The Road to Snowmass 2001

- A community event organized by the Division of Particles and Fields and Division of Physics of Beams of the American Physical Society
  Saturday, June 30 – Saturday, July 21, 2001 in Snowmass, Colorado
- Ron Davidson ⟨rdavidson@pppl.gov⟩ (DPB) and
  Chris Quigg ⟨quigg@fnal.gov⟩ (DPF) are leading the organization.
- The entire HEP community is welcome. We expect ≈ 500 participants.
- The agenda for Snowmass 2001 will be set by the community.
  We are working constructively with the laboratories and science agencies, and we will call on them for support. (Proposals in preparation)
- We are encouraging very significant international involvement, and are in regular communication with leaders from outside the U.S.


Snowmass Village
at Aspen

We have consulted broadly to formulate Snowmass 2001

- DPF and DPB executive committees
- Users organizations from Brookhaven, Cornell, Fermilab, and SLAC
- North-American physicists working at CERN and DESY
- Representatives of non-accelerator experiments
- Representatives of the linear collider, neutrino factory / muon collider, and very large hadron collider communities
- The accelerator research community
- Other physicists representing diverse backgrounds, interests, and experiences: *nuclear physics community: neutrinos, QCD, . . .*
- APS Presidential Line, Other APS officers and staff
- Directors of Cornell, Fermilab, and SLAC; CERN, DESY, and KEK
  Division Directors of Argonne, Brookhaven, Lawrence Berkeley National Lab, . . .
- Chair of HEPAP; DOE and NSF officials
- Numerous physicists from outside the United States

We have received much encouragement and many thoughtful suggestions.

Some Goals of Snowmass 2001

- ▷ Undertake a thematic survey of our vision of particle physics and its future in the most ambitious intellectual terms. Examine different scenarios for the new physics landscape. Within this broad vision, identify the questions we want to address over the next two decades.
- ▷ Looking far beyond the standard model to string theory and to clues that the coming precision cosmology might supply, understand what might lead us to identify new energy scales or frame new experimental programs.
- ▷ Consider the range of instruments that might help us achieve our scientific goals. Gain a community understanding of readiness, capabilities, costs, and technical risks of various accelerators proposed around the world. Articulate the accelerator R&D needed for near-term and longer-term projects.
- ▷ Explore fundamental research in accelerator physics and technology that will be needed to address our longer-term scientific goals.
- ▷ Educate and energize our community to create the future we want.
- ▷ Engage with the public, and with other scientists.

Snowmass 2001 will explore particle physics as a whole

- ▷ Experiments at the highest energies and experiments of exceptional sensitivity; experiments that explore very high scales through virtual effects
- ▷ Accelerators to address a broad range of scientific opportunitities; accelerator research—including its historical importance—to provide information for knowledgeable decisions about future projects, and accelerator research and technology development for the long term.
- ▷ Theory that develops hand-in-hand with experiment and visionary theory that hasn't yet engaged experimental particle physics directly

including . . .

- ▷ Accelerator experiments and experiments that use natural sources (land, sea, and sky)
- ▷ Mature subjects and subjects just opening up
- ▷ The interplay between particle physics and technology
- ▷ The interaction of particle physics with related fields
- ▷ . . .

Snowmass 2001 Organizing Committee

Particle Physics

Chris Quigg (DPF)
Sally Dawson (BNL)
Paul Grannis (Stony Brook)
David Gross (ITP/UCSB)
Joe Lykken (Fermilab)
Hitoshi Murayama (Berkeley)
René Ong (Chicago → UCLA)
Natalie Roe (LBNL)
Heidi Schellman (Northwestern)
Maria Spiropulu (Chicago)

Accelerators & Technology

Ron Davidson (DPB)
Alex Chao (SLAC)
Alex Dragt (Maryland)
Gerry Dugan (Cornell)
Norbert Holtkamp (Fermilab)
Chan Joshi (UCLA)
Thomas Roser (BNL)
Ron Ruth (SLAC)
John Seeman (SLAC)
Jim Strait (Fermilab)

Related Particle Physics Events in Summer 2001

- 2001 Particle Accelerator Conference, 18 – 22 June 2001, Chicago, Illinois
- Physics in Collision, 28 – 30 June 2001, Seoul, South Korea
- 4th Edoardo Amaldi Conference on Gravitational Waves (Amaldi 2001) 7 – 12 July 2001, Perth, Australia
- International Conference on High Energy Physics of the European Physical Society 12 – 18 July 2001, Budapest, Hungary
- 16th International Conference on General Relativity and Gravitation (GR16) 15 – 21 July 2001, Durban, South Africa
- 2001 international Conference on Lepton–Photon Interactions 23 – 27 July 2001, Rome

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Parallel event at the Aspen Center for Physics:

Electroweak Symmetry Breaking and TeV-Scale Physics After LEP

4-week workshop beginning July 7

Approximate Snowmass 2001 Working Groups

Electroweak Symmetry Breaking
Flavor Physics
Physics beyond 1 TeV
Astro/Cosmo/Particle Physics
Strong Interactions / QCD

Interaction Region
Magnet technology
RF technology
Particle Sources
Beam Dynamics
Environmental Control
High-Performance Computing
Advanced Acceleration Techniques
Diagnostics

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e^+e^- circular (dominantly below M_Z)

e^+e^- linear (dominantly above M_Z)

μ storage rings and colliders

Hadron colliders (+ lepton-hadron)

High-intensity hadron accelerators (fixed target)

Astroparticle experiments on Earth

Astroparticle experiments in the sky

Particle physics and technology

The core of Snowmass—as usual—will be the work of individuals and working groups on scientific and technical issues . . .

. . . but the times and our situation demand additional special efforts:

▷ *Important involvement of students and young physicists*

- Subsidized housing for 50 students
- Young physicists throughout the organization

▷ Educating ourselves: *teach-ins* on

- Opportunities for accelerator research
- Experimental implications of string theory ?
- The role of nonaccelerator experiments in particle physics ?

▷ Educating ourselves: IEEE/NPSS *technology school*

- Short courses and lectures on advanced technologies sponsored by IEEE Nuclear & Plasma Sciences Society ($20K committed)

Committee for NPSS Technology Emphasis

Bruce C. Brown (Fermilab)

Matthew A. Allen (SLAC)

William M. Bugg (Tennessee)

Peter Clout (Vista Control Systems)

John E. Elias (Fermilab)

Erik Heijne (CERN)

Thomas Katsouleas (USC)

Ray S. Larsen (SLAC)

Patrick LeDu (Saclay)

Alan Todd (Advanced Energy Systems)

Craig L. Woody (Brookhaven)

Special efforts . . .

- Education and outreach

  We plan an energetic and diverse program of outreach and education while in Snowmass, to reach the population of Aspen, Snowmass, and surrounding communities, and to display to all of us the many approaches to outreach our colleagues have put into practice.

  - Public lectures and events; online event displays; Particle physics on the mall
  - Physics vans
  - Extensive-air-shower detectors at high schools
  - (Particle) Physics activities in day camps
  - Teacher training (Quarknet + local teachers)

"Science Weekend" in Snowmass, July 7/8, 2001

We will seek support from DOE & NSF, URA, APS, local sources, etc.

Snowmass 2001 Outreach Coordinating Committee

Elizabeth Simmons (Boston University)

Marge Bardeen (Fermilab)

Martin Berz (Michigan State)

Bill Frazer (Aspen Center for Physics)

Evalyn Gates (Chicago & Adler Planetarium)

Joey Huston (Michigan State)

Ronen Mir (SciTech)

Mel Month (Brookhaven)

Helen Quinn (SLAC)

Deborah Roudebush (Quarknet teacher, Virginia)

Greg Snow (Nebraska)

Ken Taylor (Quarknet teacher, Texas)

Jeff Wilkes (Washington)

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We will produce three documents for the community

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1) A brief and illustrated thematic survey of what particle physics is and aspires to be, guided by the scientific imperatives.

Comment: Documents proceeding from broad scientific goals to specific questions and then to instruments and technology development have been used to excellent effect by NASA. We will produce the thematic survey in final form at the summer study, *with professional help.* It should exist in several formats (printed page, web site, seminar materials, etc.), and in versions for different audiences, including the physics community and the wider public.

We will seek financial (and other) support for this activity

. . . three documents for the community

2) A survey of accelerator research and development

- *a)* highlighting the historical importance of accelerator R&D to our field, and to science and society at large;
- *b)* giving—in broad terms—the information that will be required for informed decisions about possible future accelerator projects;
- *c)* making the case for accelerator R&D not connected with specific projects

Comment: This document can accomplish several important goals. It will provide perspectives on future possibilities and on the importance of preparing for these futures, and it will make the case for all the important R&D activities.

Some Examples of Accelerator and Technology Topics

- Instruments or Proto-projects
  - VLHC / SuperLHC
  - Linear Colliders: NLC/TESLA/JLC, CLIC, giga-Z
  - Neutrino Factory
  - Muon Collider
  - High-luminosity B Factory; B Factory Upgrades
  - Bright proton source
  - τ-Charm Factory
  - Antiproton source / Antimatter Factory
  - Large circular e^+e^- colliders
  - Lepton-Hadron Colliders

- Technology Developments
  - magnet development
  - high-frequency warm RF development
  - superconducting RF development
  - large-scale simulation
  - laser-based acceleration
  - plasma-based acceleration
  - ...

- Fundamental limits in beams and acceleration technology
  - RF Breakdown limits
  - limits to low emittance
  - quantum limits
  - magnetic field limits
  - superconducting RF limits
  - materials limits.
  - ...

. . . three documents for the community

3) A more detailed, but still $<$ 100-page "white paper" on the field in all its richness and potential.

Comment: In the spirit of the 1994 DPF Committee on Long-Range Planning Report, this document can capture our community's sense of itself. Organized around scientific and technical goals, rather than laboratory programs, it can serve as important backdrop for future policy decisions.

Work carried out by individuals and working groups for the Summer Study will be reported in the *Proceedings.* We can include working documents or project status reports on a CD-ROM, and on the web. *We will explore innovative ways to publish the work of Snowmass 2001.* (Discussions with SLAC *e*Conf, *JHEP*)

Snowmass 2001 Needs You!

- Begin investing in *your future*.
- Come to Snowmass!
  We especially welcome younger physicists and advanced students.
- Give us ideas for the working groups, suggestions for convenors, thoughts on structure of the workshop.
- Help us create an atmosphere of inclusion and optimism
  —a sense of community
  The shoot-out mentality is our enemy (applies worldwide!)
- ...