The Future of the Internet Enabling New Science

Invited Speaker
San Diego Science Festival
Mark Twain High School
San Diego, CA
April 19, 2010

Dr. Larry Smarr
Director, California Institute for Telecommunications and Information Technology
Harry E. Gruber Professor,
Dept. of Computer Science and Engineering
Jacobs School of Engineering, UCSD

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6th Period Business Careers Class

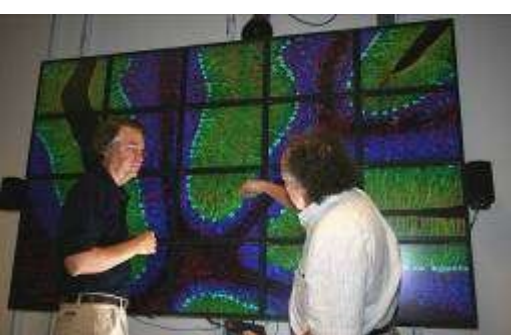
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"Broadband" Depends on Your Application: Data-Intensive Science Needs Supernetworks









- **Mobile Broadband**
  - **0.1-0.5 Mbps**

100,000 Fold Range
All Here Today!

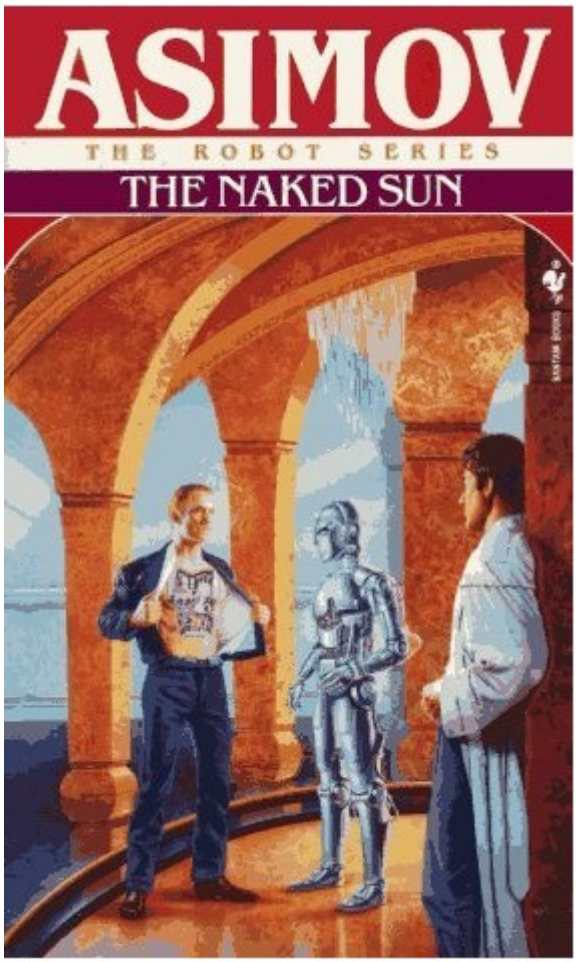
- **Home Broadband**
  - **1-5 Mbps**

"The future is already here,
it's just not evenly distributed"
William Gibson, Author of Neuromancer

- **University Dorm Room Broadband**
  - **10-100 Mbps**

- **Dedicated Supernetwork Broadband**
  - **1,000-10,000 Mbps**

Fifty Years Ago, Asimov Described a World of Remote Telepresence



1956

A policeman from Earth, where the population all lives underground in close quarters, is called in to investigate a murder on a distant world. This world is populated by very few humans, rarely if ever, coming into physical proximity of each other. Instead the people "View" each other with trimensional viewer holographic images.

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Global Innovation Centers are Being Connected with 10,000 Megabits/sec Internet Lightpaths

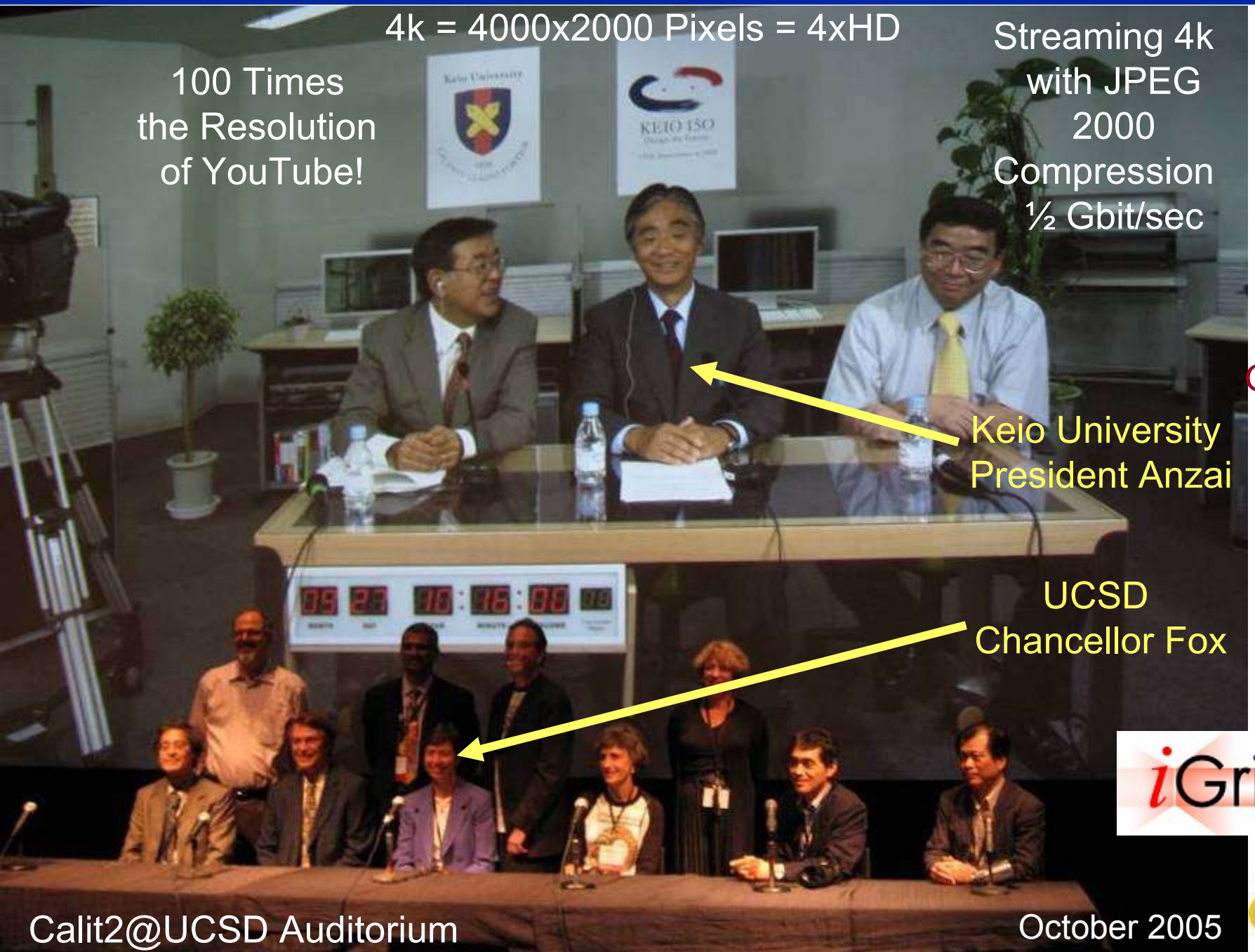


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Source: Maxine Brown, UIC and Robert Patterson, NCSA

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Telepresence Meeting
Using Digital Cinema 4k Streams



CineGrid

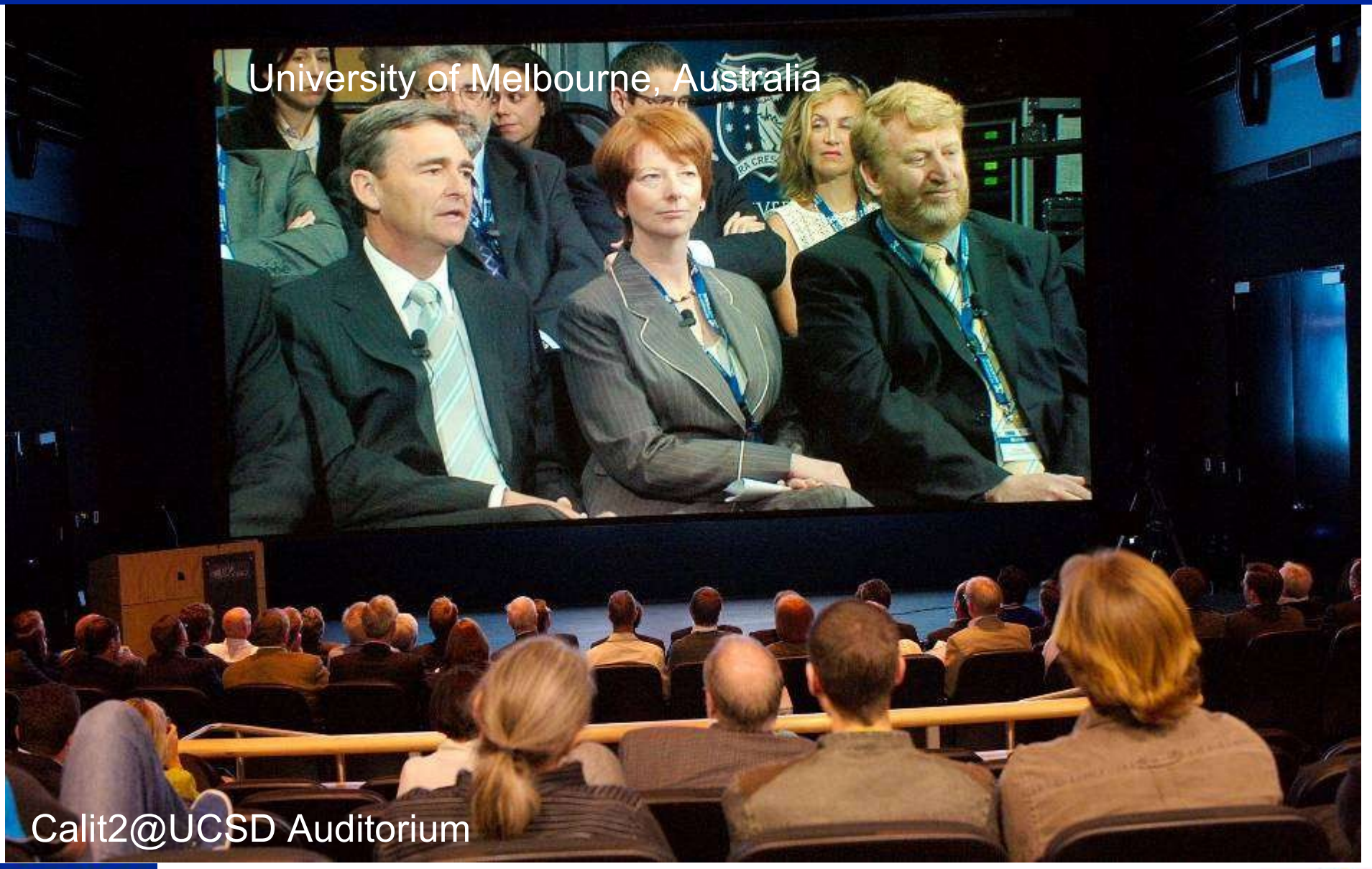
Lays
Technical
Basis for
Global Digita
Cinema

Sony
NTT
SGI

iGrid 2005

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Victoria Premier and Australian Deputy Prime Minister Asking Questions



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www.calit2.net/newsroom/release.php?id=1219

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University of Melbourne Vice Chancellor Glyn Davis in Calit2 Replies to Question from Australia



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HD Talk to Australia's Monash University from Calit2: Reducing International Travel



Qvidium Compressed HD ~140 mbps

Source: David Abramson, Monash Univ

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NSF's OptIPuter Project: Using Supernetworks to Meet the Needs of Data-Intensive Researchers

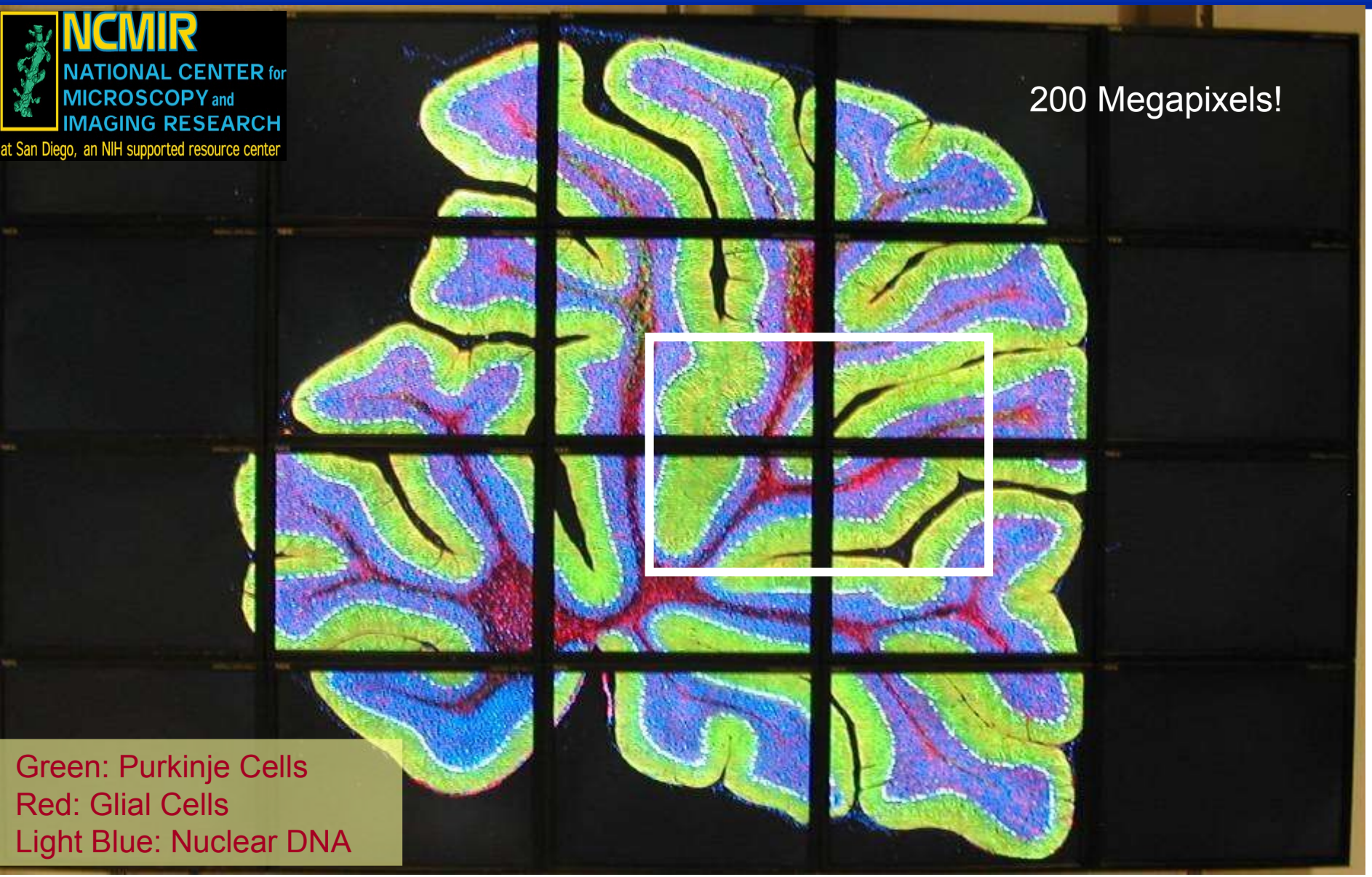


OptIPortal–Termination Device for the OptIPuter Global Backplane

Powered by Rocks

Calit2 (UCSD, UCI), SDSC, and UIC Leads—Larry Smarr PI
Univ. Partners: NCSA, USC, SDSU, NW, TA&M, UvA, SARA, KISTI, AIST
Industry: IBM, Sun, Telcordia, Chiaro, Calient, Glimmerglass, Lucent

OptIPuter Scalable Displays Are Used for Multi-Scale Biomedical Imaging



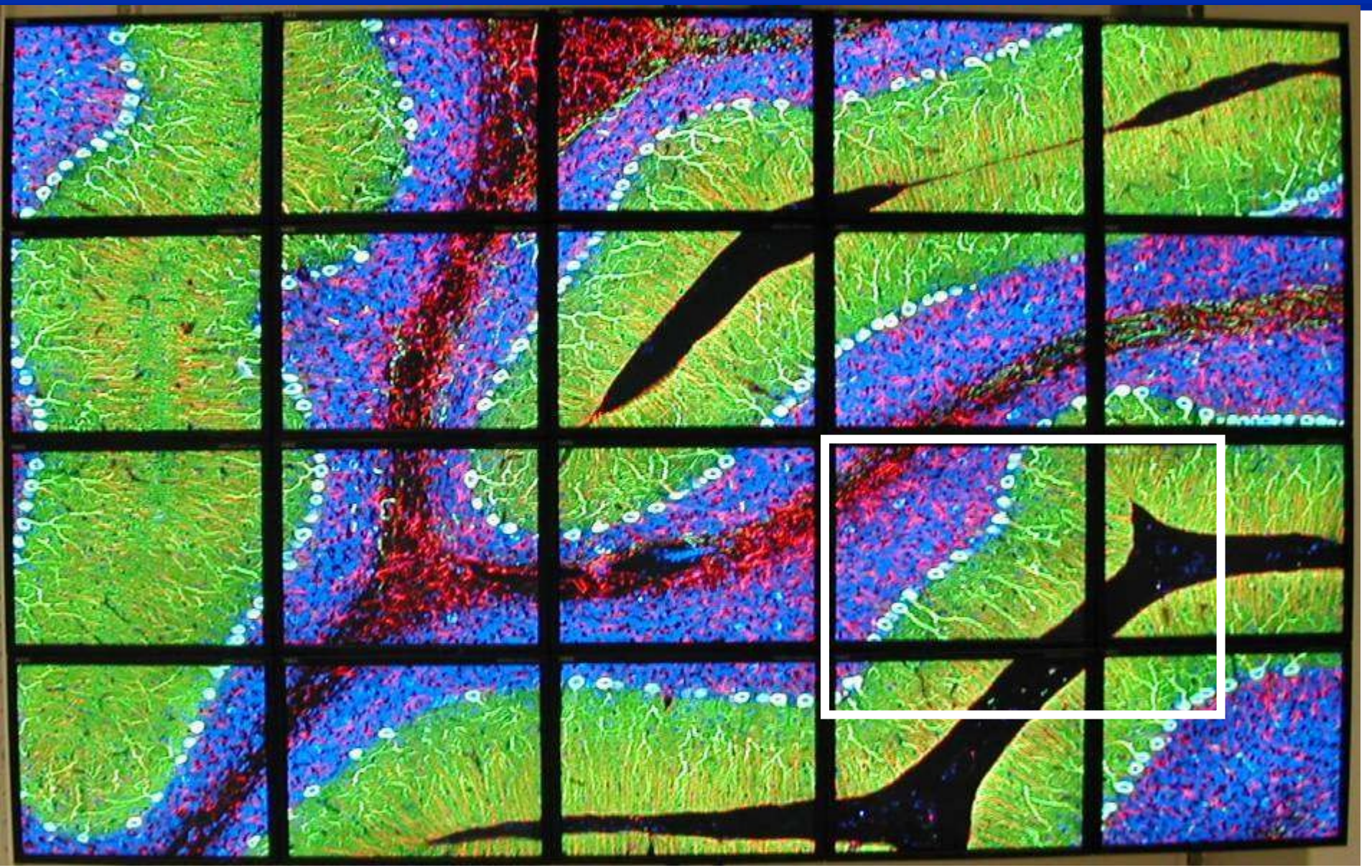
Source: Mark Ellisman, David Lee, Jason Leigh

Two-Photon Laser Confocal Microscope Montage of 40x36=1440 Images in 3 Channels of a Mid-Sagittal Section of Rat Cerebellum Acquired Over an 8-hour Period

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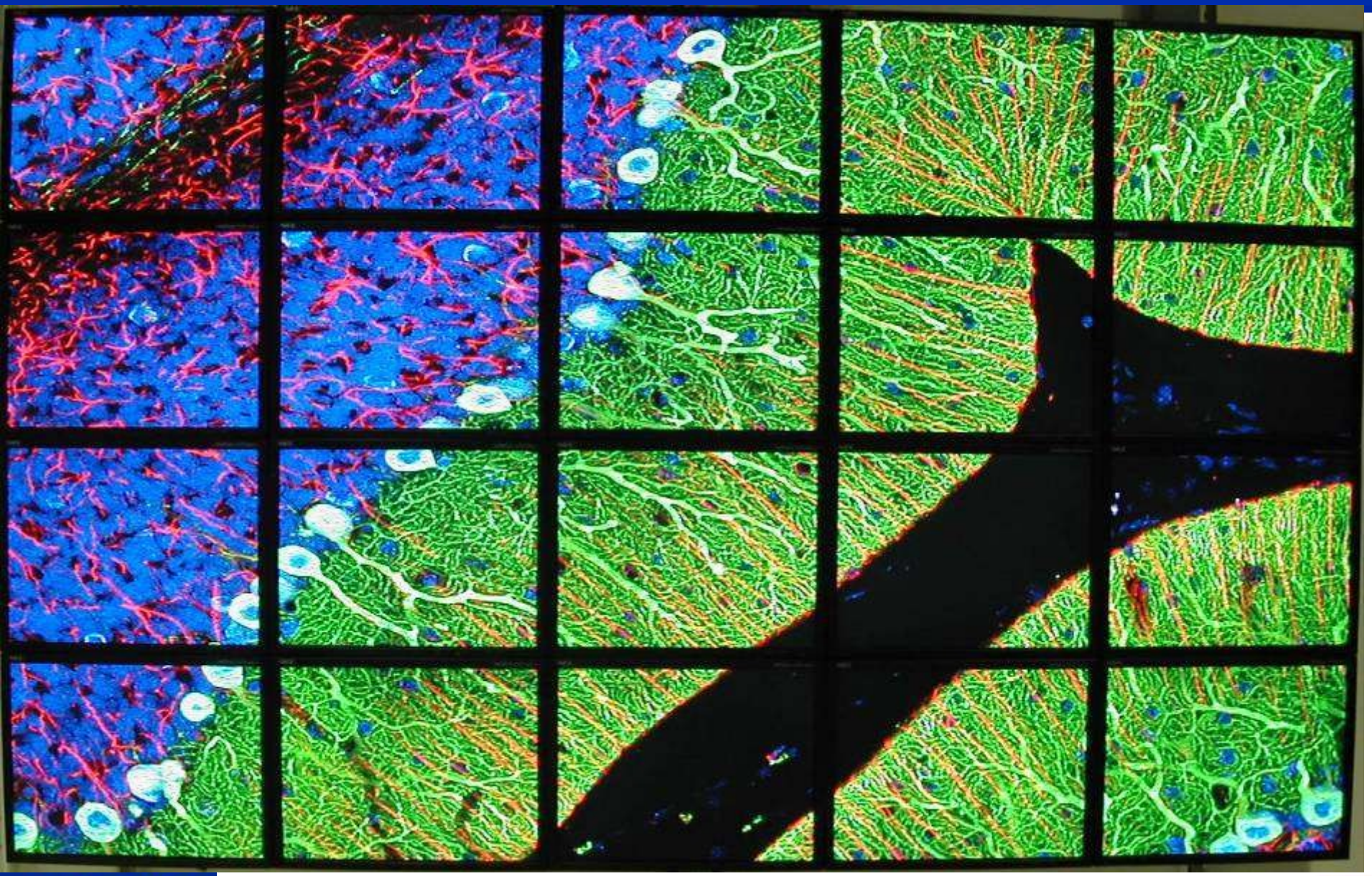
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Scalable Displays Allow Both Global Content and Fine Detail



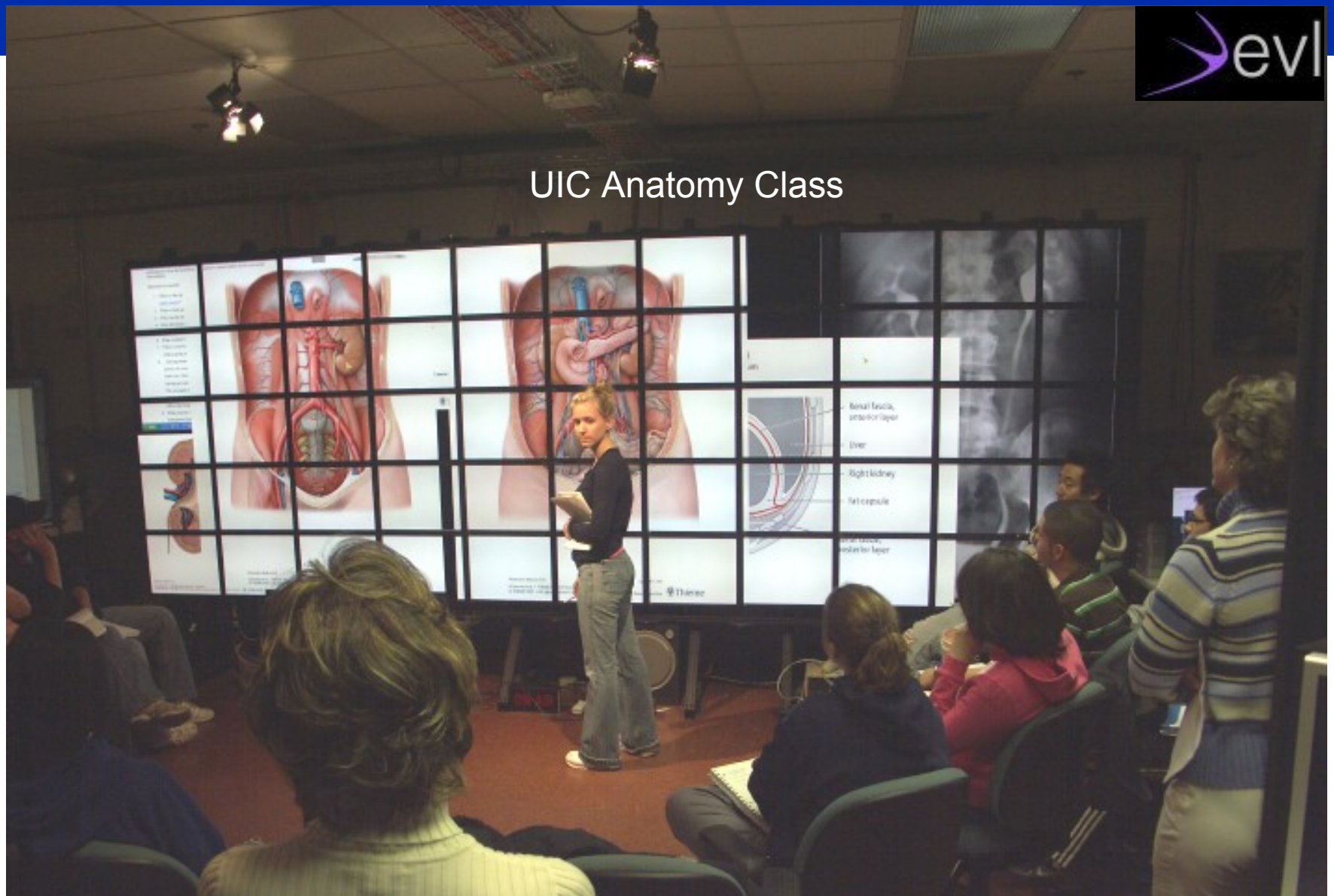
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Allows for Interactive Zooming from Cerebellum to Individual Neurons

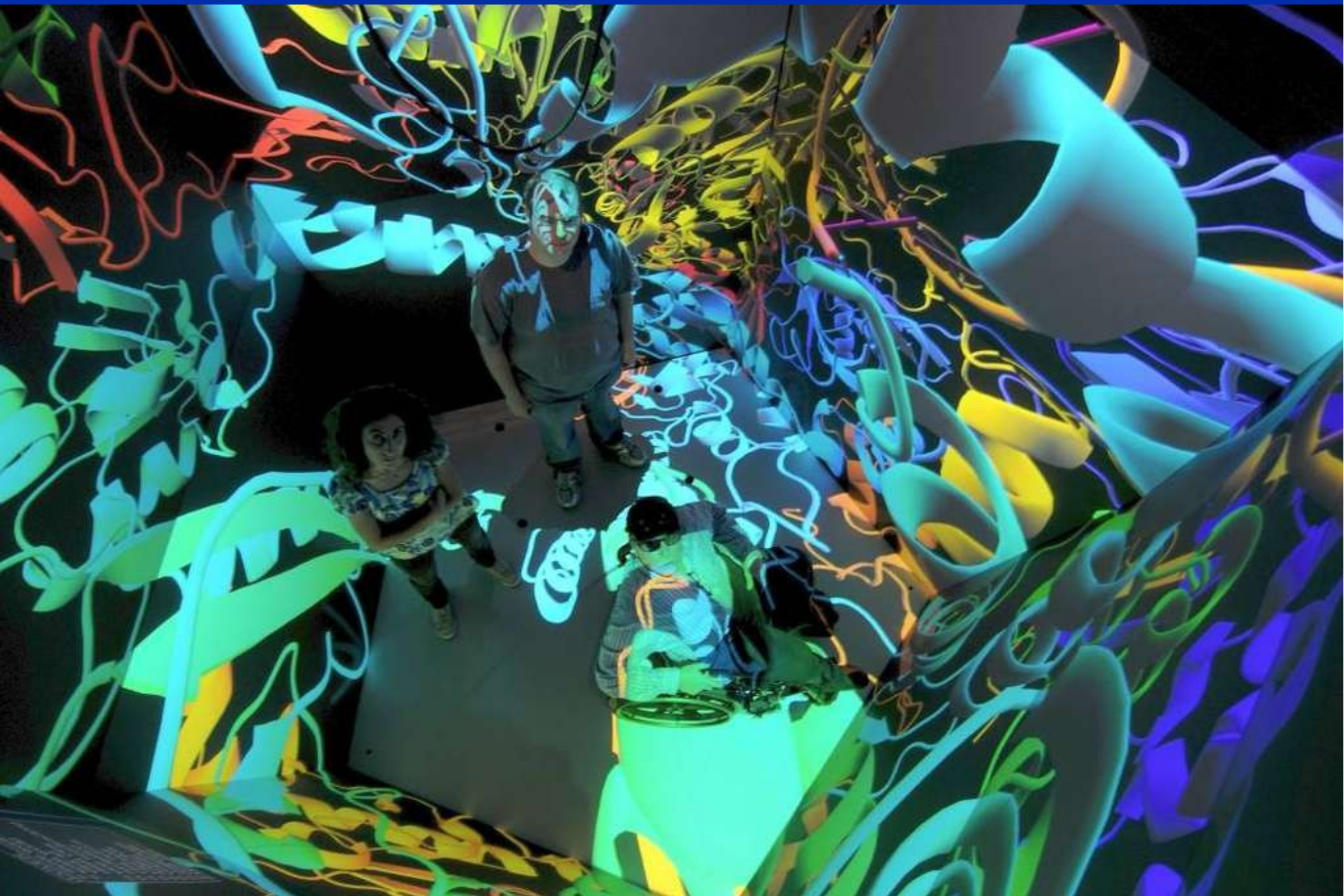


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Students Learn Case Studies in the Context of Diverse Medical Evidence



Ultra Resolution Virtual Reality: Toward a 3D Global Collaboratory



New Year's Challenge: Streaming Underwater Video From Taiwan's Kenting Reef to Calit2's OptIPortal



UCSD: Rajvikram Singh, Sameer Tilak, Jurgen Schulze, Tony Fountain, Peter Arzberger
NCHC : Ebbe Strandell, Sun-In Lin, Yao-Tsung Wang, Fang-Pang Lin

Remote Interactive High Definition Video of Deep Sea Hydrothermal Vents



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Source John Delaney & Deborah Kelley, UWash

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Using Advanced Info Tech and Telecommunications to Accelerate Response to Wildfires



Early on October 23, 2007, Harris Fire San Diego

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Photo by Bill Clayton, http://map.sdsu.edu/

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NASA's Aqua Satellite's MODIS Instrument Provided "Situational Awareness" of the 14 SoCal Fires

Calit2, SDSU, and NASA Goddard Used NASA Prioritization and OptIPuter Links to Cut time to Receive Images from 24 to 3 Hours



Moderate Resolution Imaging Spectroradiometer (MODIS)

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NASA/MODIS Rapid Response
www.nasa.gov/vision/earth/lookingatearth/socal_wildfires_oct07.html

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1/3 Billion Pixel OptIPortal Used to Study NASA Earth Satellite Images of October 2007 Wildfires



UCSD UCIrvine Powered by Rocks ROCKS

Source: Falko Kuester, Calit2@UCSD

CGLX it²

Firefighters from the Sky

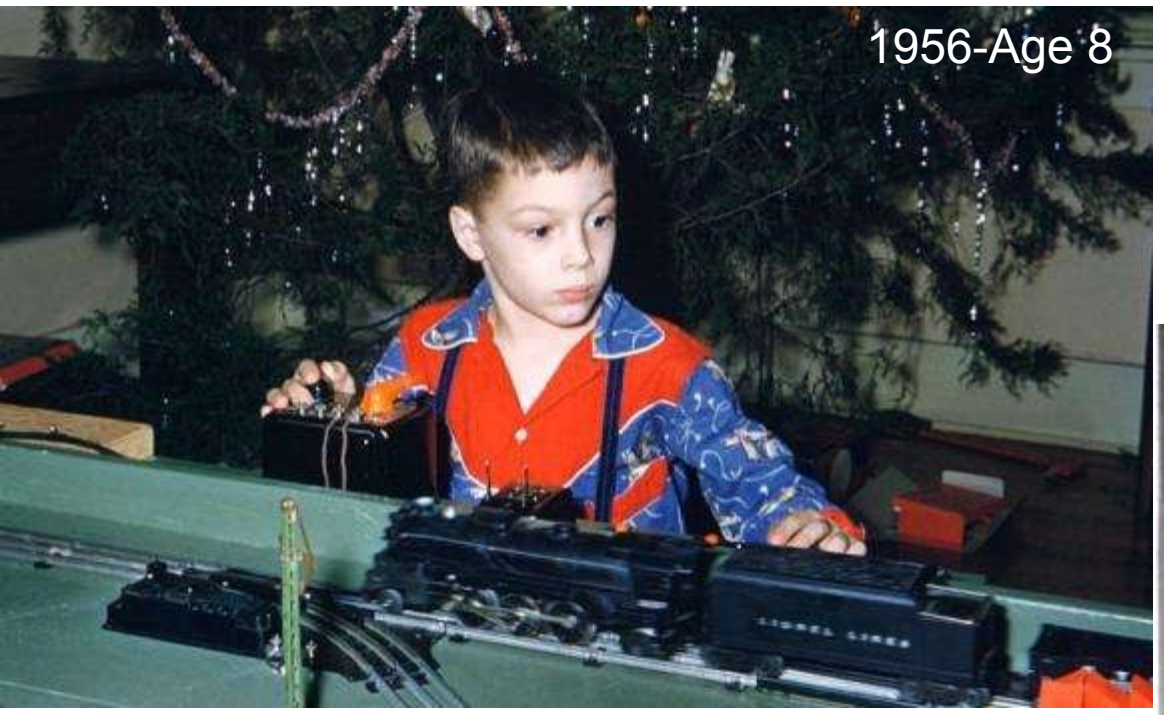


Ron Serabia
Fire Captain
Semi-Retired

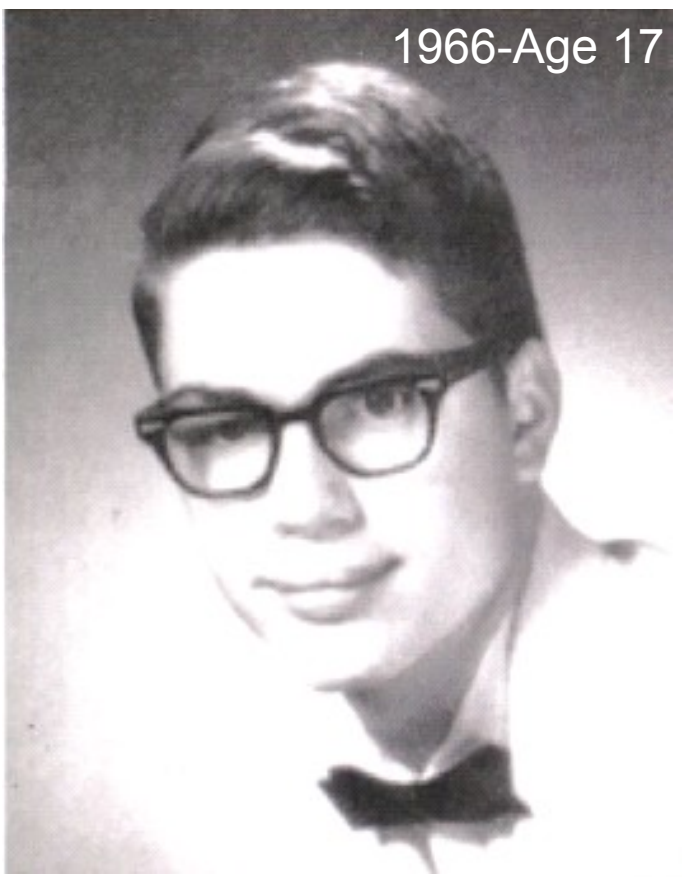
7th Period Physics Class

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From Early Engineering Experiences to Graduating from High School



I Studied Astronomy on My Own
from First Grade Through High School

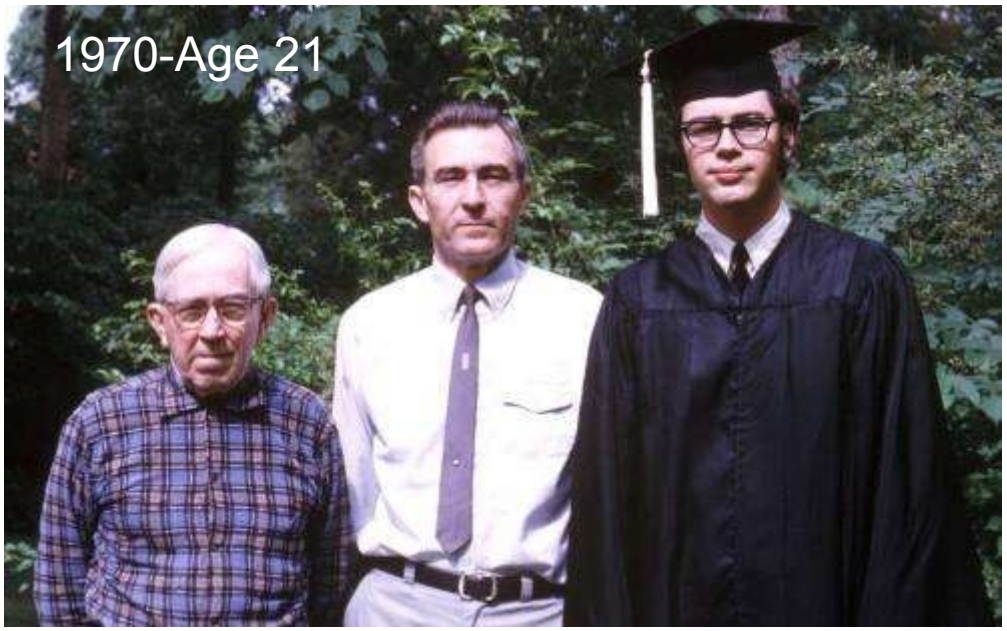


I Took My First Course
in Computer Programming in 1966

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Graduating from College to My First PhD Student



Grandfather Father Me

I Majored in Math and Physics as an Undergrad



I Applied Supercomputers to Einstein's Theory of General Relativity as a Graduate Student

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I Explored the Andromeda Galaxy's Stellar Bulge Using Radio, Optical, and X-Ray Telescopes









1978-1983

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Very Large Images Can be Viewed Using CGLX's TiffViewer



Spitzer Space Telescope (Infrared)



Hubble Space Telescope (Optical)

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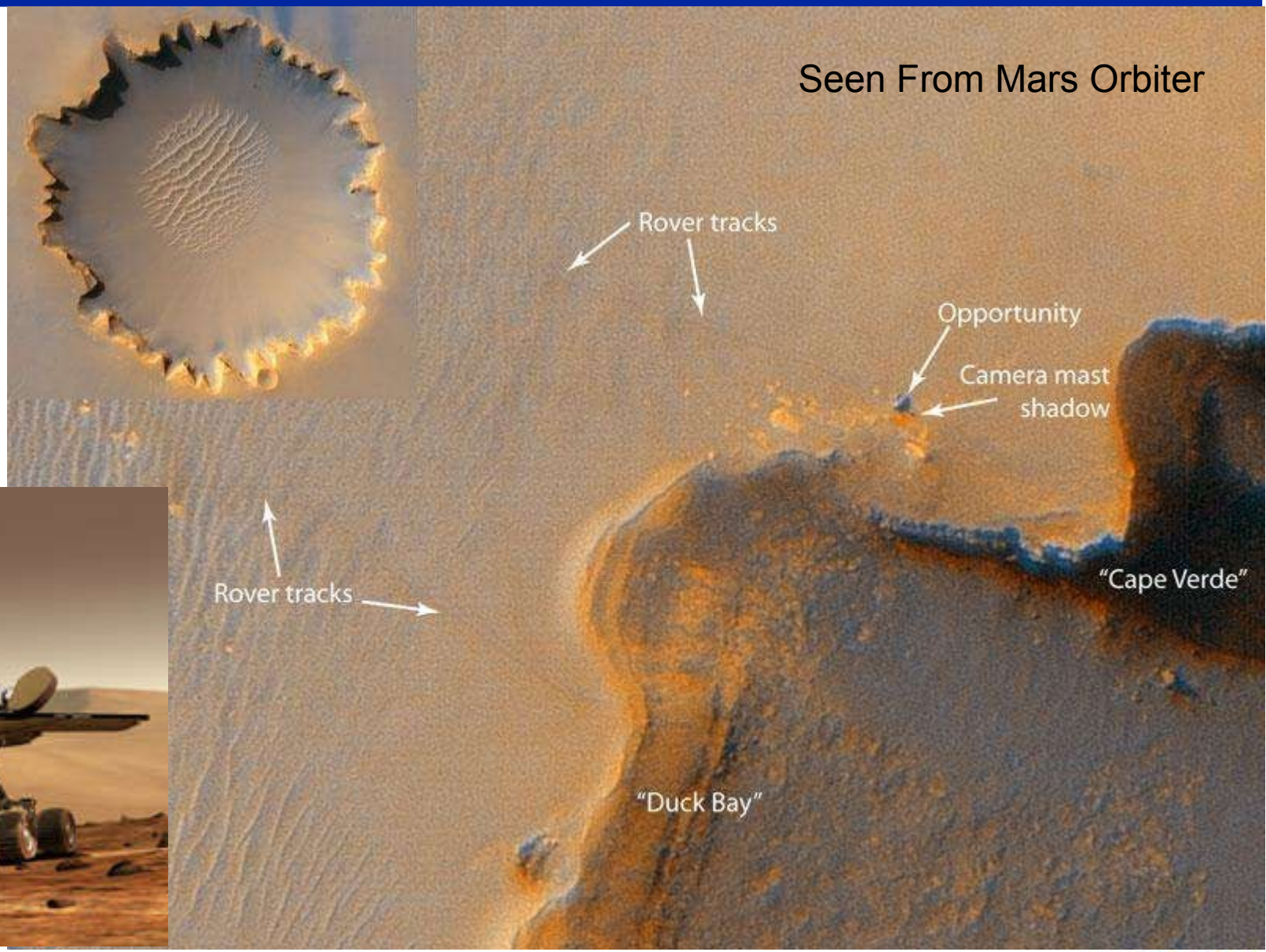
Source: Falko Kuester, Calit2@UCSD

CGLX

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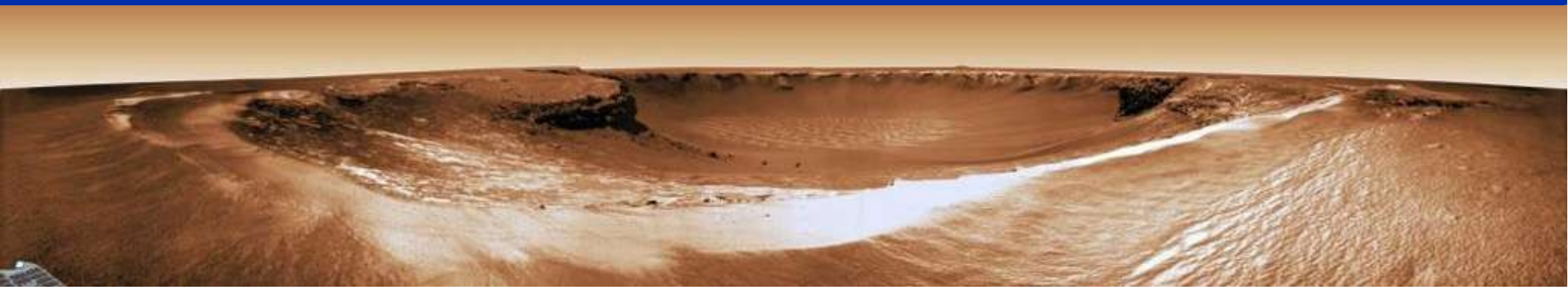
NASA Has Two Rover Robots on Mars
Spirit and Opportunity





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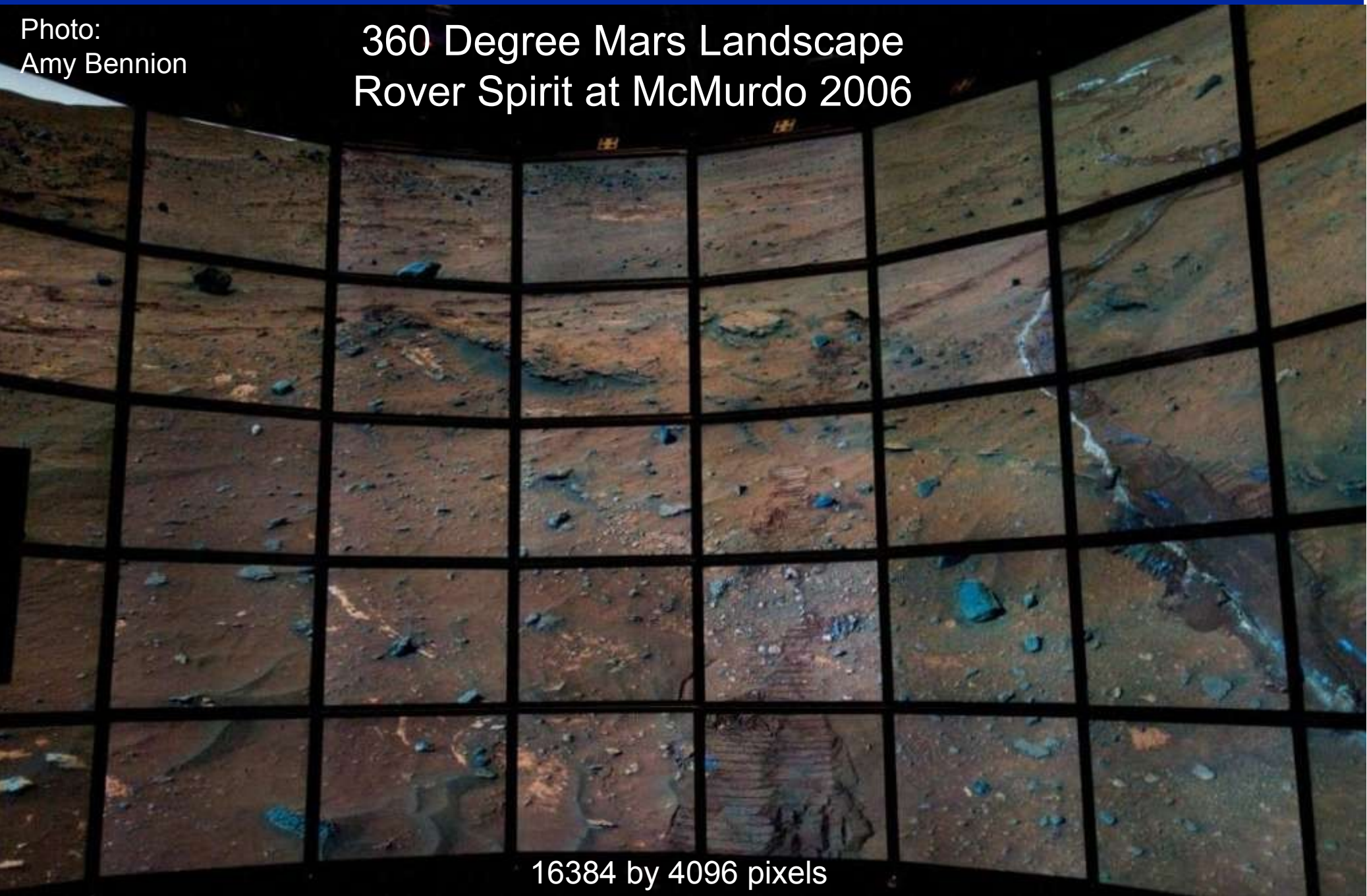
Views from Mars Rovers



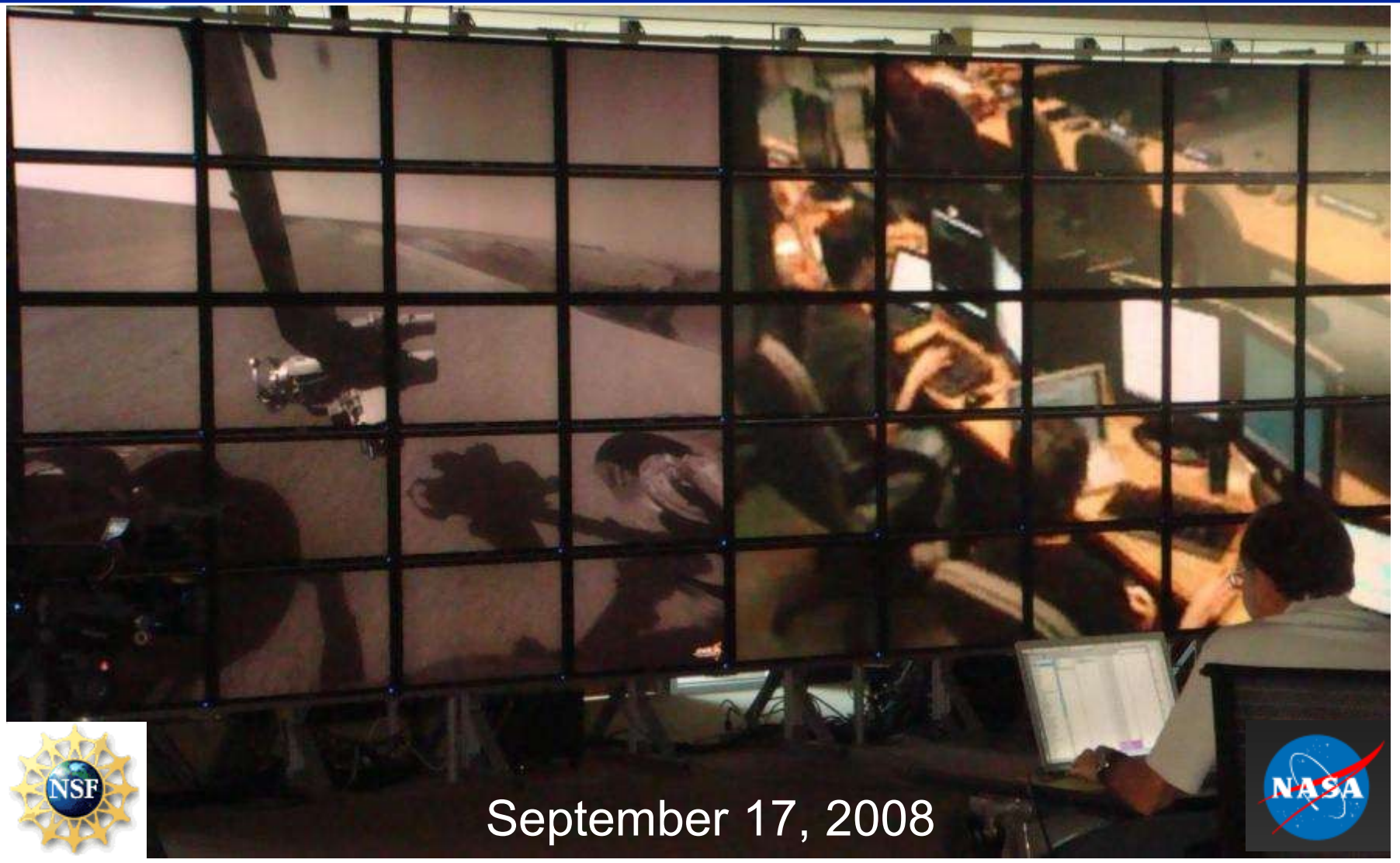


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Calit2/EVL Varrier -- 60 Screen Panorama OptIPortal



Remote Control of Scientific Instruments: Live Session with JPL and Mars Rover from Calit2



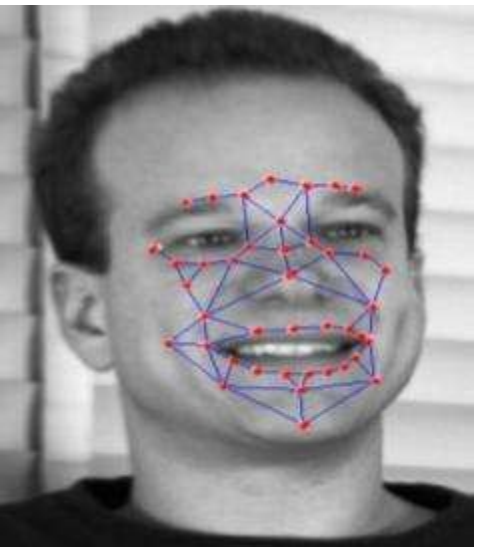
Source: Falko Kuester, Calit2; Michael Sims, NASA

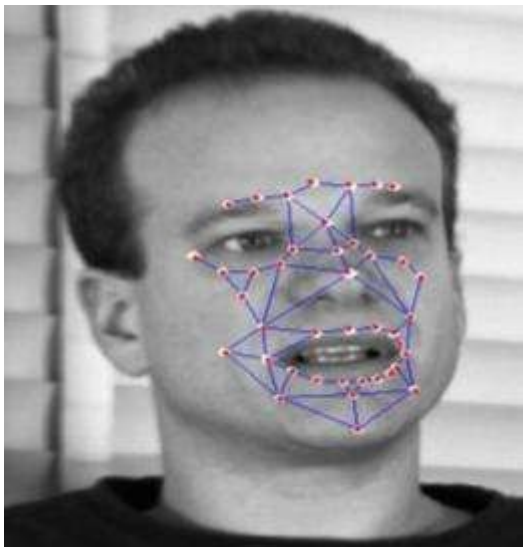
Machine Perception Laboratory: Systems that Interact with Humans

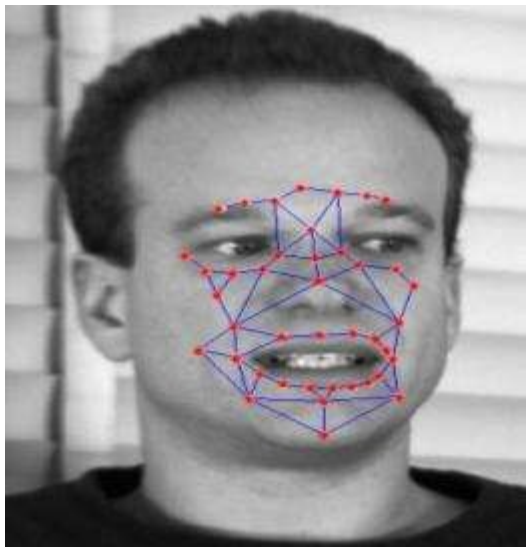


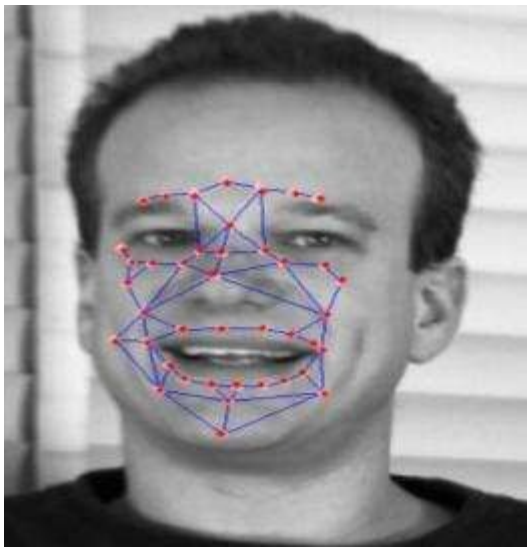












Machine Perception Lab's Einstein Robot: Facial Expression Mirror







Have an Emotional Exchange with Einstein!

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