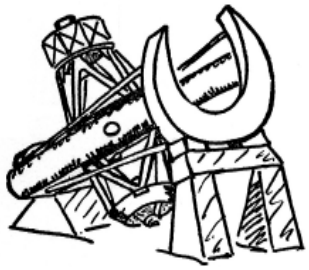
The Big Eye



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

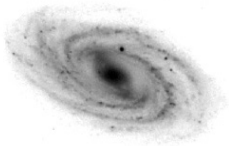
Journey to Palomar at Temecula Film Festival

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.



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 cometlike 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.

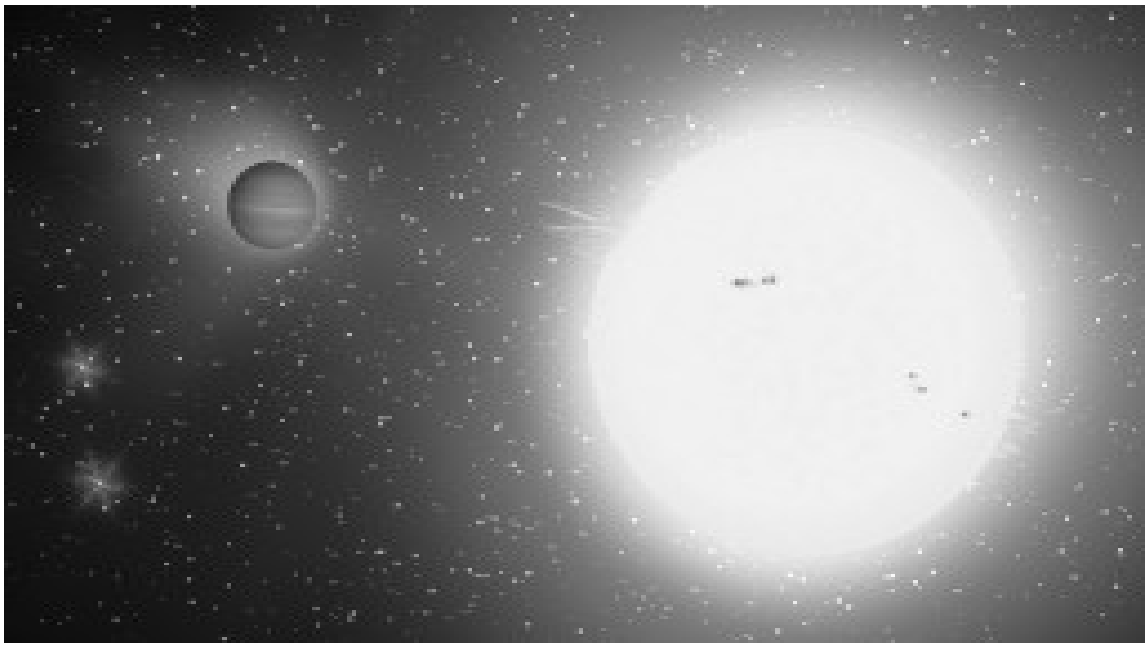
TrES-4 is noteworthy for having a radius 1.67 times that of Jupiter, yet a mass only 0.84 times Jupiter's, resulting in an extremely low density of 0.222 g cm-3. In comparison, Jupiter has a density of 1.3 g cm-3. The density of TrES-4 is so low that the planet would float on water.

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

Continued on page 2

Biggest Exoplanet Yet *continued from page 1*

the planet is a vital step in confirming that the transiting object is indeed a planet and not a star. We continue to be surprised by how relatively large these giant planets can be, says Francis ODonovan, a graduate student in astronomy at the California Institute of Technology who operates one of the TrES telescopes. But if we can explain the sizes of these bloated planets in their harsh environments, it may help us better understand our own solar systems planets and their formation. The studys lead author, Georgi Mandushev of Lowell Observatory in Arizona, noted the challenges such big planets present for theories of planet formation and evolution: This find presents a new puzzle for astronomers who model the structure and atmospheres of giant planets. It highlights the diversity of physical properties among giant planets around other stars and indicates that we can expect more discoveries of unusual and enigmatic exoplanets in the near future.



TrES is a global network of three small telescopes utilizing mostly amateur-astronomy components and off-the-shelf four-inch camera lenses: Sleuth telescope at Caltechs Palomar Observatory in San Diego County; the Planet Search Survey Telescope (PSST) at Lowell Observatory; and the STellar Astrophysics and Research on Exoplanets (STARE) telescope in the Canary Islands. Planet TrES-4 makes a complete revolution around its parent star every 3.55 days, so a year on this planet is shorter than a week on Earth. The planet is about seven million kilometers away from its starover ten times closer than Mercury is to the Sunand so it is heated by the intense starlight to about 1600 degrees Kelvin (about 2300 degrees Fahrenheit). In terms of mass and distance to its sun, TrES-4 is similar to HD209458b, and like that planet, it may have an extended outer atmosphere. Astronomers hypothesize that the outer atmospheric layers may be able to escape the planets gravity and form a curved cometlike tail. To look for transits, the small telescopes are automated to take wide-field timed exposures of the clear skies on as many nights as possible. When an observing run is completed for a particular fieldusually over an approximately two-month periodthe data are run through software that corrects for various sources of distortion and noise. The end result is a light curve for each of the thousands of stars in the field. If the software detects regular variations in the light curve for an individual star, then the astronomers do additional work to see if the source of the variation is indeed a transiting planet. One possible alternative is that the object passing in front of the star is another star, fainter and smaller.

Palomar Stories: Marcus Brownie Brown

On Friday April 10, 1936 *the* train arrived at the Lamanda Park train station in East Pasadena. It had taken 16 days for Palomars new mirror to travel three thousand miles from Corning, NY to Pasadena, CA. Optician Marcus Brown was there to greet the Pyrex disk. Once it was moved into the optical shop at Caltech he would be in charge of grinding it into the perfect shape needed to make it into a 200-inch mirror for the worlds largest telescope.

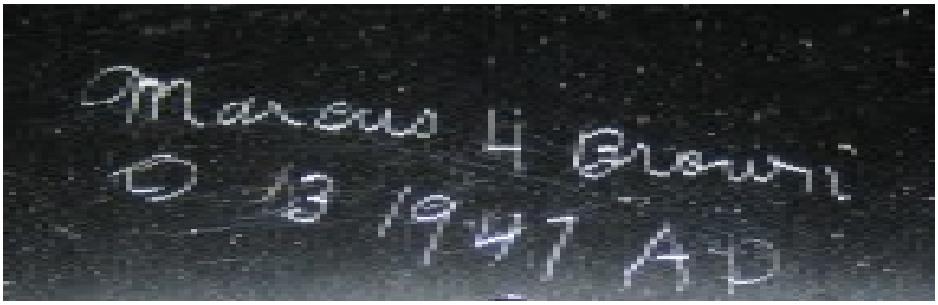
They estimated it would take five to six years to grind it into the parabolic shape needed for the mirror. It was tedious work and it took special talents to work on optics, to stand up to the routine. Not everyone had the temperament for it. The obsession with cleanliness in the optics shop was more than many men could stand. A single speck of metal under a polishing tool on the surface of a disk could make a scratch that might destroy months of work.

Mostly the endless routine got to men. Glass can only be worked slowly. Removing millimeters of glass can take months of slow grinding. In the later stages of work, polishing a disk to optical tolerance of fraction of a millimeter can take years. Week after week each day was exactly like the one before tending a machine, performing a routine task. The unchanging routine, coupled with the fear that a single lapse could destroy a priceless disk, was more than many could stand. Marcus Brown said, Time is worth less than glass around here.

There was a break in the work between February 1942 and January 1946 due to World War II. The work resumed after the war but it wasnt until November of 1947 that the mirror was finally ready to be transported to Palomar Mountain.

When the disk was finally on the trailer, workmen climbed onto the big crate to put a sheet of paper and a one-inch thick wooden cover on top of the disk. One of the workers saw what looked like a scratch on the surface of the glass in the central hole of the disk. A scratch on the inside of the hole wouldnt have any effect on the mirror, but everyone in the shop knew that the central hole had been ground smooth. From his perch the workman leaned down to examine the scratch.

It wasnt a scratch at all. He read the letters etched into the glass*: Marcus H. Brown O 13 1947 A.D.* Brown said nothing about the signature. Craftsmen and artists had always signed their masterpieces.



2007 Season Almost Gone

The September 29th event has already filled up, but seats still remain for the October 6th event. Caltechs Rachel Akeson will give a presentation on the Palomar Testbed Interferometer. The talk will be followed by viewing through the Palomar 60-inch telescope (weather permitting).

If you cannot make either event, do not despair. In 2008 the Friends of Palomar Observatory will have their best season yet as we celebrate the 60th anniversary of the dedication of the Hale Telescope. Stay tuned for information as it becomes available.

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FRIENDS OF PALOMAR OBSERVATORY

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