LBC
Large Binocular Camera, Blue (Left)
Large Binocular Camera, Red (Right)
(Configuration: Prime Focus)
Developing partner: INAF, Italy
Type: Wide field, Direct imaging CCD, visible light
http://lbc.mporzio.astro.it/

LUCIFER (unit 1 and unit 2)
LBT Near Infrared Spectroscopic Utility with Camera and Integral Field Unit for Extragalactic Research
(Configuration: Bent Gregorian)
Developing partner: LBTB, Germany
Type: Spectrograph, imager, Near IR light
http://www.mpe.mpg.de/ir/lucifer/

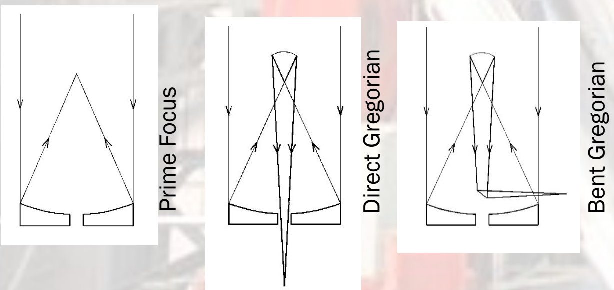
MODS (unit 1 and unit 2)
Multi-Object Double Spectrograph for the LBT
(Configuration: Direct Gregorian)
Developing partner: Ohio State University
Type: Low to medium resolution spectrograph and imager, optical /near UV light
http://www.astronomy.ohio-state.edu/MODS/index.html

LBTI
Large Binocular Telescope Interferometer
(Configuration: Bent Gregorian)
Developing partner: University of Arizona
Type: Nulling Interferometer
http://lbti.as.arizona.edu

LINC-NIRVANA
LBT Interferometric Camera Near-IR / Visible Adaptive Interferometer for Astronomy
(Configuration: Bent Gregorian)
Developing partners: INAF, Italy and LBTB, Germany
Type: Imaging Fizeau interferometric beam combiner
http://www.mpia.de/LINC/

PEPSI
Potsdam Echelle Polarimetric and Spectroscopic Instrument for the LBT
(Configuration: Direct Gregorian)
Developing partner: Astrophysical Institute Potsdam (AIP), Germany
Type: High resolution echelle spectrograph with two polarimeters
http://www.aip.de/pepsi/

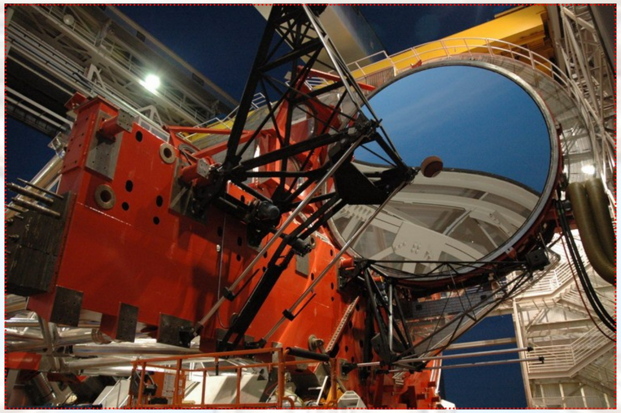
AGW
Acquisition Guiding and Wave front Sensor
Developing partners: INAF, Italy and AIP, Germany
Type: Wave front sensing cameras for mirror stabilization



Optical Path Configurations

Quick Facts

Congressional approval of site: Nov 1988
Construction began: July 1996
First light: Oct 2005
Second light: Jan 2008
Telescope mass: approx 650 metric tons
Telescope pier diameter: 14 meters (46 feet)
Building pier diameter: 23 meters (75.5 feet)
Mirror weight: approx 17.7 metric tons each
Mirror size: 8.408 meters (331 inches) each
Mirror center hole diameter: 0.889 meters (35 inches)
Mirror thickness at center hole: 0.437 meters (17.2 inches)
Mirror thickness at edge: 0.894 meters (35.2 inches)
Mirror aluminum coating thickness: 100 nanometers (0.000004 inches)
Secondary mirror diameter: 0.91 meters (36 inches)
LBT enclosure height: 51 meters (167 feet)
Observatory elevation: 3221 meters (10567 feet)
Number of LBTO employees: 50 ±
Live Views of Telescope at: www.lbto.org



The Large Binocular Telescope (LBT) is a collaboration among the Italian astronomical community (National Institute of Astrophysics —INAF), The University of Arizona, Arizona State University, Northern Arizona University, the LBT Beteiligungsgesellschaft in Germany (Max-Planck-Institut für Astronomie in Heidelberg, Zentrum fur Astronomie der Universitat Heidelberg, Astrophysikalisches Institut in Potsdam, Max-Planck-Institut für Extraterrestrische Physik in Munich, and Max-Planck-Institut für Radioastronomie in Bonn), The Ohio State University and Research Corporation (Ohio State University, University of Notre Dame, University of Minnesota, and University of Virginia).

LARGE BINOCULAR TELESCOPE

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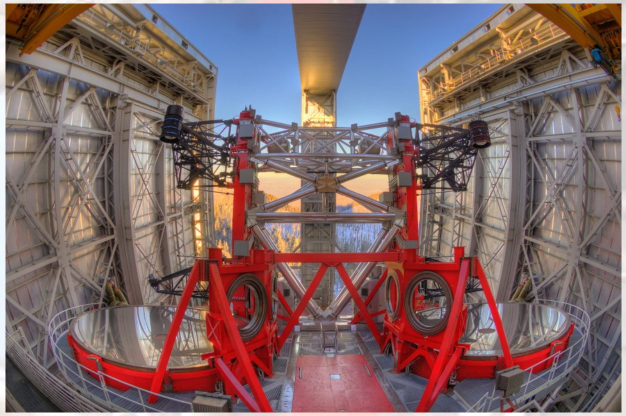
Tucson, AZ 85721-0065
TELEPHONE: 520 626-5231
FAX: 520 626-9333
http://www.lbto.org

March 2011

Check out the brochure online at www.lbto.org

Large Binocular Telescope Observatory



LARGE BINOCULAR TELESCOPE OBSERVATORY

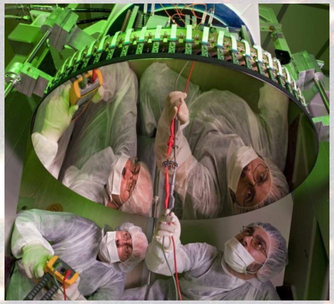
The World's Largest Optical Telescope on a Single Mount

The Telescope

The centerpiece of the LBT Observatory is a binocular telescope consisting of two 8.4-meter mirrors on a common mount. The mount for the Large Binocular Telescope is unique among the modern giant telescopes. The LBT mount was conceived and designed explicitly to support two enormous primary mirrors and auxiliary optics stiffly. The coherent combination of the two telescope beams into one image requires maintaining the difference in path length that the light travels from one side vs. the other to be constant to a fraction of a single wave of light, at the level of 1/10 of a micrometer.

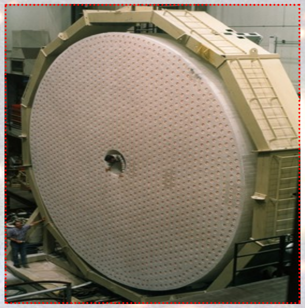
The resulting structure is very stiff and, to get that way, it is massive. The base is a concrete pier 20 meters (66 feet) high and 14 meters (46 feet) in diameter, resting on the mountain bedrock. The telescope is an altitude-azimuth design (like a gun turret on a battleship). It addresses any point on the sky by tipping to the correct angle between zenith and horizon, and rotating around its vertical axis to the correct heading. The altitude bearing is comprised of a pair of C-rings that project the 500 tons of moving weight of the structure directly to the 150-ton azimuth frame and onto the pier. The C-ring bearings and azimuth bearings float on a film of oil pumped to 120 atmospheres pressure, allowing the telescope to be driven by four 3 horsepower motors on each axis.

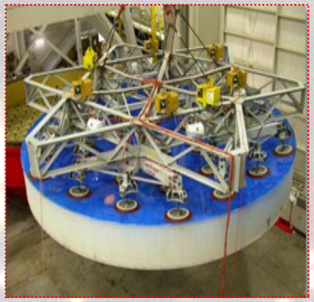
The structure's towering center section provides the pivot points for swing arms that move auxiliary optics into and out of the main beams. Two swing arms support the prime focus cameras for direct imaging. They can be retracted and secondary mirrors put into place to form images at the straight-through Gregorian foci below the primary mirrors. A pair of flat tertiary mirrors can be swung into place to divert the light to Bent Gregorian foci with the permanently mounted large instruments in the very center of the telescope structure. The primary mirrors will be protected by mirror covers that swing into place (just below the tertiaries) and that open around a central hub.



Modern large telescopes achieve their sharpest imaging by passing the light through a system to compensate for the blur of the Earth's atmosphere. Such systems are called adaptive optics (AO), with the central element being a thin, rapidly deformable mirror. The mirror surface changes shape typically 1000 times a second. The unique aspect of LBT's AO system is that the deformable mirror is the secondary mirror of the telescope itself. Having the telescope's secondary mirror serve as the AO deformable mirror avoids the introduction of substantial thermal background noise.

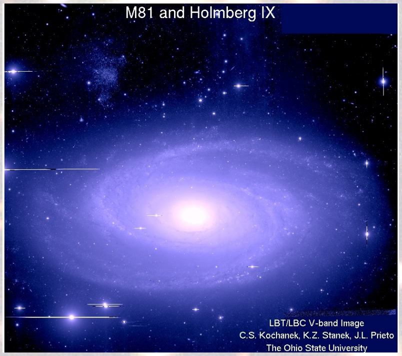
The challenge is in the size of the adaptive mirrors. The thin shell of glass that makes the deformable reflecting element is 91 cm (36 inches) in diameter and only 1.6 mm (0.063 inches) thick. It is controlled by 672 electromagnetic actuators, with magnets glued directly onto its back surface.





The Large Binocular Telescope uses two 8.408 meter (331-inch), F/1.142 primary mirrors to provide a collecting area equivalent to an 11.8 meter (465-inch) circular aperture. By having both the primary mirrors on the same mounting, the telescope will be able to achieve the diffraction-limited image sharpness of a 22.8 meter aperture, or 10X sharper than The Hubble Space Telescope. These borosilicate honeycomb primary mirrors were fabricated at the Steward Observatory Mirror Lab using E6 glass made by Ohara in Japan.

Astronomical Images



Messier 81 is a bright spiral galaxy (type Sb) in the constellation of Ursa Major. This false color image is created from very deep LBT prime focus images taken with LBC-Blue in the B (blue) and V (yellow) bands. The integration time is of order an hour per filter since the M81 field was observed several dozen times as part of a program during Science Demonstration Time in Spring 2007 to measure Cepheids and other variables in the M81 field. M81 lies at a distance of 12 million lightyears from earth. Note the faint dwarf galaxy Holmberg IX in the upper left of the image. Image provided by Chris Kochanek, Kris Stanek and Jose Prieto of Ohio State University.

Image of a stellar nursery in the Milky Way: a high-mass star forming region inside the giant molecular cloud S255, about 8,000 light-years away from Earth (1 light-year ≈ 10 trillion kilometers). Taken by Arjan Bik using the LUCIFER.

Messier 1 - This color image of Messier 1, the Crab Nebula, was taken at the Large Binocular Telescope during November 2006 by Vincenzo Testa and collaborators from Rome Observatory. The image is a true-color composite composed of separate images in red, green and blue light obtained by the 36 mega pixel Large Binocular Camera at the prime focus of the left 8.4m primary mirror. The Crab Nebula is the remnant of a supernova explosion in the constellation of Taurus which was observed in the year 1054. The Crab Nebula is located in our own Milky Way galaxy at a distance of about 6300 light years from Earth. This data was taken during commissioning tests of the camera in advance of scientific observations in spring 2007.