SIRIUS ASTRONOMER

www.ocastronomers.org

The Newsletter of the Orange County Astronomers

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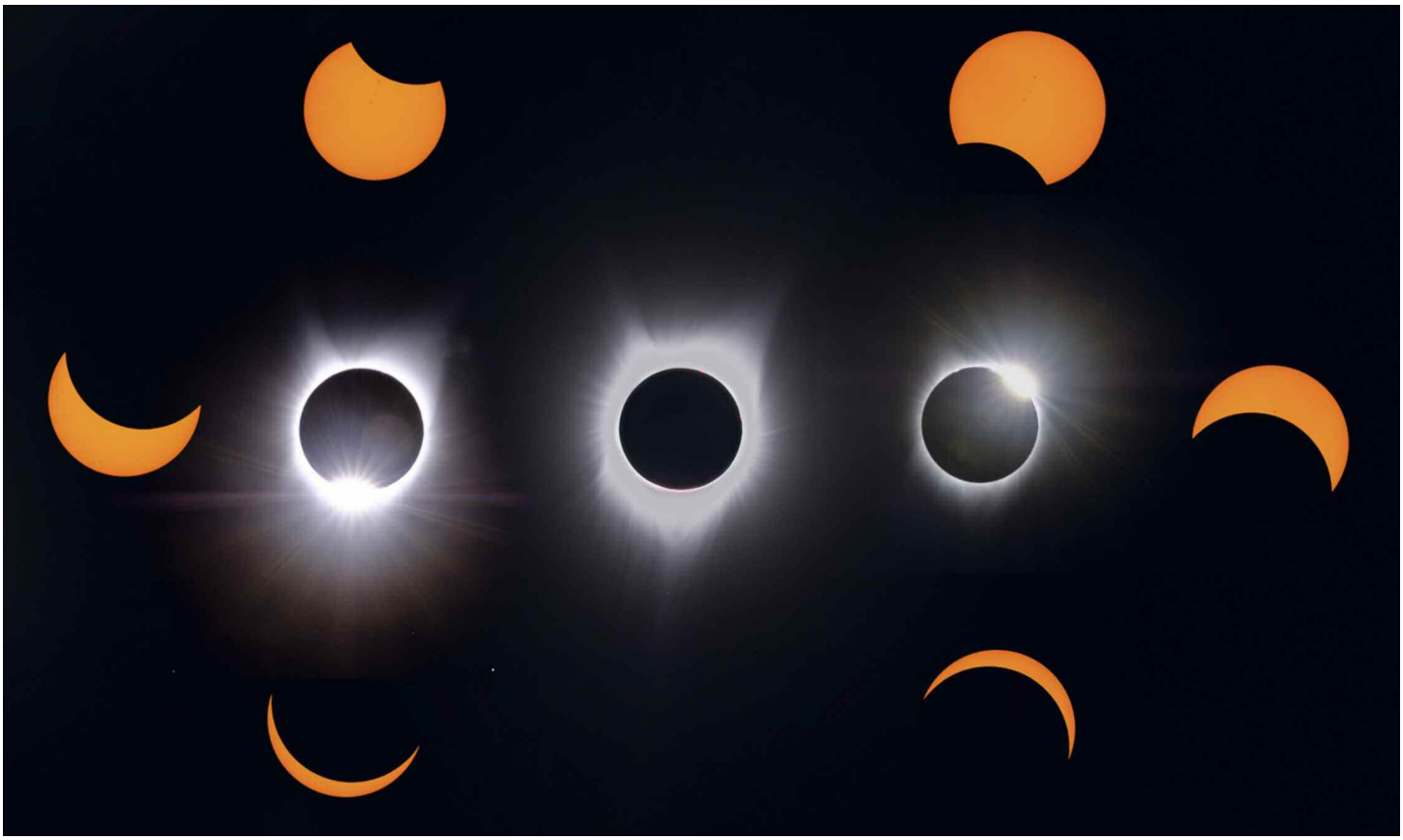


Many members shared their experiences and images of the August 21 total solar eclipse. The shots above were captured by Alan Smallbone at the rodeo grounds in Weiser, ID using a Star Adventurer mount to track the sun, and a Fujifilm X-T2 camera equipped with a Fuji 100-400mm lens, 1.4x extender at around 450mm focal length. The center totality image (which lasted 2 minutes, 5 seconds in this location) is a composite of 3 exposures without filters. The filtered images used a Thousand Oaks solar filter.

OCA CLUB MEETING

The free and open club meeting will be held on October 13 at 7:30 PM in the Irvine Lecture Hall of the Hashinger Science Center at Chapman University in Orange.

This month, NASA/JPL astronomer Trina Ray will speak about the Cassini-Huygens Mission.

NEXT MEETINGS: November 10, December 8 (speakers TBA)

STAR PARTIES

The Black Star Canyon site will be open on October 14. The Anza site will be open on October 21. Members are encouraged to check the website calendar for the latest updates on star parties and other events.

Please check the website calendar for the outreach events this month! Volunteers are always welcome!

You are also reminded to check the web site frequently for updates to the calendar of events and other club news.

COMING UP

The next session of the Beginners Class will be held on Oct 6 at the Heritage Museum of Orange County at 3101 West Harvard Street in Santa Ana.

Youth SIG: contact Doug Millar
Astro-Imagers SIG: Oct 4, Nov 1
Astrophysics SIG: Oct 20, Nov 17
Dark Sky Group: contact Barbara Toy

President's Message

By Barbara Toy

Sadly enough, after so many months of anticipation, the Great American Eclipse is now behind us. Many club members traveled to different areas along the path of totality, and those that couldn't make that trip seem to have enjoyed it as a partial eclipse from wherever they were located. Fortunately, it seems that very few people who traveled to see totality were clouded out – I've only heard of one who was clouded out entirely, though a number of people reported thin clouds.

By all accounts, traffic going to the eclipse path wasn't bad, and it seemed to be easier to find last minute viewing spots in most areas than was expected, but I've heard stories of major traffic jams in Oregon, eastern Idaho and Wyoming, in particular, when people were trying to leave afterward. One of my best friends found a last minute viewing spot in eastern Idaho, and then said she was in the worst traffic jam of her life trying to get back up to Bozeman afterward, much worse than anything she experienced in her years in Southern California. We didn't have any of those problems in western Idaho, and learned that Idaho had stopped all truck traffic from coming into the state on eclipse day, which made a big difference in our area, at least.

Many members of the AstroImagers SIG traveled to totality with detailed plans for getting pictures in addition to viewing it. The September AstroImage meeting was devoted to the early results of their work, and there's been a lot of sharing of ongoing work on the AstroImage email group. Unfortunately, we've been having problems with the club's website because of changes made by our current hosting service, and most attempts to post pictures there haven't been successful, though Reza has been working on it. The current plan is to move to another hosting service that should give us fewer problems, and hopefully then we can get more of these pictures posted for general viewing. In the meantime, some of the imagers have been posting pictures, time lapses and videos on their websites or on sites like YouTube and posting links to the email group (some to both the OCAstronomers as well as the AstroImagers group), which is another good reason to join at least one of the email groups – there's a lot of really cool eye candy coming out of this event!

There's been quite a bit of interest in having a general club event to share pictures and experiences of the eclipse, and we are tentatively planning a banquet for this that would feature presentations by several speakers with varied experiences, an slideshow of images from the eclipse and related activities, with good food and lots of opportunities for sharing memories as well as more general socializing. This will most likely be in January – stay tuned for more information!

OCA Elections

It's that time of year again! The OCA election season is starting and we will be taking nominations at the October and November meetings. As I write this, almost everyone on the current Board has agreed to run again next year. I'm particularly grateful that Reza AmirArjomand has agreed to run again for Vice President – the most important function our Vice President has is finding speakers for our meetings, and he's been finding us an array of incredible speakers even though he's having to do it at long distance.

We have eleven members on the OCA Board, four officers (President, Vice President, Secretary and Treasurer) and seven general Trustees. Any club member in good standing who has been a member for at least a year can run for the position of Trustee, Secretary or Treasurer. Anyone who has been a Trustee for at least a year can run for President or Vice President. I know there are a lot of you out there who have these basic credentials and who could contribute a lot as Board members – do consider running! And, if you have any questions about what kinds of things we do on the Board these days, please feel free to ask any Board member, or come to one of our Board meetings (the next one is November 12 at 2:00 p.m.).

The ballot will be finalized after the November meeting, so it can go out in the December Sirius Astronomer (that may seem archaic, but that's what our by-laws require). It will also be available on the website and there will be copies at the January meeting as well. You can vote by noting your choices on the ballot, putting it in an envelope and writing your name on the outside of the envelope (not on the ballot). You can either mail it to the club PO Box or deposit it in the ballot box that will be at the front table at the meetings. If more than one member of your household is a member, there needs to be a separate ballot and envelope for each person who is voting (i.e. don't put more than one ballot in the envelope). The election ends at the end of the January general meeting, so please get your ballot in before that.

Tim Hogle has generously agreed to manage the election and count the ballots again. The first step in that process is to check the names on the envelopes against the current member list to be sure each ballot is from a member in good standing, so please make that part easier by writing or printing making your name legibly on the envelope. The ballots that qualify are separated from their envelopes so, when he counts them, there is no way to tell who actually cast specific ballots.

Even if you decide that this isn't the year you want to run for a position on the Board, it's important for the health of the club that members at least participate by voting on the club leadership, so please do exercise your right to vote as a member of the club.

New WAA Representative Needed

OCA has been a member of the Western Amateur Astronomers (WAA) for decades. It's an association of clubs in the western United States (different organizations serve other areas), and its most visible current activity is selecting the annual recipient of the G. Bruce Blair Award recognizing excellence in astronomy outreach activities, which is formally awarded at RTMC each year. In the past, WAA organized conferences and provided resources for its members during times when there weren't many options available. Times change, as have the needs of member clubs, but it is still available to provide support for its members, particularly smaller or newer clubs.

Tim Hogle has been our WAA representative for many years, and would like to move out of that position. Ideally, he would like someone to volunteer to be the representative for the future, but with a transition period so he could make sure the new person has as much information as possible and is fully comfortable with the role before he leaves his position with WAA entirely.

Per the information Tim gave me, the basic responsibilities of the WAA representative are to attend two Board meetings per year (one at RTMC and one elsewhere), report back to the OCA on those meetings, solicit suggestions for OCA candidates for the G. Bruce Blair Award and formally deliver the nomination to WAA before the Winter Board meeting. Beyond that, our representative would potentially be able to influence the future course of WAA as it adapts to current conditions and determines how it can best serve the needs of its member clubs.

If you are interested in becoming the OCA representative to WAA, please email me at btoy@cox.net or Tim Hogle at TimHogle@aol.com. If you have any questions about the organization or what is involved, please contact Tim, who has worked with WAA through most of the time our club has been a member of the organization and can give you a lot of background information.

Farewell, Cassini!

September 15 marked the end of the incredibly successful Cassini mission to Saturn, with Cassini's final dive into Saturn's atmosphere. It's been such an important part of the astronomical scene for so long, with its steady stream of amazing images and all the new insights it's given on Saturn's rings, moons and the planet itself – it was like losing a fun and interesting friend. I don't know how other people took it, but I felt a deep sense of mourning on the 15th that wasn't really relieved by the fact that Cassini made its final maneuvers flawlessly and even sent back 15 more seconds of data on Saturn's atmosphere than they expected. Our close-up eye on Saturn's system is gone now – I hope those involved in funding projects like this can see the tremendous return Cassini gave us on our investment in it and will be motivated to continue funding other projects to explore our solar system and the universe beyond!

© Barbara Toy, September 2017

AstroSpace Update

October 2017
Gathered by Don Lynn from NASA and other sources

Intermediate mass black hole – Astronomers studying a compact gas cloud (called CO-0.40-0.22) near the center of our Milky Way galaxy using radiotelescopes found that the speeds of material in the cloud indicated there is a mass of about 100,000 Sun's masses in the center of the cloud. Computer simulations showed that it is most likely an intermediate mass black hole (IMBH). There are lots of known supermassive black holes (SMBHs) (millions to billions of Sun's masses) and stellar mass black holes (10-30 Sun's masses), but only scant evidence for IMBHs. It is believed that the SMBHs grew from stellar mass black holes, so they should pass through IMBH mass at some stage, so astronomers are looking very hard for IMBHs. Further work is needed to confirm this new find is an IMBH.

Gravitational lens – Astronomers using the Owens Valley Radio Observatory have discovered a gravitational lens that is allowing a magnified view of the jets spewing from a supermassive black hole. It is giving the best view yet of blobs shooting out in the jets of a supermassive black hole. The object in front, supplying the gravity that bends (radio) light and forms the gravitational lens, appears to be a massive cluster of stars. This is unusual, because most known gravitational lenses are caused by a galaxy or cluster of galaxies, not a star cluster. The resolution obtained by this lens is about a millionth of an arcsecond.

Supernova – The PROMPT telescope in Chile, which monitors about 500 galaxies, has discovered a Type Ia supernova in galaxy NGC 5643 during the first hours of its brightening. It was dubbed SN 2017cbv, and is one of the closest supernovas seen recently. A network of robotic telescopes around the world was called in immediately, providing observations as it rose in brightness. Type Ia supernovas always occur in a white dwarf star with a companion star orbiting it. It has long been debated whether the companion is a white dwarf or some other type of star. If a white dwarf, it would have to actually collide with its companion, while other types of star could cause a supernova simply by dumping part of their material onto the white dwarf. There is evidence in the past for both types of companions. The evidence in this case (light curve shape) supports a giant star companion.

Not-quite-supernova – Ordinary Type Ia supernovas destroy the white dwarf star that explodes. Over 50 cases are known, however, in which the Ia was not bright enough, and had other anomalies. These have been classed subluminous or Type Iax supernovas. A recently discovered object, dubbed LP 40-365, appears to be the remnant of a white dwarf that survived such a subluminous explosion. It has no hydrogen, helium or carbon on its surface. A subluminous supernova would be expected to blow off the hydrogen and helium, but the lack of carbon is harder to explain. Perhaps the carbon fused during the explosion or it sank below the surface. The star is speeding so fast it will leave our galaxy, another characteristic expected from a subluminous supernova.

Supernova X-rays – Scientists have discovered X-rays coming from a Type Ia supernova for the first time. It happened in galaxy ESO 336-G009, about 260 million light-years away. All previous X-rays from supernovas have been Type II. This is probably because material surrounding Type II supernovas is common, but is rare about Type Ias. The X-rays apparently are generated when shock from the explosion collides with surrounding material.

Nova remnant discovered – Astronomers have located a cloud that is the remnant of a nova explosion seen by Korean astrologers (yes, astrologers) on March 11, 1437. The star that then went nova now produces smaller dwarf nova explosions. This supports the theory that a nova and a dwarf nova (and also nova-like variable stars) are all different stages in the life of the same type of star.

Brown dwarf weather – A new computer simulation of the atmospheres of brown dwarfs best explains how the changes in winds and clouds produce the variations in brightness that we observe. Melted iron drops and silicate dust form patchy clouds. The clouds get thicker or thinner and move surprisingly fast. The clouds form in bands similar (in shape, not constituent material) to those seen on Jupiter. Brown dwarfs are stars with insufficient mass to maintain the fusion of elements that powers normal stars.

Mapping a star's surface – Astronomers have made a map of the speeds of materials on the surface of the star Antares, the first such map other than of the Sun. They used the Very Large Telescope Interferometer in Chile, which links a few telescopes together. They found unexpected turbulence in Antares' atmosphere, much farther out than turbulence predictions.

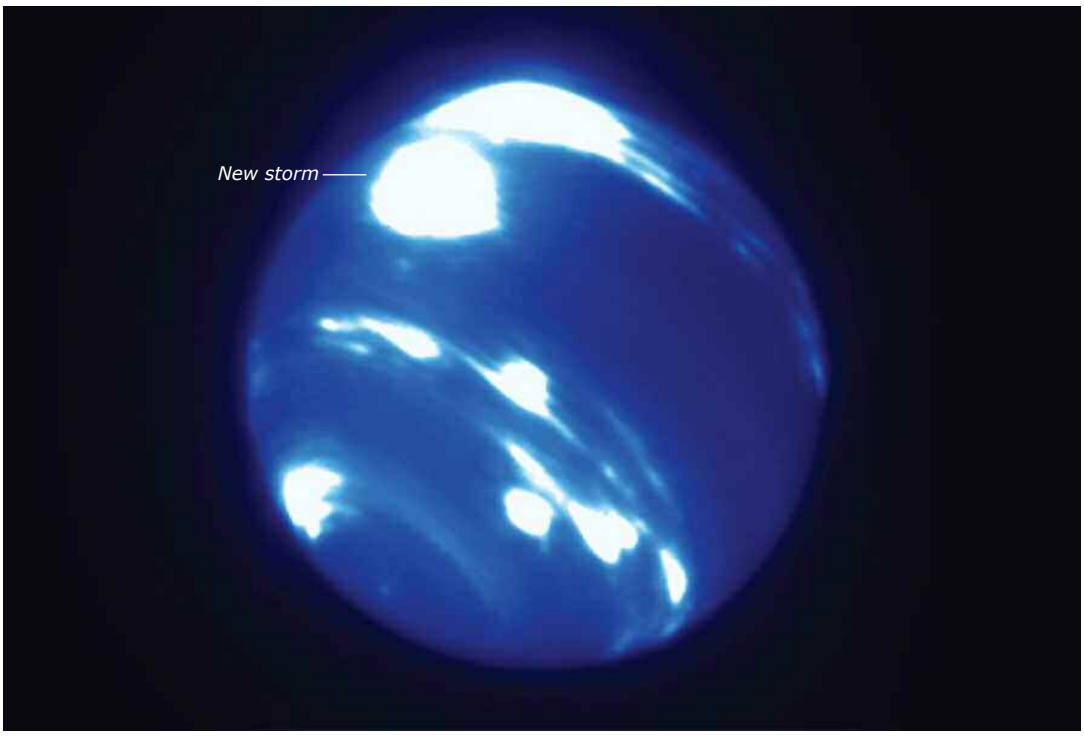
Variable Pleiades – Bright stars are too bright for professional telescopes to accurately measure their brightness. The Pleiades were in a recent field of view of the Kepler planet-finding space telescope. Variable star astronomers have been using the brightness measurements of Kepler for their work also. But the Pleiades and similar stars just saturated the Kepler detectors, making measurements inaccurate. A new technique has been developed that calibrates brightness to what is measured in pixels away from the center of saturated star images. It was applied to the Kepler data, giving the best yet measurements of variability of the brighter stars of the Pleiades. 6 of the 7 brightest Pleiades were shown to be slowly-pulsating B stars, a class that varies with a period of about a day. The other, Maia, was known to have varying

strengths of manganese spectral lines. The Kepler data showed that Maia's brightness varies with the same period (about 10 days) as the manganese. No planetary transits were seen in any of the Pleiades' light curves.

Tidally locked planets – A new study of all the possible kinds of planets, and their host stars, and planetary rotation periods, and types of orbits that are likely to form, and how those orbits age, has concluded that tidally locked planets are much more common than thought. A tidally locked planet keeps the same side toward its star as it makes each orbit. This is caused by effects of tidal forces of the star on the planet. None of the planets in our Solar System is tidally locked to the Sun, though Mercury came close, so the initial thought (before this study) was that tidal locks would be rare in exoplanets also.

Instant AstroSpace Updates

Astronaut **Peggy Whitson** returned to Earth from the International Space Station (ISS) in early September to conclude a stay in space of 288 days. She holds a number of records: Most time (665 days) in space of any American astronaut (8th behind 7 cosmonauts), 1st female to command ISS twice, most (10) spacewalks by a female, most time (60.3 hrs) spacewalking by a female, and several others.



Neptune in infrared. Credit: N. Molter/I. De Pater, UC Berkeley/C. Alvarez, W. M. Keck Observatory

A new bright storm almost the size of Earth has been discovered on **Neptune**, and it is located near that planet's equator, where no large bright storm has ever been seen.

Laboratory experiments duplicating conditions deep (over 5000 miles = 8000 km below the clouds) within ice giant planets (Uranus or Neptune) have for the first time produced **diamond snow**, previously theoretically predicted. The tiny diamonds likely slowly fall to the core where they accumulate in a layer.

A new computer simulation of Mars' atmosphere shows that it is possible for **Martian water snow** to fall during drops in temperature occurring only at night (dry ice snow has long been known to occur on Mars). It would not cover the ground deeply, but more resemble thick frost.

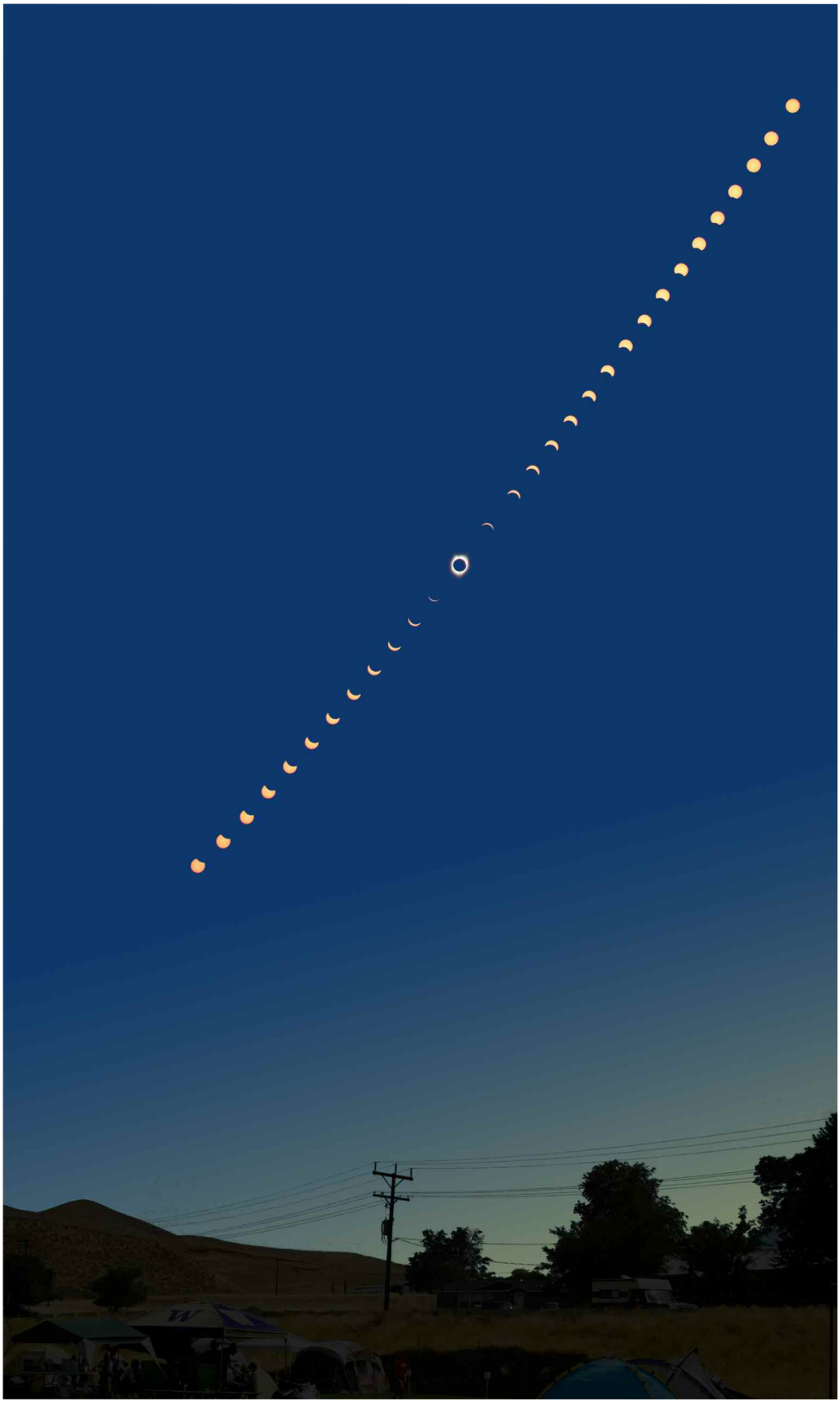
A new study of the **Rusty Rock** brought back from the Moon by Apollo 16 astronauts shows that the Moon, during its formation, likely drove off volatile material, including water, from the interior. This is in contradiction to the recent findings based on study of glass beads brought back from the Moon, which seemed to show the interior might have a fair amount of trapped water.

By the time you read this **Cassini** will have ended its mission by intentionally crashing into Saturn, burning up the spacecraft, eliminating any possibility of contaminating Saturnian moons with the few earthly microbes that likely live inside the craft. Cassini was launched in 1997 and has been orbiting Saturn since 2004, making numerous discoveries.

Jim Bridenstine, a congressman from Oklahoma, and a member of the congressional Science, Space and Technology Committee, has been nominated (subject to Senate confirmation) to **head NASA**. As is usual after election of a new President, Charles Bolden had resigned this position in January.

Gallery

Total Solar Eclipse, August 21, 2017 – Many members traveled long distances this summer to witness the rare coast-to-coast eclipse. Naturally, several have submitted their beautiful images and personal experiences. So, we decided to share a few of them in this month's newsletter. Hope you enjoy!



Credit: David Cook

Eclipse Sequence, Huntington, OR
By David Cook

Original composite image derived from the sensor size of the Canon 50D camera at 15mpix. The camera was on a fixed tripod, and I had a timer to take a picture every 5 minutes. You can see that I missed the first contact picture, since my setup for this camera was delayed by a few problems with my other camera tracking on my Skywatcher ED100 refractor.

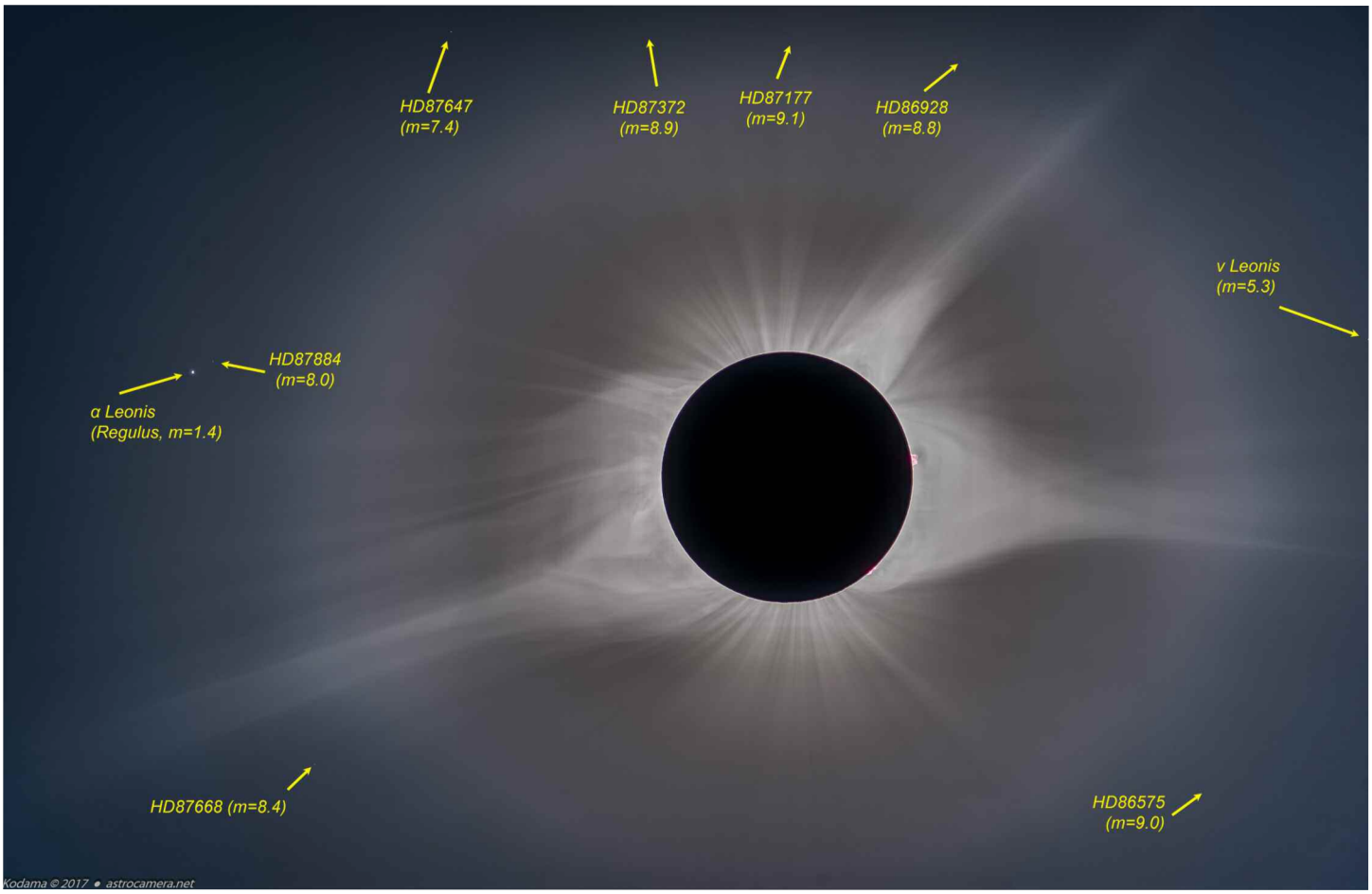
Elements of this composite image were taken with a Canon 50D, using a Sigma 18-250mm lens set at 18mm. Of the 30 separate images taken, 29 used a filter (1/500, f8, ISO 200), and one image at totality with no filter (1/8, f8, ISO 200).

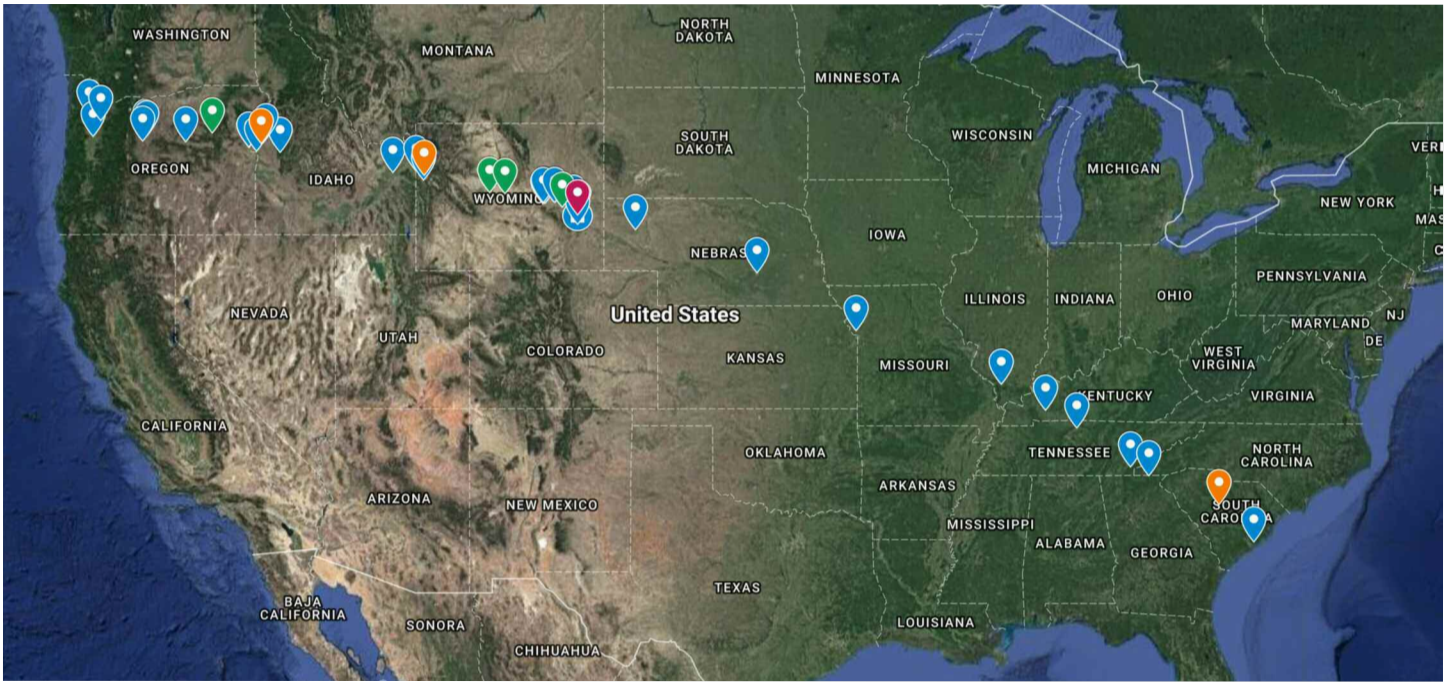
A picture of the foreground taken before the eclipse, and darkened appropriately. My picture of the sky color during totality was hopelessly over-exposed, so I had to use Photoshop to try and replicate the sky color at totality as best I could. I used Photoshop to put the images together.

For those interested, I made a video of the eclipse sequence using images taken every 60 seconds through my Skywatcher refractor, and put into a video sequence. You can view it on Youtube here: **https://youtu.be/6DDjqmXHbTs**.

Mid-Eclipse, Glendo, WY
By Dave Kodama

This is a mid-eclipse HDR (combination of a 12-frame exposure bracket) view of the corona using a Borg 100ED with 1.04x field flattener (effective focal length ~650mm). The star Regulus (α Leonis, magnitude +1.4) in the constellation Leo is visible at left. Additional stars down to 9th magnitude can be seen. Composite sequence captured starting from 1/1000 sec., up to 2 sec. using a Nikon D600 full-frame camera at ISO 100.





Dave Kodama gathered some solar eclipse observing locations of OCA members, friends and family for the 2017 eclipse. Locations of OCA members are seen in light blue. For an interactive map, go to ***http://www.astrocamera.net/2017/0821/locations/*** *Credit: Dave Kodama*

Total Eclipse Over South Falls, OR
By Jay Glowacki

I had decided on viewing the eclipse at Silver Falls State Park in Oregon a year and a half before the eclipse after having visited it the year before. I had hoped to photograph the eclipse at its North Falls and scouted it out at the 10:17 a.m. time of totality the day before. But there was no reasonable location in the narrow canyon from which to view the falls and eclipse together. Upper North Falls also was not practical. So my wife and I then went to South Falls about 11:15 a.m.

The sun was visible but there was no way to be certain that it was going to rise above and between the trees at eclipse time. Almost gave up on walking down the canyon and setting up, but when we arrived at 8:30 a.m. eclipse day, there seemed to be a good chance that somewhere along a 100 feet length of the path near the base of the falls that the sun would appear at totality. I guessed where the 'sweet' spot might be and set up on the end of the foot bridge that crosses the stream near the base of the falls.

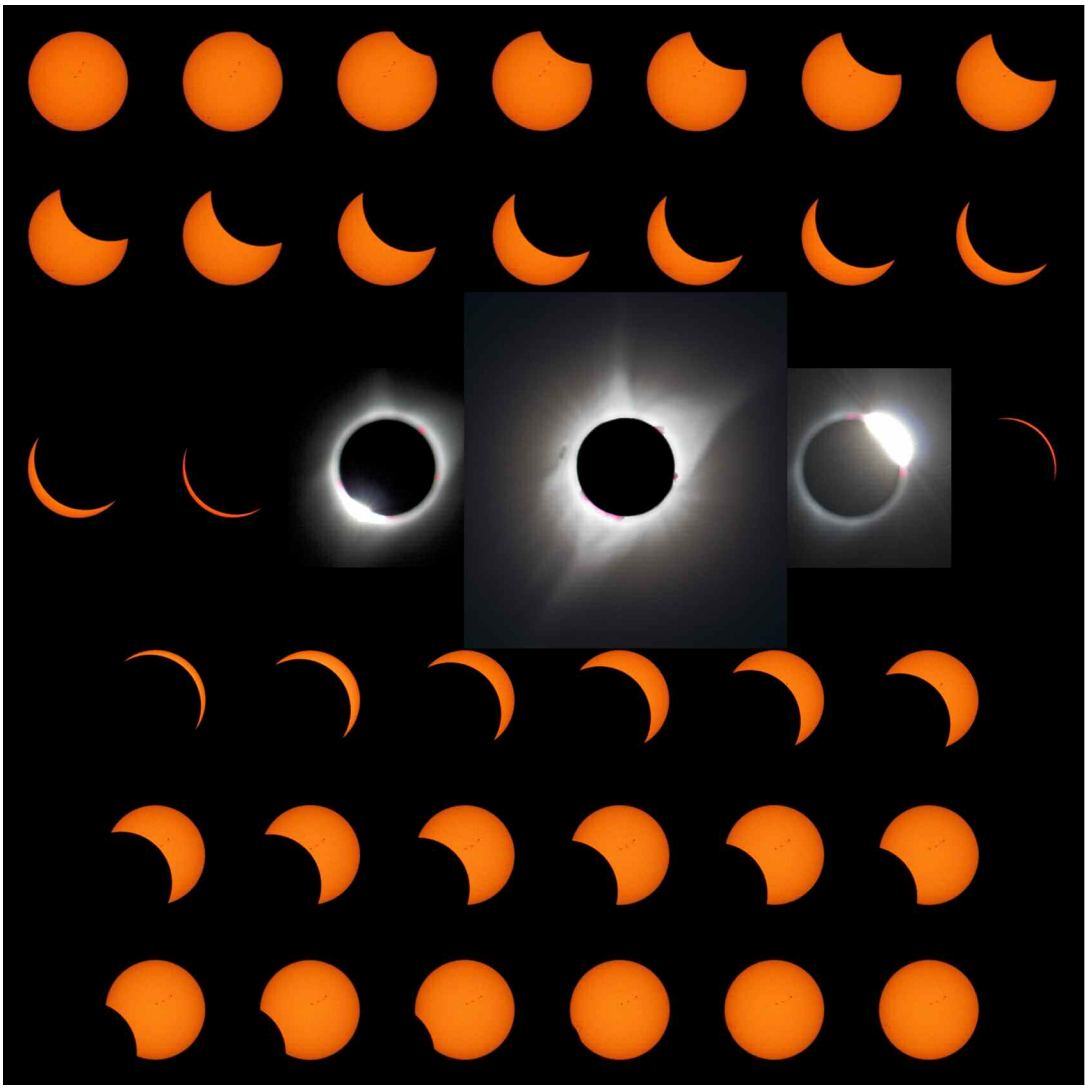
My Plan B was that at T-30 minutes if I couldn't sing *Here Comes the Sun*, I'd have 10 minutes to pack up, 12 minutes to walk up the canyon at a fast clip (it took 10 minutes to walk down) and 8 minutes to set up again. A few other visitors started congregating and 45 minutes prior to totality the sun was in the trees and assured us we'd be singing!


Credit: Jay Glowacki

At the mention by someone thatit would be really dark (my remembrance of Baja in 1991 was that it didn't get super dark), I decided to take a couple of photos while the sun was still partial and behind the trees. Totality came and went quickly and abruptly – and it was REALLY dark, but awesome!

Being in a narrow canyon 170 feet below the surrounding land likely created that darker-than-normal scene. And disappointingly, when processing the image later, no amount of 'gain' would pull out the waterfall and stream. So this is actually a composite of a before- and during-totality photo. But the scene is real – eerie but somehow peaceful.

Image was taken with a Canon EOS DLSR, at ASA100, f/4, 1/4 second exposure with 1/2 second time delay after mirror flip, RAW, noise reduction, the 3rd of an auto 3-bracket exposure, 35-135mm lens at 35mm.



Credit: Don Lynn

Eclipse Montage, Rigby, ID
By Don Lynn

I took these images from Rigby, Idaho, in the City Park. I used a tripod-mounted Canon T1i with 250 mm lens set at f8, ISO 400.

No filter for the 3 totality images, orange safe solar viewing filter mounted over the lens for the partial phases, which are mostly 1/1000 sec.

The central totality image is a stack of 10 images from 1/4 to 1/1000 sec. to cover the range of brightness of the corona. The interval between images is mostly 5 minutes, but obviously closer for the diamond-ring-totality images (totality lasted 2 minutes, 14 seconds).

The town had an eclipse street fair for the occasion where, of course, I had to buy a T-shirt. But I passed on the eclipse face painting.

Credit: John Castillo

Earth Shine, Madras, OR
By John Castillo

This was imaged at R+D Ranch in Madras, OR, using a Canon 6D with Eclipse Orchestrator to automate the shutter.

The composite combines 10 images ranging from 1/2000- to 1/2 second exposures, all at ISO 400.

November Guest Speaker: Dr. Tamitha Skov

Dr. Tamitha Mulligan Skov is a space weather forecaster who has been helping the public understand the effects of Space Weather on our daily lives since 2013. She works primarily in the fields of solar and space physics research and in the testing of spacecraft materials in realistic space radiation environments. Her forecasting work as the "Space Weather Woman" is widely known on social media such as You Tube, Twitter, and Facebook and you may have caught her on several television shows for The Weather Channel and The History Channel. She also serves on outreach panels for civil and government agencies, including NASA, The American Meteorological Society (AMS), The National Science Foundation (NSF), and more.

Tamitha received her Ph.D. in Philosophy, Geophysics and Space Plasma Physics as well as her Masters in Science, Geophysics and Space Plasma Physics, both at UCLA.

Magazine Subscriptions

Subscriptions to the Astronomy magazines are now due for renewal, if you subscribed for one year or would like to subscribe at the club rate. You may also extend an existing subscription that does not end in December for one year at the club rate. Bring your check made out to the OCA to the meeting or mail it to:

Charlie Oostdyk, Orange County Astronomers, PO Box 1762, Costa Mesa, CA 92628
Checks made out to the magazine publishers cannot be processed and will be returned to you.
If you already subscribe, please provide the mailing label or the billing invoice with your check.
One-year rates are as follows:

	Club Rate	Regular Rate
Sky & Telescope*	**$33.00**	$42.95
ASTRONOMY	**$34.00**	$42.95

***Sky & Telescope subscribers please note: Details of how on-line renewals will be handled still have not been provided by the publisher. Look for more information in the August newsletter.**

***Astronomy subscribers can now renew on-line with a credit card.**
E-mail Charlie@CCCD.EDU for special instructions and the renewal code.

The **DEADLINE** for subscribing at the club rates will be the **October monthly meeting, October 13th.** The publishers will send expiration notices to all current club subscribers about November 1st even if you renew through the club. It takes the publishers a few weeks to process renewals.

Orange County Astronomers has a new online shop! The icon link to the shop can be found on the homepage of the OCA website. **Support OCA and BUY A TEE!** The direct link is:

http://www.neatoshop.com/artist/Orange-County-Astronomers

Estate Sale:

12-inch Meade LX200 classic telescope and Meade Pictor imaging package.
Includes field tripod, wedge, keypad, power supplies and cables, 8x50 and red-dot finder scopes, eyepieces, printed documentation, and various visual and photographic accessories. All items have been stored in a dry and secure location since last used by original owner. Offered as a complete set for $2000.
Technical questions should be directed to Bruce Waddington, bw_msg01@earthlink.net, (949) 939-0063.
For other questions or to make purchase arrangements, please contact Ms. Mary Ann Wood, 562-417-5242.

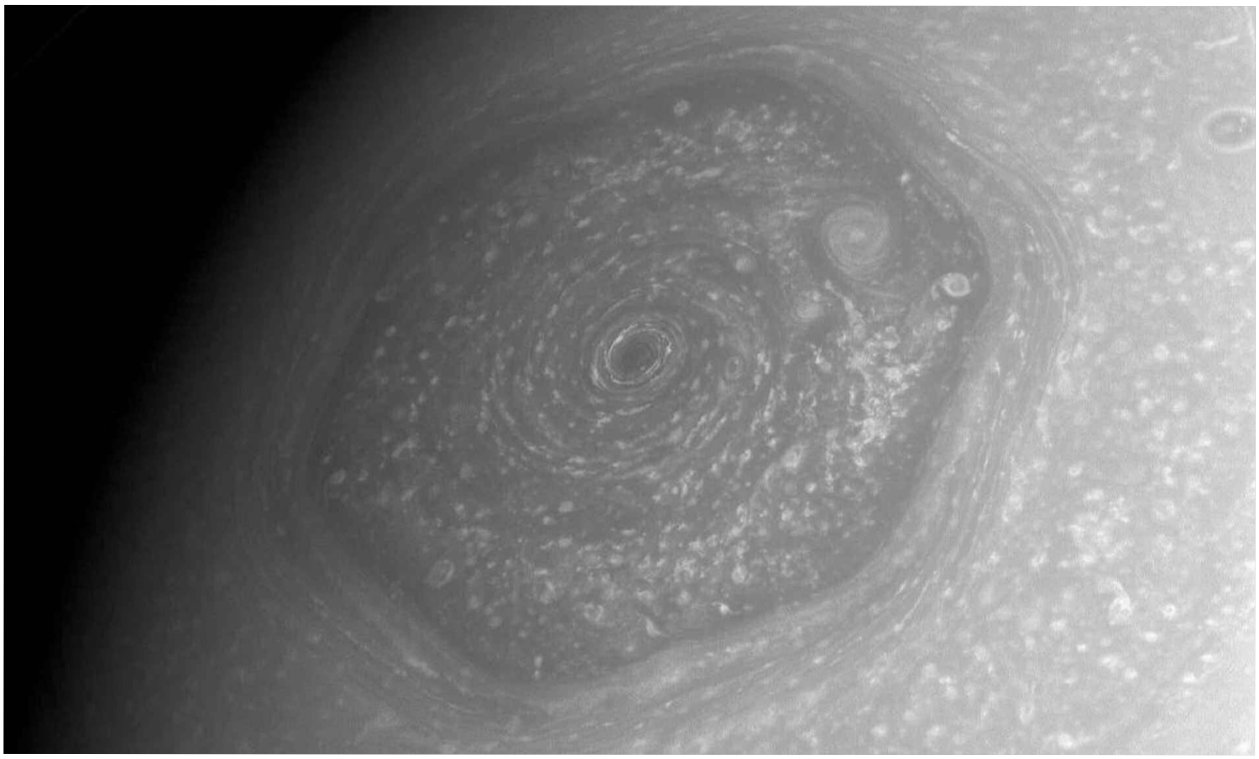
CGEM DX Series Mount & Tripod
Wifi and StarSense technology compatible. 50lb payload capacity and 40,000 object database. Includes computer hand control, car battery adapter, integrated tray/tripod, and Lithium/ion battery. Mount has only been used a few times.
$500 - You pick up or I can deliver local in the OC. (Missing 1 counterweight which I can provide for an extra $100.)
Also available, Losmandy tripod (no mount) with steel legs and Losmandy dampening paws, $100. Contact Val, 949-380-1244.

Cassini Says Goodbye

By Teagan Wall

On September 15th, the Cassini spacecraft will have its final mission. It will dive into the planet Saturn, gathering information and sending it back to Earth for as long as possible. As it dives, it will burn up in the atmosphere, much like a meteor. Cassini's original mission was supposed to last four years, but it has now been orbiting Saturn for more than 13 years!

The spacecraft has seen and discovered so many things in that time. In 2010, Cassini saw a massive storm in Saturn's northern hemisphere. During this storm, scientists learned that Saturn's atmosphere has water vapor, which rose to the surface. Cassini also looked at the giant storm at Saturn's north pole. This storm is shaped like a hexagon. NASA used pictures and other data from Cassini to learn how the storm got its six-sided shape.



This image of the hexagonal storm on Saturn's north pole was taken by Cassini in 2013. Credit: NASA/JPL-Caltech/Space Science Institute

Cassini also looked at some of Saturn's moons, such as Titan and Enceladus. Titan is Saturn's largest moon. Cassini carried a lander to Titan. The lander, called Huygens, parachuted from Cassini down to the surface of the moon. It turns out, Titan is quite an exciting place! It has seas, rivers, lakes and rain. This means that in some ways, Titan's landscape looks a bit like Earth. However, its seas and rivers aren't made of water—they're made of a chemical called methane.

Cassini also helped us learn that Saturn's moon Enceladus is covered in ice. Underneath the ice is a giant liquid ocean that covers the whole moon. Tall geysers from this ocean spray out of cracks in the ice and into space, like a giant sneeze. Cassini flew through one of these geysers. We learned that the ocean is made of very salty water, along with some of the chemicals that living things need.

If there is life on Enceladus, NASA scientists don't want life from Earth getting mixed in. Tiny living things may have hitched a ride on Cassini when it left Earth. If these germs are still alive, and they land on Enceladus, they could grow and spread. We want to protect Enceladus, so that if we find life, we can be sure it didn't come from Earth. This idea is called planetary protection.

Scientists worry that when Cassini runs out of fuel, it could crash into Titan or Enceladus. So years ago, they came up with a plan to prevent that from happening. Cassini will complete its exploration by diving into Saturn—on purpose. The spacecraft will burn up and become part of the planet it explored. During its final plunge, Cassini will tell us more about Saturn's atmosphere, and protect the moons at the same time. What an exciting way to say goodbye!

To learn more about Saturn, check out NASA Space Place: **https://spaceplace.nasa.gov/all-about-saturn**

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 ***https://spaceplace.nasa.gov/*** *to explore space and Earth science!*

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**NEWSLETTER OF THE
ORANGE COUNTY ASTRONOMERS
P.O. BOX 1762
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