nightwatch

Newsletter of the Pomona Valley Amateur Astronomers

Science when to communicate the result of its labor, has the disadvantage of being little understood . ***Michelson***

Volume 31 Number 09 ***nightwatch*** **September 2011**

President's Message

Big observatories exert a profound influence on me, and on most astronomers, both amateur and professional, and I think on most human beings in general. Everyone recognizes the mountaintop dome silhouetted against the sky, a sort of remote fastness where scientists go to plumb the mysteries of the universe. There are trainloads of mythic and cultural resonances in that image.

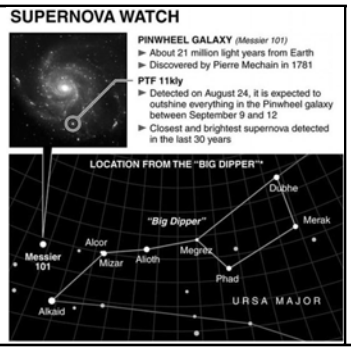
And with good reason. Observatories are probably the largest scientific installations that could not conceivably be used for any but peaceful purposes. They represent our good old primate curiosity, honed and refined by millennia of technological development and the cut and thrust of scientific debate, now turned outward to some of the biggest problems and most profound mysteries we have yet stumbled upon as a species.

All of this is on my mind because of the club's upcoming pilgrimage to Mt. Wilson, to spend a night with the 60-inch telescope. The mountain and its telescopes are also the subject of our talk this month. A hundred years ago, the 60-inch telescope was just hitting its stride as the premiere astronomical research instrument in the world. The studies performed with that scope on the sizes and distances of globular clusters paved the way for the discovery of the expansion of the universe by Hubble and Humason, using the 60-inch scope's larger sibling, the 100-inch Hooker telescope, which is also at Mt. Wilson. It's great that these magnificent machines of science are still in operation, and it's especially great that we are close enough to take advantage of that fact. I suspect that the vast majority of amateur astronomers go their entire lives without looking through a 60-inch telescope; we have the opportunity to do so yearly. Let's not take any of it for granted--not the instruments themselves, not the milestones that they represent for humankind, and especially not the chance to step up to the eyepiece and let all of that collected starlight into our eyes, our minds, and our hearts.

Matt Wedel

NEWS FLASH

Computers have discovered a nearby exploded star in the Pinwheel galaxy (M101). It is a Type Ia supernova and should brighten to 10th magnitude by next week and be visible with bionoculars. View as soon as it gets fully dark because it will get quite low in the sky after about 9:30 pm and the waning moon will add to the difficulty in seeing.



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Mount Wilson 60-inch Observing Session

Last call if you want to observe with the 60-inch scope on September 24th. The fee is $100 per person. Children must be at least 12 years-old and accompanied by an adult. If you would like to come with us, please made out a check to "PVAA" and give it to Ron Hoekwater at the General Meeting.

Club Events Calendar

September 9 – General Meeting
September 17&18 - Pacific Astronomy & Telescope Show
September 24 - Mt. Wilson Observing

October 6 - Board Meeting, 6:15
October 8 International Observe the Moon Night, Claremont
October 14 – General Meeting

October 27 - Board Meeting, 6:15
October 29 - Star Party - Joshua Tree group camping area

November 4 - General Meeting
November 26 - Star Party - To Be Announced

December 9 - Holiday Party - 7pm at Sizzlin Skillets Upland

January 5 - Board Meeting, 6:15
January 13 - General Meeting
January 21- Star Party - To Be Announced

February 2 - Board Meeting, 6:15
February 10 - General Meeting
February 18 - Star Party - To Be Announced

March 1 - Board Meeting, 6:15
March 9 - General Meeting
March 24 - Star Party - To Be Announced

April 5 - Board Meeting, 6:15
April 13 - General Meeting
April 21 - Star Party - To Be Announced

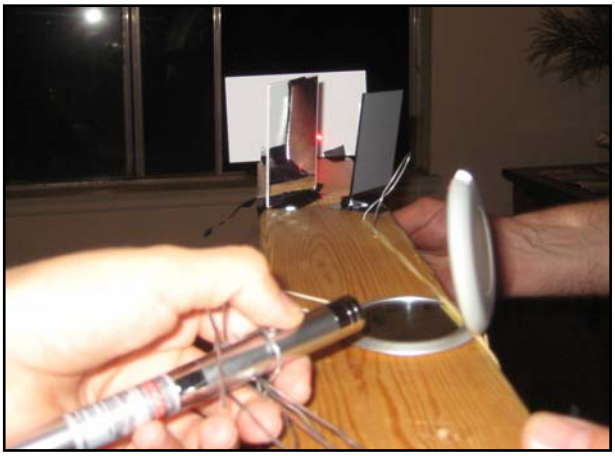
Little Laser Workbench

My 12 year old son Isaiah decided to build a laser pointer workbench. He built it out of spare parts and a 5 mW 630-680 NM laser pointer. He wants to use it to test refraction, reflection and to possibly perform the double slit experiment.

The double slit experiment was first performed by Thomas Young in 1803. He presented his findings to the Royal Society of London. By asserting that light has both the properties of a wave as well as a particle, he helped lay the foundation for what is known today as Quantum Mechanics. This experiment is one of the most duplicated in all of Physics, and it is considered by many to be the most elegant (Little).

Here are some photos of the workbench, beginning with the basic layout of the tools and parts. Tools are basic household items such as a hammer, electrical tape, nails.

Parts List:
Rubber bands,
paper clips,
electrical tape,
mirrors,
laser,
wooden plank,
3 by 5 paper
index card,
magnifying glass.



Here we are testing the pointer by reflecting the beam off a mirror and attempting to split it with another onto the index card screen. This was an attempt to perform the double slit experiment and do some very basic beam splitting.

Isaiah and Scott Little

References

Michelson, A.(1903). Light Waves and Their Uses. University of Chicago

Little, S. (2007). A Cheap and Easy Way to do The Double Slit Experiment. http://www.zuriky.com/Doubleslit.htm

How Does It Work?

We all wonder at times about why we can't see some things we have seen before. Why is that planet so blurred, for example. The problem may be turbulence in the atmosphere which is called "seeing." This article will offer a way to estimate the seeing conditions for any night and any scope.

First we begin with the diffraction limit of the scope. The spot size is twice the wavelength divided by the diameter of the aperture. I have an 8 inch, 200 mm, primary mirror. If I use green for wavelength, the calculation is easier. So, I will use 0.5 micrometers. Keeping the metric units, multiply 0.5 by 2.4 and divide by 0.2 meters. That gives a diffraction spot of 6 micro radians which is about 1.2 arc seconds. (The conversion factor is 4.85) This is the best my scope can ever do. Next look at the long wavelength, you might use 0.7 micro meters in the red. That would give a larger spot size of about 1.7 arc seconds. The spot is going to be somewhere in between depending on the star's color and your eye sensitivity.

Since we are estimating, let's use 1.5 arc seconds for convenience. If your mirror is 12 inches, multiply by 8 and divide by 12. The diffraction spot is then 1 arc seconds. If your mirror is 6 inches the spot is 2 arc seconds.

Now that we have a spot size, we can get out the scope and go to the high magnification. Center a star of magnitude 2 or brighter. At some magnification the star becomes a disk with "hair." I like 400x. That uses a 5mm eyepiece and gives me a nice large disk.

The ClearDarkSky.com site uses a scale of 5. If the night is excellent the value is 5. If it is poor the value is 1. We need to know what the spot looks like on a night of excellent "seeing." That would be a night when the scale is a 4 or 5. It should compare to the calculated value unless there is an collimation problem.

Any apparent jitter is due to atmospheric turbulence. A night of scale 5 has a jitter of the star less than 0.4 arc seconds. A night of scale 4 has a jitter of less than 1 arc second. For a 3, the jitter is 1 to 2 arc seconds. For a 2, the jitter is 3 to 4 arc seconds. And for a 1, the jitter is greater than 4 arc seconds. We often get 5 arc seconds on a windy night.

Now we look at our star image. A clean spot with fuzzy hair is a scale 5 night. If the fuzz starts to broil and the image has grown by up to 20%, it is probably a scale 4 night. (For the technical types, the diffraction spot and the jitter are not correlated so the sum is a root sum of squares.)

On my scope, as calculated above, the spot would grow by at least 20% and up to 70% on a night with a scale of 3. The resulting image jitters around the edge of the main spot. The "hair" is replaced by jittering fuzz. This is a "typical" night in southern California. If the whole spot seems to jitter and the smear is more than triple the spot size the night is a scale 1.

To understand how this might affect viewing we can consider Jupiter. It subtends an angle of about 40 arc seconds depending on where we are in our orbit and where it is. The bands are only a few arc seconds wide. On a night worse than a 4, the bands will smear and lose definition. On a night of scale 1, they will be lost completely.

On a very good night the 8 inch scope can resolve a double star that is separated by 1.5 arc seconds. On a poor night they must be separated by 4 arc seconds or more.

We also will lose the dimmer stars. When that 1 arc second star becomes 2 arc seconds on a poor night, the light is smeared over four times the area of our eye. It appears dimmer and fades into the background. That is a change of about 1.5 in magnitude. That's typical of a scale 3 night. On a windy night we can lose 3 magnitudes or more.

A difference of one magnitude is a difference of 2.51 in brightness. Use 2.51 times the log of the area ratio to determine the magnitude change.

So next time you are out on a dark night, go to high magnification and estimate how much the atmosphere is smearing your details. If nothing else, it gives an appreciation to why the artificial star and adaptive optics are needed by the large telescopes for professionals. .

Ken Crowder

August General Meeting

The August general meeting started with PVAA president Matt Wedel asking the group who was here for the first time. Several people came to their first PVAA meeting due to an announcement in the local Claremont Courier. This is very encouraging. Matt then requested their patience as he asked for nominations and seconds for the association's up coming elections of officers, board members and open positions.

Due to Lee Collins being out of town, his usual informative and entertaining "What's Up" presentation wasn't presented. Matt used the extra time to have a longer than usual break, where he used cookies and coffee to entice some more members to agree to run for the remaining open positions.

After the break guest speaker Vatche Sahakian gave a wonderful presentation titled "Fish In A Pond" Vatche Sahakian is an associate professor in the physics department at Harvey Mudd College. His topic was "From Cosmology to String Theory". A good place to look into string theory is:

http://superstringtheory.com/

He started out with saying that there are 2 puzzles and "Black Holes are neither black nor holes." He put several equations on the chalkboard involving Mass, Temperature, Plank's Constant, Entropy and the surface area of a sphere. With that he launched into puzzle #1: The information paradox and how even black holes will "evaporate or radiate away" to nothing over time. (A really, REALLY long time.)

The professor then stated two postulates of string theory: 1.) Building blocks of nature involve extended objects. 2.) All observables should be computable. He talked about the Heisenberg Uncertainty Principle, and stated that "The Big Bang was neither big nor a bang." (Of course "big" is relative.) He went on to Normal Matter, which is 4% of the universe, Dark Matter which is 26%, then to Dark Energy which theorists now peg at 70% of the universe. He finished off with the Multiverse (Multiple universes) and T Branes that can explain our expanding universe quite nicely. Professor Sahakian was informative and entertaining. You can learn more by going to his website:

http://sahakian.physics.hmc.edu/Homepage/Research.html

Gary Thompson

What's Up - Meeting A Starlike Goddess

I'm starry eyed over the Dawn spacecraft's pictures of a rotating Vesta available on line. There's a thrill in seeing the surface of a planetoid never seen before by man.

When asteroids were first discovered they were seen as minor planets or planetoids, but because they couldn't be resolved into planet sized discs by a telescope they were called "starlike objects" or asteroids. The largest asteroid and first to be discovered is Ceres (580 miles diameter). A discovery numbering system labels it 1 Ceres. It was found on the magical date of 1-1-1801 by a Catholic priest, Giuseppe Piazzi, who developed into the leading astronomer of Sicily. He named it Ceres after the Roman goddess of cereal, much revered in Sicily. It began a tradition of naming starlike objects after goddesses. 2 Pallas followed in 1802, 3 Juno in 1804 and 4 Vesta in 1807. By the time hundreds of thousands of little asteroids had turned up they had run out of goddesses, although there is one named after the fruity goddess Pomona. Now a committee judges the name chosen by the discover. A group of four are named after the Beatles. The name Hitler was rejected.

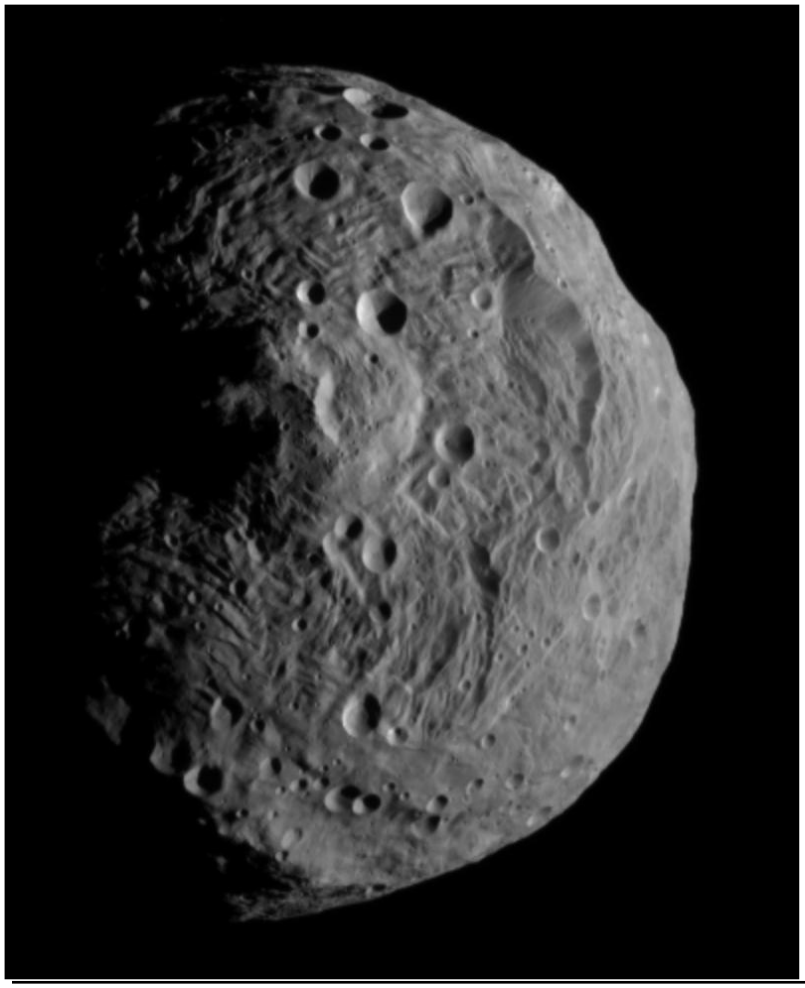
Asteroid 1 Ceres is the only one to appear truly round and to contain water. Like Jupiter's moon Europa this could make life possible beneath a frozen surface. So in 2006 when Pluto was downgraded to dwarf planet, Ceres was upgraded to dwarf planet. The Dawn spacecraft will reach and explore Ceres in 2015.

The question of a "missing planet" between Mars and Jupiter has always puzzled astronomers. The theory is that the gravitational pull between huge Jupiter and our Sun kept matter from forming a sizable planet in the area now filled by the "fragments" of the asteroid belt.

There are other asteroid groups, the Trojan asteroids move in Jupiter's orbit and the Apollo asteroids cross Earth's orbit. There is a new recognition that asteroids have struck Earth in the past resulting in the extinction of dinosaurs and other critters. This has caused a new interest in observing near earth objects of what has been called the solar system's floating junk.

But let's return to the starlike goddess Vesta which Dawn is now photographing in great detail. Discovered in 1807 by Heinrich Olbers, it's the second largest asteroid (360 miles), the brightest (5th mag), and the fourth to be discovered (4 Vesta). It's not round, but misshapen by impact craters like a much kicked beach ball. Dawn's views show it to have an equatorial band of bumpy grooves. These might have been formed by the centrifugal force of a molten spinning body like the equatorial bulge of Saturn's moon Iapetus.

Vesta is the virgin Roman goddess of the hearth fires. She is the daughter of Saturn, the sister of Jupiter. Temples of Vesta were staffed by Vestal Virgins who kept the home fires burning.



Our first close up look at these starlike objects came in 1991 when spacecraft Galileo passed asteroid Gaspra. It had a typical irregular, pitted body strewed with rocks. Its similarity to Mars' two little moons, Phobos and Deimos strengthened the belief that they're captured asteroids. Asteroids can have their own mini-moons. When Galileo passed Ida it was found to have its own moon, now named Dactyl (finger). More recently, probe DS-1 has studied asteroid Braille on its way to Comet Borrelly. Stardust looked at asteroid Annefrank while going to sample Comet Wild 2.

Up to now two asteroid missions have been highly productive. The Japanese probe Hayabusa successfully took dust samples of asteroid Itokawa and returned it to Earth. Itokawa oddly appears to be a gravitationally glued together pile of dusty rubble. Also the NEAR Shoemaker spacecraft took photos of tiny Mathilde on the way to orbit and land on Eros. No samples were retrieved from asteroid Eros but a successful landing of the craft proved it could be done. One man claimed he could homestead Eros and charge NASA parking fees, but a counter argument pointed out that NASA had actually landed on the asteroid and had all prior ownership claims.

Vesta has a fast four year solar orbit and is now in the constellation of Capricornus (Sea Goat). It's star like dot is hard to locate in The Sea Goat sagging bikini bottom shape.

Asteroids and their often secret orbits continue to be a revelation and I anxiously await the orbiting of Ceres in 2014. .

Lee Collins