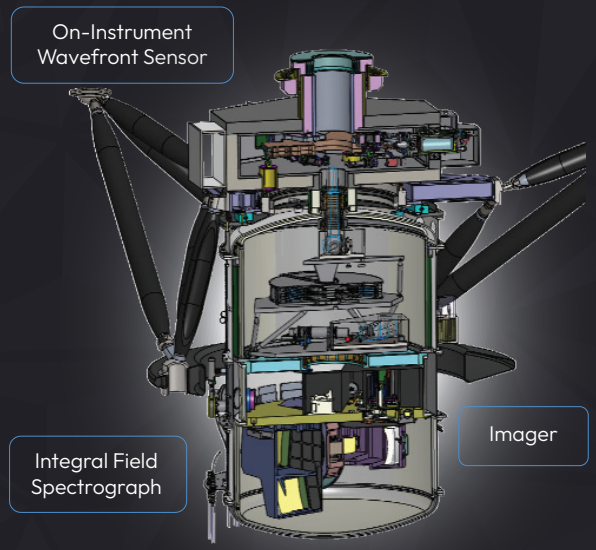
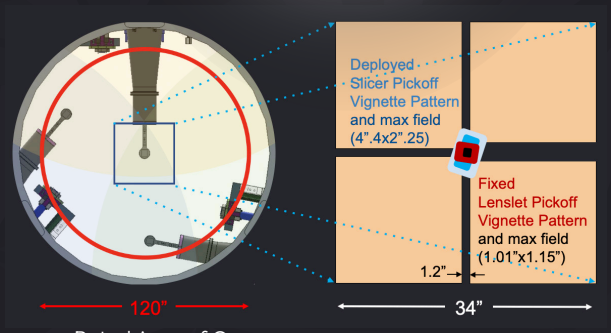
IRIS

InfraRed Imaging Spectrograph

IRIS is TMT's first-light near-infrared imager and Integral Field Spectrograph (IFS). IRIS provides diffraction-limited imaging and spectroscopy across the 0.84–2.4 μm wavelength range, with high spatial resolution and sensitivity. It makes full use of the stable, AO-corrected field delivered by NFIRAOS as it contains an imager with 4 mas pixels and a field of view >30"x30". On-axis light is fed to the IFS which has a variety of sampling and spectral resolution modes.





Patrol Area of On Instrument Wavefront Sensor

Imager and IFS pickoffs

IRIS

Design Status

Successful final designs for all major IRIS subsystems were completed in 2021 and the first of two subsystem Final Design Review was successfully completed in late 2025. IRIS was designed in close coordination with the NFIRAOS AO facility to ensure seamless integration at first light.

Keck Observatory's Liger instrument re-uses the IRIS Integral Field Spectrograph design, and is currently fabricating the grating turret and three-mirror anastigmat assemblies which helps reduce risk and cost

- Project Investigator: James Larkin
- Project Scientist: Shelley Wright
- Lead Systems Engineer: Ryuji Suzuki
- Mechanical Lead: Bob Weber
- Optical Lead: Renate Kupke
- Software Lead: Jennifer Dunn
- Project Manager: Kanaka Warad

Learn More About
TMT Instruments

Canada NRC·CNRC | Caltech | University of California | NAOJ National Astronomical Observatory of Japan

TMT
THIRTY METER TELESCOPE

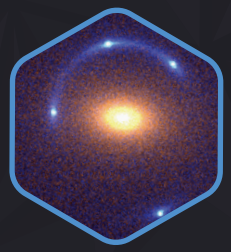
IRIS

Ground-Breaking Reach,
Space-Class Precision

Canada NRC·CNRC | University of California | Department of Science & Technology, Government of India | NINS 自然科学研究機構 | Caltech

IRIS
Science Highlights

IRIS has a very broad range of science cases that leverage the high Strehl ratios and relatively large, uniform performance delivered by NFIRAOS, and the multiple platescales and resolutions offered by its Integral Field Spectrograph (IFS).



Strong Gravitational Lenses:

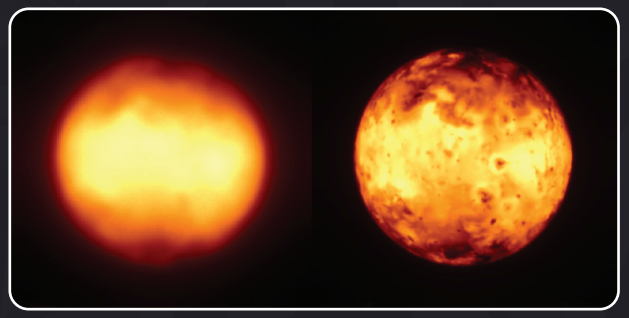
IRIS simulations of lensed QSO in a 1000s exposure. IRIS will be able to perform time-delay comosgraphy.

Credit: F.-Y. Cyr-Racine

Milky Way Black Hole:

The astrometric precision of IRIS will enable the most detailed studies yet of the Super Massive Black Holes by following the orbits of the closest stars. Orbits shown in the central 0.6"x0.6" of our galaxy.

Credit: T. Do



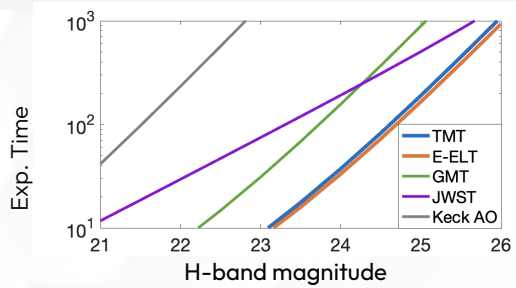
KECK AO TMT IRIS

Solar System: Simulations of Io as observed with Keck Adaptive Optics and IRIS.

Credit: T. Do

IRIS
Driving Requirements

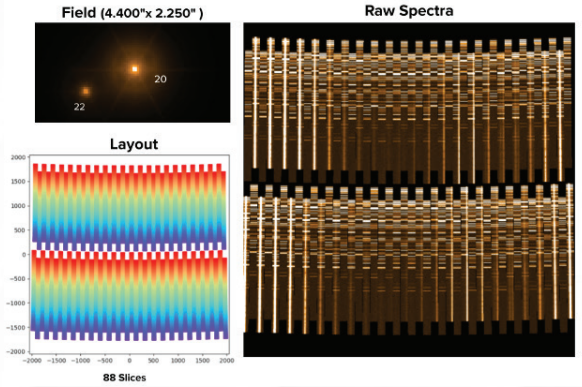
Parameter	IRIS Specifications
Wavelength Range	0.84 - 2.4 μm
Throughput (1.0-2.4 μm)	Imager :>65% Integral Field Spectrograph (IFS): >45%
Imager Sampling	4 mas/pix, Distortion of 0.28% across the FoV
Imager FoV	FoV of 34"x34"
IFS FoV	Lenslet array is 128 x 128 (0.512" x 0.512") with full performance over a 100 x 100 subset. Slicer IFU is 88 x 45 at 50 mas scale (4.4" x 2.25")
Image Quality	Diffraction-limited
Astrometric Accuracy	50 μas relative error in 100s
Filters	68 filter slots
Gratings	14 gratings in turret



Limiting magnitude for S/N-50 of TMT compared to other large and extremely large telescopes. TMT's high performance AO and throughput make TMT competitive with the larger E-ELT.

Observing Modes

Capability Mode	Spatial Sampling (mas)	Field of View (arcsec)	Spectral Resolution (λ/Δλ)
Imager	4	34 x 34	Set by filter
Slicer IFS (88x45)	50 25	4.4 x 2.25 2.2 x 1.125	4,000 10,000
Slicer IFS (44x45)	50 25	2.2 x 2.25 1.1 x 2.25	4,000 10,000
Lenslet IFS (112x128)	9 4	1.01 x 1.15 0.45 x 0.51	4,000
Lenslet IFS (16x128)	9 4	0.144 x 1.15 0.064 x 0.51	4,000 10,000



Top: Simulated Slicer Integral Field Spectrograph (IFS) data. Bottom: Simulated IFS data cube from a z~1 galaxy taken in 2 hrs. Credit UCSD OIR Lab