The Big Eye

The Newsletter of the Friends of Palomar Observatory     Vol. 3, No. 1

Biggest Exoplanet Yet

An international team of astronomers has discovered the largest-radius and lowest-density exoplanet of all those whose mass and radius are known. It is a gas-giant planet about twice the size of Jupiter, and is likely to have a curved comet-like tail. It has been named TrES-4, to indicate that it is the fourth planet detected by the Trans-atlantic Exoplanet Survey (TrES) network of telescopes, which includes a telescope on Palomar Mountain.

TrES-4 is in the constellation Hercules and is the 19th transiting planet discovered so far. It orbits the star catalogued as GSC02620-00648, which is about 440 parsecs (1,435 light-years) away from Earth.

A transiting planet is one that passes directly in front of its host star as seen from Earth. When a transiting planet passes between its star and Earth, the planet blocks some of the light from the star in a manner similar to that caused by the moon's passing between the sun and Earth during a solar eclipse. In the case of TrES-4, this reduces the starlight by one percent, a tiny, yet detectable, effect.

TrES-4 is noteworthy for having a radius 1.67 times that of Jupiter, yet a mass only 0.84 times Jupiter's, resulting in an extremely low density of 0.222 g cm⁻³. In comparison, Jupiter has a density of 1.3 g cm⁻³. The density of TrES-4 is so low that the planet would float on water.

The transiting planet also causes the star to undergo a small orbital motion, but measuring this effect (from which we can tell the mass of the planet) requires much larger telescopes, such as the Keck 10-meter telescope in Hawaii, as was used in the case of TrES-4. Measuring the mass of TrES-4 is a difficult task, but it is likely to have a mass of at least 0.84 times that of Jupiter.

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Journey to Palomar at Temecula Film Festival

At this year’s Temecula Valley International Film & Music Festival, the California Institute of Technology will sponsor and host the premier screenings of a soon-to-be-released PBS television documentary on the epic 20th century story of the birth of American astronomy and the building of the famed Palomar 200-inch telescope.

The film, entitled The Journey to Palomar, is the result of more than five years’ work by Los Angeles filmmakers Todd and Robin Mason. The film traces the story of Chicago-born astronomer George Ellery Hale, considered the father of astrophysics, as he struggles personally and professionally to build the greatest telescopes of the 20th century at the Yerkes and Mount Wilson Observatories, and finally the 20-year effort to build the million-pound telescope on Palomar Mountain — considered the “moon shot” of the 1930s and ’40s. Hale’s observatories revolutionized our understanding of the universe, making headlines throughout the 20th century with revelations such as Edwin Hubble’s 1929 discovery of the expansion of the universe.

The documentary includes rare archival footage and interviews with America’s top scientists and historians. The filmmakers anticipate a PBS release some time in 2008.

More information and the film’s trailer can be seen at www.journeytopalomar.org. Tickets can be purchased in advance at the Festival website: www.tviff.com

Screenings are first-come; first served. Show times will be announced on the Festival website after Aug. 25th.

Friends of Palomar Observatory
P.O. Box 200
Palomar Mountain, CA 92060-0200

Friends of Palomar Observatory Annual Membership Application

☐ Student/Senior Citizen Member $30 ☐ Individual Member $45 ☐ Family Membership $75

☐ New Member ☐ Renewal ☐ Donation __________

Name ____________________________ Address ____________________________

City __________________ State ______ Zip ______ Phone ____________________________

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Check ☐ Visa ☐ Mastercard (circle one) Credit Card # ____________________________

Expiration Date __________________ Signature ____________________________

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

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Sharpest Images Ever continued from page 1

The use of the camera at Palomar was a demonstration of the potential of visible-light adaptive optics and offers a glimpse of the detailed imagery to come. Astronomers at Caltech and the Jet Propulsion Laboratory are currently developing the first-ever astronomical adaptive-optics system fully capable of capturing visible-light images. The new system, known as PALM-3000, will routinely allow the 200-inch telescope at Palomar to outperform the Hubble Space Telescope even at blue wavelengths. Using state-of-the-art deformable mirrors, sensors, and a powerful laser, the upgraded Palomar adaptive-optics system will provide finer correction of the atmospheric blurring than any present adaptive optics system, allowing long-exposure images with the same fine detail as the “lucky” images taken recently.

Caltech’s Richard Dekany, principal investigator for PALM-3000, says that the upgraded instrument could be available as early as 2010. “These Lucky Imaging results underscore the science potential of diffraction-limited visible-light observations on large ground-based telescopes,” he explains. To get even sharper pictures, astronomers will need to use bigger telescopes. The results open up the possibility of further improvements on even larger telescopes, such as the 10-meter Keck telescopes on the top of Mauna Kea in Hawaii or in the future even larger telescopes, such as the Thirty Meter Telescope (TMT).

Working on the Lucky Imaging project were Law, Dekany, Mike Ireland, and Anna Moore from Caltech and the Palomar 200-inch crew. Other team members included Craig Mackay from Cambridge, James Lloyd from Cornell University, and Peter Tuthill, Henry Woodruff, and Gordon Robertson from the University of Sydney.

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The images produced in the study are the sharpest direct images ever taken in visible light either from the ground or from space. “The system performed even better than we were expecting. It was fantastic to watch the first images come in and see that we were easily doing better than Hubble,” says Nicholas Law, a postdoctoral scholar at Caltech and principal investigator for the instrument.

Most astronomical objects are so far away that astronomers are desperate to see more and more detail within them. The new pictures of the globular star cluster M13, located 25,000 light years away, are sharp enough that astronomers are able to find stars as little as one light-day apart. A light-year is the distance light travels in one year (almost 6 trillion miles). A light-day is the distance light travels in just one day. Stars in the vicinity of the solar system are much farther apart—the nearest star to our solar system is over four light-years away.

The astronomers also observed very fine detail in objects such as the Cat’s Eye Nebula (NGC 6543). It is eight times closer to earth than M13, allowing filaments that are only a few light-hours across to be resolved.

Blurred by Earth’s Atmosphere
Corrected with Adaptive Optics

The observatory provided water from its own 1 million-gallon water tank for fire units operating in the nearby community. The facility has its own generator that allowed the firefighters to access the water when there was no power on the rest of the mountain. The floor of the Hale Telescope’s large dome served as a bunkhouse for many firefighters, as did the dorm where astronomers normally stay when they are observing.

Two Palomar Observatory employees, Dan Zeiber and Greg Van Idsinga, are also members of the Palomar Mountain Volunteer Fire Department (PMVFD) and spent the week fighting the fire along with thousands of other firefighters under the direction of CAL FIRE and the Cleveland National Forest. Gift shop employee Heather Brennan provided valuable assistance the PMVFD during the crisis.

Palomar Stories: John Strong

In 1947 John Strong had been invited to come to Caltech from John Hopkins University to supervise the first aluminization process of the 200-inch disk. He was thrilled to work on the big telescope. First order of business was to get all the bugs worked out of getting the aluminizing chamber to seal with no leaks and finding pumps big enough to draw the vacuum they needed. When they were finally ready to put the thin coat of aluminum on the giant Pyrex disk to turn it into a 200-inch mirror the first attempt failed.

John Strong had discovered in his research that the worst contaminant was microscopic traces of oil from human skin. If there were any areas of the disk that weren’t perfectly free from all traces of oil, the aluminum would not coat the disk properly. John Strong had brought with him, cases of a Wildroot Cream Oil hair tonic. He said, “In order to get glass clean”, as he unpacked cases of hair tonic, “you first have to get it properly dirty.” He set to work applying his Wildroot Cream Oil treatment to the Pyrex disk. He and the opticians wiped the surface clean just before the overhead crane lowered the bell jar onto the base of the aluminizing chamber. It was a success! The telescope was three nights before Christmas 1947.

This Palomar Story, like the one on Marcus Brown in the last issue, was adapted from The Perfect Machine, by Ronald Florence – on sale in the Observatory Gift Shop.

Observatory Escapes Poomacha Fire continued from page 1

potentially cut off from the world. The observatory is fortunately equipped with back-up generators and is a partner in the High Performance Wireless Research and Education Network (HPWREN). HPWREN allowed the observatory staff to coordinate with the firefighting efforts and with Caltech in Pasadena. The ability for outside personnel to monitor weather conditions on the observatory site and for observatory staff to communicate to the outside world using Voice-Over-Internet Protocol was invaluable.

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Dan McKenna, the Deputy Site Manager, worked with the staff to assess any potential damage to the observatory’s sensitive optics and cameras from ash contamination and brought the telescopes back into operation by early November.
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