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OUT THERE

Will the United States Lose the Universe?

For more than a century, American astronomers have held bragging rights as observers of the cosmos. But that dominance may soon slip away.

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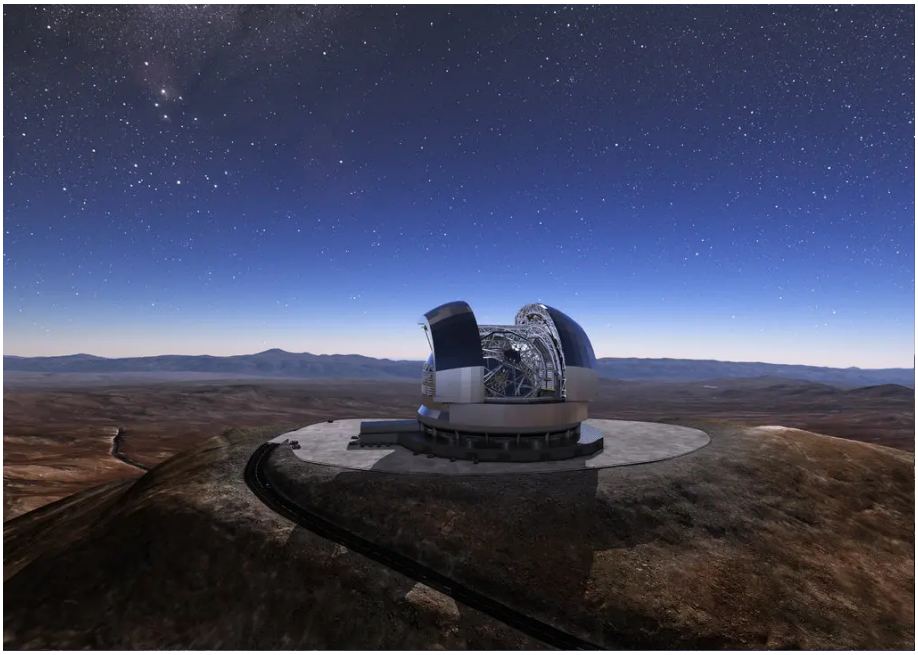
The United States is about to lose the universe.

It wouldn't be quite the same as, say, losing China to communism in the 1940s. No hostile ideologies or forces are involved. But much is at stake: American intellectual, technical and economic might, cultural pedigree and the cosmic bragging rights that have been our nation's for the last century.

In 1917, the 100-inch Hooker telescope went into operation on Mount Wilson in California, and Edwin Hubble eventually used it to discover that the universe is expanding. Until very recently, the mightiest telescopes on Earth have been on American mountaintops like Palomar, Kitt Peak and Mauna Kea. They revealed the Big Bang, black holes and quasars.

But no more. In 2025 the European Southern Observatory, a multinational treaty organization akin to CERN but looking outward instead of inward, will invite the first light into a telescope that will dwarf all others. The European Extremely Large Telescope on Cerro Paranal in Chile will have a primary light-gathering mirror 39 meters in diameter, making it 13 times more powerful than any telescope now working and more sharp-eyed than the iconic Hubble Space Telescope.

The European goliath will be able to see the glow of planets orbiting other stars and peer into the black hearts of faraway galaxies. Who knows what else it might bring into view.



An artist's rendering of the European Extremely Large Telescope, in Chile, which will go into operation in 2025. ESO/L. Calçada

There are two American-led telescope projects that could compete with the European giant, if they are ever built: the Thirty Meter Telescope, slated for construction on Mauna Kea, in Hawaii, and the Giant Magellan on Cerro Las Campanas, in Chile. But both are mired in financial difficulties and political controversies, and their completion, if it happens, is at least a decade away.

Work on the Thirty Meter Telescope, or T.M.T., has been stalled for years by a protest movement arguing that decades of telescope building on

Mauna Kea have polluted and desecrated a mountain that is sacred to Polynesian culture, and have violated the rights of native Hawaiians. The team behind the project has vowed to move it to the Canary Islands if it can't go forward in Hawaii.

Learn More About the James Webb Space Telescope

After traveling nearly one million miles, the James Webb Space Telescope arrived at its destination. It will spend years observing the cosmos.

- **In Orbit:** Now that the telescope has reached its final destination, it will allow scientists on Earth to study ancient galaxies and more.
- **Humanity's Achievement:** "We all share the quest," our science reporter writes of the observatory's mission and its significance.
- **The Journey's Beginning:** When the Webb lifted off, it was the culmination of decades of stalled development. Revisit the excitement of the launch.
- **A Controversial Name:** The telescope is named after a NASA official accused of homophobia. Some astronomers campaigned to rename it.

Both projects are hundreds of millions of dollars short of the financing they need to build their telescopes. Without them, American astronomers, accustomed to V.I.P. seating in observations of the universe, could be largely consigned to the cosmic bleachers in years to come. Early next year, probably in late February, representatives of the two telescope projects will appear before a blue-ribbon panel of the National Academy of Sciences to plead for help.

The panel is part of the so-called Decadal Survey, in which the astronomy community ranks its priorities for spending federal money. Congress and agencies like the National Science Foundation traditionally take their cues from the survey's recommendations. A high ranking could shake loose money from the National Science Foundation, which has traditionally funded ground-based observatories.

Without the National Academy's endorsement, the telescopes face an uphill struggle to reach completion. Even with an endorsement, the way will be tough. The Trump Administration appears to be trying to eliminate the National Science Foundation's funding for large facilities such as observatories. So much for successes like the Laser Interferometer Gravitational-Wave Observatory, which detected colliding black holes. Luckily for now, Congress has resisted these cuts.

The telescopes are not cheap. They will need at least a billion more dollars between them to get to the finish line, maybe more. So far, the team behind the Giant Magellan Telescope has raised about $600 million from its partners and seeks an equivalent amount from the National Science Foundation.

Telescopes at the summit of Mauna Kea in Hawaii. Gov. Ige says he and other state employees have received death threats amid the heated debate over building a giant telescope on the state's highest peak. Caleb Jones/Associated Press

The T.M.T. collaboration, now officially known as the T.M.T. International Observatory — T.I.O., in case you haven't read enough acronyms — has publicly put the cost of its telescope at $1.4 billion, but recent analyses by knowledgeable outsiders come up with a price tag of more than $2

billion.

In return for that investment, all American astronomers, not just collaboration members, will gain access to both giant telescopes to pursue certain important projects.

Granted, even without these mammoth glass eyes, American astronomers will still have instruments in space, like the beloved Hubble Space Telescope and its successor, the James Webb Space Telescope. But Hubble is growing old, and the Webb telescope, with a snake-bitten history of development, will spend a tense several months unfolding itself in space once it reaches orbit in 2021.

Astronomers will also have the Large Synoptic Survey Telescope, already under construction in Chile, which will in effect make movies of the entire universe every few nights. But that telescope is only 8 meters in size and will not see as deep into space as the Really Big Eyes. And, of course, U.S. astronomers will be able to sign on to projects as partners of their European colleagues, much like American physicists now troop to CERN, in Geneva.

The need for giant, ground-based telescopes was apparent to American astronomers 20 years ago. The Thirty Meter project originated at the California Institute of Technology and the University of California, and has grown to include Canada, Japan, China and India. The Giant Magellan started at the Carnegie Observatories and now includes several universities and research institutes, as well as South Korea, Australia and the State of São Paulo, in Brazil.

The two projects have been fighting for partners and funds ever since. Two telescopes, one in the North and the other in the South, would complement each other, so the story has gone. Until now, neither telescope has been able to enlist the federal government as a partner.

Last year the two groups agreed to make joint cause to Academy panel and the astronomical community.

As Matt Mountain, president of the Association of Universities for Research in Astronomy said then, “Both projects finally woke up to the fact they are being creamed by the European 39-meter.”

But the Thirty Meter team has yet to make peace with the protesters, in Hawaii, for whom the telescope represents a long history of colonial disrespect of native rights and culture.

Protesters continue their opposition vigil against the construction of the Thirty Meter Telescope at Mauna Kea on the Big Island of Hawaii on July 19, 2019 Bruce Asato/Honolulu Star-Advertiser, via Associated Press

Last July, construction workers arrived at Mauna Kea to start building the telescope, only to find that nine protesters had handcuffed themselves to a cattle guard, blocking the road up the mountain.

The ensuing standoff captured the imagination of people sympathetic to the plight of Indigenous people, including Dwayne “The Rock” Johnson and Representative Tulsi Gabbard, Democrat of Hawaii (who is also running for president), and generated unease within the collaboration. In July, Vivek Goel, vice president for research at the University of Toronto, one of the Canadian partners in the Thirty Meter project, issued a statement that the university “does not condone the use of police force in furthering its research objectives.”

The Thirty Meter team recently secured a building permit for their alternative telescope site, on La Palma, in Spain’s Canary Islands. But that mountain is only half as high as Mauna Kea, leaving more atmosphere and water vapor between the astronomers and the stars. Some of the

T.M.T. partners, like Canada and Japan, are less than enthusiastic about the possible switch. An environmental organization, Ben Magec, has vowed to fight the telescope, saying the area is rife with archaeological artifacts. Moreover, moving the telescope off American soil, would only complicate the politics of obtaining funding from the National Science Foundation.

Back in 2003, when these giant-telescope efforts were starting, Richard Ellis, an astronomer now at University College London, said, “We are really going to have a hard time building even one of these.” He didn’t know just how true that was.

Now, as the wheels of the academic and government bureaucracy begin to turn, many American astronomers worry that they are following in the footsteps of their physicist colleagues. In 1993, Congress canceled the Superconducting Super Collider, and the United States ceded the exploration of inner space to Europe and CERN, which built the Large Hadron Collider, about 17 miles around, where the long-sought Higgs boson was eventually discovered.

The United States no longer builds particle accelerators. There could come a day, soon, when Americans no longer build giant telescopes. That would be a crushing disappointment to a handful of curious humans stuck on Earth, thirsting for cosmic grandeur. In outer space, nobody can hear you cry.