

TMT: Tackling Our Deepest Questions

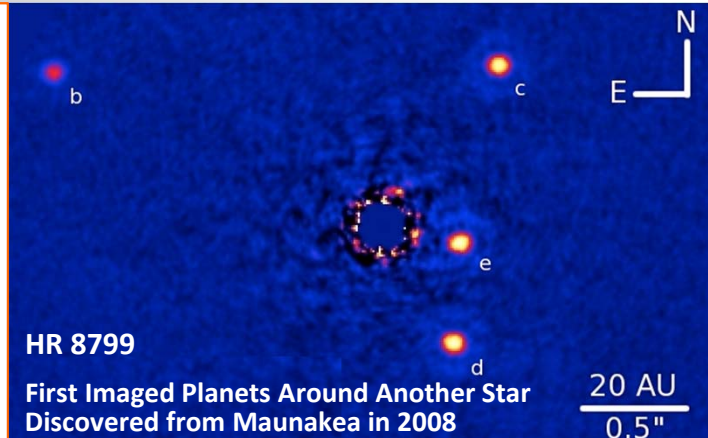


Astronomy addresses fundamental human questions. How did the universe begin? What do other worlds look like? Could they support life? With TMT, we can start to answer these questions.

Extrasolar Planets: Exploring Other Worlds

Eight years ago, Maunakea gave us the first images of planets orbiting another star (right picture; four planets). Although the planets are 750 trillion miles away from us, we can identify molecules like water and carbon monoxide (CO) in some of their atmospheres and study their clouds (picture below; a planet's "spectrum").

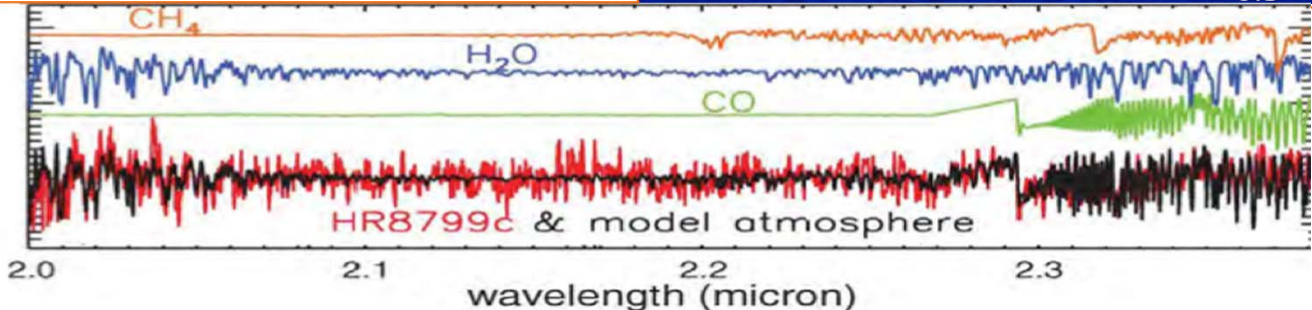
TMT will discover many more planets, show us how these planets' atmospheres compare to those of planets in our solar system, and provide clues about how these planets formed.



HR 8799

First Imaged Planets Around Another Star
Discovered from Maunakea in 2008

20 AU
0.5"



Could other planets support life?



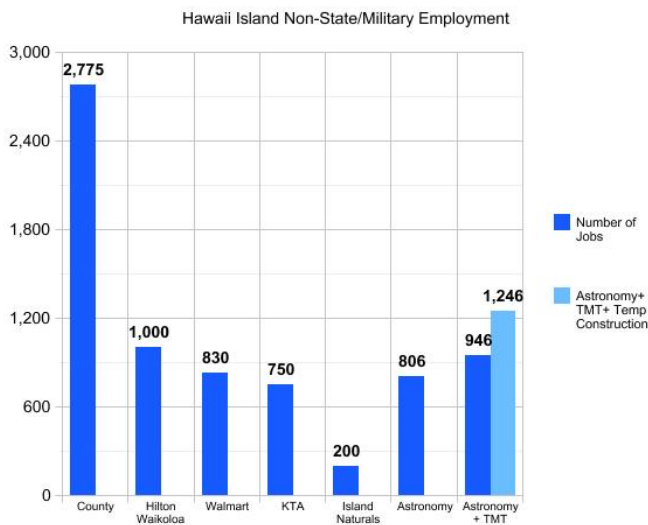
Maunakea has exceptionally calm air. With the further assistance of a technology called "adaptive optics" and dedicated planet-imaging instruments, TMT on Maunakea can give us images 3 times sharper than Keck and 12 times sharper than NASA's Hubble Space Telescope, allowing us to see planets over ten million times fainter than the stars they orbit.

TMT may allow us to see rocky planets in the "habitable zone" around the Sun's nearest neighbors for the first time ever. With a second-generation planet imager and spectrograph, it might allow us to detect oxygen in an Earth-like planet's atmosphere: a potential sign of life.

Learn more: <http://www.maunakeaandtmt.org/get-the-facts/tmt-supporting-science/the-science-behind-the-thirty-meter-telescope/>

TMT: Jobs and Education for Hawai'i

Collectively, astronomy is one of the largest providers of jobs for Hawaii's residents and a source of unique educational opportunities. TMT will provide even more local job opportunities, while nurturing a local technical workforce pipeline and helping our children achieve their educational dreams.



Astronomy on Hawai'i now employs roughly as many residents as does Walmart and KTA. Astronomy contributes nearly 170 million dollars per year to Hawai'i's economy. TMT will add:



- 140 Permanent jobs at the observatory
- 300 Multi-year construction jobs
- 26 Million dollars/year in observatory operations



TMT has already donated over \$5.5 million to the THINK fund, benefitting 26,000 students and 1,000 teachers through STEM education programs.

TMT has provided \$2.5 million in support of the Akamai Workforce Initiative, which has provided internships to 390 college students from Hawai'i in STEM fields thus far.

Learn more: <http://www.maunakeandtmt.org/get-the-facts/tmt-supporting-education/> . <https://dlnr.hawaii.gov/mk/files/2017/09/882-BLNR-FOFCOLDO.pdf>

Also see website of PUEO and ImuaTMT, independent Hawaiian groups supporting TMT for the science, jobs, and educational opportunities it provides for Hawai'i -- alohapueo.org, imuatmt.org

TMT: Environmentally Responsible

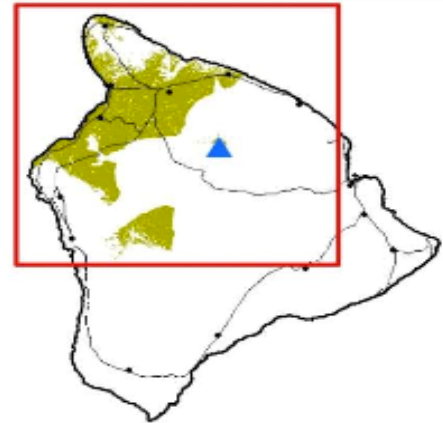
TMT is not much larger than existing observatories on Maunakea, will minimally impact existing views of Maunakea, and will honor strict rules ensuring that it poses no credible threat to our water supply.



TMT 183 feet
Gemini 152 feet
Subaru 141 feet

visibility of the TMT Observatory

Visibility	Area of Island (%)	Hawaii's Population	
		%	People
Visible	14%	15.4%	23,000
Not Visible	86%	84.6%	125,000



TMT is only somewhat taller than Subaru and Gemini and comparable in area to the Keck Observatory. It will be visible to only ~14% of Hawai'i: it cannot be seen from Hilo, Pahoa, Kona, Volcano, etc. It will be built over 600 ft below the summit, not on any cinder cones. It will not harm endangered plants or animals. Of TMT's ~1 million dollars/year in rent, \$800,000/year goes towards stewardship of Maunakea.

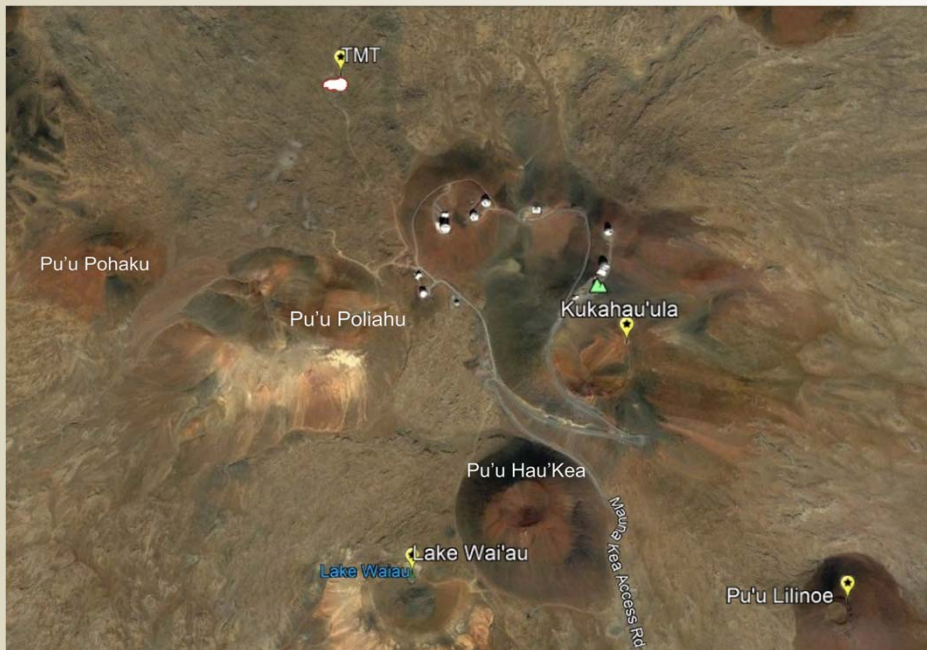


TMT's plans are consistent with Hawai'i's value of clean water. TMT will not use mercury; TMT will not be nuclear powered. TMT's site is exceptionally dry compared to lower elevations. As verified by Hawai'i's Board of Land and Natural Resources decision approving TMT's permit, it poses no credible threat to the aquifer. The strongest contaminants of our water come from local sources like cesspools. In contrast, any waste from TMT will be removed from Maunakea using trucks with double-hulled containers so that it can be safely treated in plants.

Learn more: <http://www.maunakeaandtmt.org/get-the-facts/tmt-supporting-environment/>
<https://dlnr.hawaii.gov/mk/files/2017/09/882-BLNR-FOFCOLDO.pdf>

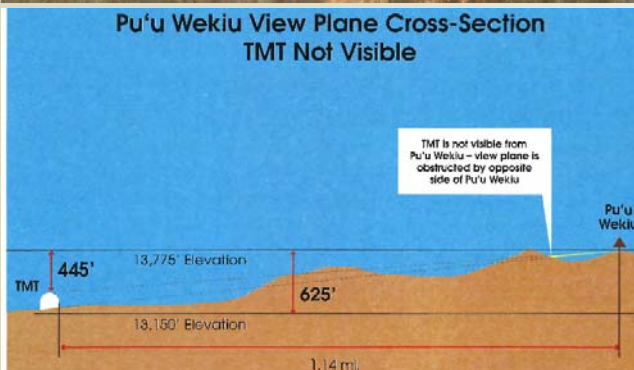
TMT: Science and Culture Coexisting

TMT was carefully designed to be minimally impactful to cultural resources on Maunakea and not interfere with long-standing religious practices.



*TMT will be located **far** from cultural practice areas on Maunakea: Pu'u Poli'ahu (0.78mi), Lake Wai'au (1.42mi), Pu'u Weikiu (1.16mi), Pu'u Lilinoe (2.02mi), etc.*

TMT will not be visible from culturally sensitive sites the summit of Kukahau'ula, Pu'u Lilinoe, and Lake Wai'au.



As TMT cannot be seen the summit of Pu'u Weikiu, it cannot interfere with long-standing solstice and equinox observations from this site.

TMT cannot interfere with the viewplane to Haleakala or the setting of the sun at Pu'u Poli'ahu.

- No known traditional/customary practices are associated with the TMT site.
- There are no shrines or burials on the TMT site.

Prior to European contact, Hawaiians did utilize Maunakea at elevations similar to TMT for mining: i.e. the adze quarries, which cover an area nearly 100 times the size of TMT, where Hawaiians mined rock to make stone tools.

TMT consulted with numerous cultural practitioners for its Environmental Impact Statement. Aspects of the telescope and mitigation measures reflect this consultation.

Learn more: <http://www.maunakeaandtmt.org/get-the-facts/tmt-supporting-culture/> <https://dlnr.hawaii.gov/mk/files/2017/09/882-BLNR-FOFCOLDO.pdf>