

Building Machines for Engagement in Science

Inspiring and Teaching Future
Thinkers and Makers



Brian Nord [FNAL]
QuarkNet and the Fermi Mars Rover System

[nord@fnal.gov]

7 Minutes of Terror (by JPL)

<http://www.jpl.nasa.gov/video/index.php?id=1090>







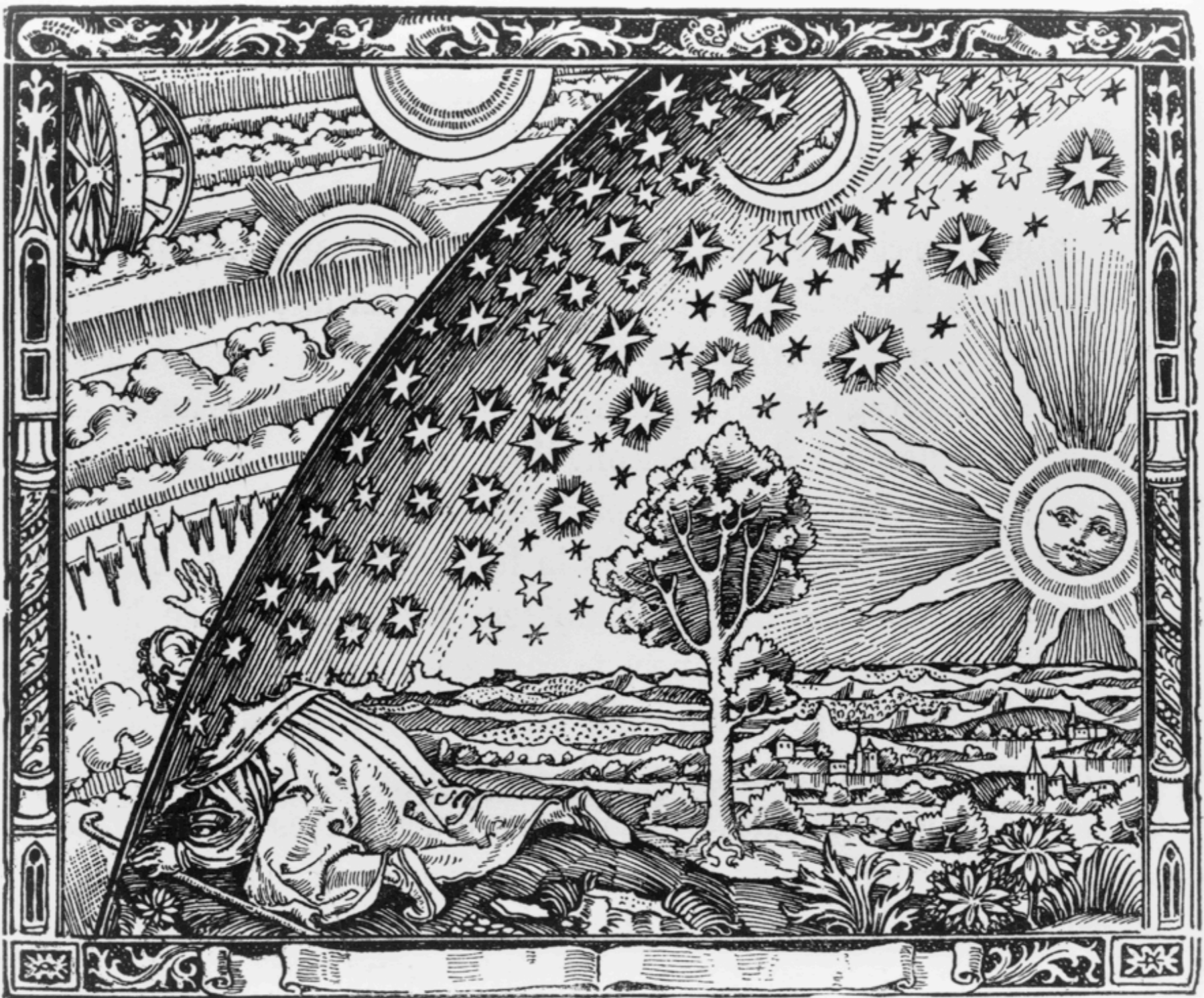
Los Angeles with the lights off.

Few ever see this in our modern age.

Photo Illustration by Thierry Cohen/Danziger Gallery (via New York Times)
http://www.nytimes.com/interactive/2013/02/03/magazine/look-stars.html?_r=0

- “Eight of every 10 kids born in the United States today will never experience a sky dark enough to see the Milky Way.”
 - -- Paul Bogard via The Atlantic

Piercing the Veil and Modern Science



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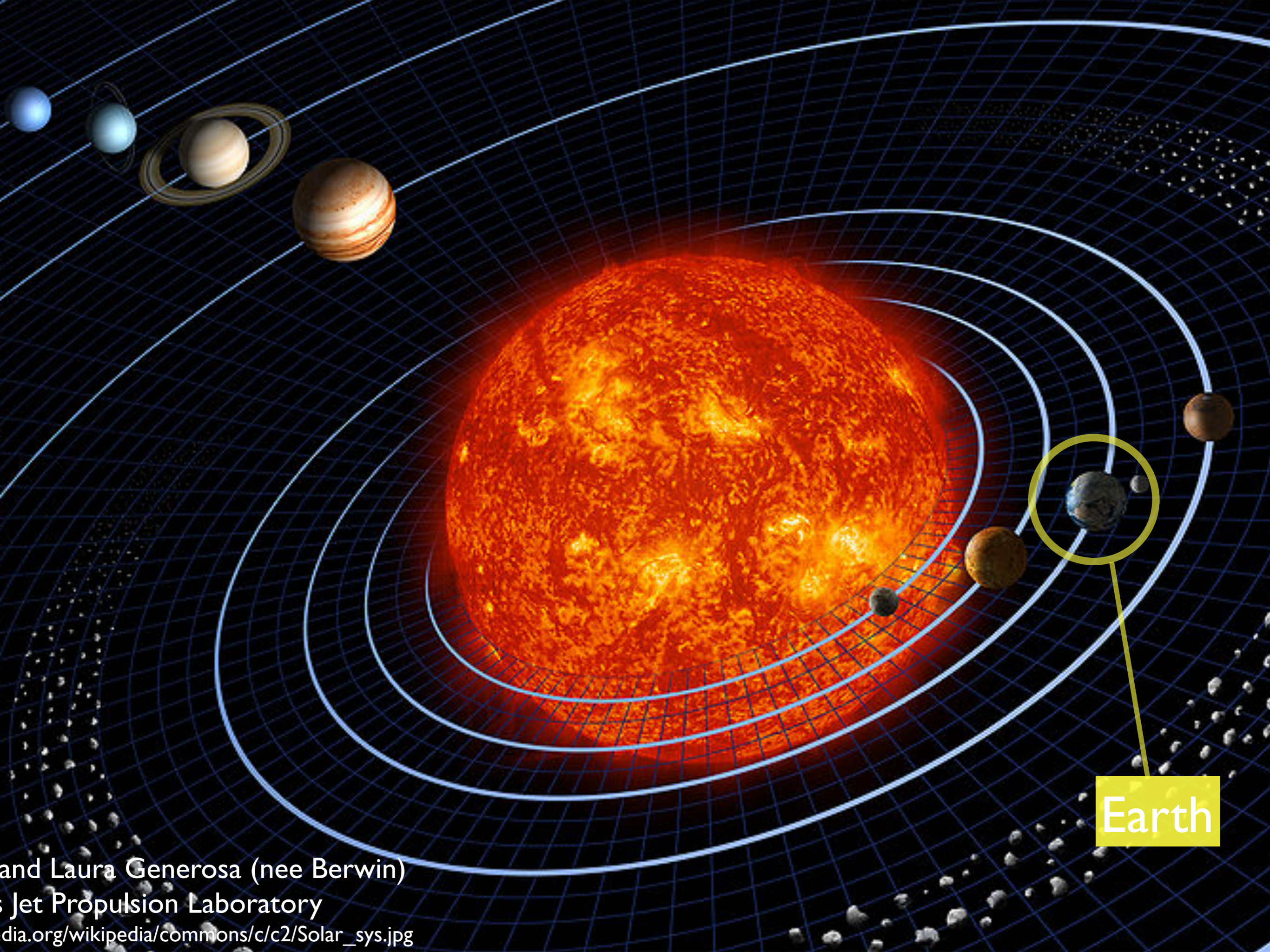


First View of Earth from Moon NASA Lunar Orbiter 1
August 23, 1966

<http://grin.hq.nasa.gov/ABSTRACTS/GPN-2000-001588.html>

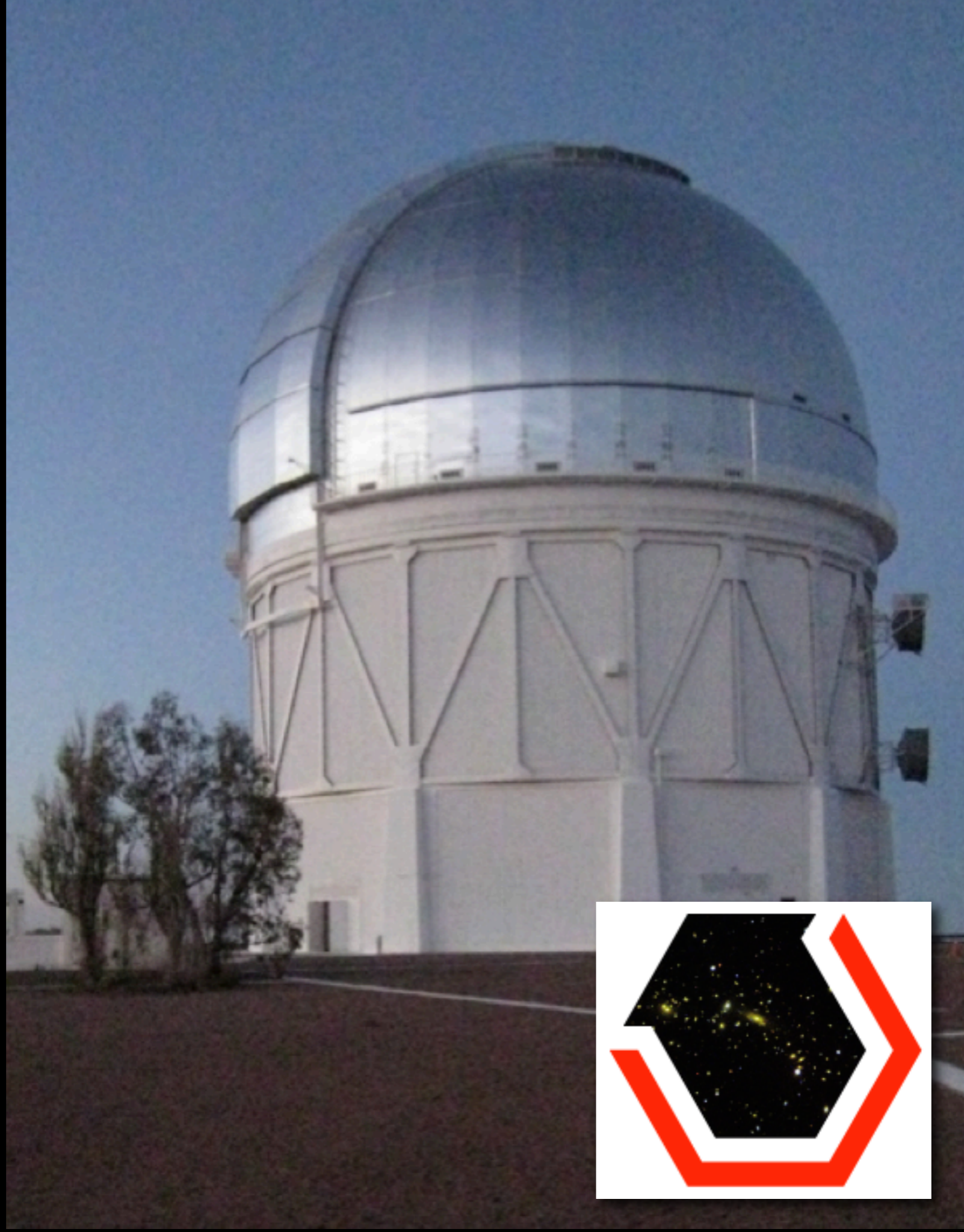


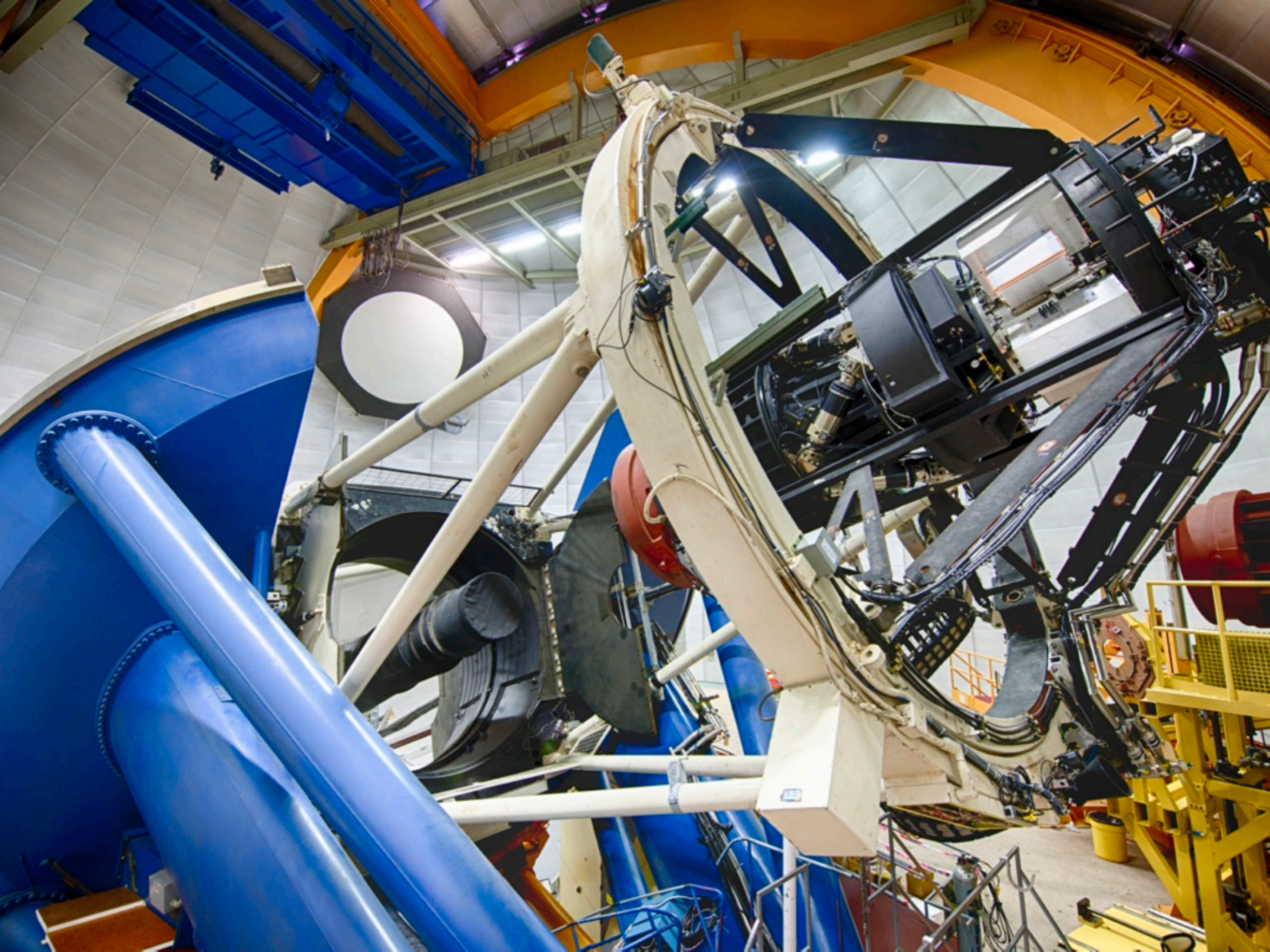
Carl Sagan



Earth

and Laura Generosa (nee Berwin)
Jet Propulsion Laboratory
https://commons.wikimedia.org/wiki/File:Solar_sys.jpg





Pop Science and Modern Culture



Example 1: Ironman
(Marvel Comics)



Example 2: *Contact*

(Film, 1997, based on book by Carl Sagan)

Machines, Science and Project Development

Bridging Pop Culture and the Scientific Method

- Machines bring together science analysis and project development.
- open-ended explorations uniquely exercise many skills needed to be a scientist in the future.
- Machine-based science projects bring modern science within reach



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6-12 JUNE 2002

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National Science Foundation: Science Hard

INDIANAPOLIS—The National Science Foundation's annual symposium concluded Monday, with the 1,500 scientists in attendance reaching the consensus that science is hard.

"For centuries, we have embraced the pursuit of scientific knowledge as one of the noblest and worthiest of human endeavors, one leading to the enrichment of mankind both today and for future generations," said keynote speaker and NSF

chairman Louis Farian. "However, a breakthrough discovery is challenging our long-held perceptions about our discipline—the discovery that science is really, really hard."

"My area of expertise is the totally impossible science of particle physics," Farian continued, "but, indeed, this newly

see SCIENCE page 8



Right: Farian explains the NSF findings.

Two Teams, One Planet, One Mission

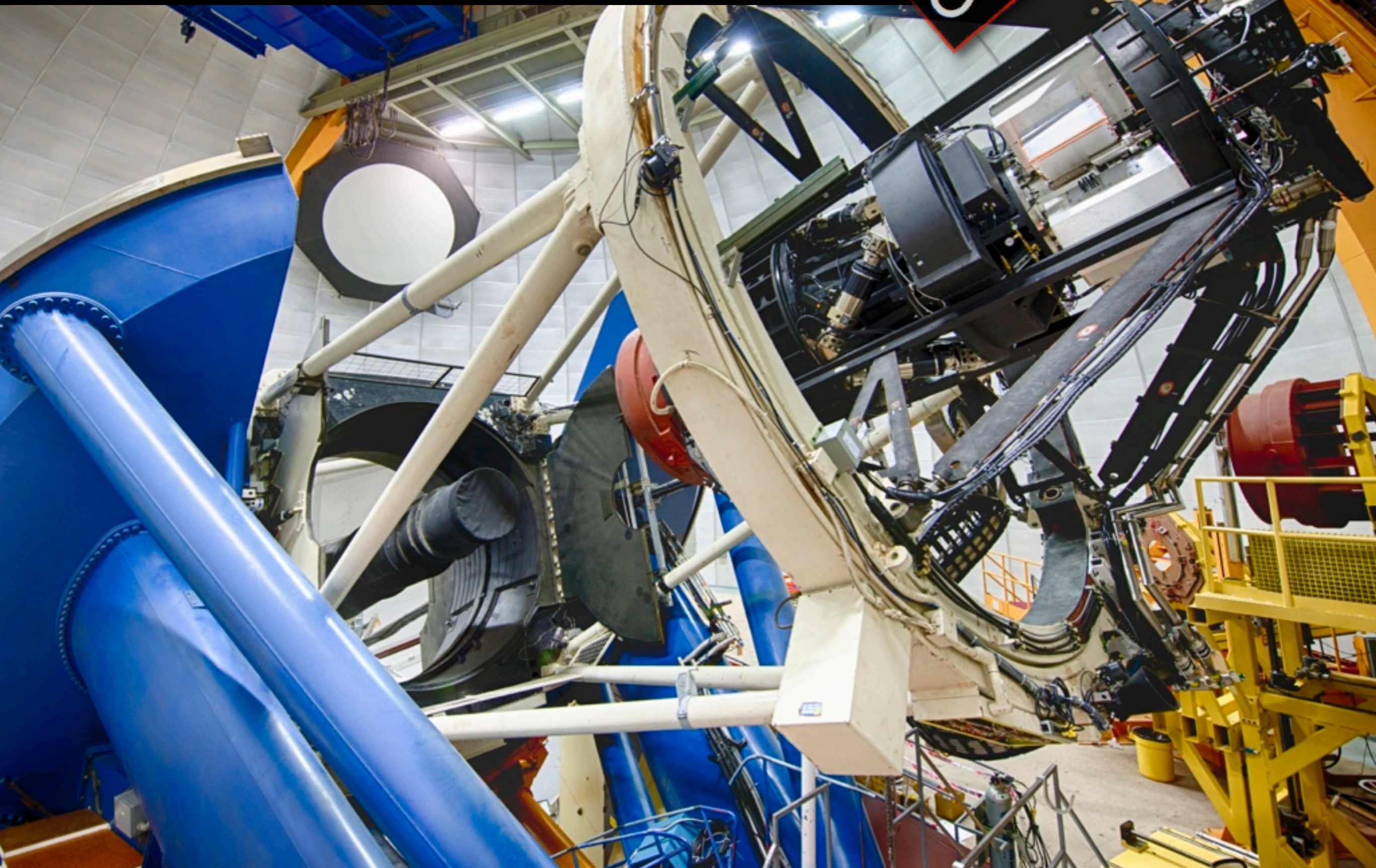
A Mars Exploration Challenge



- Two teams compete to
 - land rover
 - operate rover and on-board science instruments
 - perform science analysis

Simulate Dark Energy Camera

Concept



Your Mission to Mars

- Establish Mission Goals
- Team up by Mission Module
 - Science and Sensor Design/Choices
 - Rover Engineering
 - Control Software Development
 - Entry, Descent and Landing
 - Planetary Environment Simulation
- Design a mission
- Construct Rover

Additional Acknowledgments/ Credits

- Slide 1: <http://thebubblechamber.org/wp-content/uploads/2010/10/thinker.jpeg>