



The more the universe seems comprehensible,
the more it also seems pointless.
Steven Weinberg

Newsletter of the Pomona Valley Amateur Astronomers

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nightwatch

August 2016

President's Message

The summer Milky Way is high overhead every night right now, and the weather is nice, so it's a good time to stargaze. Although lately I have had more fun chasing planets. Jupiter, Mars, and Saturn continue their early evening dance in the southern and southwestern skies, but did you realize that it is possible to see all the other planets in one night right now?

Venus and Mercury are both visible in the western sky right after sunset, although you'll need to move quickly to catch both of them before they set. Next along the ecliptic is Jupiter, followed by Mars and Saturn, but chances are you've already been watching them.

Farther on, Neptune is in Aquarius, the Water-Carrier. You'll need to wait until 10:00 or later to catch the outermost giant. If you want to make a clean sweep of the solar system's non-dwarf planets, you'll need to stay up even later: Uranus is in Pisces and it doesn't clear the horizon until 11:00 or so.

If you're classically inclined and want to pick up Pluto, it's in Sagittarius, but you'll need a big scope and keen eyes to catch its 14th magnitude spark.

I haven't caught Pluto yet, but I have seen all of the others this month, albeit not on the same night. I'm hoping to make a run on all seven of the non-dwarf planets while they are still there to be seen.

We will have two speakers in August. Before the break for coffee and cookies, Annie Kary will speak on the changing views of Black Holes. After the break Prof. Matt Povich of Cal Poly Pomona will give a talk: *The Milky Way Project: "Citizen Scientists" Map Our Home Galaxy*. And don't forget, we're back in Beckman Hall for the rest of the meetings this year. .

Matt Wedel

Club Events Calendar

Aug 19, 2016 General Meeting – Annie Kary – Black Holes and Matt Povich – The Milky Way Project

Aug 27, 2016 Star Party – Cow Canyon Saddle, Mt Baldy

Sept 3, 2016 Star Party– Cow Canyon Saddle, Mt Baldy

Sept 8, 2016 Board Meeting

Sept 16, 2016 General Meeting – Dr. Elijah Quentin – Stars Consumed by Black Holes

Oct 1, 2016 Star Party--Palomar 200" Scope & Campground Palomar 200" Tour

Oct 6, 2016 Board Meeting

Oct 14, 2016 General Meeting

Oct 29, 2016 Star Party – Afton Canyon

Nov 10, 2016 Board Meeting

Nov 18, 2016 General Meeting

Dec 1, 2016 Board Meeting

Dec 9, 2016 Xmas Party

PVAA General Meeting 7/22/16

After greeting the members and first time attendees, PVAA President Matt Wedel had a little 'show and tell' of his trip to the impact crater in Canyonlands National Park, Utah. This crater is massive, as compared to the well-known impact crater in Arizona. The Arizona crater is 1.186 kilometers (0.737 miles) wide, while Utah's 'Upheaval Dome' crater is more than 5 kilometers (+3.1 miles) wide. He brought his very compact 100mm (4") Starblast telescope that costs ~\$110.00. At this site



the skies are truly dark, and the viewing was excellent.

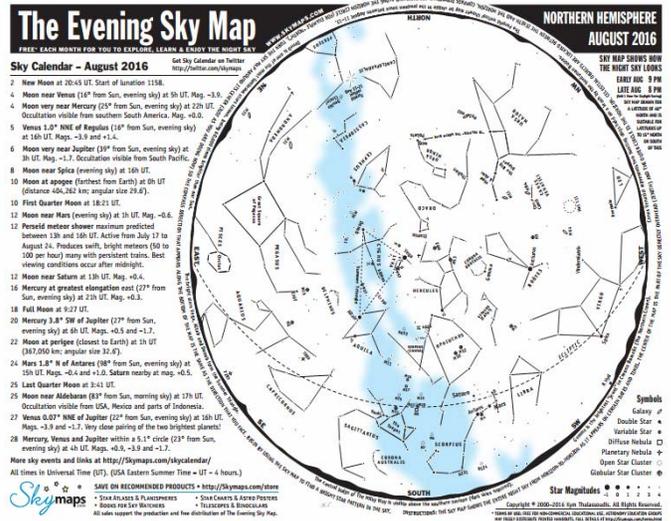
After the break, Matt was also our main speaker for the night. He talked about star systems – Polaris is a double-star system and Sigma Orionis is a 6-star system. Then he talked about DSOs (Deep Sky Objects). Objects that are truly far away such as galaxies – spiral, barred, elliptical or loosely formed. After galaxies have collided with one another, it takes a while to stabilize its new form. Other DSOs are much closer – such as nebulae, found within our own Milky Way galaxy. When a star becomes unstable it may pulsate (collapse, expand, collapse - over and over). When that happens it leaves a ring of debris around the remaining center. In early telescopes they looked like planets, and they were named 'planetary nebulae'. Many nebulae are 'diffuse' and nurseries for stars. While not all diffuse nebulae create open clusters, all open clusters started out from diffuse nebulae. An example of a diffuse nebula would be the Great Nebula in Orion, or even the Eagle nebula or the nebula known as the 'Pillars of Creation'. Open clusters are like M45 – Pleiades, or NGC290.

Globular clusters, like M13 can have hundreds of thousands of stars, or over a million stars like M13, that are grouped together in a ball. We use the "M" designation from a star

catalog that Charles Messier put together. He has a comet-hunter, and these fuzzy objects looked like comets, so he put this list together so he would quit wasting his time on them. He is more famous for this list, than the 13 comets he found. This list can be found at:

https://en.wikipedia.org/wiki/List_of_Messier_objects

The NGC objects or 'New General Catalogue' was started by William & Caroline Herschel, who also discovered the planet Uranus. The catalogue was expanded by his son John Herschel, putting in objects from the Southern Hemisphere.



Every month there is a free sky map published at <http://www.skymaps.com/> It has info on objects you can see with your eyes, binoculars and telescopes.

Gary Thompson

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Two photos by Ludd Trozpek while in Oregon



Digital camera set to manual with manual focus at infinity. 1/100 f/8 ISO 400 through 25x100 binoculars



What's Up? - Icy Planet Sized Moons

First would be Ganymede, a moon made of a lot of salty ice water. The Voyager Probe discovered Jupiter's third Galilean moon to be the largest moon in the solar system at a diameter of 3,273 miles. Titan, Saturn's huge moon was considered the largest, is slightly smaller. Ganymede is larger than planet Mercury and all the dwarf planets -- Pluto, Ceres, Eris, etc.

Like all solar system's moons, Ganymede is tidally locked with one side constantly facing enormous Jupiter. It has orbital resonances with two other Galilean moons. So for every orbit of Ganymede, Europa orbits twice and Io orbits four times. Callisto is so far out it remains coldly unaffected.

So Ganymede is the largest of Jupiter's four major moons discovered by Galileo in 1610. Galileo wanted to name the four moons after members of the rich Medici family to gain support. But fellow astronomers Johannes Kepler and Simon Marius wisely suggested he name them after four mythical lovers of Jupiter.

Io, Europa, and Callisto are three beautiful young noble ladies but Ganymede is a handsome young prince. Jupiter takes the form of an eagle (to hide from his wife Juno) and carries Ganymede off to be the cup bearer to Olympic gods. There he becomes the only lover of Jupiter to be given divine immortality and a permanent barkeeper's job. Famous artists like Michelangelo and Rembrandt painted action packed eagle abductions. There is even an old Budweiser ad where its trademark eagle snatches up the boy to serve cold beer to thirsty Olympians. The sexual suggestions of this abduction are implied. Ganymede isn't seen as a hot gay moon.

Actually Ganymede is extremely cold. It's 50% frigid water ice and 50% frozen rock. Not very gay. While sunny inner planets are made of heavy rock the remote outer moons and dwarf planets are full of light weight water ice. The European Space Agency is planning a mission to visit Europa, Callisto and Ganymede. The Jupiter Icy Moons Explorer or JUICE.

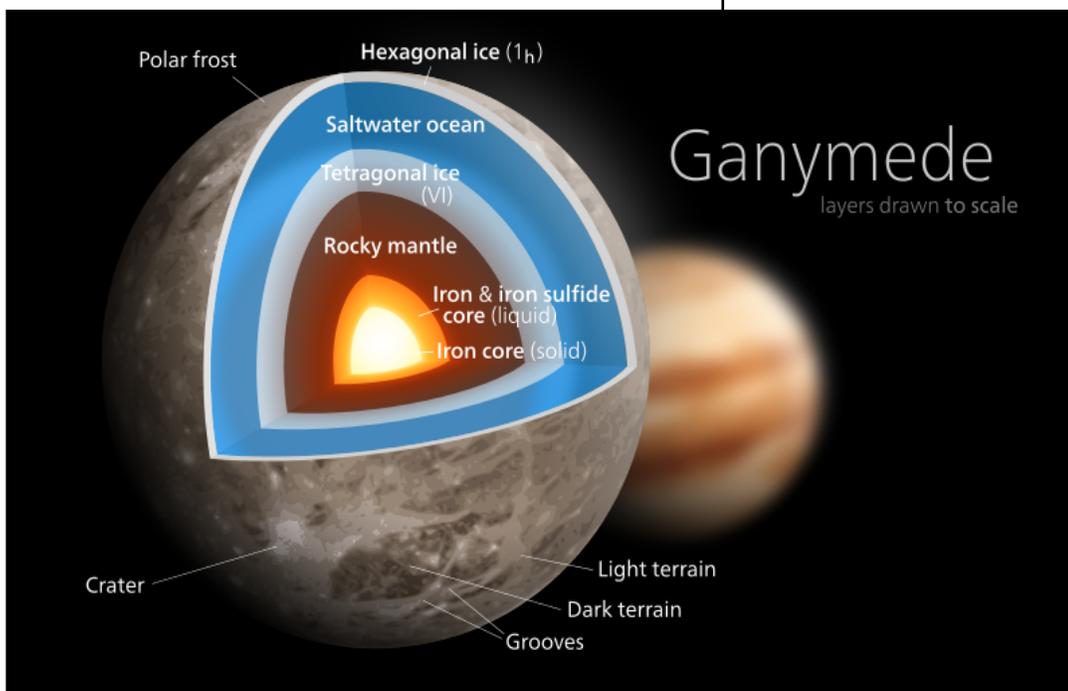
The Galileo space probe measurements indicated that a thick sea of salty water lies under Ganymede's crust. The same seems to be true of Europa and Callisto. Also Galileo's infrared spectrometer showed traces of salt on Ganymede's surface consistent with brine making its way to the surface by means of eruptions. It's been suggested that Ganymede's seas are layered like the cartoon character Dagwood's club sandwich. This unusual sandwiched mixture of salty seas and salty rock has motions that give a planetary type magnetic field to Ganymede. It's possible that these sunless seas with their rocky contacts might contain a primitive life form.

Ganymede's surface is also unique. It's a patchwork of old dark highly cratered areas made of salty rock. These darker forms are separated by lighter frozen water ice covered with mysterious sinuous grooves. These seemed to have slowly welled up from the subsurface ocean. The wave like formation of the parallel grooves remains a mystery. This odd surface is dotted with relatively newer crater impacts which bring up white ice from beneath to produce bright starry ejecta.

Callisto is next, Jupiter's last and second largest moon. It's as big as Mercury and larger than all dwarf planets. It's so far out from Jupiter that it appears to be an extremely frozen Ganymede. Again half rock and half ice. Too cold to be tidally heated inside. It is locked with one side always facing Jupiter, but doesn't have produce the orbital resonance of the other three. Its heavily cratered face seems to be the oldest unchanged surface of all the solar systems large moons. There's no volcanism or plate tectonics just a lot of white impact craters. The pure water ice of these craters has a bright albedo as high as 80% surrounded by very dark material. In this dark background lie two enormous impact features with mythic Germanic names: Asgard and Valhalla. These multi ringed structures have massive concentric fracturing that spreads dramatically across Callisto's icy surface.

In the myth Jupiter changes the nymph Callisto into a bear so his wife won't recognize her. There are different story versions, but in all of them Callisto finally becomes a constellation. So she is associated with Ursa Major and Ursa Minor. A moony bear nymph.

Lee Collins



Is there a super-Earth in the Solar System out beyond Neptune?

When the advent of large telescopes brought us the discoveries of Uranus and then Neptune, they also brought the great hope of a Solar System even richer in terms of large, massive worlds. While the asteroid belt and the Kuiper belt were each found to possess a large number of substantial icy-and-rocky worlds, none of them approached even Earth in size or mass, much less the true giant worlds. Meanwhile, all-sky infrared surveys, sensitive to red dwarfs, brown dwarfs and Jupiter-mass gas giants, were unable to detect anything new that was closer than Proxima Centauri. At the same time, Kepler taught us that super-Earths, planets between Earth and Neptune in size, were the galaxy's most common, despite our Solar System having none.

The discovery of Sedna in 2003 turned out to be even more groundbreaking than astronomers realized. Although many Trans-Neptunian Objects (TNOs) were discovered beginning in the 1990s, Sedna had properties all the others didn't. With an extremely eccentric orbit and an aphelion taking it farther from the Sun than any other world known at the time, it represented our first glimpse of the hypothetical Oort cloud: a spherical distribution of bodies ranging from hundreds to tens of thousands of A.U. from the Sun. Since the discovery of Sedna, five other long-period, very eccentric TNOs were found prior to 2016 as well. While you'd expect their orbital parameters to be randomly distributed if they occurred by chance, their orbital orientations with

respect to the Sun are clustered extremely narrowly: with less than a 1-in-10,000 chance of such an effect appearing randomly.

Whenever we see a new phenomenon with a surprisingly non-random appearance, our scientific intuition calls out for a physical explanation. Astronomers Konstantin Batygin and Mike Brown provided a compelling possibility earlier this year: perhaps a massive perturbing body very distant from the Sun provided the gravitational "kick" to hurl these objects towards the Sun. A single addition to the Solar System would explain the orbits of all of these long-period TNOs, a planet about 10 times the mass of Earth approximately 200 A.U. from the Sun, referred to as **Planet Nine**. More Sedna-like TNOs with similarly aligned orbits are predicted, and since January of 2016, another was found, with its orbit aligning perfectly with these predictions.

Ten meter class telescopes like Keck and Subaru, plus NASA's NEOWISE mission, are currently searching for this hypothetical, massive world. If it exists, it invites the question of its origin: did it form along with our Solar System, or was it captured from another star's vicinity much more recently? Regardless, if Batygin and Brown are right and this object is real, our Solar System may contain a super-Earth after all.

Ethan Siegel



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A possible super-Earth/mini-Neptune world hundreds of times more distant than Earth is from the Sun.

Image credit: R. Hurt / Caltech (IPAC)