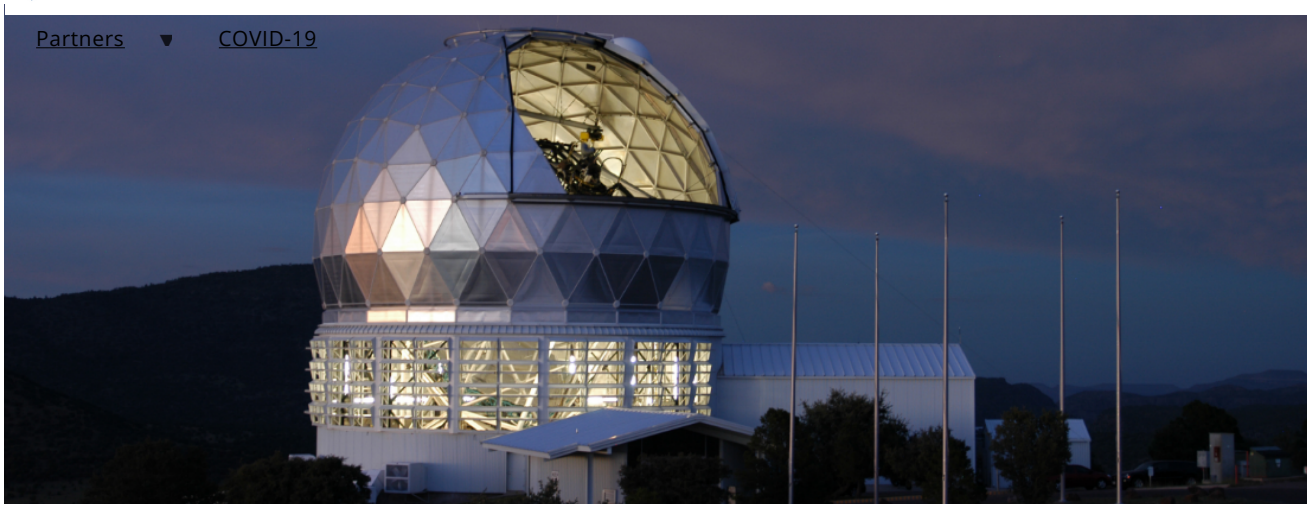

News

The Hobby-Eberly Telescope reaches 25th anniversary milestone

Penn State astronomers continue innovative research into the nature of the cosmos on the giant telescope, dedicated in 1997

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One of the world's largest optical telescopes, the Hobby-Eberly telescope (HET) at the University of Texas at Austin's McDonald Observatory, is marking 25 years of investigating the mysteries of the cosmos. The HET's unique and innovative design was developed by Penn State professors Lawrence W. Ramsey , who has served as the HET's project scientist and as the chairman of its board of directors, and Daniel W. Weedman in the early 1980s.

The telescope is named for Robert E. Eberly , a Penn State alumnus and benefactor, for whom Penn State's Eberly College of Science is also named, and former Texas Lieutenant-Governor William P. Hobby.

"This year marks an important milestone for the Hobby-Eberly telescope," said Taft Armandroff , the Frank and Susan Bash Endowed Chair at UT Austin, Director of McDonald Observatory, and HET board chair. "The HET provides the resources that our faculty and researchers from many different institutions use to do cutting-edge science."

First dedicated in 1997, the HET is currently a collaboration of four institutions: the University of Texas at Austin, Penn State, the University of Munich, and the University of Goettingen. The telescope, which has an 11-meter (433-inch) primary mirror, received a major upgrade in 2016, expanding its field-of-view to capture a section of the night sky 120-times larger than before. This capability and new instruments were celebrated in a re-dedication event in 2017.

"In addition to its enormous light-gathering power, the HET's scheduling system allows it to rapidly respond to unusual, transient events in the heavens," said Ramsey, emeritus professor of astronomy and astrophysics and Eberly College of Science Distinguished Senior Scholar. "This combination allows HET to address a wide range of scientific questions, ranging from exoplanets to the large-scale structure of the universe. In the HET's first quarter-century, over 450 peer-reviewed papers relied on HET data."

Reflections on 25 Years of Science that push the limits of investigation

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Constructing a map of the cosmos

The Hobby-Eberly Telescope Dark Energy Experiment (HETDEX) is an international collaboration that is probing dark energy, the mysterious force that is accelerating the expansion of the universe, to build an extensive three-dimensional map of the universe when it was but a fraction of its current age. By training the HET on two regions of the sky, one near the Big Dipper and one near Orion, the telescope is capturing the cosmic fingerprint of the light from 2.5 million galaxies. Astronomers are using the Visible Integral-field Replicable Unit Spectrograph, which can simultaneously obtain over 30,000 spectra in a 20-minute exposure, to address a number of fundamental questions, in particular why the expansion of the universe is speeding up over time.

“The HETDEX program involves not only the four university partners but dozens of additional scientists at several institutions from around the world,” said Donald Schneider , distinguished professor in the Department of Astronomy and Astrophysics at Penn State and a HET board member.

Searching for Goldilocks planets

HET has played an integral role in finding Earth-sized planets beyond our solar system. The Habitable Zone Planet Finder (HPF), developed by a team of scientists led by Penn State Professor of Astronomy and Astrophysics Suvrath Mahdevan, aims to identify so-called “Goldilocks planets,” exoplanets capable of supporting liquid water on their surfaces. One discovery involved K2-25b, a planet the size of Neptune orbiting a cool star. Using high-time resolution HPF spectroscopy of the system when the planet passed between Earth and the star, astronomers were able to determine the angle between the star’s equator and the orbit of the planet, which offers insights into the formation and evolution of planetary systems.

“A lot of the public thinks science has these eureka moments, but most major scientific discoveries are met with ‘hmm, that’s funny,’” said Bill Cochran, research professor at UT Austin and chair of the HET Users Committee. “Whether or not a planet is habitable is not the right question. I am interested in how the planet evolved, and I want to use the findings with the HPF to pursue these questions with my colleagues in different disciplines.”

Searching for monsters

More than 220 million light-years away in the constellation Perseus, HET discovered the largest black hole ever detected, which has a mass 17-billion times that of our sun (and several thousand times larger than the black hole in the center of our galaxy). This finding was made by the HET Massive Galaxy Survey, whose goal is to reveal how black holes and galaxies form and evolve.

Solving a supernova mystery

Numerous telescopes observed the supernova of 2014C, but the observations from each source did not present a coherent picture. The mystery was solved when HET researchers measured variations in the dying star’s brightness and spectrum. The HET team developed a model that revealed the star did not explode outward in a spherical direction; during the event, material from 2014C, which is part of a binary star system, merged with its neighbor, sharing the gaseous envelope in an expanding disc. As one star exploded, it collided with and slid along the gaseous boundary layer, producing the unusual results obtained around the world for this unique supernova event.

“These few examples provide a sample of the work being accomplished as researchers make use of the HET’s large collecting area, wide field of view, and queue scheduling, laying the groundwork for discoveries yet to be made,” said Armandroff.

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