

**Interdisciplinary and Interagency
Cooperation
in
High Energy Physics**

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Perspectives on HEP

- **The Structure of the Field**
 - **Accelerators remain the most important tool to achieve the HEP science goals ... “the energy frontier”**
 - **HEP is dominantly “large science”, involving lots of resources (human and technical)**
 - **HEP experiments and the enabling tools are typically developed and implemented through international collaborations**

Perspective on HEP

- **The National Laboratories**
 - Two large national laboratories – Fermilab and SLAC; plus ANL, BNL, LBNL and **Cornell (NSF)**.
 - Most of the resources in the field (>80%) are concentrated in the big DoE laboratories
 - They provide major accelerator and detector facilities and provide much of the field's technical infrastructure
 - They enable the development of future accelerators and detectors.

In the future, the national laboratories will continue to be at the center of particle physics, but the scope of their activities is expanding to include more interdisciplinary activities.

Perspective on HEP

- **The Universities**
 - HEP in the U.S. is built around a strong university-based community.
 - University faculty, graduate students and postdocs make up more than 80% of the scientists in the field.
 - University scientists provide training for our undergraduate and graduate students and renewal of the field

A healthy balance between universities and national laboratories is key to the success of the program.

Perspective on HEP

- **Style of the agencies is different**
 - DoE is laboratory and facility oriented
 - NSF is individual investigator oriented
 - NASA is mission oriented
- **Close cooperation between DoE & NSF in HEP**
 - HEPAP now reports jointly to NSF and DoE
 - LHC is an excellent model for agency cooperation on a complex (international) project
- **Recent cooperation between DoE and NASA**
 - GLAST is the largest cooperative project

The Field of Particle Physics



International Union of Pure and Applied Physics

Commission on Particles and Fields
C11 Commission (1957)

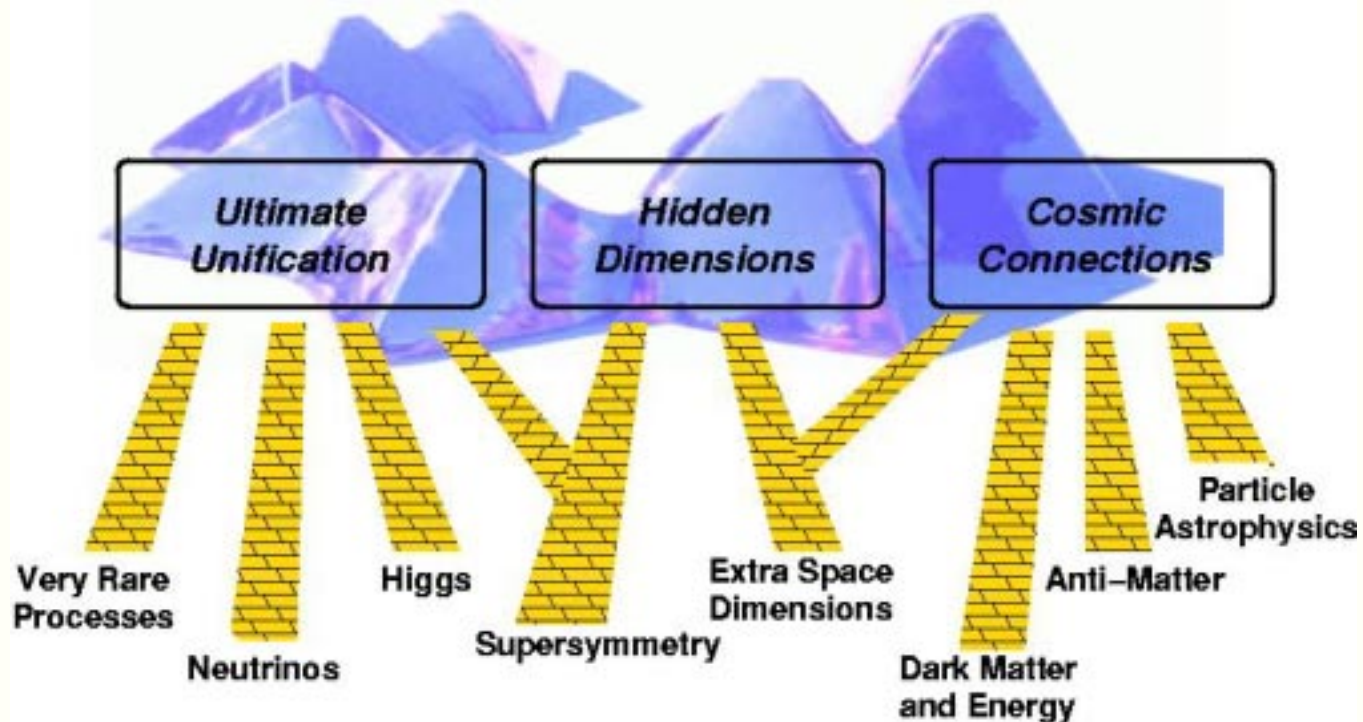
The Mandate for C11:

“... the theory and experiment concerned with the nature and properties of the fundamental constituents of matter and the forces acting between these constituents”

But, this definition is now too narrow. Particle physics has broadened its scope and is becoming more interdisciplinary !

The New Definition

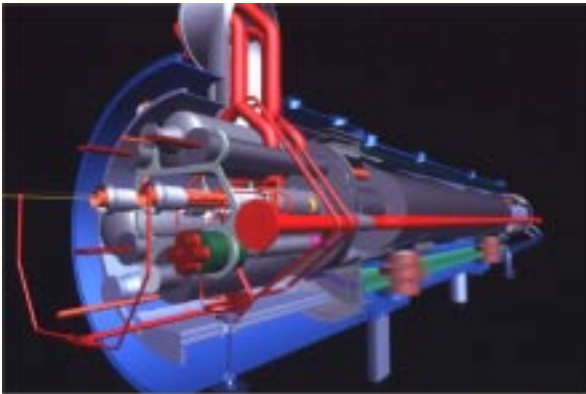
“The Science of Matter, Energy, Space and Time”



The Paths and Goals of Particle Physics

The Breadth of Particle Physics

- We have many tools at our disposal from **forefront accelerators** to **satellites in space** to **experiments deep underground**.



Accelerator
LHC Magnet



Space



The Soudan Mine
MINOS

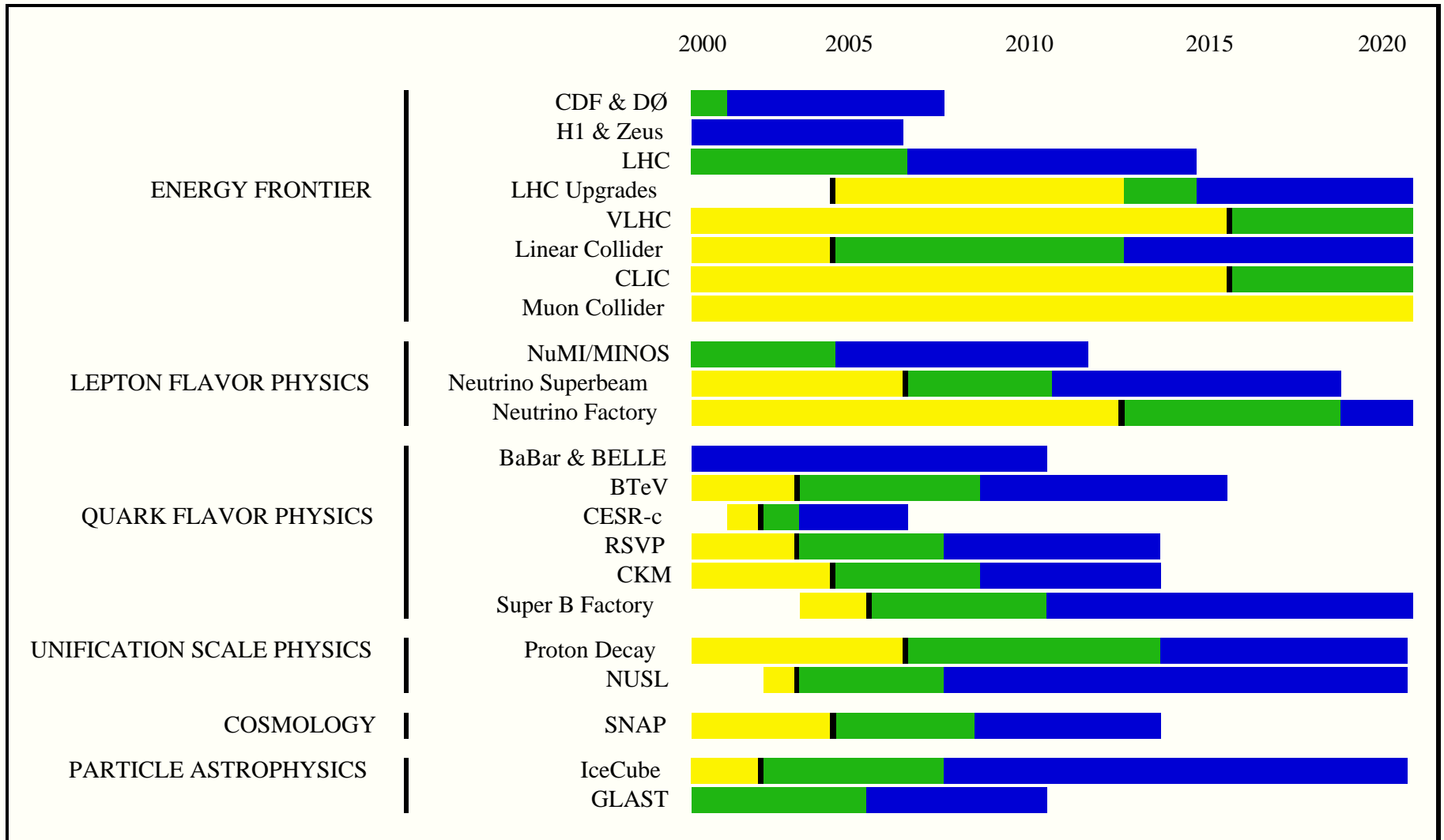
The science requires forefront accelerators at the energy and luminosity frontiers. But, it also requires innovative experiments in space, underground, and away from accelerators.

Particle Physics Project Prioritization Panel (P5)

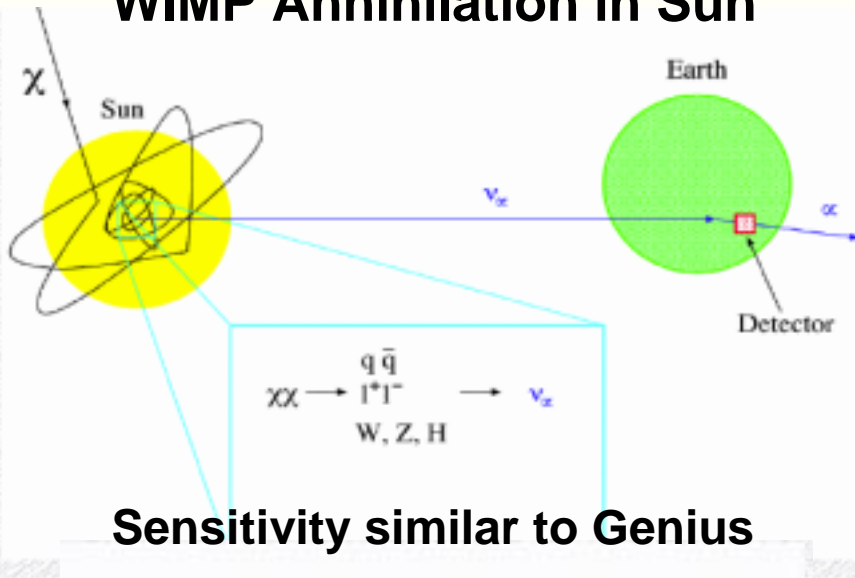
- Prioritization is central to carrying out a diverse, aggressive program of particle physics with limited resources
- P5 is being created to monitor, set priorities and make choices for midsized projects (~ \$50M to \$500M), whether on accelerators or in space.

This was one of the primary recommendations from the recent long range plan for HEP. It is just being implemented.

The Particle Physics Roadmap



WIMP Annihilation in Sun

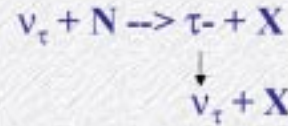


Sensitivity similar to Genius

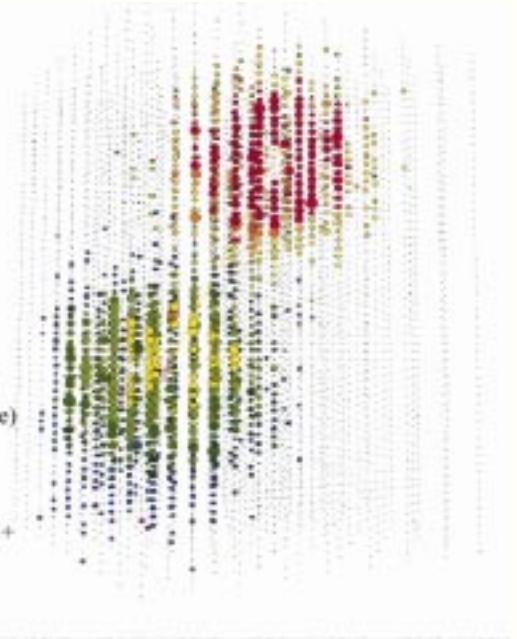
Astrophysics and Particle Physics

IceCube

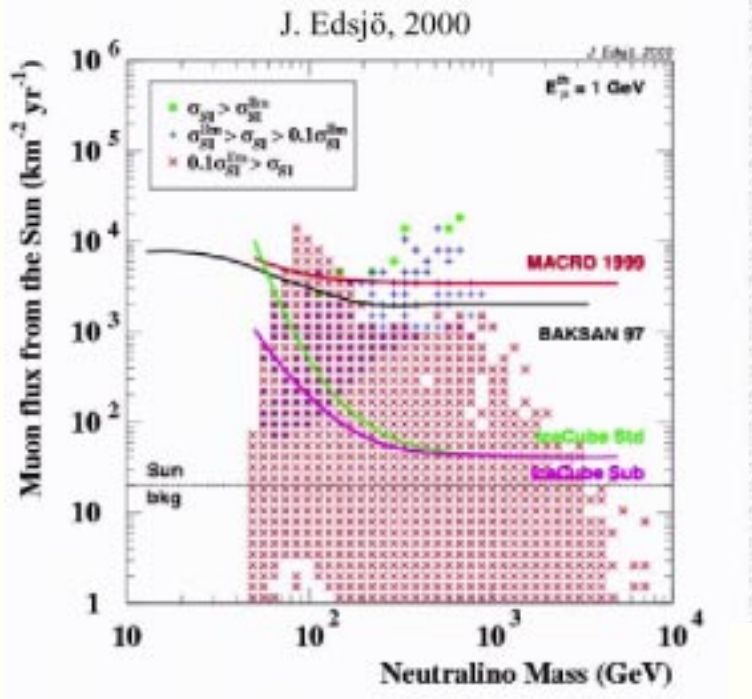
Double Bang



- $E \ll 1$ PeV: Single cascade (2 cascades coincide)
- $E = 1$ PeV: Double bang
- $E \gg 1$ PeV: Second cascade + tau track

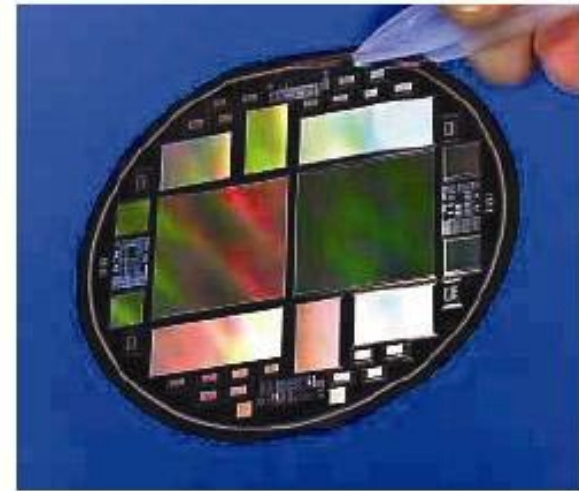
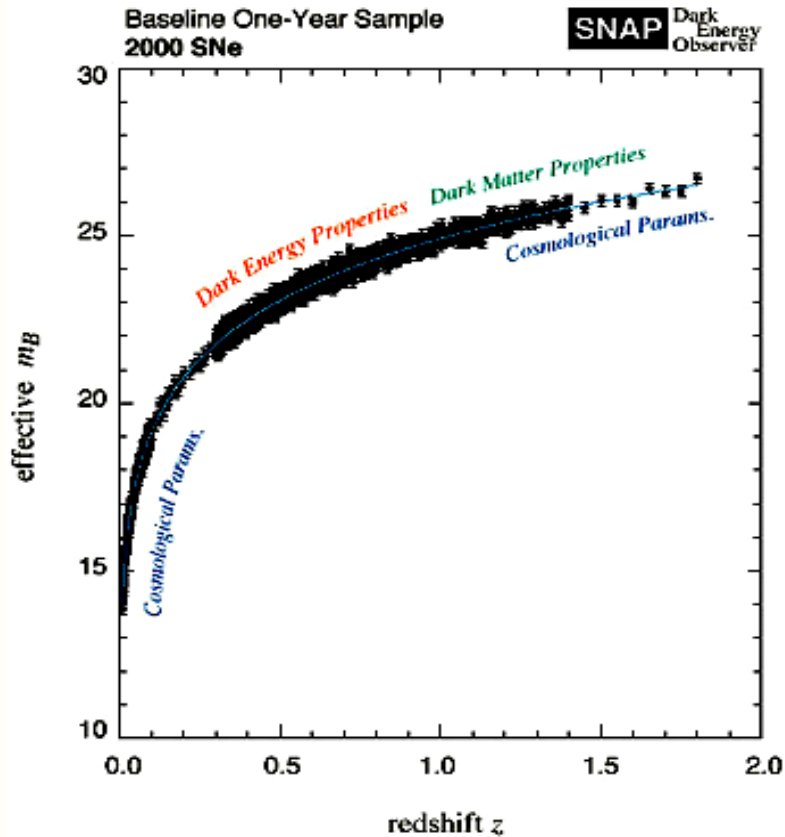
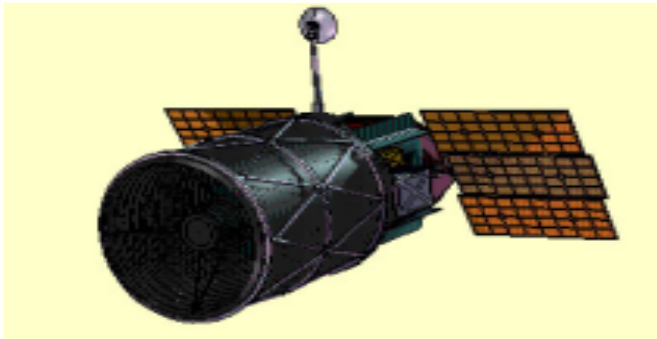


Characteristic signature for ν_τ interactions



Cosmology and Particle Physics

Dark Energy



The SNAP Dark Energy Detector. SNAP requires R&D to develop a detector with one billion CCD's.

Conclusions

- **As the scope of HEP broadens, projects that involve major commitments of multiple agencies are becoming more common.**
 - **Need to develop consistent methods for setting priorities, reporting, monitoring, oversight, etc.**
- **HEP is a truly international field.**
 - **Major U.S. based projects typically involve significant international collaboration and resources. Major projects outside the U.S. typically have significant U.S.collaboration and resources.**
 - **Need to develop systems of planning, budgeting and reporting that will be satisfactory both our agencies and to our foreign partners.**