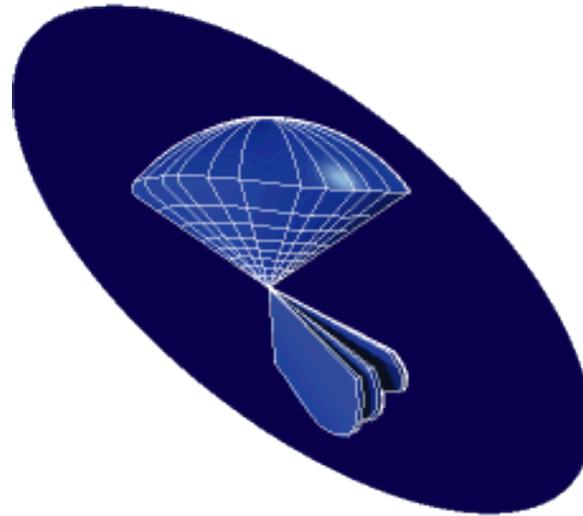


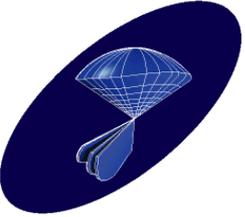
# **The Sloan Digital Sky Survey: From Asteroids to Cosmology**



## **Director's Perspective 2**

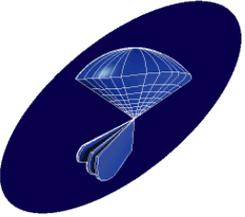
**John Peoples**

**August 16, 2008**



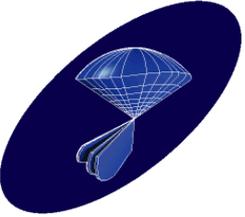
# Mapping the Universe Project and Fermilab

- Fermilab sought to expand the scope of its scientific portfolio after Texas was selected as the SSC site and formed a long term planning committee, which included astrophysics. (Fall 1989)
  - \* It recommended, among other possibilities, participation in astrophysics.
- Astronomers from Chicago invited Fermilab to join the Mapping the Universe Project. (Spring 1990)
  - \* The URA Board of Trustees and the Fermilab Board of Overseers encouraged the Fermilab Director to join the Project.
  - \* The Fermilab Director wrote to UC President Hannah Gray and expressed his desire for Fermilab to join the Project subject to DOE approval.
  - \* The Fermilab Experimental Astrophysics Group was formed with Rich Kron as its head and Fermilab joined the project.



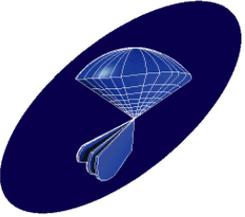
## 1994 Snowmass Summer Study on Nuclear and Particle Astrophysics and Cosmology

- A broad range of topics at the interfaces of particle physics, astrophysics and cosmology were studied in the 1994 Snowmass Summer Study on Nuclear and Particle Astrophysics and Cosmology (with DOE and NSF support). The topics included:
  - \* Very large area cosmic ray detectors (Pierre Auger, HiRes)
  - \* Dark Matter Detection and Deep Underground Laboratories (CDMS)
  - \* MACHO detection (MACHO Project)
  - \* Large Scale Structure including weak lensing (SDSS)
- The study report recommended that NSF and DOE work together to mount and carry out experiments in this interdisciplinary field.



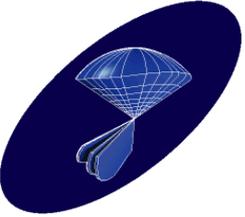
# SAGENAP

- SAGENAP was formed to advise DOE and NSF on non-accelerator experiments.
  - \* It helped DOE and NSF select dark matter and cosmic ray experiments and to sustain the participation in offshore underground neutrino experiments
  - \* Experiments that used the tools of astronomy were not included in its mandate. However, SDSS continued to move ahead with the support of the Sloan Foundation, NSF and private funding and in-kind support from Fermilab.
- Several years later in March 2000 SNAP and SDSS made information presentations to SAGENAP.



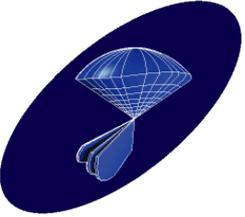
## 1999 was a big year for cosmology: Success helped

- Two groups of astronomers independently announced the discovery of dark energy and captured the attention of physicists and astronomers alike. One group was being supported by DOE through Berkeley Lab.
- SDSS completed construction and began to take data after nearly ten years of building.
- Inner-Space Outer Space II was held at Fermilab in May 1999.
  - \* Dan Goldin (NASA Administrator), Ernie Moniz (DOE Under Secretary) and Bob Eisenstein (Director of NSF MPS) urged the astronomers and particle physicists to bring big ideas forward to pursue fundamental physics.
  - \* The proponents of SNAP and the Dark Matter Telescope present their ideas to understand dark matter and dark energy. These were big ideas.



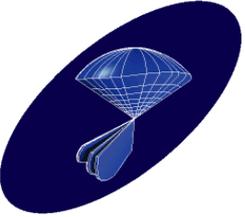
# Connecting Quarks with the Cosmos (2003)

- At the urging of the NASA Administrator, the DOE Under Secretary and the Assistant NSF Director for MPS the National Academy formed a study team to explore the science that lies at the interfaces of astronomy, astrophysics, particle physics and cosmology and to recommend how science in this interdisciplinary field might be organized and pursued.
- Of the many recommendations in the report two would be critical;
  - \* The formation of an interagency task force to determine how the federal agencies should work together to support the emerging interdisciplinary science.
  - \* The pursuit of observational cosmology with space (SNAP like) and ground based observatories (LSST like).
- The profound results from the SN1a observations and the success of the SDSS helped to make these recommendations plausible.



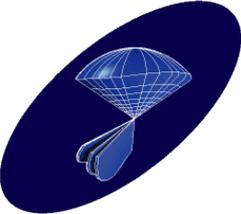
## The Agencies begin to respond (2004)

- OSTP created an interagency task force to study the recommendations in Connecting Quarks with the Cosmos. The DOE Office of High Energy Physics was engaged in the task force that produced The Physics of the Universe.
- NASA astronomy panel recommended the Beyond Einstein Probes, which include a space based dark energy project.
- NASA and DOE developed a plan for a Joint Dark Energy Mission (JDEM).
- NSF received and responded to a proposal for LSST R&D.



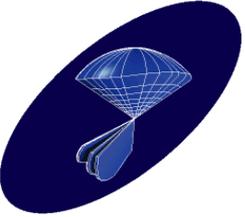
# New astronomical survey proposals

- Collaborations began designing (~2000-04) equipment for new astronomical surveys including:
  - \* SNAP with R&D funding from DOE OHEP through LBNL
  - \* LSST with R&D funding from NSF and private sources. DOE labs help out as well.
  - \* Medium scale experiments such as the Dark Energy Survey (DES) with support from DOE OHEP Fermilab, international agencies and private partners.
  - \* PanSTARRS and more!



# The Dark Energy Task Force (2005-2006)

- HEPAP and AAAC created the Dark Energy Task Force at the request of DOE, NASA, and NSF. It was charged to recommend the most promising approaches to explore dark energy.
  - \* It studied various approaches that submitted white papers and developed a figure of merit to compare approaches.
  - \* It recommended the prompt pursuit of dark energy experiments of modest scale (Stage III experiments)
  - \* It recommends R&D for stage IV projects, which were of a much larger scale
  - \* It presented its report to P5, HEPAP and AAAC in May 2006 and their recommendations were accepted.



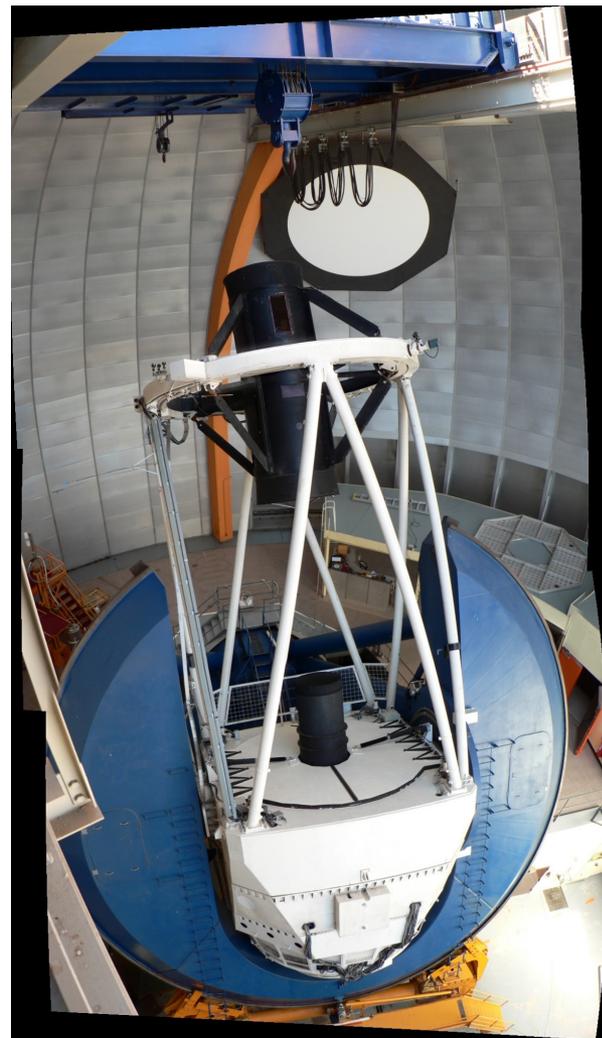
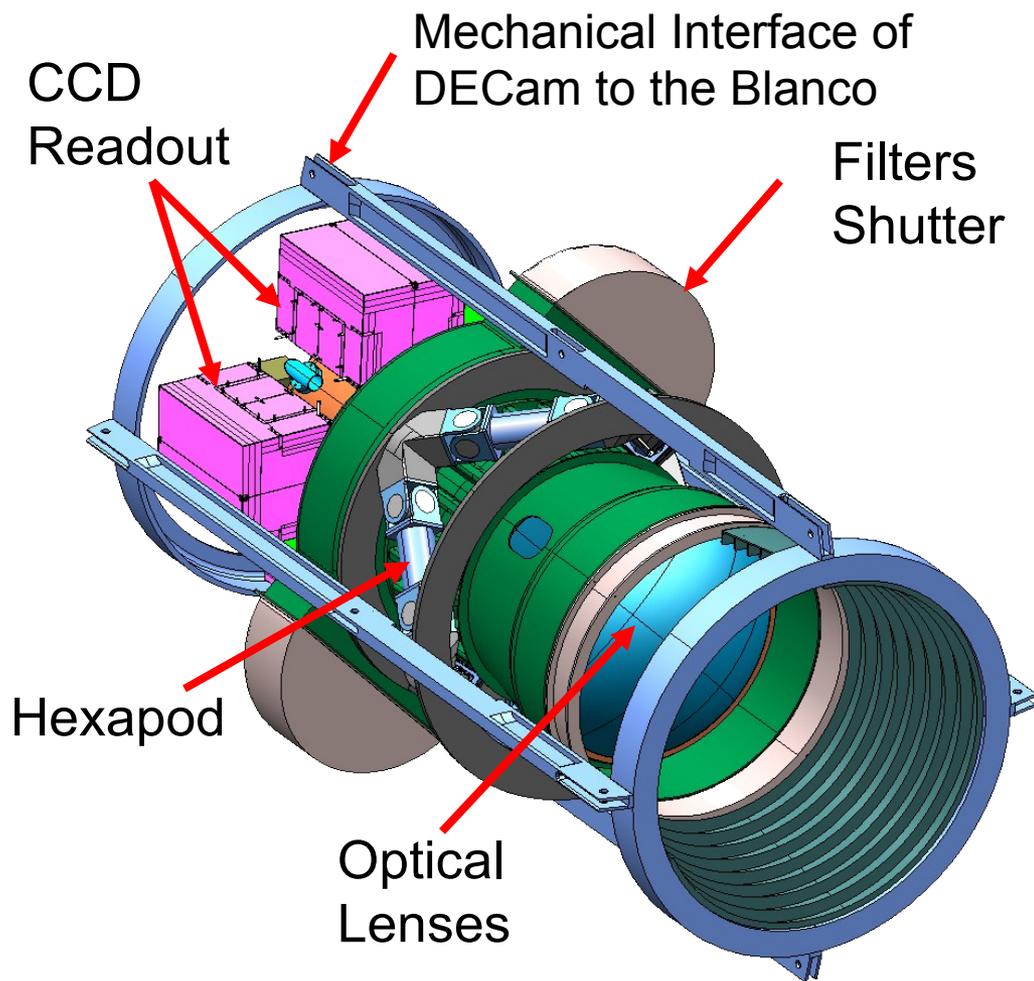
## **P5: The Particle Physics Projects Priority Panel (2005-2006)**

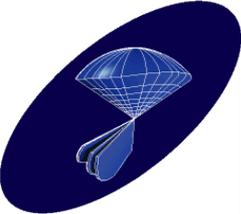
- P5 was charged in 2005 by HEPAP at the request of DOE and NSF to establish a ten year road map for particle physics. A major input to P5 was the Decadal Survey (2005) of Particle Physics. The P5 report recommendations included:
  - \* Strong support of the US participation in LHC experiments and strong support of US participation in the global R&D effort for the ILC.
  - \* Start of Construction of DES and CDMS-25kg in FY2008 and R&D for stage IV projects, SNAP and LSST.



DARK ENERGY  
SURVEY

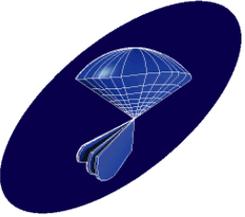
# DES Instrument: DECam





## **P5 Redux (2007-2008)**

- P5 was charged in late 2007 by HEPAP at the request of DOE and NSF to establish a sustainable long term road map for particle physics after the [DOE] Undersecretary concluded that the ILC would not be ready for construction before the middle of the next decade. P5 recommended in June 2008 that DOE and NSF pursue science at three frontiers:
  - \* The Energy Frontier through strong US participation in LHC experiments.
  - \* The Intensity Frontier through DUSEL and long base line neutrino experiments.
  - \* The Cosmic Frontier through dark matter and dark energy experiments, including JDEM and LSST as well as Stage III experiments such as DES and SDSS III.



## Conclusions

- Astrophysics and Cosmology are now an integral part of the US [DOE] Program in Particle Physics through the Cosmic Frontier.
- Without the enormous success of SDSS I and II, including the public release of the data and catalogs, this would not have happened.
- SDSS III and DES are offspring of SDSS I and II and DOE and NSF are supporting them.