nightwatch
Newsletter of the Pomona Valley Amateur Astronomers

The September meeting will convene in Shanahan B460

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What's Up? - Methane Moon

Titan, the largest moon of Saturn, is totally unique for its lakes and seas of liquid methane. They are the only stable bodies of surface liquid outside of Earth. These liquid hydrocarbon bodies have been long hidden by Titan's thick atmosphere. They've been confirmed and studied by the Cassini-Huygens probe in 2004. The most analyzed lake, near the south pole, has been named Ontario Lacus. Like Titan's other bodies of methane it's basically shallow. In the northern hemisphere lies Ligeia Mare with an average depth of 8 meters. Many have stream-like channels that flow into them. A long river of 400 kilometers has been discovered. Additional liquid exists in a theory that Titan is made of icy shells kilometers thick that float on top a global ocean. This subsurface ocean would be composed of water and ammonia. The presence of ammonia would keep water liquid even at temperatures a low as -100 C.

Titan is the only moon in the solar system to have an atmosphere. It's density is 1.45 times Earth's. It's opaque haze blocks most sunlight, resulting in a cold surface that receives only 1% of Earth's.

Initially, Titan was thought to be larger than it really is because it's lower gravity allows its atmosphere to extended way out creating the illusion of a larger moon. Also Titan is a "super rotator" like Venus with an atmosphere that rotates much faster than its surface increasing the its atmospheric extension. Because of this atmospheric enlargement, Titan was long thought to be our solar system's largest moon at 5,200 mile in diameter. That was until Voyage I discovered Ganymede, Jupiter's largest moon, to be 70 miles larger.

Titan's atmosphere produces an unusual evaporation and rain cycle of liquid methane like our water cycle on Earth, but at a much lower temperature. Interestingly, the gradual loss of methane into space doesn't account for its continued existence in the atmosphere. Therefore additional methane must be added by the volcanic activities of cryovolcanism. The atmosphere's 95% nitrogen must also be outgassed from the interior. Some visibly long lived bright spots could be cryovolcanoes. Titan's unusual atmosphere is so dense and its gravity so low that humans could fly through it by flapping "wings" attached to their arms. In spite of Cassini Huygen's recent studies it's unusual atmosphere still shrouds Titan in mystery.

Titan, a general term referring to the brothers of Saturn, is as large as its name implies. Its titanic size is 50% larger than Earth's moon, making it bigger than all the dwarf planets (Pluto, Ceres, etc) and Mercury.

Titan is gravity locked and always shows the same face at Saturn. Its rotational period is the same as its orbital period.

Titan was discovered in 1655 by Dutch astronomer Christiaan Huygens as a result of better telescopes he'd built with his brother. It was left to John Herschel to name it Titan in 1847 when he gave Saturn's other moons the names of titans.

The probe that arrived in the Saturn system in 2004, is named after Saturn's pioneer observers, Christiaan Huygens and Giovanni Cassini. A joint NASA and European Space Agency project; it used a variety of smog penetrating techniques to take the first high resolution images of features formed by the movement of fluids.

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On January 14, 2005 the Huygens probe landed on the surface to snap one picture (before it froze up) of a shrouded surface with far off low hills and a dry stream running through small stones of water ice. A darkness of the ground is probably the result of misty precipitation from hydrocarbon haze. The rounded nature of the ice stones indicates that liquid methane has flowed by the landing site. Despite an orange haze the picture has an Earth like appearance. It's the furthest from Earth that any man made object has ever landed.

A search for microbial life on Titan, in an atmosphere that could be similar to an early Earth, presents many problems. Water, so necessary to life, exists only in solid form because of the deep cold. There's no water vapor or even carbon dioxide in the atmosphere. Any living creatures would have a very exotic methane based chemistry. However, it's also theorized the subsurface sea could also possess a biotic environment. Unfortunately Cassini-Huygens doesn't have the equipment to provide evidence of bio-signatures or complex organic compounds. Maybe life could exist in the cryogenic hydrocarbons of Titan's methane lakes just as Earth organisms live in water. A NASA statement in 2010 proclaimed that, "some scientists believe there are chemical signature bolstering an argument for a primitive, exotic form of life or precursor to life on Titan's surface."

Lee Collins

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Our speaker this month is **Laureano Alberto Cangahuala**. The September meeting is in Shanahan B460.

Interplanetary Navigation

In order to conduct science experiments in other parts of the solar system, spacecraft trajectories must be planned with great detail, and the spacecraft navigated with high fidelity to their destinations. This talk will describe the essential steps in navigating spacecraft throughout the solar system, with an emphasis on the multiple physical effects at work which make these efforts challenging. Results from ongoing missions and exciting plans for upcoming activities will be shown as well.

Al Cangahuala has worked at the Jet Propulsion Laboratory since 1992 with a technical background in deep space orbit determination. Until recently he was the manager of the Mission Design and Navigation Section, and is now the Mission System Manager for the Europa Clipper pre-project. He currently

Club Events Calendar

September 12, General meeting in Shanahan B460
September 27, Mt Wilson Observing

October 2, Board meeting 6:15
October 10, General meeting
October 25, Star Party

October 30, Board meeting, 6:15
November 7, General meeting
November 22, Star Party

December 4, Board meeting, 6:15
December 12, Christmas Party, Sizzlin' Skillets 7:00pm
No scheduled Star Party

PVAA General Meeting 08/15/14

Jim Gallivan's talk was entitled "The Unification of Astronomy, Astrology, GPS, Supernovae and UFO's". He presented a diverse perspective of his research work in the Astronomical, Science and Aero-Space fields. He also covered dissimilar interests in the cosmos and phrenology.

The Invisible Shield of our Sun

Whether you look at the planets within our solar system, the stars within our galaxy or the galaxies spread throughout the universe, it's striking how empty outer space truly is. Even though the largest concentrations of mass are separated by huge distances, interstellar space isn't empty: it's filled with dilute amounts of gas, dust, radiation and ionized plasma. Although we've long been able to detect these components remotely, it's only since 2012 that a manmade spacecraft -- Voyager 1 -- successfully entered and gave our first direct measurements of the interstellar medium (ISM).

What we found was an amazing confirmation of the idea that our Sun creates a humongous "shield" around our solar system, the heliosphere, where the outward flux of the solar wind crashes against the ISM. Over 100 AU in radius, the heliosphere prevents the ionized plasma from the ISM from nearing the planets, asteroids and Kuiper belt objects contained within it. How? In addition to various wavelengths of light, the Sun is also a tremendous source of fast-moving, charged particles (mostly protons) that move between 300 and 800 km/s, or nearly 0.3% the speed of light. To achieve these speeds, these particles originate from the Sun's superheated corona, with temperatures in excess of 1,000,000 Kelvin!

When Voyager 1 finally left the heliosphere, it found a 40-fold increase in the density of ionized plasma particles. In addition, traveling beyond the heliopause showed a tremendous rise in the flux of intermediate-to-high energy cosmic ray protons, proving that our Sun shields our solar system quite effectively. Finally, it showed that the outer edges of the heliosheath consist of two zones, where the solar wind slows and then stagnates, and disappears altogether when you pass beyond the heliopause.

Unprotected passage through interstellar space would be life-threatening, as young stars, nebulae, and other intense energy sources pass perilously close to our solar system on ten-to-hundred-million-year timescales. Yet those objects pose no major danger to terrestrial life, as our Sun's invisible shield protects us from all but the rarer, highest energy cosmic particles. Even if we pass through a region like the Orion Nebula, our heliosphere keeps the vast majority of those dangerous ionized particles from impacting us, shielding even the solar system's outer worlds quite effectively. NASA spacecraft like the Voyagers, IBEX and SOHO continue to teach us more about our great cosmic shield and the ISM's irregularities. We're not helpless as we hurtle through it; the heliosphere gives us all the protection we need!

Dr. Ethan Siegel

Want to learn more about Voyager 1's trip into interstellar space?
Check this out: http://www.jpl.nasa.gov/news/news.php?release=2013-278.

Kids can test their knowledge about the Sun
at NASA's Space place: http://spaceplace.nasa.gov/solar-tricktionary/.

Image credit: Hubble Heritage Team (AURA / STScI), C. R. O'Dell (Vanderbilt), and NASA, of the star LL Orionis and its heliosphere interacting with interstellar gas and plasma near the edge of the Orion Nebula (M42). Unlike our star, LL Orionis displays a bow shock, something our Sun will regain when the ISM next collides with us at a sufficiently large relative velocity.