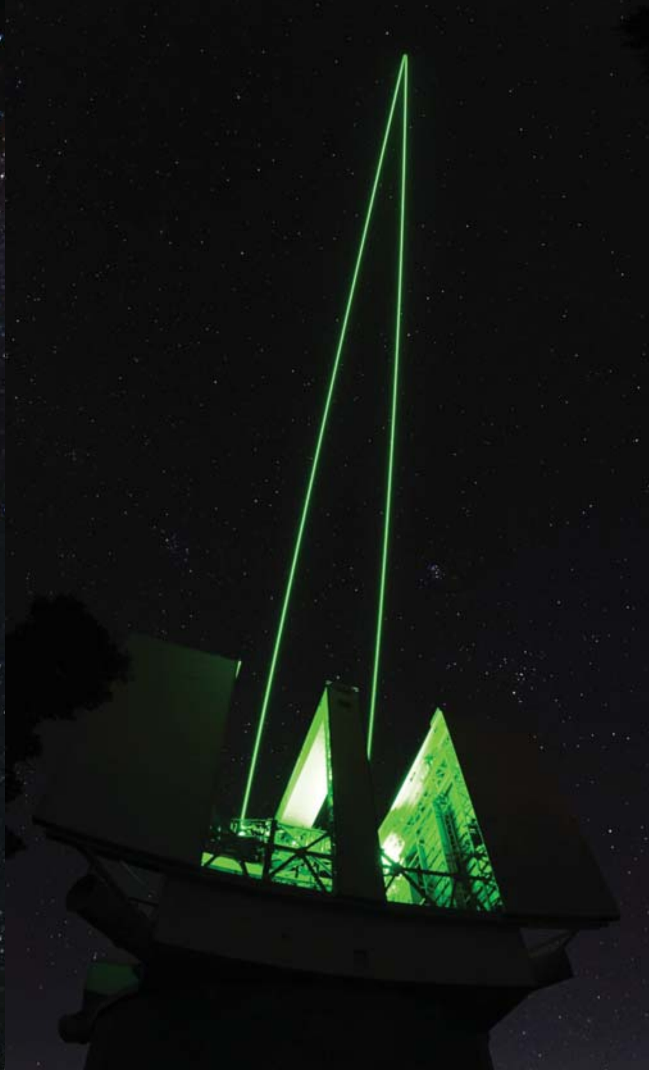

ARGOS (Advanced Rayleigh guided Ground layer adaptive Optics System) will eventually bring Ground Layer Adaptive Optics (GLAO) capabilities to LBT. ARGOS is dedicated to observations with LUCI1 and LUCI2, LBTO's pair of near-IR imagers and multi-object spectrographs.

ARGOS is projecting three beams per LBT's eye, creating a constellation of three artificial stars on a circle of 2' in radius. This constellation will allow a significant improvement of the image quality over the 4' field of view of the LUCIs. Each of the six Nd:YAG lasers sends a beam of green (532nm) pulses at a rate of 10kHz with a power of 14W to 18W. Three beams are launched on-axis from a mirror on the back of each of the two LBT secondary mirrors.

The Large Binocular Telescope (LBT) is a collaboration encompassing

- the Italian astronomical community (INAF: National Institute of Astrophysics);
- the University of Arizona, Arizona State University, and Northern Arizona University;
- the LBT Beteiligungsgesellschaft in Germany (LBTB: Max Planck Institute for Astronomy, University of Heidelberg Center for Astronomy, Leibniz Institute for Astrophysics Potsdam, Max Planck Institute for Extraterrestrial Physics, Max Planck Institute for Radio Astronomy);
- the Ohio State University; and
- the Research Corporation (representing the University of Notre Dame, University of Minnesota, and University of Virginia).

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For observatory visits:
www.eac.edu/discoverypark/mgio.shtm

Large Binocular Telescope Obervatory
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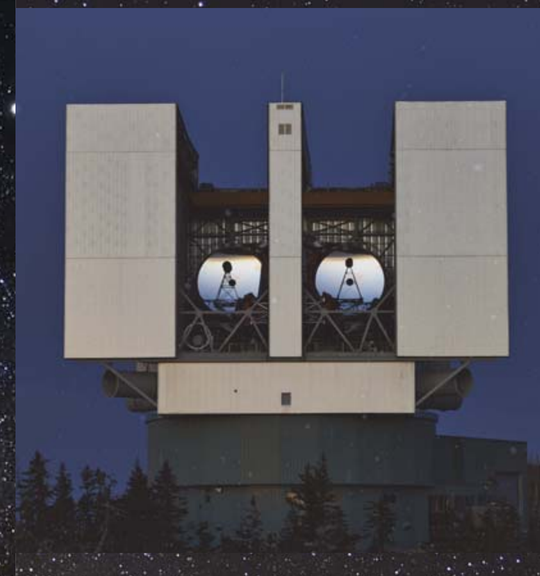
Large Binocular Telescope Observatory



Location: Mount Graham, Arizona, in the Pinaleno Mountains on Emerald Peak (near Safford) - Elevation: 3221 m

2 x 8.41 m binocular Gregorian optical/infrared telescope

Effective aperture: 11.8 m

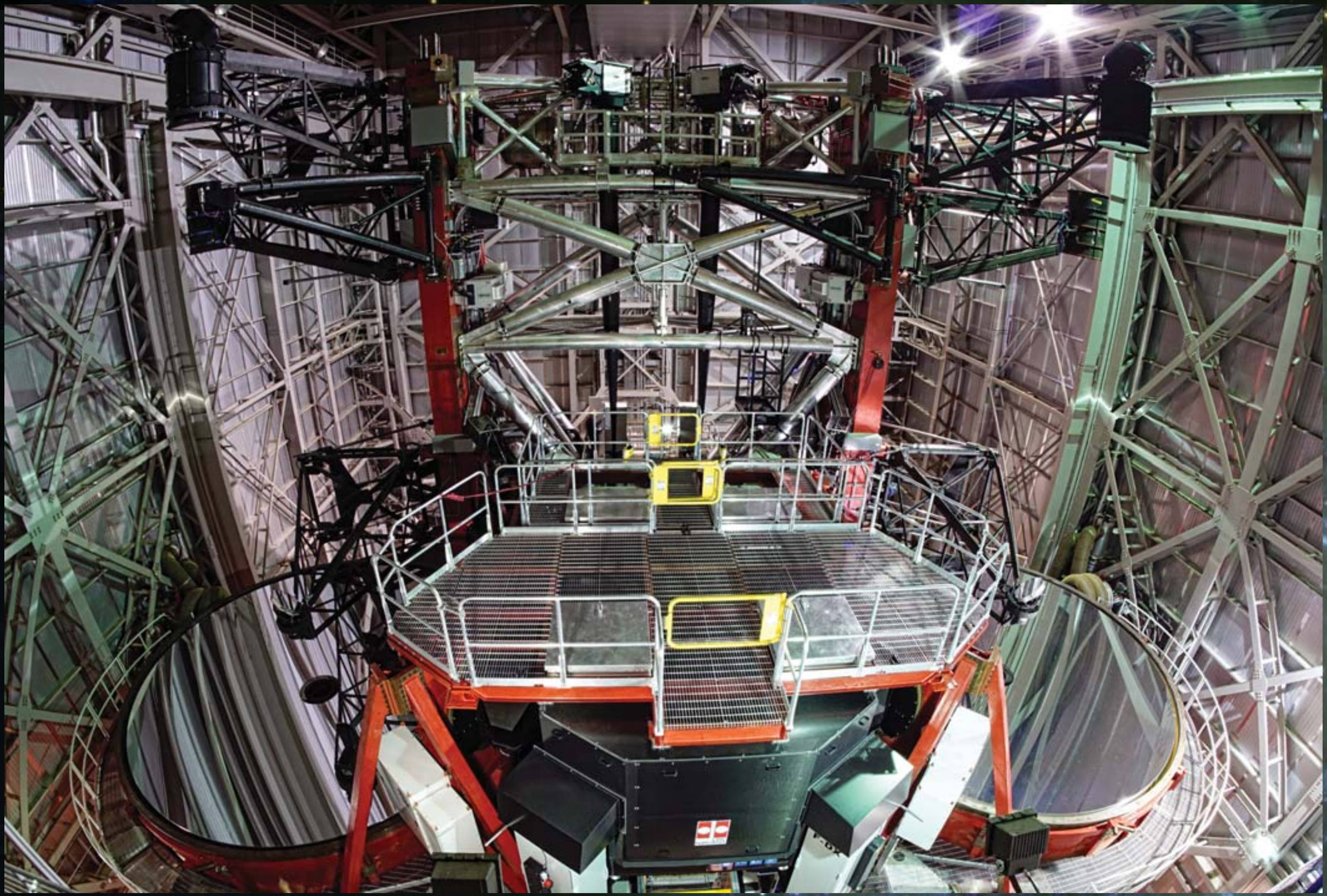
Interferometric baseline: 22.8 m

Angular resolution : Up to 20 mas with the 22.8 m baseline (K band) ; up to 40 mas with a single aperture (H-band)

Focal stations: 6 pairs (F/1.14 prime; F/15 bent front, center, rear, and PEPSI fiber unit; and F/15 Direct)

Available modes: Wide field prime focus optical imaging; seeing-limited optical and infrared imaging, spectroscopy, and multi-slit spectroscopy; ultra high resolution optical spectroscopy; diffraction-limited infrared imaging and long-slit spectroscopy; coherently-combined infrared Fizeau and nulling interferometry

The binocular design of the LBT has two identical 8.41 m telescopes mounted side-by-side with an edge-to-edge separation of 22.8 m on a common altitude-azimuth mounting for a combined collecting area of a single circular aperture 11.8 m telescope. By having both the primary mirrors on the same mounting, the telescope is able to achieve through coherent beam combination the diffraction-limited image sharpness of a 22.8 meter aperture telescope. The binocular design, combined with integrated adaptive Gregorian secondary mirrors to compensate for atmospheric phase errors, provides a large effective aperture, high angular resolution, low thermal background, and exceptional sensitivity for the detection of faint objects. The entire telescope and enclosure are very compact by virtue of the fast primary mirror focal ratio of F/1.14. The mount for the LBT is unique among the modern giant telescopes. The mount was conceived and designed explicitly to rigidly support two enormous primary mirrors, auxiliary optics, and large massive scientific instruments. 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 of the telescope versus the other side to be constant to the level of 1/10 of a micrometer.



The LBT is a very versatile platform for astronomical observations. The design incorporates six focal station pairs on the structure that can be accessed by swing arms that move and rotate auxiliary optics in and out of the main telescope beams. It takes 20 minutes or less depending on the configuration to change focal stations and to a different scientific instrument. All of the instruments are mounted on the telescope simultaneously and can be available for use during the night to take advantage of exquisite but rare observing conditions, flexible and queue scheduling, mixed-mode observing programs, and targets of opportunity. Two swing arms support the prime focus cameras (LBCR-LBCB) for direct optical imaging observations. They can be retracted and the adaptive secondary mirrors moved into place to direct the light to the straight-through direct F/15 Gregorian foci below the primary mirrors for optical spectroscopy and spectropolarimetry (MODSx2). A pair of flat tertiary mirrors can also be moved into place just above the primary mirrors to direct the light to one of several bent F/15 Gregorian foci at the center of the telescope structure. Located here are the large permanently mounted interferometric instruments that can utilize the two phase-combined telescopes for high angular resolution (LBTI in operation, LINC-NIRVANA in development), a multi-mode infrared imager and spectrograph that can also utilize the facility adaptive optics system (LUCIx2), and a pair of ports that house optical fibers that feed light to a large and environmentally stable high resolution spectrograph chamber (PEPSI) in the

Modern large telescopes achieve their sharpest image quality by passing the light through an auxiliary system that can compensate for the turbulence of the Earth's atmosphere above the telescope which degrades the quality of astronomical images. These systems utilize adaptive optics (AO), where the central component is a thin rapidly deformable mirror. The shape of the mirror surface changes at a typical rate of 1000 times a second to improve the image quality of a science target in response to changes in the image quality of a nearby reference star brought on by atmospheric turbulence.

An adaptive secondary mirror (ASM) reflecting its primary mirror. On the picture opposite, each ASM can be seen hanging from the highest arm on each side of the telescope.

The LBT is the first telescope to have an integrated adaptive optics system in which 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 and may enable wider fields of view at higher angular resolution. The secondary mirrors of the LBT consist of a thin shell of glass that makes the deformable reflecting element. The thin glass shell is 91 cm in diameter and only 1.6 mm thick. It is controlled by 672 electromagnetic actuators, with magnets glued directly onto its back surface which push and pull on the glass to correct the images of astronomical objects and compensate for the atmosphere.

The back of the shell with its glued magnets is seen below separated from the the body of the ASM.