ground, and dark matter experiments employing different technologies. New large experiments with high energy cosmic rays, gamma rays, and neutrinos could only be carried out under the higher funding scenarios.

The most recent subpanel was the Particle Astrophysics Scientific Assessment Group (PASAG) chaired by Steve Ritz, which presented its report at the October HEPAP meeting. It was charged with recommending a detailed program for the Cosmic Frontier again under a number of budget scenarios. The task was especially challenging because many of the experiments address important scientific questions in both particle physics and astronomy. PASAG prioritized based on importance to our field, leaving the astronomy prioritization to the ASTRO2010 process. The subpanel considered experiments to study dark matter, dark energy, high energy cosmic rays, gamma rays, and neutrinos. The scientific merit of the proposals made selection difficult, especially in the lower budget scenarios. They gave highest priority to dark energy and dark matter, recommending significant funding in all of the budget profiles. Large expenditures for the study of high energy cosmic particles could be included only in the higher budget scenarios.

The next HEPAP meeting will be March 11-12 when we will hear details of the President's FY11 budget. ■

News from the Large Hadron Collider

Katie Yurkewicz, Fermilab, US LHC Communications and Harvey Newman, Caltech, US LHC Executive Committee Chair

The Large Hadron Collider at CERN in Geneva, Switzerland is now the world's highest-energy particle accelerator, and is on its way to becoming the most powerful. Following more than 15 years of construction, and one year of repairs following a meltdown of a busbar between two superconducting magnets in September 2008, beams of protons once again circulated in the LHC on November 20.

After rapidly capturing and circulating the beams, and completing the first series of measurements of the machine optics in a time shorter than expected, the LHC's first-ever proton collisions at the injection energy of 450 GeV per beam (900 GeV in the center of mass) were recorded by the ALICE, ATLAS, CMS and LHCb detectors on November 23. Less than one week later, after preparing the "ramp" sequence to accelerate the beams while controlling the machine tune, the LHC set a world record for beam energy by accelerating protons to an energy of 1.18 TeV, surpassing the previous record of 0.98 TeV that had been held since 2001 by Fermilab. Collisions at 2.36 TeV center-of-mass energy soon followed, with the first physics runs taking place shortly after midnight on December 14. The last two weeks of the LHC's 2009 run, which ended December 16, were particularly exciting. The accelerator met all of its operational goals in storing, measuring, accelerating, and squeezing the beams, and the experiments demonstrated their ability to produce rapid results.

The first runs at 900 GeV center-of-mass energy provided large data samples that allowed the experiments to improve on their calibration, alignment and timing, and test their reconstruction and analysis chains. Clean peaks soon appeared that showed light mesons such as pions, etas and lambdas decaying to photons or charged particles. Together with distributions of the charge multiplicity per event and jets and their spread, these results signaled a good understanding of the detectors and their responses and provided an excellent beginning to the LHC physics program. The first physics runs at 2.36 TeV center-of-mass energy resulted in record data flows across the Atlantic and to several sites in Europe. Results at both collision energies were reported by all LHC experiments at the CERN Council Meeting on December 18.

These first low-energy collisions are milestones on the way to the ultimate goal: billions of high-energy collisions in the center of the four main LHC detectors. Teams at CERN are now preparing the accelerator for collisions at 3.5 TeV per beam in the first quarter of 2010.

Scientists from U.S. universities and national laboratories celebrated along with their peers around the world as each milestone was passed, and eagerly await the next steps. In all, 10,000 people from 60 countries have helped conceive, design and build

the LHC accelerator, its experiments, and the Worldwide LHC Computing Grid, including more than 1,700 scientists, engineers, students and technicians from 97 institutions in 32 U.S. states and Puerto Rico. U.S. participation is funded by the Department of Energy's Office of Science and the National Science Foundation.

American participation is vital to the two biggest LHC experiments, ATLAS and CMS. U.S. scientists have contributed to the construction of almost every sub-system of the ATLAS and CMS detectors as well as their software, computing and networking systems, continue to play key roles in the operation of the detectors, and are gearing up toward intensive work on all aspects of data analysis, from precision top quark and other measurements of Standard Model physics in a new energy range, to Higgs and supersymmetry searches, to more exotic new physics scenarios such as gravitons signaling the existence of extra dimensions, or low mass strings. In the ALICE experiment, American participation has ramped up over the last several years with the contribution of the detector's electromagnetic calorimeter. U.S. scientists also contribute to the LHCb and TOTEM experiments.

On the accelerator front, scientists from American institutions have contributed critical components to the construction of the LHC, including the final-focus magnet systems that guide

beams into collision in the heart of the experiments and superconducting beam separation dipole magnets.

Collisions at 3.5 TeV per beam are the initial goal for the LHC's 2010 run, but more may be in store. Once a significant data sample has been collected by the LHC experiments and the operations team has gained experience in running the machine at that energy, beam energies may be increased to a maximum of 5 TeV per beam. At the end of 2010, the LHC will be run with lead ions for the first time. After that, the LHC will shut down and work will begin on moving the machine towards the design goal of 7 TeV per beam.

The speed at which the LHC was recommissioned and the beams were brought into collision, and the degree to which the beam optics are understood, speak both to the precision of the collider's magnet lattice and construction accuracy, and the excellence of the teams who built and are operating the accelerator. The same can be said of the LHC experiments and the teams who built and operate the detectors, as well as their trigger and data acquisition, software and computing systems, who were ready and waiting to acquire, reconstruct, record and immediately analyze the first samples of events. Even these first steps have been an exciting experience for the thousands of physicists, students and engineers at sites throughout the world participating in the LHC program, as they embark on the long awaited physics program in a new range of collision energies. ■

For the latest news from the LHC, please check this link from the CERN press office: press.web.cern.ch/press/lhc-first-physics/

News from Fermilab

Jeffrey Appel, Fermilab Directorate

Fermilab is moving aggressively on fulfilling the promise of its current program, beginning funded efforts on the next generation of experiments, and doing R&D for the future beyond that. The breadth of the research program should be evident in this brief summary. And, there is recent positive news in all areas.

The Fermilab accelerators came back very fast after a long summer maintenance-and-repair shutdown. That shutdown followed a Collider run lasting about 20 months. After the shutdown, initial instantaneous luminosities returned to the level of $3 \times 10^{32} \text{ cm}^{-2}\text{s}^{-1}$. The Tevatron Collider continues to provide integrated luminosity at near record levels. Over the last year, several weeks have seen greater than 60 pb^{-1} of integrated luminosity. The record was set in April, 2009, at just over 74 pb^{-1} . Contributing to the excellent performance has been the record number of antiprotons delivered to the Recycler Ring, the record being the 4.04×10^{12} during the week including Christmas, 2009, with nearly as many the following week, giving the best two-week period for antiproton delivery. For fiscal year 2010, the expectation is for an additional 2.25 fb^{-1} for each of the Collider experiments; and a total of about 12 fb^{-1} by the end of the scheduled running through fiscal year 2011. This could allow seeing evidence of the Higgs boson over some of the expected mass range of the Standard Model, or exclusion throughout that range if the Higgs is not there to be seen. There is a host of other results across the full range of collider physics. The two Fermilab Collider experiments are continuing their enviable refereed-journal publication rate of about one each per week.

Also central to Fermilab's productivity is support of and participation in the accelerator, detector, and physics efforts for the Large Hadron Collider program. The recent successes in restarting the LHC and first use of collision data have had major contributions from Fermilab, both in helping understand the accelerator issues associated with the LHC problems of last year and as part of US CMS in analyzing the data. Fermilab is the host institution for US CMS, and operates the Remote Operations Center (ROC), a Tier 1 Computing Center, and the LHC Physics Center (LPC) in support of these efforts.

The neutrino program is also benefiting from record accelerator performance. The protons on target (POT) for the NuMI beam reached 92.1×10^{17} POT during the week of Jan. 4-10 (the third of three weeks in a row with sequential new records for POT), and 14.0×10^{17} POT on January 9, a new record for a single day. The MINOS experiment in the NuMI beamline has provided some of the most interesting neutrino results recently, with a hint of sensitivity to the elusive neutrino mixing angle, θ_{13} , as well as the most precise determination of the atmospheric-mixing mass-difference. Results from 7×10^{20} POT, double the previous data sample, are expected soon. One recent highlight of the neutrino program has been the observation of particle tracks in the liquid argon TPC of ArgoNeuT. In addition, MINERvA is nearing completion of construction of its detector, with regular running using the full detector expected to begin by March 1. Finally, the Mini-

BooNE experiment has integrated well over 1.3×10^{21} POT in the Booster Neutrino Beam, and both MiniBooNE and SciBooNE have been publishing interesting results. The low-energy excess seen in MiniBooNE remains unexplained.

In particle astrophysics, the Laboratory's involvement in dark-matter searches across a range of technologies has been very visible. The approaches to observing dark matter by Fermilab experiments extend from direct searches via nuclear recoils to the effects of gravitational lensing on a cosmic scale. The most recent stir in the community was created by the new results from the Cryogenic Dark Matter Search experiment (CDMS). Pushing CDMS sensitivity to new, leading levels has resulted in two events with an anticipated background of less than one event. The race for increased sensitivity in various dark-matter particle mass ranges includes the solid-state germanium devices used by CDMS, new CF_3I bubble-chambers used by the Chicagoland Observatory for Underground Particle Physics (COUPP), depleted liquid argon detectors to be used by the DarkSide experiment (which recently received Stage I approval from Fermilab), and laser-“brick-wall” apparatus used by the GammeV axion search experiment. Dark energy is another component of the Fermilab particle astrophysics program. Starting with data from the Sloan Digital Sky Survey (SDSS) 2.5 meter telescope in New Mexico, the dark-energy density parameter has been constrained by the power spectrum of galaxies. More broadly, the SDSS ranks as the facility with the highest impact in astronomy for the fourth year in a row. The Dark Energy Survey (DES) is making good progress on preparing a new camera which should be operational in 2011 at the 4 meter telescope at Cerro Tololo, Chile, and the data handling and analysis software to use the data from the camera. The Pierre Auger Observatory continues to raise interesting questions about the source and nature of the very highest energy cosmic rays, even after demonstrating the GZK cut-off. Beyond DES, Fermilab is planning for participation in the Joint Dark Energy Mission (JDEM), whose space telescope could benefit were Fermilab selected as the JDEM Science Operation Center.

In summary of the current Fermilab program, it is useful to note that the program is providing the most results among all particle physics sources for publications in refereed journals and presentations at recent international conferences.

There is also major progress in preparations for the next round of experiments. With part of the American Recovery and Reinvestment Act (ARRA) funds provided to Fermilab, NOvA, the off-axis neutrino oscillation experiment will be sped up. Part of the NOvA Project is an upgrade of the NuMI beam intensity from 400 kW to 700 kW. NOvA also includes a 14 kiloton detector sited at a distance of 810 km in Ash River, Minnesota. Using technology identical to that of the far detector, a 215-ton near detector is sited off the NuMI beam axis, but on the Fermilab site at a distance of 1 km from the primary target. Recent progress includes the groundbreaking for and construction of the NOvA far-detector hall.

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DPF Meetings

Patricia McBride, Fermilab, DPF Chair-Elect

The 2009 DPF Meeting was held last summer at Wayne State University in Detroit, Michigan from July 16-31, 2009. The DPF 2009 Meeting (www.dpf2009.wayne.edu/) featured many interesting presentations in the parallel and plenary sessions. There were social events at the Detroit Public Library and the Henry Ford Museum and a public lecture by Lawrence Krauss: "Einstein's Biggest Blunder: A Cosmic Mystery Story." Pier Od-done, Director of Fermilab, gave the final talk of the plenary sessions which emphasized the importance of accelerators and accelerator R&D in expanding our reach in particle physics research. The DPF 2009 organizing committee was chaired by Alexey Petrov and Paul Karchin from Wayne State University. Proceedings from the meeting will be published electronically through the SLAC Electronic Proceedings repository (eConf C090726). The next DPF Meeting will be held in 2011.

The annual APS "April Meeting" 2010 (www.aps.org/meetings/april/index.cfm) will return to Washington, DC this year. The 2010 meeting will be held from February 13-16, 2010 at the Marriott Wardman Park Hotel in Washington, DC. The annual APS April meeting will be held in conjunction with the American Association of Physics Teachers (AAPT), and we expect a diverse scientific program. The DPF sessions will start on Saturday, February 13 with an invited session on results from first collisions at the LHC.

The Division of Particles and Fields has partnered with other divisions of the APS to put together a broad program for the meeting. There will be joint invited sessions with the Division of Astrophysics (DAP), the Division of Physics of Beams (DPB), the Division of Nuclear Physics (DNP) and the Forum for International

Physics (FIP). The topics for the invited session include neutrinos, plans for new accelerators, dark matter, new topics in theory and international cooperation in science. There will also be invited sessions devoted to the Panofsky, Bouchet and Wilson Prizes, the Sakurai Prize, the Sakharov Prize and the DPF Thesis Award.

Rob Roser from Fermilab will present "The Search for the Higgs Boson and More at the Tevatron Collider" during one of the large 2010 APS April Meeting plenary sessions. In addition, the DPF will co-sponsor a session on "Beyond the Standard Model: Searches for New Physics" on Saturday, February 13 together with the National Society of Black Physicists (NSBP) and the National Society of Hispanic Physicists (NSHP). More than 200 abstracts were submitted to the DPF contributed sessions for the April meeting. It has been a tradition that the contributed talks are twelve minutes including time for questions. In the Fall, the contributed abstracts were assigned to sessions and speakers were notified. The abstracts covered a wide variety of topics including many recent physics results, theory predictions and developments in instrumentation for particle physics.

Each year the DPF hosts a "Business Meeting" for Division members to discuss the issues. This year it will be during the Washington APS meeting - on Monday, February 15 at 5:30 pm. The DPF executive committee and officers will briefly review news items and current issues to the DPF community. This will be a good place to raise your concerns and voice your opinions. We welcome an open dialogue on issues relating to research in Particle Physics. Please come to the meeting and speak up! ■

Results of DPF Elections

Al Goshaw, Duke University, 2009 DPF Secretary-Treasurer

The annual DPF election for members of the Executive Committee was completed on December 1, 2009. This year, in addition to the election of the Vice-Chair and two new member-at-large, the positions of Secretary-Treasurer and Division Councilor were filled. The five people elected are:

Pierre Ramond (University of Florida) Vice-Chair
Alice Bean (University of Kansas) Secretary-Treasurer
Marjorie Corcoran (Rice University) Division Councilor
Kara Hoffman (University of Maryland) Member-at large
Kate Scholberg (Duke University) Member-at-large

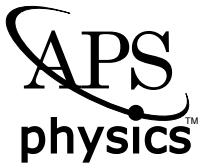
These people will join seven continuing Executive Members on January 1, 2010.

The 2010 members of the DPF Executive Committee and the final year of their terms are:

Chair: Chip Brock (2010)
Chair-Elect: Patty McBride (2010)
Vice-Chair: Pierre Ramond (2010)
Past Chair: Boris Kayser (2010)
Secretary-Treasurer: Alice Bean (2012)
Division Councilor: Marjorie Corcoran (2013)

Executive Committee Members: JoAnne Hewett and Ritchie Patterson (2010); Kevin Pitts and David Saltzberg (2011); Kara Hoffman and Kate Scholberg (2012)

You are encouraged to contact these representatives of the DPF community if you have suggestions for how the Executive Committee can better serve our community.



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News from Fermilab *(continued from page 4)*

Longer-term initiatives like MicroBooNE, Mu2e, and the Long Baseline Neutrino Experiment (LBNE) all have recently received CD-0 approval by the DOE. These are major projects that will draw strong national and international participation. Proposals for other experiments that are not currently on the roadmap, like the New g-2 Experiment and the proposed measurement of the ultra-rare kaon decay process, $K^+ \rightarrow \pi^+ \nu \text{ anti-}\nu$ using the Tevatron as a stretcher-ring, are world-class, and have strong collaborations pushing to move their experiments onto the HEP roadmap.

The strategy for the longer-term future has broad support. It is a challenging and exciting program, with Project X the central, first part of a multistep plan. Project X is a high intensity source aimed at pursuing the Intensity Frontier in neutrino and rare-decay physics. The plans for Project X include very flexible capability for the varied beam structures needed for the range of neutrino and rare process experiments. LBNE and next-generation lepton and rare kaon decay experiments, once built, would benefit further from the availability of Project X beams. Fermilab is leading a collaboration of all the major US accelerator laboratories working together on the R&D for Project X. Project X requires advances in superconducting rf technology. This technology is also necessary for any number of future energy-frontier options, as well as other accelerator developments in other fields. The HEP world expects to need a lepton collider once the Tevatron or LHC establishes the

energy scale necessary for pursuing expected discoveries. If appropriate, the ILC will be the easiest machine to build. Technology development for Project X will help position the US to be a major player for the ILC. Should an ILC not be capable of reaching the required energies, community interest will focus on the directions of a dual-beam electron accelerator, CLIC, and of a muon collider. Fermilab has been asked to host a national effort on Muon Accelerator R&D. The Laboratory is working closely with the existing collaboration to form a new national Muon Accelerator Program (MAP). MAP will pursue important aspects of a muon collider that require new technologies and will complete a muon collider Design Feasibility Study (DFS) over the next several years. Again, the technology developments for Project X will be a crucial piece in our ability to build a muon collider. The time scale for either CLIC or a muon collider is well beyond a possible ILC.

Fermilab seeks neighboring communities' advice and counsel on every public-related issue, from the effects on local residents of neutrino beamline cavern blasting to the future of US particle physics. The Laboratory has launched a new Community Advisory Board, a group of 26 local residents, who will help the Laboratory analyze the development of its program and the interactions with the surrounding community. The involvement of the laboratory neighbors has been outstanding in the past and continues to be outstanding. ■