How Fermilab and UChicago changed the course of cosmology and brought particle physics and cosmology together and what’s next!

Fermilab 50th Symposium
PRC 31 October 2017
Michael S. Turner and Brian Nord
… and thousands of physicists and astronomers working together to figure it all out.
6 numbers describe the Universe from the big bang and quantum fluctuations until today
circa 1970: The search for two numbers ($H_0$ and $q_0$)

... and tens of astronomers working (together) to figure it all out

COSMOLOGY:
A SEARCH FOR TWO NUMBERS

Precision measurements of the rate of expansion and the deceleration of the universe may soon provide a major test of cosmological models.

ALLAN R. SANDAGE

Allan Sandage, Hubble’s “student”
1979: Fermilab proposes for STScI

URA BEGINS PREPARING PROPOSAL FOR SPACE TELESCOPE SCIENCE INSTITUTE

Universities Research Association has made the decision to prepare a proposal for locating a Space Telescope Science Institute at Fermilab.

URA is preparing the proposal in cooperation with astronomers from the University of Chicago, in association with astronomers from the University of Wisconsin, University of Illinois, University of Texas and Beloit College.

Work on the proposal has already begun, said James C. Matheson, URA vice president. When completed later this year, the proposal will be submitted to the National Aeronautics and Space Administration, the agency that will probably make the final decision.

"Of course, we will be competing with other consortia for the institute. However, we are convinced Fermilab offers significant advantages over other sites."

"Among these he listed:

A uniquely attractive site with respect to scientific ambience, technical support, central location and proximity to a strong university astronomical community.

The capacity to call on the full potential of URA's existing management strength and broad geographical membership representation.

NASA is expected to formally request proposals for the Space Telescope Science Institute.
1981: Schramm & Lederman hike in the Dolomites
1982: Lederman dares Deputy NASA Administrator Hans Mark to fund an outrageous proposal – and he does
Fall 1983: Turner and Kolb arrive

Tevatron achieves 512 GeV
1980s: Go Go junk bond days of early Universe cosmology
Chicago at the center, Fermilab = the mother church

Explore the consequences of bold ideas in particle physics about unification to the early Universe

Turner & Kolb
Inner Space/Outer Space
May 1984
Beginnings of $\Lambda$CDM
InnerSpace/OuterSpace at Fermilab (1984)

Inflation, Monopoles, CDM rising, HDM falling, CMB limits only, LSS: CfA1, Cosmic Strings, Axions, SUSY dark matter still to come
UChicago doesn’t publish conference proceedings, …
MICHAEL TURNER
CO-CHAIRMAN
INNER SPACE/OUTER SPACE

THE OFFICIAL CONFERENCE OF
THE 1984 SUMMER OLYMPICS
1990s: Sloan Digital Sky Survey
UChicago, Fermilab, JHU, Princeton, UWash
High-Impact Astronomical Observatories

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Abstract

We derive the ranking of the astronomical observatories with the highest impact in astronomy based on the citation analysis of papers published in 2006. We also present a description of the methodology we use to derive this ranking. The current ranking is lead by the Sloan Digital Sky Survey, followed by Swift and the Hubble Space Telescope.

<table>
<thead>
<tr>
<th>Rank</th>
<th>Facility</th>
<th>Citations</th>
<th>Participation</th>
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<tbody>
<tr>
<td>1</td>
<td>SDSS</td>
<td>1892</td>
<td>14.3%</td>
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<tr>
<td>2</td>
<td>Swift</td>
<td>1523</td>
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<td>7</td>
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<tr>
<td>10</td>
<td>HESS</td>
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Fermilab Center for Particle Astrophysics
8 December 2004

Craig Hogan arrives as 1st Director 2008
FCPA Portfolio

• Theoretical Astrophysics (1983)
• Survey Science
  – SDSS (1990s) → DES (2005s) → DESI (2015) → LSST (2020s) → ??
• Pierre Auger Observatory (1995)
• Dark Matter
• Cosmic Microwave Background
• Holometer (2010s)
What does success look like for a Fermilab?