



# Reflections

The Newsletter of the Popular Astronomy Club

ESTABLISHED 1936



December 2020

## President's Corner December 2020



Alan Sheidler

Welcome to the December edition of "Reflections", the newsletter of the Popular Astronomy Club. This issue has many astronomy related news items as well as many fine

examples of club member's photographic work. The use of cameras enables us to "see" things that we might not otherwise be able to discern by glimpsing directly into the eyepiece of the telescope. While some PAC members have become very proficient with the use of their scopes and cameras, there are still many opportunities to also do visual observing. For those of you that do not own a telescope or who don't wish to haul your scope out and bother with the setup, I would remind you that the Paul Castle Observatory is available for club members to use. The observatory's CPC1100 HD scope is one of the finest scopes of its size available today and requires virtually no set up. Simply open the observatory, turn on the scope, perform an alignment and you are ready to embark on an evening of discovery. Your membership in PAC entitles you to use the Paul Castle Observatory, which is an amazing value. I would urge all club members to come out to the observatory and get training on its operation. If you are familiar with operating a GOTO scope already, it will

(Continued in next column)

be a simple matter for you to learn how to safely open and close the observatory. For those of you who are unfamiliar with the night sky and operation of telescopes, fear not. This is why we have a club. Those of us who are knowledgeable will help and train you in the use of the observatory. Rusty Case (observatory director), Terry Dufek, Dale Hachtel and I have used the observatory and stand ready to help you learn and become "certified observatory operators". I urge you to contact one of us to get trained and use the observatory.

This December is a great time for you to consider coming out to observing sessions and use the observatory. For one, sunset occurs very early enabling ample observing time without the need of staying up late. There are also many objects visible this time of year that are not accessible at other times. If you are looking for a list of objects to observe in December, I suggest you take a look at doing the NCRAL Autumn and/or Winter Seasonal Messier Lists. Links to one of these are included here in the newsletter. By completing one of these observing lists, you can earn an award from NCRAL. The newsletter also has a nice list of double stars you can observe on page 17. Double stars are fun and easy to see visually and often have components with dramatically different brightnesses, contrasting colors, and differing separations. This December is also a great time to view planets. Mars, Jupiter, Saturn, Uranus and Neptune are all

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visible in the early evening. On the evening of December 21st, there will be a fantastic conjunction of Jupiter and Saturn. These planets and their retinue of moons will all be visible simultaneously in the same eyepiece field of view. This is not to be missed! I suggest we plan to meet at the Paul Castle Observatory that evening (weather permitting) to observe this wonderful conjunction of the solar system's two largest planetary levathans. The telescope in the Paul Castle Observatory is an ideal instrument for viewing these planets, double stars, and Messier Objects.

I would also like to draw your attention to another December happening: the Geminid Meteor Shower on December 13th. This year's shower is predicted to yield up to 120 meteors per hour (that is one meteor every 30 seconds!). Since the moon will be out of way that evening, we should be able to see even the smallest ones as they blaze across the sky. If the weather cooperates, let us pencil this in our calendars too--let's meet at the Paul Castle Observatory and have a meteor party!

If you have not already done so, let me also remind you to renew your PAC membership. Your club offers you many opportunities to observe, access equipment, attend Zoom meetings and learn about the science of astronomy. Show your support of your club by keeping your membership current. Keep looking up!

**Al Sheidler**

## ANNOUNCEMENTS / INFO



### NCRAL Seasonal Messier Marathon Program

NCRAL's Seasonal Messier Marathon observing program is NOT designed to qualify observers for the Astro-nomical League's Messier Observing program; the two programs are unrelated and observing requirements are quite different. In the NCRAL program, the main requirement is to quickly observe and essentially check off items from one of four seasonal lists of Messier objects as noted in the section to follow.

NCRAL recognition will consist a suitable printed certificate and a 3/4-inch enameled star pin (a different color for each season). There will be no direct cost to the membership for participating in the award program; the cost of the program (pins, certificates, mailers, postage) will be borne by the Region as a benefit of affiliation. Relevant program documents are linked below

[NCRAL Seasonal Messier Marathon Program Rules](#)

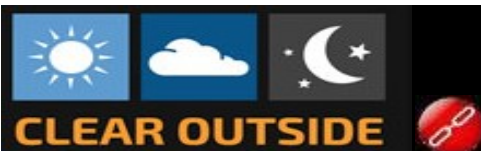
[NCRAL WINTER Seasonal Messier List](#)

[NCRAL SPRING Seasonal Messier List](#)

[NCRAL SUMMER Seasonal Messier List](#)

[NCRAL AUTUMN Seasonal Messier List](#)

**meteoblue**  
weather ✨ close to you



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# ANNOUNCEMENTS / INFO



**READY FOR  
MEMBERSHIP  
OR TO RENEW?**



For PAC Documents  
Use  
**"Enrollment Form"**



## SUBMISSIONS

If you have an article or photos to submit or items of interest, we encourage you to send them in by the 25th of the month. Links to stories are welcome also.

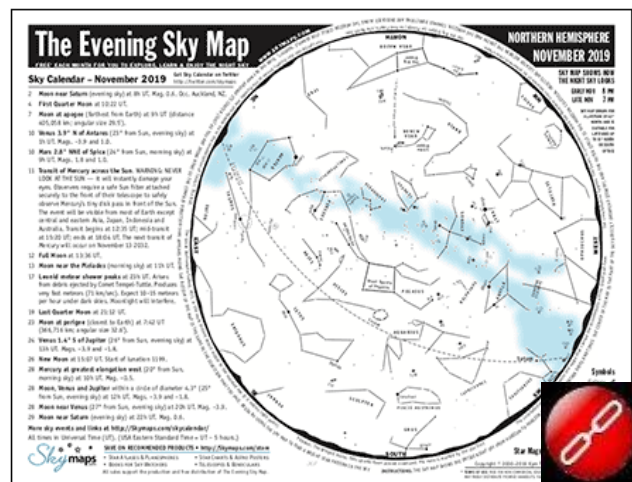
**Thank you!**

## Astronomical League Observing Programs

The Astronomical League provides many different Observing Programs. These Observing Programs are designed to provide a direction for your observations and to provide a goal. The Observing Programs have certificates and pins to recognize the observers' accomplishments and for demonstrating their observing skills with a variety of instruments and objects



Check out the Astronomical  
League **ONLINE!**



Check out  
the North  
Central  
Region  
of the  
Astronomical  
League  
(NCRAL)  
online



# ANNOUNCEMENTS / INFO

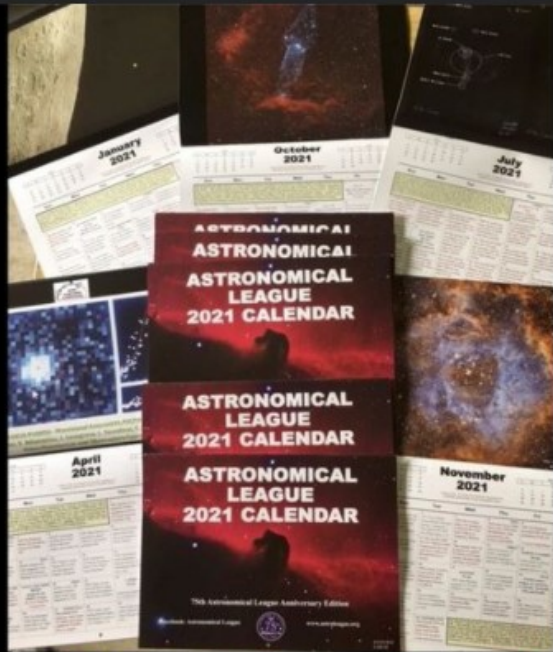


Astronomical League

17h · 🌐

Now at League Sales – the 2021 Astronomical League Calendar!  
75th Anniversary Collector's Edition

The 75th Anniversary Planning Committee encourages your purchase as these calendars have historical notations about your Astronomical League.... See More



**2021 AL Calendar - 75th Anniversary Collectors Edition**

Celebrating our 75th year November 15, 1946

The 75th Anniversary Planning Committee encourages your purchase as these calendars have historical notations of the Astronomical League.

Starting in January, events are planned that tie in to the month's trivia.

The profits from the sales goes to the ALCon Jr. budget.

THANK YOU FOR YOUR CONTINUED SUPPORT AND  
ENJOY OUR ANNIVERSARY CELEBRATION YEAR!

Astronomical League

## Now at League Sales – the 2021 Astronomical League Calendar!

### 75th Anniversary Collector's Edition

The 75th Anniversary Planning Committee encourages your purchase as these calendars have historical notations about your Astronomical League.

Available for \$13 at League Sales:

<https://store.astroleague.org/>



*Thank you for  
Renewing Your  
Membership!*

*Mike and Wanda Gacioch  
Roy and Jan Gustafson  
Michael and Helen Haney  
Ian Spangenberg  
Frank Stonestreet*



**Interesting article** in the current **Science News** about using sonification of astronomical images. The web site sounds particularly interesting.

**Gerry Pearson**





# CONTRIBUTIONS



***Spend some time looking through these photos, and you'll thoroughly enjoy yourself. You probably will not believe much of what you see. And their locations are included.....***



***(above) contributed by Mike Dannenfeldt***



# CONTRIBUTIONS



North Central Region of the Astronomical League -  
NCRAL  
@northcentralregionastronomicalleague

## DECEMBER 21 CLOSE CONJUNCTION

Text modified from an article by  
Jeffrey Hunt.  
Drawing by cjw.

Jupiter's conjunction with Saturn occurs on December 21. This conjunction ( $0.1^\circ$ ) is the closest since 1623. The two will appear to be separated by a distance equal to  $1/3$  of the moon's diameter. As September closed, Saturn's retrograde ended as Jupiter's direct motion continued to carry the Giant Planet toward the Ringed Wonder. The gap is  $7.8^\circ$ .

The Jovian planet pair was  $90^\circ$  east of the sun during early October. On October 22, one hour after sunset, the thick crescent moon (6.2d, 44%),  $23^\circ$  up in the south, made a nice triangle with Jupiter and Saturn. The crescent was  $4.4^\circ$  to the lower left of Jupiter and  $4.2^\circ$  to the lower right of Saturn. The Jupiter – Saturn gap is now about  $5.7^\circ$ . During November, the planetary duo is in the south-southwest during the early evening hours, setting before 9 p.m. standard time. As viewed from the sun, Jupiter passes Saturn on November 2 – a heliocentric conjunction. Jupiter cuts the distance to Saturn in half by month's end.

The moon passes through again on



November 18. Look for the crescent moon (3.8d, 18%) over  $16^\circ$  in altitude in the south-southwest. It is  $6.8^\circ$  to the lower right of Jupiter.

The Jupiter – Saturn gap is  $3.5^\circ$ . Jupiter is to the lower right of Saturn. By November's end, the planets' gap is approaching  $2.0^\circ$ . During early December, find them about  $20^\circ$  up in the southwest during the latter stages of evening twilight.

By December 11, they are  $1.0^\circ$  apart, and the gap closes about  $0.1^\circ$  each evening. On December 16, the thin crescent moon joins the planets. One hour after sunset, the moon (2.3d, 7%) – over  $6^\circ$  up in the southwest – is about  $5^\circ$  below Jupiter. The Jupiter – Saturn gap is  $0.5^\circ$ . On December 21, Jupiter is  $0.1^\circ$  to the lower left of Saturn. This will be the closest these two

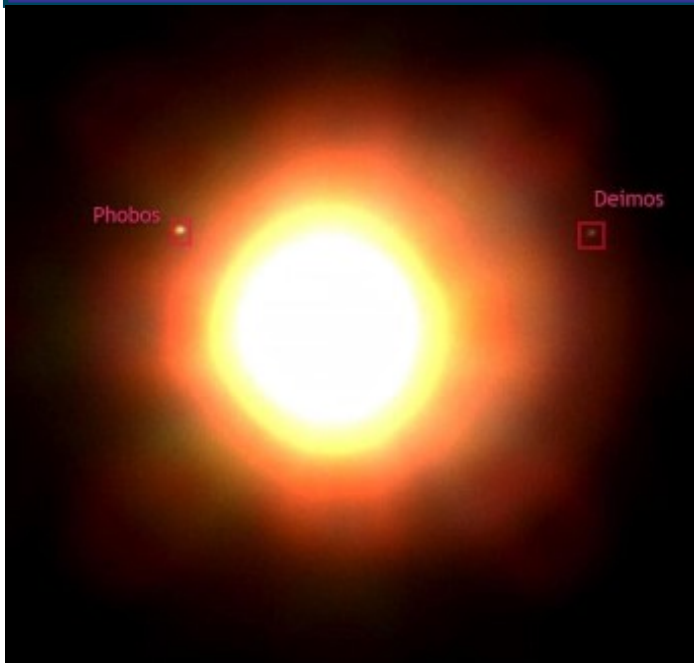
gas giants will appear together in the sky during the rest of our lifetimes. The last time they were this close was in 1623, a mere 13 years after Galileo first turned his telescope to the heavens.

By the end of the year, Jupiter is  $1.1^\circ$  to the upper left of Saturn, and they are less than  $10^\circ$  in altitude in the southwest. Saturn sets at the end of evening twilight.

The accompanying diagram shows the planets at two-week intervals starting October 26th. More information will follow in the coming weeks. Be sure to begin watching now as the two close in each other. They currently can be found in the SSW after dark.

*Editors note: from NACRAL Facebook post*

# CONTRIBUTIONS



## The Satellites of Mars

While many of you would have seen pretty pictures of Mars, given it is closest to earth this time of the year, I went the other route to see what else I can see...

This is an over-exposed disk of Mars taken on the Slooh Canary 4 Telescope. The intent was to reveal what else is there to see beyond the surface features on the planet. Lo and behold! The two satellites of Mars quickly popped into view. Both satellites seem to be lost in the glow of Mars' atmosphere, but the exposures clearly show the satellites, and a degree of circularity in them rather than just appearing as points.

What is even more astonishing is that you can see these 12 km (Phobos) and 22km (Deimos) size rocks from right here with amateur telescopes, sitting about 62 million kilometers away.

From <<https://www.facebook.com/photo?fbid=10159205924762642&set=qm.3612993008731977>

Harry Treece of the AASI (Astronomical Association of Southern Illinois) sent me a link to this item and I thought it good enough to share on our PAC web-site. The link is in Articles and Documents - Info and Presentations.

The Astronomical Society of the Pacific is selling an umbrella with an accurate picture of our Milky Way Galaxy. It makes a great display item and keeps the rain off!

Thanks,

**Dino Milani**

## ASP Galaxy Umbrella

This exclusive educational umbrella features artist Robert Hurt's rendering of astronomers' best understanding of the Milky Way Galaxy. The high-quality, collapsible umbrella, part of our Big Astronomy toolkit, includes a key to scaled distances, including our place in the galaxy, the farthest stars we see, and distances to nearby galaxies.

**\$19.95**





# VIDEO CONTRIBUTIONS

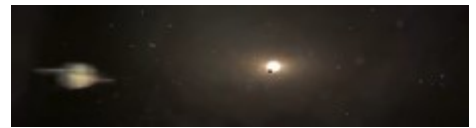


*Some **You Tube** videos for you to view while being home bound*

Interview: Fred Watson, Australia's  
Astronomer at Large



Why the Earth exists because of  
Saturn | Migration of Planets



The NEW Largest Star In The Universe  
2020, Stephenson 2-18



NASA Rocket Launch Photography -  
John McGill - Ford Astronomy Club



What I Did for MARS ...Heavenly  
Backyard Astronomy



Ghost Galaxies



The Hydrogen-Alpha Galaxy Trick



M14 - Cluster Destruction -  
Deep Sky Videos



Small vs. Huge Telescope  
for Astrophotography





# Arecibo to be Decommissioned

On November 19th, 2020 , It was decided after decades of aiding astronomical discoveries, one of the most powerful telescopes on Earth will cease its observation of the universe after sustaining irreparable damage. The 305-meter telescope at Arecibo Observatory in Puerto Rico will be decommissioned, according to an announcement made by the US National Science Foundation. The spherical radio/radar telescope includes a radio dish 1,000 feet across and a 900-ton instrument platform suspended 450 feet above it. Cables connected to three towers hold the telescope in place. An auxiliary cable came loose from a socket on one of the towers in August, creating a 100-foot gash in the dish. Engineers were assessing and working on a plan to repair the damage when another main cable on the

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tower broke on November 6. When it broke, the cable crashed into the reflector dish below, causing additional damage. After the break on November 6, engineers inspected the rest of the cables and discovered new breaks as well as slippage from some of the sockets on the towers. Multiple engineering companies reviewed the damage. They determined that the telescope could collapse because it is "in danger of catastrophic failure" and the cables are weaker than expected.

## The Arecibo Observatory

(list of some but not all accomplishments)



**1963-** Arecibo Ionospheric Observatory Commissioned for service, 1 November, 1963.

**1965-**One of its first accomplishments: Establishing the rotation rate of Mercury, which turned out to be 59 days rather than the previously estimated 88 days.

**1968-**Sporadic radio pulses from the direction of the Crab Nebula supernova remnant found at Green Bank were shown by Arecibo to come from a 33-ms period pulsar situated at the center of the nebula.

**1974-**The first pulsar in a binary system was discovered, leading to important confirmation of Einstein's theory of general relativity and a Nobel Prize 1993 for astronomers Russell Hulse and Joseph Taylor

**1980-**first radar ranging to an Earth-crossing asteroid (1862 Apollo)

**1981-**First radar maps of the geologic surface of Venus are produced.

**1982-**The discovery of millisecond pulsars, which rotate several hundred times per second. This demonstrated the existence of two classes of pulsars: the millisecond pulsars and the slower-rotating pulsars, which rotate about once per second.

Late 80's-Detailed maps of the distribution of galaxies in the universe produces 3D description of the Universe.

Early 90's-The first planets outside the solar system were discovered around Pulsar B1257+12, a rapidly rotating pulsar with three Earth-like planets in orbit. (early 1990s)

**Oct 1992-**Ice is discovered in shadowed craters at Mercury's north pole. Later observations show ice in south pole craters as well. (Harmon et al., 1992 Science vol. 258, no. 5082, p. 640-643.)

**Sep 2000-**Discovery that 2000 DP107 was the first near-Earth asteroid identified by radar as a binary system. The primary is roughly spherical with a diameter of 800 meters (a half mile) and the smaller secondary, which orbits it in 1.8 days, is about 300 meters (1000 feet)

**2003-**Evidence for hydrocarbon lakes on the Saturn satellite Titan is established using the Observatory planetary radar.

**2005-**Radar refinement of the 2029 miss distance of the NEO asteroid Apophis.

**2005- 2012-** Radar imaging of Mars reveals lava flows and near-surface geologic features not seen in visible images. This provides new insights into Mars surface geology

**2006-** First ground-based images of a cometary nucleus are recovered.

**Mar 2007-** Radar images of Mercury reveal features to be studied further by the Messenger spacecraft over the next several years.

*Link to more accomplishments*



# ASTRONOMY IN PRINT

## Different Seasons Offer Different Views

By Dale Hachtel, Popular Astronomy Club

As the earth revolves around the sun, the tilt of the earth's axis creates seasons which give us a variety of celestial objects to view during the year. In autumn in the Midwest now we can be thankful that although the weather turns colder, we have the beautiful fall colors to view on earth. In astronomy, there are also seasons. Because the earth revolves completely around the sun in a year, each day gives us a slightly different view of the sky from the dark side of the earth, while the earth's rotation points us away from the sun. Therefore, each season gives us a different set of celestial objects to view. The stars, nebulae, and galaxies repeat each year, but planets and some other objects in our solar system show up at various times in different seasons. Astronomers can also be thankful in this season that we have earlier sundown and longer nights, and that the cooler weather often results in clearer skies.

An asterism is a group of stars, usually obvious in the sky and well known, but normally not coinciding with a constellation. Asterisms are often a part of a constellation, or a group of stars from adjacent constellations. The most common example is the Big Dipper asterism, which is part of the constellation Ursa Major. In previous Skywatch articles this year, we have identified the winter triangle, spring triangle, and summer triangle asterisms, which were high in the evening sky and visible, even in well-lighted cities, during their respective seasons. In the autumn season, we deviate from the triangle pattern, with the most prominent asterism overhead in the prime viewing time being the Square of Pegasus.

In November this year, the Square of Pegasus is visible high overhead in the evening. The Square of Pegasus can be found by locating Mars, the bright

red planet in the eastern sky, and then look up almost twice as high to see the Square of Pegasus. This is a slightly distorted square, and in mid evening, around 8:00 pm, will contain the four brightest stars just to the east of the zenith, or straight overhead position.

Another way to find the square is to face due north, look up 42 degrees from the horizon (about half the way up to the zenith) to find Polaris, the North Star. The Big Dipper, normally used to locate the North Star, may not be visible if you have an obstruction to the north, as it is very low near the horizon at this time of the year. Continue looking up from Polaris toward the zenith, and you will see the Square of Pegasus. It will be slightly east of the zenith if you are observing soon after sunset.

Most of the Square of Pegasus asterism is in the constellation Pegasus, which is a mythological flying horse. If you face south, and look up at the square, the star on the top left or northeast corner is Alpheratz, the brightest star of the square. It is about 97 light years from the earth and is a binary star, although you cannot distinguish between the two with most telescopes. Each star of the binary is larger than our sun. Although it's part of the Square of Pegasus, it is actually in the constellation of Andromeda.

The star to the right of Alpheratz, is Scheat, on the northwest corner of the square, which is 196 light years from earth. This star has twice the mass of our sun, but the surface temperature is cooler than that of our sun. It is the upper arm or shoulder of the horse.

Following around to the bottom left, or southwest corner, is the star Markab, about 133 light years from earth, and having a radius five times that of our sun. It is the saddle of the horse.

Continuing to the lower right, or southeast corner, we come to Algenib, about 390 light years from earth. It is a giant with a mass about nine times that

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# ASTRONOMY IN PRINT

of the sun, and is glowing with blue-white brightness. It is in the wing of the flying horse.

One other star in Pegasus is worth noting here. If you follow a line from Algenib through Markab, continue about that much farther, you come to Enif, the brightest star in Pegasus. It forms the nose of the horse, and is a red giant 690 light years from earth, having 12 times the Sun's mass and 185 times its radius.

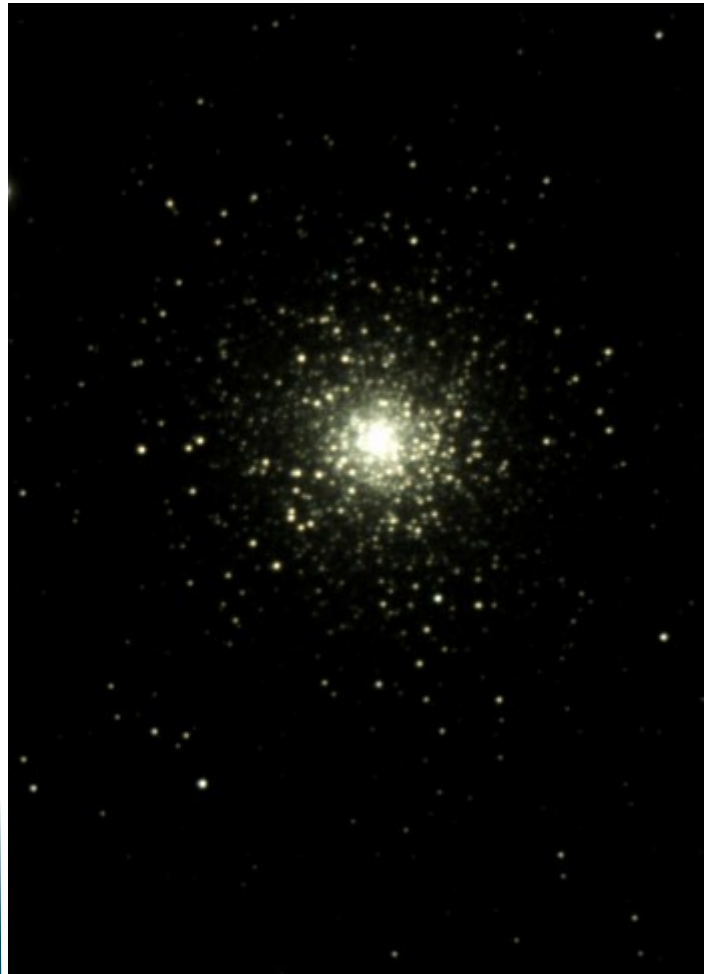
Not far to the east of Enif is Messier object 15 (*right*), a globular cluster about 33,000 light years from the earth, containing over 100,000 stars, one of the most dense globular clusters known. It can be seen as a fuzzy spot with binoculars or a small telescope, and with a larger telescope, some individual stars in the cluster can be resolved, as shown in the photograph.

If you follow a line from Algenib through Alpheratz, towards Polaris, when you are halfway to Polaris you will see an asterism that looks like a slightly flattened "W". This is Cassiopeia. Cassiopeia is not actually a seasonal constellation, as it is close enough to the North Star to remain in the night sky all year.

If you are in a dark area, away from city lights, and let your eyes adjust to the darkness, you may be able to see the Milky Way as it spreads from the northeast horizon, through Cassiopeia, and on to the southwest horizon. At the middle of that imaginary line you followed from Alpheratz to the middle of the "W", and just to the east, you may also see a very dim fuzzy spot. This is the core of the Andromeda Galaxy. At 2.5 million light years from earth, it is the most distant object in the sky visible to the naked eye. That galaxy is similar in size to the Milky Way and is estimated to have about a trillion stars. If you stay out observing long enough, by midnight, you can see a preview of the next season's stars as they rise in the east. The first ones to notice will be the Pleiades cluster of 7 stars visible with the naked eye, and the constellation Orion.

The Popular Astronomy Club has had to cancel the

monthly public viewing sessions at Niabi Zoo this year, and conduct meetings online, it hopes to resume public observing in March, if conditions permit, to once again show off the night sky to the public. For information see the web site [www.popularastronomyclub.org](http://www.popularastronomyclub.org), or look on Facebook at Popular Astronomy Club - Quad Cities.



(above) Messier 15, globular cluster



(Continued in next column)





November  
2020

## Hello, Bennu!

Not long ago OSIRIS-REx, a spacecraft sponsored by the University of Arizona and flown by NASA gently touched the surface of asteroid No. 101955, an asteroid named Bennu, tried to grab some material, and then quickly took off again. It was the first try, but it was a huge success! The craft gathered more than twice what was expected—so much that some small pieces of material started to leak out.

Of course, if all the sample leaked out, then there was no sample. But that won't happen. NASA plans to transfer the material to a safe storage container earlier than expected, and then the sample will be safe.

The mission, run jointly by NASA and the University of Arizona, cost the U.S. taxpayers about eight hundred million dollars, plus about 185 million for the launch aboard an Atlas V rocket. The Osiris-Rex is an acronym for Origins, Spectral Interpretation, Resource Identification, Security, Regolith Explorer. Asteroid Bennu is an interesting choice. Bennu was the name for an Egyptian mythological bird associated with creation, the Sun, and rebirth. But much as the name might inspire us to look back at the early days of our solar system (which it does), that's not the real reason this particular asteroid was chosen. Bennu is a C-type asteroid. It is also a sort of time capsule dating back to the birth and early evolution of the solar system. C is for carbonaceous asteroid, but it is a B sub-type because it is primitive. The reason for this is that it had undergone almost no geological change since it formed.

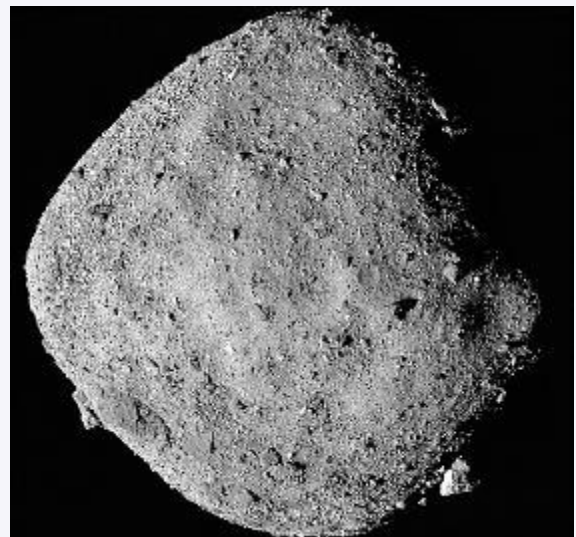
Especially if you pay taxes to the government of the United States, you may wonder why more than 800 million dollars was sent to this distant spot of light in the sky. I could begin to answer this by saying that Bennu's sample will teach us about what the solar system was made of at its for-

mation. From that, Bennu could give us a healthy idea about what the Earth itself was like at its birth. Sometime after it was formed, its orbit changed so that now, every few dozen years it gets pretty close to Earth. There is a very small chance that it might hit Earth in the distant future.

Dolores Hill, a long-time member of the OSIRIS-Rex team adds: "NASA sent this mission to Bennu, a primitive body, to return a pristine, protected sample so we could better understand the beginning and history of the solar system, formation of organic compounds important to life, and understand how Main-belt asteroids migrate to the inner solar system to become Near-earth asteroids."

All this is fine, but couldn't that money be better spent on Earth, to feed the starving, cure those afflicted with coronavirus, house the homeless, and do all the other things we thought we could do when we decided to go to the Moon in the 1960s?

Yes, it could. Except for one thing. Going to the Moon seemed pointless until we all were glued to television, watching breathlessly as one human stepped onto the surface of another world. Dear readers, we are explorers. It is in our blood, our DNA, in our hopes and dreams. And in the midst of this horrible pandemic, a small piece of human-built machinery tapped the surface of a distant world and grabbed a sample. Indeed, space journeys like this one help make life worth living. We live here. This is our neighborhood. We reach for the stars.



*(Continued in next column)*

# UPCOMING EVENTS



**Date:** December 14th, 2020

**Event:** Business Meeting

**Location:** Zoom (*details to follow*)

**Program Speaker:** Roy Gustafson (year in review)

**All these dates and times are Tentative due to conditions! Please check your emails for any updates as to whether the Event will Occur!**

- **January 11th, 2021** PAC regular meeting at via Zoom at 7:00 PM. Presentation: Cosmic Horizons - Chuck Allen, Vice President, Astronomical League
- **February 8th, 2021** PAC regular meeting at Butterworth Center at 7:00 PM. Presentation: "The Year In Space" program by Larry Boyle, Chicago Society for Space Studies
- **March 8th, 2021** PAC Business Meeting at Butterworth Center at 7:00 PM. Presentation: Smorgasbord
- **April 12th, 2021** PAC Regular Meeting at Butterworth Center at 7:00 PM. Presentation: "Skies and Skywatchers of Ancient North America" Bill Iseming, Cahokia Mounds State Historic Site
- **May 10th, 2020** PAC Regular Meeting at Butterworth Center at 7:00 PM. Presentation: "NASA Solar Missions", program by Dr. Therese Kucera, NASA Goddard

**Mark your calendars and watch upcoming e-mails for more information!**

## The Binocular Sky



# SIGN UP REPORT

| MONTH     | NEWSPAPER ARTICLES | CONSTELLATION REPORT | PROGRAM  |
|-----------|--------------------|----------------------|--|
| AUG 2020  | Al Sheidler        | None Scheduled       | PICNIC   |
| SEPT 2020 | Ian Spangenberg    | None Scheduled       | Mr. Zach Luppen, University of Iowa, Zach will discuss the upcoming JUICE and Europa Clipper Missions )  |
| OCT 2020  | Paul Levesque      | None Scheduled       | Virtual Banquet  |
| NOV 2020  | Dale Hachtel       | None Scheduled       | Presentation by Adeene Denton "Exploring Pluto after New Horizons: Oceans, Volcanism, and Habitability at the Edge of the Solar System" via Zoom |
| DEC 2020  | Terry Dufek        |                      | Roy Gustafson (Year n Review)  |
| JAN 2021  | Chris Nordick      | None Scheduled       | Presentation: Cosmic Horizons - Chuck Allen, Vice President, Astronomical League via Zoom<br>See bio in December Newsletter                      |
| FEB 2021  | Wayland Bauer      | None Scheduled       | "The Year In Space" program by Larry Boyle, Chicago Society for Space Studies, via Zoom.   |
| MAR 2021  | Paul Levesque      | Ally Nordick         | SMORGASBORD (SEE BELOW)  |
| APR 2021  | Roy Gustafson      | None Scheduled       | Presentation: "Skies and Skywatchers of Ancient North America" Bill Iseminger, Cahokia Mounds State Historic Site via Zoom                       |
| MAY 2021  | Dave Smith         | None Scheduled       | "NASA Solar Missions", program by Dr. Therese Kucera, NASA Goddard, via Zoom   |
| JUN 2021  |                    | None Scheduled       | "Association of Lunar and Planetary Observers", program by Matthew Will, Secretary & Treasurer ALPO, via Zoom                                    |
| JUL 2021  |                    | None Scheduled       | Green Bank Observatory - Virtual Tour and Current Projects   |

*Editors Note:*  
*Paul Levesque is willing to review and edit any newspaper article submissions.*  
*Thank you*

**All these dates and times are Tentative due to conditions! Please check your emails for any updates as to whether the Event will Occur!**

| SMORGASBORD |       |
|-------------|-------|
| MARCH       |       |
| _____       | _____ |
| _____       | _____ |
| _____       | _____ |
| JUNE        |       |
| _____       | _____ |
| _____       | _____ |
| _____       | _____ |
| SEPTEMBER   |       |
| _____       | _____ |
| _____       | _____ |
| _____       | _____ |



## ASTRONOMICAL CALENDAR OF EVENTS

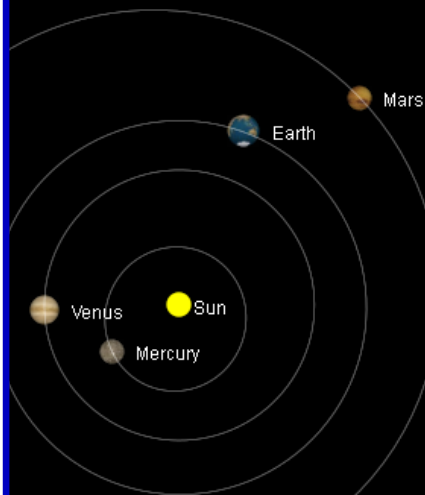
Dec 01 01:46 Moon at Ascending Node  
 Dec 03 19:24 Pollux 3.8°N of Moon  
 Dec 04 19:10 Beehive 2.4°S of Moon  
 Dec 06 10:28 Regulus 4.8°S of Moon  
 Dec 07 18:37 **LAST QUARTER MOON**  
 Dec 12 14:40 Venus 0.8°S of Moon:  
 Occultation.  
 Dec 12 14:42 Moon at Perigee:  
 361777 km  
 Dec 13 19:00 Geminid Meteor Shower  
 Dec 14 05:03 Moon at Descending  
 Node  
 Dec 14 10:13 Total Solar Eclipse;  
 mag=1.025  
 Dec 14 10:17 **NEW MOON**  
 Dec 16 22:28 Jupiter 2.9°N of Moon  
 Dec 16 23:25 Saturn 3.1°N of Moon  
 Dec 19 21:00 Mercury at Superior  
 Conjunction  
 Dec 21 04:03 **Winter Solstice**  
 Dec 21 17:41 **FIRST QUARTER MOON**  
 Dec 21 17:00 **Jupiter- Saturn**  
**Conjunction 6' separation**  
 Dec 22 03:00 Ursid Meteor Shower  
 Dec 23 08:48 Venus 5.5°N of Antares  
 Dec 23 12:30 Mars 5.6°N of Moon  
 Dec 24 10:32 Moon at Apogee:  
 405010 km  
 Dec 27 14:20 Aldebaran 4.6°S of Moon  
 Dec 28 09:03 Moon at Ascending Node  
 Dec 29 21:28 **FULL MOON**  
 Dec 31 01:41 Pollux 3.8°N of Moon

**The Sun** starts out December in Ophiuchus moving into Sagittarius on December 17<sup>th</sup>.

**Mercury** starts off in Libra on the 1<sup>st</sup> (mag: -.6, dia: 4.9", illum: 95.9%), 10° west of the Sun. It is about 6° 15' above the E-SE horizon. It recedes to superior conjunction on the 19<sup>th</sup>. Mercury barely peaks over the SW-W horizon at 46' on the 31<sup>st</sup>.

**Venus** is Libra on the 1<sup>st</sup> (mag: -3.90, dia: 11.64", illum: 88.8%) staying about 20° in western elongation from the Sun throughout the month. It is about 16° above the SE horizon at 6:30 am. The Moon is 2° 22' west of the Moon, on January 12<sup>th</sup>, moving toward an occultation at around 2pm. Venus passes Beta Scorpio on the 18 by 9'.

### Inner Solar System



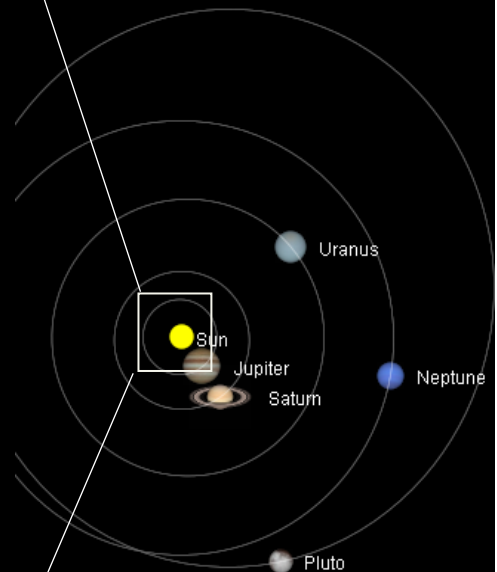
*Views are on Dec 1st*

**Mars** is in Pisces on December 1<sup>st</sup> (mag: -.93, dia: 14.43", illum: 92.2%). It is 50° above the southern horizon at 7:00 pm. The planet has dimmed in brightness and reduced in apparent size over the previous month. It is now in retrograde motion. The planet is north of the Moon on the 23<sup>rd</sup> by 5.6°. Mars is 9° 22' west of Uranus on the 31<sup>st</sup>. Mars passes 1 ½ ° north of Uranus on January 20<sup>th</sup>, 2021.

**Jupiter** is in Sagittarius on December 1<sup>st</sup> (mag: -2.03, dia: 34.35"). It is 16° above the SW horizon at 6:00 pm. It is 4° above the horizon by month end. Saturn is 2° east of Jupiter on the 1<sup>st</sup>, closing to a close conjunction later in the month. On December 21st, 2020, Jupiter and Saturn will share the same right ascension, with Jupiter passing 0° 06' to the south of Saturn. At around the same time, the two objects will also make a close approach, technically called an appulse. The pair will become visible around 16:54 (CST) as the dusk sky fades, 17° above your southwestern horizon. They will then sink towards the horizon, setting 2 hours and 23 minutes after the Sun at 18:56. Jupiter will

## THE PLANETS December 2020

### Outer Solar System



be at mag -2.0, and Saturn at mag 0.5, both in the constellation Capricornus. The pair will be close enough to fit within the field of view of a telescope but will also be visible to the naked eye or through a pair of binoculars.

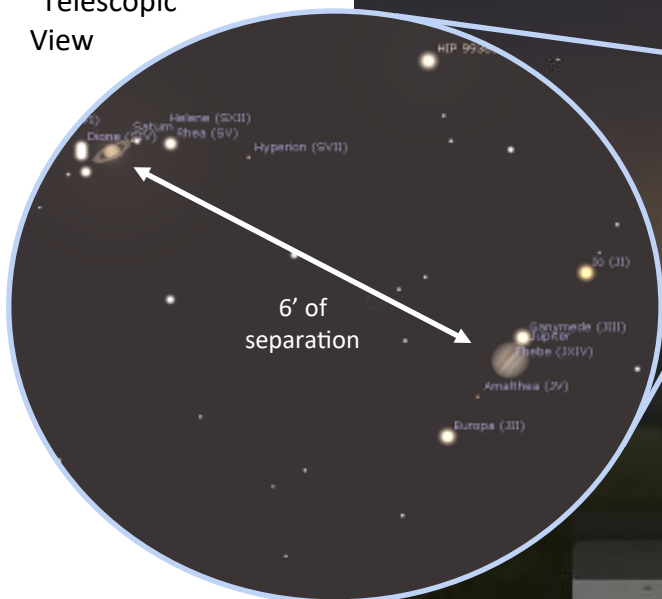
**Saturn** is in Sagittarius on December 1<sup>st</sup> (mag: .64, Dia: 15.65", rings dia: 36.45") with an altitude of 17° 32' above the SW horizon at 6:00 pm. Saturn is moving toward conjunction with Jupiter on the 21<sup>st</sup> (see above). The Moon on the 17<sup>th</sup> makes a nice combination with the gas giants.

**Uranus** is Aries on December 1<sup>st</sup> (mag: 5.68, dia: 14.22") and 35° above the E-SE horizon at 6:00 pm. Mars is 19 1/2° to the west and the Moon is 50° to the east. Mars, in retrograde draws steadily closer to Uranus though out the month until it is 8° 56' away. The Moon, on the 24<sup>th</sup> passes 2° 23' north of Uranus.

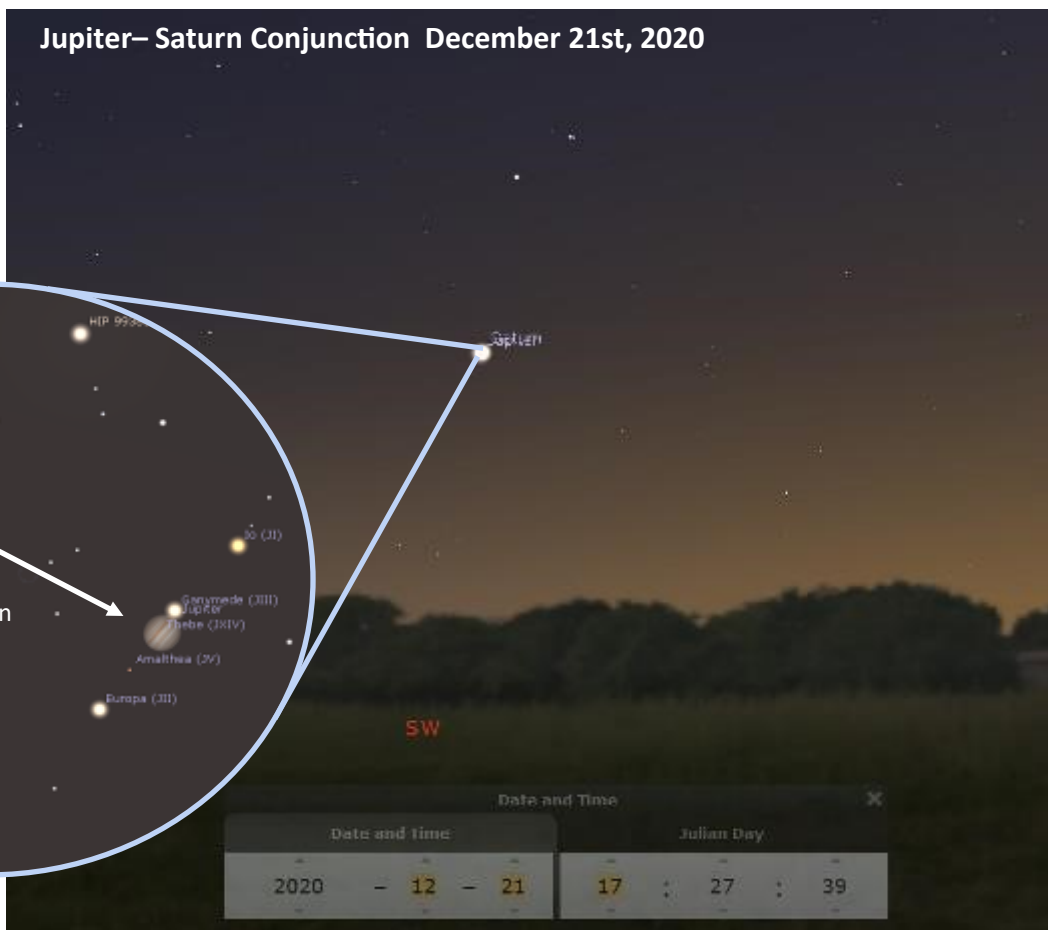
**Neptune** is in Aquarius on December 1<sup>st</sup> (mag: 7.88, dia: 5.83") almost due south with an altitude of 42°. Mars is about 28 1/2° to the east. The Moon passes south on the 20<sup>th</sup> by about 3° 39'.



Telescopic View



## Jupiter– Saturn Conjunction December 21st, 2020



## Geminids Meteor Shower

## Moon near Jupiter and Saturn on Dec. 17th

16

# Planetary Alignments in December 2020

| Phenomenon         | Date and Time              | Object 1       | Object 2        | Separation         | Solar Elongation    | Lunar Elongation    |
|--------------------|----------------------------|----------------|-----------------|--------------------|---------------------|---------------------|
| Occultation        | 2020-12-12 16:02:55        | Venus          | Moon            | —                  | +24°49'54.1"        | —                   |
| Transit            | 2020-12-06 13:39:29        | Jupiter        | Callisto (JIV)  | —                  | +42°09'47.6"        | +147°29'12.0"       |
| Transit            | 2020-12-11 12:39:01        | Jupiter        | Io (JI)         | —                  | +38°09'04.4"        | +78°28'20.3"        |
| Transit            | 2020-12-13 03:24:57        | Jupiter        | Europa (JII)    | —                  | +36°50'50.2"        | +53°43'28.4"        |
| <b>Conjunction</b> | <b>2020-12-17 00:10:53</b> | <b>Jupiter</b> | <b>Moon</b>     | <b>+3°10'20.9"</b> | <b>+33°44'30.3"</b> | <b>—</b>            |
| Conjunction        | 2020-12-21 07:31:03        | Jupiter        | Tethys (SIII)   | +0°06'14.3"        | +30°17'43.7"        | +55°11'25.1"        |
| Conjunction        | 2020-12-21 07:52:08        | Jupiter        | Dione (SIV)     | +0°06'27.0"        | +30°17'01.9"        | +55°24'48.8"        |
| Conjunction        | 2020-12-21 09:51:40        | Jupiter        | Titan (SVI)     | +0°07'16.3"        | +30°13'05.5"        | +56°37'02.6"        |
| Conjunction        | 2020-12-21 10:50:44        | Jupiter        | Enceladus (SII) | +0°05'56.1"        | +30°11'09.1"        | +57°09'46.4"        |
| <b>Conjunction</b> | <b>2020-12-21 12:22:08</b> | <b>Jupiter</b> | <b>Saturn</b>   | <b>+0°06'07.0"</b> | <b>+30°08'09.0"</b> | <b>+57°55'50.1"</b> |
| Conjunction        | 2020-12-21 15:16:31        | Jupiter        | Rhea (SV)       | +0°05'35.4"        | +30°02'24.7"        | +59°08'27.4"        |
| Conjunction        | 2020-12-21 16:42:18        | Jupiter        | Mimas (SI)      | +0°06'02.6"        | +29°59'34.5"        | +59°38'31.8"        |
| Conjunction        | 2020-12-22 08:49:48        | Jupiter        | Iapetus (SVIII) | +0°03'59.6"        | +29°27'15.7"        | +67°40'44.8"        |
| Transit            | 2020-12-23 10:14:10        | Jupiter        | Callisto (JIV)  | —                  | +28°36'40.4"        | +80°04'31.7"        |
| Transit            | 2020-12-23 22:11:22        | Jupiter        | Io (JI)         | —                  | +28°12'57.0"        | +85°02'14.1"        |
| Occultation        | 2020-12-29 04:00:07        | Jupiter        | Europa (JII)    | —                  | +24°03'03.3"        | +146°54'23.4"       |
| Occultation        | 2020-12-31 21:26:22        | Jupiter        | Io (JI)         | —                  | +21°53'44.5"        | +176°08'13.3"       |
| Conjunction        | 2020-12-14 03:40:25        | Mercury        | Moon            | +0°37'10.7"        | +3°19'43.9"         | —                   |
| Conjunction        | 2020-12-19 12:23:33        | Mercury        | Sun             | +1°26'07.0"        | —                   | +65°16'14.5"        |
| Conjunction        | 2020-12-07 16:47:55        | Moon           | (4) Vesta       | +0°17'33.3"        | +90°54'00.0"        | —                   |
| Conjunction        | 2020-12-14 08:44:10        | Moon           | Sun             | +1°01'21.3"        | —                   | —                   |
| Conjunction        | 2020-12-16 13:14:10        | Moon           | Pluto           | +2°39'55.0"        | +28°27'46.4"        | —                   |
| Conjunction        | 2020-12-17 00:47:27        | Saturn         | Moon            | +3°18'02.3"        | +34°13'08.3"        | —                   |
| Conjunction        | 2020-12-24 21:17:55        | Uranus         | Moon            | +3°33'36.7"        | +123°05'59.5"       | —                   |

From stellarium

| DOUBLE STARS IN DECEMBER |                                    |          |          |       |      |      |
|--------------------------|------------------------------------|----------|----------|-------|------|------|
| Object                   | RA                                 | DEC      | MAG      | SEP   | PA   | Year |
| Eta Cassiopeiae          | 00 <sup>h</sup> 49 <sup>m</sup> .1 | +57° 49' | 3.5, 7.4 | 13.2" | 323° | 2012 |
| 65 Piscium               | 00 <sup>h</sup> 49 <sup>m</sup> .9 | +27° 43' | 6.3, 6.3 | 4.3"  | 115° | 2013 |
| Psi 1 Piscium            | 01 <sup>h</sup> 05 <sup>m</sup> .6 | +21° 28' | 5.3, 5.4 | 29.7" | 159° | 2012 |
| Zeta Piscium             | 01 <sup>h</sup> 13 <sup>m</sup> .7 | +07° 35' | 5.2, 6.3 | 22.8" | 63°  | 2012 |
| Gamma Arietis            | 01 <sup>h</sup> 53 <sup>m</sup> .5 | +19° 18' | 4.5, 4.6 | 7.2"  | 2°   | 2013 |
| Lambda Arietis           | 01 <sup>h</sup> 57 <sup>m</sup> .9 | +23° 36' | 4.8, 6.6 | 37.1" | 48°  | 2012 |
| Alpha Piscium            | 02 <sup>h</sup> 02 <sup>m</sup> .0 | +02° 46' | 4.1, 5.2 | 1.7"  | 266° | 2012 |
| Gamma Andromedae         | 02 <sup>h</sup> 03 <sup>m</sup> .9 | +42° 20' | 2.3, 5.0 | 9.4"  | 63°  | 2013 |
| Iota Trianguli           | 02 <sup>h</sup> 12 <sup>m</sup> .4 | +30° 18' | 5.3, 6.7 | 3.8"  | 69°  | 2012 |
| Alpha Ursa Minoris       | 02 <sup>h</sup> 31 <sup>m</sup> .8 | +89° 16' | 2.1, 9.1 | 18.1" | 233° | 2013 |
| Gamma Ceti               | 02 <sup>h</sup> 43 <sup>m</sup> .3 | +03° 14' | 3.5, 6.2 | 2.1"  | 298° | 2012 |
| Eta Persei               | 02 <sup>h</sup> 50 <sup>m</sup> .7 | +55° 54' | 3.8, 8.5 | 31.4" | 295° | 2012 |
| Struve 331               | 03 <sup>h</sup> 00 <sup>m</sup> .9 | +52° 21' | 5.2, 6.2 | 11.9" | 85°  | 2012 |
| 32 Eridani               | 03 <sup>h</sup> 54 <sup>m</sup> .3 | -02° 57' | 4.8, 5.9 | 6.9"  | 348° | 2013 |
| Chi Tauri                | 04 <sup>h</sup> 22 <sup>m</sup> .6 | +25° 38' | 5.4, 8.5 | 20.4" | 24°  | 2012 |
| 1 Camelopardalis         | 04 <sup>h</sup> 32 <sup>m</sup> .0 | +53° 55' | 5.8, 6.8 | 10.6" | 308° | 2012 |
| 55 Eridani               | 04 <sup>h</sup> 43 <sup>m</sup> .6 | -08° 48' | 6.7, 6.8 | 9.3"  | 318° | 2011 |

From the Astronomical League



# DEEP SKY WONDERS

For December  
Evening Skies

| Name                                 | RA (J2000) | Dec (J2000)  | Mag. | A.S., ' | S.B.  | Type                               |
|--------------------------------------|------------|--------------|------|---------|-------|------------------------------------|
| NGC 55 (String of Pearls)            | 0h14m53.6s | -39°11'47.9" | 8.87 | 38.000  | 14.25 | galaxy                             |
| IC 10 (Starburst Galaxy)             | 0h20m23.2s | +59°17'34.7" | 9.64 | 10.000  | 12.83 | galaxy                             |
| NGC 129                              | 0h30m00.0s | +60°13'04.8" | 6.64 | 21.000  | 12.99 | open star cluster                  |
| NGC 147                              | 0h33m12.1s | +48°30'31.5" | 9.63 | 21.000  | 14.40 | galaxy                             |
| NGC 185                              | 0h38m58.0s | +48°20'14.6" | 9.33 | 21.700  | 14.24 | galaxy                             |
| M 110                                | 0h40m22.1s | +41°41'07.1" | 8.20 | 32.900  | 13.90 | galaxy                             |
| M 32                                 | 0h42m41.8s | +40°51'54.6" | 8.21 | 15.000  | 12.31 | galaxy                             |
| M 31 (Andromeda Galaxy)              | 0h42m44.3s | +41°16'07.5" | 3.57 | 250.800 | 13.48 | galaxy                             |
| NGC 225 (Sailboat Cluster)           | 0h43m39.1s | +61°46'30.0" | 7.14 | 12.000  | 12.27 | open star cluster                  |
| NGC 247 (Burbidge Chain)             | 0h47m08.6s | -20°45'37.4" | 9.40 | 28.300  | 14.56 | active galaxy                      |
| NGC 253 (Sculptor Galaxy)            | 0h47m33.1s | -25°17'19.7" | 8.34 | 34.300  | 13.76 | active galaxy                      |
| NGC 288                              | 0h52m45.2s | -26°34'57.4" | 8.49 | 12.000  | 13.62 | globular star cluster              |
| NGC 300 (Southern Pinwheel Galaxy)   | 0h54m53.5s | -37°41'03.8" | 8.84 | 37.400  | 14.91 | galaxy                             |
| NGC 381                              | 1h08m19.9s | +61°35'02.0" | 9.44 | 6.000   | 13.07 | open star cluster                  |
| NGC 436                              | 1h15m58.1s | +58°48'43.2" | 8.94 | 4.000   | 11.68 | open star cluster                  |
| NGC 457 (Dragonfly Cluster)          | 1h19m35.0s | +58°17'13.2" | 6.54 | 20.000  | 12.78 | open star cluster                  |
| NGC 559                              | 1h29m31.2s | +63°18'07.2" | 9.64 | 7.000   | 13.60 | open star cluster                  |
| M 103                                | 1h33m23.0s | +60°39'00.0" | 7.54 | 6.000   | 11.17 | open star cluster                  |
| M 33 (Triangulum Galaxy)             | 1h33m50.9s | +30°39'35.8" | 5.85 | 110.300 | 14.23 | galaxy                             |
| M 33 (Triangulum Galaxy)             | 1h33m50.9s | +30°39'35.8" | 5.85 | 110.300 | 14.23 | galaxy                             |
| M 74 (Phantom Galaxy)                | 1h36m41.8s | +15°47'00.5" | 9.53 | 20.000  | 14.27 | galaxy                             |
| NGC 637                              | 1h43m04.1s | +64°02'24.0" | 8.34 | 3.500   | 10.80 | open star cluster                  |
| NGC 654 (Fuzzy Butterfly Cluster)    | 1h44m00.0s | +61°53'06.0" | 6.64 | 5.000   | 9.87  | open star cluster                  |
| NGC 659 (Yin-Yang Cluster)           | 1h44m24.0s | +60°40'12.0" | 8.04 | 5.000   | 11.27 | open star cluster                  |
| NGC 663 (Lawnmower Cluster)          | 1h46m08.9s | +61°14'06.0" | 7.24 | 15.000  | 12.86 | open star cluster                  |
| NGC 869 (Double Cluster)             | 2h19m00.0s | +57°07'40.8" | 3.94 | 30.000  | 11.06 | open star cluster                  |
| NGC 884 (Double Cluster)             | 2h22m23.0s | +57°07'30.0" | 3.94 | 30.000  | 11.06 | open star cluster                  |
| IC 1805 (Heart Nebula)               | 2h32m42.0s | +61°27'00.0" | 6.64 | 120.000 | 15.27 | cluster associated with nebulosity |
| NGC 1023 (Perseus Lenticular Galaxy) | 2h40m24.0s | +39°03'47.7" | 9.48 | 7.963   | 11.98 | interacting galaxy                 |
| M 34 (Spiral Cluster)                | 2h42m05.0s | +42°45'43.2" | 5.33 | 25.000  | 12.06 | open star cluster                  |
| M 77 (Cetus A)                       | 2h42m40.8s | -0°00'47.8"  | 9.05 | 13.100  | 12.86 | galaxy                             |
| NGC 1245 (Patrick Starfish Cluster)  | 3h14m48.2s | +47°15'10.8" | 8.54 | 30.000  | 15.66 | open star cluster                  |
| NGC 1269 (Snow Collar Galaxy)        | 3h17m18.6s | -41°06'29.1" | 9.82 | 8.870   | 12.76 | galaxy                             |
| NGC 1342 (Little Scorpion Cluster)   | 3h31m37.9s | +37°22'37.2" | 6.84 | 15.000  | 12.46 | open star cluster                  |
| NGC 1407 (Eridanus A Group)          | 3h40m11.9s | -18°34'49.4" | 9.99 | 7.338   | 12.55 | galaxy                             |
| M 45 (Pleiades)                      | 3h47m00.0s | +24°07'01.2" | 1.35 | 220.000 | 11.30 | cluster associated with nebulosity |
| NGC 1502 (Jolly Roger Cluster)       | 4h07m49.9s | +62°19'55.2" | 7.05 | 7.000   | 11.01 | open star cluster                  |
| NGC 1514 (Crystal Ball Nebula)       | 4h09m17.0s | +30°46'33.5" | 9.63 | 3.346   | 10.49 | planetary nebula                   |
| NGC 1528 (m & m Double Cluster)      | 4h15m23.0s | +51°12'54.0" | 6.55 | 25.000  | 13.27 | open star cluster                  |
| NGC 1545 (m & m Double Cluster)      | 4h20m56.9s | +50°15'10.8" | 6.35 | 18.000  | 12.36 | open star cluster                  |
| NGC 1647 (Pirate Moon Cluster)       | 4h45m55.0s | +19°06'54.0" | 6.58 | 40.000  | 14.33 | open star cluster                  |
| NGC 1664 (4-H cluster)               | 4h51m06.0s | +43°40'30.0" | 7.76 | 15.000  | 13.38 | open star cluster                  |

\* Data from Stellarium

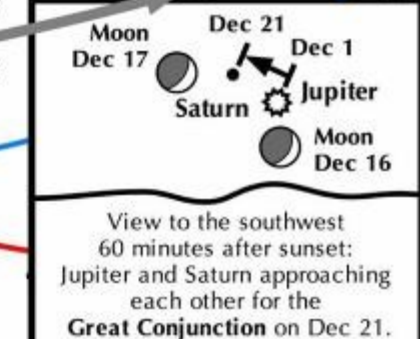
# Navigating the December Night Sky

For observers in the middle northern latitudes, this chart is suitable for late November at 9 p.m. or early December at 8 p.m.

The stars plotted represent those which can be seen from areas suffering from moderate light pollution. In larger cities, less than 100 stars are visible, while from dark, rural areas well over ten times that amount are found.

The Ecliptic represents the plane of the solar system. The sun, the moon, and the major planets all lie on or near this imaginary line in the sky.

The Ecliptic represents the plane of the solar system. The sun, the moon, and the major planets all lie on or near this imaginary line in the sky.



Relative sizes and distances in the sky can be deceiving. For instance, 360 "full moons" can be placed side by side, extending from horizon to horizon.

→ • Relative size of the full moon.

## Navigating the December night sky: Simply start with what you know or with what you can easily find.

- 1 Face south. Almost overhead is the "Great Square" with four stars about the same brightness as those of the Big Dipper. Extend an imaginary line southward following the Square's two westernmost stars. The line strikes Fomalhaut, the brightest star in the southwest. A line extending southward from the two easternmost stars, passes Deneb Kaitos, the second brightest star in the south.
- 2 Draw another line, this time westward following the southern edge of the Square. It strikes Altair, part of the "Summer Triangle."
- 3 Locate Vega and Deneb, the other two stars of the "Summer Triangle. Vega is its brightest member while Deneb sits in the middle of the Milky Way.
- 4 Jump along the Milky Way from Deneb to Cepheus, which resembles the outline of a house. Continue jumping to the "W" of Cassiopeia, to Perseus, and finally to Auriga with its bright star Capella.

### Binocular Highlights

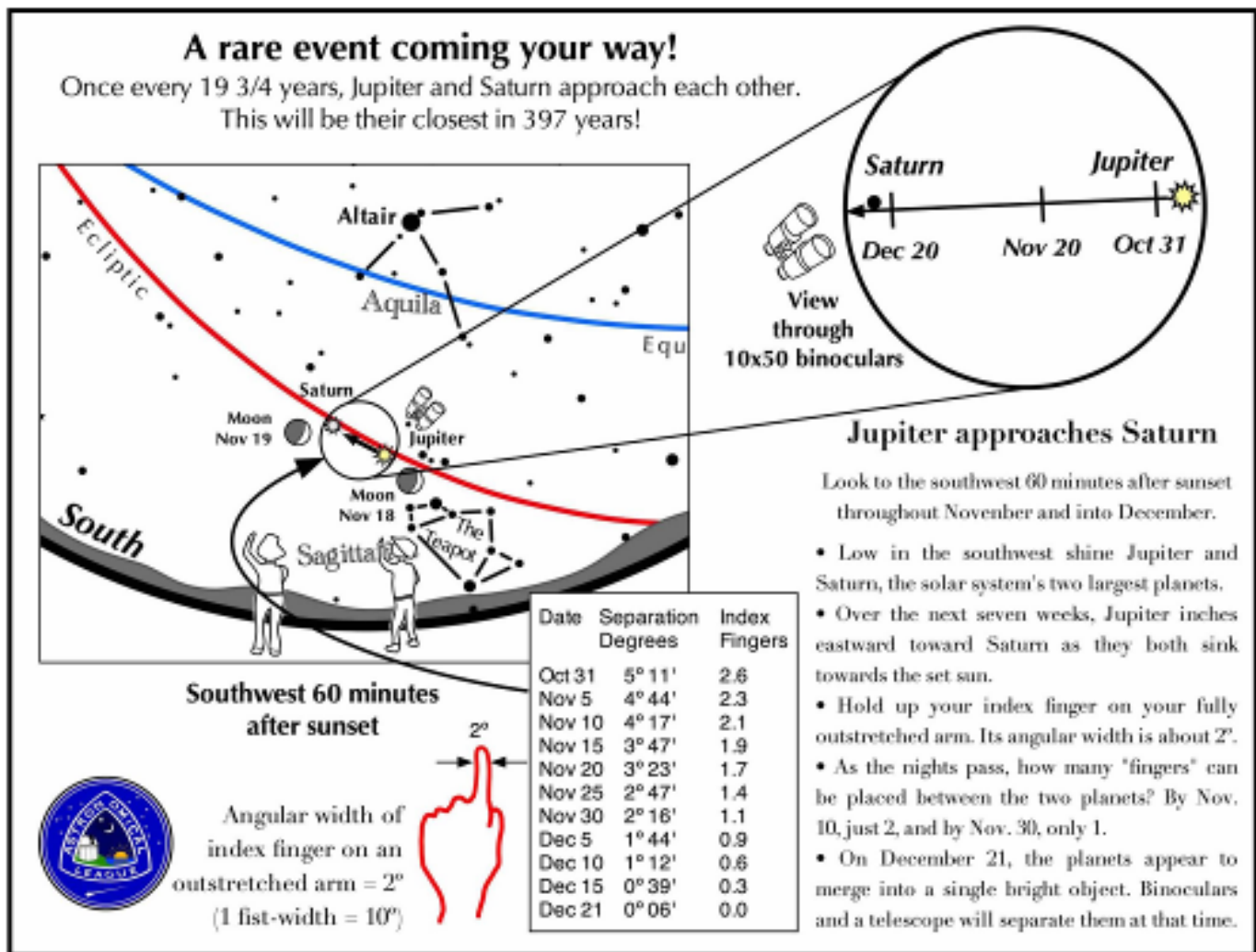
**A and B:** Examine the stars of the Pleiades and Hyades, two naked eye star clusters.

**C:** The three westernmost stars of Cassiopeia's "W" point south to M31, the Andromeda Galaxy, a "fuzzy" oval.

**D:** Sweep along the Milky Way from Altair, past Deneb, through Cepheus, Cassiopeia and Perseus, then to Auriga for many intriguing star clusters and nebulous areas.







## Explore Scientific USA

The Astronomical League is co-hosting their **first monthly Global Star Party** called "The Astronomical League Live" Event. This event is for all members of the League as well as the general public, and all are free to attend.

Featuring the Associate Director of The Center for Interdisciplinary Exploration and Research in Astrophysics at Utah State University, Professor Shane Larson, with his lecture "The Shaking Cosmos: Observing the Universe in Gravitational Waves".

Co-hosted by League Secretary Terry Mann and Explore Scientific's Scott Roberts. Highlights include presentations from League President Carroll Iorg, Astrophotographer Molly Wakeling and NCRALs Carl Wenning.

Watch on **December 5th from 13:00 to 15:00 Central** on <http://www.explorescientific.com/live#astronomicalleague#livebroadcast#globalstarparty#blackholes>

• **Carroll Iorg, AL President**

• **Scott Roberts**

• **Molly Wakeling**

• **Terry Mann**

• **Carl Wenning, NCRAL**

WORLD-RENNAMED SPACERS - LIVE ASTROPHOTOGRAPHY  
LIVE CHAT - SPACE ART - POETRY - DOORPRIZES  
**5 DEC - 14:00 to 16:00 EASTERN**  
[ExploreScientific.com/live](http://ExploreScientific.com/live)  
**ASTRONOMICAL LEAGUE**

**FEATURING**

**and Shane Larson, Dept Physics, Utah State University**

**The Shaking Cosmos:**

*Observing in Universe in Gravitational Waves*





# Spotlight: NGC 1023-Perseus Lenticular Galaxy

NGC 1023 (also known as Arp 135) is a barred lenticular galaxy of more than 50,000 light-years across, located roughly 34 million light-years away from Earth in the northern constellation of Perseus, while it is receding from us at about 637 kilometers per second. It is the brightest member of the NGC 1023 Group of galaxies in the Local Supercluster (or the Virgo Supercluster).

The galaxy is elongated in east west direction. It has a disk shape and a very bright central bulge of stars like our own Milky Way galaxy, but no spiral arms in the disk. The galaxy is surrounded by a fainter halo. In its center lies a supermassive black hole of a mass between 40 million and 60 million solar masses.



Some of the stars closest to this black hole form a small flattened disk, instead of whirling about in random directions like most of the other stars in the galaxy's central bulge. Although several of these stars are moving as fast as 1.3 million miles (almost 2 million kilometers) per hour, they are still unable, even at this extreme speed, to escape from the powerful gravity of the supermassive black hole.

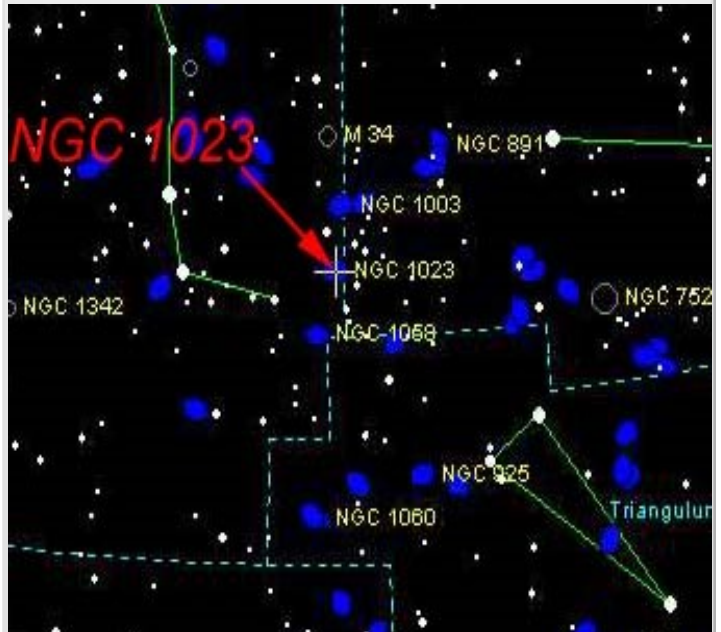
*(continued in next column)*

NGC 1023 has an almost unnoticeable low-surface brightness irregular companion on its eastern side, designated PGC 10139 (but usually called NGC 1023A because of its apparent connection with NGC 1023), leading to its designation as Arp 135.

The galaxy has three populations of globular clusters, including a relatively young population that forms a ring-like structure that probably formed during a tidal encounter about one billion years ago. These young globular clusters are associated with the former spiral arms of NGC 1023, and should therefore follow the rotation of the disk of NGC 1023, which was probably disturbed during a past interaction that transformed NGC 1023 from a spiral into a lenticular galaxy.

This galaxy apparently forms a group with several nearby .

It is magnitude 10.2 with a size of 7.9' X3.5'





### This article is distributed by NASA Night Sky Network

The Night Sky Network program supports astronomy clubs across the USA dedicated to astronomy outreach. Visit <https://nightsky.jpl.nasa.gov/> to find local clubs, events, and more!

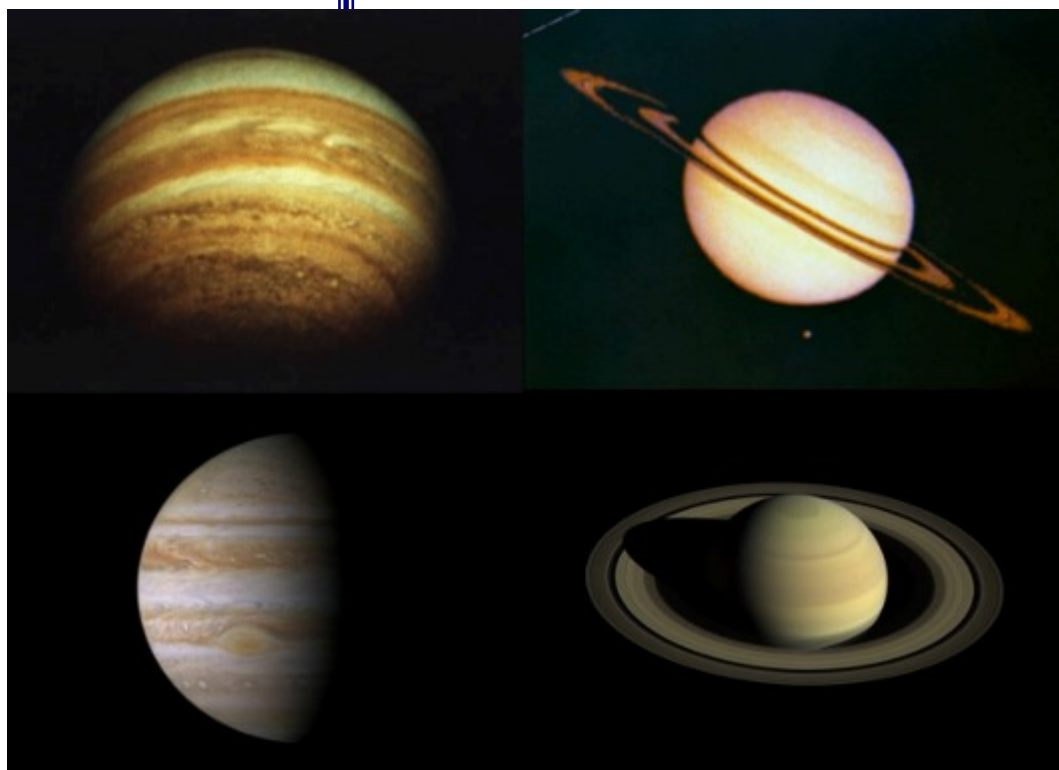
## Visitors to Both Jupiter and Saturn

David Prosper

Have you observed Jupiter and Saturn moving closer to each other over the past few months? On December 21, the two worlds will be at their closest, around 1/5 of a full Moon apart! While the two gas giants may appear close, in reality they are hundreds of millions of miles apart. Despite this vast distance, a select few missions have visited both worlds by using a gravity assist from giant Jupiter to slingshot them towards Saturn, saving time and fuel. Pioneer 11 was the first mission to visit both worlds! Launched in 1973, the probe flew past Jupiter in late 1974, passing just 26,4000 miles above its stormy clouds. In 1979, it became the first spacecraft to encounter Saturn. Pioneer 11 took the first up-close photos of Saturn and its satellites, and made many exciting discoveries, including the detections of its magnetic field and a faint "F" ring, before departing Saturn and eventually, the solar system. The Voyager missions quickly followed up, taking a "Grand Tour" of the four largest and most distant planets in our solar system. Both probes were launched within two weeks of each other in 1977. Voyager 1

flew past Jupiter in March 1979, discovering Jupiter's faint ring and two new moons, along with active volcanoes on Io's surface! The probe then flew past Saturn in November 1980, discovering five new moons, a new "G" ring, mysterious ring "spokes," and "shepherd moons" shaping the rings. After a brief encounter with Titan revealed evidence of complex organic chemistry and liquid

*(continued on next page)*



*The difference in technology between generations of space probes can be stunning! The top two photos of Jupiter and Saturn were taken by Pioneer 11 in 1974 (Jupiter) and 1979 (Saturn); the bottom two were taken by Cassini in 2000 (Jupiter) and 2016 (Saturn). What kinds of photos await us from future generations of deep space explorers?*

*(continued in next column)*





## Visitors to Both Jupiter and Saturn

David Prosper

on the moon's frigid surface, Voyager 1 was flung out of the plane of the solar system. Following close behind, Voyager 2 took detailed photos of Jupiter's moons and cloud tops in July 1979. Flying past Saturn in August 1981, Voyager 2 measured the thickness of Saturn's rings and took detailed photos of many of its moons. This second explorer then captured images of Uranus and Neptune before leaving our solar system. Cassini-Huygens was the last mission to visit both worlds. Launched in 1997, the mission flew past Jupiter in late 2000 and took incredibly detailed photos of its stormy atmosphere and faint rings. Cassini entered into Saturn's orbit on July 1, 2004. The Huygens probe

*(continued in next column)*

separated from Cassini, landing on Titan to become the first probe in the outer solar system. Cassini discovered geysers on Enceladus, fine details in Saturn's rings, many more moons and "moonlets," the changing oceans of Titan, and seasonal changes on Saturn itself. After revolutionizing our understanding of the Saturnian system, Cassini's mission ended with a fiery plunge into its atmosphere on September 15, 2017. What's next for the exploration of the outer worlds of our solar system? While Juno is currently in orbit around Jupiter, there are more missions in development to study the moons of Jupiter and Saturn. Discover more about future NASA missions to the outer worlds of our solar system at [nasa.gov](https://nasa.gov).





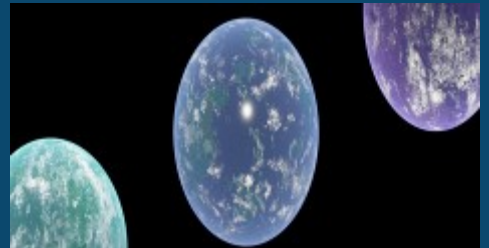
## OSIRIS-REx In the Midst of Sample Stowage

October 28th, 2020



## The Color of Habitable Worlds

October 25th, 2020



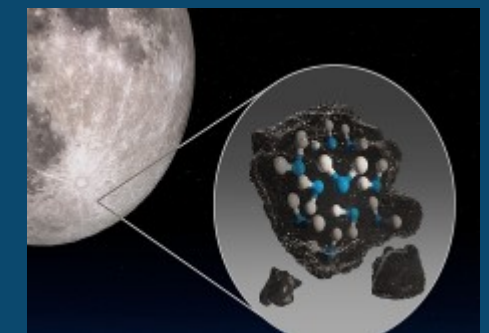
## Astronomers Map Out the Raw Material for New Star Formation in the Milky Way

October 26th, 2020



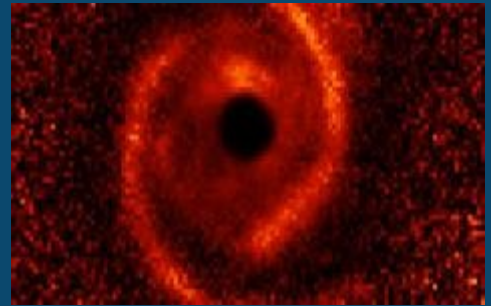
## NASA Announces the Discovery of Water in the Sunlit Parts of the Moon

October 30th, 2020



## Checking the Speed of Spirals

November 2nd, 2020



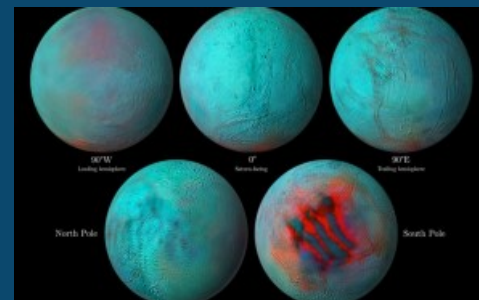
Scientists have used the Spitzer Space Telescope to confirm seventy-five new substars uncovered by the citizen science project Backyard Worlds: Planet 9

October 12th, 2020



## Infrared Eyes on Enceladus: Hints of Fresh Ice in Northern Hemisphere

September 18th, 2020



## 3 ancient underground lakes of liquid water discovered on Mars

September 30th,



Moon may have a lot more  
water than once thought

October 27th, 2020



Astronomers find smallest 'rogue planet'  
in the Milky Way

October 30th, 2020



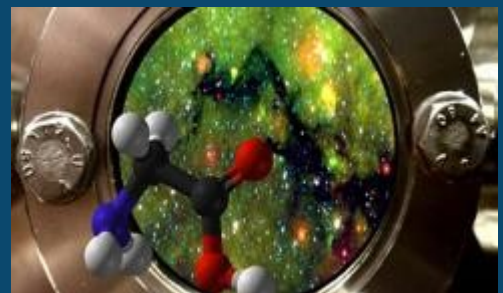
Scientists spot a 'kilonova' flash so  
bright they can barely explain it

November 12th, 2020



Amino Acids Can Form Long Before Stars  
and Planets: Study

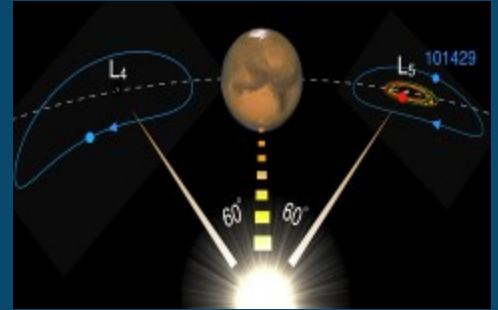
November 16th, 2020





One Mars Trojan asteroid has the same chemical signature as the Earth's moon

November 7th, 2020



Vera Rubin Should be Able to Detect a Couple of Interstellar Objects a Month

November 7th, 2020



Most light pollution isn't coming from streetlights

November 9th, 2020



Arecibo radio telescope, an icon of astronomy, is lost

November 19th, 2020



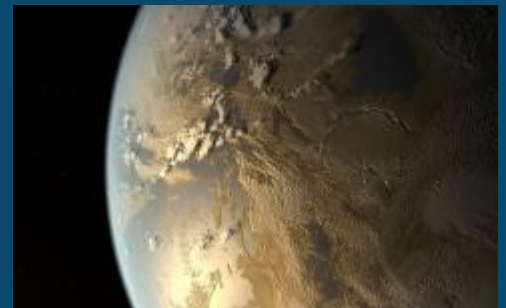
## The Average Temperature of the Universe has Been Getting Hotter and Hotter

November 14th, 2020



## What Role do Radioactive Elements Play in a Planet's Habitability?

November 15th, 2020



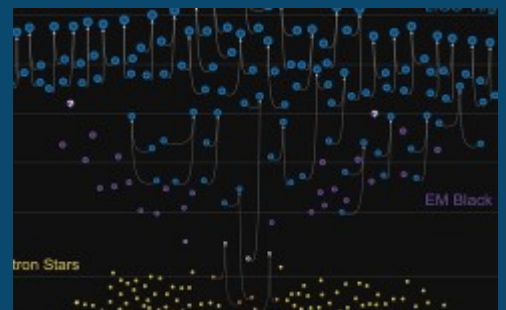
## New Horizons Saw the Universe With Even Less Light Pollution than Hubble's View

November 16th, 2020



## Merging Black Holes and Neutron Stars. All the Gravitational Wave Events Seen So Far in One Picture

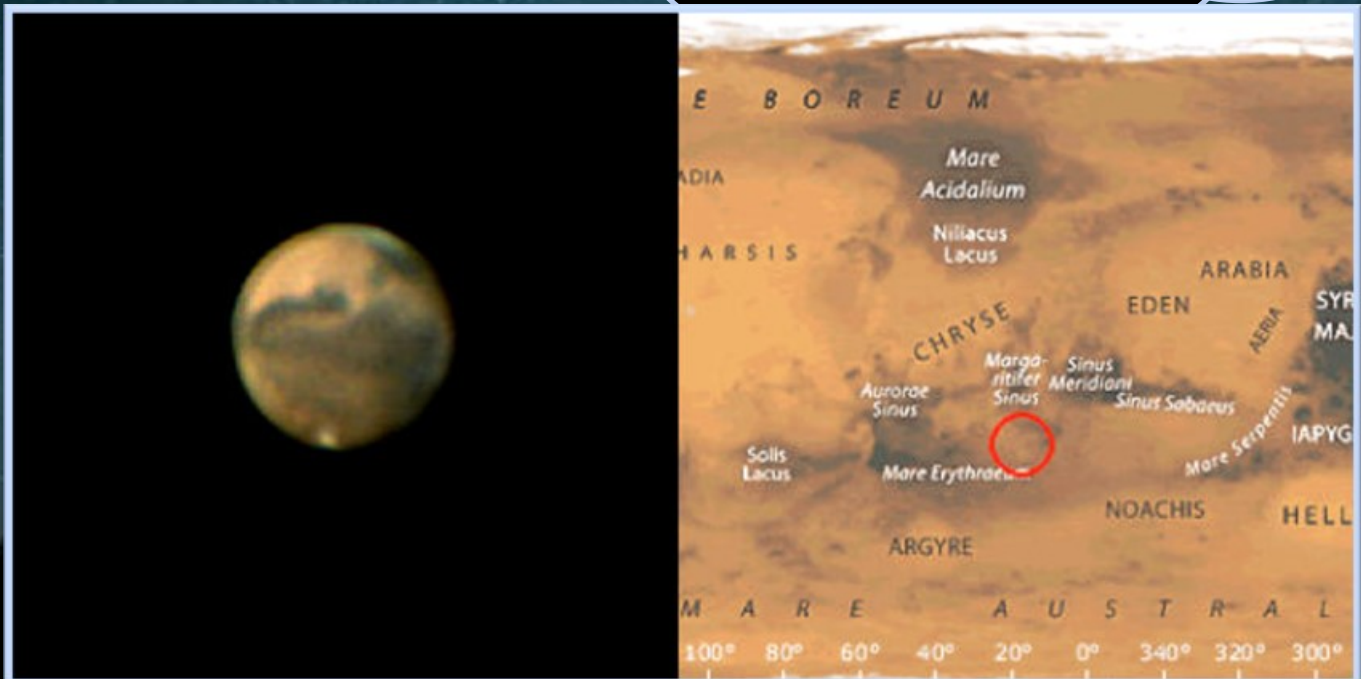
November 17th, 2020



# MEMBER OBSERVATIONS

(right) Finally photographed the planet Uranus. The air was very smooth. Used a Celestron 8 with a zwo asi camera (120) and 2 x binning. Also used a 2X bar-low for maximum magnification. Exposure was 30 seconds. post work in paintshop pro to clean up with denoise and despeckling . The smaller inset is what I started with. Uranus has a decent size of 3.75" (compared to Mars at 19"). It is just 4 days past opposition. The main reason I wanted to take this was to see how much of a difference cleaning the corrector plate would make and it really does for planetary photography

**Terry Dufek**



(above) Mars last night. 11/2/2020. The polar cap can clearly be seen. It may not be seen a few nights later however because the polar cap of Mars does not set directly over the planets axis of rotation. Planet is about 98% illuminated . **Terry Dufek**



# MEMBER OBSERVATIONS

Byron Davies has a new telescope (a Skywatcher Quattro 200P ) and these are his first images with it. Caught all 3 galaxies in this view

Messier 31

Messier 45

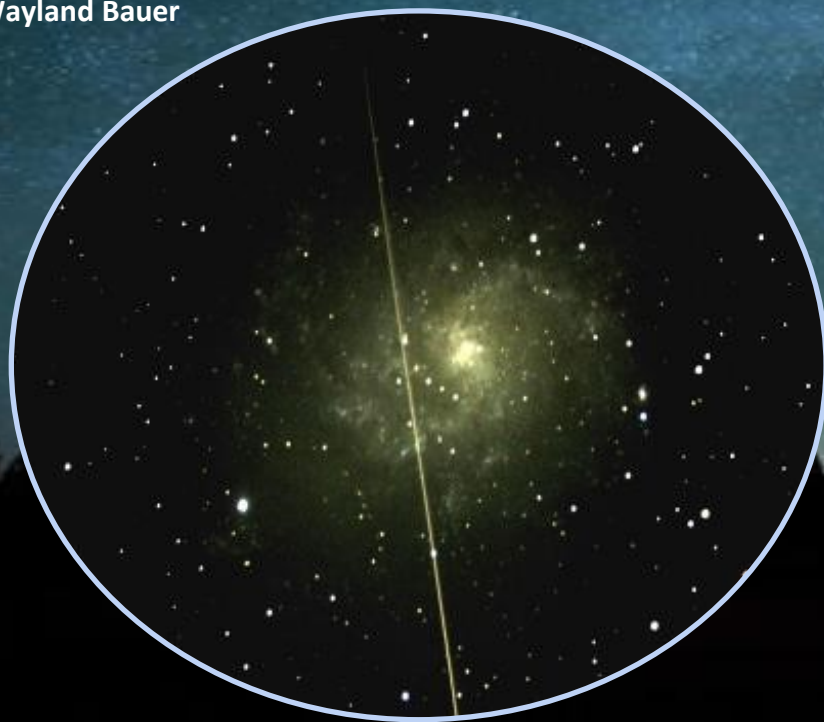
Perseus  
Double Cluster

# MEMBER OBSERVATIONS



"I finally successfully used "Precise GoTo" Friday night (Nov. 6th, 2020) . I felt these were 2 of my better attempts. The Double Cluster (above) was too big to get it all in. (ISO 1600 for 6 seconds). M92 (right) (ISO 3200 for 15 seconds)".

**Wayland Bauer**



(left) Caught meteor crossing in front of M33 on November 6th, 2020. Used Zwo 294 camera on Celestron 8 with focal reduce. 2 minute 30 second stacked exposure.

**Terry Dufek**



# MEMBER OBSERVATIONS



M2



M10



M13



M54



M15

Al Sheidler spent the evening (November 6th, 2020) taking photos of various Globular Clusters. Here is a sample of some of his imaging.



NGC3857



M22



M71



# MEMBER OBSERVATIONS



NGC 7354



NGC 7027  
Magic Carpet  
Nebula



NGC 6905 Blue  
Flash Nebula

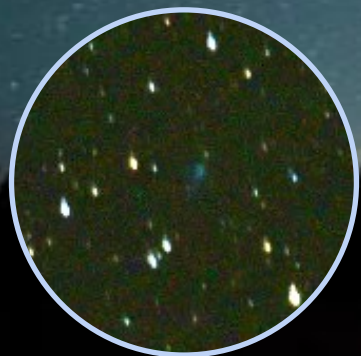


NGC 7026  
The Cheeseburger  
Nebula

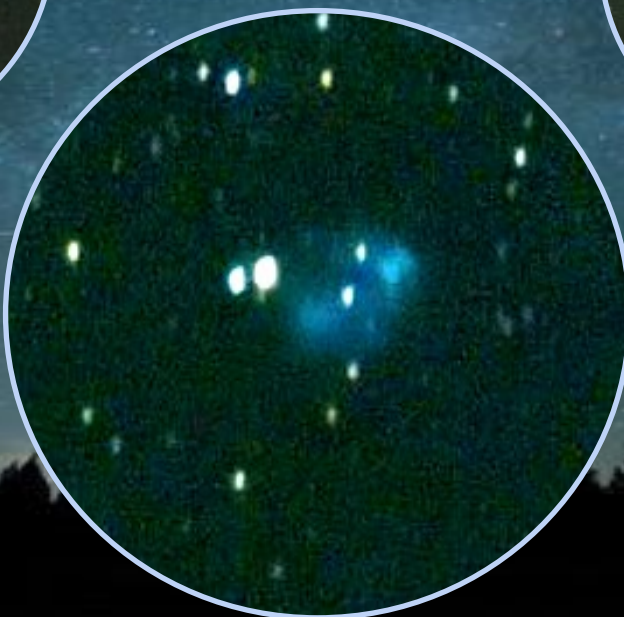
Al Sheidler also imaged  
Planetarys on the evening of  
November 6th, 2020 on this  
and the following page



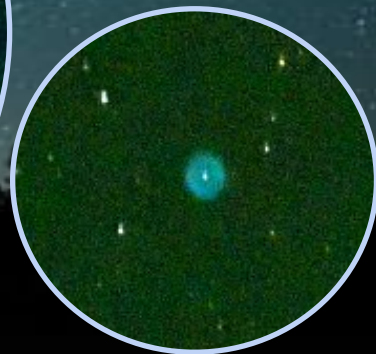
NGC 6826  
The Blinking Planetary  
Nebula



NGC 6765



NGC 7008  
The Fetus Nebula

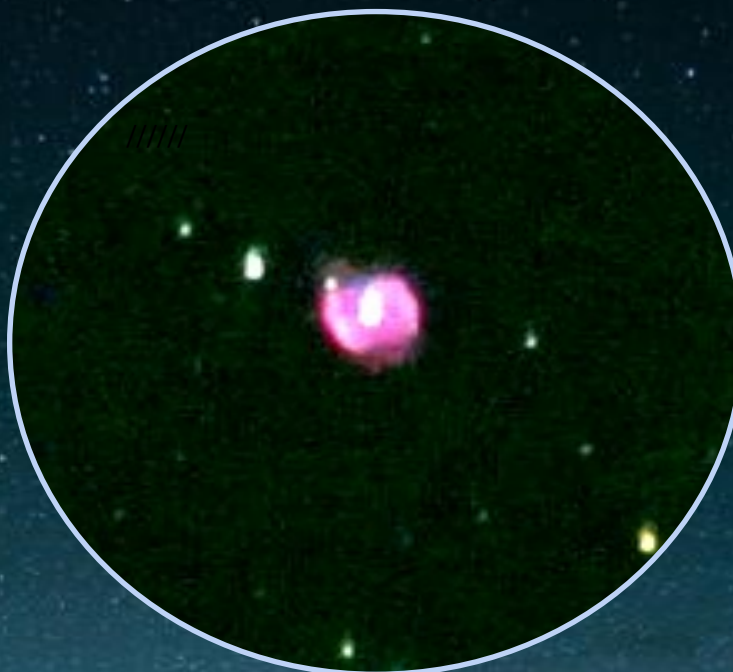


NGC 1501  
The Camels Eye

# MEMBER OBSERVATIONS



NGC 1360  
Robins Egg Nebula



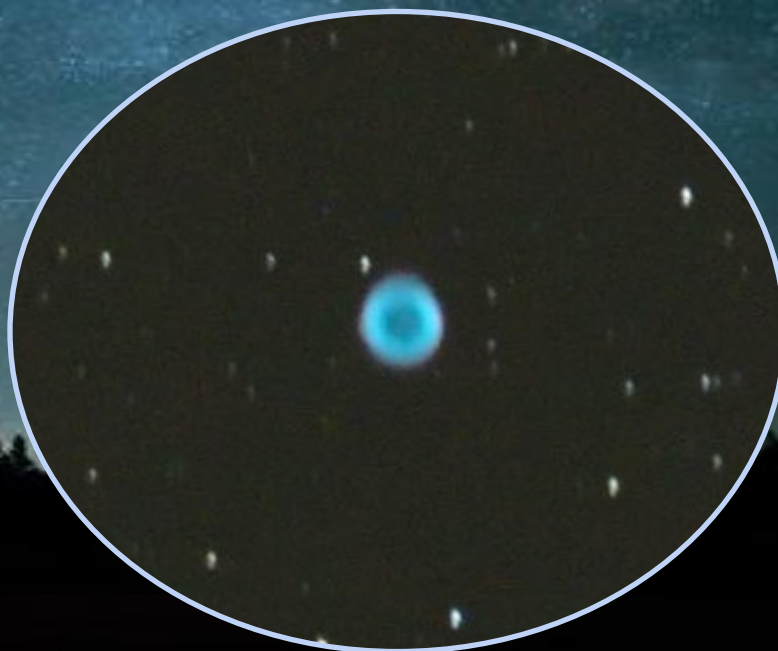
NGC 40 Bowtie or Scrab Nebula



IC3568



IC1747



M 57 / The Ring Nebula

Photos by Al Sheidler



# MEMBER OBSERVATIONS



M 45

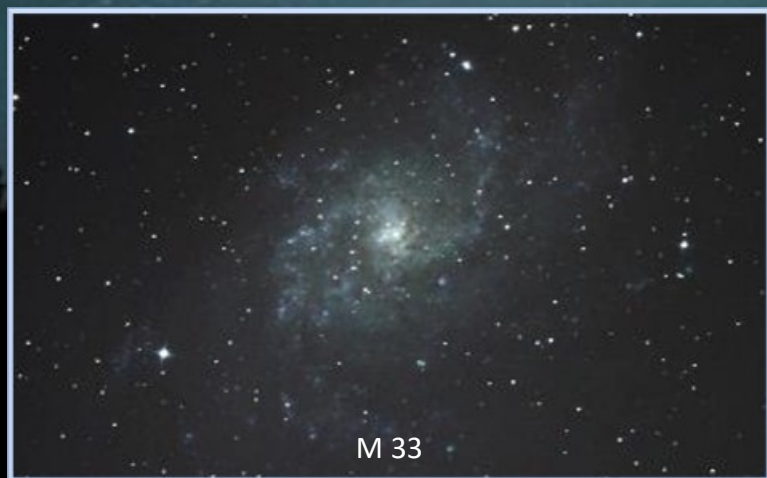


Helix Nebula

Photos this page by  
Byron Davies at  
Paul Castle on  
November 11th,  
2020. He was  
using his  
Skywatcher  
Quattro 200P



M 31

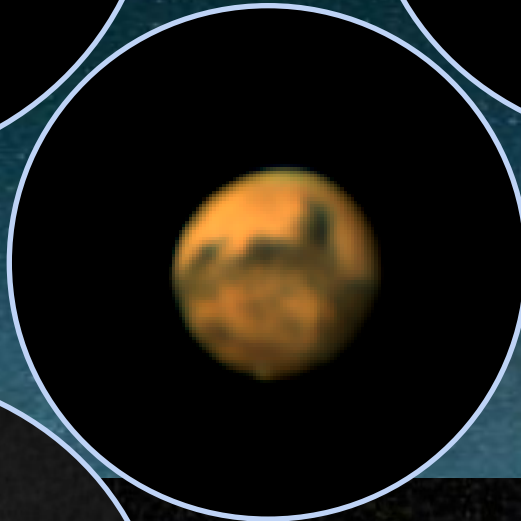


M 33





# MEMBER OBSERVATIONS



Photos this page by Terry Dufek. Planets taken with a C8 and a ZWO ASI120.. Deep Sky taken with a ZWO ASI294. Taken at Paul Castle on November 11th, 2020



M 74

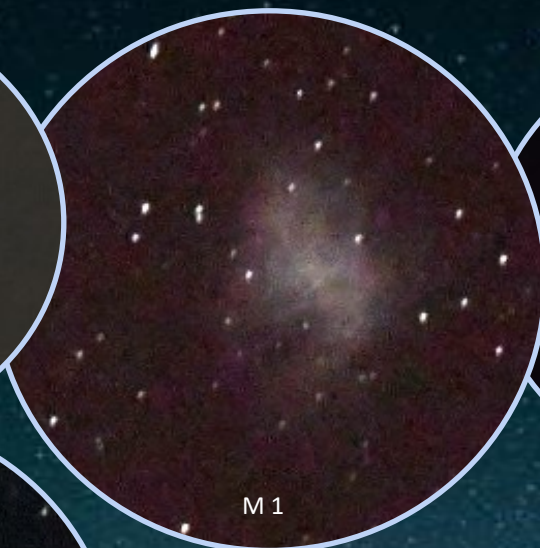
*Uranus and 4 of its moons.  
Taken with a C8 and a ZWO  
ASI 294 camera*



# MEMBER OBSERVATIONS



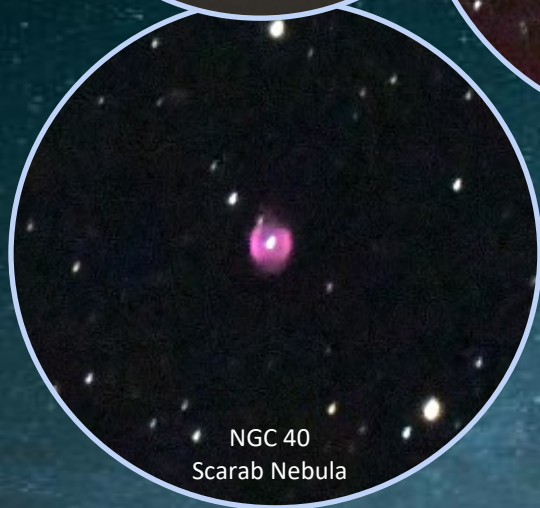
Baby Eskimo  
IC 3568



M 1



M 57

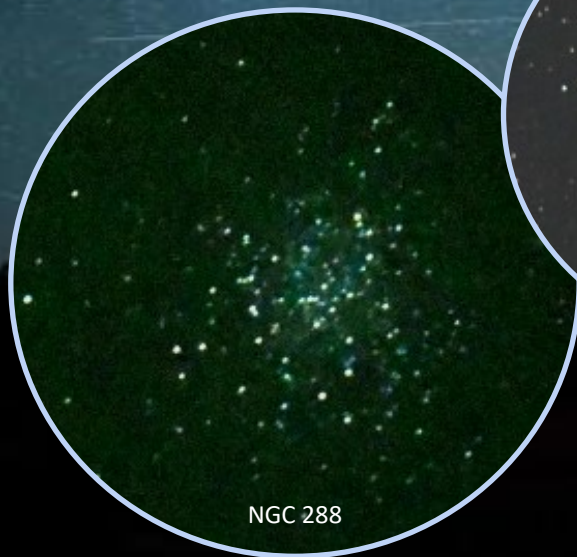


NGC 40  
Scarab Nebula

Photos this page by  
Al Sheidler  
at Paul Castle  
On November 11th,  
2020



Little Dumbbell  
M 76



NGC 288



M27



NGC 1514  
Crystal Ball  
Nebula



# MEMBER OBSERVATIONS



NGC 6058



NGC 6741  
Phantom Streak  
Nebula



NGC 6543  
Cats eye  
Nebula



NGC 6742

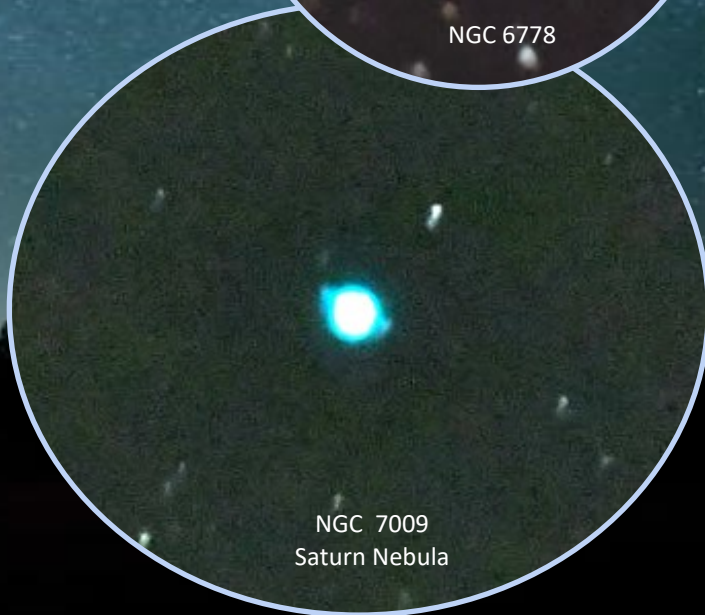


NGC 6778

Photos this page by  
Al Sheidler  
at Paul Castle  
On November 11th,  
2020



NGC 7048



NGC 7009  
Saturn Nebula



# MEMBER OBSERVATIONS

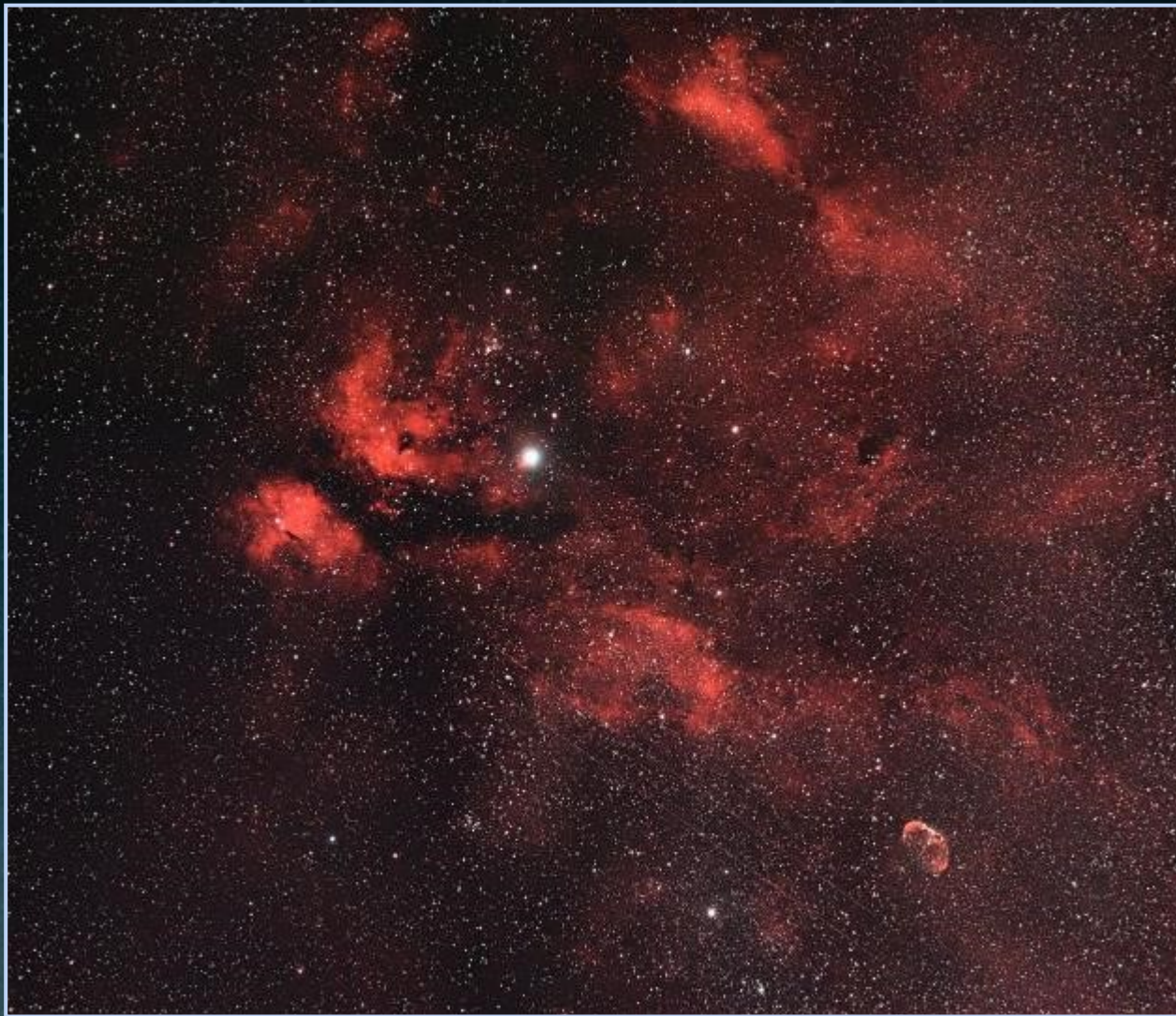


photo that Ken Boquist had taken of the Gamma Cygni Nebula

This is a stitch of nine separate images taken with an 80mm

AI presented this photo at the November meeting



# Paul Castle Observing Sessions

## Paul Castle Observing Session November 6th, 2020

An observing session was held at Paul Castle with Al Sheidler, Dale Hachtel, Terry Dufek, Wayland Bauer and Steven Sinksen and Gary Nordick with Clint Bostick attending. The skies were clear with above average transparency however steadily increasing winds began to affect imaging. Dale was in the observatory. Wayland was using the Revolution Imager with his scope (see photos in this issue). Al was observing various globulars and planetaries (see photos in this issue). He was also checking out some of Stevens eyepieces that he was selling. Terry was imaging various planets and deep sky objects. He may have viewed Miranda, Uranus's moon but it was inconclusive because it was at his camera's limitations. We concluded the observing session at around 11:30 pm with the Moon rising in the northeast.



# Paul Castle Observing Sessions

## Paul Castle Observing Session November 11th, 2020

An observing session was held at Paul Castle this evening with Al Sheidler, Dale Hachtel, Terry Dufek, Rusty Case and Byron Davies. Rusty and Dale arrived later and are not in the photo. It was cooler but very clear. Al continued to image planetaries and Byron did imaging. There pictures are posted in this issue. Dale was using the observatory to do visual. Terry did

imaging of the planets and managed to catch Uranus and 4 of its moons. There were a few intermittent clouds later on in the evening and a slight breeze came up but it did not interrupt a great night of viewing.



## Paul Castle Usage (October-November)

| Member                          | 10/06/20  | 10/07/20                                | 10/10/20    | 10/13/20  | 10/30/20  | 11/06/20                                    | 11/11/20                                  |
|---------------------------------|---|---|-------------|---|---|---|---|
| TOTAL MEMBER PARTICIPANTS       | 10  | 4                                       | 4           | 7   | 6   | 6   | 5   |
| Visitors (See Log Book)         | 0   | 0                                       | 0           | 0   | 2   | 1   | 0   |
| GRAND TOTAL                     | 10  | 4                                       | 4           | 7   | 8   | 7   | 5   |
| Notes:                          | Jupiter, Saturn, Mars and deep sky. Messier fall list | Deep Sky Imaging. Mars with great views | clouded out | mars and planets. Some deep sky observing and imaging | nearly full moon rising. Mars, jupiter, saturn, uranus, neptune. Deep sky imaging | planets, deep sky imaging, late rising moon | planets, deep sky imaging, cool and clear |
| Observatory Used? 1(yes)/ 0(no) | 1   | 1                                       | 1           | 1   | 1   | 1   | 1   |





# PAC MONTHLY MEETING

President Alan Sheidler arranged (with the help of Dale Hachtel) for the November 2020 meeting of the Popular Astronomy Club to be conducted via (Zoom) at 7:00 p.m. local time, on November 9th, 2020. We had 27 members, 6 guests and our speaker attending.

President Al Sheidler welcomed all members and guests.

Dale Hachtel indicated he is receiving renewals but are only at about 1/2 so far. Renewal forms are online and at the end of this newsletter.

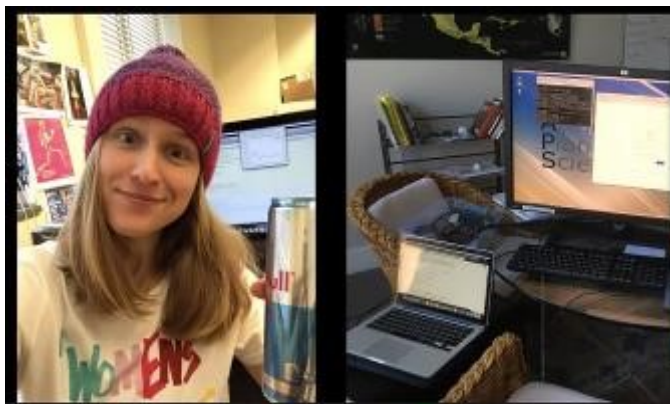
Al introduced our speaker for the evening, Adeene Denton along with her biography and profile.

Adeene Denton's presentation was, "Exploring Pluto after New Horizons: Oceans, Volcanism, and Habitability at the Edge of the Solar System" Questions were taken afterward.

Al showed photo that Ken Boquist had taken of the Gamma Cygni Nebula (see page 39).

The next meeting is on December 14th with Roy Gustafson presenting the "Year in Review"

The meeting was concluded.



Primary Goal: Further explore the hidden interior of Pluto, focusing on two major topics:

Topic 1: The formation of the Sputnik Planitia impact basin and its relationship to Pluto's interior

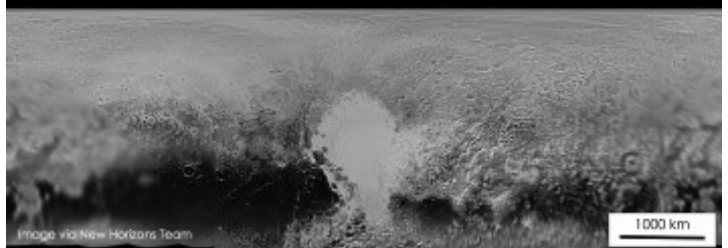
Topic 2: Possible cryovolcanism and the different possibilities for volcanism on an icy world

Sputnik Planitia defines the history of Pluto's nearside.

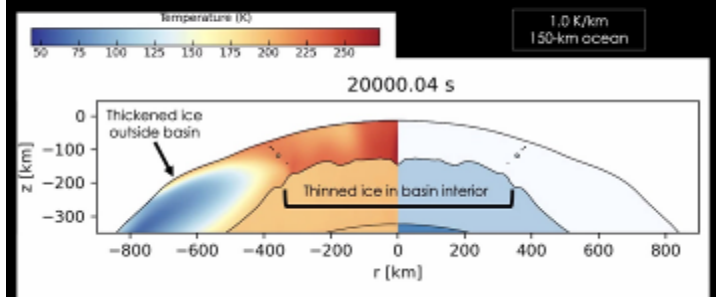
Inferred massive impact basin

Recent estimates increase basin size

Location inferred as evidence for ocean



Updated simulations for Sputnik Planitia indicate planetary-scale deformation



Volcanism, including cryovolcanism, requires open communication between the surface of a planet and its interior.

Our central hypothesis:

**Cryovolcanism, if it exists,** can be used to assess the **relationship between** Pluto's (potential) liquid ocean and the overlying ice shell.

Image via New Horizons Team



# POPULAR ASTRONOMY CLUB



Thank you for your interest in the Popular Astronomy Club. To renew your membership or to apply as a new member, please fill in the information and either mail this form to the address below, or bring it to a PAC event. The membership year runs from October 1<sup>st</sup> through September 30th. There is a pro-rated amount if you join anytime during the year (see below). Our club newsletter, REFLECTIONS, will be e-mailed to you and it will be posted on the club website.

**Submission of this application and payment confirms the applicant's agreement to abide by the policies and procedures detailed in the PAC Policy & Procedures Document available at our website:**  
**[www.popularastronomyclub.org](http://www.popularastronomyclub.org)**

Membership pro-rated (for new members) amount by month:

Oct-\$30.00, Nov-\$27.50, Dec-\$25.00, Jan-\$22.50, Feb-\$20.00, Mar-\$17.50, Apr-\$15.00, May-\$12.50, Jun-\$10.00, Jul-\$7.50, Aug-\$5.00, Sep-\$2.50

**PAC renew or new member:**

(a) Regular Membership \$30.00 \$ \_\_\_\_\_

(b) Additional family member (\$7.50 each) x (#) \_\_\_\_\_ \$ \_\_\_\_\_

Or you can elect c, d, or e (this includes the \$30.00 membership, with the balance a tax deductible gift to PAC):

(c) Supporting Member \$40.00 \$ \_\_\_\_\_

(d) Sustaining Member \$60.00 \$ \_\_\_\_\_

(e) Patron Member \$80.00 \$ \_\_\_\_\_

(f) Student Member \$10.00 \$ \_\_\_\_\_

**Grand Total** \$ \_\_\_\_\_

Your Name: \_\_\_\_\_

Address: \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

E-Mail \_\_\_\_\_

Home Phone: \_\_\_\_\_ Cell Phone \_\_\_\_\_

Please enter name (s) of ADDITIONAL FAMILY MEMBERS:

\_\_\_\_\_

Emergency Contact: \_\_\_\_\_ phone # \_\_\_\_\_

**THANK YOU!! Welcome to the Popular Astronomy Club!!**

Make your check payable to the **Popular Astronomy Club, Inc.** Mail or present at a PAC meeting to:

Dale Hachtel (treasurer)  
1617 Elm Shore Drive  
Port Byron, Illinois 61275  
cell # [614-935-5748](tel:614-935-5748)