HEPAP SUBPANEL

Mid-Course Report

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Snowmass

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HEPAP SUBPANEL

I have previously spoken to you about the subpanel's charge and membership. Today I will discuss its approach to planning.

- Strategic Decisions
- Questions for the Community

Web site:

http://hepserve.fnal.gov:8080/doehep/lrp_panel/index.html

SUBPANEL STRATEGY

- We began the planning process by engaging the community ...
  - Listen to presentations
  - Ask questions, start discussions
- We are continuing with a systematic process ...
  - Identify physics opportunities
  - Evaluate experiments and facilities needed to accomplish the scientific goals
  - Work in an international context, considering priorities and initiatives of other countries

SUBPANEL STRATEGY

- Our goals are to prioritize where possible …
  - Very large facilities (billions $$)
  - Medium facilities (hundreds of millions $$)
- And to develop a viable long range plan …

  … within technical, political and fiscal realities

MEETINGS

The panel held a series of meetings where it heard presentations of the major scientific programs. It also hosted town meetings to receive advice from the community and senior leaders in the field. All were webcast to the world; presentations are on our web site.

- Gaithersburg, Maryland, March 28-29, 2001
- Brookhaven National Laboratory, April 19-20, 2001
- Stanford Linear Accelerator Center, May 23-24, 2001
- Fermi National Accelerator Laboratory, June 11-12, 2001

GAITHERSBURG

- NSF, DOE
- F. Gilman, HEPAP
- A. Bunner, NASA
- M. Turner, Physics of the Universe
- J. Bahcall, Underground Laboratory
- M. Tigner, Perspectives
- M. Holland and D. Radzanowski, OMB
- H. Watson, Congress

BROOKHAVEN

- Neutrino Factory / Muon Collider
- LHC Accelerator and Detectors
- MECO, K0PI0
- W. Zajc, RHIC
- T. Kirk, BNL Future
- J. Symons, NSAC Long Range Plan
- N. Samios, J. Sandweiss, Perspectives
- Town Meeting and Reception

SLAC

- Linear Collider
- PEP II and BaBar
- Advanced Accelerator R&D
- SNAP, CDMS, GLAST
- J. Dorfan, SLAC Future
- M. Tigner, Cornell Future
- J. Siegrist, LBNL Future
- S. Drell, B. Richter, G. Trilling, Perspectives
- Town Meeting and Reception

FERMILAB

- Very Large Hadron Collider
- Run IIa and IIb
- Neutrino and Fixed Target Physics
- BTeV, CKM, KAMI
- Accelerator R&D
- Auger, Ice Cube, SDSS
- M. Witherell, Fermilab Future
- L. Lederman, J. Peoples, Perspectives
- Town Meeting / Users Meeting and Reception

SNOWMASS

The panel is also meeting at the beginning and end of Snowmass.

The Snowmass Summer Study comes at an excellent time!

- Snowmass, July 1-3 and July 17-20, 2001
- Washington, D.C., August 16-18, 2001
- Santa Fe, September 9-14, 2001 (Final Meeting)

In Washington we will hear summary reports on Snowmass. We will also have that session webcast.

No conclusions will be reached until after Snowmass!

SNOWMASS

- Plenary Sessions, Town Meetings
- Overseas Laboratory Directors
  - L. Maiani, H. Sugawara, A. Wagner
- European and Japanese Communities
  - L. Foa, S. Yamashita
- American Physical Society
  - A. Chao, J. Franz, C. Quigg
- PPARC
  - I. Corbett, I. Halliday

SNOWMASS

- Underground Laboratory
- M.K. Gaillard, NSB
- T. Appelquist, Physics in a New Era
- D. Lehman
- K. Bloom, Young Physicist Panel
- Theory Roundtable
- Agency Roundtable
- Private Sessions with Snowmass Participants

QUESTIONS TO THE COMMUNITY

The panel has also posed a set of questions to the community.

These are questions with which we are grappling.

- We have requested that letters be sent to panel@pha.jhu.edu
- All letters are being posted on our web site.

Please help us with the answers!

QUESTIONS

What is the scope of particle physics?

The intellectual scope of the field has broadened.

Today, the main themes include –

- The nature of matter and energy
- The structure of space and time
- The origin and evolution of the Universe

How do we now describe our field ??

QUESTIONS

What are the most important scientific questions facing the field?

The main thrust of the next few years –

- Understand electroweak symmetry breaking
- Investigate the origin of CP violation
- Measure neutrino masses and oscillations

What else ?? What are the scientific priorities that will drive our field for the next 20 years ??

QUESTIONS

What tools and approaches are required to address these questions?

The main tools and approaches include

- New collider experiments/facilities
- Upgrades to existing experiments/facilities
- Experiments/facilities away from accelerators

What do we need to address our science questions ??

QUESTIONS

Does the science require a major new facility?

Major new facilities being proposed include –

- Linear Colliders
- Neutrino Factories / Muon Colliders
- Very Large Hadron Collider

These are multibillion dollar facilities. Is the scientific case strong enough for the world community to pursue any of these projects ??

QUESTIONS

If so, should the U.S. bid to host it? What are the advantages and disadvantages? How might the disadvantages be mitigated?

- What are the costs and benefits to the host country?
- How should the U.S. structure its program if the next major facility is built here? Or abroad?

Should the U.S. bid to host a new major facility ??
Why or why not ??

QUESTIONS

What are the essential elements of a successful international partnership? How should it be implemented?

- How should we create an international partnership?
  - Management structure ?
  - Role of the host country ?
  - Criteria for cost sharing ?

How can an effective international partnership be formed ??

QUESTIONS

What is the role of astroparticle physics and cosmology in the field?

- National Underground Laboratory
- New experiments in space
- New generation of proton decay, dark matter and solar neutrino experiments

Astroparticle physics has emerged as a vital part of our field. How should we view experiments in this area ?? How should we support them and set priorities ??

QUESTIONS

What is the relation between particle physics and other fields of science and technology?

- Connections to astrophysics, cosmology, nuclear physics and cosmic ray physics?
- Applications of instrumentation and particle detection techniques to other fields?
- Uses of accelerators and acceleration techniques in other fields?

What are the connections between particle physics and other fields ?? How do they benefit from each other ??

QUESTIONS

What are the important issues facing university groups? What is their role in the future evolution of the field?

- What is the present role of universities to the field ?
  - Intellectual and educational
- How can we enhance university infrastructure and support?

The university program has been at heart of high energy physics in the U.S. What are the problems and opportunities that universities face ?? What changes should be made ??

QUESTIONS

What are the most pressing R&D goals for accelerators and detectors?

- What accelerator R&D is needed to develop the next generation of accelerators? What are the highest priorities?
- What detector R & D is needed for the next generation of experiments? How should it be supported and prioritized?

Significant R&D funding is needed for any new accelerator. We need to make the proper arguments. What are they ??

QUESTIONS

What does particle physics offer to society?

- Knowledge
- Education
- Technology
- Leadership

A large investment in science requires very strong arguments. What are they ??

QUESTIONS

What are the contributions of our field to other areas of science and technology?

- Medicine and Biology
- Electronics and Advanced Computing
- WWW
- ???

Which areas of science have advanced as a result of high energy physics ?? Which technologies ?? Which technologies have been transferred to industry ??

QUESTIONS

How do accelerator and detector R&D benefit society?

- Applications to other fields of physics or science?
- Applications to medicine or other needs of society?

Particle physics plays a leadership role in developing new accelerator techniques, as well as new particle detection and data analysis tools. How does this benefit society ??

QUESTIONS

What should the particle physics community do differently?

- Roles of the national laboratories?
- Sociology of enormous collaborations?
- Publication and size of author lists?
- Education for graduate students?
- Recruitment of the best young scientists?

What should we do to improve the way we do research in particle physics ??

CONCLUSIONS

- **The field has been very productive in recent years**
  - Precision tests of electroweak theory
  - Neutrino oscillations
- **The coming years look very bright**
  - Electroweak symmetry breaking
  - CP violation
  - Neutrino masses and mixings
- **Promising opportunities for a long range plan**
  - Balancing act ……
    - Ambitions, opportunities and reality
  - Require tough choices and priorities to
    - Develop a program the community wants
    - Create a program we can sell!