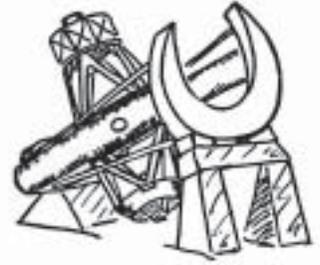


The Big Eye



The Newsletter of the Friends of Palomar Observatory Vol. 1, No. 1

Welcome to *The Big Eye*!

Welcome to the Premiere Issue of *The Big Eye*! In this and future issues you will find articles on the current research of the Observatory, its history, new educational exhibits, and exclusive events for the Friends of Palomar Observatory. We hope that you will find *The Big Eye* to be an informative source on everything related to the Palomar Observatory.



Now and Then

Fifty-six years ago legendary astronomer Edwin Hubble ascended to the Hale Telescope's prime focus cage and began a new era in astronomy. On January 26, 1949 he took the first official photos with the then new 200-inch telescope. In a nod to his own astronomical past, he photographed an object that now bears his name Hubble's Variable Nebula.

Hubble had first studied this object at the Yerkes Observatory, where he determined that this cloud of gas appears to change its shape. In 1919 he photographed the nebula on his first night of observing at Mt. Wilson's 100-inch Hooker Telescope. Hubble went on to use the 100-inch to discover that galaxies were large, distant conglomerations of stars and gas, separate from our own Milky Way galaxy, and that the universe itself was expanding.

Palomar's Hale Telescope was large enough that Hubble could ride inside the telescope in what is known as the prime focus cage. From that lofty vantage point he and the astronomers who followed him took photographs on glass plates. During the long exposures astronomers had to carefully control the motion of the telescope to ensure that it didn't wander even slightly off target. It was vital for them to give their full attention to this for many hours. The long dark and cold of Palomar nights required them to be made of stern stuff.

By comparison, the modern astronomers at Palomar have it easy. Observing at the 200-inch takes place in a heated room where they have ready access to computers, a stereo, hot coffee, and even a bathroom! Improvements in tech-



Edwin Hubble's 1949 photograph from the Hale Telescope of Hubble's Variable Nebula .

Continued on Page 3

Artificial Stars at Palomar

In a planetarium, artificial stars are projected onto a domed ceiling to give the audience the illusion of being out under the night sky. Astronomers at Palomar recently made an artificial star of their own in the real sky.

To make this artificial star, a laser was broadcast into the sky. This was the first step in creating a laser-guide star for use with a technique known as adaptive optics. Adaptive optics allows astronomers to correct for the fuzzy images produced by Earth's moving atmosphere, giving them a view that often surpasses that of smaller space-based telescopes.

The Palomar Observatory currently employs the world's fastest astronomical adaptive-optics system on its 200-inch Hale Telescope. The system is able to correct for changes in the atmosphere 2,000 times per second. Astronomers from Caltech, JPL, and Cornell University have exploited this system to discover brown dwarf companions to stars, to study the weather on a moon of Saturn, and to see the shapes of asteroids.

Currently, astronomers at Palomar can use the adaptive-optics technique only if a moderately bright star is sufficiently close to their object of interest. The adaptive-optics system needs a star to monitor and correct for the distortions produced by Earth's atmosphere. Natural stars of sufficient brightness are rare enough that the technique can be used for only 1 percent of the sky.

Employing the laser will allow astronomers to place an artificial corrective guide-star wherever they see fit. To do so, they shine a narrow sodium laser beam up through the atmosphere. At an altitude of about 60 miles, the laser beam interacts with a small amount of naturally occurring sodium gas, making it glow. The reflected light from the glowing gas serves as the artificial guide-star for the adaptive-optics system. The laser beam is too faint to be seen except by observers very close to the telescope, and the guide-star it creates is even fainter. It can't be seen with the unaided eye, yet it is bright enough to allow astronomers to make their adaptive-optics corrections. It uses the same sodium wavelength that we recommend for city street lights to minimize glare and maintain dark astronomy-friendly skies.

The new program will place Palomar in elite company as only the third observatory worldwide to deploy a laser-guide system. This laser will greatly expand the science performed at Palomar and pave the way for future projects on telescopes that have not yet been built.



"This is a terrific technical achievement, which not only opens up a bold and exciting scientific future for the venerable 200-inch telescope, but also demonstrates the next step on a path toward future large telescopes such as the Thirty Meter Telescope," says Richard Ellis, Steele Family Professor of Astronomy and director of the Caltech Optical Observatories. "The next generation of large telescopes requires sodium laser guide-star adaptive-optics of the type being demonstrated at Palomar Observatory," he adds.

The Palomar adaptive-optics instrument was built and continues to be supported by the Jet Propulsion Laboratory as part of a Caltech—JPL collaboration.

Support for the adaptive-optics research at Caltech's Palomar Observatory comes from the Gordon and Betty Moore Foundation, the Oschin Family Foundation, and the National Science Foundation Center for Adaptive Optics.

Donations and Docents Boost Outreach

As 2004 drew to a close and 2005 began, two events took place that will have a positive effect on public outreach at the Palomar Observatory. The first was the donation of some small telescopes that will be used for public outreach. The second was the first meeting and training session for the Observatory's first-ever crop of volunteers.

Roy Callahan donated a beautiful 15-inch Obsession Dobsonian telescope that will likely be used during some evening events for the Friends. Along with the telescope came a wealth of eyepieces and related equipment that make viewing through this telescope a delight.

In his memory, the family of Winfried Beykirch donated some items that are useful for daytime astronomy. These items will give weekend visitors to Palomar a revealing look at our nearest star, the Sun. A unique device called a SolarScope nicely shows off the disk of the Sun with its sunspots, and the Personal Solar Telescope reveals solar prominences – large clouds of gas above the Sun's surface. Both instruments safely show the Sun as most people have never seen it.

The details of both donations were worked out by the good folks at Oceanside Photo & Telescope. We would particularly like to thank Craig Weatherwax and John Downs for their help in making the donations possible.

Helping the members of the public use these solar instruments are Palomar's first-ever crop of volunteer docents. Most of them have been receiving training since January on the history and operations of the Observatory. Visitors can soon expect to see the docents on weekends, when they will also lead walking tours to the 200-inch telescope. They are a great group of people who are giving up their free time to be here helping the members of the general public to learn more about Palomar.



Seen at right are John Downs, Roy Callahan (shaking hands), Craig Weatherwax, and Scott Kardel. Seen just behind the handshake is the donated 15-inch telescope.

Now and Then, continued from page 1

ology have made photographic plates obsolete. All modern astronomical imaging is done with digital cameras that are 50 times more sensitive to light than the chemical processes of photography with film.

New technologies allow the astronomers who use Palomar's 60-inch and 48-inch Samuel Oschin telescopes to completely skip coming to Palomar. The telescopes are now fully robotic. This allows astronomers to get a full night's sleep while the telescope automatically collects their data; and can also rapidly switch to a newly discovered source of interest. The information is beamed off the mountain via microwave to Caltech and other institutions. The technique has worked well, allowing astronomers to use these telescopes to study gamma-ray bursts and to do some prospecting as they hunt for near-earth asteroids, objects in the outer solar system, and quasars on the farthest shores of the universe.

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Friends of Palomar Observatory Annual Membership Application

G Student/Senior Citizen Member \$30 **G** Individual Member \$45 **G** Family Membership \$75

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Check Visa Mastercard (circle one)

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For questions call (760) 742-2111, e-mail friendsofpalomar@astro.caltech.edu, or visit
www.friendsofpalomarobservatory.org