TMT

THIRTY METER TELESCOPE

TMT'S SCIENTIFIC VISION

EXPANDING THE BOUNDARIES OF ASTRONOMY

WWW.TMT.ORG

TMT'S ROBUST PARTNERSHIP

The TMT International Observatory (TIO) is a strong partnership among leading scientific institutions and nations from around the Pacific: **India, Japan, Canada, the University of California, and Caltech.** With a 30 meter segmented mirror, TMT will revolutionize astronomy by having a larger collecting area than the combined areas of the 10 largest telescopes today and 4.5 times the spatial resolving power of the James Webb Space Telescope. TIO is committed to advancing our understanding of the universe while respecting the cultural and natural significance of Maunakea, Hawaiʻi, its preferred site.

Caltech

NINS
National Institutes of Natural Sciences
自然科学研究機構

Canada
NRC·CNRC

Department of Science & Technology, Government of India
सत्यमेव जयते

UNIVERSITY OF CALIFORNIA

TMT ADDRESSES THE BIG QUESTIONS

Q. Are we alone in the universe?

A. TMT will search for life by studying the atmospheres of exoplanets in the habitable zone of nearby stars. By detecting water and biosignatures like oxygen and methane, TMT will bring us closer than ever to discovering whether life exists beyond Earth.

Q. How do stars and planets form?

A. TMT will observe stellar nurseries and protoplanetary disks to uncover the processes that create stars and planets. Its infrared capabilities will allow astronomers to see through the dust that surrounds these regions, revealing how solar systems form.

Q. What are dark matter and dark energy, and how do they shape the universe?

A. Dark matter and dark energy make up most of the cosmos, yet their nature remains a mystery. TMT will map dark matter through gravitational lensing and study distant galaxies and supernovae to refine our understanding of dark energy and its role in the accelerating expansion of the universe.

Q. How did the first galaxies form, and how have they changed with time?

A. TMT will peer back billions of years to observe the first galaxies that formed after the Big Bang. By studying their structure, star formation, and evolution, TMT will reveal how these ancient galaxies transformed the early universe from darkness to light.

Q. What is the relationship between supermassive black holes and their host galaxies?

A. Supermassive black holes, located at the centers of most galaxies, play a critical role in shaping galaxy evolution. TMT will study the dynamics of stars and gas around these black holes, revealing how they grow and interact with their galaxies over cosmic time.

Read the full TMT Detailed Science Case

Credit: T. Slovinský, NOIRLab

TMT'S COMMITMENT TO COMMUNITY-BASED ASTRONOMY

Maunakea is a Special Place

Maunakea is truly unique. For astronomers, it is one of the best places on earth for TMT to observe the night sky due to its clear, dry, and cold conditions combined with excellent astronomical seeing.

Maunakea is also a sacred place for many Native Hawaiians. According to legend, the sky father Wākea and earth mother Papa gave the first birth to the Island of Hawai‘i and then created the first kānaka or Hawaiian people, who were the ancestors of the Native Hawaiians. Also called Mauna a Wākea or the Mountain of Wākea, Maunakea is symbolic of Native Hawaiian ties with their akua (gods) and kūpuna (ancestors).

TMT's goal is not just about exploring new ways to see the universe. It is also about finding new ways to work respectfully and cooperatively with Hawai‘i and Native Hawaiian communities. We are committed to contributing to an open and constructive conversation that respects the Mauna's extraordinary cultural and spiritual significance.

Environmental Considerations for Maunakea

The TMT site was chosen to minimize its archaeological, cultural, and environmental impact. Located 500 feet below the summit of Maunakea and existing observatories, the observatory's footprint and height have been kept to a minimum. No waste from TMT will be left on the mountain and no water will be discharged from TMT. In addition, every employee and contractor is trained to protect the cultural and natural resources on Maunakea. TMT also supports community initiatives, including efforts to remove invasive weeds and plant native trees on Maunakea.

TMT aims to become a model for a sustainable observatory by protecting the mountain's precious resources.

Community Engagement in Hawai‘i

TMT is committed to a community model of astronomy based on the values of respect, inclusion, and mutual stewardship. That means conducting scientific research in a way that respects the local culture and tradition of Native Hawaiians who consider Maunakea sacred. It means sharing the benefits of astronomical exploration with everyone in Hawai‘i. And it means working together to build a brighter future for the next generation.

We put these values to work in partnership with the host community to co-create programs that address the unique needs and interests of Hawaiian communities. These include tutoring, workforce development, STEM curriculum development, teacher workshops, culture-based education, and environmental protection and conservation. Our initiatives are community-led, executed together, and ultimately assessed by the community.

TMT staff regularly visit local schools to provide tutoring, participate in career fairs, and deliver engaging classroom presentations.

TMT supports traditional wayfinding workshops with Polynesian navigation experts.

Hawaiian students and Penticton Indian Band students in Canada visit each other as part of the TMT-sponsored ‘Ale Lau Loa culture exchange program.

THE NEXT GENERATION TELESCOPE
DESIGNED FOR UNPARALLELED PRECISION

Location:

Among the Extremely Large Telescopes (ELTs), **TMT will be the only ELT in the Northern Hemisphere**, which enables ELTs to observe the full sky. Maunakea is the preferred location for the Thirty Meter Telescope based on its stable and dry climate, high-altitude site and clear skies. Maunakea provides optimal conditions for operating adaptive optics systems on an extremely large telescope.

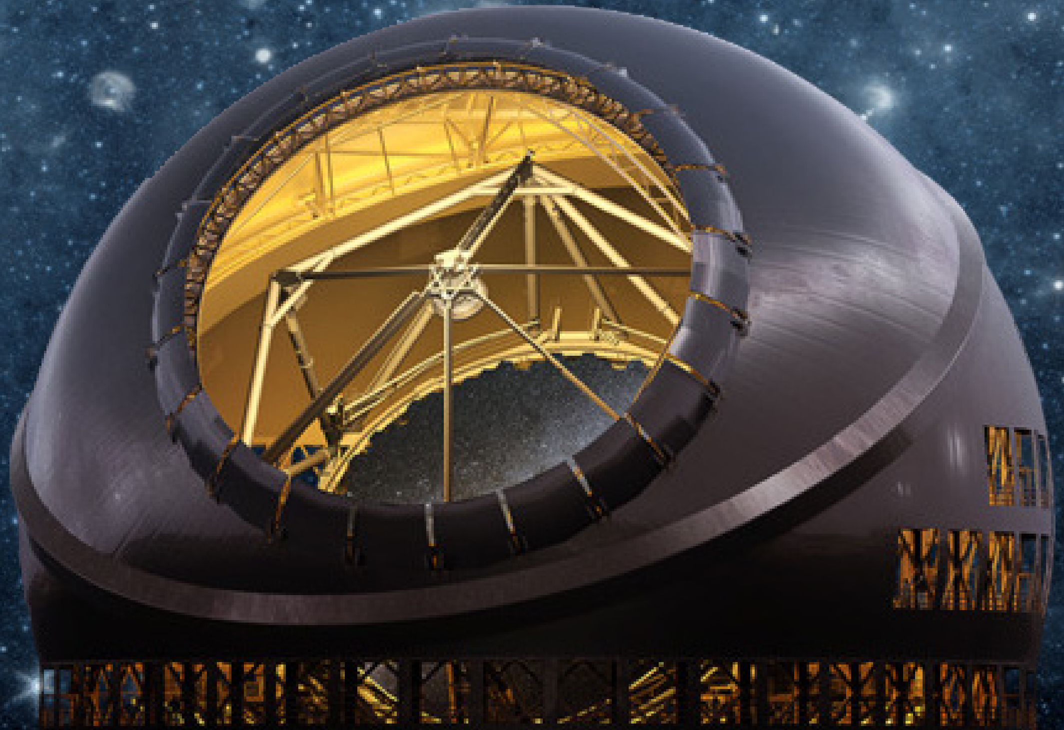
Advanced Optics:

With a 30 meter segmented mirror—three times the size of today's largest telescopes—TMT will gather an immense amount of light and observe objects at the edge of the observable universe. **TMT is based on the proven design of the Keck Observatory.** Throughout the design process, an emphasis has been placed on maximizing sensitivity, speed, and performance. Adaptive optics will deliver images 4.5 times sharper than JWST by overcoming distortions caused by Earth's atmosphere.

Dynamic Structure:

TMT's structure is designed to minimize vibration while being able to rapidly switch between targets, maximizing observing time. TMT's compact dome ensures smooth airflow, optimizing image quality.

Jerry Nelson, a pioneering astronomer known for his innovative design for advanced telescopes, conceived the revolutionary segmented mirror design of the Keck Observatory's twin 10 meter telescopes and the 30 meter TMT.



POWERFUL INSTRUMENTS TO UNLOCK COSMIC MYSTERIES

TMT's instruments are engineered for versatility and precision. Four powerful instruments will be available at TMT's first light:

NARROW FIELD INFRARED ADAPTIVE OPTICS SYSTEM (NFIRAOS):

TMT's facility multi-conjugate adaptive optics system will provide a uniform, high Strehl (50% in H-band) correction across a two arcminute field view with high sky coverage. NFIRAOS will enable the measurement of the position of faint stars with 15 microarcsecond accuracy.

INFRARED IMAGING SPECTROGRAPH (IRIS):

Fed by NFIRAOS, IRIS contains an imager with a half arcminute field of view and an integral field spectrograph. IRIS will simultaneously capture images and spectra of faint targets. IRIS will observe stars, galaxies, and planetary systems, and is capable of resolving the motion of stars around black holes in the center of nearby galaxies.

MULTI-OBJECTIVE DIFFRACTION-LIMITED HIGH-RESOLUTION INFRARED SPECTROGRAPH (MODHIS):

MODHIS will deliver high resolution spectra and precision radial velocities in the near infrared aided by the adaptive optics correction of NFIRAOS. With its high sensitivity and precision, MODHIS will explore exoplanetary atmospheres and stellar dynamics, seeking life signatures like oxygen and methane around distant worlds.

WIDE FIELD OPTICAL SPECTROMETER (WFOS):

WFOS will capture images and spectra across a large field of view, from ultraviolet to near-infrared wavelengths. WFOS's ability to obtain spectra for up to 96 targets simultaneously makes it ideal for studying everything from objects in our solar system to distant galaxies. With its powerful multi-object spectroscopy, WFOS will allow astronomers to survey large regions of the sky efficiently, providing insights into galaxy formation, evolution, and the nature of dark matter.

Instrument	Wavelength Range (µm)	Resolving Power	Field of View
First generation instruments			
NFIRAOS	0.8–2.4	10 mas @ J-band	Laser Guide Star Multi-Conjugate AO 120"
IRIS	0.8–2.4	4,000–10,000	Imager: 34"x 34" @ 0.004" / pix IFU: 0.512"x 0.512" @ 0.004" /spaxel 2.25"x 4.4" @ 0.050" / spaxel
MODHIS	0.98–2.46	100,000 with 30 cm/s precision	Single object 6"x 6" imaging guider
WFOS	0.31–1.0	1,500–5,000	96 configurable slits over 8.3'x 3' Imaging over full field
Second generation instruments			
MICHI	3.4–13.8	IFS: 600–1000 Spectrometer: 120,000	Imager: 28.1"x 28.1" @0.011" pixel IFU: 9.175"x 0.07" @0.035"/spaxel
IRMOS	0.8–2.5	2,000–10,000	Multiple IFU in a 5' diameter field
HROS	0.31–1.0	25,000–100,000	Single Object Multi-Object 10' diameter
PSI	0.6–5.3	50–100,000	Contrast of 10^8

Learn more about TMT Instruments

SEARCHING FOR LIFE ON DISTANT WORLDS

Are we alone in the universe? TMT will help us find out. Astronomers have discovered thousands of exoplanets, but the next frontier is identifying planets that could harbor life. TMT's extraordinary precision and ability to directly image planets orbiting distant stars will allow scientists to explore these alien worlds in novel ways. TMT will study the atmospheres of planets in the habitable zone, the region around a star where conditions might be right for liquid water—and possibly life.

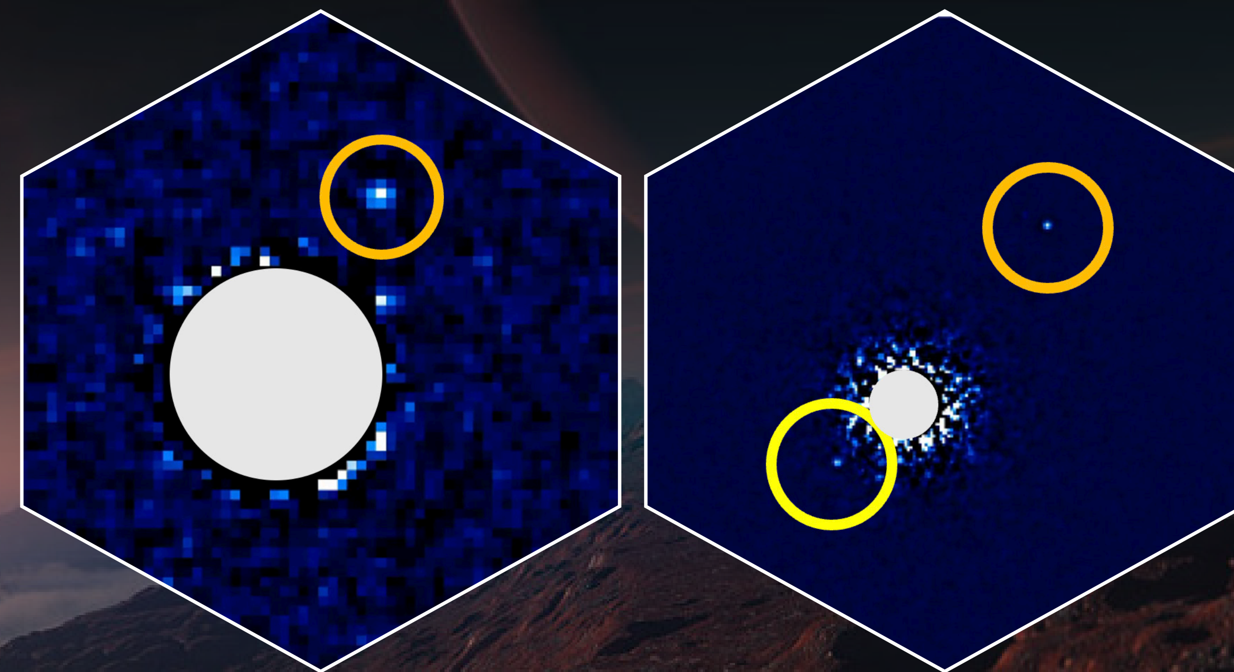
TMT will search for the signatures of life, such as oxygen or methane in planetary atmospheres. Imagine the excitement of discovering a true Earth analog—another planet with conditions similar to our own!

WHY TMT?

Direct Imaging and Spectroscopy:
Instruments like **PSI** and **MODHIS** will allow TMT to image exoplanets and analyze their atmospheres in unprecedented detail.

High Contrast Observations:
TMT's large mirror diameter, clean aperture, and excellent adaptive optics will enable the study of faint planets in close orbits around nearby stars.

Synergies:
TMT will complement **JWST** and **Transiting Exoplanet Survey Satellite (TESS)** discoveries by following up on exoplanet candidates and providing detailed characterizations. TMT will also feed candidates to the **Habitable Worlds Observatory (HWO)** to capitalize on the power of this future space telescope.



Gemini GPI | TMT IRIS

Comparison of images expected from Gemini Observatory (left) and TMT (right) of the 51 Eri planetary system with a hypothetical additional inner planet that could be detected with TMT due to its increased sensitivity and higher angular resolution. Credit: J. Wang

Credit: IAU, L. Calçada

UNVEILING THE BIRTH OF STARS AND PLANETS

How do stars and planets come into being? TMT will transform our understanding of these fundamental processes. By observing stellar nurseries—regions where new stars are born—TMT will uncover the conditions that lead to star formation. It will also study the disks of gas and dust surrounding young stars, where planets take shape.

TMT's ability to observe in the infrared will allow it to peer through the dust that obscures these regions, revealing the birthplaces of stars and planets in unprecedented detail.

WHY TMT?

Protoplanetary Disks:

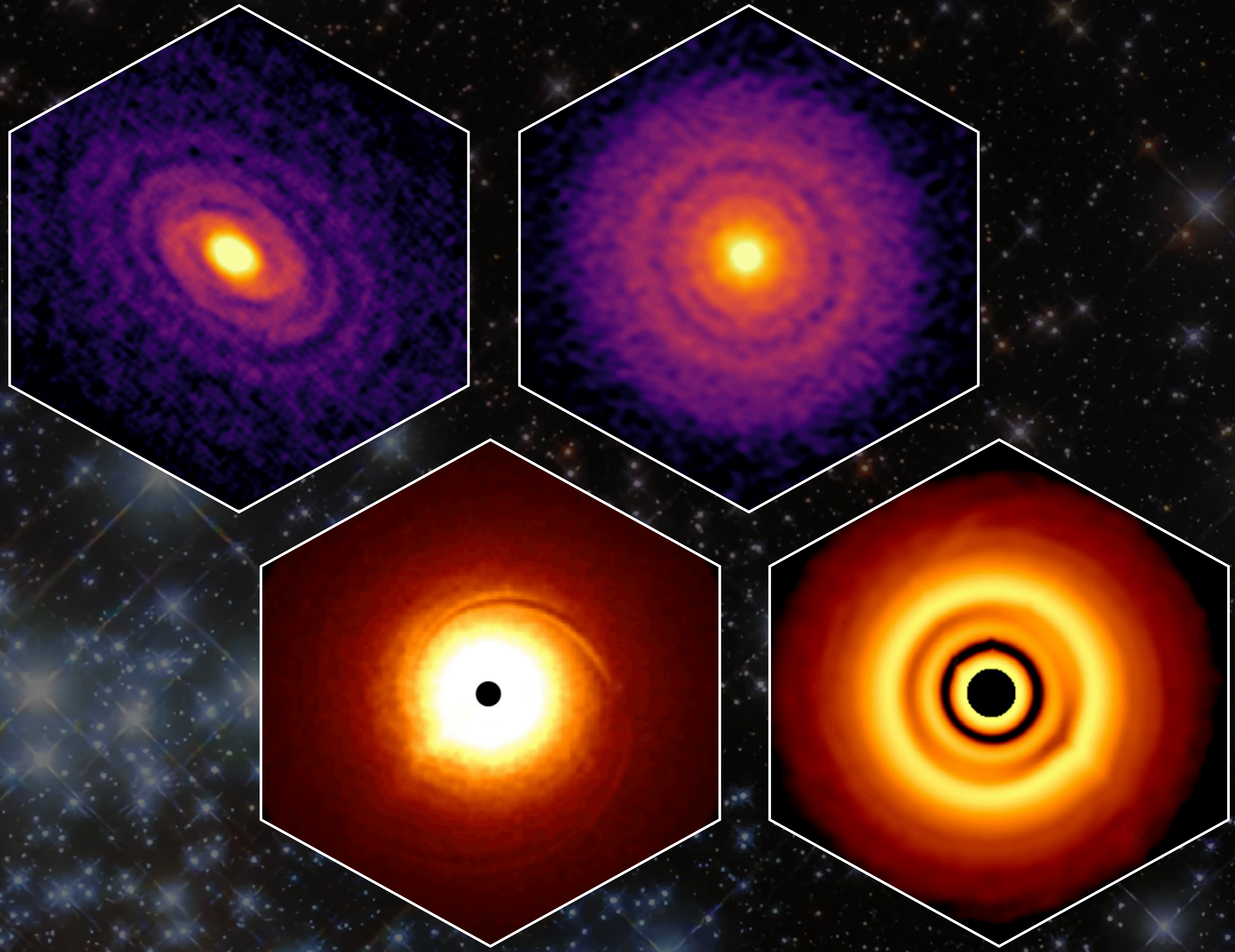
Instruments like the **PSI** and **MODHIS** will study the disks where planets form, helping us understand the conditions for planet formation.

Mid Infrared Observations:

MICHI will peer through the dust of star-forming regions, revealing the early stages of stellar and planetary life. Maunakea is one of the driest astronomical sites in the world which enables the deepest ground-based midinfrared observations.

Synergies:

TMT will complement **ALMA** and **JWST**, providing higher resolution images of the birthplaces of stars and planets.



Top: Rings, cavities, spirals, and azimuthal asymmetries are commonly identified in ALMA surveys of cold dusty protoplanetary disks. Credit: ALMA (ESO/NAOJ/NRAO), S.Andrews et al.; N. Lira. Bottom: Simulated near infrared imaging of the nascent solar system at a distance of 140 pc as would be observed by TMT, showing spiral arms excited by Neptune (left) and gaps opened by Saturn and Jupiter in the inner region (right). TMT's superb angular resolution will enable the detection and characterization of nearby forming planetary systems. Credit: Sallum et al.

Credit: ESA, Hubble & NASA

CAPTURING THE UNIVERSE IN MOTION AND TIME

The universe is full of dynamic events: stars explode in supernovae, black holes tear stars apart, and neutron stars collide to create gravitational waves. These fleeting, high-energy events are unpredictable, but TMT's agility will allow follow up in mere minutes. Imagine catching the earliest moments of a supernova or observing the cosmic fireworks of two neutron stars merging. Astronomers will use TMT to provide critical details about the physics and evolution of these explosive events.

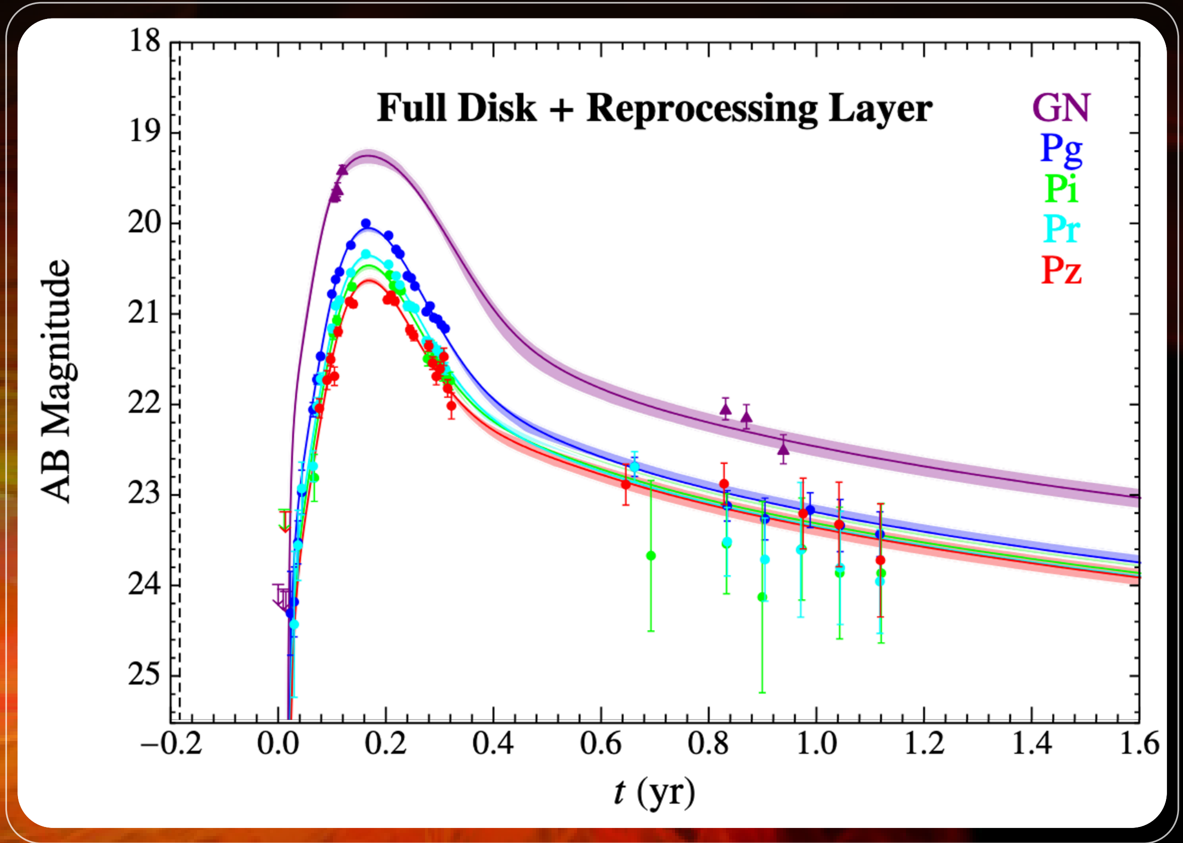
With its rapid adaptability and ability to observe in multiple wavelengths, TMT will provide the high-resolution data needed to understand the universe's most extreme and transient phenomena.

WHY TMT?

Rapid Response:
TMT's **adaptive queue system** will allow it to react quickly to transient events like supernovae or gamma-ray bursts. The compact telescope design allows TMT to switch targets and instruments in under 10 minutes.

Wide Wavelength Coverage and Sensitivity:
Instruments like **WFOS, IRIS, and MICHI** will leverage the TMT collecting area to capture these events from the ultraviolet to the midinfrared.

Synergies:
TMT will respond to alerts from the **Rubin Observatory** and the **Laser Interferometer Gravitational-wave Observatory (LIGO)**, and will provide high spatial and spectral resolution follow-up observations of these dynamic events.



Observed and modeled light curves taken in different filters of a star being tidally disrupted by a supermassive black hole (Guillochon et al. 2014). Only two tidal disruption events have captured the rise, peak, and decay of the flare. The increased sensitivity of TMT will enable it to capture many more such events in the future.

Credit: NASA, AEI, ZIB, M. Koppitz and L. Rezzolla

INVESTIGATING THE UNIVERSE'S DEEPEST MYSTERIES

What is the universe made of? Dark matter and dark energy make up most of the cosmos, yet we still don't know what they are. TMT will be a powerful tool in the hunt for dark matter by mapping its influence on galaxies and cosmic structures. Using gravitational lensing, TMT will reveal hidden dark matter structures that we've never seen before, helping to unlock the nature of this invisible component of the universe. TMT will also shed light on dark energy—the mysterious force driving the universe's accelerated expansion. By studying distant supernovae and galaxy clusters, TMT will help refine our understanding of cosmic expansion.

TMT will probe extreme environments like neutron stars—the remnants of massive stars that have collapsed under their own gravity. These objects are natural laboratories for testing the limits of physics. TMT's ability to measure neutron star masses with high accuracy will help reveal how matter behaves under extreme conditions that can't be replicated on Earth.

WHY TMT?

High Sensitivity:

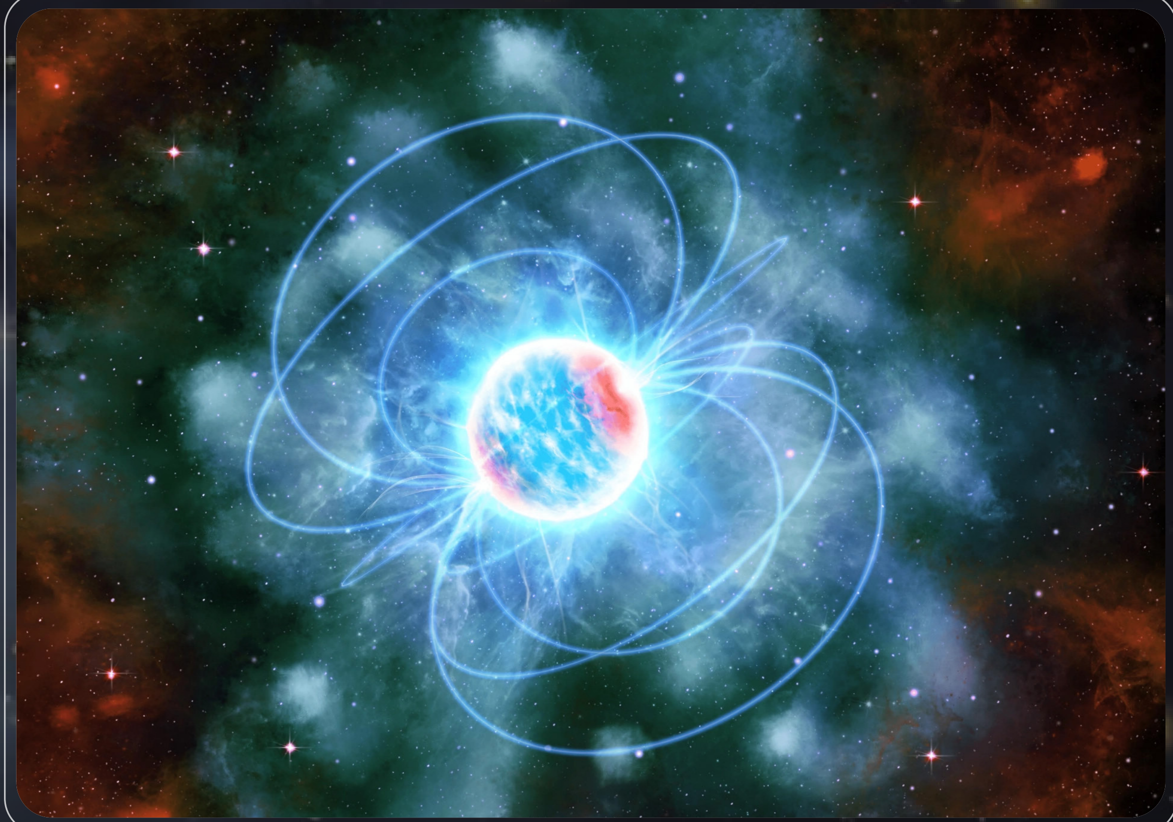
TMT's huge mirror will collect light from faint, distant galaxies, helping to trace the distribution of dark matter.

Sharpest Images:

IRIS behind **NFIRAOS** will produce incredibly detailed images, enabling us to observe structures that have been invisible until now.

Synergies:

TMT will complement **NASA's Roman Space Telescope** and the **Rubin Observatory**, which will map dark matter on cosmic scales, by providing high spatial and spectral resolution follow-up observations.



An artist's impression of a neutron star. Blue lines indicate the magnetic field lines, looping between the sphere's two poles. TMT will be able to measure the masses of neutron stars with unparalleled accuracy which will shed light on the extreme condensed matter physics of these amazing objects. Credit: ICE-CSIC, D. Futselaar, Marino et al.

Credit: NASA, JPL-Caltech, ESA, IIAA-CSIC, UPV, EHU, JHU

HUNTING FOR THE UNIVERSE'S FIRST LIGHT

How did the first galaxies form, and what were the early days of the universe like? TMT will look back in time to when the universe was only a few hundred million years old. By studying the first galaxies to emerge from the cosmic dark ages, TMT will reveal how the universe transitioned from darkness to light.

These ancient galaxies hold clues about the birth of stars, the formation of black holes, and the evolution of the universe's large-scale structure. TMT will be an extremely sensitive tool for observing these distant, faint objects that will give astronomers their best view yet of the early universe.

WHY TMT?

Sharpest Images:

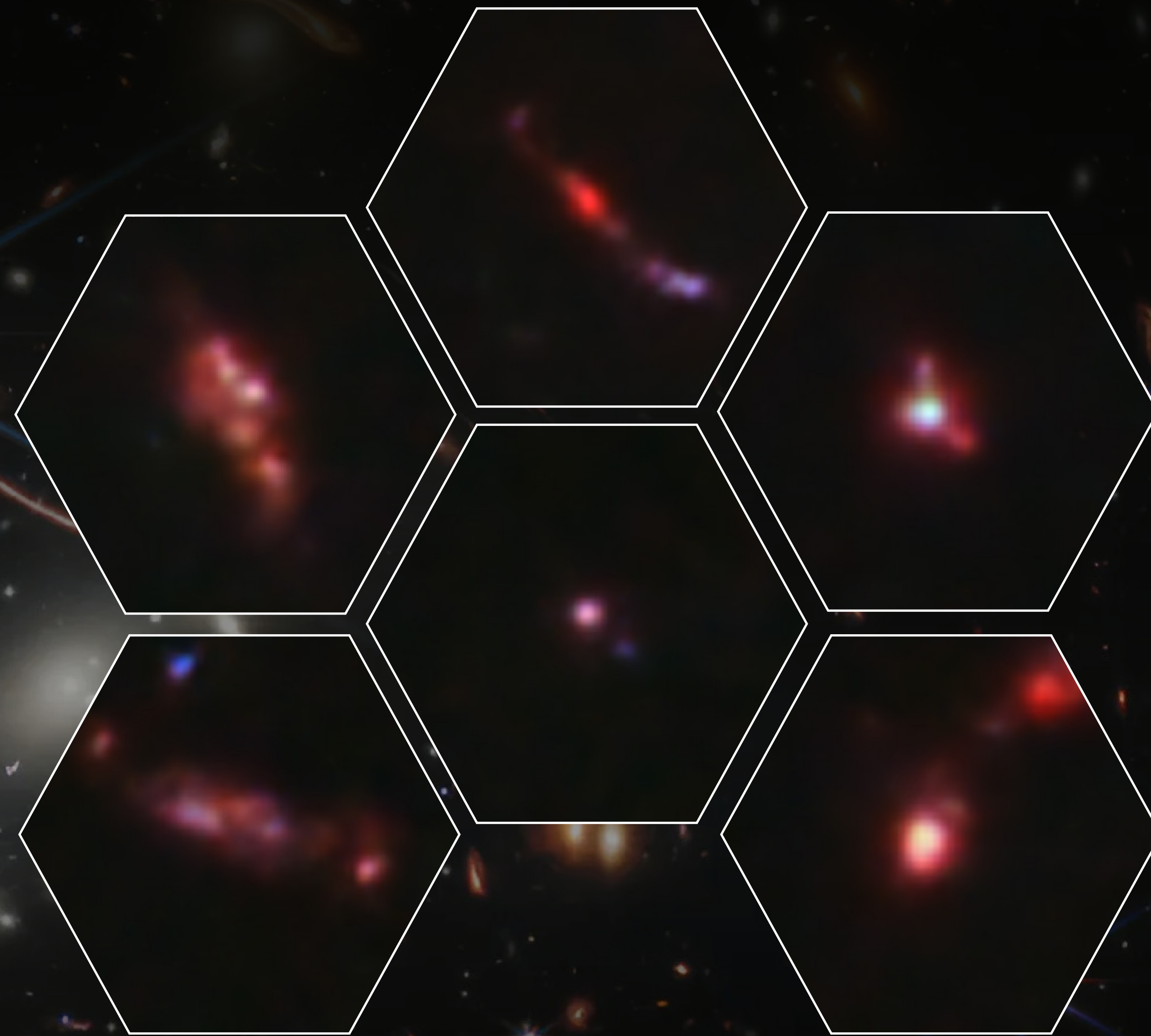
IRIS and **IRMOS** will allow TMT to study the structure and composition of the earliest galaxies with clarity.

Deep Observations:

TMT's powerful light-collecting ability and the light concentrating power of adaptive optics will enable it to study galaxies at extremely early epochs beyond the reach of current ground-based telescopes.

Synergies:

TMT will follow up on discoveries made by **JWST**, confirming and characterizing the most distant galaxies. These first galaxies are very compact which complements a TMT strength; TMT is more sensitive in the near infrared than JWST for compact objects because the relative background from TMT will be small over the limited area subtended by these sources.



JWST has returned extraordinarily detailed images and spectra of galaxies that existed when the universe was only 900 million years old. Galaxies in the early universe are very compact, so TMT's spatial resolution, 4.5 times better than JWST, is required to study them in more detail. Credit: NASA, ESA, CSA, S. Lilly, D. Kashino, J. Matthee, C. Eilers, R. Simcoe, R. Bordoloi, R. Mackenzie, A. Pagan

Credit: NASA, ESA, CSA, STScI

DECODING GALAXY FORMATION

Galaxies are the building blocks of the universe, but how do they grow and evolve? TMT will provide the detailed observations needed to understand the life cycles of galaxies. By studying how gas flows into galaxies and how stars form, TMT will uncover the processes that shape galaxies over billions of years.

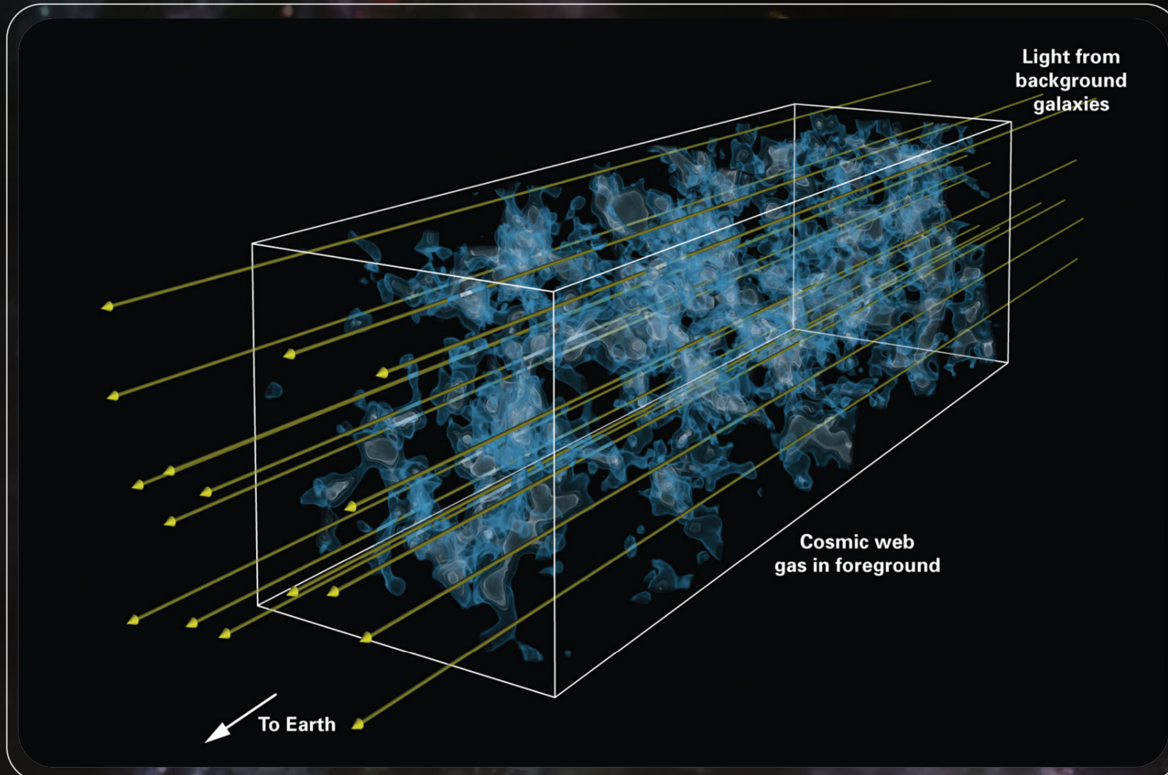
TMT will also investigate how galaxies merge and interact, revealing the role of dark matter and gravity in galaxy formation. With its advanced instruments, TMT will trace the evolution of galaxies from their infancy to the mature systems we see today.

WHY TMT?

Spectroscopy of Gas Flows:
TMT's **WFOS** and **HROS** will analyze the gas around galaxies, revealing how galaxies interact with their environment.

Detailed Observations of Galaxy Mergers:
TMT's sharp imaging with **NFIRAOS** and **IRIS's** integral field unit will untangle the complex interactions between merging galaxies.

Synergies:
TMT will complement observations of the Inter Galactic Medium made by the next generation radio synthesis telescopes. **TMT** will take spectra of numerous Lyman Break Galaxies across many sightlines that can be used to reconstruct a map of the primordial gas.



An artist's conception of mapping the Inter Galactic Medium with light from background galaxies going through the diffuse gas before making it to Earth. WFOS has the sensitivity and field of view to simultaneously observe spectra along multiple sightlines in order to reconstruct an accurate 3D map of the Inter Galactic Medium. Credit: C. Stark and K.G. Lee

Credit: NASA, ESA, CSA, STScI

EXPOSING THE SECRETS OF SUPERMASSIVE BLACK HOLES

Supermassive black holes are found at the heart of most galaxies, including our own Milky Way. These objects are millions to billions of times the mass of the Sun and play a crucial role in galaxy evolution. TMT will probe the environments around black holes, measuring their masses and observing how they grow by accreting material.

By studying the relationships between black holes and their host galaxies, TMT will help answer fundamental questions about the role black holes play in shaping the cosmos. Astronomers will also use these observations around black holes to test General Relativity. Imagine observing the chaotic regions where matter spirals into a black hole or witnessing a star being torn apart by one of these cosmic giants.

WHY TMT?

Extreme Resolution:

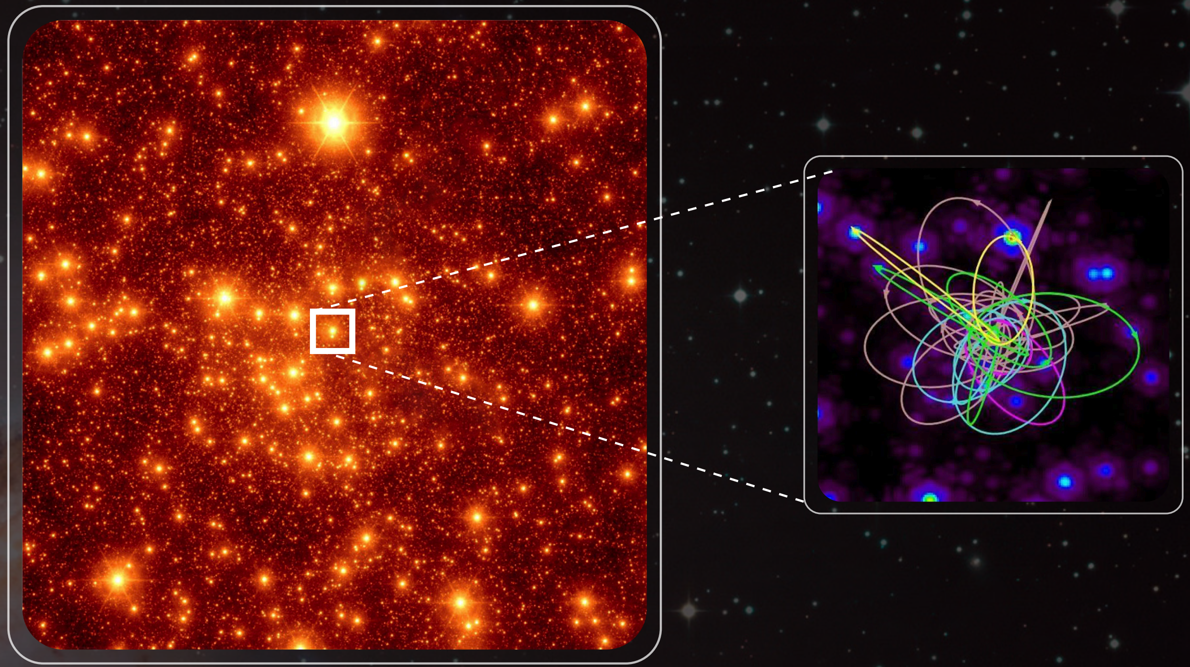
TMT's **NFIRAOS** will enable precise measurements of stellar orbits around black holes, allowing us to test Einstein's theory of relativity.

Black Hole Growth:

MODHIS and **IRIS** will study the accretion of material into black holes, shedding light on their growth over cosmic time.

Synergies:

TMT will complement the discoveries of the Event Horizon Telescope by providing detailed imaging and spectroscopy of black hole environments.



Simulated TMT IRIS image of the central 17''x17'' of the Galaxy, centered on the supermassive black hole, Sgr A*. The image contains 200,000 stars. Right: In the central half arcsecond, TMT IRIS will increase the number of measurable short period orbits by an order of magnitude and find systems that orbit the super massive black hole with orbital periods that are a factor of five times smaller than now known. Credit: UCLA Galactic Center Group

Credit: ESO,WFI (Optical); MPIfR,ESO,APEX,A.Weiss et al. (Submm); NASA,CXC,CfA,R.Kraft et al. (X-ray)

TRACING THE LIFE STORY OF THE MILKY WAY AND NEARBY GALAXIES

TMT will open a new chapter in our understanding of the Milky Way and its neighbors. By studying individual stars in unprecedented detail, TMT will allow astronomers to reconstruct the history of our galaxy. How did the Milky Way form and evolve? How do its stars move and interact with dark matter?

TMT's ability to resolve stars in nearby galaxies will provide new insights into their formation and evolution, revealing the connections between stars, gas, and dark matter. The majority of our neighboring galaxies are only visible from the Northern Hemisphere.

WHY TMT?

High Resolution Spectroscopy:

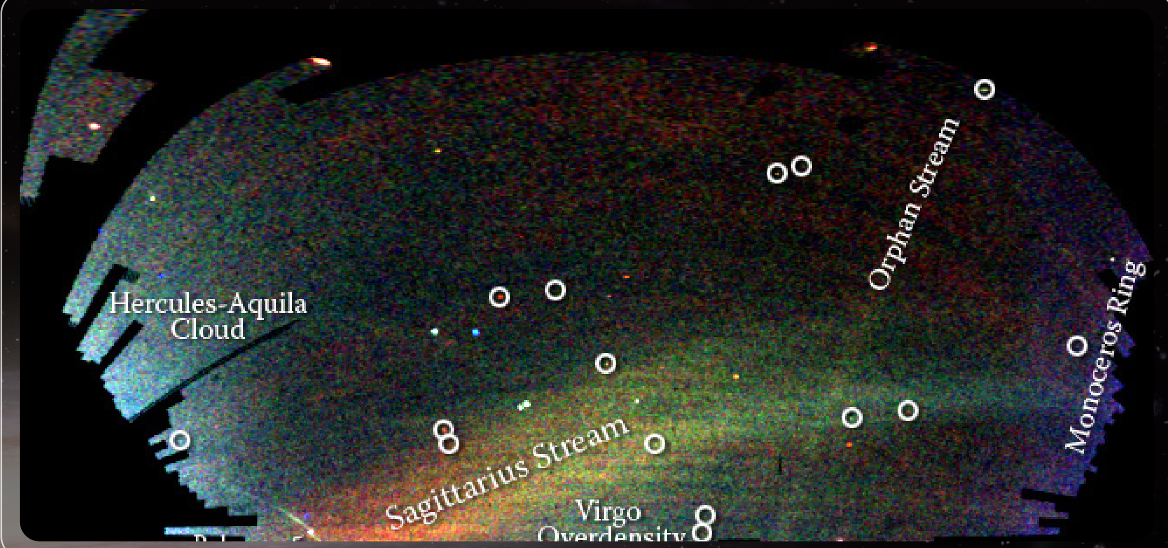
HROS and **MODHIS** will precisely measure the motions and chemical compositions of stars, revealing the history of star formation and galaxy growth.

Mapping Dark Matter:

The microarcsecond precision astrometry (~15 µas noise floor) enabled by **NFIRAOS** will allow **IRIS** to create 3D maps of stellar motions that will help trace dark matter's influence in our galaxy and its neighbors.

Synergies:

TMT's astrometric precision is on par with **Gaia, the ESA space telescope that currently provides state of the art astrometry measurements for brighter stars**, but TMT will accurately measure locations of much fainter stars, extending the Gaia science case to neighboring galaxies.



A map of stars in the outer regions of the Milky Way showing stellar streams that provide insights into the formation history of our galaxy. The color indicates the distance of the stars, while the intensity indicates the stellar density. TMT will be able to study the motions and properties of the stars in these streams to help us better understand how our galaxy was formed. Credit: V. Belokurov, SDSS

Credit: J. Josephides; S5 Collaboration

EXPLORING THE SOLAR SYSTEM

TMT will revolutionize our understanding of the solar system by studying planets, moons, asteroids, and comets in greater detail than ever before. From tracking the storms on Jupiter to investigating the icy moons of Saturn, TMT will uncover new secrets about the bodies closest to home.

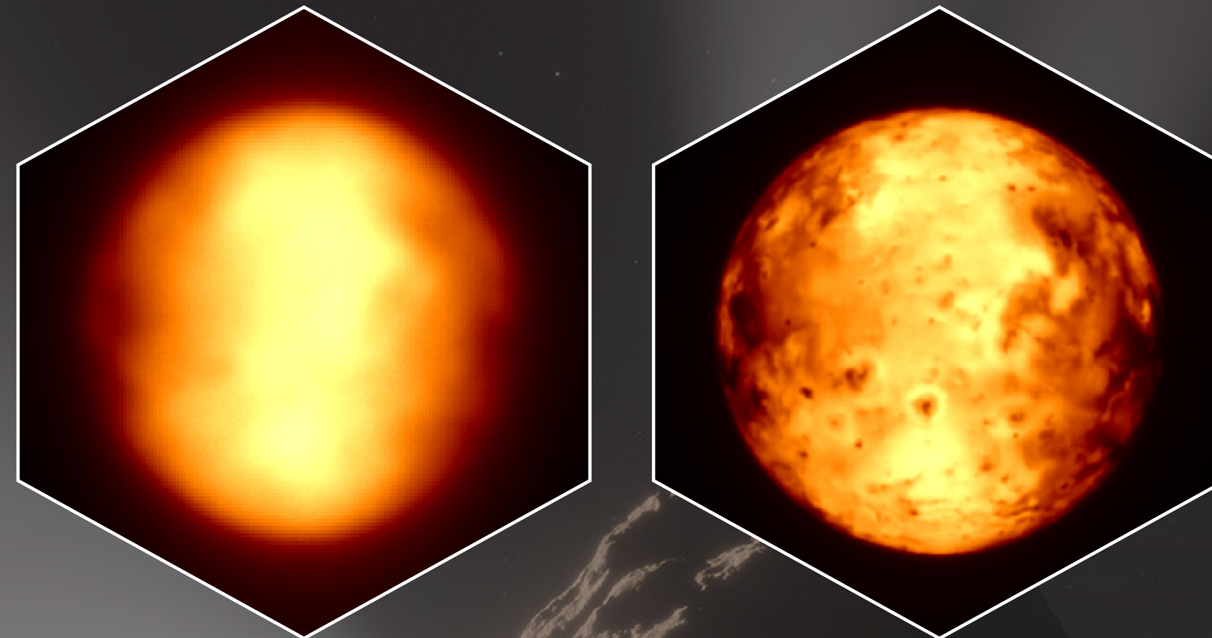
TMT's powerful imaging capabilities will also allow astronomers to study distant objects in the Kuiper Belt and beyond, providing insights into the solar system's formation and evolution.

WHY TMT?

High-Resolution Imaging:
TMT's adaptive optics system **NFIRAOS** will enable **IRIS** to capture stunning details of planets and moons, revealing their atmospheres and surface features.

Kuiper Belt Objects:
TMT's sensitive spectrographs will investigate the composition of distant solar system bodies, providing clues about the early solar system.

Synergies:
TMT will complement missions like **Juno** and **Europa Clipper**, augmenting observations of solar system bodies from Earth.



Keck AO H-band

TMT IRIS H-band

The Sulfur-covered surface of Jupiter's satellite, Io. These simulated images show a comparison between adaptive optics observations of Io surface in reflected near-infrared light (H band) made with the 10 m Keck telescope (left) and the TMT (right). Circular features are regions of ejecta fallback from active volcanoes. Credit: T. Do

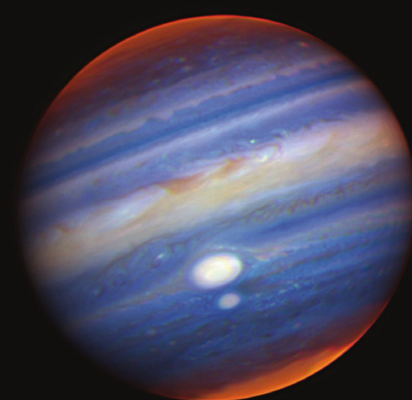


Image of Jupiter taken in the near infrared using adaptive optics at Gemini observatory. TMT adaptive optics images will be more than 3 times sharper. Credit: Gemini Observatory/NOIRLab

Credit: NASA, ESA, CSA, L. Hustak

SYNERGIES WITH GROUND OBSERVATORIES

Working in tandem with other major observatories, TMT will maximize our view of the cosmos.

EXTREMELY LARGE TELESCOPES (ELT):

As part of the US Extremely Large Telescope Program, and alongside the European ELT, TMT will enable full-sky coverage for ELTs. TMT, taking advantage of its excellent site, high performance adaptive optics system NFIRAOS, and efficient telescope and instrument designs will be scientifically competitive with E-ELT.

TODAY'S LARGEST TELESCOPES:

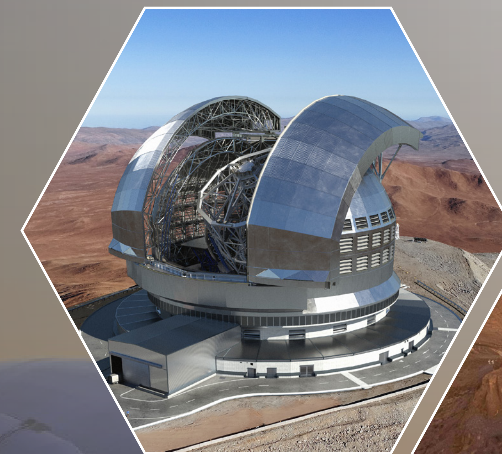
TMT will extend the reach of the current largest class of optical telescopes, including the Vera C. Rubin Observatory, W.M. Keck Observatory, Gemini Observatory, and the Subaru Telescope. TMT is designed to be able to rapidly switch instruments to follow up discoveries from these telescopes in fine detail. The sensitivity of ELTs is essential to spectroscopically follow up 10 m class telescope discoveries in the Northern Hemisphere.

ATACAMA LARGE MILLIMETER ARRAY (ALMA):

TMT will complement ALMA's submillimeter observations of cold, dusty regions where stars and planets form with optical and infrared views to help complete the picture of these stellar nurseries and protoplanetary disks.

NEXT GENERATION RADIO OBSERVATORIES (SKA AND ngVLA):

These radio observatories will map gas clouds, magnetic fields, and cosmic structures at resolutions as sharp as 30 mas. TMT's high-resolution optical and infrared spectrographs will complement these observations at similar spatial scales and inform our view of galaxy evolution, black holes, and star formation.



SYNERGIES WITH SPACE OBSERVATORIES

JAMES WEBB SPACE TELESCOPE (JWST):

JWST is a game changer that is making new discoveries in the infrared. TMT will be able to follow up these discoveries across the optical and infrared. TMT's spatial resolution is 4.5 times greater and its collecting area is almost 20 times greater.

NANCY GRACE ROMAN SPACE TELESCOPE:

The Roman Space Telescope will conduct wide-field infrared surveys to uncover vast populations of galaxies, exoplanets, and dark matter structures. TMT will build on Roman's discoveries by providing high-resolution follow-up observations, focusing on individual objects in exquisite detail.

HABITABLE WORLDS OBSERVATORY (HWO):

TMT will provide a catalog of the most promising extrasolar planet observations that HWO will draw upon in its search for habitable planets.

THE FUTURE OF DISCOVERY

With TMT's unmatched power and advanced instruments, we are on the brink of a new era in astronomy. TMT will push the boundaries of knowledge, exploring questions that have intrigued humanity for centuries. Together with other observatories — in space and on the ground — TMT promises to expand our view of the universe, unlocking secrets that will redefine our place in the cosmos.

Credit: NASA, ESA, CSA, M. McCaughrean, S. Pearson

TMT

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