Somewhere, something incredible is waiting to be known.
Carl Sagan n

Newsletter of the Pomona Valley Amateur Astronomers

Volume 36 Number 5 ***nightwatch*** **May 2016**

President's Message

Lots of fun stuff to look at in the sky right now. Jupiter and Mars are well-placed for early evening observing. Jupiter's apparition is timely, given that the Juno probe will arrive this July 4, to begin what will hopefully be almost two years of detailed studies. Mars is getting no new visitors this year - at least not from Earth - but there are already 7 active missions on or around Mars. Those include the NASA rovers Curiosity, which will celebrate 4 years on Mars this August, and Opportunity, which by the time you read this will be about 4500 days (or almost 12.5 years) into its 90-day mission. Not bad, JPL, not bad at all.

We're entering our club's busiest season. At the coming general meeting we'll vote on club officers and on the update to the bylaws to reflect our new status as a tax-exempt non-profit corporation. Dues are also, well, due - $30 for individuals, $40 for families, and $12 for youths under 18. If you haven't already, please make your checks out to the PVAA and either mail them in (to P.O. Box 162 Upland, CA 91785) or give them to our treasurer, Gary Thompson, or another club officer at the meeting.

But it's not all club business - we're going to Mount Wilson soon! We have the evening of June 3 scheduled on the 100-inch Hooker telescope, and the following evening on the 60-inch telescope. Costs are $330 per person for the 100-inch or $100 per person for the 60-inch. Please let us know ASAP if you want in on either of these trips, as we're at the point of needing to reach outside the club to fill the rosters.

Our speaker this month is Dr. Jason Gallicchio, Assistant Professor of Physics at HMC. His talk is "Using quasars to test the mysteries of quantum mechanics." The general meeting starts this Friday, May 20, at 7:30 PM. I hope to see you there.

Matt Wedel

Club Events Calendar

`May 20, 2016 General Meeting
– Dr Jason Fallicchio –
Quasars to Test Quantum Mechanics

June 3, 2016 Mt Wilson Observing 100”
June 4, 2016 Mt Wilson Observing 60”
June 16, 2016 Board Meeting
June 24, 2016 General Meeting

July 30, 2016 Star Party - Grandview
July 14, 2016 Board Meeting
July 22, 2016 General Meeting

Aug 27, 2016 Star Party – Cow Canyon Saddle, Mt Baldy
Aug 11, 2016 Board Meeting
Aug 19, 2016 General Meeting

Sept 3, 2016 Star Party– Cow Canyon Saddle, Mt Baldy
Sept 8, 2016 Board Meeting
Sept 16, 2016 General Meeting
– Elijah Quentin –
Stars Consumed by Black Holes

Oct 1, 2016 Star Party--Afton Canyon
Oct 6, 2016 Board Meeting
Oct 14, 2016 General Meeting

Oct 29, 2016 Star Party
Nov 10, 2016 Board Meeting
Nov 18, 2016 General Meeting

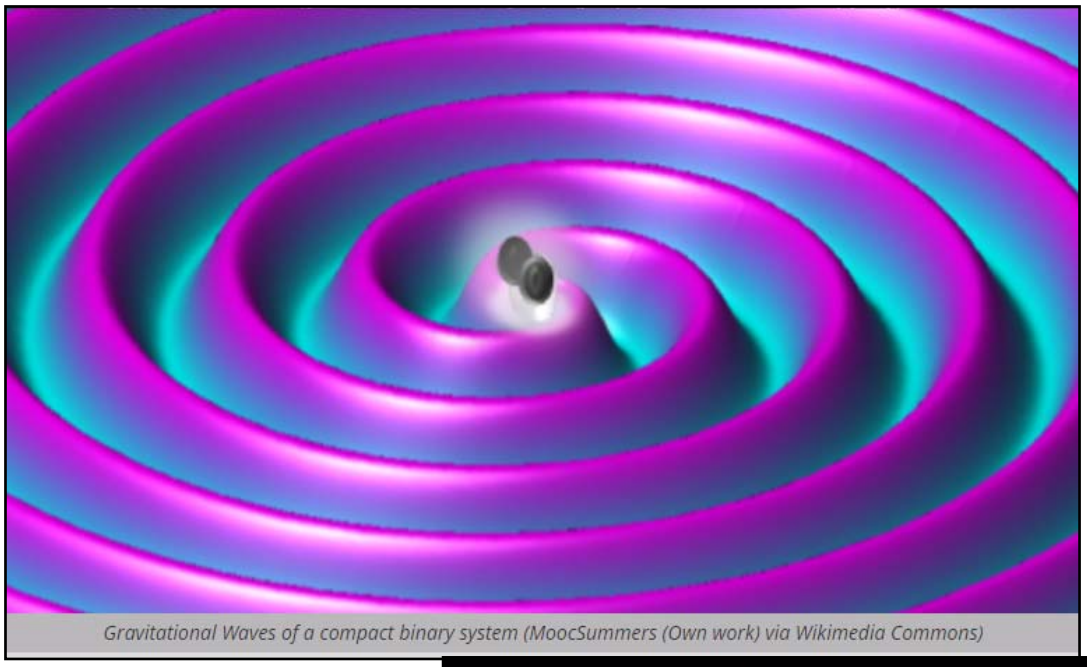
PVAA General Meeting 4/22/16

Ron Hoekwater opened the meeting and welcomed at least 6 people that were first time attendees. He also announced that there was still slots for the Mount Wilson 100" and 60" observatory nights on June 4th and 5th. The RTMC (Riverside Telescope Makers Conference) is Thursday, May 26th through Monday, May 30th. It will be held at YMCA Camp Oakes, five miles southeast of Big Bear City, California on State Route 38 at Lake Williams Road between mileposts 44 and 45.

The main speaker for the night was Citrus College Professor & member Dave Kary on Gravitational Waves, titled "Shaking Space".

Back in 1916 Einstein predicted gravitational waves, after publishing his theory on special relativity in 1905, and his theory of general relativity in 1915. Special Relativity states that if you move towards or away from a light source, the speed of light is the same as not moving. - The wavelength changes, not the speed. General Relativity extends Special Relativity to cases of acceleration. His prediction that gravity bends light was confirmed in 1920 during a total solar eclipse. Stars were plotted next to the sun, and were found to be slightly off, due to the gravity of the sun bending space.

It wasn't until 100 years later – in 2016 that scientist announced they had detected gravitational waves. LIGO – Laser Interferometer Gravitational-Wave Observatory is actually two detectors: One in Livingston, Louisiana and one in Hanford, Washington. The waves were detected during an engineering run on September 14th, 2015. Both widely spaced detectors recorded the waves. This was a long time in coming. The first LIGO detectors were completed in 1999. They were re-designed and upgraded to be ten times more sensitive between 2010 and 2014. These gravitational waves were detected within days of the new detectors coming on-line. LIGO is designed to detect a change in distance between its mirrors 1/10,000th the width of a proton! This is equivalent to measuring the distance to the nearest star to an accuracy smaller than the width of a human hair! (The mirrors are 4 kilometers apart.)

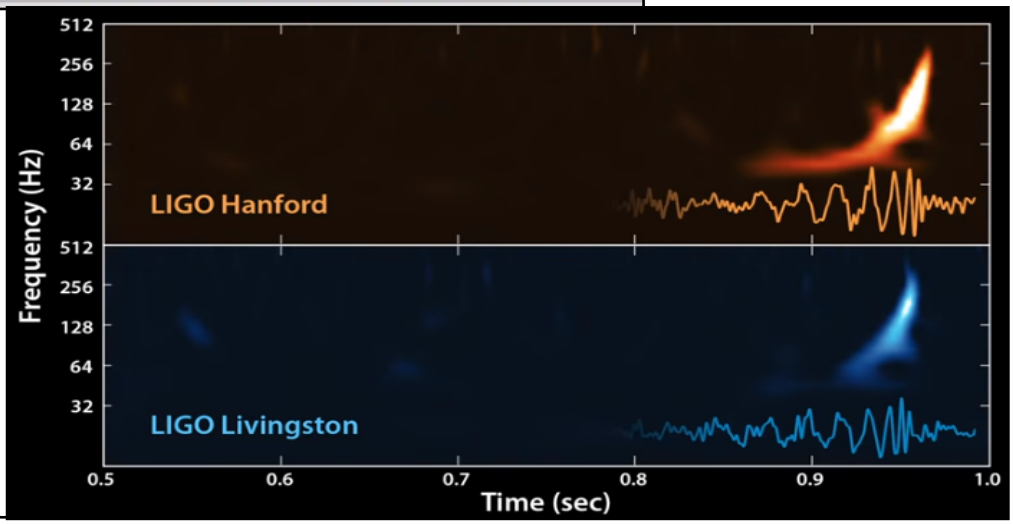


Gravitational Waves of a compact binary system (MoocSummers (Own work) via Wikimedia Commons)

So, just what are gravitational waves? Gravity is created by mass. Mass can bend the path of light. The light itself is not 'bent', but the space around the mass is warped around the mass. Light, going in a straight line follows the warped space, and seems to bend around an object. Now, lets take two massive objects – two black holes orbiting each other, bending space. These bends rotate with the black holes in their orbits. - Crossing each other – creating gravitational waves.

Gary Thompson

The LIGO website is:
https://www.ligo.caltech.edu/



48th Annual RTMC Astronomy Expo

Memorial Day weekend is almost here and for nearly half a century that means one thing to Southern California's amateur astronomers, the Riverside Telescope Makers Conference and Astronomy Expo. For many years RTMC AE, the oldest event of its kind in the western United States, has been held at Camp Oakes. But don't go because it's old. Go because it is loads of fun!

The 2016 theme is "Fun with Our Sun." Going along with that theme, this year the keynote speaker is Tamitha Mulligan Skov, a solar astronomer and "space weather forecaster." Tours of the Big Bear Solar Observatory will be available. There will be lectures on Sun related topics and vendors will display solar telescopes and filters.

At night, enjoy the 7000 foot elevation and dark skies of Camp Oakes while you hunt for faint fuzzies. This year, in addition to deep sky objects, Mars, Jupiter, and Saturn will be out as will many other amateur astronomers and telescopes.

RTMC AE is a great place to check out different equipment before you decide about a purchase. And vendors often offer special RTMC discounts. There is also a Swap Meet where you can hunt for bargains or sell that equipment that you don't use anymore.

In recent years RTMC AE has featured a Beginner's Corner for those just entering the hobby. This year is no exception. Beginners' Corner activities will involve the family in safe solar observation and there will be a Beginners' Star Party at night.

In the Main Hall there are lectures on various astronomical topics, an awards ceremony, and a free drawing for great prizes.

In addition to all the astronomy related stuff, Camp Oakes will have a schedule of various activities offered by the Camp. Everyone may enjoy the swimming pool, lake canoes, archery, mountain biking (your own bike), climbing tower, catch & release fishing, and zip line (fee charged by the camp).

This year's RTMC Astronomy Expo will run from Thursday, May 26 until Monday, May 30. The location is Camp Oakes just outside Big Bear off Highway 38. The fee is $30 for one day and $50 for the entire weekend. Children 17 and under are free. Students with student ID are ½ price.

Ron Hoekwater

PVAA Observing Sessions on Mount Wilson

PVAA has reserved the 100-inch telescope at Mount Wilson Observatory on Friday, June 3, 2016. We have the 60-inch telescope the next night, Saturday, June 4, 2016. Having the telescopes on consecutive nights will allow those who wish, to compare the two. Besides being historic instruments where great scientific discoveries of the 20th century were made, these two scopes are probably the best in the world that are available for amateurs to use.

In early June the planets Mars, Jupiter, and Saturn will all be near opposition. Early June also gives us the best chance of having a perfect night; that is a night with a dense marine layer to hold down the city lights and very steady seeing. Late summer might be better for steady seeing, but not for a marine layer to block the city light.

On a night with steady seeing both telescopes are great for observing planets. All of my best views of the planets have been with the scopes on Mount Wilson. In the past, we have seen festoons in the clouds on Jupiter and the moons of Mars.

When it comes to deep sky objects both telescopes are best at showing small, high surface brightness objects, such as planetary nebulae, globular clusters, and unusual stars. On a good night, in the 60-inch scope, the Cat's Eye Nebula or the Eskimo Nebula will knock your socks off. The 100-inch is even better, so I recommend not wearing socks or waiting until after the Eskimo to put them on. We have seen one of the Andromeda Galaxy's globular clusters. I am hoping that we might see the Einstein Cross. The Einstein Cross is a gravitationally lensed quasar about 8-9 billion light-years from Earth. To see it will require a near perfect night but, June 3-4 give us a chance for such a night. Imagine being hit in the eye by photons that are twice as old as the Earth.

Don't miss out by waiting too long. There are still spots available for both scopes. We are allowed a maximum of 25 people in the 60-inch dome and a maximum of 18 in the 100-inch dome. The minimum age permitted by the observatory is 12 years. The price for the 60-inch scope is $100.00 ($25.00 non-refundable after May 4) and the price for the 100-inch is $330.00 ($80.00 non-refundable after May 3). For questions or to reserve a spot contact Ron Hoekwater at astro4ron@gmail.com.

Ron Hoekwater

PVAA Officers and Board

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What's Up? - Crazy Pizza Moon

That's Io, the innermost moon of Jupiter. It's the most colorful object in the solar system. Its odd surface is constantly crazed by the eruptions of over 400 sulfur volcanoes. This gives it an yellow-orange scarred look that has been compared to pizza or a rotten citrus fruit. Io is larger than dwarf planets like Pluto, Ceres, and Eris. Pizza dwarf planet.

Io is unique in many other ways. It has the shortest name of any solar system object in keeping with its short synchronous rotation (always facing Jupiter like our own Moon). With over 400 erupting sulfur volcanoes it's the most geologically active of all solar system objects. This constant geological activity comes from the strong friction of tidal heating as Io is yanked between the gravity of Jupiter and its other three Galilean moons (Europa, Ganymede, and Callisto). With Io's low gravity volcanoes can send plumes of sulfur dioxides to the remarkable height of 300 miles. Its tidal heating gives Io a flexible shape that's flattens its poles. So Io has an equatorial bulge that alters over 330 ft during its speedy rotation. Because of its volcanic warmth it has no ice (or water) which makes it unique among the icy outer planets and their moons. It's has a silicate rock composition wrapped around an iron sulfide core. Its rocky composition is more like an inner planet than an icy outer one. This gives it a high density among outer planetary objects. Its crazed face features Everest high mountains, complex volcanic features, and the solar system's only surface with no known impact craters. It also has a very high level of radiation from Jupiter's magnetosphere. This makes it dangerous to the electronics of probes and potentially fatal to astronauts. It also has an unique doughnut shaped plasma torus within Jupiter's intense radiation caused by ionized sulfur, sodium, and chlorine erupting from Io's surface. An unearthly place, a crazy Hell.

Io was discovered by Galileo Galilei with a primitive refracting telescope in 1610 along with Jupiter's three other large moons (Europa, Ganymede, and Callisto). The four came to be known as the Galilean Moons. The fact that they orbited around a planet furthered the acceptance of the Copernican model of a Sun centered system. They also played a part in Johannes Kepler's laws of motion. Galileo's rival Simon Marius claimed to have seen them first, but Galileo published earlier and got the credit. But at Kepler's suggestion Marius did became responsible for naming the moons after Jupiter's lovers.

Pioneer 10 and 11 (1973 & '74) were the first spacecrafts to take photos and studies of Io. They noted it was ice free compared to the other very icy Galilean moons. Unexpected high radiation from Jupiter caused the loss of some of Pioneer's information.

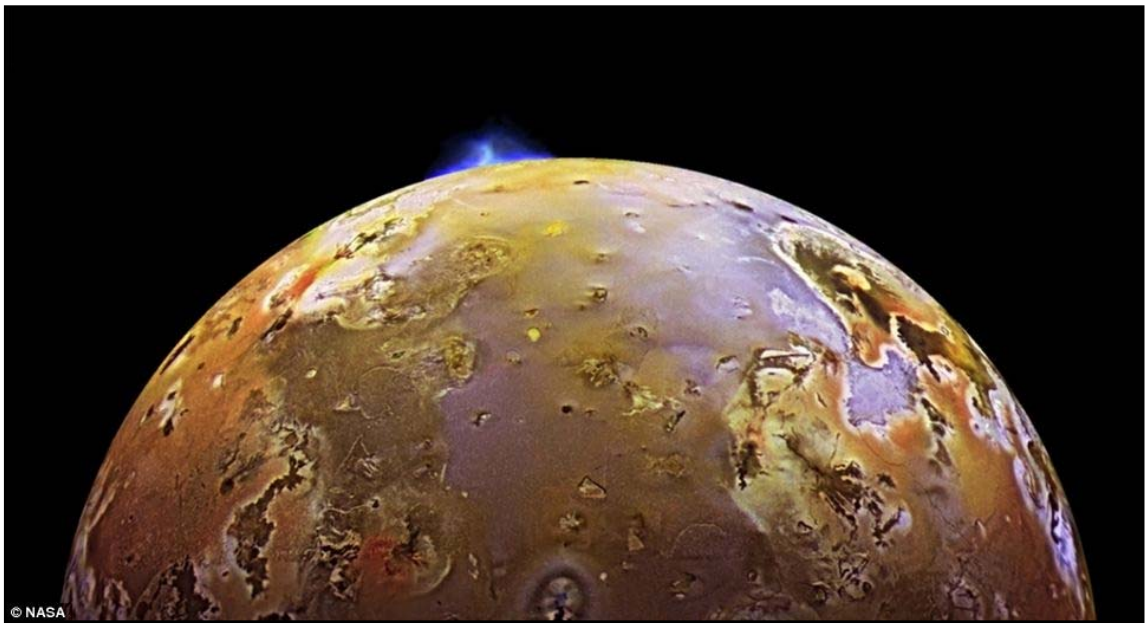
Next came Voyager I and 2 (1979) with their improved imaging systems they were able to photograph Io's crazy volcanic landscape. They also showed the first umbrella shaped plumes that proved Io to be the most volcanically active object in the Solar system.

In 1995 the Galileo spacecraft reached Jupiter. It noted many geologic changes in Io's features since the previous probes. Features such as patera (volcanic depressions) fluctus (lava flows), vallis (lava created valleys) and mons (shield volcanoes) would be named after aspects of the Io myth.

In the classical myth, Io is a priestess of the Temple of Jupiter's wife Juno. Nevertheless, Jupiter lusts after the virginal Io. In order to hide her from his wife, Jupiter turns Io into a cow. Juno finds out and sends Io (still a cow) to be watched over by Argus (a 100 eyed being). Jupiter then frees Io by ordering Mercury to play peaceful panpipe tunes to put Argus to sleep and then kill him. But Juno discovers the murder and sends a gadfly to sting Io forcing her to cow wonder across the Earth. Perhaps because of that, Io is often associated with the Earth's Moon. She was called the "Horned Moon Virgin" among her cult followers. Accordingly, moon Io is about the same size as our Earth's Moon. Jupiter eventually rescues Io and returns her to human form. Then they have two semi-divine children.

Now highly improved telescopes like the Keck in Hawaii and the orbiting Hubble are able to watch ongoing volcanic changes on Io. The New Horizons spacecraft on its way to Pluto noted the birth of entirely new volcanic vents. Future probes include Juno (launched in 2011) and JUICE (Jupiter Icy Moon Explorer) being built by the European Space Agency. Exploration of the crazy pizza moon has just begun.

Lee Collins



The Transit of Mercury from Colorado

I was in Utah from May 4 to May 15, chasing dinosaurs with Mike Taylor, a colleague of mine from England. I took a telescope along in hopes of getting some dark-sky time, and to hopefully catch the transit of Mercury on May 9.

Things did not look promising at dawn on the 9th. I was in Fruita, Colorado, and when I got out of bed, the sky was completely overcast. Mike and I decided to head out west of town to visit Rabbit Valley, where a nearly complete skeleton of the long-necked dinosaur Camarasaurus is visible in a hard sandstone ledge. We spent about two hours measuring and photographing the skeleton, and as we did so, the clouds started to break up a bit. By the time we got back to Fruita, a little after 11:00 AM, the sky was clear except for a few scattered wisps of cloud. I set up my telescope in front of the Dinosaur Journey museum and started watching and photographing the transit.

I was using my Celestron C80ED refractor, a Celestron 8-24mm zoom eyepiece, and a GoSky full aperture solar film filter. For photography, I used a Nikon Coolpix 4500 for still photos and my iPhone 5c for video.

I caught about the last hour of the transit, and I got to share the view with about a dozen museum staff and passersby. A few light clouds drifted through the field of view, which looked pretty cool and didn't obscure the view at all.

At 12:42 Mercury finished exiting the disk of the sun. The next Mercury transit will be in 2019 - I hope I'm as lucky then as I was this time.

Matt Wedel

NOAA's Joint Polar Satellite System (JPSS) to revolutionize Earth-watching

If you want to collect data with a variety of instruments over an entire planet as quickly as possible, there are two trade-offs you have to consider: how far away you are from the world in question, and what orientation and direction you choose to orbit it. For a single satellite, the best of all worlds comes from a low-Earth polar orbit, which does all of the following:

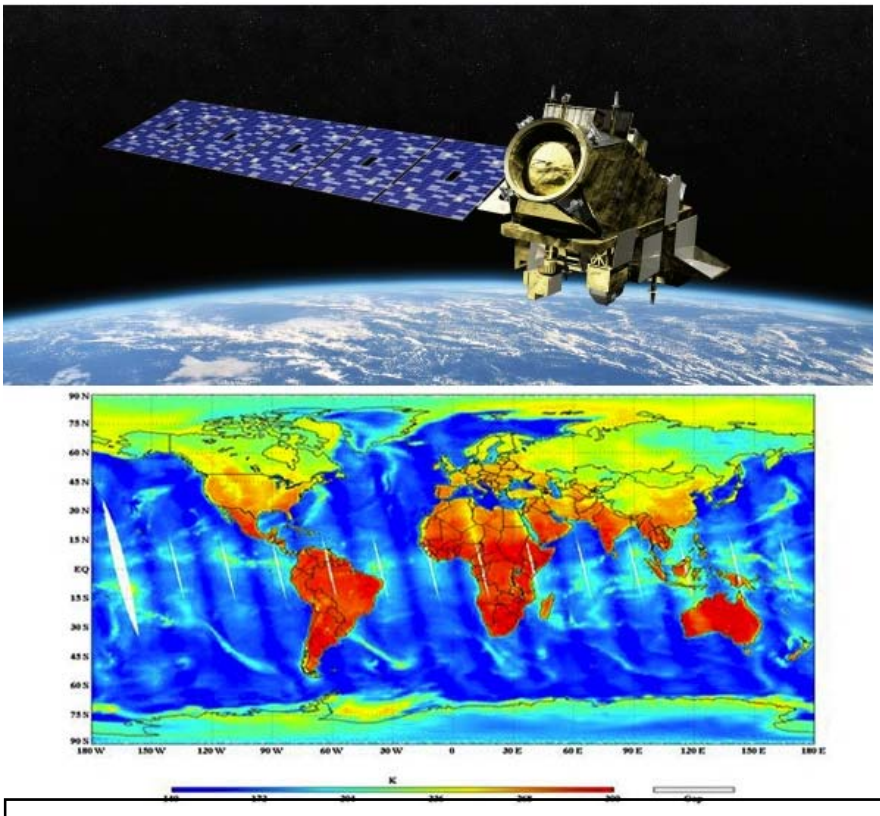
- orbits the Earth very quickly: once every 101 minutes,
- is close enough at 824 km high to take incredibly high-resolution imagery,
- has five separate instruments each probing various weather and climate phenomena,
- and is capable of obtaining full-planet coverage every 12 hours.

The type of data this new satellite – the Joint Polar Satellite System-1 (JPSS-1) -- will take will be essential to extreme weather prediction and in early warning systems, which could have severely mitigated the impact of natural disasters like Hurricane Katrina. Each of the five instruments on board are fundamentally different and complementary to one another. They are:

1. The Cross-track Infrared Sounder (CrIS), which will measure the 3D structure of the atmosphere, water vapor and temperature in over 1,000 infrared spectral channels. This instrument is vital for weather forecasting up to seven days in advance of major weather events.
2. The Advanced Technology Microwave Sounder (ATMS), which assists CrIS by adding 22 microwave channels to improve temperature and moisture readings down to 1 Kelvin accuracy for tropospheric layers.
3. The Visible Infrared Imaging Radiometer Suite (VIIRS) instrument, which takes visible and infrared pictures at a resolution of just 400 meters (1312 feet), enables us to track not just weather patterns but fires, sea temperatures, nighttime light pollution as well as ocean-color observations.
4. The Ozone Mapping and Profiler Suite (OMPS), which measures how the ozone concentration varies with altitude and in time over every location on Earth's surface. This instrument is a vital tool for understanding how effectively ultraviolet light penetrates the atmosphere.
5. Finally, the Clouds and the Earth's Radiant System (CERES) will help understand the effect of clouds on Earth's energy balance, presently one of the largest sources of uncertainty in climate modeling.

The JPSS-1 satellite is a sophisticated weather monitoring tool, and paves the way for its' sister satellites JPSS-2, 3 and 4. It promises to not only provide early and detailed warnings for disasters like hurricanes, volcanoes and storms, but for longer-term effects like droughts and climate changes. Emergency responders, airline pilots, cargo ships, farmers and coastal residents all rely on NOAA and the National Weather Service for informative short-and-long-term data. The JPSS constellation of satellites will extend and enhance our monitoring capabilities far into the future.

Ethan Siegel



Images credit: an artist's concept of the JPSS-2 Satellite for NOAA and NASA by Orbital ATK (top); complete temperature map of the world from NOAA's National Weather Service (bottom).