The Prairie Astronomer

October 2015 Volume 56, Issue #10

Pluto: Blue Sky in the Kuiper Belt

October Program

Brett Boller

Beginning Astrophotography

"Who would have expected a blue sky in the Kuiper Belt? It's gorgeous," said Alan Stern, New Horizons principal investigator.

Night Sky Network

The Newsletter of the Prairie Astronomy Club

The Prairie Astronomer

NEXT PAC MEETING: October 27, 7:30pm
At Hyde Memorial Observatory

PROGRAM

“Beginning Astrophotography” by Brett Boller.

FUTURE PROGRAMS

November: “How to Buy a Telescope”

December: PAC Holiday Gathering

January: “How to Use Your Telescope”

Buy the book! The Prairie Astronomy Club: Fifty Years of Amateur Astronomy.
Order online from Amazon or lulu.com.

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EVENTS

October 24, Homestead National Monument, Howling Homestead

PAC Meeting
"Beginning Astrophotography" Brett Boller
Tuesday October 27th, 2015, 7:30pm
Hyde Observatory

Branched Oak Observatory Star Party
November 14

PAC Meeting
"How to Buy a Telescope"
Tuesday November 24th, 2015, 7:30pm
Hyde Observatory

PAC Holiday Gathering (members only)
Tuesday December 29th, 2015, 7:30pm
Location to be determined

Newsletter submission deadline November 15

2015 STAR PARTY DATES

Photo by Brian Sivill

Dates in underlined are closest to the new moon

Jan 16,23, Feb 13,20
Mar 13,20, Apr 10,17
May 8,15, Jun 12,19
Jul 10,17
NSP Jul 12-17
Aug 7,14, Sep 4,11
Oct 9,16, Nov 6,13
Dec 4,11

Lunar Party Dates
Mar 27, Apr 24, Jul 24, Aug 21

(Lunar party dates are tentative, sites to be determined.)

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Subscribe through GoogleGroups.
To post messages to the list, send to the address:

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Panhandleastronomyclub.com
www.universetoday.com/
www.planetary.org/home/
http://www.darksky.org/

Night Sky Network

PAC Meeting Minutes

Minutes for the meeting of Sept. 29, 2015

President Jim Kvasnicka called the meeting to order, 14 members, no visitors.

Upcoming events:

Hyde Observatory is open every Saturday night, 7-10 PM

The next PAC star parties are Friday October 9 and October 16 at the Farm.

Branched Oak Observatory is having a Star-B-Q fundraiser also on Oct. 9th Brian mentioned the efforts of Michael Sibbernsen to construct an observatory at Branched Oak Lake and the event he has on the 9. Brian encouraged PAC members to attend with 'scopes, etc. to support Mike's efforts.

Homestead National Monument will host 'Howling Homestead' on Saturday Oct. 24 from 7 to 10PM.

The next PAC meeting will be Tuesday Oct. 27 at 7:30PM.

Twilight on the Tall Grass at Spring Creek Prairie was a great success with over 500 people in attendance Saturday, September 26. Also, the lunar eclipse viewing at Homestead was well attended.

Jim provided his monthly observing report. He highlighted the constellation Aquarius and its notable objects for observing.

Club business:

Treasurer's report. One CD has been renewed and our 990-N has been filed. John has been updating the membership roster, noting that we had 60 paid members. The AL has been trying to institute paperless publications, notably, the bi-monthly newsletter. John will keep us posted. The Amazon smile program has been generating some money for us.

Nominations for club officers:

President: Jim Kvasnicka

Vice President: Brett Boller

2nd Vice President: Beth Jenckes

Secretary: Lee Taylor

Treasurer: John Reinert

Nominations will remain open until the October meeting.

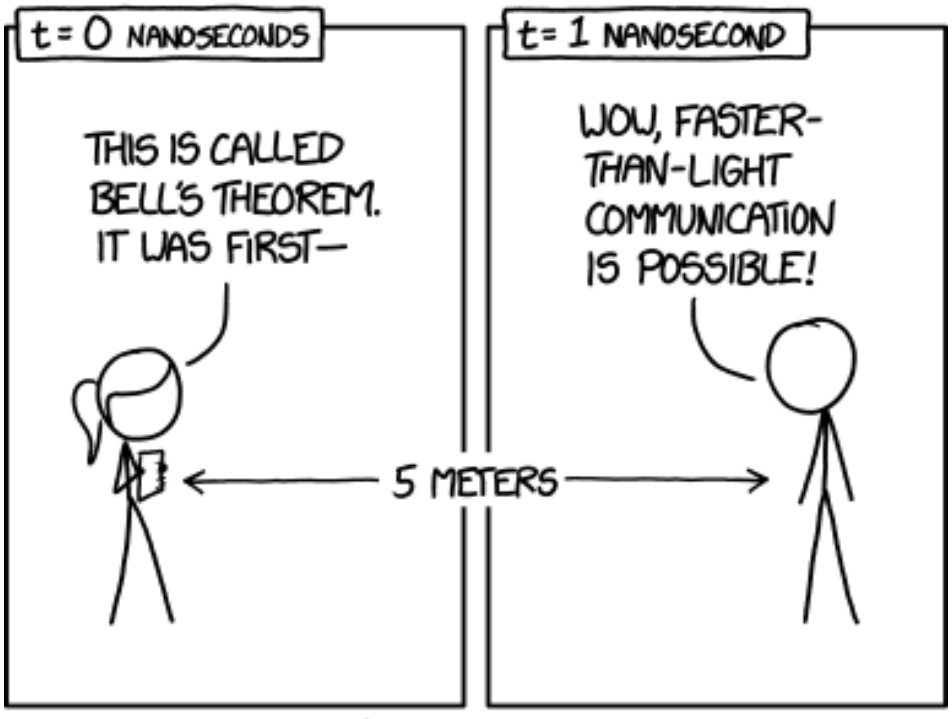
Jim invited discussion about Branched Oak as to the suitability for an observing site, etc. Brian noted that the north sky is darker than the south, in contrast to the farm which has good south skies, and limited to the north by Lincoln skyglow. He proposed holding one of our two monthly star parties there to assess the site. Jim asked Brett and Brian to keep us posted on the progress at Branched Oak.

Jim voiced concerns about needing volunteers at Branched Oak when we have trouble staffing Hyde currently.

Adjourn to tonight's program: 'What you're missing by not doing outreach'.

2016 Star Party Dates

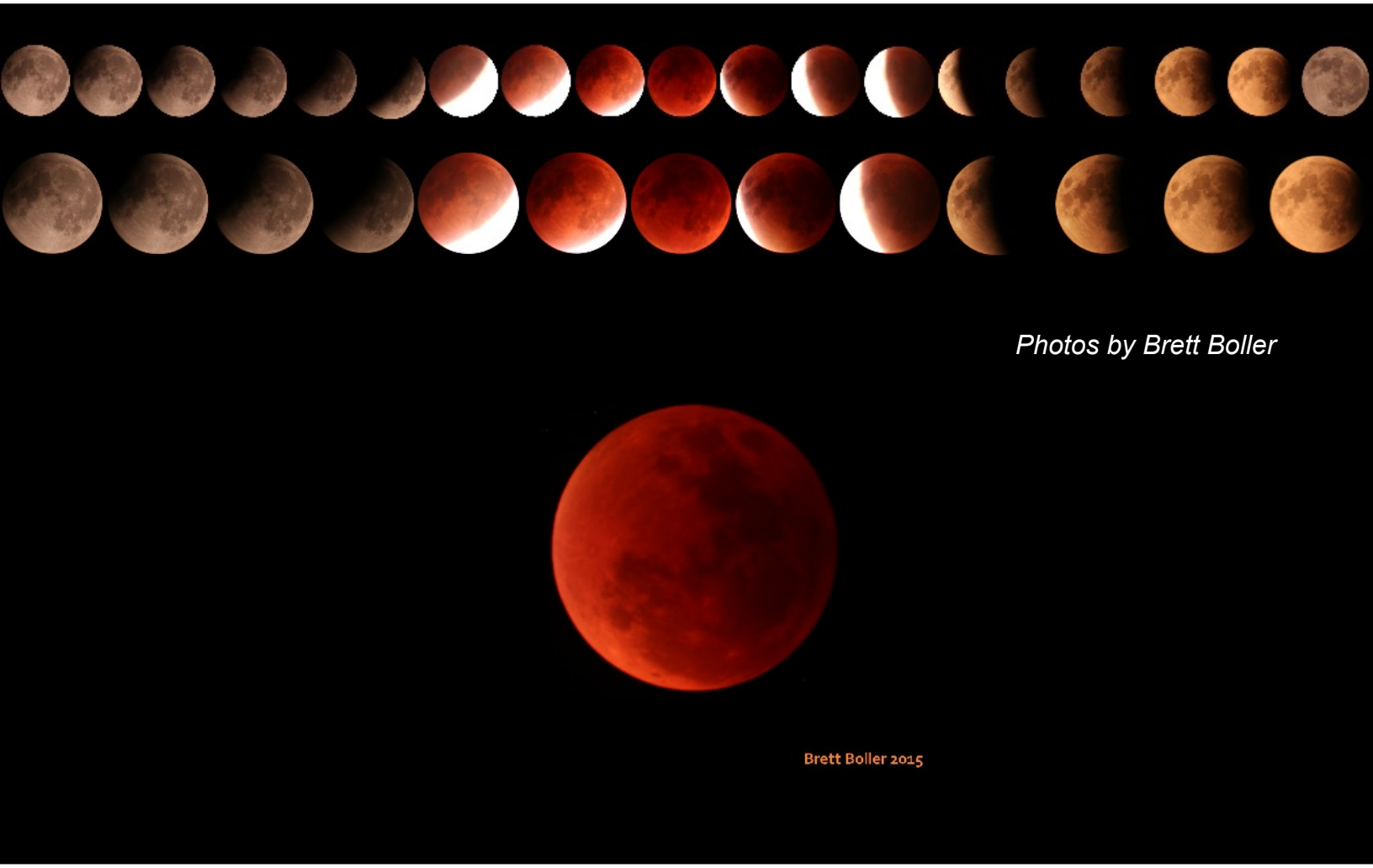
	Star Party Date	Star Party Date	Lunar Party Date
January	Jan 1st	**Jan 8th**	
February	Jan 29th	**Feb 5th**	
March	Mar 4th	**Mar 11th**	
April	Apr 1st	**Apr 8th**	Apr 15th
May	Apr 29th	**May 6th**	May 13th
June	May 27th	**Jun 3rd**	
July	**Jul 1st**	Jul 8th	
NSP	**July 31st - August 5th**		
August	Jul 29th	**Aug 5th**	Aug 12th
August	Aug 26th	**Sep 2nd**	Sep 9th
September	Sep 23rd	**Sep 30th**	
October	Oct 21st	**Oct 28th**	
November	Nov 25th	**Dec 2nd**	
December	Dec 23rd	**Dec 30th**	



xkcd.com

BELL'S SECOND THEOREM:
MISUNDERSTANDINGS OF BELL'S THEOREM HAPPEN SO FAST THAT THEY VIOLATE LOCALITY.

Lunar Eclipse Photos, September 27, 2015



Photos by Brett Boller

Photos by Mark Dahmke

Photos by Mark Dahmke

New Pluto Images: Blue Sky in the Kuiper Belt

The first color images of Pluto's atmospheric hazes, returned by NASA's New Horizons spacecraft last week, reveal that the hazes are blue.

"Who would have expected a blue sky in the Kuiper Belt? It's gorgeous," said Alan Stern, New Horizons principal investigator from Southwest Research Institute (SwRI), Boulder, Colorado.

The haze particles themselves are likely gray or red, but the way they scatter blue light has gotten the attention of the New Horizons science team. "That striking blue tint tells us about the size and composition of the haze particles," said science team researcher Carly Howett, also of SwRI. "A blue sky often results from scattering of sunlight by very small particles. On Earth, those particles are very tiny nitrogen molecules. On Pluto they appear to be larger — but still relatively small — soot-like particles we call tholins."

Scientists believe the tholin particles form high in the atmosphere, where ultraviolet sunlight breaks apart and ionizes nitrogen and methane molecules and allows them to react with each other to form more and more complex negatively and positively charged ions. When they recombine, they form very complex macromolecules, a process first found to occur in the upper atmosphere of Saturn's moon Titan. The more complex molecules continue to combine and grow until they become small particles; volatile gases condense and coat their surfaces with ice frost before they have time to fall through the atmosphere to the surface, where they add to Pluto's red coloring.

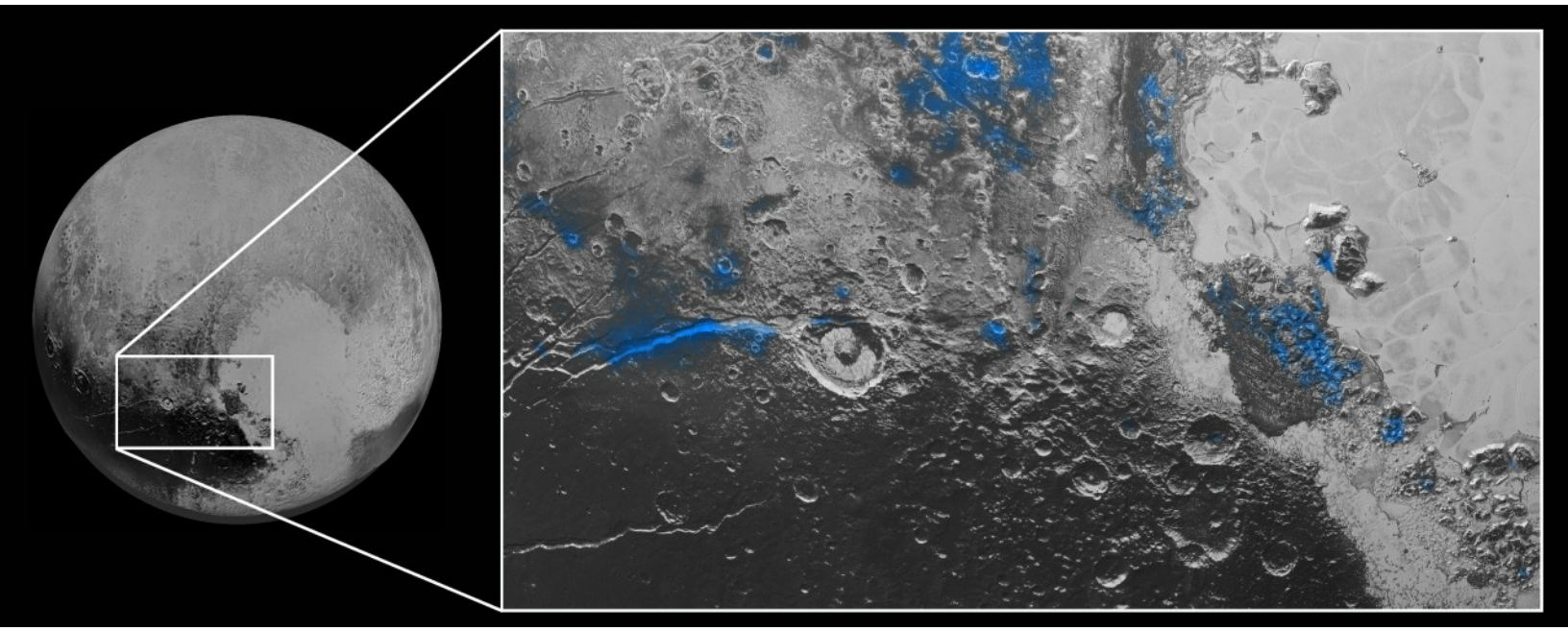
In a second major finding, New Horizons has detected numerous small, exposed regions of water ice on Pluto. The discovery was made from data collected by the Ralph spectral composition mapper on New Horizons.

"Large expanses of Pluto don't show exposed water ice," said science team member Jason Cook, of SwRI, "because it's apparently masked by other, more volatile ices across most of the planet. Understanding why water appears exactly where it does, and not in other places, is a challenge that we are digging into."

A curious aspect of the detection is that the areas showing the most obvious water ice spectral signatures correspond to areas that are bright red in recently released color images. "I'm surprised that this water ice is so red," says Silvia Protopapa, a science team member from the University of Maryland, College Park. "We don't yet understand the relationship between water ice and the reddish tholin colorants on Pluto's surface."

The New Horizons spacecraft is currently 3.1 billion miles (5 billion kilometers) from Earth, with all systems healthy and operating normally.

New Horizons is part of NASA's New Frontiers Program, managed by the agency's Marshall Space Flight Center in Huntsville, Alabama. APL designed, built, and operates the New Horizons spacecraft and manages the mission for NASA's Science Mission Directorate. SwRI leads the science mission, payload operations, and encounter science planning.

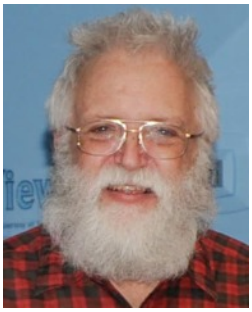


Water Ice on Pluto: Regions with exposed water ice are highlighted in blue in this composite image from New Horizons' Ralph instrument, combining visible imagery from the Multispectral Visible Imaging Camera (MVIC) with infrared spectroscopy from the Linear Etalon Imaging Spectral Array (LEISA). The strongest signatures of water ice occur along Virgil Fossa, just west of Elliot crater on the left side of the inset image, and also in Viking Terra near the top of the frame. A major outcrop also occurs in Baré Montes towards the right of the image, along with numerous much smaller outcrops, mostly associated with impact craters and valleys between mountains. The scene is approximately 280 miles (450 kilometers) across. Note that all surface feature names are informal. (Credit: NASA/JHUAPL/SwRI)

Cover: Pluto's Blue Sky: Pluto's haze layer shows its blue color in this picture taken by the New Horizons Ralph/Multispectral Visible Imaging Camera (MVIC). The high-altitude haze is thought to be similar in nature to that seen at Saturn's moon Titan. The source of both hazes likely involves sunlight-initiated chemical reactions of nitrogen and methane, leading to relatively small, soot-like particles (called tholins) that grow as they settle toward the surface. This image was generated by software that combines information from blue, red and near-infrared images to replicate the color a human eye would perceive as closely as possible. (Credit: NASA/JHUAPL/SwRI)

NGC 5248

Rick Johnson



NGC 5248 is a spectacular spiral galaxy that doesn't get nearly the attention from amateur imagers as it should. It is located in the very southwest corner of Bootes just over the border from Virgo and is considered a member of one arm of the Virgo Cluster. That means its distance is likely in the 50 to 60 million light-year range. I can't find any consensus in the literature. I'm going to go with the 60 million light-year figure as it is a good average for the cluster. Even though the average of all non redshift measurements at NED are only 50 million light-years with the newest estimates at only 40 million. Assuming the 60 million light-year distance it is some 170,000 light-years in diameter when the very faint outer arms are included. Some but not all classifications consider these outer arms a pseudo ring giving its classification as (R)SB(rs)bc. It also has a Seyfert 2 core with HII emission. This comes from a ring of star forming clouds 12" in diameter around the core. Seeing was fair for my image but I only picked up this ring as a mottling around the outer edge of the round core. High resolution images from the HST show the core has its own spiral structure, sort of a spiral with in a spiral. https://upload.wikimedia.org/wikipedia/commons/f/f1/Ngc5248-hst-R814G547B336.jpg Oddly, even with all this star formation going on one paper calls the galaxy inactive. http://mnras.oxfordjournals.org/content/379/4/1249.full.pdf They also give its distance as 74 million light-years. While the core is quite active the disk appears to have little star formation. Some images show a few HII regions in the main dust lane but they are small. The over all color of the galaxy is much redder than in most

spirals. It may be this lack of disk star formation that caused it to be listed as inactive in the paper though it does contrast it to Seyfert 2 galaxies without ever mentioning it too is a Seyfert 2 galaxy.

While all sources call it a slightly barred galaxy I am unable to see any hint of the bar, even in the HST image. Occasionally the bar is seen only at radio frequencies. This might be such a case. It is true the arms come off this 12" diameter ring of star formation rather than the core but I see no bar leading to this ring.

The galaxy was discovered by William Herschel on April 15, 1784. It is in the original Herschel 400 observing program. My notes from that read: "Large, almost round galaxy with nearly starlike nucleus. Interesting detail seen in the halo. I can almost see the spiral arms. I must come back to this one on a good night." My notes on conditions read "Thick ground fog". As you likely know I often mention reshooting an image but it rarely happens. Seems I had that same issue back in April of 1985 as I never recorded revisiting it even though I put several exclamation points after that comment. It's a big universe out there with too much to explore for me to find time to go back to the old. That's my excuse anyway.

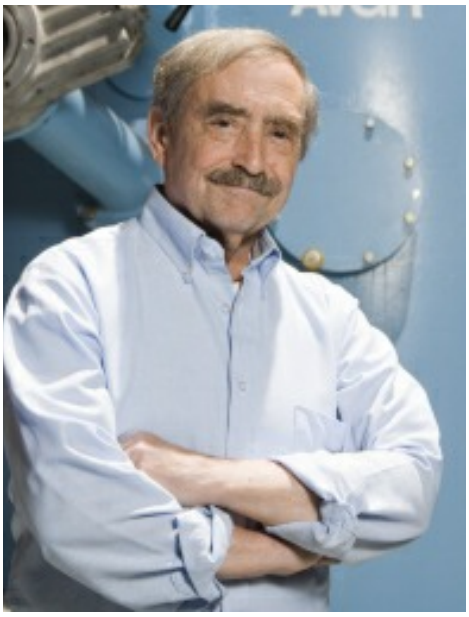
Large but faint outer arms like seen here are often the sign of interaction with another galaxy. None are in my frame though I didn't check around the area outside the field. More likely lack of star formation in the disk as well as the active core are due to something it digested in the past. This can kill star formation except in the dense core giving a galaxy this appearance. But it certainly isn't required that this happened. It may just be natural for this galaxy.

Only one quasar and two asteroids are in the image The field contains a lot of galaxies but few had redshift data leading to a rather sparse annotated image. As with much of my imaging of late the night went south on me. Color data is highly suspect. One green frame never was taken as it was scheduled last and conditions got so bad that after the first green frame the observatory shut down. I didn't discover the missing green frame until I went to process it. Fortunately green is the least critical color and there was no space junk in the single green frame. Every blue and 3 luminance frames had at least one piece of space junk, some frames had two. With no space junk I managed to make the one green frame do.

NGC5248 cropped at 0.8” per pixel.

What Smacks into Ceres Stays on Ceres

Ceres, the largest object in the asteroid belt and closest dwarf planet to Earth, had been remarkable for its plain surface. New research suggests that most of the material that has struck Ceres in high-speed collisions has stuck — billions of years worth of meteorite material.



"This is really contrary to previous estimates for small bodies," Schultz said. "The thought was that you'd eject more material that you'd collect, but we show you can really deliver a ton of material." Peter Schultz is a planetary geoscientist at Brown University. [Pete was also a founding member of PAC.]

PROVIDENCE, R.I. [Brown University] — A new set of high-velocity impact experiments suggests that the dwarf planet Ceres may be something of a cosmic dartboard: Projectiles that slam into it tend to stick.

The experiments, performed using the Vertical Gun Range at NASA's Ames Research Center, suggest that when asteroids and other impactors hit Ceres, much of the impact material remains on the surface instead of bouncing off into space. The findings suggest the surface of Ceres could consist largely of a mish-mash of meteoritic material collected over billions of years of bombardment.

The research, by Terik Daly and Peter Schultz of Brown University, is published in Geophysical Research Letters .

Ceres is the largest object in the asteroid belt and the nearest dwarf planet to Earth. Until the recent arrival of the Dawn spacecraft, all that was known about Ceres came from telescopic observations. The observations showed Ceres to be mysteriously low in density, suggesting it is made either of very porous silicate material, or perhaps contains a large layer of water ice. Observations of its surface were remarkable as well — largely for being unremarkable.

"It's really bland in the telescopic observations," said Daly, a Ph.D. student at Brown and the study's lead author. "It's like someone took a single color of spray paint and sprayed the whole thing. When we think about what might have caused this homogeneous surface, our thoughts turn to impact processes."

And to understand impact processes, the researchers turned to NASA's Vertical Gun Range, a cannon with a 14-foot barrel that can launch projectiles at up to 16,000 miles per hour. For this work, Daly and Schultz wanted to simulate impacts into low-density surfaces that mimic the two broad possibilities for the composition of Ceres's surface: porous silicate or icy.

"The idea was to look at those two end-member cases, because we really don't know yet exactly what Ceres is like," Daly said.

For the porous silicate case, the researchers launched impactors into a powdered pumice. For the icy case, they used two targets: snow, and snow covered by a thin veneer of fluffy silicate material, simulating the possibility the Ceres's ice sits below a silicate layer. They then blasted these targets with pebble-sized bits of basalt and aluminum, simulating both stony and metallic meteorites.

The study showed that in all cases, large proportions of the impact material remained in and around the impact crater. This was especially true in the icy case, Daly said.

“We show that when you have a vertical impact into snow — an analog for the porous ice we think might be just beneath the surface of Ceres — you can have about 77 percent of the impactor’s mass stay in or near the crater.”

The results were a bit of a surprise, said Schultz, who has studied impact processes for many years as professor of earth, environmental, and planetary sciences at Brown.

“This is really contrary to previous estimates for small bodies,” Schultz said. “The thought was that you’d eject more material that you’d collect, but we show you can really deliver a ton of material.”

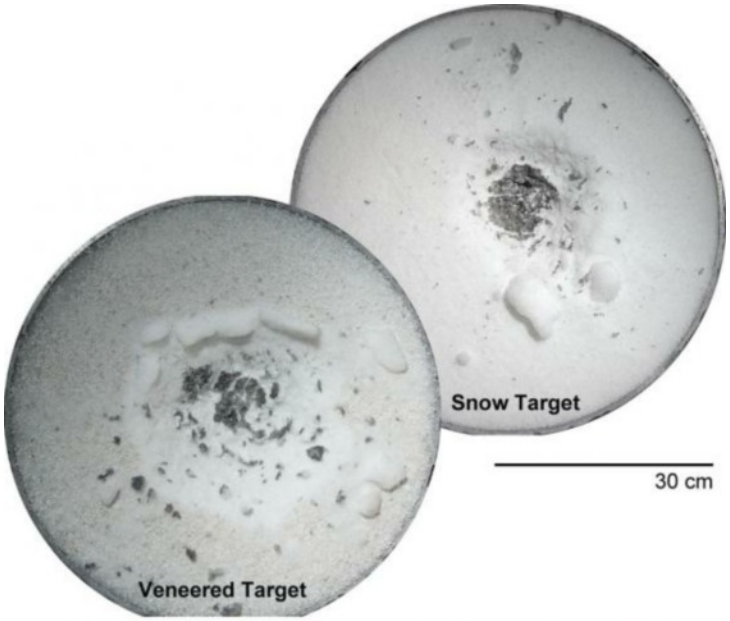
The impact speeds used in the experiments were similar to speeds thought to be common in asteroid belt collisions. The findings suggest that a majority of impacts on porous bodies like Ceres cause an accumulation of impact material on the surface.

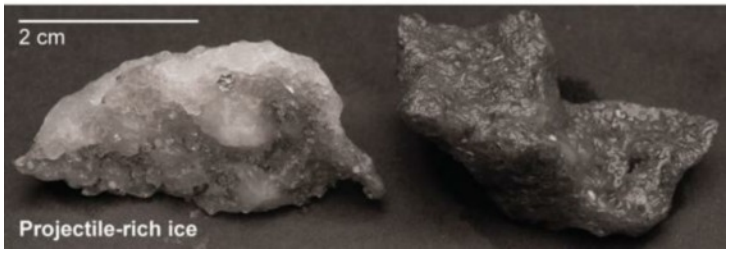
“People have thought that perhaps if an impact was unusually slow, then you could deliver this much material,” Schultz said. “But what we’re saying is that for a typical, average-speed impact in the asteroid belt, you’re delivering a ton of material.”

Over billions of years of such impacts, Ceres may have accumulated quite a bit of non-native material, Daly and Schultz said, much of it mixing together to create the relatively nondescript surface seen from telescopes. The researchers are hopeful that as the Dawn spacecraft scans the surface at much higher resolution, it might be able to pick out individual patches of this delivered material. That would help confirm the relevance of these experiments to celestial bodies, the researchers say.

The results have implications for missions that aim to return asteroid samples to Earth. Unless the landing sites are carefully chosen, the researchers say, those missions could end up with samples that aren’t representative of the object’s original material. To get that, it might be necessary to find an area where there has been a relatively recent impact.

“You can’t do this like the old claw crane from the arcade,” Schultz said. “You can’t just reach down and grab whatever’s there. You may need to find a fresh impact where perhaps the native stuff has been churned up.”





Cosmic flypaper

Experiments using a high velocity cannon suggest that when asteroids hit targets that are icy or made of porous silicate materials, much of the impact material stays in the crater. The findings have implications for the surface composition of the dwarf planet Ceres.

Image: NASA Ames Research Center

Finding Time and Finding your Latitude like Lewis & Clark did!

Eugene Lanning

Lewis & Clark are not exactly noted for their astronomical skills, but for their explorations in 1804-1806 of the Louisiana Territory, and points on to the West. What is not appreciated is that what they did required astronomical skills to be able to provide important information to the map makers! Their accuracy was amazing, given that they only had relatively primitive tools to accomplish their goals, but were skilled in the use of their tools. This report is about re-discovering the use of the tools that Lewis & Clark had at their disposal. The intriguing question became could I do as good as a frontiersman in 1804? Exactly how did they use their tools?

Most of us know that seafarers of old used a sextant and "brought down" the image of the Sun to the horizon, read the sextant and then made a Hollywood inspired proclamation. Well, there is just so much factual learning a person can extract from modern films! I was fortunate to borrow a sextant from the Lewis and Clark Interpretive Center (in Nebraska City, NE). From literature and basic optics I learned not only how to correctly use the sextant, and also how to calibrate the sextant.

One issue, a critical one, presented itself. Seafarers know where the horizon is – it is obvious and it is all around them! Now take the land situation that Lewis and Clark, and I, were in: hills, mountains, and trees all make the position of the horizon uncertain. Fortunately, Lewis' journals had not only a write-up of how they solved the problem, but a really good description of the instrument too! They used an "Artificial Horizon", and there are two basic types. It was confirmed to be used by Lewis in his journals. It took considerable practice, and trial and error, to perfect the

decided to construct the type that Lewis said was his preferred type, a mirrored type. Using my wood shop I was successful in creating an artificial horizon that matched Lewis' description (see photos).

Um, now I have the tools, but can I use them as Lewis and Clark did to determine when noon is? There is a process of using the sextant and sighting on the Sun in the morning and in the evening called "Equal Altitudes",

process while sitting out in the Sun. On September 1 of this year I took the necessary readings, and was able to determine the time of Noon with only 11 seconds of error! During the experimentation I found that one must account for the change in declination of the Sun between the readings, and that Lewis & Clark also took that into account – so they were astronomically savvy enough to know about the changing declination of the Sun. Also, in Lewis' journals it is mentioned that they set their chronometer (a watch) to mean solar time vs the "sundial noon" that the Equal Altitudes process provides, so one concludes that Lewis & Clark were astronomically savvy that the Earth's speed in its orbit is not consistent.

Lewis and Clark also used their sextant and artificial horizon to determine their latitude by taking sightings on Polaris (Yes, Lewis' journals shows he was able to correctly identify many of the brighter stars). It was decided that too would be an interesting experiment to try. Unfortunately the optics of the sextant were such that Polaris could not be used because of sextant light losses. It was possible, however, to determine the latitude from sighting on the Sun. Why Lewis elected to stay up late to sight on Polaris vs the Sun is a mystery to me, as the corrections are comparable in complexity for either of the methods. The corrections needed include refraction of the atmosphere, topographic position to geocentric position, and the declination of the Sun. For all of those corrections, and more, there is evidence that both Lewis and Clark were proficient with the corrections - corrections that even today many amateur astronomers do not know about.

On September 11 the sextant and the artificial horizon were used to measure the position of the Sun at 13:25, 13:32, and 13:40 (times around "Sundial Noon" that was previously established) and the result was that the latitude at the observation point was determined to be only 21 arc-seconds different from the GPS readings. The 21-arc-second translates to an error in position of just 0.4 miles!

The accuracy of 11 seconds for noon, and my position accurate to 0.4 miles convinced me that the methods used by Lewis & Clark were reproduced. Other minor changes could be implemented that should further improve the accuracy. It is also evident that Lewis and Clark need credit for being explorers, botanists, frontiersmen, but also as savvy astronomers! No GPS units, no Schmidt-Cassegrain telescope for them, they did it using primitive equipment!

The artificial horizon has been donated to the Lewis and Clark Interpretative Center and will go on display early in 2016.

Project support:

- Mr. Friedi (Executive Director, Lewis & Clark Interpretive Center, Nebraska City) for loan of a sextant and allowing hours reading Lewis & Clark journals, general support, and for the opportunity to discuss the project in public meetings at the Center
- Nebraska City Utilities, for the donation of a level that has a sensitivity of only two arc-second per 2 mm
- Bob Marron (North American Survey Supply Cop., Philadelphia) for donating transit leveling screws so that the artificial horizon could be leveled very precisely

November Observing: What to View

Jim Kvasnicka

This is a partial list of objects visible for the upcoming month.

Planets

Saturn: Low in the southwest sets about 1½ hours after sunset.
Neptune and Uranus: In Aquarius and Pisces.
Mars, Venus, and Jupiter: Jupiter rises just after 3:00 a.m. followed by Venus and then little Mars.
Mercury: Reaches superior conjunction with the Sun on November 17th and is too low in the dusk to be seen for most of the month.

Meteor Showers

Leonids: The weak shower peaks the night of November 17-18.
Taurids: Late October through mid-November. The Taurids are known for bright fire balls

Messier List

M27: The Dumbbell Nebula in Vulpecula.
M30: Class V globular cluster in Capricornus.
M56: Class X globular cluster in Lyra.
M57: The Ring Nebula in Lyra.
M71: Class XII globular cluster in Sagitta.
M72: Class IX globular cluster in Aquarius.
M73: Asterism in Aquarius.
Last Month: M11, M16, M17, M18, M24, M25, M26, M55, M75
Next Month: M2, M15, M29, M31, M32, M39, M110

NGC and other Deep Sky Objects

NGC 488: Galaxy in Pisces.
NGC 524: Galaxy in Pisces.
NGC 752: Open cluster in Andromeda.
NGC 7541: Galaxy in Pisces.
NGC 7640: Galaxy in Andromeda.

Double Star Program List

Iota Trianguli: Yellow primary with a pale blue secondary.
Gamma Arietis: Two equal white stars.
Lambda Arietis: Yellow and pale blue pair.
65 Piscium: Yellow pair.
Psi 1 Piscium: Equal bluish white pair.
Zeta Piscium: White primary with a yellow secondary.
Alpha Piscium: Close white pair.
Gamma Andromedae: Almach, gold and greenish blue pair.

Challenge Object

NGC 7782 Galaxy Group: NGC 7782 is the brightest in a group of five galaxies including NGC 7778, NGC 7779, NGC 7780, and NGC 7781 in Pisces. A large aperture telescope will be required.

Focus on Constellations: Andromeda

Jim Kvasnicka

Andromeda
Andromeda the Princess extends from the NE corner of the Great Square of Pegasus. Andromeda is the 19th largest constellation with an area of 722 square degrees. Due to her position away from the galactic plane few nebulae can be found in the constellation; however, the area is a window to deep space allowing us to see galaxies of all types. The most famous is M31 the Andromeda Galaxy along with its two companion galaxies M32 and M110. These are the only Messier objects in the constellation. Andromeda is best seen in the month of November.

Showpiece Objects
Galaxies: M31 (The Andromeda Galaxy), M32, M110, NGC 891
Planetary Nebulae: NGC 7662 (The Blue Snowball)
Double Stars: Gamma Andromedae (Almach)

Mythology
The mythology around Andromeda is one of the most famous Greek myths. Andromeda was chained to the rocks on the shore by her father, Cepheus, as a sacrifice to appease the avenging sea monster Cetus. The hero in the myth, Perseus, comes to her rescue riding Pegasus the winged horse. Perseus slays the monster and marries Andromeda. Adjacent constellations represent all the characters in the myth: her parents Cepheus and Cassiopeia, her hero Perseus and his winged horse Pegasus, and the sea monster Cetus.

Number of Objects Magnitude 12.0 and Brighter
Galaxies: 8
Open Clusters: 3
Planetary Nebulae: 1

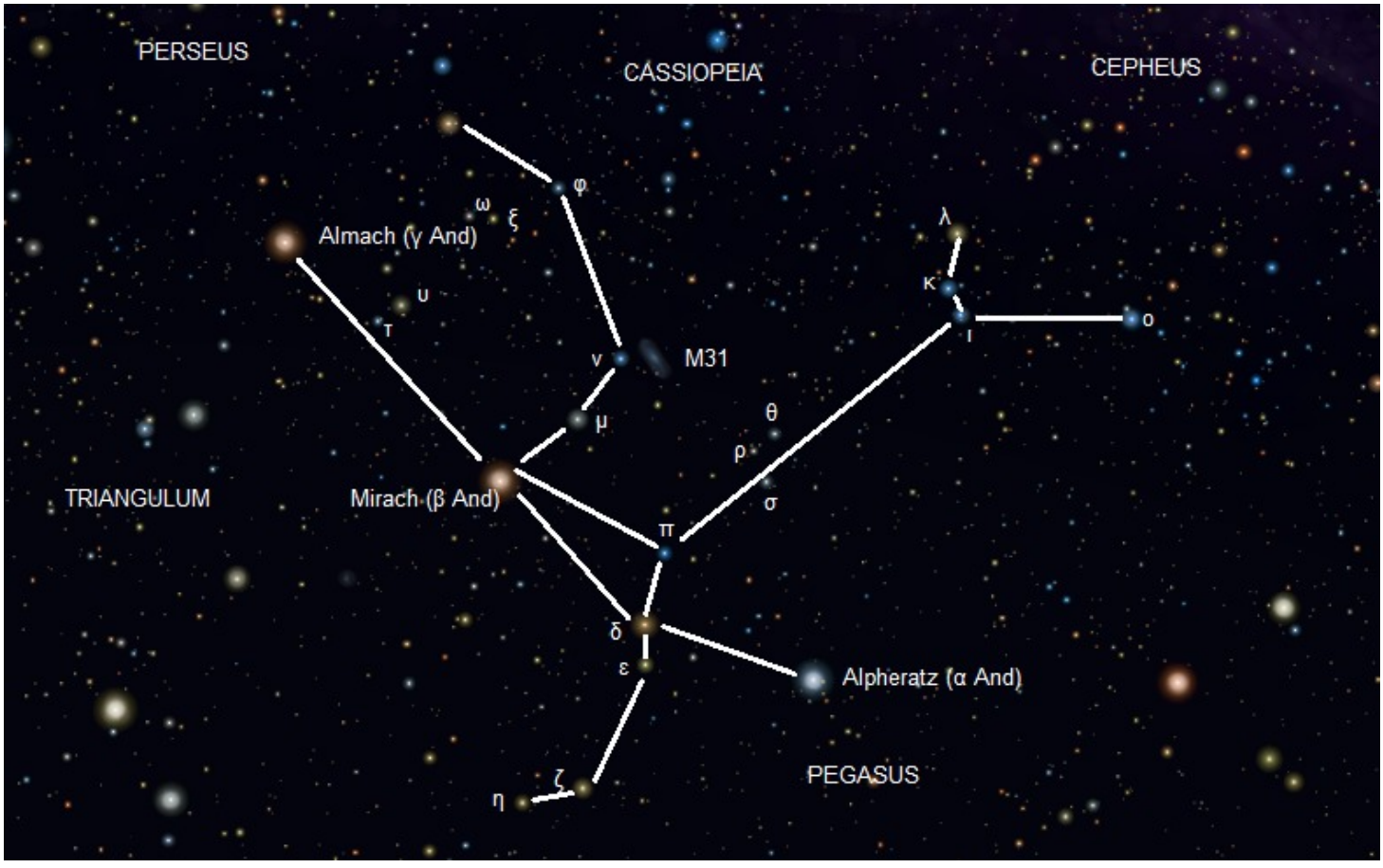


Photo credit: Wikipedia. Derived from photo by Roberto Mura.

How We Know Mars Has Liquid Water on Its Surface

Ethan Siegel

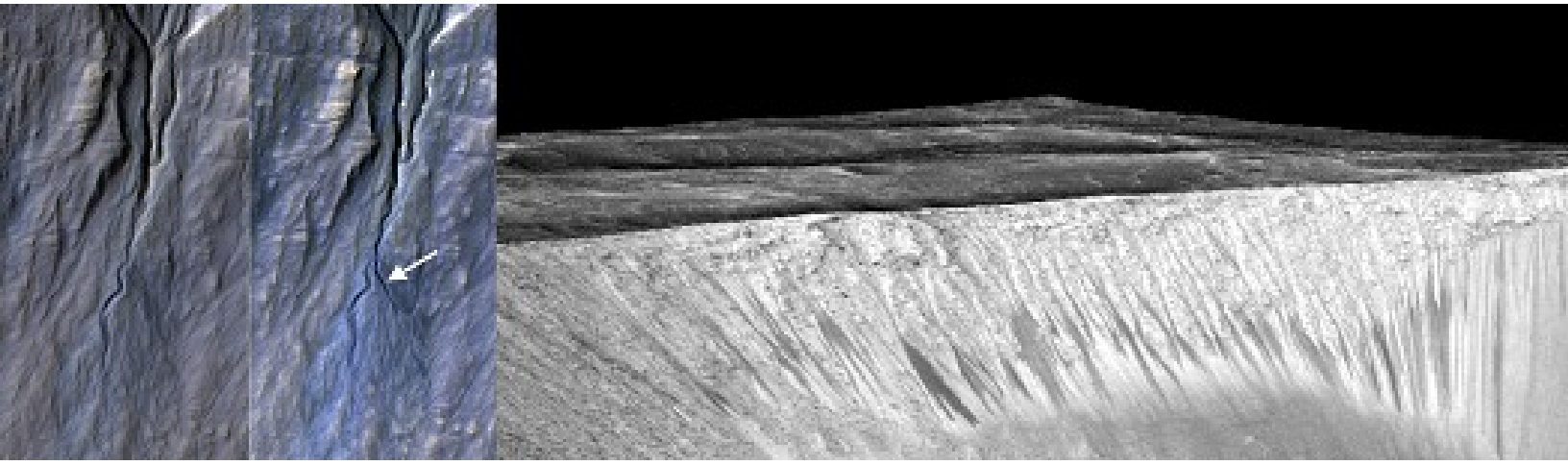
Of all the planets in the solar system other than our own, Mars is the one place with the most Earth-like past. Geological features on the surface such as dried up riverbeds, sedimentary patterns, mineral spherules nicknamed "blueberries," and evidence of liquid-based erosion all tell the same story: that of a wet, watery past. But although we've found plenty of evidence for molecular water on Mars in the solid (ice) and gaseous (vapor) states, including in icecaps, clouds and subsurface ices exposed (and sublimated) by digging, that in no way meant there'd be water in its liquid phase today.

Sure, water flowed on the surface of Mars during the first billion years of the solar system, perhaps producing an ocean a mile deep, though the ocean presence is still much debated. Given that life on Earth took hold well within that time, it's conceivable that Mars was once a rich, living planet as well. But unlike Earth, Mars is small: small enough that its interior cooled and lost its protective magnetic field, enabling the sun's solar wind to strip its atmosphere away. Without a significant atmosphere, the liquid phase of water became a virtual impossibility, and Mars became the arid world we know it to be today.

But certain ions—potassium, calcium, sodium, magnesium, chloride and fluoride, among others—get left behind when the liquid water disappears, leaving a "salt" residue of mineral salts (that may include table salt, sodium chloride) on the surface. While pure liquid water may not persist at standard Martian pressures and temperatures, extremely salty, briny water can indeed stay in a liquid state for extended periods under the conditions on the Red Planet.

It's more of a "sandy crust" like you'd experience on the shore when the tide goes out than the flowing waters we're used to in rivers on Earth, but it means that under the right temperature conditions, liquid water does exist on Mars today, at least in small amounts.

The measured presence and concentration of these salts, found in the dark streaks that come and go on steep crater walls, combined with our knowledge of how water behaves under certain physical and chemical conditions and the observations of changing features on the Martian surface supports the idea that this is the action of liquid water. Short of taking a sample and analyzing it in situ on Mars, this is the best current evidence we have for liquid water on our red neighbor.



Images credit: NASA/JPL-Caltech/Univ. of Arizona, of a newly-formed gully on the Martian surface (L) and of the series of gullies where the salt deposits were found (R).

Cassini's Close Flyby of Enceladus Yields Surprising, Perplexing Imagery

Nancy Atkinson, Universe Today

If you thought Saturn's moon Enceladus couldn't get any more bizzare — with its magnificent plumes, crazy tiger-stripe-like fissures and global subsurface salty ocean — think again. New images of this moon's northern region just in from the Cassini spacecraft show surprising and perplexing features: a tortured surface where craters look like they are melting, and fractures that cut straight across the landscape.

"We've been puzzling over Enceladus' south pole for so long, time to be puzzled by the north pole!" tweeted NASA engineer Sarah Milkovich, who formerly worked on the Cassini mission.

While the Cassini mission has been at the Saturn system since 2004 and flown by this moon several times, this is the spacecraft's first close-up look at the north polar region of Enceladus. On October 14, 2015 the spacecraft passed at an altitude of just 1,839 kilometers (1,142 miles) above the moon's surface.

The reason Cassini hasn't been able to see the northern terrain of Enceladus previously is that it was concealed by the darkness of winter. It's now summer in the high northern latitudes, and scientists have been anxious to take a look at this previously unseen region. Gauging by the posts of "Wow!" and "Enceladus what are you doing??" by scientists on social media, the Cassini team is as excited and perplexed by these images as the rest of us.

"We've been following a trail of clues on Enceladus for 10 years now," said Bonnie Buratti, a Cassini science team member and icy moons expert at NASA's Jet Propulsion Laboratory. "The amount of activity on and beneath this moon's surface has been a huge surprise to us. We're still trying to figure out what its history has been, and how it came to be this way."

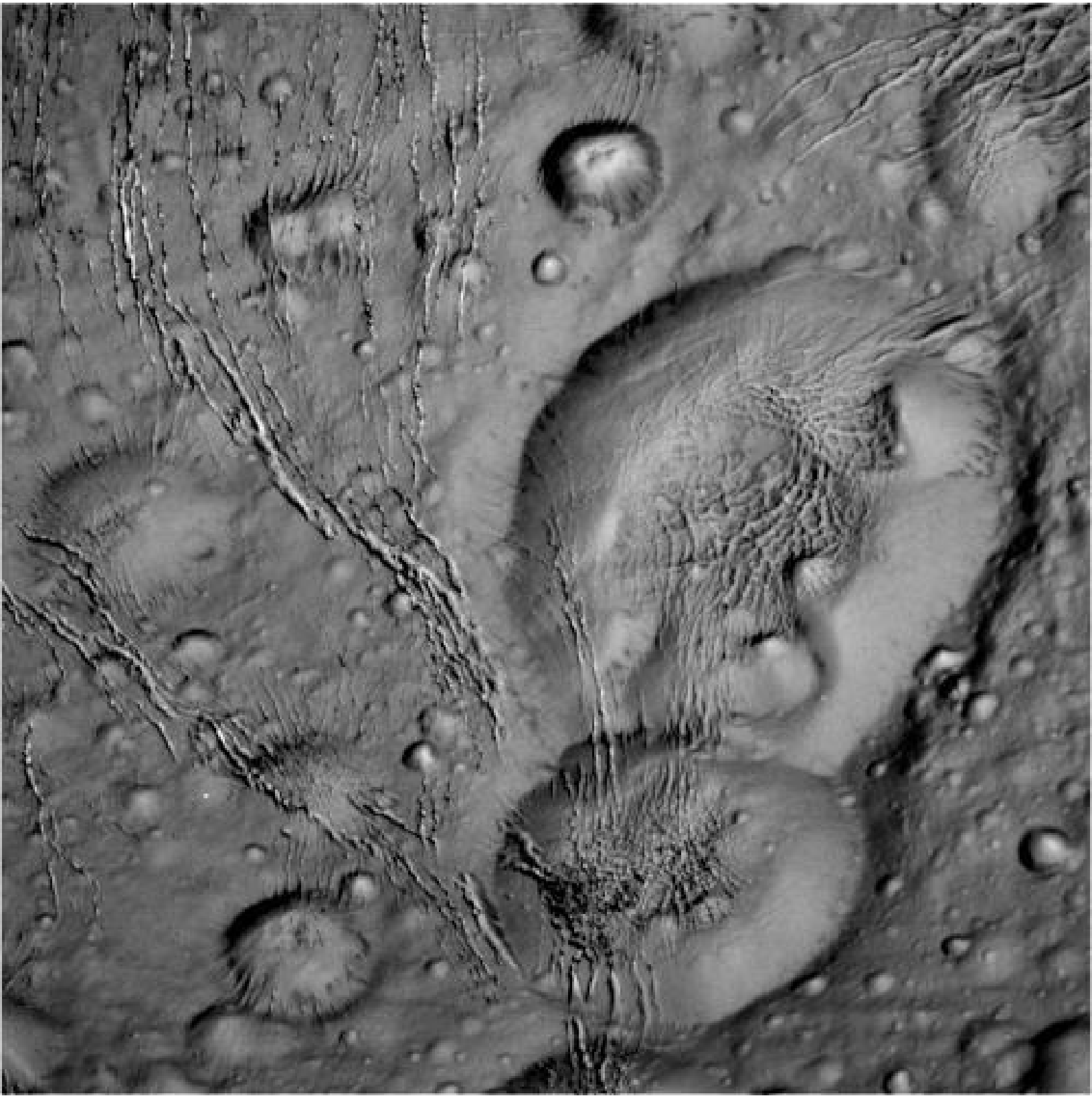
While these raw images just arrived this morning, already image editing enthusiasts have dived into the data to create composite and color images. Here are two from UT writer Jason Major and image contributor Kevin Gill:

In an email, Cassini imaging team leader Carolyn Porco explained the flyby: "Our cameras were active during most of this encounter, allowing the imaging team and other remote-sensing instrument teams to observe the Saturn-opposing side of Enceladus on the inbound leg of the encounter, and a narrow, sunlit crescent outbound."

From previous imagery and study of this moon, it has been suggested that the fractured and wrinkled terrain on Enceladus could be the scars of a shift in the moon's spin rate. The moon has likely undergone multiple episodes of geologic activity spanning a considerable portion of its lifetime.

While these images are incredible, get ready for even more. An even closer flyby of Enceladus is scheduled for Wednesday, Oct. 28, during which Cassini will come dizzyingly close to the icy moon, passing just 49 kilometers (30 miles) above the moon's south polar region. NASA says that during this encounter, Cassini will make its deepest-ever dive through the moon's plume of icy spray, collecting images and valuable data about what's going on beneath the frozen surface. Cassini scientists are hopeful data from that flyby will provide evidence of how much hydrothermal activity is occurring in the moon's ocean,

Craters and a possible straight fracture line mar the surface of Enceladus in this raw image from the Cassini spacecraft taken on October 14, 2015. Credit: NASA/JPL-Caltech/Space Science Institute.



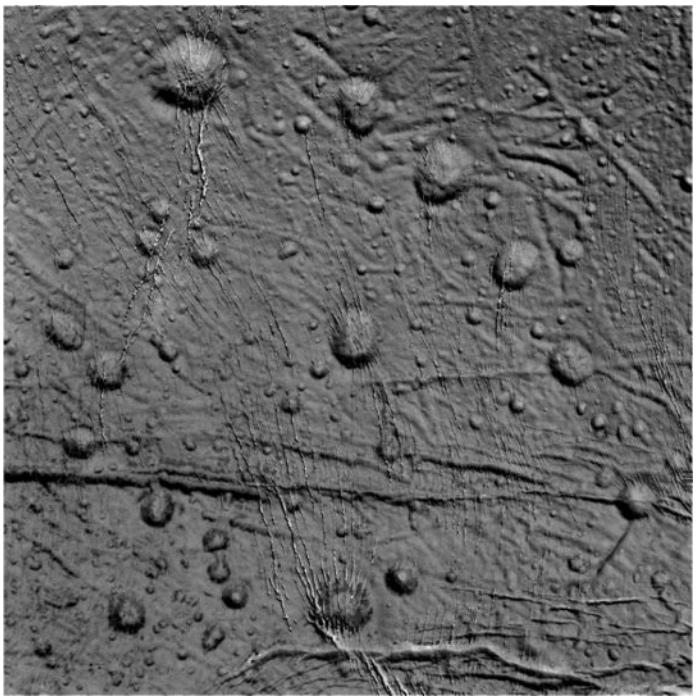
Craters near Enceladus' north pole region appear to be 'melting' into each other. Image taken by Cassini spacecraft on October 14, 2015. Credit: NASA/JPL-Caltech/Space Science Institute

and how the amount of activity impacts the habitability of Enceladus' ocean.

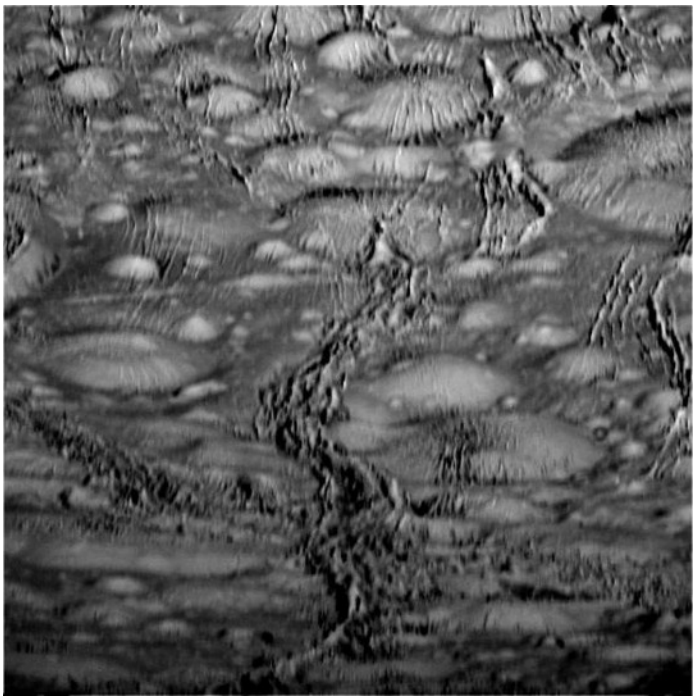
Then another flyby — Cassini's final scheduled close flyby of Enceladus — on Dec. 19 will examine how much heat is coming from the moon's interior from an altitude of 4,999 kilometers (3,106 miles).

An interesting side note is that the Cassini mission launched 18 years ago today (October 15, 1997).

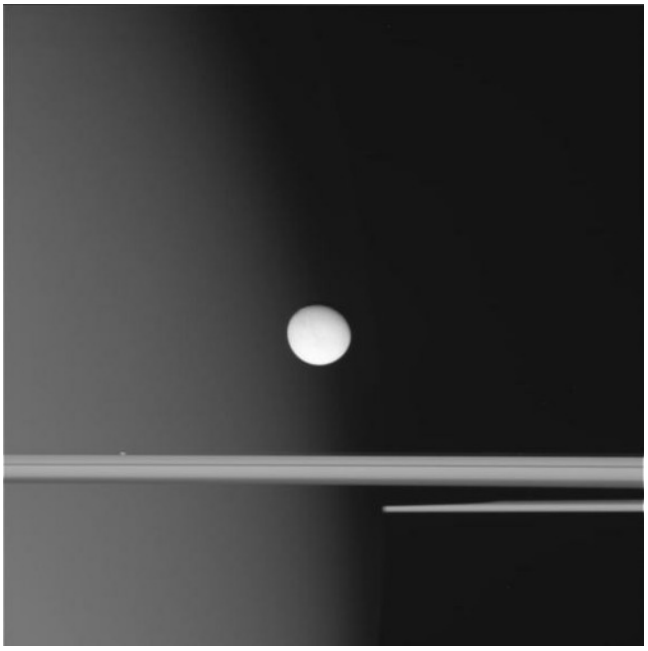
Again stay tuned for more, and you can see all of Cassini's raw image here, and find out more details of the upcoming flybys at this CICLOPS page.



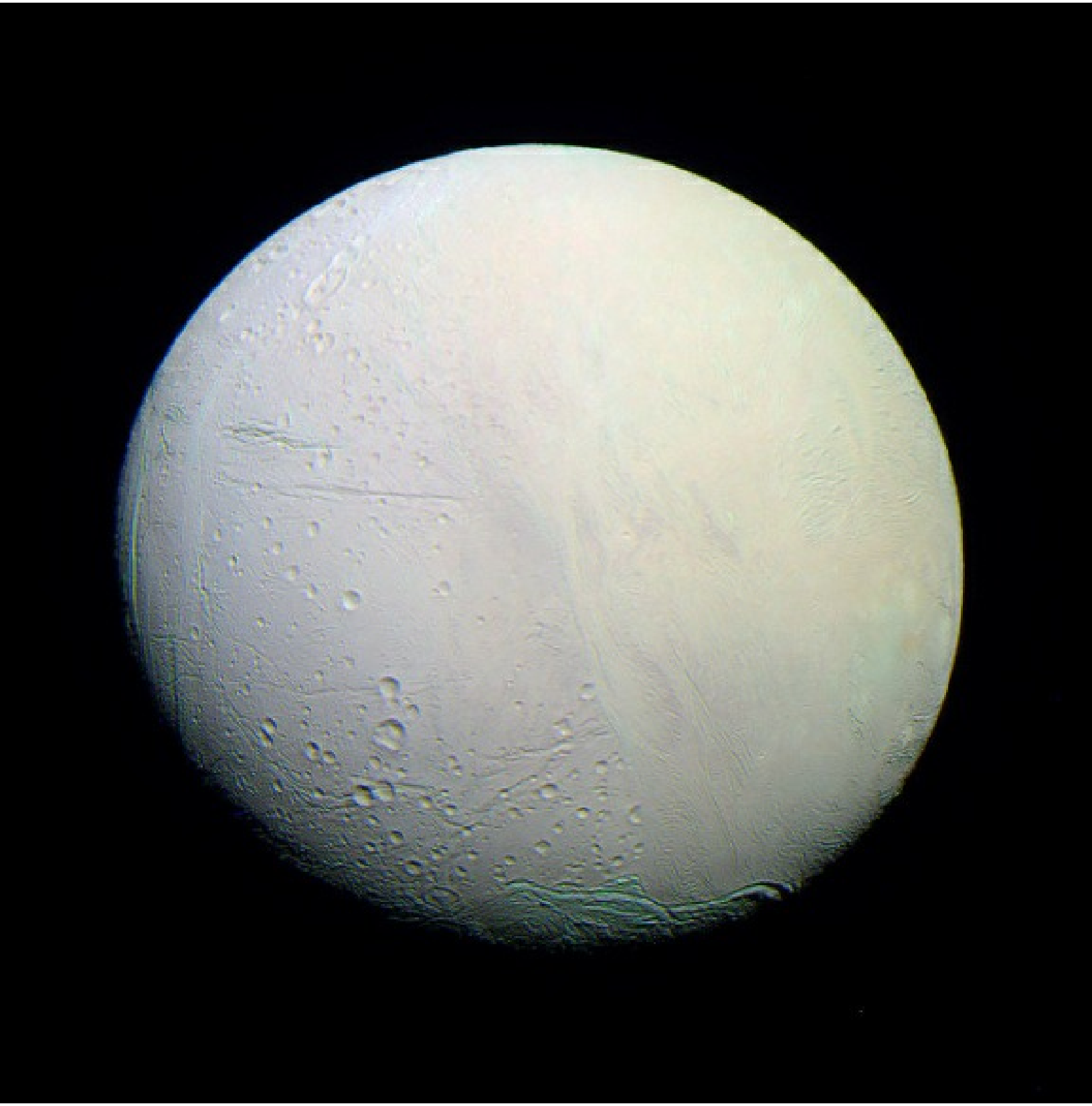
Craters and fractures dot the landscape of the northern region of Enceladus in this raw image from the Cassini spacecraft taken on October 14, 2015. Credit: NASA/JPL-Caltech/Space Science Institute.



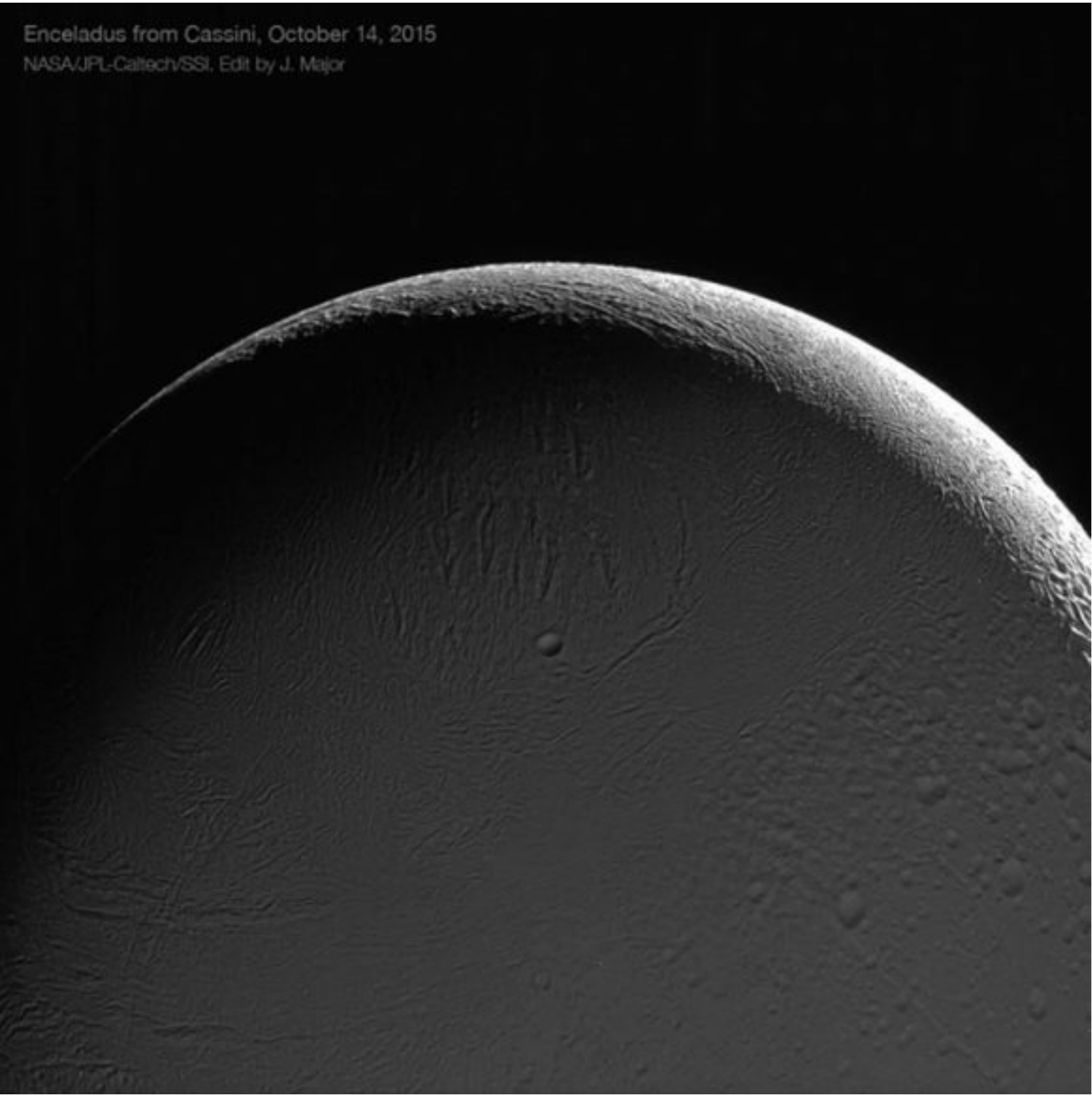
A complex region of craters and fractures near the north polar region on Saturn's moon Enceladus. Image from Cassini spacecraft taken on October 14, 2015. Credit: NASA/JPL-Caltech/Space Science Institute



Enceladus hovers over Saturn's rings in this raw image from the Cassini spacecraft taken on October 14, 2015. Credit: NASA/JPL-Caltech/Space Science Institute.



Saturn's icy moon Enceladus on October 14th, 2015 during Cassini's latest encounter. Assembled from uncalibrated images using infrared, green, and ultraviolet light. Image Credit: NASA/JPL-CalTech/ISS/Kevin M. Gill



A beautiful view of the night side of a crescent Enceladus, lovingly lit by Saturnshine. This was captured by the Cassini spacecraft during a close pass on Oct. 14, 2015. The 6.5-mile-wide Bahman cater is visible near the center. Credit: NASA/JPL-Caltech/Space Science Institute, image editing by Jason Major.

Branched Oak Observatory

Michael Sibbernsen

What do you get when you combine the Mars rover, grilled hamburgers, and a bevy of astronomy enthusiasts? Why, the World Space Week Star-B-Q, of course!

Over 160 visitors descended upon Branched Oak Observatory on October 9th for an evening of "space-craft" activities, good food, and out-of-this-world conversation. Although the skies decided to stay overcast throughout the evening, beautiful views availed themselves for the guests who returned the following night.

Though Branched Oak Observatory has already hosted a number of star parties this year, the Star-B-Q was the first official charity event for the facility. Michael Sibbernsen and Matthew Anderson, the chief officers of Branched Oak Observatory, welcomed the crowd and described the future plans of the facility. In the immediate timeframe, a 250-foot long fence will be built to surround the parking lot help keep headlights out of the observing field, and a new structure, donated by Talon Steel Buildings, will be constructed to act as a visitor's center and as a "warm room" during colder months.

Michael was inspired and humbled with the financial support received during the event. "Just as important," Michael explains, "was the increased community awareness a gathering like this elicits." Michael would like to express his sincere, "Thank You," to the members of the Prairie Astronomy Club, the Omaha Astronomical Society, and the Branched Oak Observatory Associates who attended Friday and Saturday evenings and helped make the event a rousing success. The next star party at Branched Oak Observatory will be Nov. 14th from 7-10PM.

The World Space Week Star-B-Q was supported in part by Fallbrook Super Saver, Union Bank, and the Sibbernsen Foundation.

From the Archives: November, 1967

Here's a page out of a 1967 newsletter. Since it was highly legible I thought I'd try something different and include a scan of the full page.

There are several things that I would like to hit upon in this "editorial". First of all, I would like to print the election results from last month's meeting: Earl Moser was re-elected president unanimously, Larry Stepp was elected vice-president, Jess Williams was re-elected secretary, Rick Johnson was re-elected treasurer, and Scott Coatsworth and I were elected or appointed, I'm not sure which, co-editors of the newsletter and program committee chairmen.

From now on our club should be having more-or-less regular skyshows at Gateway Shopping Center and we will be paid $50 a night. Since we are getting paid, I feel that more members should make an effort to get out to Gateway, even if they don't have a telescope, because after all its their money that a few of us are earning every month and besides its a lot of fun. Especially if you have your own telescope. It makes you realize how much you really know about astronomy compared to the normal man on the street.

There was quite a bit of interest at the last meeting concerning telescope making groups, but that's as far as it got. I think that there were about nine interested. We are trying to get something going but it is turning out to be harder than anticipated.

-Monte Cole

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THE MEETING -NOV. 28

The meeting this month will be held in the Weslyan Science hall 7:30-9:00. There will be a telescope display put on for the Students of schools who are interested in buying a telescope. As it stands now there will also be movies of the occultation of Saturn, and slides and movies of last month's eclipse. Sounds like a good meeting, see you there!

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PRESIDENTS REPORT

Six of our club members made a trip to Sabetha, Kan. on Sunday, November 12th. A very successfull Saturn-Moon graze was observed and photographed. A more detailed account will be eslsewhere in this newsletter.

The regular monthly payment on the telescope is due Dec. 13th. $60 will have to be raised by that time. Here is an oppertunity for those of you who haven't helped pay for the telescope yet, to take part in the payments of the clubs telescope.

Our next meeting at Weslyan will be on Nov. 28. We will have a public dispkay of telescopes at this meeting. Bring your telescope if you can. We will also have the films as promissed.

What Are the Odds of an Alien Megastructure Blocking Light From a Distant Star?

Anders Sandberg. The Conversation

Right now the star KIC 8462852 is really hot – and not just because it is a F-type star – but because the Kepler space telescope has discovered that it flickers in a highly unusual way, as if something is obscuring it. These dips in the light are different to what you would expect from planets blocking the star.

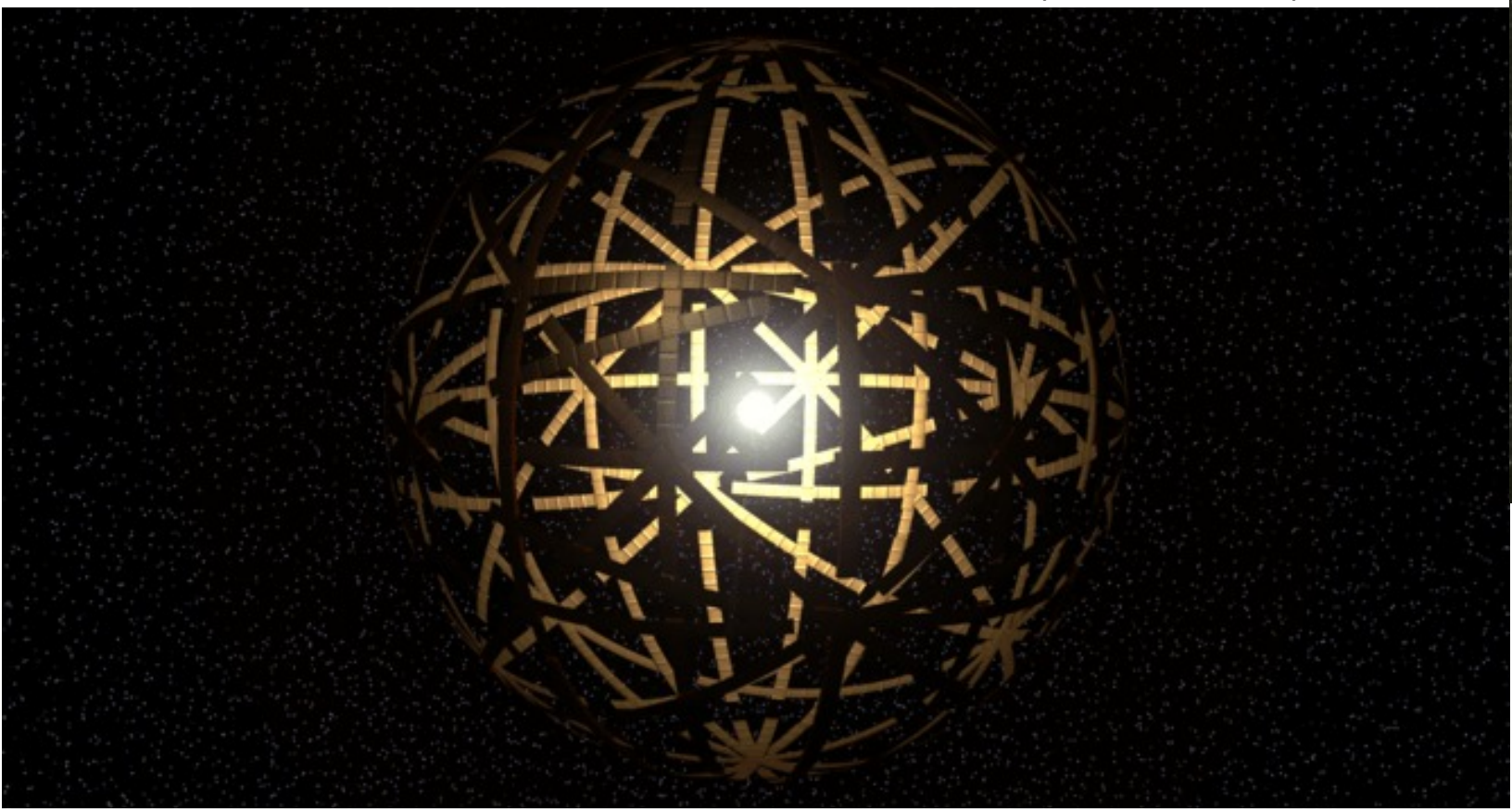
Scientists are failing to come up with an explanation for the phenomenon based on natural astrophysical processes, so attention has turned to the potential of an alien megastructure blocking the light. But what would such a structure be exactly and how likely is it that Kepler has spotted one?

Many possibilities

It is true that dips in the light from the star are odd, both in shape and timing. They are unlikely to be caused by a surrounding cloud of dust, as the star is too old to have such a planet-forming disk. But what about a storm of comets? They are actually not very good at obscuring stars, so it is not all that likely either. Fragments from a planetary collision might work, except that such events are so rare that we would not expect to see any with Kepler.

The lack of a simple explanation has made a lot of people quietly (or not so quietly) ask whether this could be an alien megastructure, known as a Dyson sphere.

The Dyson sphere was first described by Freeman Dyson in the 1960s, who argued that a technologically advanced alien civilisation would use more and more energy as it grew. As the biggest source of energy in any solar system is the star at its centre, it would make sense that the civilisation would build orbiting solar panels to try to capture it. Such structures would take up more and more space until



Concept of a Dyson sphere. Kevin Gill/Flickr, CC BY-SA

they eventually covered the entire star like a sphere. However, a complete sphere would be invisible to Kepler as it would absorb all of the light from the star, so signs of this would have to come from something currently under construction.

Could this be the case? I doubt it. My basic argument is this: if a civilisation builds a Dyson sphere, the sphere is unlikely to remain small for a long period of time. Just as planetary collisions are so rare that we should not expect to see any with Kepler, the time it takes to make a Dyson sphere is also very short: seeing it during construction is very unlikely. Even if we knew a Dyson sphere would eventually be built in a solar system the chance of actually witnessing it happening is low.

How do we know this? To build a Dyson sphere, one would need to disassemble a nearby body, like a planet, to provide the material for the solar captors. In a recent paper written with a colleague, we calculated that disassembling Mercury to make a partial Dyson shell could be done in 31 years. One way of doing this would be to mechanically disassemble the planet, much like we do in our aluminium and steel industries. From these industries, we know a lot already about the energy cost of such work, so the trick is to use already mined material to build more mining equipment and solar collectors to power it, achieving an exponential feedback loop.

The time it would take to disassemble any terrestrial planets is not much longer than for Mercury, while the gas giants would take a few centuries. Our aim in the paper was to show that using a small fraction of the resources in the solar system it is possible to harness

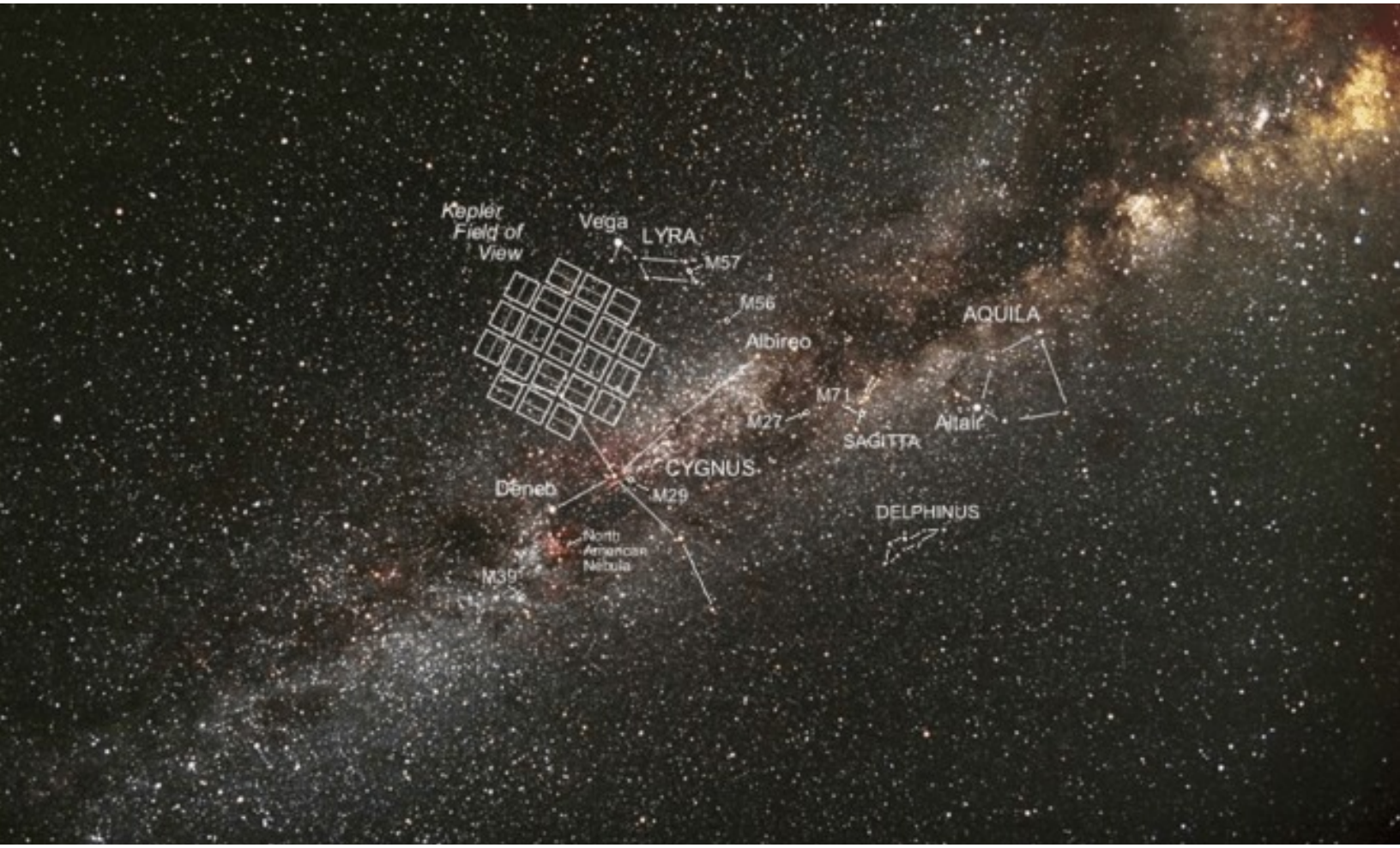


Image showing the region Kepler can see, where the mysterious star is located. NASA

enough energy to launch a massive space colonisation effort (literally reaching every reachable galaxy, eventually each solar system), but the important point is that this kind of planetary engineering is fast on astronomical timescales.

Over the history of an F5 star like KIC 8462852, even 1,000 years to build a sphere is not much. Given the estimated mass of the star as 1.46 solar masses, it will have a lifespan of 4.1 billion years. The chance of seeing it while being englobed by a Dyson sphere is one in 4.1m.

This is the probability assuming there will eventually be a sphere. Presumably only a few stars would have aliens and will be hidden this way, so the actual probability of seeing one in the process is much lower. Of the 150,000 stars Kepler watches we should not expect any of them to be in this state.

Junk planet or laid-back aliens

Another possibility is that the structure is an abandoned, unmaintained Dyson shell. Such a structure would likely start gravitationally clumping together into streams of wreckage, which makes this sound like a promising explanation – at first. But the timescale of coalescing into a junk planet is likely faster than natural planetary formation timescales (100,000 to a few million years) since the fragments involved would be in nearly identical orbits from the start. So the probability that we are looking at Dyson remains is still low.

But it is indeed several orders of magnitude more likely for us to see the decay of the shell than its construction. Like normal ruins, these often hang around far longer than the time it took to build the original structure.

What about if the aliens were building the sphere extremely slowly? This is in a sense what we are doing here on Earth (disassembling it to a tiny extent) by launching satellites one by one. So if an alien civilisation wanted to grow at a leisurely rate or just needed a bit of Dyson shell they could of course do it.

However, if you need something like 30 quintillion Watts (which could correspond to a 100,000km collector at 1 astronomical unit around the star) your demands are not modest. Dyson originally proposed the concept based on the observation that human energy needs were growing exponentially, and this was the logical endpoint. Even at 1% growth rate a civilisation quickly – in a few millennia – need most of the star's energy.

In order to get a reasonably high probability of seeing an incomplete shell we need to assume growth rates that are exceedingly small. While it is not impossible, it seems rather unlikely given how life and societies tend to grow.

Other alien structures?

Dyson shells are not the only megastructures that could cause intriguing transits. Research has suggested that an alien civilisation could, for example, sort asteroid material using light pressure, engineer climate using shades or mirrors, or travel using solar sails. Most of these tools are small compared to stars, but Kepler might notice them if there were enough of them.

Another study has calculated the possibility of detecting stellar engines – gigantic mirror arrays for moving entire solar systems – based on light curves. But unfortunately the calculated curves do not fit KIC 8462852 as far as I can tell.

In the end, we need more data. The stakes are high. If there is no intelligent life in space it means either that we are very lucky – or that intelligent species die out fast. But if there is (or was) another technological civilisation it would be immensely reassuring: we would know intelligent life can survive for at least some sizeable time.

But in truth, I think we will instead learn that the ordinary processes of astrophysics can produce weird transit curves, perhaps due to strange objects (remember when we thought hot Jupiters were exotic?). The universe is full of strange things, which makes me happy I live in it. But it makes sense to watch the star, just in case.

Anders Sandberg, James Martin Research Fellow, Future of Humanity Institute & Oxford Martin School, University of Oxford

CLUB MEMBERSHIP INFO

REGULAR MEMBER - $30.00 per year. Includes club newsletter, and 1 vote at club meetings, plus all other standard club privileges.

FAMILY MEMBER - $35.00 per year. Same as regular member except gets 2 votes at club meetings.

STUDENT MEMBER - $10.00 per year with volunteer requirement.

If you renew your membership prior to your annual renewal date, you will receive a 10% discount.

Club members are also eligible for special subscription discounts on Sky & Telescope Magazine.

CLUB TELESCOPES

To check out one of the club telescopes, contact Dave Churilla. If you keep a scope for more than a week, please check in once a week, to verify the location of the telescope and how long you plan to use it. The checkout time limit will be two weeks, but can be extended if no one else has requested use of a club scope.

100mm Orion refractor: Available

10 inch Meade Dobsonian: Available

13 inch Truss Dobsonian: Available

CLUB APPAREL

Order club apparel from cafepress.com:

Shop through Amazon Smile to automatically donate to PAC:

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