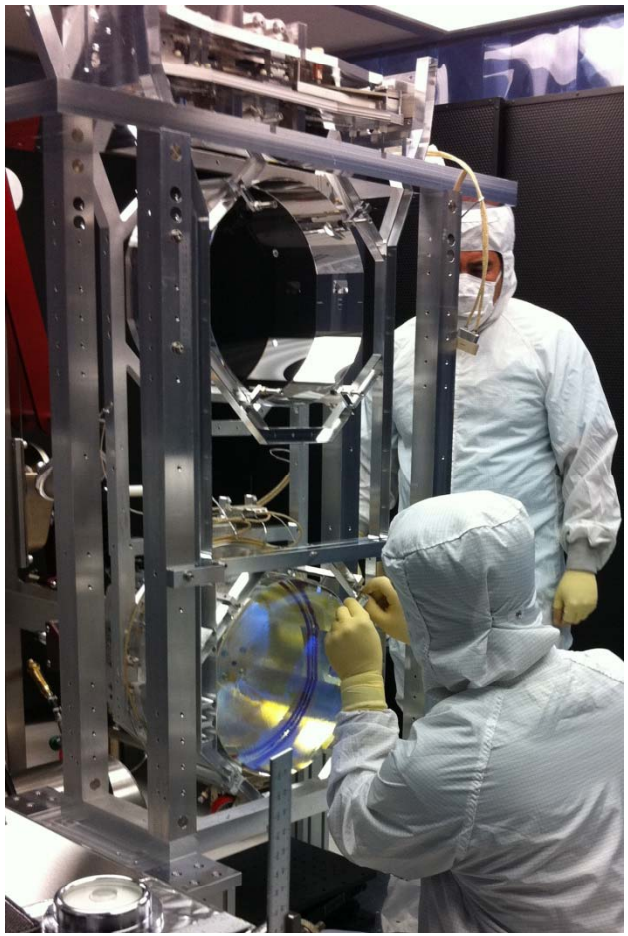
LIGO at a Distance

- Dale Ingram on behalf of the LIGO Laboratory Public Outreach Team
- LIGO Hanford Observatory, Richland, WA
- www.ligo.caltech.edu
- outreach@ligo-wa.caltech.edu
- 509-372-8248
- Exhibit Hall Booth #105

LIGO: Opening a new field of astronomy through the search for gravitational waves

- LIGO: Laser Interferometer Gravitational-wave Observatory. 4-km interferometers in WA and LA, designed to make direct detections of gravitational waves from astrophysical sources.
- Exquisitely sensitive instrumentation capable of resolving test mass displacements of 10^{-19} m.
- A leader in the growing global network of gravitational wave detectors.
- Funded by NSF; operated by Caltech and MIT; an international collaboration of more than 900 scientists engaged in data analysis and detector R&D.



Giving students a look at STEM through the lens of cutting-edge science research

- What should I do when I grow up?
- Why should I consider a future in science or engineering?
- What are the daily activities of scientists and engineers?
- What's the relationship between degree level and the level of professional opportunity in science and engineering?
- What types of skills, attributes and attitudes are important for technical professionals?
- What level of compensation could I expect from a technical career?

What opportunities does LIGO provide for those who are located far from the Observatories?

- Level one – general acquaintance:
- Web-based:
  - www.ligo.org (LIGO Scientific Collaboration (English and Spanish))
  - www.ligo-wa.caltech.edu (LIGO Hanford)
  - www.ligo-la.caltech.edu/SEC.html (LIGO Livingston Science Education Center)
  - www.einsteinsmessengers.com (Einstein's Messengers companion Web site)
  - www.advancedligo.mit.edu/ (Advanced LIGO)
  - LSC, LIGO-LA and LIGO-WA Facebook pages
  - LIGO Magazine (PDF available at www.ligo.org)

Level two: LIGO-related activities for students

- Einstein@Home -- http://einstein.phys.uwm.edu/
- AMNH LIGO Web site: http://www.amnh.org/explore/science-bulletins/(watch)/astro/documentaries/gravity-making-waves
- Classroom activities: www.einsteinsmessengers.org, http://www.ligo.org/students_teachers_public/activities.php (LSC Web site)
- On-line games: Black Hole Hunter, Black Hole Pong, Spacetime Quest,Gravity Slingshot

Level three: Interactive activities and projects

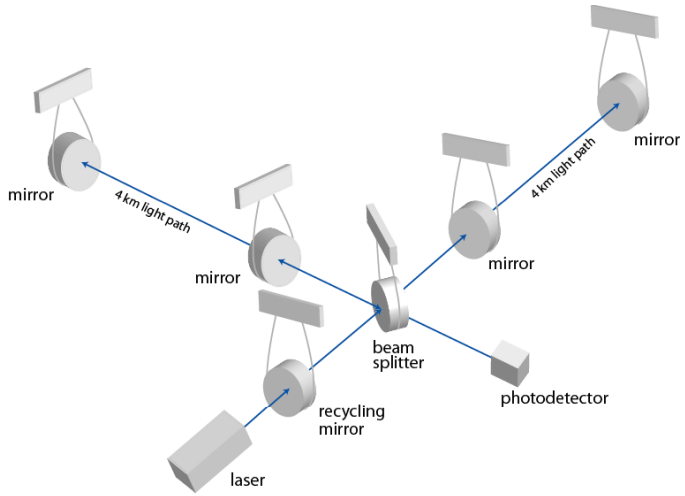
- Blogs: http://ligonews.blogspot.com/, http://stuver.blogspot.com/ . Send questions to Amber at stuver.blogspot.com!
- Video conferencing with LIGO Lab or LSC personnel. A possibility for students and for teacher professional development activities. Platform = Skype, ?
- Use LSC and LIGO Lab personnel for consultations on student projects. LIGO Lab outreach can play matchmaker.

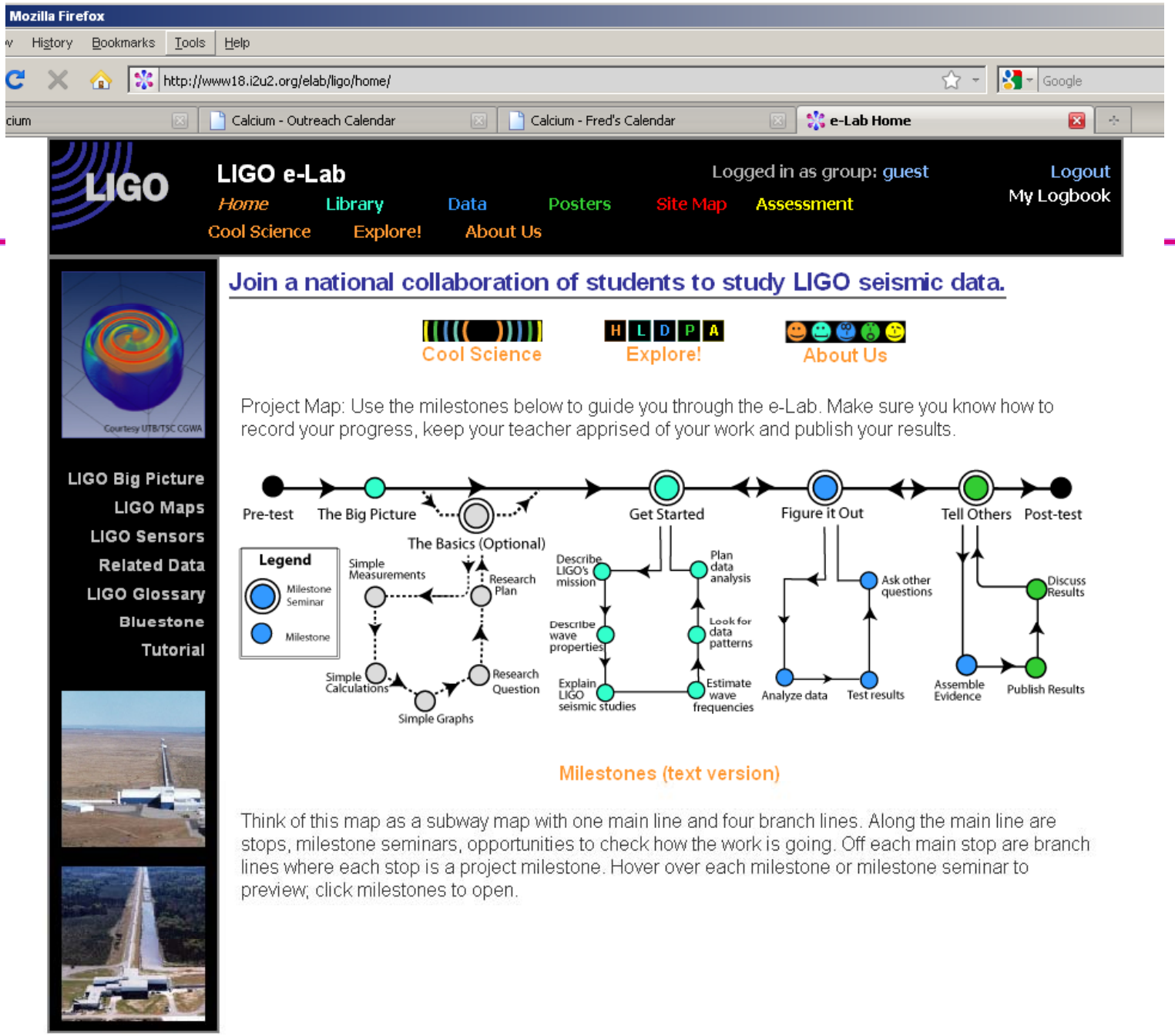
Student research: NSF's *Interactions in Understanding the Universe* (I2U2) Program

- www.i2u2.org
- Also supported by the Office of High Energy Physics in the Office of Science , U.S. Department of Energy.
- Students use I2U2 e-Labs (virtual laboratories) to conduct science research using data sets from large projects.
- I2U2 partners include Fermilab, QuarkNet, U. of Chicago, LIGO, Notre Dame and the Adler Planetarium.

The LIGO e-Lab offers students access to a large archive of LIGO seismometer data

- LIGO operates a network of seismometers at each facility to monitor the effects of seismicity on detector operations.
- Seismometer data forms the central focus of the LIGO e-Lab. The e-Lab data pool also includes magnetometers and weather stations.
- The data flow to the LIGO e-Lab currently is broken due to Advanced LIGO construction. We hope to restore the data flow soon.

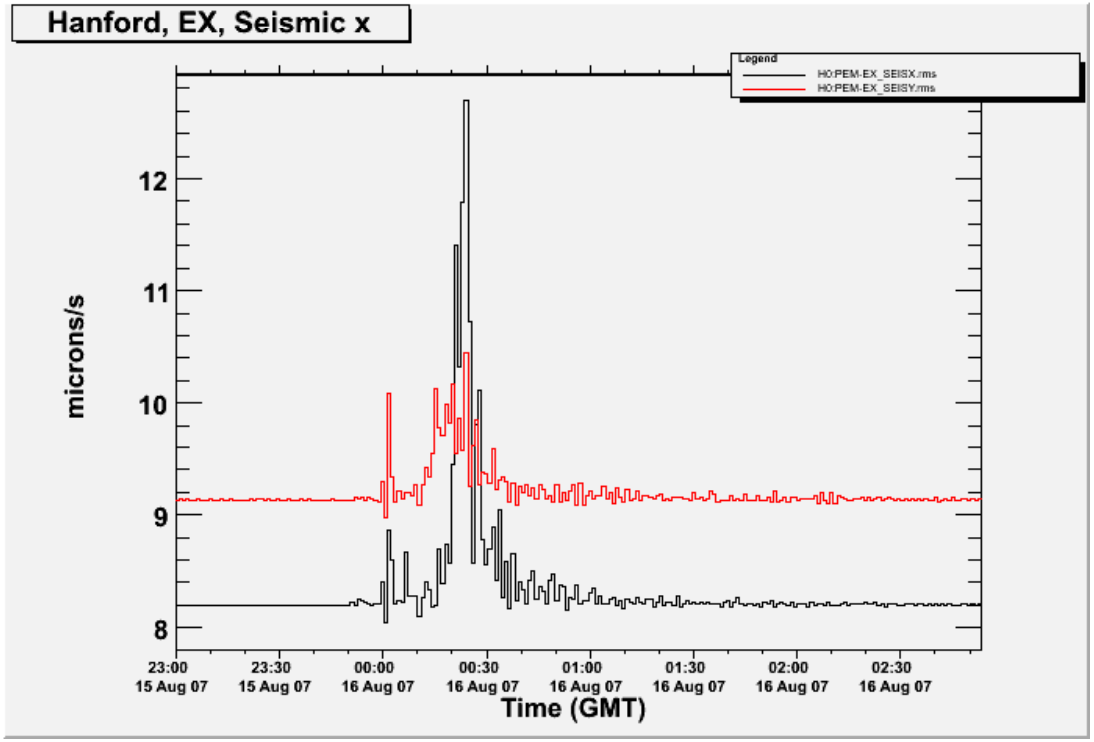




The LIGO e-Lab Web site

Common Investigation Themes with the LIGO e-Lab

- Noise-hunting studies ("What caused that?").
- Earthquake studies (Lots of possible research questions here).
- Correlation studies of natural seismic drivers (wind, rain, ocean waves).
- Correlation studies of human activity (traffic patterns, day-night patterns).
- Frequency-based studies using filtered channels.



Directionality of 8.0 Peru Earthquake at LIGO Hanford in 2007 *(Hanford High School student investigation)*

Avenues for Teacher Involvement

- Become part of the e-Lab teacher community!
- Subscribe to the LIGO e-Lab newsletter (outreach@ligo-wa.caltech.edu).
- Find a group of like-minded colleagues and request an e-Lab workshop.
- Use outreach@ligo-wa.caltech.edu as the point of contact for any e-Lab questions or requests.

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