Astronomy compels the soul to look upwards and leads us from this world to another.

Plato

Newsletter of the Pomona Valley Amateur Astronomers

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President's Message

It's been a big month in the solar system. On July 16, the Dawn spacecraft arrived at the asteroid Vesta and went into orbit, the first time that a spacecraft has orbited an asteroid. Then the asteroid 2010 TK7 was confirmed as the Earth's first known Trojan asteroid--one that orbits around one of the Earth-Sun Lagrange points and therefore shares roughly the same path around the sun. Very roughly, in this case, since 2010 TK7's orbit is inclined at 21 degrees to the ecliptic and its distance from the sun varies by a third over the course of a year. Then on August 4, NASA released photos from the Mars Reconnaissance Orbiter showing dark streaks on crater walls that change with the seasons, and may be evidence for periodic flows of liquid water. The very next day, the Juno spacecraft lifted off for its five-year cruise to Jupiter, where it will study the gravitational and magnetic fields of Jupiter and map its interior.

Of all of these events, the one that resonates most strongly with me is the discovery that 2010 TK7 is a Trojan asteroid of Earth, making it the first known object in that class. This is a path we've been on for a long time. In 1781, William Herschel discovered Uranus, the first planet known to us that was not also known to the ancients. Ceres was discovered in 1801, and although it was at first taken to be a new planet and is now recognized as a dwarf planet, it was also the first representative of a wholly new class of objects: asteroids. Similarly, the discovery of Pluto in 1930 opened up another new class, the Kuiper Belt objects. With the recognition of 2010 TK7 as Earth's Trojan, the solar system has just grown a little more, not in physical dimensions but in terms of the kinds of things it contains.

This sort of discovery is about to go into overdrive. The big automated sky surveys that are coming online now and in the next few years, such as PanSTARRS and the Large Synoptic Survey Telescope (LSST), will be able to see and track fainter objects than any previous Earth-based observing program, and will do so more continuously. For example, as of this spring just over 4000 Trojan asteroids of Jupiter had been identified; the LSST is expected to find tens of thousands more, as well as the first Trojan asteroids of Saturn and several other planets, and even more new objects in other classes. Some of those classes will undoubtedly be new--not just new things, but new kinds of things, which will reveal to us more of the inner workings of this increasingly crowded solar system. The more we look, the more we find, the pace of discovery does not seem to be slowing down. For someone raised on nine planets and one belt of rocks, these are heady days.

A bit of shameless self-promotion: next Friday night, August 19, I'll be on television talking about dinosaurs. The show is "Jurassic CSI" on the National Geographic Channel. Details, showtimes, and a couple of photos are available here:

http://channel.nationalgeographic.com/series/jurassic-csi/4495/Overview#tab-Photos/0

Matt Wedel

How Does It Work?

Albert Nagler was born in the Bronx in 1935. It is more than likely that history will add his name to the list of Huygens, Kellner, Plossl, et. al. Nagler took advantage of the major changes in technology and computer power to revolutionize the design of an eyepiece.

After World War II the demand for optical systems of various types resulted in new glass materials, coatings and cements. New polishing machines and techniques were developed to aid in production of large quantities. By 50 years ago IBM had offered a computer that was able to be programmed to assist design.

Nagler built his own 8 inch reflector telescope while he was in high school. In 1957 he went to work for Farrand Optical Company. He continued to develop his design skills under the aegis of some of the finest mentors in the country. He became a Senior Optical Designer and was eventually involved in the design for NASA of the Apollo lunar landing visual simulator. The simulator had a 110 degree field of view. He continued at Farrand until 1973.

Nagler would later say that his inspiration for his eyepiece design came from his work on the NASA simulator. He wanted to give the feeling of a "space walk" to amateur astronomy. In 1977 TeleVue was established to design and market projection lenses for televisions. By 1979 his first eyepiece design was prototyped and a patent was granted.

The original design was a 13.1 mm eyepiece which utilized 7 elements including 2 doublets. The novel part of his design eliminated astigmatism by using a negative lens as the first element. Two high index glasses and anti-reflection (AR) coatings were used to create an 80 degree FOV which reviewers were to say was a whole new experience in astronomy. The quality of the image was further enhanced by an 18 mm eye relief.

Nagler has since revised his basic design several times. While offering a very special experience, the original design was large and heavy. It would have been enormous if scaled to give a 40 mm focal length. Although the current designs are large and heavy, they each offer an exceptional quality, wide FOV and good eye relief.

In the original Plossl and other designs the doublets had to be formed by hand polishing. Today those surfaces are controlled by a computer. Glasses which were once considered exotic have become catalogue items.

An air-glass interface will reflect about 4 percent of the incident light. A thin lens can therefore lose as much as 8 percent. An uncoated doublet will lose a bit more due to the cemented joint between two different glasses. An uncoated Plossl may therefore lose up to 20 percent of the incident light.

AR coating can reduce the loss to as little as 1 percent per surface interface. That gives a net loss of about 5 percent for a well designed, AR coated Plossl.

A Nagler designs have 10 or more air-glass surfaces. These are each AR coated and will probably lose about 10 to 15 percent. Before AR coatings were practical the design would have easily lost over 50 percent and would have been impractical.

The eye may respond to a bright star in the FOV. So if we want to look at a faint fuzzy near a bright star, the large FOV may not be desirable. The eye can only focus on about a 50 degree FOV at a time. That is why the Nagler designs with their large FOV gives the amateur that feeling of a Space Walk that Nagler wanted to provide.

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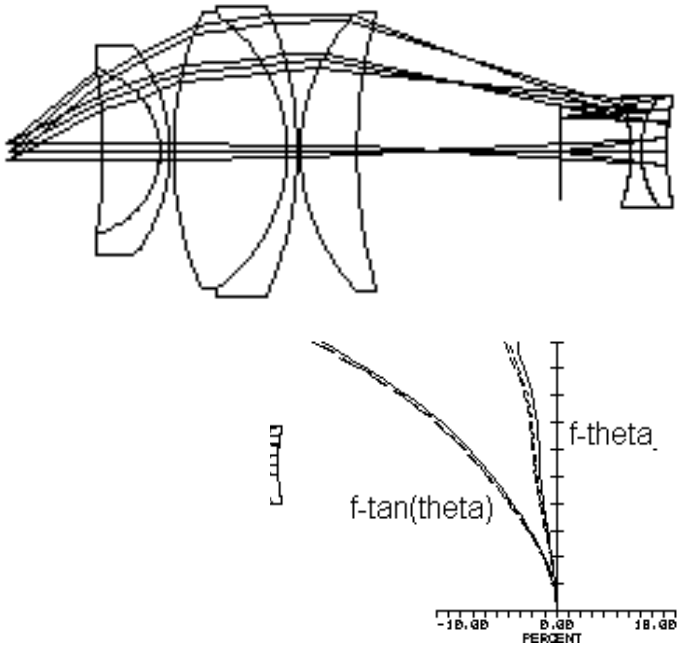
Ken Crowder



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July General Meeting

Matt Wedel opened the meeting and gave the upcoming events and announcements. Get ready to vote! Yep, that time again. PATS is coming this September 17th -18th.

http://www.rtmcastronomyexpo.org/PATS.htm

Lee Collins pointed out that the Southern Cross constellation is on 5 national flags, while the north star is on the Alaskan State Flag. The Alaskan state flag has the "Big Dipper", which is an asterism, and not a constellation. He also pointed out constellations that were named after drafting devices, like the Triangulum Australe.

July's general meeting featured Robert K Buchheim with the topic "The Sky Is Your Laboratory" – which is also the name of his book. His presentation was so inspiring that I immediately bought his book. – 299 pages if you include the index. In his presentation he pointed out several advantages that amateurs have over professional astronomers. First is telescope time. Our telescope is available to us whenever we want it. There is no waiting list. Second, we can look at anything we want, for as long as we want. (We can look at Jupiter and its moons 5 times tonight, and we don't have others breathing down our neck wanting and waiting to point it someplace else.) If they sky is cloudy, we can try tomorrow night. A professional might have to wait until his next scheduled time, which could be next year. While "the big guys" have access to "the big guns", CCD cameras have really helped amateurs produce quality data. The professionals were using a 60 inch and even a 100 inch telescope and debating if there were other galaxies not that long ago. An 8 second exposure with a CCD on an 8 inch driven telescope can produce remarkable results.

Another advantage of the amateur is that we are mobile. Large observatories are not portable. We can take our scopes to where the action is. If you want to catch an asteroid eclipse, you will need to be in the eclipse's path.

One more advantage is that we can be watching an object that the big guys are not concentrating on.

Anthony Wesley is now a famous amateur astronomer for videoing objects slamming into Jupiter.

http://www.youtube.com/watch?v=Yo6LHljBKW8

He was looking were the pros weren't. The universe is too big for the professionals to be looking everywhere all the time.

With diligence and accurate bookkeeping, you can make a difference.

Gary Thompson

Mount Wilson 60-inch Observing Session

Good news for those of you observing with the 60-inch scope on September 24th. In addition to a night observing with a great telescope, we get a special tour from Dave Jurasevich, Superintendent of Mount Wilson Observatory. Dave promises to show us the places that you never see on the usual tours. Be there by 5:30 PM if you want to go on the tour.

If you have not yet signed up, the Mount Wilson Institute allows us to have up to 25 people in the 60-inch dome. 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 send it to:

PVAA
PO Box 162
Upland CA, 91785.

Ron Hoekwater

Club Events Calendar

August 12 – General Meeting -
Our speaker will be Vatche Sahakian. He is a professor of physics at Harvey Mudd College and his talk will be "Fish In a Pond: From Cosmology to String Theory."

Aug 27 - Star Party - Angelus Oaks

September 1 - Board Meeting, 6:15
September 9 – General Meeting
September 24 - Mt. Wilson Observing

October 8 International Observe the Moon Night, Claremont
October 14 – General Meeting

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

What's Up - Blackeye - Norma's Great Galactic Attractor

The "Great Attractor" is a mysterious phenomenon discovered about forty years ago. It's a force attracting all the galaxies in the Milky Way's area, including the entire Coma-Virgo galaxy cluster, to move in its direction. This "Great Attractor" is located in the otherwise unimportant constellation of Norma (draftsmen's square).

Norma, along with Lupus and Centaurus, lies in the dense central area of our galaxy. This is a "Zone of Avoidance" because normal telescopes always have trouble sorting out the crowded nature of it all. However powerful radio telescopes have now isolated radiation suggestive of distant colliding galaxies and their black holes. They have revealed a cloaked Norma Galactic Super Cluster about 250 million light years behind the Milky Way. This could be the "Great Attractor." A gravitational concentration of innumerable hidden galaxies

Norma, located near our horizon, is one of three draftsman's instrument constellations unimaginatively dreamed up by chart-maker Nicolas de Lacalle. They fill in a space between Scorpius and Lupus (wolf) - Centaurus (Centaur). The others are Triangulum Australe (draftsman's triangle) and Circinus (draftsman's compass). Oddly there's a second faint compass constellation not too far away, Pyxis (ship's compass).

Our Milky Way's central core in Sagittarius is obscured by even more amounts of gas and dust. Deeper observations are only possible with x-ray, gamma ray, and sub-millimeter radio telescopes. The bright bulge of light in Sagittarius, Ophiuchus and Scorpius has long indicated the center of the Milky Way. However, its exact location is a powerful radio telescope radiant, Sagittarius A. It's believed to be a super massive black hole near the very center of our galaxy.

Scattered in a spherical halo around this gravitational core are the oddly beautiful globular clusters. They seem like small left over galactic cores themselves. Maybe they are. The stars in the almost 200 known globulars are the oldest stars in our galaxy. They have no "star nursery" clouds to give birth to new stars. Their high star density is unfavorable to any nebulas or planetary systems. There's a high rate of collisions and near-collisions. This creates newer rare stars like low-mass X-ray binaries, millisecond pulsars and blue stragglers. A hot blue straggler is created from the merger of two stars. Many globulars have a very bright center resulting from larger slower stars falling into the core.

But the true origin of globular clusters remains a mystery. Are they ancient nodules left over from an earlier age of galactic creation, are they the core remains of smaller galaxies stripped of outer stars by our Milky Way, or the product of some even stranger force?

The largest globular, Omega Centaurus (pictured), has a black hole in its core. This suggests the remains of a dwarf galaxy gobbled up by the Milky Way Galaxy. Suggestive examples which lie beyond the edge of the Milky Way are definitely parts of near-by dwarf galaxies. These are M79 in Canis Major, and M54 in Sagittarius.

The third brightest globular is M22 in Sagittarius, it would be brighter if it wasn't surrounded by galactic dust. Sagittarius and Ophiuchus near the galactic center have a large concentration of globulars. In Hercules, M13 shines farther out in darker skies as does nearby M92. Several are so interesting they were among the first objects catalogues by Messier. These are M2 in Aquarius, M3 in Canes Venatici, the close M4 in Scorpius near Antares, M5 in Serpens Caput, and M9, M10, M12 in Ophiuchus. Some, like M15 in Pegasus, are in convenient viewing locations. But two others, although visible to the unaided eye, lie out of California sight down near the South Pole. These are the second largest globular 47 Tucanae near the Small Magellanic Cloud, and NGC 6752 in Pavo the peacock.

Edmond Halley of comet fame first studied these fuzzy spheres as early as 1677. Messier listed 29 round nebulae. William Herschel with his larger telescope saw them as made up of hundreds of thousands of stars. By 1749, Herschel was listing 70 of what he called "globular clusters" in his catalogue. In 1917 Harlow Shapley published a study categorizing them according to their degree of star concentration toward their cores. But still their origin remains a mystery.

So both our own galactic core and the cores of globular clusters conceal deep secrets yet to be unveiled by bold new observing technologies.

Lee Collins