

SOME THOUGHTS ABOUT A
**VIRTUAL (or REAL) PHENOMENOLOGY
INSTITUTE**

TALK AT IRVINE DPF MEETING
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National Science Foundation
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THANKS TO WU-KI TUNG FOR PROVIDING
COPIES OF PECCEI REPORT AND HEPAP
REPORT
AND
B.F. L. WARD FOR HELPING INTITIAE THE
DIALOGUE

CONTINUING CRISIS IN US SUPPORT OF PHENOMENOLOGY THEORY

1990-PECCEI REPORT

Report of American Physical Society Division of Particles and Fields Ad Hoc Committee on Particle Theory April 13, 1990 R.D. Peccei, Chair T. Appelquist E.L. Berger R.D. Carlitz J. Dorfan E. Eichten M.B. Einhorn M.K. Gaillard H. Georgi P. Langacker F. Paige M. Shochet

Career Positions: If particle physics is to remain as robust and intellectually exciting as it has been, it is crucial that particle theorists whose work is related to experiment be able to find faculty appointments in the leading physics departments of the country. Departments are urged to consider the question of balance within particle theory as a normal part of the appointments process.

Presentation to HEPAP Subpanel On Long Range
Planning For U.S. High Energy Physics
SNOWMASS 2001

Wu-Ki Tung Michigan State University

Issue: Crisis in physics research infrastructure facing the US HEP community which, if not addressed, would undermine the physics payoff of all current and collider programs.

The Issue

In the overall US HEP enterprise, phenomenological efforts which underpin the extraction of physics, both new and old, from measurements in current and the proposed collider facilities are grossly inadequate for the challenges which lie ahead—for any of the options likely to be advocated by the Subpanel. The problem is structural and cultural.

It has been known for at least 15 years. But it has now reached crisis proportions.

- Research funding and faculty positions for this kind of physics (compared to visionary theory and new scenarios physics) is becoming an ever smaller fraction of the total;

- Young physicists trained in this kind of physics have been leaving in droves for lack of career opportunities;
- Ever fewer new graduate students are entering the field;
- As a result of this seemingly unstoppable trend, established physicists in this area are becoming increasingly frustrated, and are being forced to rethink their own commitments to this kind of work.

Serious question: In five year's time, is HEP in US going to face a real crisis in infrastructure – an irreparable gap between visionary theory/"phenomenology" and real-life experimental physics – because of these developments?

TASK FORCE NEEDED- TO READDRESS THESE FINDINGS AND COME UP WITH A PLAN FOR A VIRTUAL OR REAL PHENOMENOLOGY INSTITUTE!

- 1) Assess the present status of our understanding of QCD and the standard model as well as various generalizations and develop a roadmap of calculations that would tie in with planned and ongoing experiments
- 2) Determine manpower needs to perform necessary improvements in existing calculations such as going beyond NLO, renormalization group improvements, etc. etc. etc.
- 3) What should be appropriate mix of Senior Scientists at Government Labs and Universities, as well as young Assistant Professors, Post-Docs and Students.

WHAT IS THE BEST APPROACH TO ADDRESS THESE ISSUES?

- 1) RIKEN MODEL -- Support young assistant professors- at universities 1/2 funded by some government agency. Summers spent at some Government Lab such as Fermilab

- 2) EU model- an umbrella type proposal which would then include those activities that each of the respective groups would like funded at its respective institution: a collection of group proposals from each of our groups to be presented as one big package for funding via the VPI.

- 3) Real Institute at the Proposed Underground Lab

- 4) Real Institute at a University or Consortium

VERY IMPORTANT FOR THE US TO Get Ready For
The Next Generation Of Accelerator Experiments,
Neutrino Experiments CMB Experiments

ROADMAP NEEDED FROM TASK FORCE :

1)What Theoretical Improvements Are Needed
(Given The Accuracy Of Experimental Uncertainties)
To Improve Our Understanding Of Beyond The
Standard Model Physics. (Lattice Gauge Theory
Community Has Done This).

2)Converse Problem- Given the errors of our
standard model (AND BEYOND) calculations, what
level accuracy of future experiments is needed to pin
down the parameters of non-standard model physics
approaches.

3) How Does One Ensure Training Of Next
Generation Of Phenomenologists- Support Of Young
Post-Docs, Students At Universities. WHAT ARE
EXPECTED SUSTAINABLE MANPOWER
NEEDS.

Peccei Report---(1990) Career Positions

Over the past five years or so, many theorists have moved toward more formal, mathematical physics. Along with this evolution of the field, a great many physics departments have added young faculty whose interests lie in these directions. Even though this group of young theorists includes many of the most able of their generation, this has led to a concern among the community that theoretical particle physics will drift too far from problems more directly accessible experimentally. While the abundant data emanating from new and upgraded facilities in the 1990's may help alter this trend, it is important that physics departments give serious consideration to this matter when planning for new appointments. Specifically, the Committee recommends that

The process leading to the appointment of a new particle theorist to the faculty of a physics department or to the staff of a laboratory should include thoughtful discussion of the balance between formal and more real-world work, both in the specific institution and in the field as a whole. There are many bright and creative young theorists whose work is motivated more directly by physical questions including some who deal directly with problems of current experimental interest. It is crucial that these people be able to find faculty appointments in the leading physics departments of the country. Experimentalists can and should play an important role in these discussions of theoretical appointments.

COLLIDER PHYSICS – CTEQ

REPORT

- A great deal of progress has been made since the first LO analyses were made;
- But, many areas of uncertainties and uncharted territories remain.

Yet to be done: (before we can really understand the parton structure of nucleon, and are able to make reliable predictions)

- Reliable methods of **quantifying uncertainties**; (several groups)
- **Gluons** at large and small x ; (all groups)
- d/u at large x ; $(db-ub)/(db+ub)$ at large x ; (CTEQ)
Isospin violation (i.e. d_n .ne. u_p); (MRST-DIS04)
- Strangeness $s(x)$; and **strangeness asymmetry**; (CTEQ, NuTeV)
- **Heavy quark** (c and b) parton distributions. (CTEQ)

FINANCIAL REALITIES

Because of Budgetary Constraints the Call for Frontier Centers in Physics at NSF has been moved back to 2008.

Until then, a small program to have 5 year postdocs. One in 2006, two in 2007, 3 in 2008 is a realistic stop-gap measure. This could be a supplement for an existing NSF grant with an Advisory Board selecting the Post-Docs who could be at any University.

By that time the field should be able to decide whether a REAL Institute at say the National Underground Laboratory, or at a University would be preferable to a VIRTUAL Institute administered by an Advisory Board which would select Post-Docs and Assistant Professors. Or a virtual Institute on the Lines of the European Model.

B.F.L. Ward is the point person for the Task Force. The costs of such a task force can be underwritten by the NSF and DOE either under HEPAP or as a totally separate entity.

INITIAL E-MAIL TO START THE DIALOGUE

Hello Everyone,

Fred Cooper of NSF would like the community to discuss a Virtual Phenomenology Institute (VPI) that could be funded by the NSF at the level of multi-\$M/yr possibly as a Physics Frontier Center (. It would need the blessings of HEPAP, etc. It would support post-doc's, students, travel, summer salaries,

and other research expenses as required by cutting edge research in high energy phenomenology, where this funding would be located at participating institutions but would be provided by the Virtual Phenomenology Institute. One model would be in analogy with the EU Networks for HEP Theory that are now funded by the European Union in Europe. We would write an umbrella type proposal

which would then include those activities that each of our respective groups would like funded at its respective institution: a collection of group proposals from each of our groups to be presented as one big package for funding via the VPI.

The purpose of this e-mail is to get your reactions, feedback critiques, etc., to find out if you would like to participate, and to ask you to spread the word about the idea to anyone that is not already on the mailing list above.

Thanks.

Best regards,

Bennie

PS: I realize that some on this list are beyond the reach of NSF but your input is still welcome.

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