

# LIGO Contractors Briefing

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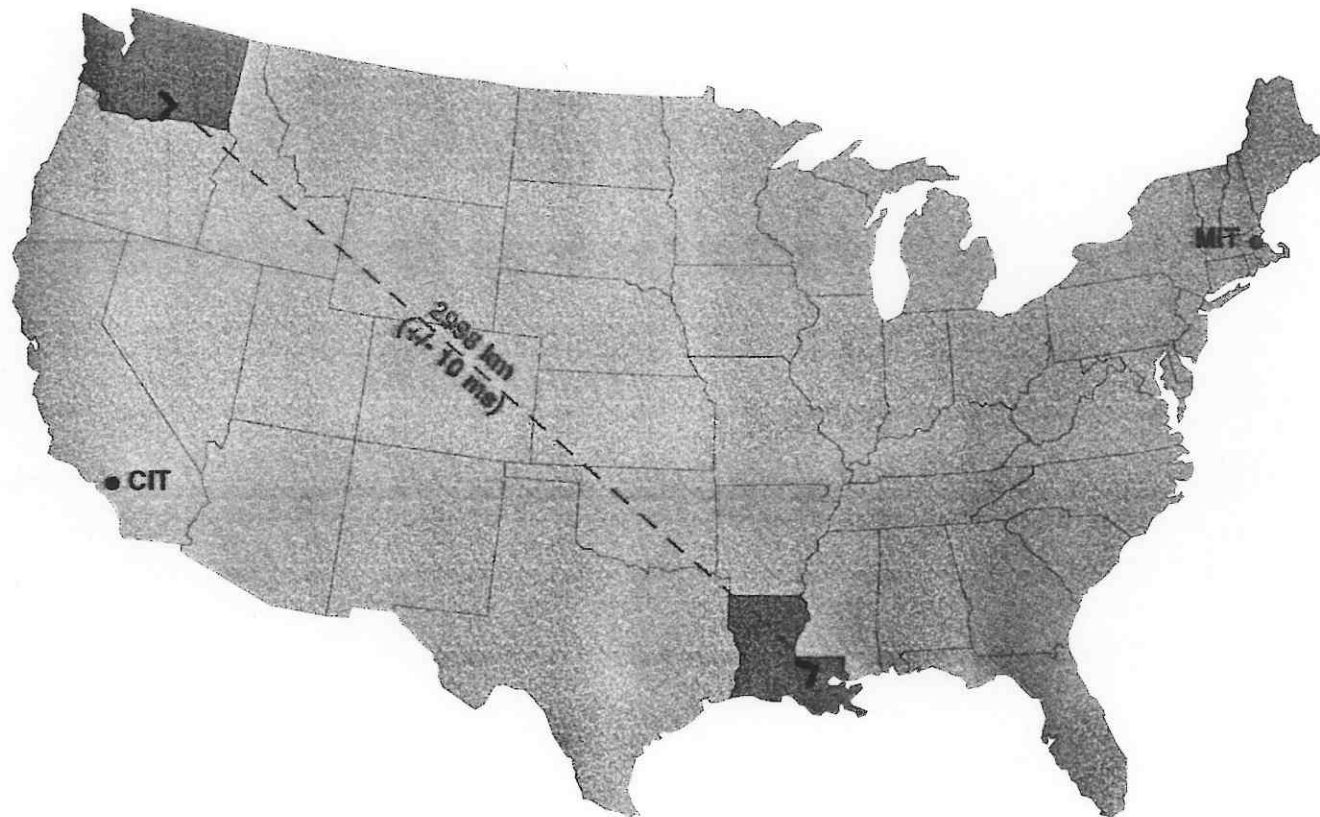
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- LIGO stands for Laser Interferometer Gravitational-Wave Observatory
- Joint project of California Institute of Technology (Caltech) and Massachusetts Institute of Technology (MIT)
- Funded by National Science Foundation (NSF)
- Goal: To make the first detection of gravitational waves, predicted by Albert Einstein 80 years ago, and to use these waves to learn about violent events in the distant universe
  - ›› State-of-the-art scientific facility
  - ›› Center for high-technology development
  - ›› Part of emerging international network of observatories



# LIGO OBSERVATORY SITES

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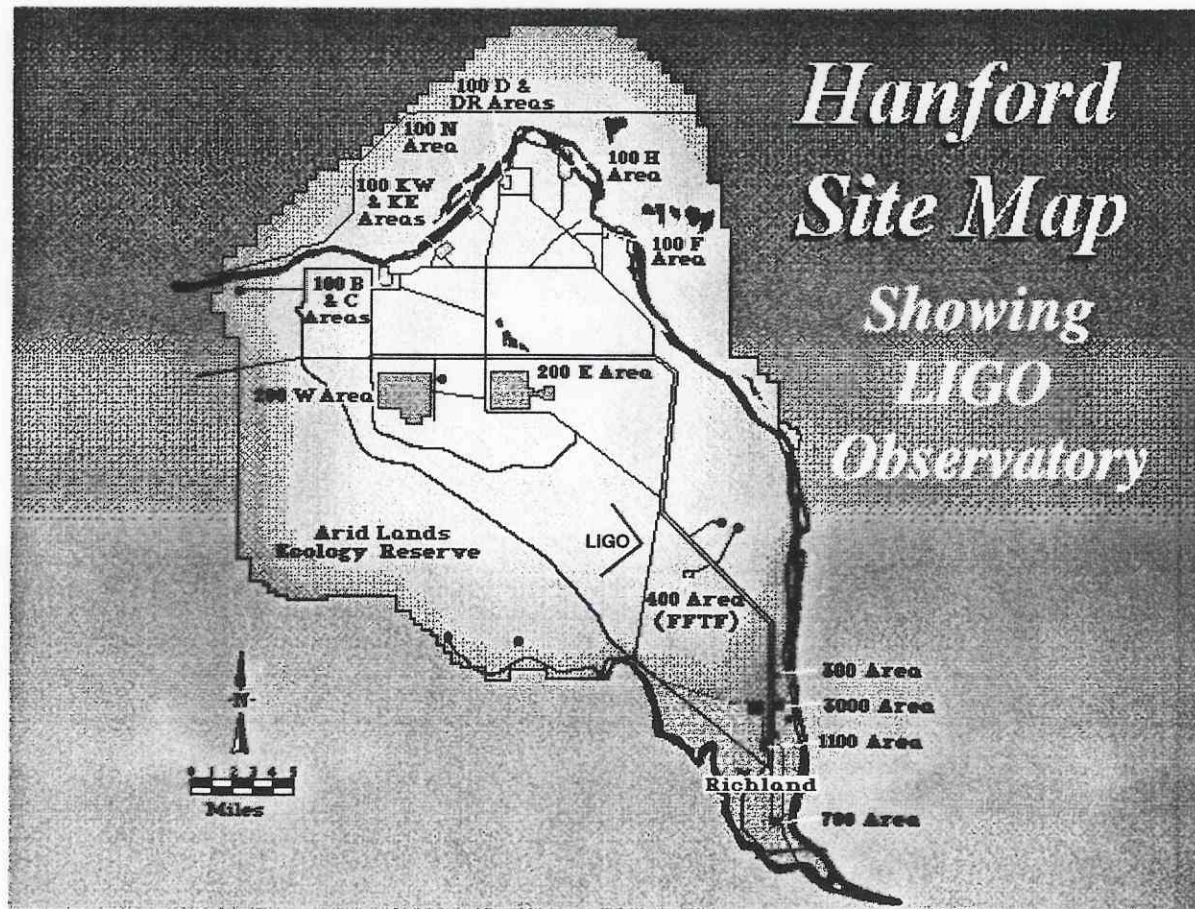


# State-of-the-Art Scientific Facilities at LIGO Hanford Observatory

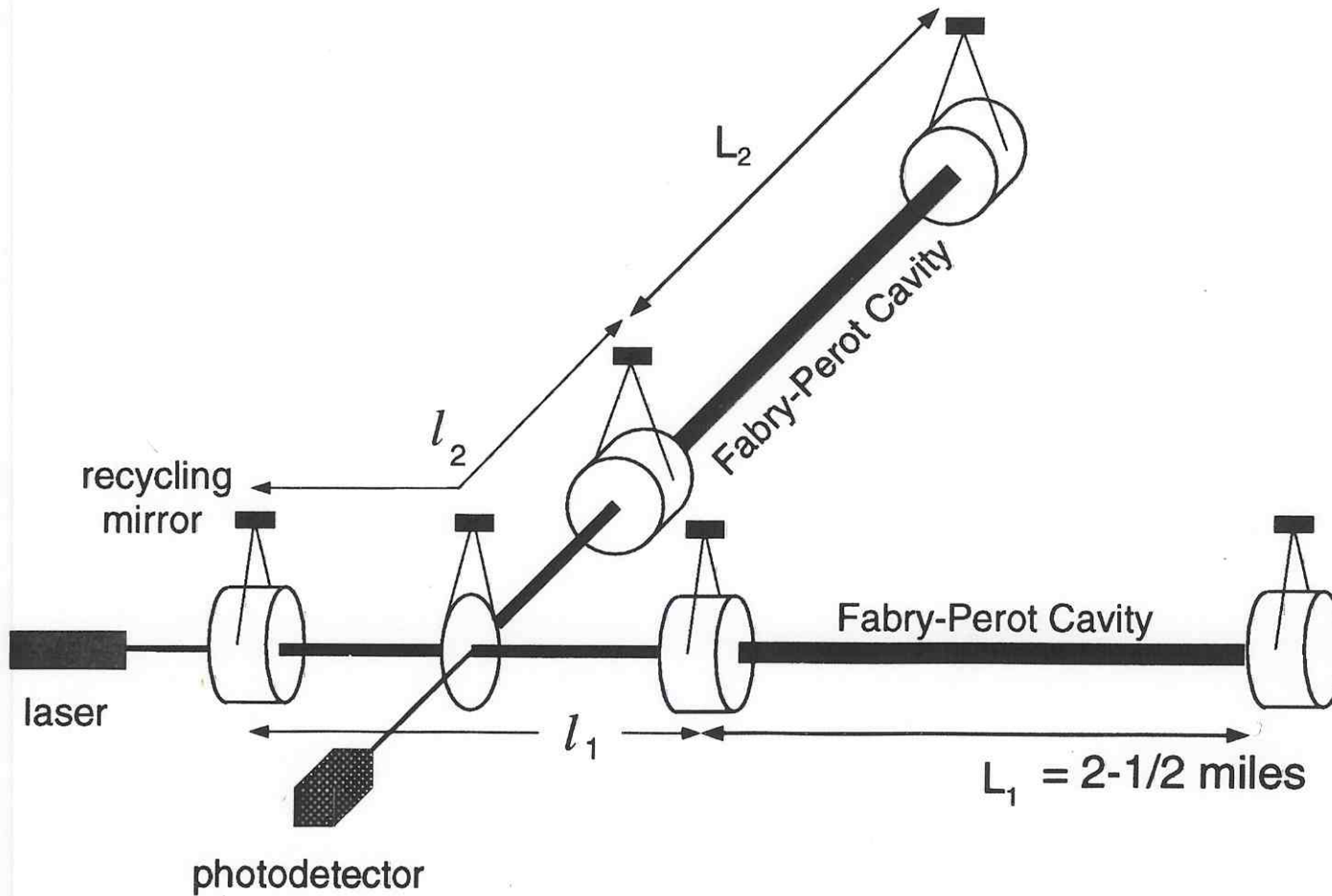
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- L-shaped observatory complex 2-1/2 miles on a side
  - ›› One of the world's largest vacuum systems
  - ›› Five main scientific buildings provide:
    - ultraclean environments for lasers and optics
    - ultralow-vibration environment
    - laboratories for lasers, optics, vacuum, electronics, computers
    - offices and conference areas for scientific staff and visiting scientists
- World's most sensitive optical instruments
  - ›› Separations between mirrors will be measured over the 2-1/2-mile long baseline to a such high precision that motions less than 1/10,000,000,000,000-th of the thickness of a human hair can be detected, using ultra-high-precision lasers

# Location of LIGO at Hanford, WA



# LIGO Laser Interferometer

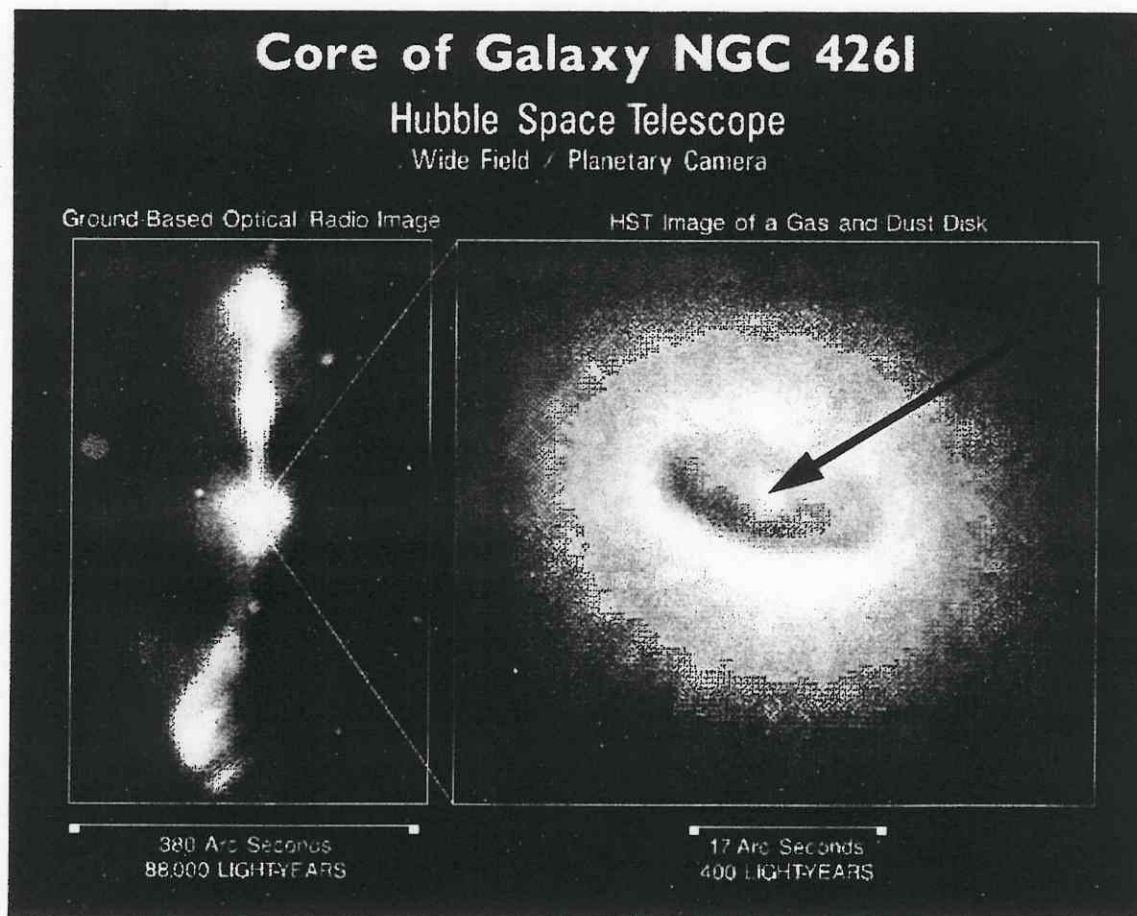


# LIGO Will Open an Entirely New Window on the Universe

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- For most of history, astronomy has used various shades of light, made up of electric and magnetic forces
- We now know that only about 1/10 of the matter in the universe can be seen this way
- LIGO will detect the underlying disturbances created by violent motions of matter, using the force of gravity
- LIGO will provide a new “sense” to look for:
  - ››vibrations of black holes
  - ››colliding or collapsing stars
  - ››motions of burnt-out cores of stars
  - ››echoes from the birth of the universe

# Example: Does a Black Hole Exist Here?



Position of Possible  
Black Hole

The immense tug of gravity from the black hole is thought to be the engine powering the glow of surrounding gas atoms and driving jets deep into space.

Credit: HST graphic by NASA  
Radio Image by NRAO.

# LIGO Operations Plan

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- Scientific operations begin with installation of detector hardware at completion of facilities construction and shakedown
  - Detector installation, integration and shakedown at both sites will take about two years
  - Around-the-clock searches for gravitational waves begin with detectors at both Hanford and Livingston in 2000
  - Approximately 25 resident observatory staff at Hanford, plus a comparable number of visiting scientists
  - Approximately 175 scientists world-wide are currently planning research involvement in LIGO
  - Future expansion is anticipated at both observatory sites