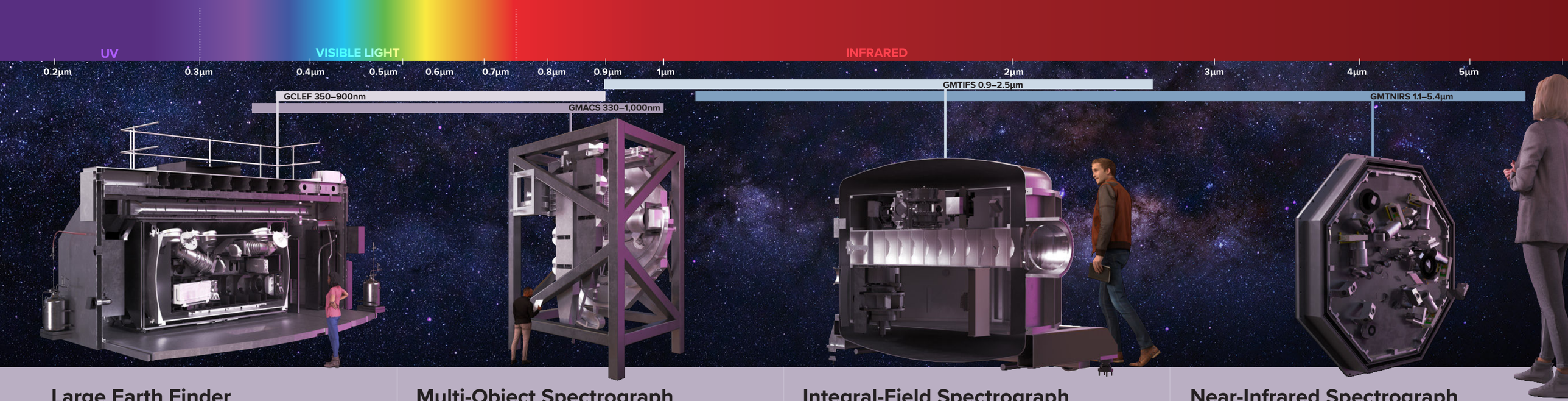


Large Earth Finder
GCLEF

A high-spatial-resolution, visible light, echelle spectrograph with red and blue channels, capable of utilizing natural seeing and adaptive optics. It is the only such spectrograph planned for the first decade on the two US-based ELTs and for the first-generation instrument suite on the European ELT.

Science Capability

- Exoplanets: planetary characteristics, precise velocities, atmospheric properties, biosignatures
- Stars: abundances, isotopes, and velocities
- Dwarf galaxies: abundances, dark matter
- Cosmology: chemical evolution, fine structure constant

Technical Specifications

SPECTRAL RESOLUTION
20,000–100,000

WAVELENGTH RANGE
350–950 nm

VELOCITY PRECISION
<50 cm/s per observation
<10 cm/s over time

FIELD OF VIEW (Imager)
300 arcmin²
with fibers (MANIFEST)

MODES
High throughput, medium-resolution, high-resolution, precision radial velocity, multi-object (with MANIFEST fiber system)

AO Modes

NS **GLAO** **NGAO** ~~LTAO~~

Designer: Harvard and Smithsonian Center for Astrophysics, with contributions from several partners in the Giant Magellan Telescope international consortium

Multi-Object Spectrograph
GMACS

A versatile spectrograph with red and blue channels that is optimized for observation of more than 100 objects simultaneously using slits or fibers in natural seeing or ground layer adaptive optics modes.

Science Capability

- Nearby galaxies: chemical enrichment history, dark matter distribution, stellar populations and evolution, transient follow-up
- Distant galaxies: Lyman-α luminosity function at z < 6.5, chemical enrichment of ISM, redshift surveys

Technical Specifications

SPECTRAL RESOLUTION
1,000–6,000

WAVELENGTH RANGE
330–1,000 nm

FIELD OF VIEW (Imager)
300 arcmin²
with fibers (MANIFEST)

FIELD OF VIEW (Diameter)
7 arcmin × 6 arcmin with slits

ALTERNATE INPUT
100s of fibers

Multi-slit mask count
24 masks 50–100 masks/slit

AO Modes

NS **GLAO** ~~NGAO~~ ~~LTAO~~

Designer: Harvard and Smithsonian Center for Astrophysics, Steiner Institute for Instrumentation and Data Science

Integral-Field Spectrograph
GMTIFS

A high-throughput, high-spatial-resolution spectrograph, and diffraction-limited imager, accommodating up to sixteen filters and operating across the YJHK bands using natural guide star and laser guide star adaptive optics.

Science Capability

- Young stars: star and planet formation processes
- Nearby galaxies: chemical enrichment history
- First galaxies: structure and assembly
- Massive black holes: masses and physics of galaxy nuclei
- Gamma ray bursts: intergalactic medium at z~7

Technical Specifications

SPECTRAL RESOLUTION
5,000/10,000

WAVELENGTH RANGE
0.9–2.5 µm

SPATIAL RESOLUTION (IFU)
6/12/25/50 mas

FIELD OF VIEW (IFU)
0.5 arcsec × 0.25 arcsec–
4 arcsec × 2 arcsec

SPATIAL RESOLUTION (Imager)
0.005 arcsec/pixel

FIELD OF VIEW (Imager)
20 arcsec × 20 arcsec

AO Modes

~~NS~~ ~~GLAO~~ **NGAO** **LTAO**

Designer: Australian National University

Near-Infrared Spectrograph
GMTNIRS

A single-object, near-infrared to mid-infrared, echelle spectrograph that provides extraordinary efficiency with simultaneous coverage of the full JHKLM bands. It is ideal for spectroscopy of young star and planet formation.

Science Capability

- Exoplanets: atmospheric chemistry and internal structure
- Stars: formation of stars, disks, and planets, abundances
- Nearby galaxies: chemical evolution history and current stellar composition
- Distant galaxies: composition of universe in Lyman-α systems, and evolution

Technical Specifications

SPECTRAL RESOLUTION
65,000 (JHK)

WAVELENGTH RANGE
1.1–5.4 µm

SPECTRAL RESOLUTION
80,000 (LM)

SLIT LENGTH
1.2 arcsec

AO Modes

~~NS~~ ~~GLAO~~ **NGAO** **LTAO**

Designer: The University of Texas at Austin in collaboration with the Korean Astronomy and Space Science Institute

GIANT MAGELLAN TELESCOPE
THE UNIVERSE AWAITS

GIANT MAGELLAN TELESCOPE

Science Instruments and Observing Modes

Four Observing Modes

NS **Natural Seeing**

Available over the Giant Magellan's full wavelength range and field of view, with image quality limited by atmospheric wavefront distortion.

GLAO **Ground Layer Adaptive Optics**

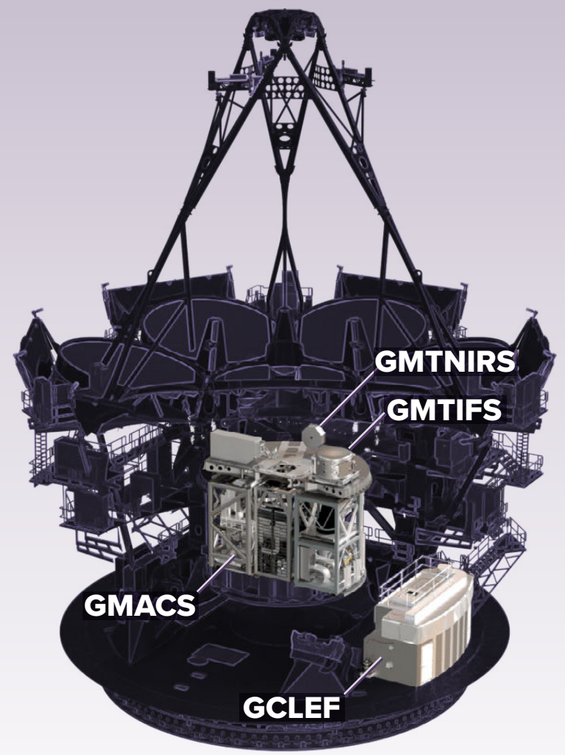
The Gregorian design and integrated adaptive optics system allow ground layer atmospheric turbulence to be corrected over a wide field of view, improving natural seeing image quality by 20–50% from the visible to near-infrared (with the greatest improvements at red wavelengths). The Giant Magellan uses wavefront sensors that allow any instrument to receive GLAO corrected images.

NGAO **Natural Guide Star Adaptive Optics**

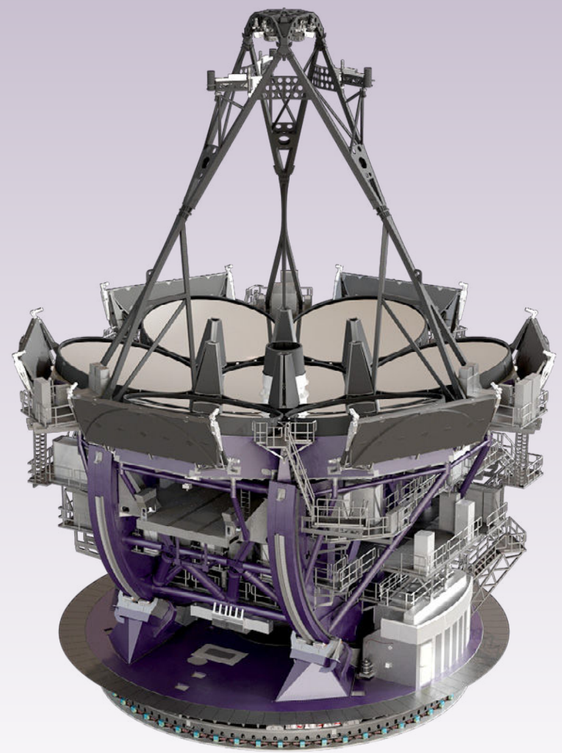
NGAO uses a single natural guide star (bright) to deliver diffraction limited, high Strehl ratio images (>75 % Strehl in the K band) at wavelengths from 0.6 µm into the mid-infrared over a field of view a few arcseconds in diameter.

LTAO **Laser Tomography Adaptive Optics**

LTAO uses six laser guide stars and a single natural guide star (faint) to extend diffraction-limited performance to nearly the full sky with moderate Strehl ratio (>30 % Strehl in the H band) at infrared wavelengths over a much wider field of view than NGAO (~20" at 1µm) and is available to any instrument designed to use this mode.



For more technical specifications and capabilities, visit GiantMagellan.org/for-scientists



Technology designed to explore and discover the unknown

The Giant Magellan Telescope

can accommodate ten visible to mid-infrared instruments designed to take advantage of the telescope's four observing modes. This specialized suite of high-resolution imagers and spectrographs will explore the unknown: From analyzing exoplanet atmospheres in search of biosignatures to resolving galaxy formation and the coevolution of galaxies with black holes over cosmic time. The discoveries they make could rewrite history as we know it.

Performance Specifications

Optical Prescription	Aplanatic Gregorian
Focal Plane Scale	0.997 arcseconds/mm
Wavelength Range	0.32 – 25 µm
Field of View	20 arcminute diameter
Primary Mirror Diameter & Collecting Area	25.4 m, 368 m^2
Primary Mirror f/#	0.71
Final *f*/# [with Wide Field Corrector]	8.16 [8.34]
Diffraction-limited Angular Resolution	0.01 arcsecond at 1 µm

The focal ratio of the Giant Magellan (~f/8) will come to focus twice as fast as the other Giant Segmented Mirror Telescopes. This enables the telescope enclosure to be more compact than a larger focal ratio optical system and deliver a smaller plate scale at the focal plane, which in turn enables the instruments to remain relatively small while still capturing a best in-class wide field of view.