Temecula Valley Astronomer

The monthly newsletter of the Temecula Valley Astronomers Jun 2017

Events:

General Meeting : Monday, June 5, 2017 at the Temecula Library, Room B, 30600 Pauba Rd, at 7 pm. A "What's Up" will be provided by Skip Southwick., Dr. Shoko Sakai, assistant research astronomer, UCLA Astrophysics Dept and member of the Galactic Center Group, will make a special presentation "Sizing Black Holes at the centers of galaxies and specifically the evidence for the Black Hole that we can't see at our own Galactic center". If time permits, Clark Williams will present an IFI (Identify & Find It). Refreshments by Skip Southwick.

For the latest on Star Parties, check the web page.

An irregular mare patch in the Mare Tranquillitatis. Image Credits: NASA/GSFC/Arizona State University

WHAT'S INSIDE THIS MONTH:

Send newsletter submissions to Mark DiVecchio <markd@silogic.com> by the 20th of the month for the next month's issue.

Like us on Facebook

General information:
Subscription to the TVA is included in the annual $25 membership (regular members) donation ($9 student; $35 family).

President: Mark Baker 951-691-0101 <shknbk13@hotmail.com>
Vice President: Skip Southwick <skipsouthwick@yahoo.com>
Past President: John Garrett <garrjohn@gmail.com>
Treasurer: Curtis Croulet <calypte@verizon.net>
Secretary: Deborah Cheong <geedeb@gmail.com>
Club Librarian: Bob Leffler <bobjleffler@msn.com>
Facebook: Tim Deardorff <tim-deardorff@yahoo.com>
Star Party Coordinator and Outreach: Deborah Cheong <geedeb@gmail.com>

Address renewals or other correspondence to:
Temecula Valley Astronomers
PO Box 1292
Murrieta, CA 92564

Member's Mailing List: tvastronomers@googlegroups.com
Website: http://www.temeculavalleyastronomers.com/

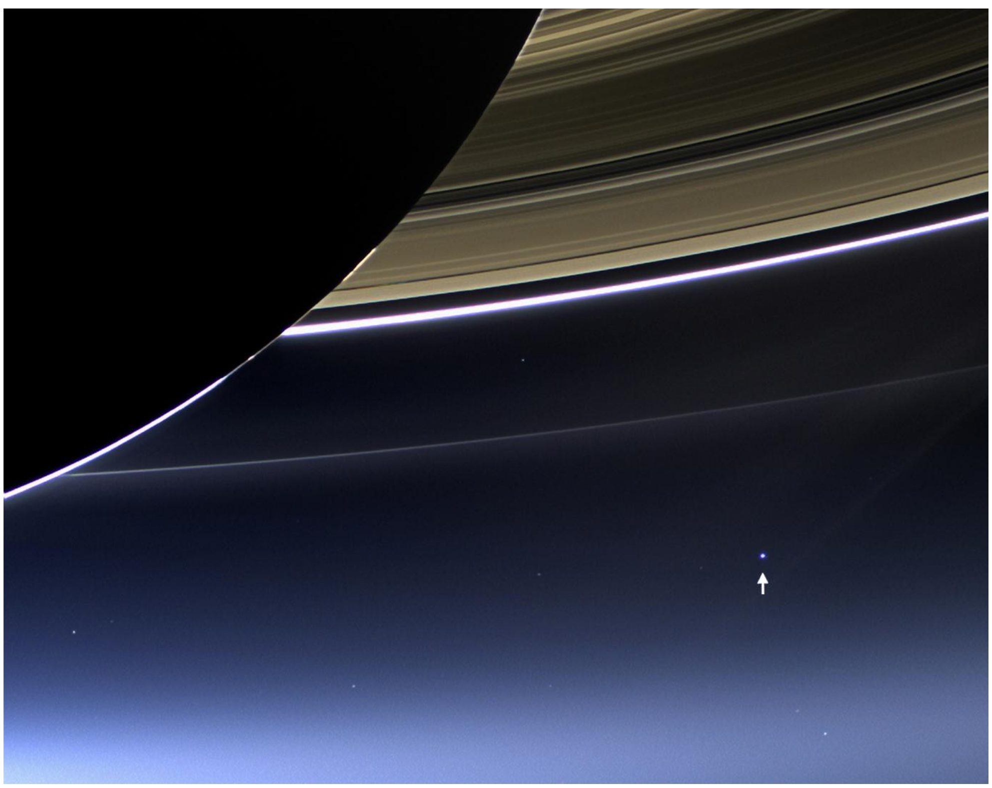
Cosmic Comments – June/2017
by President Mark Baker

On September 15, 2017, one of the most epic and highly successful space missions will, literally, come crashing down and be terminated. Since July 4th, 2004, the Cassini spacecraft and the Huygens probe have provided a wealth of information and knowledge. And some of the pictures have been nothing short of spectacular…!!!

As with most missions, the data will take years to fully analyze and appreciate. Even its demise is the result of the better understanding we have of the Saturn neighborhood, especially a couple of moons that appear to have the makeup to support life. Rather than risk any potential for contamination to such environments, Cassini will be sent on a dive into Saturn's atmosphere calculated to burn it up.

I plan to monitor the processional to its doom, as it gets ever closer to atmosphere, and continues to send back awesome pictures… for more information or real time viewing, go to https://saturn.jpl.nasa.gov/

And a special thanks to all those that have worked the past two decades on and with the Cassini team, including past TVA speaker Dr. Diane Frobischer… you all did good!!! And, as the picture shows, thanks for reminding us of our cosmic significance…



19 July 2013 The Day the Earth Smiled

Clear, Dark Skies my Friends…

Looking Up – June 2017
by Curtis Croulet

First Quarter Moon is June 1 at 5:42 AM PDT; **Full Moon** is June 9 at 6:10 AM PDT; **Last Quarter Moon** is June 17 at 4:33 AM PDT; **New Moon** is June 23 at 7:31 PM PDT.

Mercury is too close to the Sun to be observed.

Venus is in the morning sky at mag -4.3.

Mars crosses from Taurus into Gemini during June. The "red planet" finally descends into the glow of the Sun and becomes unobservable.

Jupiter, which we gleefully greeted when it reached opposition in April, is now past the meridian as the sky becomes dark. By the end of June, the gas giant is setting before 1 AM.

Saturn, on the other hand, reaches opposition on June 14. This means it'll be in prime observing position most of the summer.

Uranus is in the morning sky. It's in Pisces. It'll be another couple of months before Uranus is in good observing position in the middle of the night.

Neptune is also a morning object, but, being in Aquarius, it rises earlier than Uranus.

Pluto is in northeastern Sagittarius, now coming into the evening sky. You need a big scope and a dark sky to see this one. The July 2017 issue of Sky & Telescope has a detailed finder chart for the dwarf planet on pp.48-49.

The only meteor shower I can find for June is the **June Boötids**. They occur between June 23 and 25, with a peak on June 24, during the middle of the day. Don't expect to see much.

Let's look up.

As mentioned above, Saturn reaches opposition on June 14. That means it'll rise about same time as the Sun sets. Also, Saturn will approximately be at its closest to Earth, at around 843 million miles away. It's all downhill from there. Saturn will slowly become farther and smaller during the following weeks. A good case can be made that you should begin your exploration of Saturn on the very next clear night, even if that means viewing after midnight. The sky is usually better, anyway, after, say, 11 PM. Lights are extinguished all over southern California, and the air is usually steadier late at night.

Here are some basic facts about Saturn: The span of the rings is about 150,000 miles; the diameter of Saturn's disc is about 75,000 miles. Its rotational period is about 10.5 hours. Its period of revolution around the Sun is about 29.5 years.

Seemingly more so than Jupiter, Saturn places a premium on good optics. But Saturn is jaw-droppingly spectacular in almost any scope. The 40mm 30x telescope I had when I was a kid showed Saturn's rings clearly, even though the planet was tiny. I've never been able to see the rings in birding binoculars. Maybe younger eyes can do it.

In a good telescope on a steady night, Saturn appears to be almost etched against the sky. Guests at outreach events often suggest that maybe you pasted a photo of Saturn in front of your telescope (most people don't realize that a photo pasted over the scope's aperture would be essentially invisible). We don't usually hear such remarks about Jupiter. But Saturn is small. At their respective oppositions, Saturn is almost twice as far as Jupiter. The visible diameter of Saturn's rings is about the same as the disk of Jupiter. To me, Saturn is a very pale vanilla color, but most viewers at outreach events say it's white. Saturn's disk shows very subtle banding, far different from the bold zones and belts of Jupiter. On rare occasions white spots have erupted on Saturn's disk.

Saturn's most interesting feature is its rings, of course. They were discovered by Galileo in July 1610. The rings weren't fully open at the time, and the imperfect image in Galileo's telescope caused him to believe that Saturn consisted of a planet with two small planets on each side. We are at a fortunate moment when the rings are almost as favorably tilted as they can be. The nature of the rings as an apparent disk around the planet was discovered by Christian Huygens in 1650.

Saturn's period of revolution around the Sun is about 29 years, and twice during that revolution the rings present themselves edge-on. But that's not the situation right now.

In your telescope, you should be able to see Cassini's Division, that sharp, black break between the A and B Rings (the B Ring is the widest ring). The Cassini spacecraft has shown that Cassini's Division isn't really empty. If you have a really good scope and a really good night, you might also glimpse the grayish Crepe Ring or C ring. Saturn has other rings, but they're not visible in amateur telescopes.

Saturn has 62 known satellites or "moons." The matter of how many "moons" Saturn possesses often comes up at outreach events. Different sources give different numbers. I'm relying on the 2016 edition of the *Observer's Handbook* of the Royal Astronomical Society of Canada. In most amateur telescopes, only four satellites are visible. Three of the four can be dodgy, depending upon the size of your scope. The largest and brightest satellite, Titan, is visible in just about any scope. The next brightest satellite, Rhea, can be a challenge. It flickers in and out in my NP101is (101mm aperture, i.e. 4-inches) refractor, but it's usually easy in my 8-inch f/6 Cave reflector. Fainter (in order) are Tethys and Dione. Sometimes I think I glimpse them, fleetingly, in my 4-inch. I can usually see them in the 8-inch reflector. Other satellites, like Iapetus and Hyperion may be within the reach of large reflectors.

Summer often brings not just clear, but steady skies in southern California. Let's hope you get some good nights to view Saturn.

Clear skies.

Random Thoughts
by Chuck Dyson

For this month's ramble, I thought we could take a look at volcanoes and what they can tell us about our planet and other planets. I am actually cheating this month because I am studying volcanoes in my geology class and giving a talk to the students on volcanoes and so almost all the research needed for this ramble is already done. OK I may have lied a little bit on the fact that most of the research had been done, mainly because just like volcanoes themselves being dynamic entities the understanding of them and how they work is also in flux so writing an article that is even somewhat up-to-date requires frequent review of geology and NASA sites on the web.

The big change in our understanding of volcanoes started in 1953 with the first echo soundings in the Atlantic Ocean that revealed the presence of a mid ocean mountain chain. During WWII navy ships had operated echo sounders when crossing the Atlantic in order to map the ocean floor and a review of the charts that were created soon revealed not a mountain chain but an entire ocean ridge that even extended beyond the confines of the Atlantic Ocean. At the same time other geologists were busy sampling the ocean floor and the core samples showed that the floor sediment was thinnest at the mid ocean ridge and thickest at the continental edges also sediment analysis showed that no part of the ocean floor was older than 180 million years, with youngest sediment at the ridge and oldest at the continental edge.

At about the same time it was recognized by Professor Chushiro Hayashi that the Sun was a T Tauri type star[1] and that T Tauri stars have a very violent flare period in their development when they are burning lithium as their nuclear fuel instead of hydrogen and this flare period would have completely stripped Earth's entire atmosphere off of the planet. In a period of about twenty years our understanding of the Earth went from a planet of rigid crust with volcanoes fixed in location and an atmosphere that has always been with us and slowly changes over time to a planet of moving crustal plates, volcanoes designed by their point of origin on those plates, and no atmosphere or ocean either for that matter. Over the next four billion years on Earth the volcanoes have provided an atmosphere, most of the water in the oceans (today it is believed that there is still up to three times as much water in the Earth's mantle as in all the oceans) and inorganic molecules that could serve as food (energy sources) for the first life forms on the Earth.

I keep saying Earth because until 1971 when the Mariner spacecraft orbiting Mars photographed the Olympus Mons we didn't actually know that there were volcanoes on any of the other planets in the solar system. Naturally as soon as presumptive volcanoes were photographed on Mars, I say presumptive because there has not been a conformation of any volcanic eruptions on Mars and until there is an eruption or geologic evidence is obtained the

1 T Tauri stars are young suns of >0.5 solar masses to <3.0 solar masses or <2.0 solar masses, depends on researcher writing the paper but most agree it includes F, G, K, and M class stars. These types of suns have a tendency to go through a period of Li (lithium) burning as their source of energy for a period of about 100 million years and then switch to H to He burning and be on the main sequence. During the Li burning phase large convection currents are set up and the sun has a tendency to lash out at the universe. So, T Tauri is not so much a class as a stage of the star's development (the teenage years).

volcanoes are presumptive, geologists started to work trying to figure out what type of volcanoes they were and what was planet's history vis-à-vis plate tectonics. It is generally accepted that Mars is now geologically dead with volcanoes dead and plates locked and fixed in place.

Hold on there for just a minute, a paper published in 2012 argues that Mars is still very much geologically alive because there is a line of volcanoes, Tharsis Montes, drifting over a hot spot just like the Hawaiian Islands and a close examination of the Valles Marineris reveals markers on both walls of the valley that have moved 150 Km relative to each other indicating plate movement.

Who is right? In 2018 NASA will launch the Mars probe InSight, this probe will monitor the seismic activity and the thermal activity in the mantel of Mars; so, stay tuned for some great geologic papers in 2020.

Next stop on our volcano tour is Venus and Venus was presumptive for volcanic activity until 2014. By radar Venus is volcano paradise having plenty of images of every volcano type found on earth and a couple that aren't. In 2010 the IR (infrared) images of the Venus Express satellite imaged three large hot spots that were thought of be cooling lava flows but could not be confirmed. In 2012, there was a spike in the sulfur dioxide levels in the upper atmosphere indicating a volcanic eruption but no hot spot was found and this was again thought to be suggestive but not conclusive of active volcanoes on Venus.

Finally in 2014 (Venus seems to like even numbered years), three compact IR sources were identified and Venus joined the active volcano club. Because the surface temperature of Venus is 480 °C and the atmospheric pressure is around 1400 psi, landing a probe on Venus is not something that is likely to happen anytime soon (plus NASA has not funded any Venus missions for the next year so there is nothing on the drawing board); therefore, we will not anytime soon know the plate and mantel dynamics acting on Venus to create all of these volcanoes.

As long as we are in the area let's visit Mercury. Small and with a core that is 42% of the planet compared to Earth's 17%, there should not be much mantel to fuel volcanic activity; what we see is at odds with what we expected. There are clearly cinder cones on Mercury along with vents that are volcanic in origin in addition young craters on Mercury (around 1 billion years old) have volcanic ash in them indicating a possible three billion year history of volcanic activity. Volcanic ash indicates explosive eruptions by the volcanoes and this indicates significant out-gassing of the mantel by volcanic activity, but because of Mercury's low gravity along with high temperatures and a strong solar wind Mercury has only a wisp of its atmosphere left today.

If you think that there will not be any surprises discussing volcanism on the Moon, you need to think again. We all know that the Moon is not active today and the only volcanic activity that the Moon had was rock melt from big impacts that then flowed to fill the craters. The word on the observatory floor these days is yes, there were impacts, but the craters were filled about 100 million years or more after the impacts. The Moon's mantel does not have the water content that the Earth's mantle does and has a low silicon dioxide content so there are no explosive events but rather just a slow flow of liquid rock into the lunar basins. And that was the end of our lunar geology story until the Apollo 15 astronauts, while orbiting the Moon, noticed a small irregular patch of lunar basalt that appeared to be less than 1 billion years old, this was a very recent lava flow by lunar standards. This finding was considered to be an anomalous event until the Lunar Reconnaissance Orbiter discovered up to seventy more of these patches, all young, and this prompted one researcher to name them Irregular Mare Patches (IMP's). IMP's are now thought to represent the last gasp of lunar volcanic activity but is does indicate that the Moon is warmer and more active than we thought.

Beyond Mars we enter the realm of the cryovolcanoes. Cryovolcanoes are thought to be the result of tidal heating of moons by the parent planet. The poster child for tidal heating and volcanic activity it Jupiter's moon Io. A little review of physics, the gravitational attraction between two objects decreases with distance, any distance; therefore, it stands to reason that the gravitational pull of one body on another is greater on the sides facing each other and less on the far sides of the two objects. When you are in close orbit around Jupiter, like Io, the pull can be considerable and the surface bulge generated on Io by Jupiter is 100 meters. This bulge is enough to heat up the mantel to 1650 °C while the surface temperature is only -130 °C. This rotating bulge produces constant volcanic activity on Io although most of it is sulfur compounds that are liquid at 220 °C a much lower temperature than the melting point of the basalt lava found on Earth and thus the term cryovolcanoes. Cryovolcanoes are found around all of the giant planets and all are thought to be powered by tidal heating. The only body that doesn't go along with this plan is the dwarf planet Ceres with a four kilometer high ice volcano. There is no planet to warm this body up but there are lots of craters on Ceres and researchers think that a large asteroid hit may have released enough energy and shuffled enough volatiles close to the surface to account for the presence of this volcano. Stay tuned for further developments.

Because it appears that no matter where we look in the solar system there are volcanoes it could be foolish to think that there are not volcanic surprises waiting for us in the Kuiper belt and beyond.

Cheers
Chuck

The Fizzy Seas of Titan
By Marcus Woo

With clouds, rain, seas, lakes and a nitrogen-filled atmosphere, Saturn's moon Titan appears to be one of the worlds most similar to Earth in the solar system. But it's still alien; its seas and lakes are full not of water but liquid methane and ethane.

At the temperatures and pressures found on Titan’s surface, methane can evaporate and fall back down as rain, just like water on Earth. The methane rain flows into rivers and channels, filling lakes and seas.

Nitrogen makes up a larger portion of the atmosphere on Titan than on Earth. The gas also dissolves in methane, just like carbon dioxide in soda. And similar to when you shake an open soda bottle, disturbing a Titan lake can make the nitrogen bubble out.

But now it turns out the seas and lakes might be fizzier than previously thought. Researchers at NASA's Jet Propulsion Laboratory recently experimented with dissolved nitrogen in mixtures of liquid methane and ethane under a variety of temperatures and pressures that would exist on Titan. They measured how different conditions would trigger nitrogen bubbles. A fizzy lake, they found, would be a common sight.

On Titan, the liquid methane always contains dissolved nitrogen. So when it rains, a methane-nitrogen solution pours into the seas and lakes, either directly from rain or via stream runoff. But if the lake also contains some ethane—which doesn't dissolve nitrogen as well as methane does—mixing the liquids will force some of the nitrogen out of solution, and the lake will effervesce.

"It will be a big frothy mess," says Michael Malaska of JPL. "It's neat because it makes Earth look really boring by comparison."

Bubbles could also arise from a lake that contains more ethane than methane. The two will normally mix, but a less-dense layer of methane with dissolved nitrogen—from a gentle rain, for example--could settle on top of an ethane layer.

In this case, any disturbance—even a breeze—could mix the methane with dissolved nitrogen and the ethane below. The nitrogen would become less soluble and bubbles of gas would fizz out.

Heat, the researchers found, can also cause nitrogen to bubble out of solution while cold will coax more nitrogen to dissolve. As the seasons and climate change on Titan, the seas and lakes will inhale and exhale nitrogen.

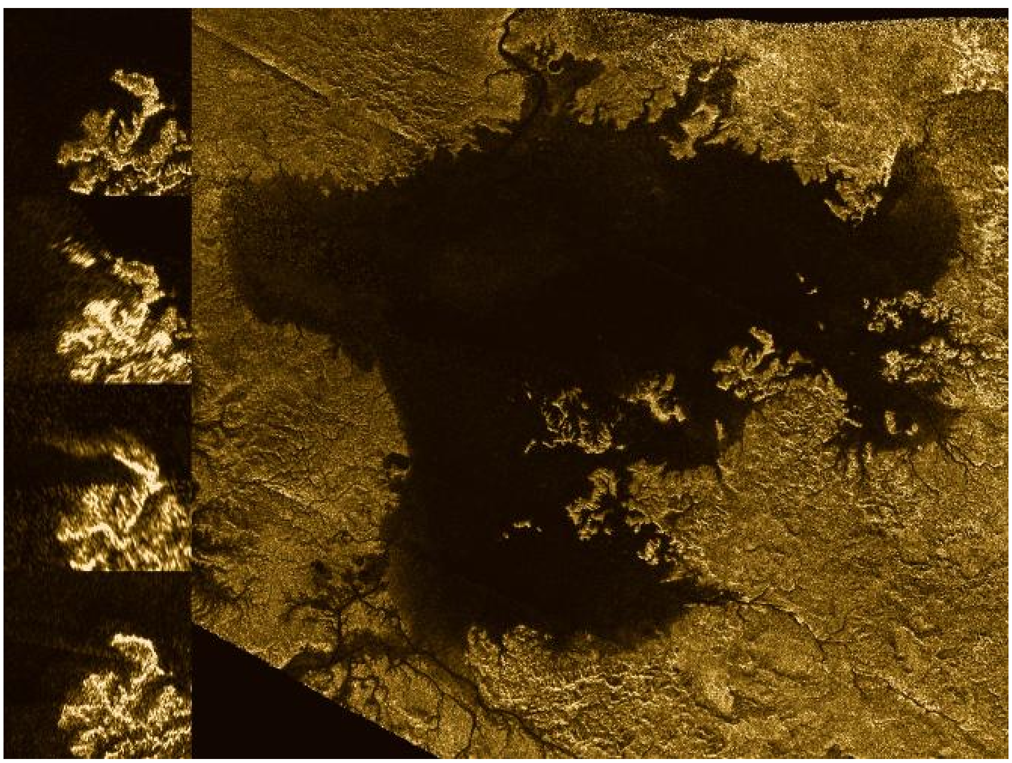
But such warmth-induced bubbles could pose a challenge for future sea-faring spacecraft, which will have an energy source, and thus heat. "You may have this spacecraft sitting there, and it's just going to be fizzing the whole time," Malaska says. "That may actually be a problem for stability control or sampling."

Bubbles might also explain the so-called magic islands discovered by NASA's Cassini spacecraft in the last few years. Radar images revealed island-like features that appear and disappear over time. Scientists still aren't sure what the islands are, but nitrogen bubbles seem increasingly likely.

To know for sure, though, there will have to be a new mission. Cassini is entering its final phase, having finished its last flyby of Titan on April 21. Scientists are already sketching out potential spacecraft—maybe a buoy or even a submarine—to explore Titan's seas, bubbles and all.

To teach kids about the extreme conditions on Titan and other planets and moons, visit the NASA Space Place: https://spaceplace.nasa.gov/planet-weather/

Radar images from Cassini showed a strange island-like feature in one of Titan's hydrocarbon seas that appeared to change over time. One possible explanation for this "magic island" is bubbles. Image credits: NASA/JPL – Caltech/ ASI/Cornell



This Article is provided by NASA Space Place.
With articles, activities, crafts, games, and lesson plans, NASA Space Place encourages everyone to get excited about science and technology.

*Visit **spaceplace.nasa.gov** to explore space and Earth science!*

The TVA is a member club of The Astronomical League.