The Big Eye

The Newsletter of the Friends of Palomar Observatory Vol. 4, No. 2

Celebrate the International Year of Astronomy

In celebration of the 400th anniversary of Galileo's first astronomical observations, the International Astronomical Union and the United Nations have designated 2009 as the International Year of Astronomy (IYA).

There are many ways to celebrate the IYA. The best way is to get outside under the night sky. Even better, spend some time looking through a telescope. The Friends of Palomar will have at least six observing nights in 2009 (details are coming soon), but if that isn't enough, seek out your local astronomy club and look to see when they are holding star parties.

There will be lots of star parties in conjunction with the IYA's 100 Hours of Astronomy (100HA) event to be held April 2 – 5. It is a four-day, round the world star party. Visit their website at http://www.100hoursofastronomy.org/ to find local events.

Embedded within the 100HA event is Around the World in 80 Telescopes. It is a 24-hour live webcast event that will take place from the control rooms of research telescopes located around the globe. Included in the mix will be Palomar Observatory.

Most people have no idea what happens during the night at a research observatory. The expectation is that astronomers are looking through telescopes – a concept that is 100 years out of date. The Around the World in 80 Telescopes event will give people an inside look to what really happens by letting them take their own trip to observatories located across the globe (and in space too).

Scheduled to participate are observatories in 15 countries—spanning every continent (including Antarctica), and 11 observatories located in space.

The final stop in this around-the-world tour of observatories will be Palomar Observatory. Scott Kardel will be hosting

Palomar's segment and along with the astronomers using Palomar's 200-inch Hale Telescope that night, he will be answering questions and explaining the research underway.

Palomar Observatory's participation in the event is only possible through its high-speed data connection provided by the High-Performance Wireless Research and Education Network (HPWREN). HPWREN provides 155 megabits per second (OC-3 capacity) terrestrial microwave links that network Palomar Observatory to the rest of the world. This high-speed connectivity is essential for current and future research programs at Palomar, but it also provides the necessary bandwidth to allow for this and other live broadcasts to take place from the observatory.

The live webcast will begin on 3 April 2009 at 02:00 a.m. Pacific Daylight Time (09:00 UT) with the telescopes on Mauna Kea in Hawaii, before moving westwards around the planet. The event ends on 4 April 2009, 02:00 a.m. Pacific Daylight Time (09:00 UT). Palomar Observatory's portion of the event is scheduled to begin at 1:40 a.m. PDT on April 4th. The live video webcast will be available on the 100 Hours of Astronomy website.

April 4 is also the date that our weekend tours of the Hale Telescope begin again. This year tours will be held at 11:30 a.m., 1:30 p.m. and 2:30 p.m. on both Saturdays and Sundays. These tours are free for Friends of Palomar Observatory members.

A Brief History of the Telescope

By Mike Vergara

Astronomy would not be the same without the telescope. In this multi-part series, we will give you a brief history of the telescope and how that history influenced the building of Palomar Observatory.

Do you ever wonder who invented the telescope? The first telescope ever used (that we know of and can document!) was a "refracting" telescope. A refracting telescope uses lenses, ground and polished to a certain specific curvature, to gather and focus the light from stars (or terrestrial objects like armies or ships) into an observer's eye or into a camera. It is the specific combination of lenses and types of glass that make a telescope a telescope.

Lenses, made of glass or clear minerals and ground into specific shapes, have been known to humans for centuries. It seems incredible that ancient Greeks, Romans, Egyptians and Phoenicians knew of lenses and their optical properties, but it was never recorded that someone held two lenses one in front of the other and discovered that distant objects appeared to be closer.

This is most likely because it takes a long time to polish and shape a piece of crystal or glass into a lens, and the ancient lenses which have been discovered (like the Nimrud Lens, uncovered in 1850 and estimated to be about 3,000 years old) are of a very short focal length. Most likely these were used by artisans to make very small inscriptions, and for kings and courtesans to read them.

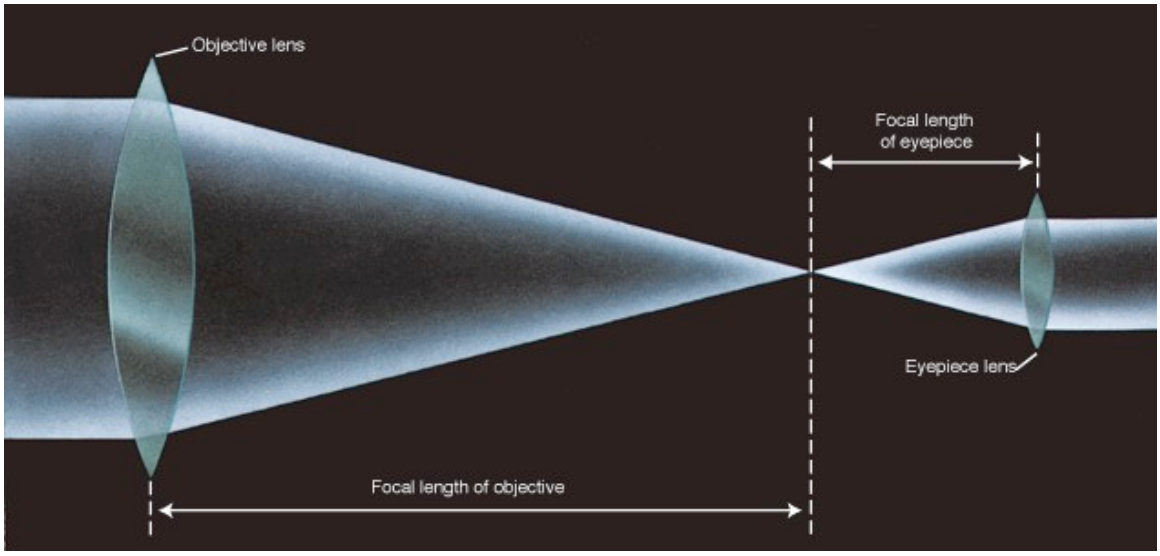
There are writings of inventors and scientists that seem to hint of a telescope. Leonardo da Vinci wrote himself a note to "construct glasses to see the moon magnified." Around 1266, Roger Bacon, a Franciscan Friar and Oxford scholar, wrote of shaping and arranging transparent lenses such that he would see objects at an incredible distance. Thomas Digges, an English inventor, wrote around 1570 that his father had a device that would show distant objects up close, but the device itself was never displayed. Telescopes seemed simply to be a fanciful idea.

That changed in September of 1608. A Dutch spectacle-maker named Hans Lipperhey turned up at his government's patent office with a device made of two lenses in a tube. It was variously called "the instrument for seeing far," "the instrument invented by Johan [*sic*] Lipperhey," and "the invention to stretch out sight." Whether it was by plagiarism, ingenuity, or sheer accident that he discovered what we now call a Galilean telescope we'll probably never know. What is certain is that since his country was embroiled in the Eighty Years' War (against Spain), he was hoping to receive a patent and a financial windfall.

Shortly after Lipperhey applied for his patent, another optician appeared with a similar device. Then another was brought out in France, and more started appearing elsewhere. The Dutch government immediately appointed a committee to study the issue of similar patent claims. They then requested Lipperhey to build another device that could be used with both eyes. They had just been handed the first recorded telescope, and now they wanted binoculars!

So what did Lipperhey's "device for seeing far" look like? It had a 'weak' (long focal length) convex lens to act as the light-gathering objective, and a 'strong' (short focal length) concave lens which acted as the eyepiece. Both lenses were set into a metal tube. It is estimated that this telescope had a magnification of about 3 times the unaided eye. This may not seem very powerful today, but in 1608 it was nothing short of miraculous.

Schematically, it looks like this:



The way it works is quite simple. Light from the star is refracted by its passage through the "Objective Lens" to a point inside the telescope. The light does not stop there! The focus point is simply the point where all the light rays gathered by the objective lens meet. The light keeps going, and is re-refracted by the "Eyepiece Lens" into an image that a human eye can recognize. How much a telescope will magnify an object depends on the "focal length" of each lens.

To calculate the magnification, divide the focal length of the objective lens by the focal length of the eyepiece lens. Easy!

More important to an astronomer is the idea that a telescope will gather much more light than a human eye alone, or that bigger telescopes gather more light than smaller telescopes.

For example, the human eye has an average maximum diameter of 0.5 cm – half a centimeter. The size of Lipperhey's telescope was not recorded, but Galileo's first telescope (of which you will hear more later) had an objective lens of about 3 cm diameter. The light-gathering capability is based on the area of the opening, so the average human eye has a collecting area of 0.2 cm^2, and Galileo's telescope had a collecting area of 7 cm^2 - around 35 times the area of an eye! No wonder we can see more stars through a telescope!

Eventually, Lipperhey built four devices; the original and three binocular versions. For these he received 900 guilders, but no patent, and he is not usually recorded by history as the inventor of the telescope because of the other instruments that appeared within a relatively short time.

If history has slighted Lipperhey, it has been absolutely overwhelming in it's recognition of another great name associated with early telescopes – Galileo Galilei. We'll tell you about him in Part Two of this series.

Palomar Observatory Needs You

In this line up, can you pick out the retired police officer? How about the high school teacher or the college professor? Can you find the electrical engineer, the accountant, the information systems specialist or the consultant? These are just some of our Palomar Observatory Docents. They come from every background and all have one thing in common. They all share a common interest in Palomar Observatory and they're not afraid to tell you about it.

Anyone can become a docent. You don't need to be an astronomer, a physicist or even an amateur astronomer. Docent training provides you with information about the history and what's currently happening at Palomar Observatory. You will also be trained on how to give a tour and you'll work with other experienced docents. All you need is a desire to learn about Palomar and to enjoy conveying what you learn to the observatory visitors.

The docents have a lot of fun and they meet people from all over the world. Not only do they work with the general public on tours but they also do special programs for school kids, scout troops, astronomy clubs, as well as star parties and evening events. Docents also have the opportunity to participate in docent only events, fieldtrips and educational talks by observatory employees and astronomers.

If this sounds like something you would be interested in doing, don't be shy. Contact Scott Kardel at 760-742-2111 or send in an application from our web site at: http://www.astro.caltech.edu/palomar/docents.html You'll be glad you did.

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** _____

Email _____

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