The InfraRed Imaging Spectrograph (IRIS)

IRIS is one of TMT's workhorse first-light instruments, working with the TMT Narrow Field InfraRed Adaptive Optics System (NFIRAOS). It combines an imager and an integral field spectrograph to deliver diffraction limited imaging and spatially resolved spectroscopic capabilities over its 0.84 - 2.4 µm range.

Principal Investigator: James Larkin
University of California at Los Angeles
UCLA - USA

IRIS Project Manager: David Andersen (TMT)

For questions, email: inquiry@tmt.org

Notes

SCAN ME

tmt.org

UNIVERSITY OF CALIFORNIA Caltech

INDIA TMT

NAOC

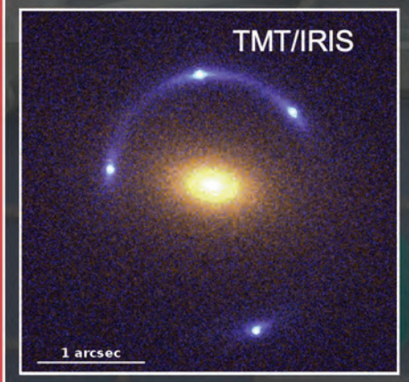
NRC·CNRC Canada

国立天文台 NAOJ National Astronomical Observatory of Japan

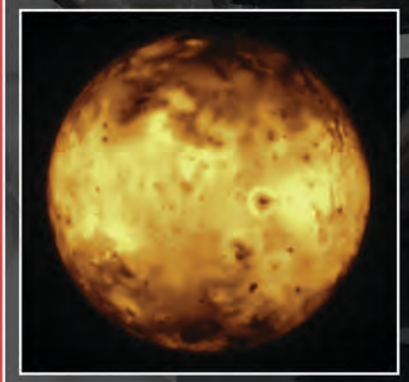
TMT
THIRTY METER TELESCOPE

IRIS
Infrared Imaging Spectrograph

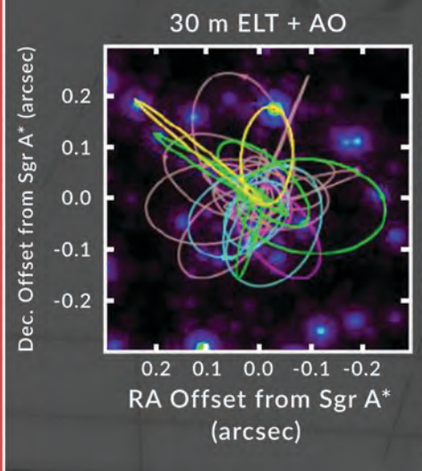
The InfraRed Imaging Spectrograph (IRIS)



IRIS's unprecedented angular resolution will allow unique studies of distant gravitationally-lensed galaxies. These observations will provide unique insights on the distribution of dark matter in the sub-structure of galaxies in the early universe. This simulated IRIS image demonstrates how IRIS will resolve the distant lensed galaxy, which is seen as four blue arcs, as well as the foreground lens galaxy shown in red.



IRIS will be able to resolve and map active volcanism on Jupiter's moon, Io. This IRIS simulation at H-band shows the dark surface features near Io's equator spanning 100 km wide lava flows, which can be studied in real-time.



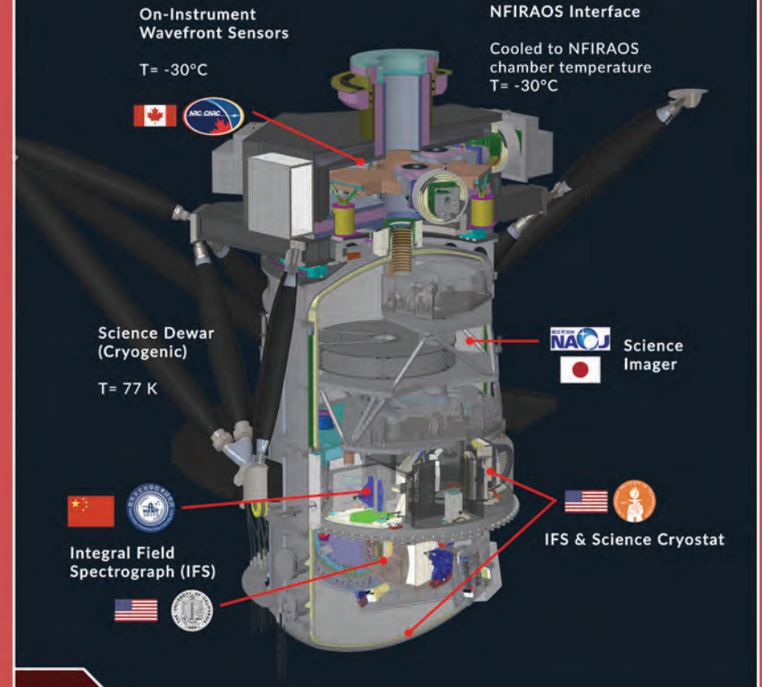
IRIS will be able to conduct detailed studies of inner-arcsecond sources orbiting the supermassive black hole (SMBH) at the center of the Milky Way. The exquisite spatial resolution will allow us to map stars that orbit the SMBH with a period of 1 year. These unique observations will enable high-precision measurements for studying fundamental physics in the Galactic Center. (Simulation courtesy of UCLA Galactic Center Group).

Performance category	Value	Comment
Expected Strehl ratio for greater than 50% of sky	J band: 0.41 H band: 0.60 K band: 0.75	For on-axis object. Relative Strehl ratio variations of 1.5-2.5% across the full IRIS field may occur due to the multi-conjugate AO correction.
Airy ring size	J band: 21 mas H band: 28 mas K band: 37 mas	Diameter (FWHM).
Ensquared energy	J band: 0.35 - 0.57 H band: 0.50 - 0.66 K band: 0.62 - 0.72	Over 34 x 34 arcsec^2 imager field. Energy in box with diameter of PSF FWHM. The range originates from different conversions between WFE and EE.
Astrometric accuracy	Relative precision: 10 µas Relative accuracy: 30 µas Absolute accuracy: 2-4 mas	Average precision obtained using diverse reference fields and after visiting the science field a multiple number of times.
Limiting magnitude (Imager)	J band: 27.8 H band: 27.3 K band: 26.9	Point source sensitivity. Five hour integration, S/N = 100, 2λ/D aperture. AB magnitude.
Limiting magnitude (Spectrograph)	J band: 25.8 H band: 26.0 K band: 25.2	Point source sensitivity for 4 mas pixel scale. Other scales are significantly more sensitive. Five hour integration, S/N = 10, 2λ/D aperture. AB magnitude.

Expected performances

Capability mode	Spatial Sampling (mas)	Field of view (arcsec x arcsec)	Resolution (λ/Δλ)
Imager	4 mas	34 x 34	Set by filter
Slicer IFS 88 x 45 Spaxels	50 mas 25 mas	4.4 x 2.25 2.2 x 1.125	4,000, 8,000 4,000, 8,000
Lenslet IFS 112 x 128 Spaxels	9 mas 4 mas	4.4 x 2.25 2.2 x 1.125	4,000 4,000
Lenslet IFS 16 x 128 Spaxels	9 mas 4 mas	0.144 x 1.15 0.064 x 0.51	8,000 - 10,000 8,000 - 10,000

IRIS will be one of TMT's workhorse instruments providing at first-light diffraction-limited spectroscopy and imaging in the near-infrared wavelength regime. The combination of TMT's large collecting area, its unprecedented angular resolution and astrometric accuracy, will have a direct impact on a broad range of science programs that span from the search for extrasolar planets to studies of our own solar system bodies, the nature of the first stars that illuminated the Universe, or the supermassive black holes at the center of our own and nearby galaxies. IRIS will be equipped with a large set of broad- and narrow-band filters and gratings covering the diverse needs of the TMT scientific community.



Observing modes