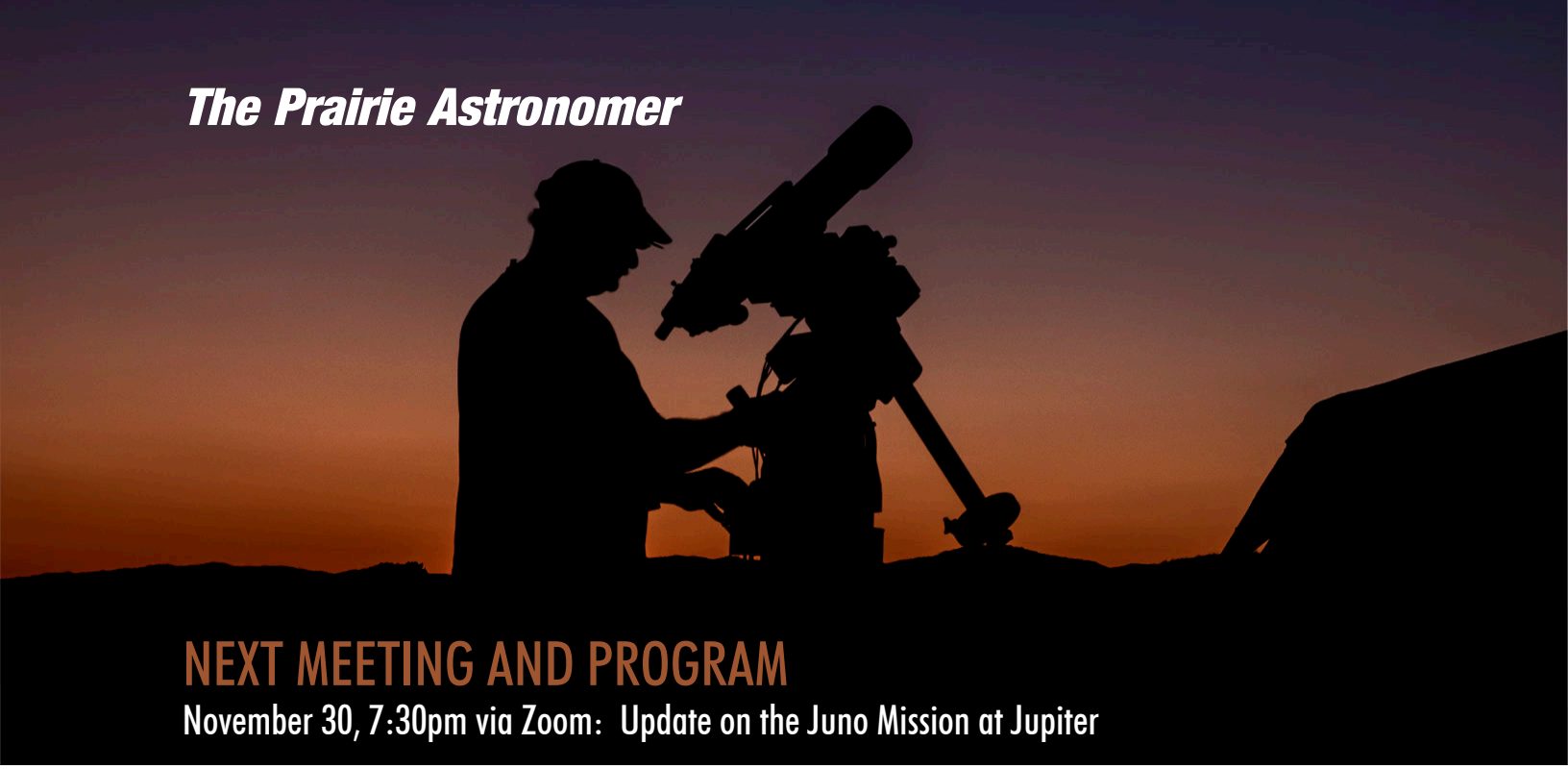
The Prairie Astronomer

November 2021 Volume 62, Issue #11

Earthrise: Apollo 17

The Newsletter of the Prairie Astronomy Club

The Prairie Astronomer



NEXT MEETING AND PROGRAM

November 30, 7:30pm via Zoom: Update on the Juno Mission at Jupiter

Speaker: Christopher Mick

We will take a brief look at the history of robotic exploration of Jupiter. The science behind the Juno Mission, some of its most recent discoveries, and what is next for exploration of the largest planet in our Solar System.

FUTURE PROGRAMS

December: PAC Christmas Family Party
January: New Technologies in Planetarium Shows

CONTENTS

Cover: A surreal crescent earthrise. Taken by the crew of Apollo 17, December 16, 1972.
Credit: NASA. Image restoration by Toby Ord: www.tobyord.com

CALENDAR

PAC Meeting
November 30, 7:30pm, via Zoom

Basic Astronomy Class
December 2, 7-9 PM at Hyde Observatory.

PAC Christmas Family Party
Tanners Bar and Grill (8600 S 30th and Yankee Hill Road) party room.
December 21, 7pm

PAC Meeting
January 25, 7:30pm, either Zoom or if possible live meeting at Hyde. Jack Dunn will provide an update on new technologies that have changed planetarium shows.

PAC Meeting
February 22, 7:30pm

2021 STAR PARTY DATES

	Date	Date
January	8	15
February	5	12
March	5	12
April	2	9
May	7	14
June	4	11
July	2	9
August	Jul 30	6
September	Aug 27	3
October	1	8
November	Oct 29	5
December	Nov 26	3

Dates in BOLD are closest to the New Moon.

CLUB OFFICERS

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Night Sky Network

www.prairieastronomyclub.org

Meeting Minutes

Bill Lohrberg

PAC meeting minutes October 26, 2021 as recorded by Bill Lohrberg

The meeting was hosted by President Bob Kacvinsky via Zoom beginning at 7:32 pm, 20 participants grew to 24 by the end of the meeting.

Jim Kvasnicka presented the observing report for November and announced upcoming club start parties for Oct 29 and Nov 5, and possibly another Lunar observing party Nov 11 at Jim's home. It was noted that 6 attended the October 6 lunar observing party.

For upcoming events and activities Bob repeated that Hyde observatory remains on hold until the Covid risk dial has lowered to the "green" for 2 weeks. The next PAC meeting November 30th will be another Zoom meeting. Also, plans were announced for a series of 4 classes with topics from beginning astronomy and basics to more advanced, astrophotography and solar observing with start date targeted for Dec 2nd. Bob also reminded the membership of the Astronomical League Convention ALCON 2022 will be in Albuquerque NM.

Club treasurer John Reinert gave a brief update on status of financials and was pleased to report the club audit from 2019 to the present was completed with special thanks to Jason O'Flaherty and Jim Kvasnicka for their help. Balances were given and at the levels consistent with what is expected. We also had a new family membership sign up with Steven Copple and family.

The elections for club officers were held with a motion by Bob Kacvinsky for nominations to be closed and called to elect the full slate of nominees. All indicated in favor, none opposed for the following club offices

- President Bob Kacvinsky
- First Vice President Jason O'Flaherty
- 2nd Vice President Bill Lohrberg
- Treasurer John Reinert
- Secretary Jim White

The non-elected positions have been retained as follows

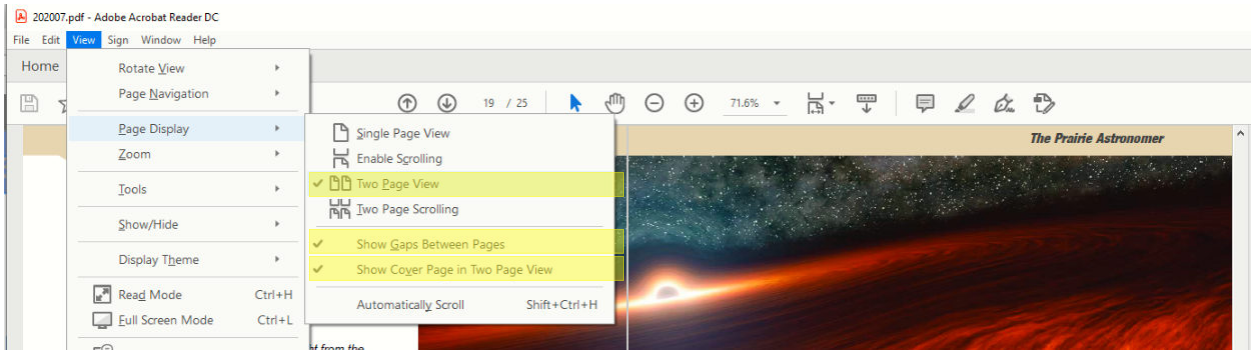
- Outreach coordinator Mike Kearns
- Observing Chair Jim Kvasnicka
- Newsletter and Publications Mark Dahmke
- Rich Littrell club library and telescope loaner check out (this is a somewhat new position in coordination with 2nd VP)

Bob also identified and asked for help from the membership for two additional positions to be filled; program chair, and social media relations specialist. It was pointed out that these traditionally fall under the responsibilities of the 2nd VP, but Bob explained the goal is to split duties out to help the 2nd VP fulfill those duties, and at request of Mark Dahmke. Details will be under discussion and further review.

At approximately 7:54pm the meeting was adjourned to the program presentation by Tyler Cohen and Montana Williams of the National Radio Astronomy Observatory.

New Newsletter Format

How to Adjust Adobe Acrobat Settings for Two Page View



To view this newsletter in magazine spread format in Acrobat, select View ->Page Display->Two Page View. Acrobat will then show two pages side by side. Also make sure the checkboxes "Show Cover Page in Two Page View" and "Show Gaps Between Pages" are checked. **If you have it setup correctly, the cover page will be displayed by itself and subsequent pages will be side by side with the odd numbered pages on the left.**

PAC Newsletter Archive

Back issues of the Prairie Astronomer from 1962 to present are now available online: https://www.prairieastronomyclub.org/newsletters

PAC-LIST

Subscribe through GoogleGroups or contact Mark Dahmke to be added to the list. You'll need a Google/gmail account, but if you want to use a different email address, just associate that address with your google account to access Google Groups. Once subscribed, you can view message history through the GoogleGroups website.

The President's Message

Bob Kacvinsky

Wow. Amazing over the last two months we have gone from dark skies at 8:30 to observable dark skies at 5:30 pm. Time to put on your boots, scarves, and jackets and get out and enjoy the view of Jupiter and Saturn as they dance across our fall evening skies.

I've never been a fan of the color orange. It mostly stemmed from rival sports teams, but I have found a new hatred of orange in the risk dial. Yet, we are going to move forward as a club with caution and safety but also with a purpose. Your new PAC Board will be meeting in early December to set our direction for the upcoming year. If you have any suggestions, ideas, recommendations, or thoughts of what we can do to make your PAC membership more enjoyable please let us know. PAC is your club, and we want to serve your needs as best we can.

We have several upcoming PAC events.

November 30th. 7:30 PM: PAC Meeting via Zoom. Our special live program will be Christopher Mick, STEAM NASA guest speaker from Hudson, Wisconsin. Chris will present an update "Juno Discoveries from Jupiter." Juno has been orbiting Jupiter and getting some great close-up videos of the planet and making numerous discoveries. Please plan to attend to join in the journey.

December 2nd. 7-9 PM: Basic Astronomy Class held at Hyde Observatory. Dan Delzell, Jim Kvasnicka, and Bob Kacvinsky will present a basic Astronomy program covering common terminologies, observing techniques, and what to expect when attending and setting up for a star party. Costs will be $10 for members to cover the extensive handout printed materials. Nonmembers costs will be $20. Attendees are asked to register ahead so we have adequate handouts.

December 21st. 7-8:30 PM: PAC Christmas Dinner. Tanners Bar & Grill, 8600 S 30th & Yankee Hill Road just west of Anderson Mazda. In 2020 we missed the opportunity to gather for our traditional Christmas social gathering. We have the party room reserved for you and family to join for drinks and order food off the menu. We are not planning any formal meeting but just a time to gather. We moved the date up a week from our traditional last Tuesday to avoid missing those that might be traveling between the Holidays. Hope you and any family members will be able to attend.

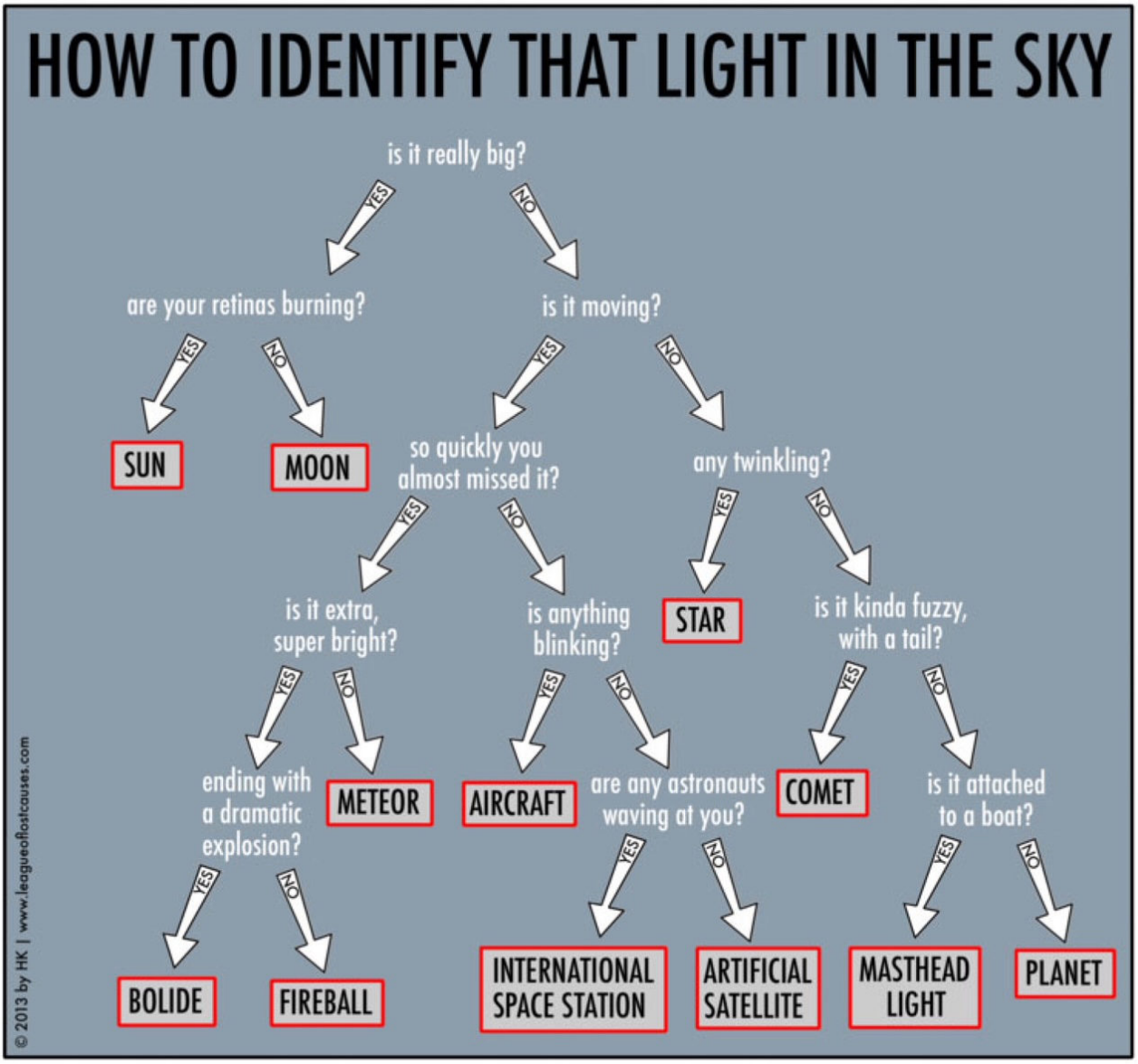
January 25th. 7:30 PM: PAC Meeting. Program presented by Jack Dunn on the newest technologies being incorporated into planetarium shows. Jack will share how innovations have completely changed the planetarium experiences from what most of us know. Meeting location is still in limbo, but we are hoping for Hyde, but are exploring the option of Branched Oak Observatory or back to Zoom. I'm a Packers fan so hope for green or a little yellow dial.

If you are looking at getting a new telescope

or upgrading, please let one of the officers know. We have members who have recently upgraded equipment and there are a 6”, 8”, and 12” Dob style reflector telescopes available for sale. We typically do not advertise items for sale, but this is an opportunity to get a high-quality telescope upgrade from within our club. Let us know if you are interested.

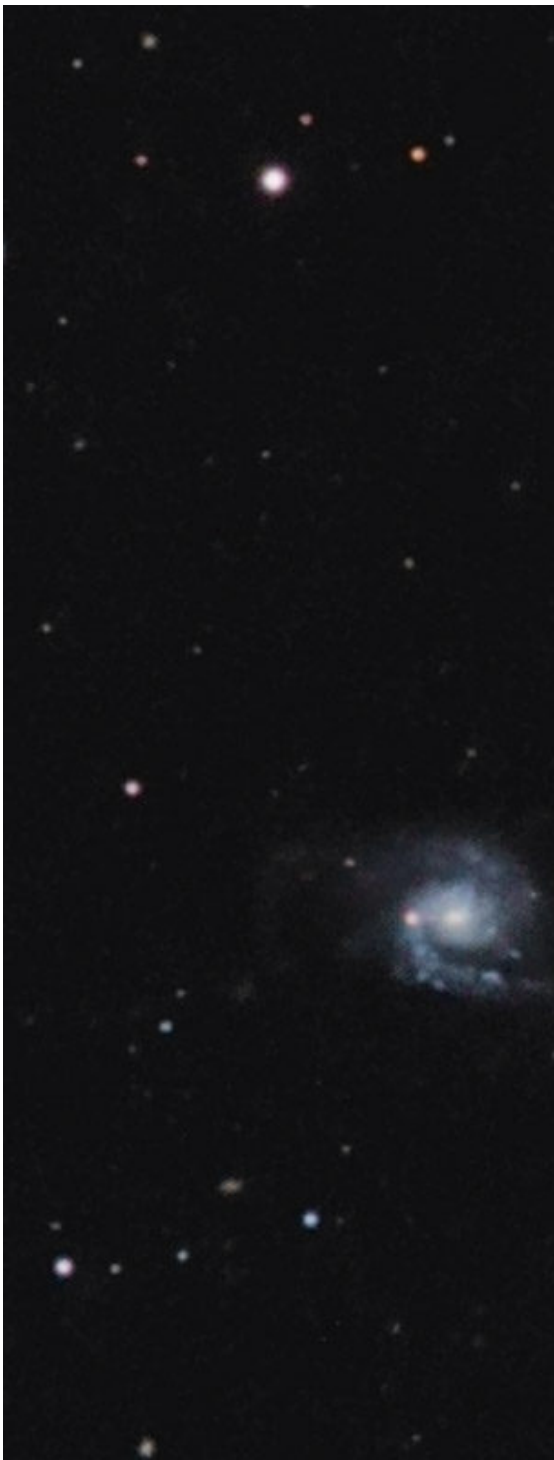
Over the past 20 months Covid has wreaked havoc with our society, community, and PAC Outreach activities. Our club has a great reputation for our involvement in the community through Hyde and public observing events. I suspect many of you are anxious like me to get back out to sharing the wonders of our Universe with others. Once this latest wave of Covid subsides (at some point it will) please consider how you can safely re energize your Astronomy passion. Whether volunteering at Hyde, participating on PAC Outreach events, or just gathering again at meetings. The public will be looking for activities to safely “get out” and being outside looking at the night sky is a great place to begin.

Dark and Clear Skies to you, Bob Kacvinsky
PAC-President
kacvinskyb@yahoo.com
402-840-0084



ARP 36

Rick Johnson



Another twofer deal in Arp galaxies located in Canes Venatici, about 3 degrees northeast of M3. Arp 183 on the left is UGC 8560 and Arp 36 on the right is UGC 8548. Both are about 240 million light-years distant. Both appear highly distorted yet are cataloged very differently by Arp. This image was taken through some haze for 4 of the 6 luminosity frames so doesn't pick up the faint parts of the galaxy as well as I'd have liked. Another I should revisit but probably won't.

Arp 183 is in Arp's class of galaxies with narrow filaments. Apparently he is referring to the very faint spur above the apparently drawn out arm. At least that's what his comment probably refers to when he says: "3 faint patches constitute third arm or filament." The patches are better seen in his image. The two galaxies along the long drawn out arm of Arp 183 are SDSS J133451.48+312306.9 of unknown distance and 2MASX J13345139+3123014/ SDSS J133451.36+312301.3 at 1.5 billion light-years. The latter is obviously not related to Arp 183. The former, if at the same distance as Arp 183 seems way too small to be involved. NED classes Arp 183 as an Sb spiral about 240 million light-years distant. The best candidate for what distorted Arp 183 is nearby Arp 36 which is also apparently distorted.

Arp 36 is, like Arp 183 about 240 million light-years distant. It is classed as SB? Arp put it in his Spiral Galaxies: Integral sign class. Though it makes a rather poor integral sign to me. His comment: "Knots in arms approach appearance of small companion." I would certainly agree with that comment. In fact, some catalogs do list the brightest knot in the

The Mantrap Skies Image Catalog

Rick Johnson, a founding member of the Prairie Astronomy Club, passed away in January, 2019. His legacy lives on through his comprehensive catalog of over 1600 images at www.mantrapskies.com.

eastern (left) arm as a separate object. Oddly, a note at NED under Arp 36 actually refers to Arp 183 when it says: "SB with a double companion at the end of the single developed arm." As shown above, at least one of these "companions" is a distant background galaxy. Another note, this one on Arp 36 asks the question "Two cores?" I don't think so. This other bright object seems, in my image, to be a blue knot of new massive stars at the end of the western bar where the arm starts. There's a similar dimmer one at the start of the eastern. Several others are visible as well. Such massive star formation is common in near galaxy collisions as may have happened here. Both galaxies certainly show this effect.

The tight trio of galaxies below Arp 36 consists of WAS 75 at about a half billion light-years and 2MASX J13341649+3117095 at about three-quarters billion light-years. The third galaxy is SDSS J133417.21+311718.0 distance unknown. Below is small S0 like spiral SDSS J133417.57+311645.5 also distance unknown.

The two with unknown distances are labeled with a question mark. West of this group is a pair of very red objects. The bright one is 2MASX J13340124+3117057 at 1.5 billion light-years. The SDSS catalog lists the western one as a 20th magnitude star. Its PSF doesn't look like a star in my data. Looking at the SDSS image I tend to doubt the star label but that's what I've labeled it in the annotated image. It could be the halo of the galaxy is causing the confusion so I'll reluctantly defer to the SDSS.

Below the above galaxies is, the IR strong galaxy 2MASX J13341158+3114204 at 1.5 billion light-years. It is classed as S0. It's very unusual for an S0 galaxy to have the star formation in its core needed to reach the level of an IR galaxy. Also, it must be huge to appear so large at such a distance. A quick calculation assuming it is fully face on to us puts it at about 160 million light-years in long diameter. I can't recall an S0 galaxy that large. Sure would like a closer look at this one.

Near the left edge is the distorted galaxy SDSS J133539.83+312336.1 at 800 million light-years. It is partly hidden behind a bright star, unfortunately.

There's one asteroid in the image, (239730) 2009 BL170 at an estimated magnitude of 19.4. It is moving in pro-grade motion rather than retrograde as it was taken early in the morning. It also shows how conditions improved during the image. The first part of the trail (long part) is dimmer than the shorter later luminosity images. Dawn was breaking so I couldn't get any more and never went back. The gap is due to the taking of the color frames.

December Observing

Jim Kvasnicka

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

Planets

Jupiter, Saturn, Mercury, Venus: All four planets in the SSW at dusk. Jupiter in Aquarius at magnitude -2.1, Saturn in Capricornus at +0.7, Mercury and Venus in Sagittarius at -0.7 and -4.5.
Neptune and Uranus: Neptune in Aquarius at magnitude 7.9, Uranus in Aries at 5.7.
Mars: In the morning dawn at magnitude +1.6 in Sagittarius.

Meteor Showers

Geminids: Peaks the night of December 13-14 with the Moon setting by 2:00 am.

Comets

C/2021 A1 Leonard: May become a naked eye morning comet to start December.

Messier List

M2: Class II globular cluster in Aquarius.
M15: Class IV globular cluster in Pegasus.
M29: Open cluster in Cygnus.
M31: The Andromeda Galaxy.
M32/M110: Companion galaxies to M31.
M39: Open cluster in Cygnus.

Last Month: M27, M30, M56, M57, M71, M72, M73
Next Month: M33, M34, M52, M74, M76, M77, M103

NGC and other Deep Sky Objects

NGC 578: Elongated galaxy in Cetus.
NGC 779: Elongated galaxy in Cetus.
NGC 869/884: The Double Cluster in Perseus.
NGC 972: Galaxy in Aries.
NGC 1187: Galaxy in Eridanus.

Double Star Program List

Eta Cassiopeiae: Yellow primary with a rose colored secondary.
Sigma Cassiopeiae: Yellow and light blue stars.
Theta Aurigae: Bright white and pale blue pair.
1 Camelopardalis: White and pale blue stars.
32 Camelopardalis: Equal white pair.
Gamma Ceti: White primary with a pale yellow secondary.
Chi Tauri: White primary with a pale blue secondary.
118 Tauri: White and yellow stars.

Challenge Object

NGC 697 Galaxy Group: Group of six galaxies in Aries that include NGC 678, NGC 680, NGC 691, NGC 694, NGC 695, and NGC 697.

Focus on Constellations

Perseus

Jim Kvasnicka

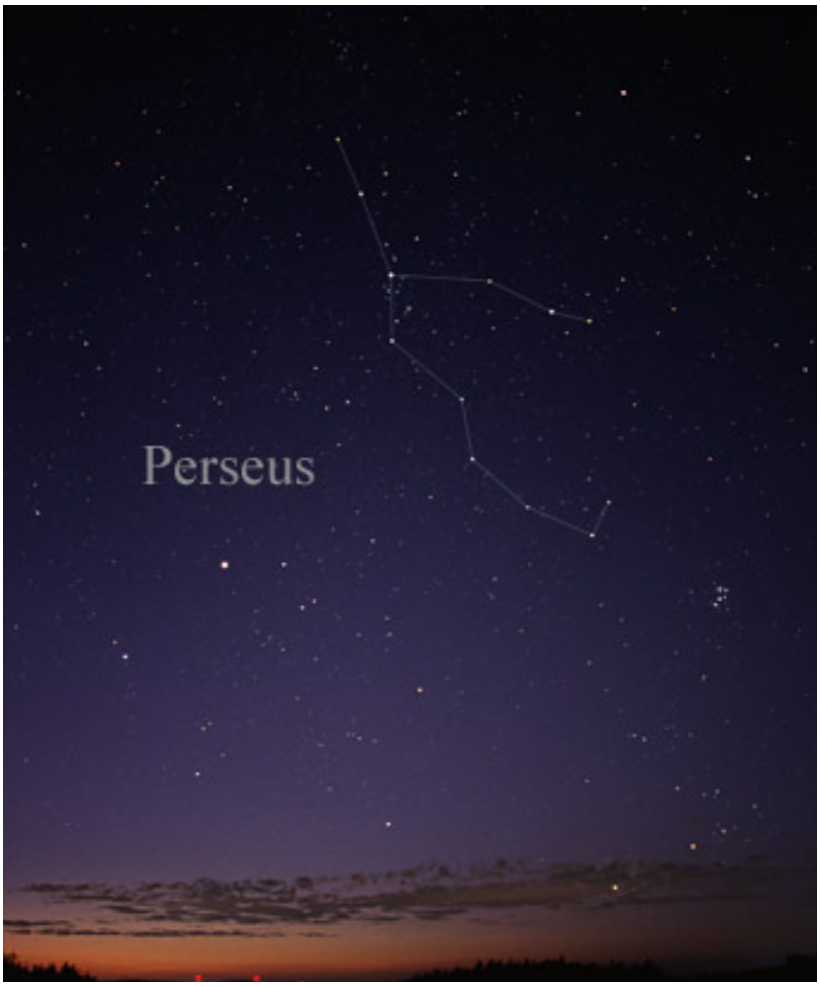
Perseus the Hero lies in the Milky Way and is rich in such typical Milky Way objects as open clusters and diffuse nebulae. Perseus has two Messier objects, open cluster M34 and the planetary nebula M76. Both are fine sights but the most outstanding object in Perseus goes to the Double Cluster, NGC 869 and NGC 884. The constellation Perseus is best seen in December.

Showpiece Objects
Open Clusters: M34, NGC 869 and NGC 884 (The Double Cluster)
Planetary Nebulae: M76 (The Little Dumbbell)
Double Stars: Theta Persei, Eta Persei (Miram)
Variable Stars: Beta Persei (Algol)

Mythology
Perseus slew the Medusa, the snake haired Gorgan. Anyone who looked at Medusa would turn into stone. Perseus got around this problem by not looking directly at her. He did this by looking at her reflection in his shield. He killed the Medusa by cutting off her head. Some of her blood fell into the sea and mixed with sea foam out of which sprang Pegasus the white winged horse. Later while riding Pegasus he came across Andromeda chained to the rocks on the sea shore as a sacrifice to the sea monster Cetus. Perseus was able to kill the Cetus by pulling the head of the Medusa from a bag and holding it up to Cetus. The monster looked at the head of Medusa and was turned into stone.

Number of Objects Magnitude 12.0 and Brighter

Galaxies: 9
Open Clusters: 19
Planetary Nebulae: 1
Bright Nebulae: 1
Dark Nebulae: 1



By Till Credner - Own work: AlltheSky.com, CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=20042019

Astrophotography

By Dave Knisely

Taken early morning November 13, from my front porch while waiting to watch a Falcon 9 morning rocket launch (30 sec exposure ISO 1600 on Canon EOS Rebel XT camera with 18mm lens).

Vast Patches Of Glassy Rock In Chilean Desert Likely Created By Ancient Exploding Comet

Heat from a comet exploding just above the ground fused the sandy soil into patches of glass stretching 75 kilometers, a study led by Brown University researchers found.

Pete Schultz is a founding member of the Prairie Astronomy Club

Around 12,000 years ago, something scorched a vast swath of the Atacama Desert in Chile with heat so intense that it turned the sandy soil into widespread slabs of silicate glass. Now, a research team studying the distribution and composition of those glasses has come to a conclusion about what caused the inferno.

In a study published in the journal Geology, researchers show that samples of the desert glass contain tiny fragments with minerals often found in rocks of extraterrestrial origin. Those minerals closely match the composition of material returned to Earth by NASA's Stardust mission, which sampled the particles from a comet called Wild 2. The team concludes that those mineral assemblages are likely the remains of an extraterrestrial object — most likely a comet with a composition similar to Wild 2 — that streamed down after the explosion that melted the sandy surface below.

"This is the first time we have clear evidence of glasses on Earth that were created by the thermal radiation and winds from a fireball exploding just above the surface," said Pete Schultz, a professor emeritus in Brown University's Department of Earth, Environmental and Planetary Sciences. "To have such a dramatic effect on such a large area, this was a truly massive explosion. Lots of us have seen bolide fireballs streaking across

New research finds that the dark silicate glass strewn across a vast swath of the Atacama Desert was created by an exploding comet around 12,000 years ago. Credit: P.H. Schultz, Brown University

the sky, but those are tiny blips compared to this."

The glasses are concentrated in patches across the Atacama Desert east of Pampa del Tamarugal, a plateau in northern Chile nestled between the Andes Mountains to the east and the Chilean Coastal Range to the west. Fields of dark green or black glass occur within a corridor stretching about 75 kilometers. There's no evidence that the glasses could have been created by volcanic activity, Schultz says, so their origin has been a mystery.

Some researchers have posited that the glass resulted from ancient grass fires, as the region wasn't always desert. During the Pleistocene epoch, there were oases with trees and grassy wetlands created by rivers extending from mountains to the east, and it's been suggested that widespread fires may have burned hot enough to melt the sandy soil into large glassy slabs.

But the amount of glass present along with several key physical characteristics make simple fires an impossible formation mechanism, the new research found. The glasses show evidence of having been twisted, folded, rolled and even thrown while still in molten form. That's consistent with a large incoming meteor and airburst explosion, which would have been accompanied by tornado-force winds.

The mineralogy of the glass casts further serious doubt on the grassfire idea, Schultz says. Along with researchers from the Fernbank Science Center in Georgia, Chile's Universidad Santo Tomás and the Chilean Geology and Mining Service, Schultz and colleagues performed a detailed chemical analysis of dozens of samples taken from glass deposits across the region.

The analysis found minerals called zircons that had thermally decomposed to form baddeleyite. That mineral transition typically happens in temperatures in excess of 3,000 degrees Fahrenheit — far hotter than what could be generated by grass fires, Schultz says.

The analysis also turned up assemblages of exotic minerals only found in meteorites and other extraterrestrial rocks, the researchers say. Specific minerals like cubanite, troilite and calcium-aluminum-rich inclusions matched mineral signatures from comet samples retrieved from NASA's Stardust mission.

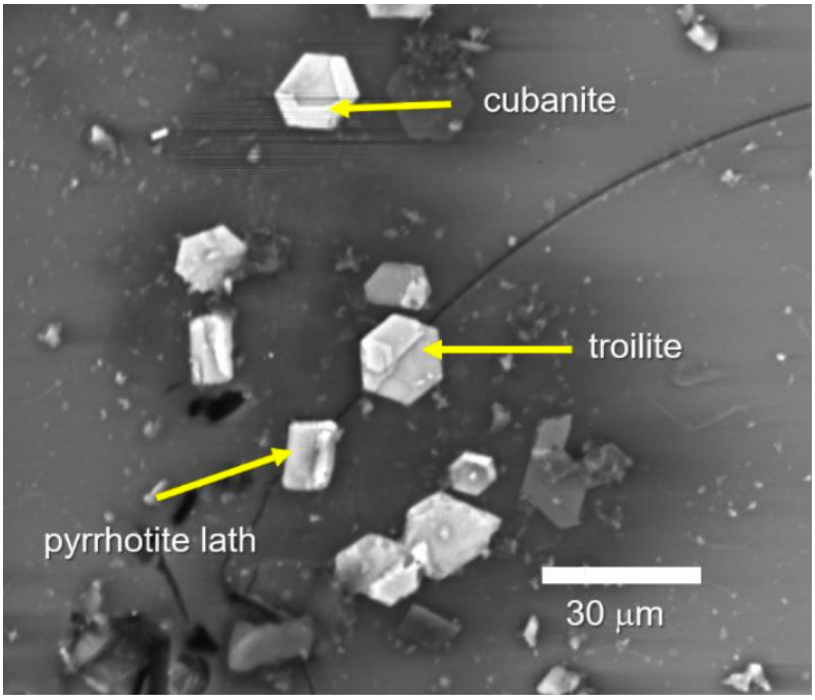
"Those minerals are what tell us that this object has all the markings of a comet," said Scott Harris, a planetary geologist at the Fernbank Science Center and study co-author. "To have the same mineralogy we saw in the Stardust samples entrained in these glasses is really powerful evidence that what we're seeing is the result of a cometary airburst."

More work needs to be done to establish the exact ages of the glass, which would determine exactly when the event took place, Schultz says. But the tentative dating puts the impact right around time that large mammals disappeared from the region.

"It's too soon to say if there was a causal connection or not, but what we can say is that this event did happen around the same time as when we think the megafauna disappeared, which is intriguing," Schultz said. "There's also a chance that this was actually witnessed by early inhabitants, who had just arrived in the region. It would have been quite a show."

Schultz and his team hope that further research may help to constrain the timing and shed light on the size of the impactor. For now, Schultz hopes this study may help researchers identify similar blast sites elsewhere and reveal the potential risk posed by such events.

"There may be lots of

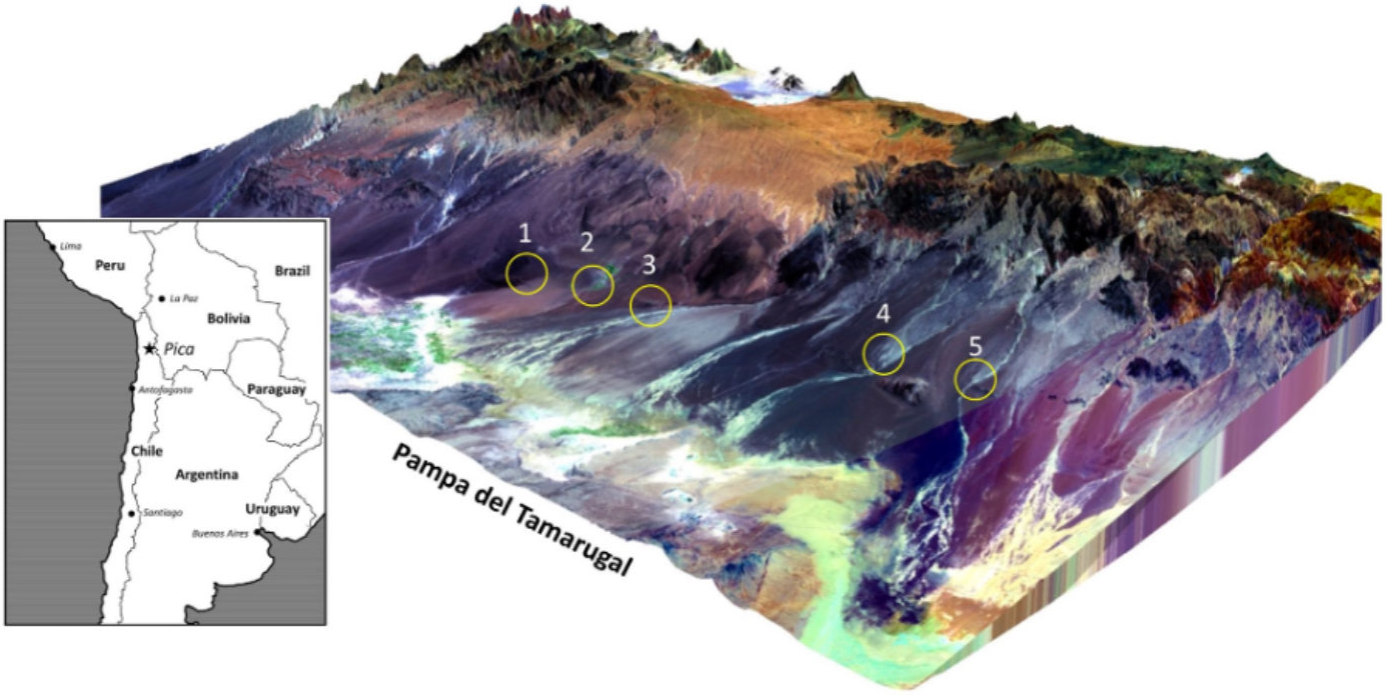


Analysis of the samples revealed a mineralogy consistent with a cometary origin.

these blast scars out there, but until now we haven't had enough evidence to make us believe they were truly related to airburst events," Schultz said. "I think this site provides a template to help refine our impact models and will help to identify similar sites elsewhere."

Other authors of the study were Sebastian Perroud, Nicolas Blanco and Andrew Tomlinson.

This news release is courtesy of Brown University.



The glass deposits stretch along a 75-kilometer corridor in northern Chile.

NASA's Juno: Science Results Offer First 3D View of Jupiter Atmosphere

NASA's Jovian orbiter lends deeper understanding of what happens below the gas giant's striking clouds.

New findings from NASA's Juno probe orbiting Jupiter provide a fuller picture of how the planet's distinctive and colorful atmospheric features offer clues about the unseen processes below its clouds. The results highlight the inner workings of the belts and zones of clouds encircling Jupiter, as well as its polar cyclones and even the Great Red Spot.

Researchers published several papers on Juno's atmospheric discoveries today in the journal Science and the Journal of Geophysical Research: Planets. Additional papers appeared in two recent issues of Geophysical Research Letters.

"These new observations from Juno open up a treasure chest of new information about Jupiter's enigmatic observable features," said Lori Glaze, director of NASA's planetary science division at the agency's headquarters in Washington. "Each paper sheds light on different aspects of the planet's atmospheric processes – a wonderful example of how our internationally-diverse science teams strengthen understanding of our solar system."

Juno entered Jupiter's orbit in 2016. During each of the spacecraft's 37 passes of the planet to date, a specialized suite of instruments has peered below its turbulent cloud deck.

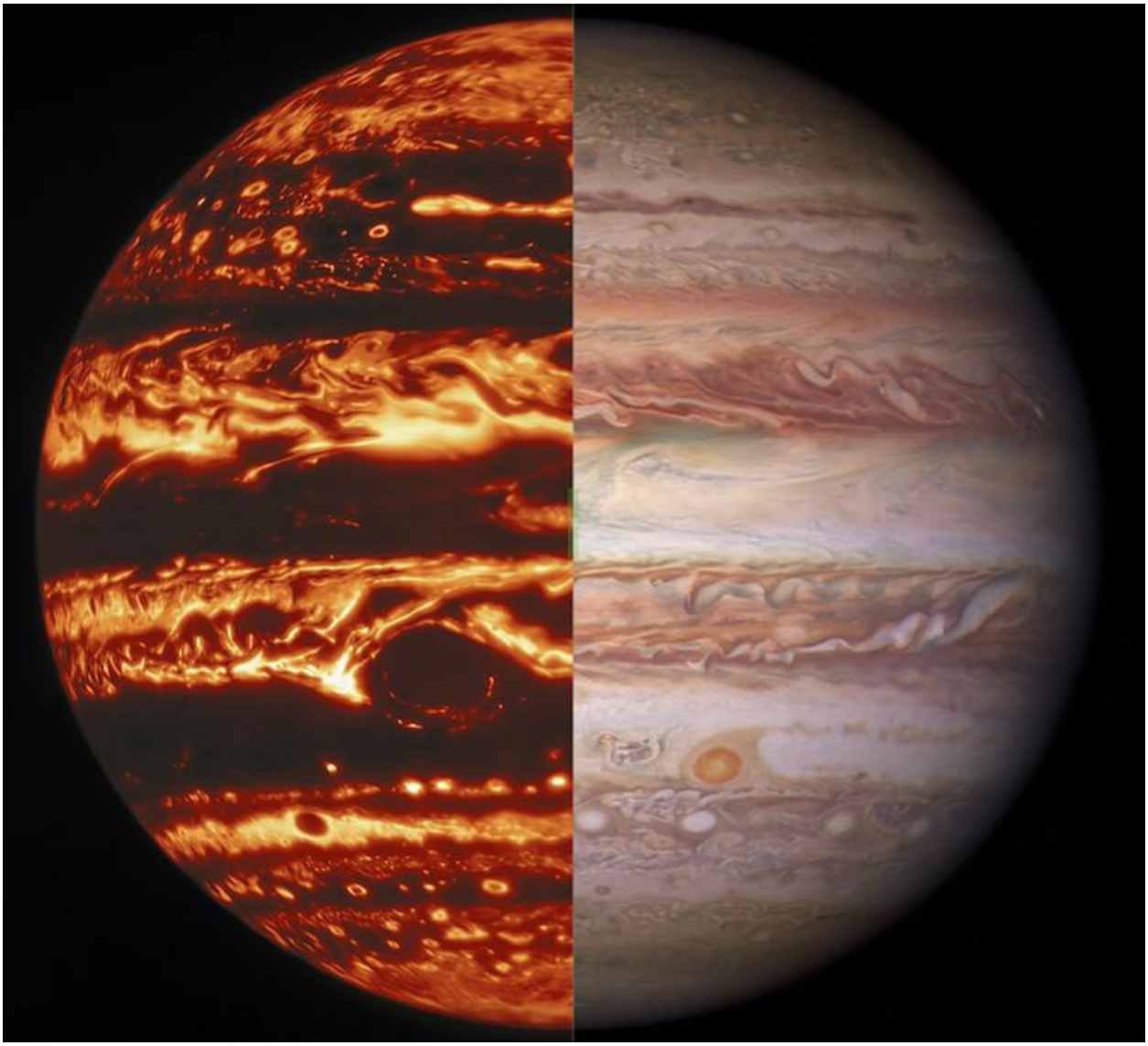
"Previously, Juno surprised us with hints that phenomena in Jupiter's atmosphere went deeper than expected," said Scott Bolton, principal investigator of Juno from the Southwest Research Institute in San Antonio

The JunoCam imager aboard NASA's Juno spacecraft captures a Jovian cyclone known as a barge type in polar jet stream called "Jet N4."

Credit: Image data: NASA/JPL-Caltech/SwRI/MSSS. Image processing: Gerald Eichstädt CC BY

and lead author of the Science journal paper on the depth of Jupiter's vortices. "Now, we're starting to put all these individual pieces together and getting our first real understanding of how Jupiter's beautiful and violent atmosphere works – in 3D."

Juno's microwave radiometer (MWR) allows mission scientists to peer beneath Jupiter's cloud tops and probe the structure of its numerous vortex storms. The most famous of these storms is the iconic anticyclone known as the Great Red Spot. Wider than Earth, this crimson vortex has intrigued scientists since its discovery almost two centuries ago.



Jupiter's banded appearance is created by the cloud-forming "weather layer." In this composite image, the image on the left show's Jupiter's thermal energy being emitted in infrared light, with dark cloudy bands appearing as silhouettes against Jupiter's thermal glow. The image on the right shows Jupiter's appearance in visible light, with white cloudy "zones" and the relatively cloud-free "belts" appearing as red-brown colors.

The composite was created using infrared data collected by the Gemini North telescope (left) and a visible-light image taken by NASA's Hubble Space Telescope. Both images were created from data captured on Jan. 11, 2017.

The new results show that the cyclones are warmer on top, with lower atmospheric densities, while they are colder at the bottom, with higher densities. Anticyclones, which rotate in the opposite direction, are colder at the top but warmer at the bottom.

The findings also indicate these storms are far taller than expected, with some extending 60 miles (100 kilometers) below the cloud tops and others, including the Great Red Spot, extending over 200 miles (350 kilometers). This surprise discovery demonstrates that the vortices cover regions beyond those where water condenses and clouds form, below the depth where sunlight warms the atmosphere.

The height and size of the Great Red Spot means the concentration of atmospheric mass within the storm potentially could be detectable by instruments studying Jupiter's gravity field. Two close Juno flybys over Jupiter's most famous spot provided the opportunity to search for the storm's gravity signature and complement the MWR results on its depth.

With Juno traveling low over Jupiter's cloud deck at about 130,000 mph (209,000 kph) Juno scientists were able to measure velocity changes as small 0.01 millimeter per second using a NASA Deep Space Network tracking antenna, from a distance of more than 400 million miles (650 million kilometers). This enabled the team to constrain the depth of the Great Red Spot to about 300 miles (500 kilometers) below the cloud tops.

"The precision required to get the Great Red Spot's gravity during the July 2019 flyby is staggering," said Marzia Parisi, a Juno scientist from NASA's Jet Propulsion Laboratory in Southern California and lead author of a paper in the journal Science on gravity overflights of the Great Red Spot. "Being able to complement MWR's finding on the depth gives us great confidence that future gravity experiments at Jupiter will yield equally intriguing results."

Belts and Zones

In addition to cyclones and anticyclones, Jupiter is known for its distinctive belts and zones – white and reddish bands of clouds that wrap around the planet. Strong east-west winds moving in opposite directions separate the bands. Juno previously discovered that these winds, or jet streams, reach depths of about 2,000 miles (roughly 3,200 kilometers). Researchers are still trying to solve the mystery of how the jet streams form. Data collected by Juno's MWR during multiple passes reveal one possible clue: that the atmosphere's ammonia gas travels up and down in remarkable alignment with the observed jet streams.

"By following the ammonia, we found circulation cells in both the north and south hemispheres that are similar in nature to 'Ferrel cells,' which control much of our climate here on Earth," said Keren Duer, a graduate student from the Weizmann Institute of Science in Israel and lead author of the Science journal paper on Ferrel-like cells on Jupiter. "While Earth has one Ferrel cell per hemisphere, Jupiter has eight – each at least 30 times larger."

Juno's MWR data also shows that the belts and zones undergo a transition around 40 miles (65 kilometers) beneath Jupiter's water clouds. At shallow depths, Jupiter's belts are brighter in microwave light than the neighboring zones. But at deeper levels, below the water clouds, the opposite is true – which reveals a similarity to our oceans.

“We are calling this level the ‘Jovicline’ in analogy to a transitional layer seen in Earth’s oceans, known as the thermocline – where seawater transitions sharply from being relative warm to relative cold,” said Leigh Fletcher, a Juno participating scientist from the University of Leicester in the United Kingdom and lead author of the paper in the Journal of Geophysical Research: Planets highlighting Juno’s microwave observations of Jupiter's temperate belts and zones.

Polar Cyclones

Juno previously discovered polygonal arrangements of giant cyclonic storms at both of Jupiter’s poles – eight arranged in an octagonal pattern in the north and five arranged in a pentagonal pattern in the south. Now, five years later, mission scientists using observations by the spacecraft’s Jovian Infrared Auroral Mapper (JIRAM) have determined these atmospheric phenomena are extremely resilient, remaining in the same location.

“Jupiter’s cyclones affect each other’s motion, causing them to oscillate about an equilibrium position,” said Alessandro Mura, a Juno co-investigator at the National Institute for Astrophysics in Rome and lead author of a recent paper in Geophysical Research Letters on oscillations and stability in Jupiter’s polar cyclones. “The behavior of these slow oscillations suggests that they have deep roots.”

JIRAM data also indicates that, like hurricanes on Earth, these cyclones want to move poleward, but cyclones located at the center of each pole push them back. This balance explains where the cyclones reside and the different numbers at each pole.

More About the Mission

JPL, a division of Caltech in Pasadena, California, manages the Juno mission. Juno is part of NASA’s New Frontiers Program, which is managed at NASA’s Marshall Space Flight Center in Huntsville, Alabama, for the agency’s Science Mission Directorate in Washington. Lockheed Martin Space in Denver built and operates the spacecraft.

Follow the mission on Facebook and Twitter, and get more information about Juno online at:

https://www.nasa.gov/juno

Astrophotography

By Jim White

Taken at the PAC Star Party on 11-5-2021. Dave Knisely and I were the only two that were there, it was a bit cold with a little breeze blowing but we made it until about midnight when the dew settled in. Dave made the suggestion that I try shooting this target. This is NGC 891 (also known as Caldwell 23, The Silver Sliver Galaxy and the Outer Limits Galaxy) visible in the constellation Andromeda. This was 30 two minute exposures at ISO 200 taken with a Nikon D750 (unmodified), Celestron OAG (off axis guider) with ZWO ASI 174MM Mini Mono guide camera, Celestron 925 EdgeHD SCT on a Celestron CGX mount and PHD2 guide software. The images were stacked in DeepSkyStacker, processed in GIMP and Lightroom.

Lunar eclipse, 3am November 19. Panasonic Lumix G9 with 75-300mm Olympus lens at f/7 0.5 seconds, ISO 1600. Two images stacked in Photoshop.

From the Archives

November, 1971

The President's Report, Earl Moser

Last month I suggested the possibility of changing the time and day of our meeting if the majority of club members felt a need for It.

Since a there has been no one wanting a change and a few that said that the last Tuesday evening of the month was the best time for the meeting, then we'll let things go on the way they have been.

On Thursday evening, November 11, our club was host to about 30 NU astronomy students and faculty for a star party at my place.

I want to thank the 12 club members who came out with their telescopes and helped to make the event a success.

You wouldn't believe, unless you were there, what an interesting, enlightening, and rewarding time can be had when you get 4 professional astronomers, 25 students and a dozen amateur astronomers with their telescopes together for a party.

Even though some of The deep sky objects were partially obscured by high, thin clouds, a fine time was had by all and we look forward to similar events in the future

Earl Moser

A 1964 PAC Star Party. Photo by Pete Schultz

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, please contact a club officer. Scopes can be checked out at a regular club meeting and kept for one month. Checkout can be extended for another month if there are no other requests for the telescope, but you must notify a club officer in advance.

100mm Orion refractor: Available
10 inch Meade Starfinder Dobsonian: Available
13 inch Truss Dobsonian: Needs repair
10 inch Zhumell: Needs mount

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

ADDRESS

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