Temecula Valley Astronomer
The monthly newsletter of the Temecula Valley Astronomers February 2023

Events: General Meeting, Monday, February 6, 2023, at the Ronald H. Roberts Temecula Library, Room B, 30600 Pauba Rd, and/or ZOOM, at 6:00 PM.

- **IFI & Gallery by Clark Williams**
- **NASA's Eyes… A Different Way to Look at Things!! by Mark Baker**
- **Refreshments by Rita Orr**
- **Star Parties at South Coast Winery every Friday evening in February.**
- **For upcoming school Star Parties check the Calendar on the web page.**

WHAT'S INSIDE THIS MONTH:

Send newsletter submissions to Paul Kreitz <pkreitz@sbcglobal.net> by the 20th of the month for the next month's issue.

Comet C2/2022 E3 (ZTF) on January 27 from Glen Oak Hills in Temecula. This image was captured using a 5" refractor and comprises 3hr total exposure (sub-frame exposures of 180sec). It's a combination of comet-tracked and star-tracked exposures for best resolution. A tricky object to capture and process! Photo by Bill Fallon.

General information:
Subscription to the TVA is included in the annual $25 membership (regular members) donation ($9 student; $35 family).

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Cosmic Comments –February 2023

By Mark Baker

I have touted the benefits of taking in the Greenway Talks provided by CalTech Palomar Observatory for many years now. They provide wonderful insight into a plethora of technical topics as presented by experts in their related fields… and they are usually done in "layman" terms so we all can learn from them!!

The latest talk on January 21, 2023 was no exception as we were edified by Dr Robert Korechoff, who worked for JPL as an optical engineer for 26 years… his claim to fame?? He was instrumental over three harrowing years in determining the actual cause of the initial Hubble failure, and with the rescue team, developing a range of possible solutions, and finally designing the optical "fix" that saved the telescope and its mission. Another quiet Hero in my book…

But the most important gleaning from this session was that we all finally learned the "real" cause of Hubble's problem after thirty years!!! Basically, the 2.4 meter space telescope had an almost perfect surface but was ground to the wrong shape… many of us have asked how that happened over the decades. Quantitatively, the error amounted to, at most, one millionth of a meter. But that aberration allowed the mirror to only deliver 15% of the captured photons to the camera equipment, and made it impossible to focus…and the resolution is now history!!!

As solutions poured in to the team, it was often proposed to just bring it back to Earth and fix it down here. There are two main problems with that…one, Hubble was delivered by the Space Shuttle and there was zero chance that the shuttle could handle the load and land safely. And two, Congress was already at its patience limit on funding and would probably have not authorized the repairs, much less a return to orbit… Hubble would literally become a junk pile in that case.

So just what was the real cause of such a finely engineered optical tool failing so badly, you might ask?? It turned out that the mirror manufacturer had developed a state of the art test bed to ensure the mirror was as close to parabolic perfection as technically possible, and much better than ANY other mirror to date. But the test bed itself that the manufacturer had 100% confidence in had an imperfection that caused the wrong shape to be ground… and only those with a "need to know" status were ever privy to this.

Luckily for you, if you want more details on this subject, they are available, like all Greenway Talks, on the observatory's YouTube page… just because you missed the live talk doesn't mean you have to miss out completely!!!

Just one more benefit of being a TVA member…worlds of wonder continue to open up before us!!!

Clear, Dark Skies my Friends…

Looking Up Redux – February 2023

Compiled by Clark Williams
from these sources:
SeaSky.org
Wikipedia.com
in-the-sky.org
The American Meteor Society, Ltd.
cometwatch.co.uk
NASA.gov
TVA App (2.0.1296)
FullAndNewMoon App (2.0)
Starry Night Pro Plus 7 (7.6.3.1373)
SkySafari 6 Pro (6.1.1)
Stellarium (0.18.2)
timeanddate.com/astronomy
https://www.fourmilab.ch/earthview/pacalc.html

ALL TIMES ARE LOCAL PACIFIC TIME (PST / PDT) UNLESS NOTED OTHERWISE

Times are given in 24-hour time as: (hh is hours, mm minutes, ss seconds)
hh:mm:ss or hhmmss
hhmm**+** (time of the next day)
hhmm− (time of the previous day)
hhmm (seconds not shown)
yyyymmddThhmmss (Full date as: year month day Time separator hours minutes seconds)

Moon Phases for the month by date:

Sunday	**the 5th**	**@1029 FULL in GEMINI**
Monday	**the 13th**	**@0801 THIRD QTR in VIRGO**
Sunday	**the 19th**	**@2306 NEW in OPHIUCHUS**
Monday	**the 27th**	**@0006 First QTR in ARIES**

Apogee comes on 2023-02-04 @ **0057 – 406,475 km (252,572 mi)**
Perigee comes on 2023-02-19 @ **0107 – 358,266 km (222,616 mi)**

2023 has: (12) new moons, (12) 1st Qtr moons, (13) Full moons, (12) 3rd Qtr moons
(1) Blue moon and (0) Black moons

Daylight Savings: Starts: 2023-Mar-12 : Ends: 2023-Nov-05 (traditional) CA keeps PDT year-round

Luna: Luna is waxing gibbous on the first of the month, headed for Full on the 5th rising at **1343**, transiting at **2120** and setting by **0458+**. Luna by the 15th is waning crescent at 23% illumination. Rising at **0235** and transiting at **0703** setting at **1224**. By the-end-of-the-month Luna is waxing gibbous, rising at **1138** transiting at **1915** and setting by **0254+**.

Highlights: (distilled from**: SeaSky.org** and **Clark's planetary Orrey** program[s]**)**

February 5 - Full Moon. The Moon will be located on the opposite side of the Earth as the Sun and its face will be fully illuminated. This phase occurs at **1030**. This full moon was known by early Native American tribes as the Snow Moon because the heaviest snows usually fell during this time of the year. Since hunting is difficult, this moon has also been known by some tribes as the Hunger Moon.

February 19 - New Moon. The Moon will located on the same side of the Earth as the Sun and will not be visible in the night sky. This phase occurs at **2308**. This is the best time of the month to observe faint objects such as galaxies and star clusters because there is no moonlight to interfere.

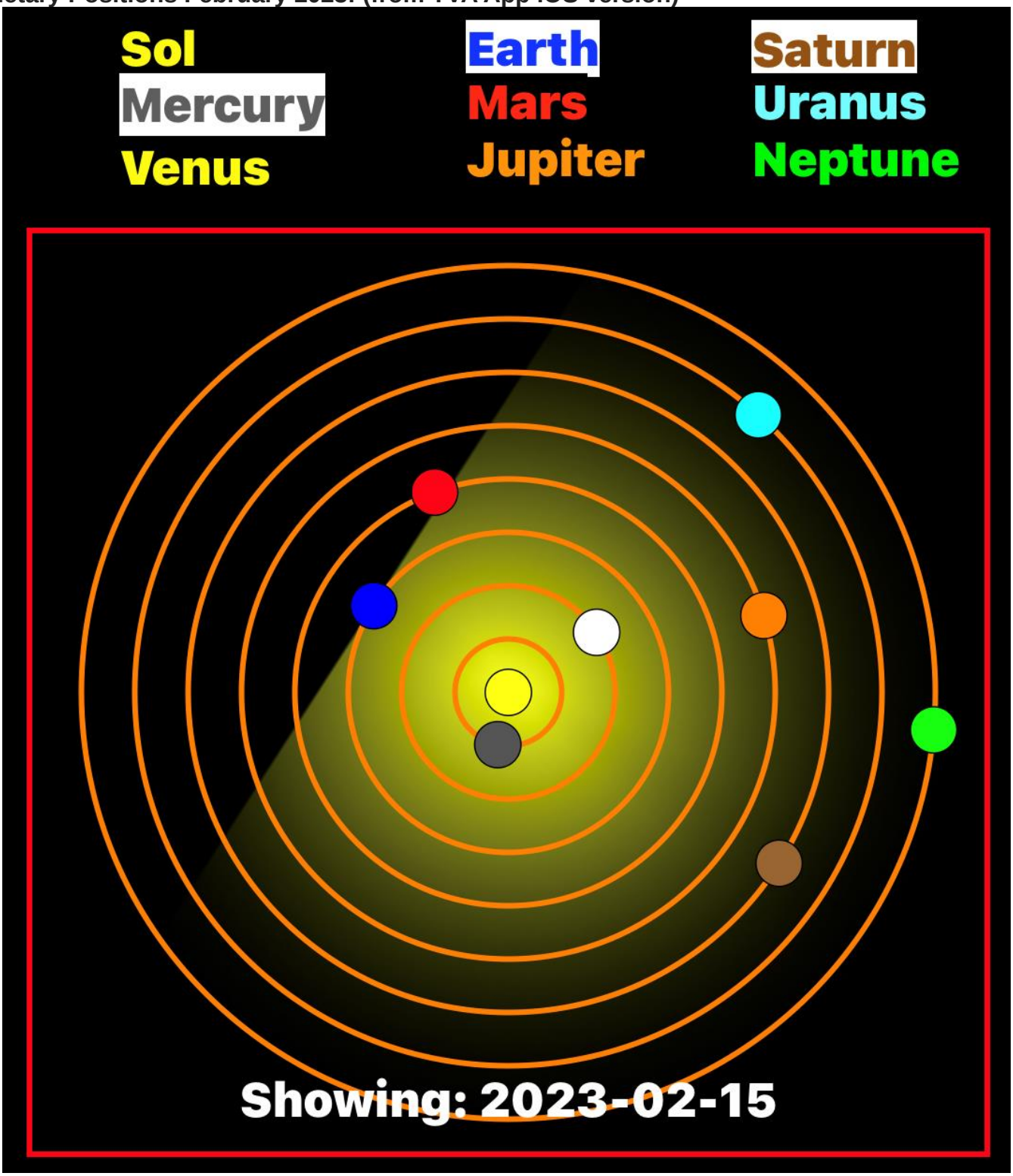
Algol minima: (All times Pacific Time)

02/02/2023	**0844**
02/05/2023	**0535**
02/08/2023	**0223**
02/10/2023	**2312**
02/13/2023	**2002**
02/16/2023	**1651**
02/19/2023	**1340**
02/22/2023	**1030**
02/25/2023	**0719**
02/28/2023	**0408**


01 02 03 04
WAX GIB WAX GIB WAX GIB WAX GIB
05 06 07 08 09 10 11
FULL WAN GIB WAN GIB WAN GIB WAN GIB WAN GIB WAN GIB
12 13 14 15 16 17 18
WAN GIB 3rd QTR WAN CRSN WAN CRSN WAN CRSN WAN CRSN WAN CRSN
19 20 21 22 23 24 25
NEW WAX CRSN WAX CRSN WAX CRSN WAX CRSN WAX CRSN WAX CRSN
26 27 28
WAX CRSN 1st QTR WAX CRSN
2023 February

Planets:

Planetary Positions February 2023: (from TVA App iOS version)



- **Mercury:** Mercury is a morning object in the beginning of the month. It is illuminated at 66% and -0.09 apparent magnitude. Mercury rises at **0515** with the sun following at **0643**. Mercury by the 15th is still a morning object rising at **0533** with the .Sun rising at **0631**. Mercury is now 82% illuminated. By the 28th Mercury has "fallen" in toward the Sun again making it riskier to view. The Sun rises at **0617** and Mercury rises at **0548**.

- **Venus:** Is the Evening Star on the first of the month, setting by **1916**. Venus is 91% illuminated and has an apparent magnitude of -3.93. By the 15th Venus is still the Evening Star, setting at 1944**.** By end of month Venus sets at **2009**.

- **Mars:** Mars is back in the sky and growing brighter as an evening object. On the first of the month Mars transits at **1934**. However, there is a waxing gibbous Moon 89% illuminated just 29.5° to the east along the ecliptic. By mid-month (15th) Mars transits at **1856** and doesn't set until **0213+**. End-of-month finds the Warrior transiting at **1826** and setting at **0144+**. All month long Mars is in a good position to view or image.

- **Jupiter:** Jupiter is an evening object on the first of the month transiting at **1526**. It should become visible by 1815 or so. Jupiter doesn't set until **2133**. By mid-month (15th) Jove is visible by about **1830** low near the western horizon. Jupiter sets at **2051**. Come the end-of-month Jupiter is very close to Venus in the western sky. Only about 1° 12' angular separation It should be easily visible in a 25mm or 26mm eyepiece. Also a great imaging opportunity although a tricky image since Jupiter will be at -2.09 apparent magnitude and Venus will be at -3.97.

- **Saturn:** Saturn is an evening object on the first of the month and is getting very close to the Sun. Saturn sets at **1821**. Saturn by mid month is lost to the Sun. By the end-of-the-month Saturn is just beginning to peek out behind the Sun rising at 0554 followed by sunrise at 0617.

- **Uranus:** On the first of the month Uranus is an evening object transiting at **1751** and not setting until **0038+**. Uranus is being chased by a 88% illuminated waxing gibbous Moon about 48.5° to the East of Uranus. By the ides (15th) Uranus should be visible by **1830.** Uranus is at apparent magnitude of 5.77 so in dark skies it should be naked eye visible (just barely). Uranus sets at **2344**. Uranus' apparent magnitude is 5.71 and with dark skies should be a naked eye visible object. End-of-month finds Uranus again visible at about **1830**. Uranus competes all night with a 67% illuminated first quarter Moon.

- **Neptune:** Neptune in the beginning of the month should be visible sometime around **1815**. You'll still need a scope to see it; say 200mm (8in). Neptune is sitting about half-way between Jupiter and Venus in the western sky. Neptune sets at **2033**. By the 15th Neptune is very near Venus from our perspective. In fact on the 15th at **0206** Neptune and Venus will be in close conjunction within 0° 7' of each other. Unfortunately you won't see it because they are both below the horizon. I put this in just to see if anyone is reading this – cool huh? Neptune sets at **1940**. By the end of the month Neptune sets at **1851,** too close to the Sun to see much.

- **Pluto:** Pluto on the first of the month Is lost in the glare of the Sun. By mid-month Pluto is virtually invisible. By the 28th Pluto has moved into being a morning object and rises at **0424** followed by sunrise at **0617**.

Asteroids:

- Still a dearth of asteroids. I searched for asteroids in 2023 with a reasonable magnitude; say less than or equal to +10 in February there is nothing except the regulars: Juno, Vesta. Hebe, Eros and Herculina. So consult your local planetarium software or try: https://www.asteroidsnear.com/year?year=2023

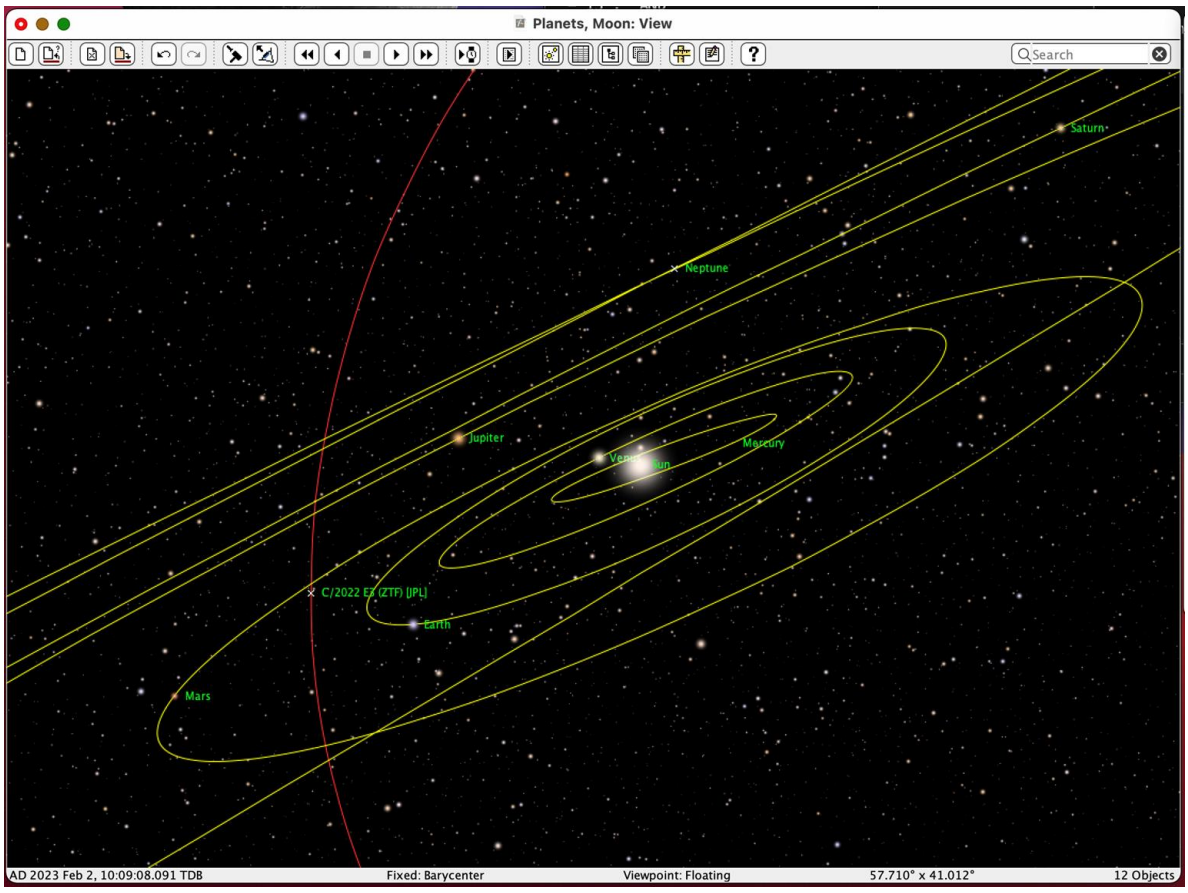
Meteors:

- Geminids Meteor Shower. (see Highlights above)
- Ursids Meteor Shower. (see Highlights above)

Comets: come in various classifications:

- 1) Short Period comets – further broken down into:
  - Halley Type: The Halley Types are believe to come from the Kuiper Belt and have periods in excess of 20-years.
  - Jupiter Type: The Jupiter types have a period less than or equal to 20-years.
  - Short period comets have a near circular orbit or an elliptical orbit. The latter being far more common.
- 2) Long Period comets – thought to originate from the Oort cloud these comets have periods of over 200 years and have random inclinations around the celestial sphere.

Comet C/2020 E3 (ZTF) .closest approach to earth on 2023 Feb 02



Deep Sky:
Notes:

L/Z abbreviation for ALT/AZ
R/D abbreviation for Right Ascension/Declination
α is right ascension
δ is declination
In each case, unless otherwise noted, you should look for the following on or about the 15th Day of February 2023 at 2100 PDT and you will have about 20 minutes of viewing time total.

Lets take a look at some favorite objects (at least for me):

Illustration 1: By Genuson - Own work, CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=32255243

- NGC 884**:**

NGC 884 (also known as χ Persei) is an open cluster located 7640 light years away in the constellation of Perseus. It is the easternmost of the Double Cluster with NGC 869. NGC 869 and 884 are often designated h and χ Persei, respectively. The cluster is about 14 million years old. Located in the Perseus OB1 association, both clusters are located physically close to one another, only a few hundred light years apart. The clusters were first recorded by Hipparchus, thus have been known since antiquity.

The Double Cluster is a favorite of amateur astronomers. These bright clusters are often photographed or observed with small telescopes. Easy to find, the clusters are visible with the unaided eye between the constellations of Perseus and Cassiopeia as a brighter patch in the winter Milky Way. The Double Cluster was also included in the Caldwell catalogue, a catalogue of astronomical objects for amateur observation.
In small telescopes, the cluster appears as a beautiful assemblage of bright stars located in a rich star field. Dominated by bright blue stars, the cluster also hosts a few orange stars that add to the visual interest. Both clusters together offer a spectacular low-magnification view. (Wikipedia)

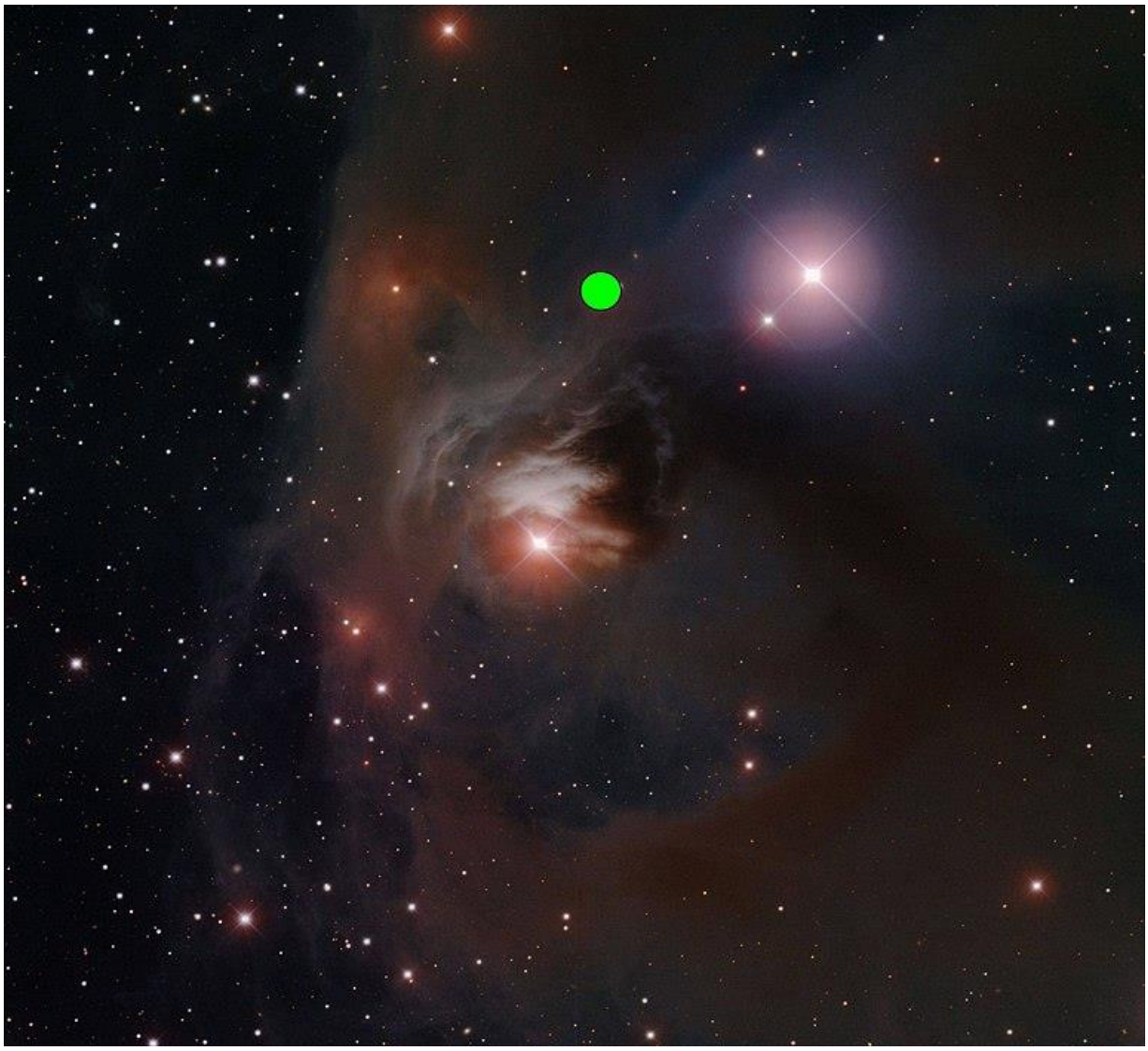


Illustration 2: By Wolfmanwolf45 - Own work, CC BY-SA 4.0, https://commons.wikimedia.org/w/index.php?curid=54858480

NGC 1554:

NGC 1554, Struve's Lost Nebula, is a list entry in the New General Catalogue of Nebulae compiled by John L. E. Dreyer. The nebula was discovered by the German-Russian astronomer Otto Wilhelm von Struve and confirmed by Heinrich Louis d'Arrest.

Reported location of NGC 1554 by Otto Wilhelm von Struve relative to NGC 1555

Dreyer describes it as

!!! var, S, R, Nn = *13

which in NGC's encoding is expanded to

a magnificent or otherwise interesting object, variable, small, round, nucleus north of a star of the 13th magnitude

The identification is uncertain; many sources think it is related to NGC 1555, Hind's Variable Nebula, but at NGC 1554's coordinates, (epoch J2000) 04h 22m 00.0s +19° 36′ 00″ there is no nebula. However, there is a 14th magnitude star, 4' west-southwest of T Tauri, so there is a possibility that the nebula Struve discovered was surrounding a variable star and it only flares up every now and then (perhaps even on a centuries long cycle). Alternatively it may have been an error caused by a pair of faint stars (Wikipedia)

February is great for both viewing and imaging. Spend some time outside with your scope. Winter is here.

For now – Keep looking up.

RANDOM THOUGHT February 2023
By Chuck Dyson

IS ET LIVING IN MY KITCHEN???

With the discovery that over 80% of the suns in our galaxy appear to have planets, the enthusiasm for finding life on at least one of those planets has gone into high gear along with the funding of research proposals. And, today, astronomers who claim to be astrobiologists are considered to be real scientists not just escapees from Disney's Tomorrowland.

OK, now that we know that there is a potential for ET life in the galaxy the three big questions are: Where do we look for ET? How do we look for ET's planet? What signatures do we look for?

Where do we look would seem to be an easy question to answer, "Around stars, DUH!" However, we quickly discover there are two choices: 1) Our star, the solar system, and 2) Every other star in the galaxy. In the search for life in our solar system we have not found the civilizations and cities that H. G. Wells "War of the Worlds", Edger Rice Burroughs "John Carter of Mars" and "Carson of Venus" nor the canals of Mars and Venus that Percival Lowell predicted. In the 1970's. The Viking 1 & 2 Mars probes landed on Mars and using four different tests looked for life. The first results came back and it looked as if finding life on Mars was going to be "That was easy.". But as more and conflicting results came in things changed to "This sucks!" and the results of the experiments are controversial to this day. Finding life and knowing if you have really found life is not going to be easy. Because we can drop probes onto the surfaces of the planets and moons of our solar system finding evidence of life here is going to be a lot easier than finding life on the planets or their moons of distant stars where all we can do is analyze the light we get from those extra solar bodies once we find them.

With 300 billion stars in our galaxy, rather than ask where we should look for life it is probably better to ask where we should not look, as observing time on big scopes is limited and expensive. Thanks to a lot of studies of star clusters, how old they are, and which classes of stars are in them, we know that large stars do not live long happy lives. For a star to live for billions of years it needs to be smallish and burn its hydrogen fuel slowly. A star that is only 1.5 times the mass of the Sun will live in Main Sequence for about three billion years; if we look at the timeline of life on Earth (Fig. 1) we see that after three billion years life on Earth is advanced, eukaryotic cells and possibly some multicellular fungi. If the Earth model is typical, to find advanced intelligent life in other solar systems we are going to need smaller stars with longer Main Sequence times. The bad news is that the Sun is bigger than 90% of the stars in our galaxy; so, we haven't eliminated that many solar systems, but it is a start.

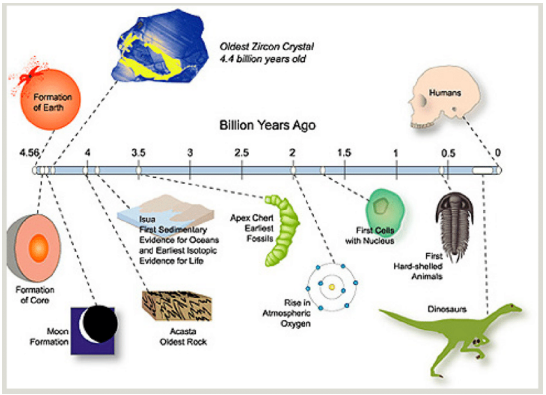


Fig 1

Marco Polo did not travel to China and other Asian countries to purchase spices for exotic meal preparation for the European rich. He was getting spices to cover the smell and taste of rotting meat as successful storage options for fresh meat were, to say the least, limited in the 1200's. Today your kitchen is the place in your house that is dedicated, by every means possible, to denying archaea, bacteria, and fungi a meal from the food you have in there. Just how dedicated and determined is our attack on these food hungry critters? Enter Conan the bacterium. When a sealed tin of meat started bulging because of gas production from within, the owner returned it to the manufacturer. The container had been sterilized by exposing it to 15,000 grays of radiation (A gray is a rather large unit of radiation that is absorbed by the target). As a reference 10 grays will kill you and me, 1,000 grays will kill a cockroach. Cockroaches are known survivors. When the tin was opened researchers were able to grow colonies of Deinococcus radiodurans A.K.A. Conan the bacterium. 15,000 grays of radiation was thought to be more than any living organism could absorb and survive. Conan proved us wrong and showed just how much radiation living things can absorb and how life could be found on planets with so much radiation even cockroaches die. Conan is actually listed in the Guinness Book of World Records for its survival feat. Earth's oceans have about 35ppt (parts per thousand) of salt in them and humans, healthy ones at least, can survive about two weeks on seawater as we just cannot handle that much salt. The Salton Sea has about 60ppt of salt and marine fish cannot handle that much salt. The Great Salt Lake has 280ppt of salt and not only do red algae survive in it but there are large colonies of brine shrimp feeding on the red algae. Finally in 1964 Thomas Brock, an ecologist, stopped off in Yellowstone Park just to visit the park. Brock was fascinated by the bacterial matts he found growing in the hot springs and later when questioning his microbiologist colleagues about them he found they had no idea what he was talking about and had always assumed the bacteria were incidental organisms that were wind delivered and didn't really grow there. Today Brock's bacteria, Thermus aquaticus, is known to live happily in 180F (Fahrenheit) water. Humans suffer third degree burns in 160F water after only one second of exposure. Further field work has found that Methanopyrus kandleri can at least survive in 251F water (water boils at 212F). No matter what we do to preserve the food in our kitchens it appears that neither salt, nor heat, nor radiation will stay microbes from having their dinner. Where do we look for ET? On planets that we would never consider it possible for humans to survive on.

How do we find stars with planets that ET could live on? First, we need to look in our galaxy's own "habitable zone". The galaxy "habitable Zone" is an area where star forming clouds have enough "metals" to form rocky planets but not so much metallicity that multiple Jupiter sized planets are formed. Multiple Jupiters tend to migrate inward and outward in the planetary zone and throw Earth sized planets either into that solar systems sun or out into deep space. Metal rich areas get that way because generations of large stars have lived short lives, gone nova, and then have been reassembled into large stars (A large star is at least 10 solar masses, but the best ones are 20 to 50 solar masses, they really go BANG.) and when large stars go supernova, they tend to put out enough radiation to kill all life within a radius of 130 light years. The largest star within 100 light years of Earth is Sirius and it is 8.7 light years away and only 2.06 solar masses. This makes our neighborhood relatively safe. In the outer galactic disk it is thought that star formation is slower and this results in stars, in general, having a lower metallic content and forming fewer rocky planets per star. Note: All of the above assumptions are moderately controversial, because of a lack of large data sets on the actual metallic content of stars in the different regions {Moderate means that astronomers just shout at each other when discussing this issue and do not actually throw laptops at each other}.

Once we have a region of the galaxy that is relatively life friendly and identify a star that will live long enough in the Main Sequence part of its life for organic life to have a chance to develop the fun really begins because we actually need to find planets. We have two main methods of finding planets. First is the doppler shift method. When two bodies orbit each other the little body does not go around the larger body instead they both orbit a common center of gravity, their barycenter. However, if one body is really larger than the other for example the Sun is 333,000 times more massive than Earth; thus, the barycenter for these two bodies is well inside the Sun. The Sun is 1000 times the mass of Jupiter and the Sun/Jupiter barycenter just beyond the surface of the Sun. Obviously the Sun moves more with Jupiter than with Earth and has more of a doppler shift in its spectrum when it moves toward us and away from us. {Notes: 1) the orbital planes of the planets must be parallel to our orbital plane for us to see a doppler shift. 2) The planet is not seen but inferred from the doppler shifts. 3) This method is best at detecting big planets close to small stars.} Second is the transit method. Just like eclipses here on earth when an exo planet crosses its sun and is between the sun and Earth there is a dip in the sun's light as the planet blocks a small portion of the light (Jupiter blocks 1% of our Sun's light and Earth only .0084%). This method also favors large planets in tight orbits around small suns.

Now that we have our target solar systems how do we look for life? The search has settled into two separate approaches, both described by the Drake equation (Fig.2). When Drake in 1961 created the original equation, the top equation in Fig. 2, there were no extrasolar planets and none would be found for 32 years so the only option was to listen for electronic signals from advanced civilizations. After 61 years of listening by SETI (Search for Extraterrestrial Intelligence) and other groups, there has been no confirmed contact despite continued improvement in the sensitivity of the equipment used. But the search goes on and in the last three years optical sensors are being used to look for possible laser signals from advanced civilizations. The main problem with this approach is that it requires an advanced communicating civilization and on our planet that is the last 122 years out of 3.5 billion years of life (I have chosen the first transmission of radio signals across the Atlantic Ocean in 1901 as the start date), Lots of life, no transmissions. The second approach for finding ET was proposed by Sara Seager in 2010 and she outlined her approach with a modified Drake equation, the bottom half of Fig.2. Seager's version of the Drake equation focuses on not only red dwarf stars but quiet dwarf stars (some red dwarf stars are known to be flare stars, and its solar flares would cook any planet life on a regular basis). Other problems with red dwarf stars is that for planets to be in the habitable zone they need to be so close to their star that they have tidal lock with it, like the Moon with one side always facing Earth, and no one is certain how this would support life; also, red dwarf stars produce longer wavelength light. The longer the wavelength the less energy, and it could be difficult for plants to photosynthesis on red dwarf associated planets.

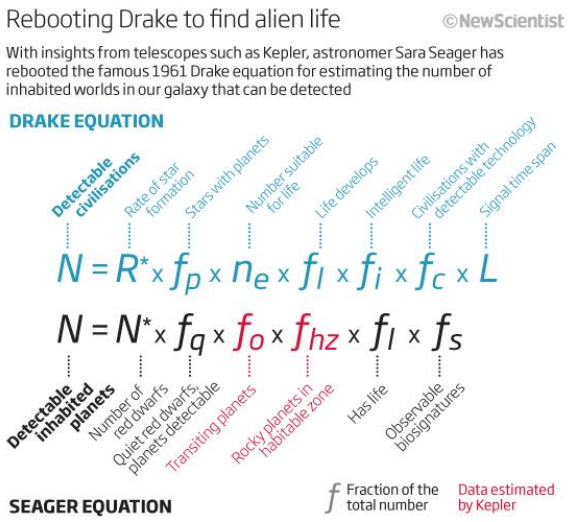


Fig. 2

Observing time could be more productive observing K type, orange, stars rather than M type, red, stars. In 2010 we had already discovered more than 500 exoplanets and several of those planets were in orbits

that did allow them to transit their star as seen from Earth. If we get a spectrograph of the star when the planet is behind it and second one when the planet is in transit and then subtract the first spectrograph from the first, and the planet does have an atmosphere, we are left with a very, very weak, dim, spectrograph that represents the planet's atmosphere (Fig. 3). As of today, astronomers have managed to obtain spectrographs from both space and ground based telescopes and naturally it is the hot Jupiters, Jupiter sized planets really close to their star, with puffed up atmospheres that they are the most successful with. With early successes comes the beginning of understanding the myriad of problems and challenges astronomers will face just getting that spectrograph and, just to make matters worse, trying to interpret it for actual signs of life (Fig.4). In one review article the author pointed out that a planet 40 to 50 light years from Earth has the same optical magnitude as the faintest galaxies Hubble has been able to observe. This reality is exactly why all astronomers are focused on the James Webb telescope as it is the only kid on the block big enough to possibly get the answers to our questions.

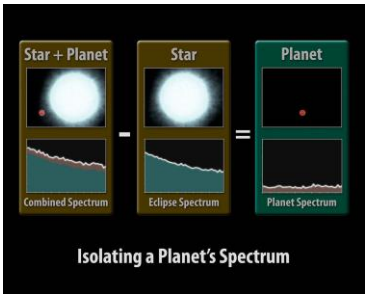


Fig 3.

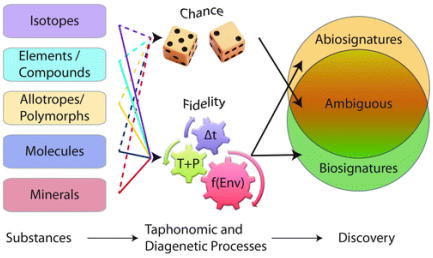


Fig. 4

In 1969 the rock group Moody Blues released their fourth album entitled "The Threshold of a Dream". Perhaps in 2023 we are on the threshold of the dream of finding life on another planet.

CHEERS, CHUCK

Another Look February 2023

By Dave Phelps

New Moon-February 20, Full Moon-February 5

February 5 will mark the Lunar New Year for many cultures, celebrated in their own particular way. Since it signifies renewal, the February new moon is called by some the “House of the Burning Moon” and the “Budding Moon”.

South-Western Native Americans called it the “Moon of Purification and Renewal”. Other Native Americans call it the Snow Moon or Bone Moon while it’s the Celtic Moon of Ice.
Our modern name is Snow Moon

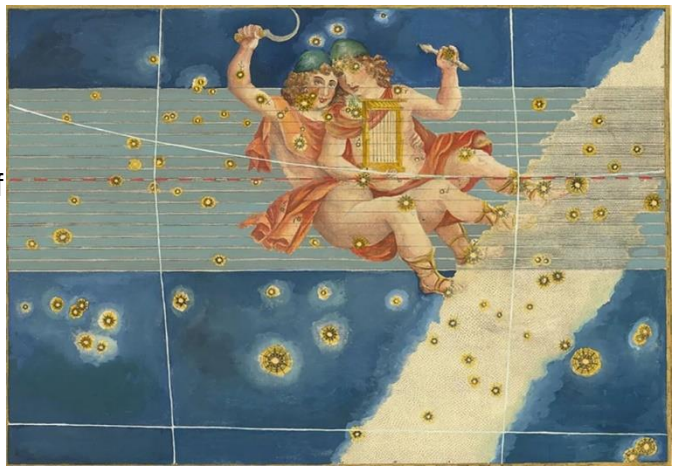
Transiting the meridian and near the zenith in the evening hours in February and March when the weather is changing from frigid to merely cold, it is no wonder that herdsmen from the fertile crescent to Scandinavia north identified Castor and Pollux as harbingers of spring, when herds grew and grain sprouted.

> *Instead of twin brothers, however, the ancients imagined these stars represented two Kids. There was a significance in this title quite apart from its relation to the herds that they were daily concerned with. We see in this region of the sky three ancient and important constellations named after domestic animals that figured prominently in the pastoral life of early times, the Ram, the Bull, and the Kids. Plutarch tells us that "in the reproduction of species among the herds familiar to primitive man, the first produced in the vernal season are the lambs, then come the calves, and later the kids, so that it was natural that the ancients who devised the constellations should characterise(sic) in this order the three constellations through which the sun passed in the vernal season.*

“Star Lore of All Ages” Olcott

The two stars are almost universally identified as twins throughout our western culture though seen differently from Egypt to Polynesia and Australia.

To the Australian aborigine they were two young men chasing the young women of the Pleiades. the Arabs saw two peacocks, the Egyptians two sprouting plants, and the Hindus twin deities, while in the Buddhist zodiac they represented a woman holding a golden cord and the Polynesian Islanders a pair of twins. It is also interesting to learn that the Bushmen of South Africa identified the two stars as young women, the wives of the Eland, their great antelope and the Gemini were the Ape of the early Chinese solar zodiac. Later on, in China, the constellation was known as the Yin/Yang, two principals familiar to us today.



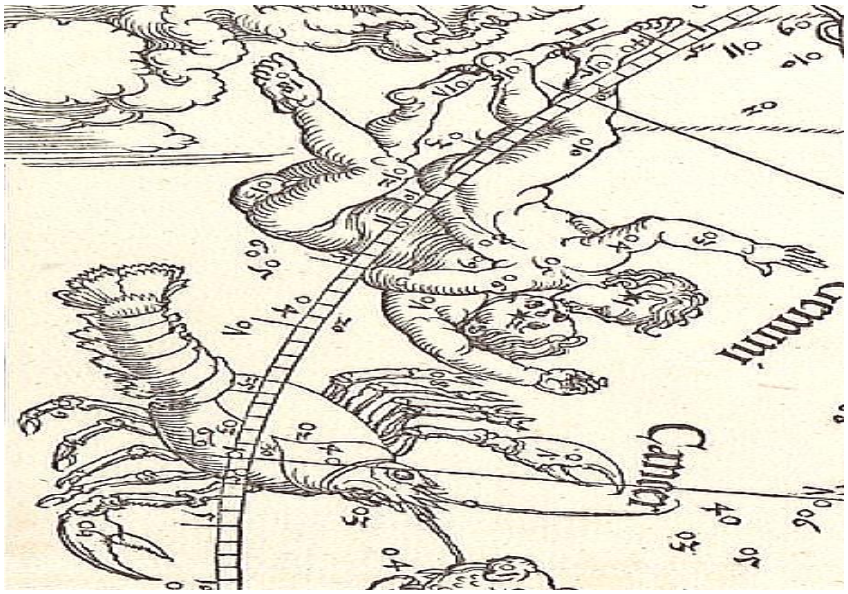
What this tells us is that for thousands of years cultures have identified the stars of Gemini with the position and path of the sun, moon, planets and their location against the stars signifying special times of the year. We are told that on the Babylonian monuments and boundary stones, the oldest we have, there is a set of symbols repeated over and over again, and always given a position of prominence. It is the so-called "Triad of Stars," a crescent lying on its back and two stars near it.

The Triad of stars
From a Babylonian Boundary Stone
Approximate date 1200 B.C.

The significance is that four thousand years BC, Castor and Pollux served as indicators of the first new moon of the year, just as the star Capella did two thousand years later. This Triad of the moon and two stars is a picture of what men saw in the sunset sky, at the beginning of the first month 6000 years ago. It is the earliest record of an astronomical event that has made its way to us.

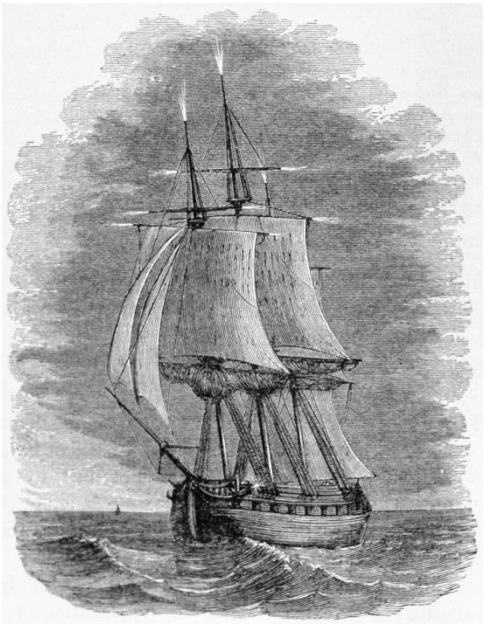
The name Gemini as we know it has only been such since classical times. It comes from the Latin geminī, plural of geminus, meaning “twin. The Greeks and the Romans know them as Castor and Pollux, twin brothers of different fathers, hatched from an egg, one immortal and one not. Still, I don’t think the name Gemini actually was used till the 13th century when the first charts were drawn and globes constructed.

I have never been all that interested in Castor and Pollux. I see them as a pair of bullies always looking for a fight. The Romans saw them leading their armies in battle and the Greeks saw them as crew on the Argos in its search for the golden fleece.



https://www.metmuseum.org/art/collection/search/358366

Albrecht Dürer | The Celestial Map- Northern Hemisphere
1515

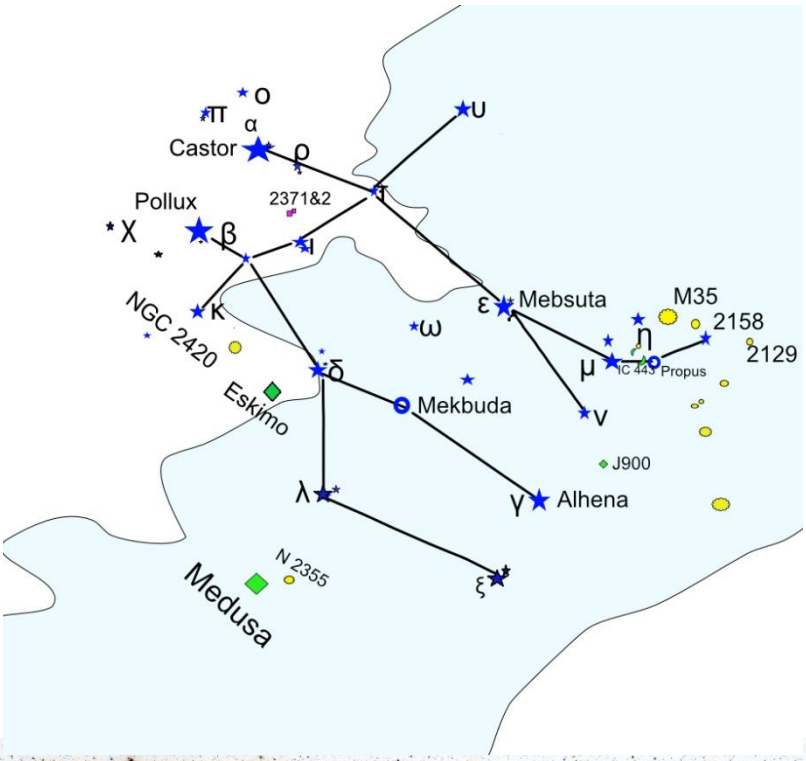


Safe comes the ship to Haven
Through billows and through gales,
If once the great Twin Brethren
Set shining on the sails.
Macaulay
Public Domain

The twins are also the first reference we have to the atmospheric phenomenon known today as St. Elmo's fire; an electrical glow off the tips of masts and spars on our old wooden sailing ships. During the three years I spent at sea I never saw it personally but a report taken from one of the survivors of Magellan's circumnavigation describes the fire of the twins during its passage through the strait.

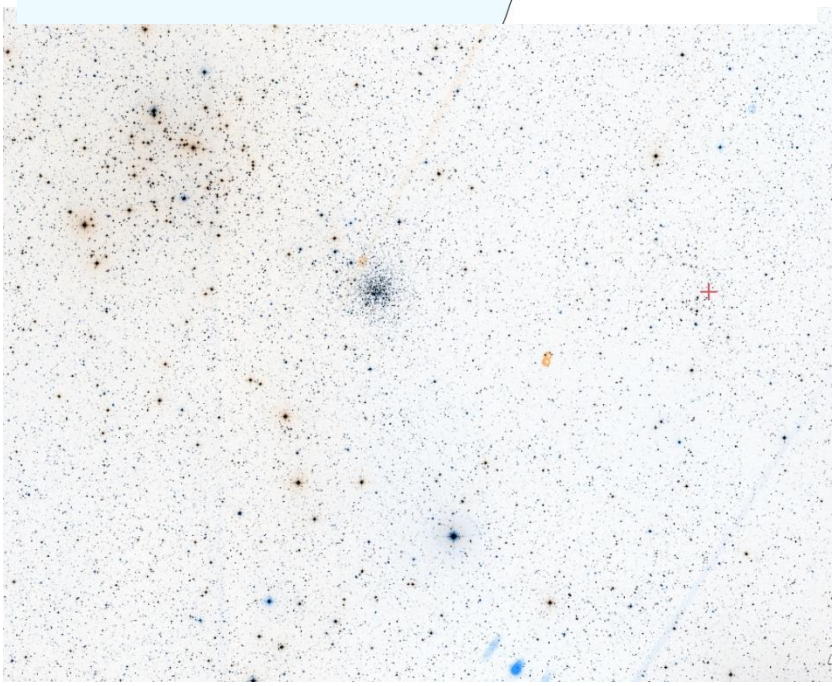
Last night saw Saint Elmo's stars,
With their glittering lanterns all at play
On the tops of the masts and the tips of the spars,
And knew we should have foul weather to-day.
Longfellow's "Golden Legend of the Padrone"

No less a luminary as Herschel named Castor, α Geminorum, as the "finest example of a double star in the northern hemisphere". Smyth in the "Bedford Catalog" gives it three pages, Webb a long description and Houston rhapsodized over its companions noticeable change in position angle. We still use Castor as a primary star, using a Sextant, in Celestial navigation.



Physically, Castor is a sextuplet, three visible stars and each with its own spectroscopic binary. The three visible components are essentially 2, 3 and 10th magnitudes and can be split in a three inch refractor, though I am pretty sure I never looked for C. While up there check out 5th magnitude pi π, it has an 11th magnitude companion.

While we are speaking about superlatives, at the foot of Castor is M35, one of our finest examples of an open cluster. NGC 2158 is next to M35 and NGC 2159, marked by a cross. IC 2157 is next to N2129 and difficult.

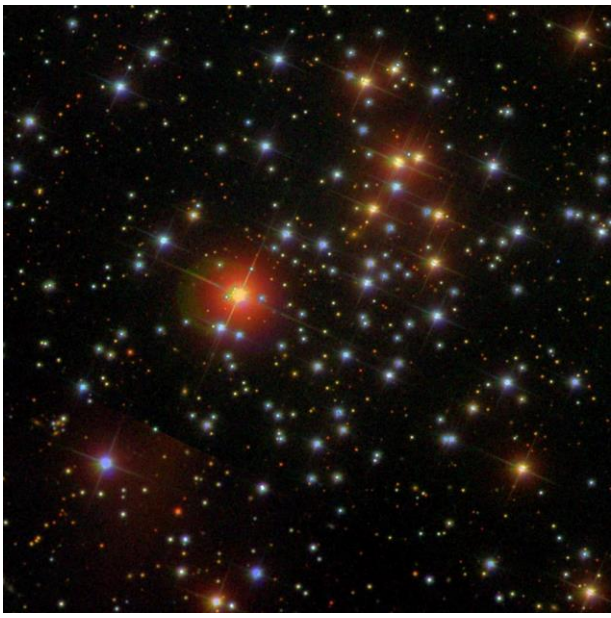


Dripping down from the foot of Castor like icicles on a fir tree is a line of star clusters and objects curving into and out of Gemini. All are visible in your telescope. The one that struck me was a difficult planetary Scotty mentioned in his column. Jonckheere 900 also known as PK 194+2.1 and J900, is a planetary nebula that will be a tough find at 12th mag. In the area, just over the border into Orion is NGC 2174-5, the Monkey Head. I mention it because local astrophotographer Rick Gonzalez took this amazing image.

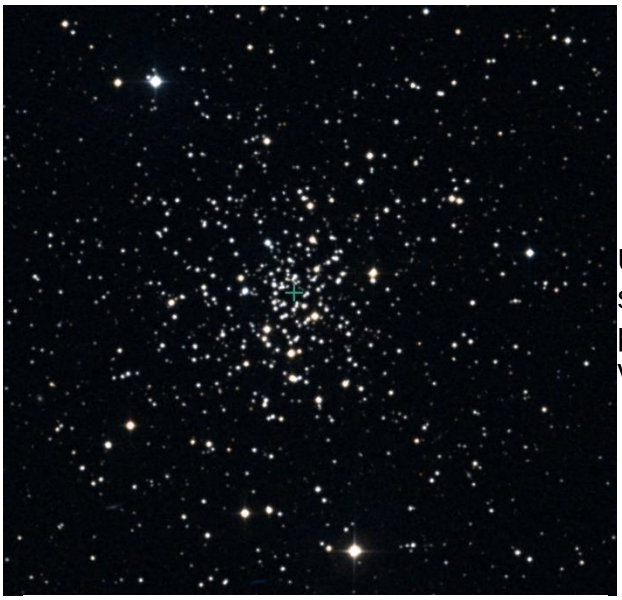
NGC 2174-5 Rick "Speedy" Gonzalez

If by now, you are asking "why so many open clusters?", remind yourself that we are still in the Milky Way and clusters and nebulae permeate. We are not done yet, we have a few more doozys.

NGC 2420 is up by the Eskimo so you can use it as a starting off point for star hopping. N2420 will come up on you quickly as a dense misty patch but will resolve nicely to your telescopes limit. It's 8th magnitude and interestingly right on the ecliptic. Another interesting open cluster is over by the Medusa, NGC 2355. It's nice, a few bright stars, a few red ones and easy to pick out from the background. N2355 is 10th magnitude and 10 arcmin across.



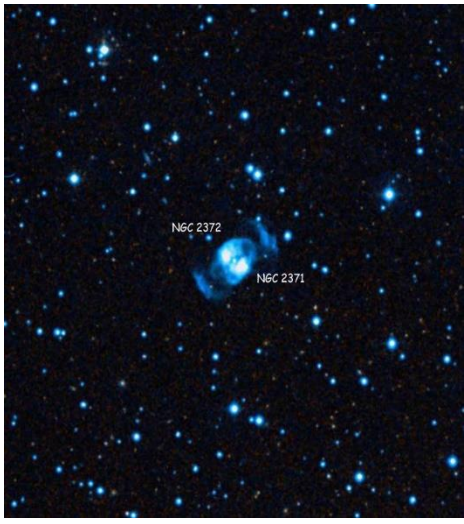
https://en.wikipedia.org/wiki/NGC_2355#/media/File:NGC2355_-_SDSS_DR14_(panorama).jpg



https://simbad.u-strasbg.fr/simbad/sim-id?Ident=NGC+2420

Up On the other side of Gemini, making the top of the spindle with ι, ρ and τ is the Gemini double planetary. It's small and only 11th magnitude but visible in your 8".

I did some comparisons. Tycho is 45 arcmins. Picture him in your telescope. The Gemini double, NGC 2371 and 2372, are .73 arcmins. Use an OIII filter if you have one. Modern images show a lobed shape, though different telescopes can show different images, the double NGC designation comes from the reports Draper got after it was found. The Herschel's reported two nebula with a dark lane between them, hence the two



NGC Catalog #2371

number designation. There are magnitude differences based on the authority, but the NGC catalog lists 11.2, so I'm sticking to it until I find two sources that agree on the same number.

There are three amazing deep sky wonders in Gemini that are almost certainly on every amateur's to-do list.

The first is the Eskimo Nebula, NGC 2392, Caldwell 39, and also know familiarly as the Clown Face. Some years back my club had a Monday evening at Griffith Observatory's beautiful 12" Zeiss refractor. The image of the nebula was nothing short of amazing. So is its size. By comparison, NGC 2392 is just a smidge smaller than Copernicus in your eyepiece.

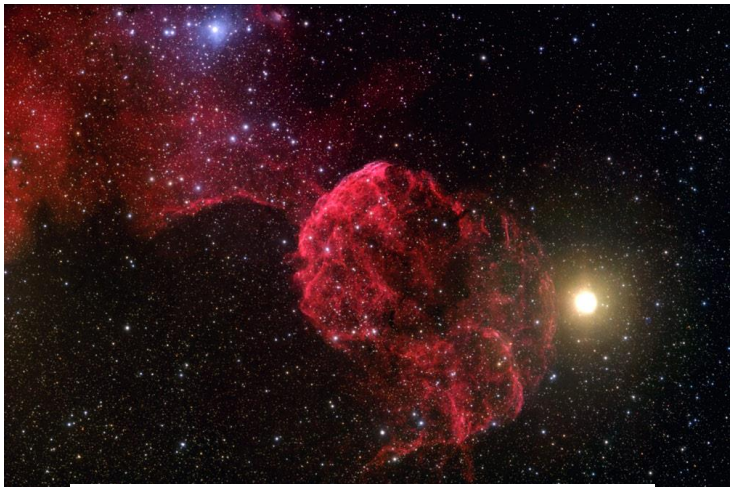

https://ocastronomers.org/wp-content/uploads/2018/12/N2392LRGB-3-25-03.jpg Bill Hall

The Medusa Nebula is a little off by itself closer to Canis Minor and not too far from NGC 2395, an open star cluster of 8th magnitude. The Medusa , also Abell 21, is a lot fainter, about 16th magnitude, though, from the attached image I grabbed from Simbab, they are

https://simbad.cds.unistra.fr/simbad/simidIdent=ngc+2395&NbIdent=1&Radius=2&Radius.unit=arcmin&submit=submit+id

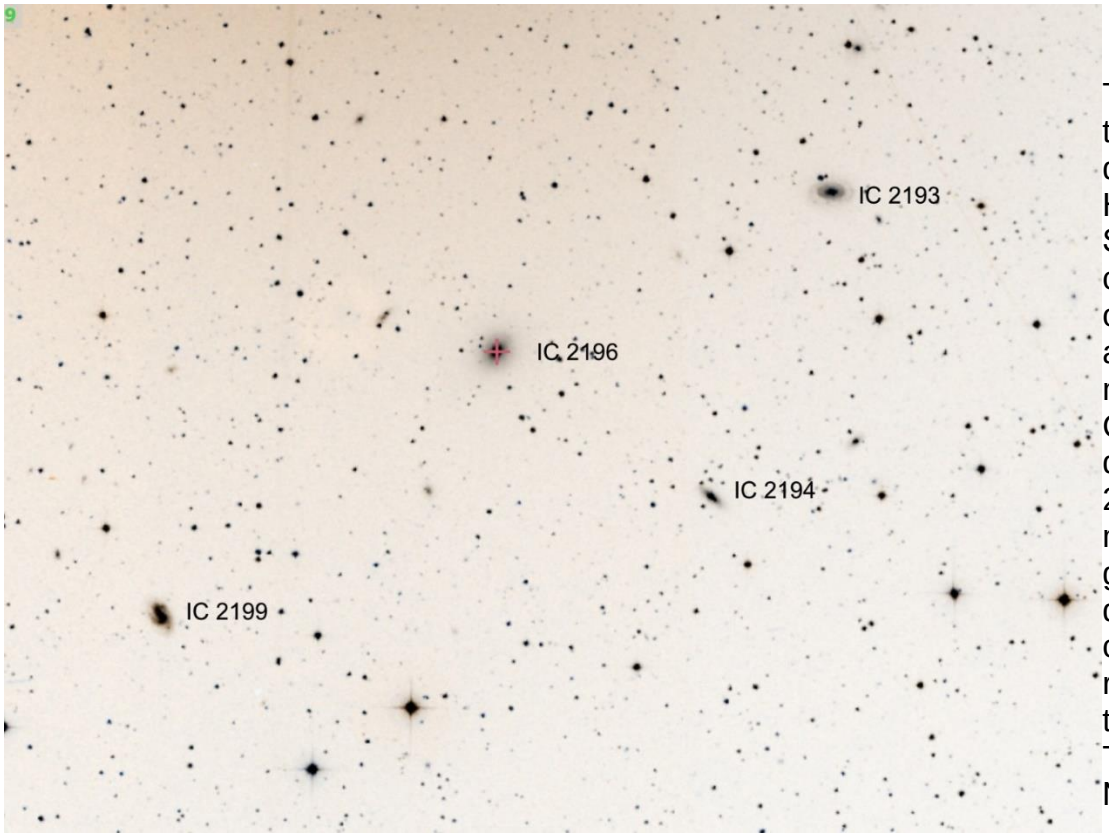
of about the same angular dimensions, 14x14 arcmin, though maybe the Medusa is a little closer to 10 arcmin, about a third the size of the full moon.

Back in the late 80's while writing for a local astronomy club, I offered a challenge to find a supernova remnant near the foot of Castor. Fast forward 40 years and IC 444 and IC 443 are easy pickings for our stellar astrophotographers. It will still be a challenge visually, however. I could see the



Https://ocastronomers.org/wp-content/uploads/2018/12/IC443-102608-HaRGB-S.jpg *John Castillo*

bright rim in the 17" and even trace some of the nebulosity that extends from IC443 to IC444. It's down there by Propus, η Geminorum and is in a very rich field of objects, next to Collinder 89, M35 and NGC 2128 as well as η and μ. H'ς proper name is Tejat Prior and also Propus. Propus is a triple star system but probably more famously the planet nearest Uranus when it was discovered by Herschel. M'ς proper name is Tejat Posterior, meaning the Heel.
You can put Mu and Eta in the same field and see the extent of IC's 443 and 444, but I don't know how much you can capture with your eye. Its bright enough at 11th magnitude but so spread out its hard to see. I used a Hα back then, you will do better.
You can find images all over the internet of the nebula, the OCA website has a dozen, but I chose this one by John Castillo because it is just extraordinary.



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The last five objects this month were described by Scott Houston in his "Deep Sky Wonders" column he wrote for over 40 years for Sky and Telescope magazine. Near Castor about a degree north is NGC 2410 a 13th magnitude spiral galaxy that was discovered, cataloged and rediscovered several times.
The other four are NGC's 2193, 2194, 2196 and 2199. Just below Castor, you can see the glow of him in the image. They are all 12th and 13th magnitude galaxies that Scotty thought might rival Stephan's Quintet. I think you'll get'em with your 12.5" and good, dark skies.

Dark Skies
Dave Phelps

Spot the King of Planets: Observe Jupiter

by David Prosper (NASA/JPL)

Jupiter is our solar system's undisputed king of the planets! Jupiter is bright and easy to spot from our vantage point on Earth, helped by its massive size and banded, reflective cloud tops. Jupiter even possesses moons the size of planets: Ganymede, its largest, is bigger than the planet Mercury. What's more, you can easily observe Jupiter and its moons with a modest instrument, just like Galileo did over 400 years ago.

Jupiter's position as our solar system's largest planet is truly earned; you could fit 11 Earths along Jupiter's diameter, and in case you were looking to fill up Jupiter with some Earth-size marbles, you would need over 1300 Earths to fill it up – and that would still not be quite enough! However, despite its awesome size, Jupiter's true rule over the outer solar system comes from its enormous mass. If you took all of the planets in our solar system and put them together, they would still only be half as massive as Jupiter all by itself. Jupiter's mighty mass has shaped the orbits of countless comets and asteroids. Its gravity can fling these tiny objects towards our inner solar system and also draw them into itself, as famously observed in 1994 when Comet Shoemaker-Levy 9, drawn towards Jupiter in previous orbits, smashed into the gas giant's atmosphere. Its multiple fragments slammed into Jupiter's cloud tops with such violence that the fireballs and dark impact spots were not only seen by NASA's orbiting Galileo probe, but also observers back on Earth!

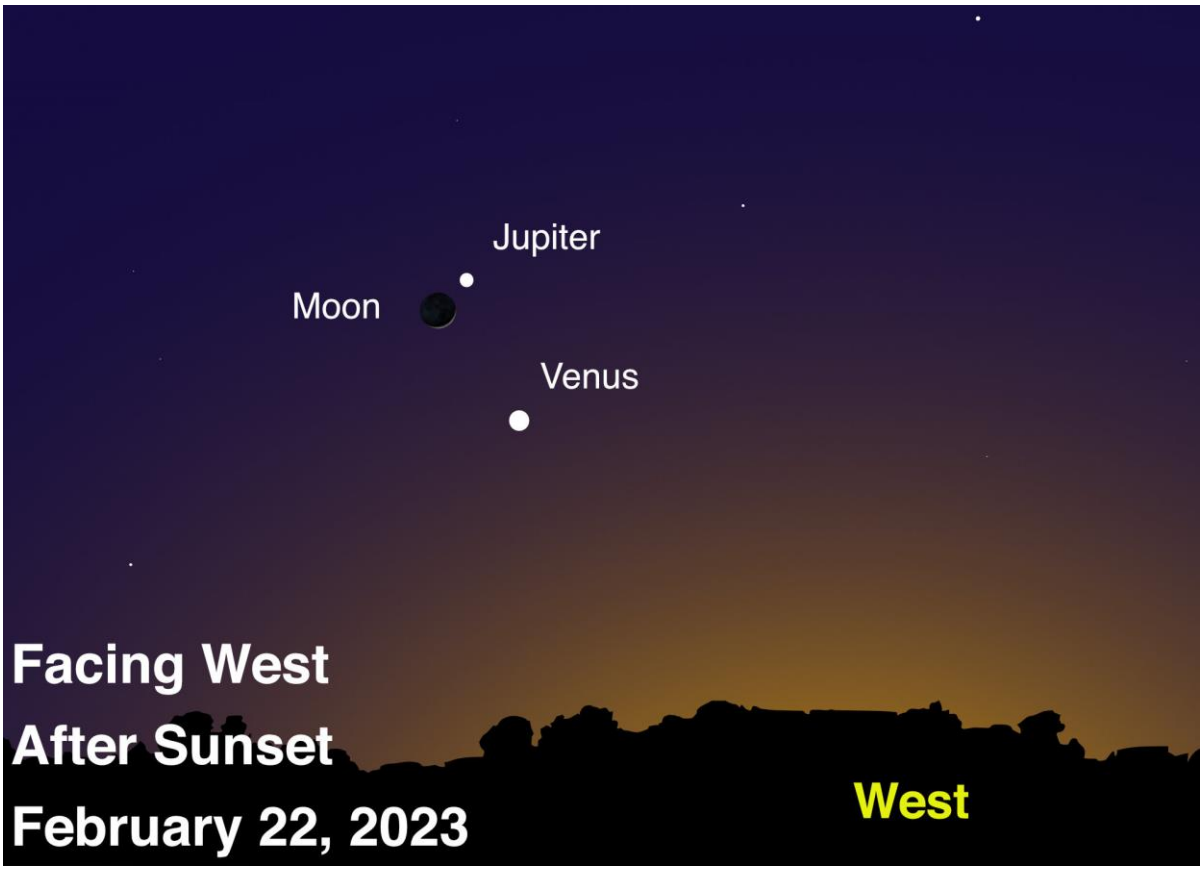
Jupiter is easy to observe at night with our unaided eyes, as well-documented by the ancient astronomers who carefully recorded its slow movements from night to night. It can be one of the brightest objects in our nighttime skies, bested only by the Moon, Venus, and occasionally Mars, when the red planet is at opposition. That's impressive for a planet that, at its closest to Earth, is still over 365 million miles *(587 million km)* away. It's even more impressive that the giant world remains very bright to Earthbound observers at its furthest distance: 600 million miles *(968 million km)*! While the King of Planets has a coterie of around 75 known moons, only the four large moons that Galileo originally observed in 1610 – Io, Europa, Ganymede, and Calisto – can be easily observed by Earth-based observers with very modest equipment. These are called, appropriately enough, the *Galilean moons.* Most telescopes will show the moons as faint star-like objects neatly lined up close to bright Jupiter. Most binoculars will show at least one or two moons orbiting the planet. Small telescopes will show all four of the Galilean moons if they are all visible, but sometimes they can pass behind or in front of Jupiter, or even each other. Telescopes will also show details like Jupiter's cloud bands and, if powerful enough, large storms like its famous Great Red Spot, and the shadows of the Galilean moons passing between the Sun and Jupiter. Sketching the positions of Jupiter's moons during the course of an evening - and night to night – can be a rewarding project! You can download an activity guide from the Astronomical Society of the Pacific at bit.ly/drawjupitermoons

NASA's Juno mission currently orbits Jupiter, one of just nine spacecraft to have visited this awesome world. Juno entered Jupiter's orbit in 2016 to begin its initial mission to study this giant world's mysterious interior. The years have proven Juno's mission a success, with data from the probe revolutionizing our understanding of this gassy world's guts. Juno's mission has since been extended to include the study of its large moons, and since 2021 the plucky probe, increasingly battered by Jupiter's powerful radiation belts, has made close flybys of the icy moons Ganymede and Europa,

along with volcanic Io. In 2024 NASA will launch the Europa Clipper mission to study this world and its potential to host life inside its deep subsurface oceans in much more detail. Find the latest discoveries from Juno and NASA's missions at nasa.gov.

This stunning image of Jupiter's cloud tops was taken by NASA's Juno mission and processed by Kevin M. Gill. You too can create amazing images like this, all with publicly available data from Juno. Go to missionjuno.swri.edu/junocam to begin your image procession journey – and get creative!

Full Image Credit: NASA/JPL-Caltech/SwRI/MSSS; Processing: Kevin M. Gill, license: CC BY 2.0) https://creativecommons.org/licenses/by/2.0/ Source: https://apod.nasa.gov/apod/ap201123.html



Look for Jupiter as it forms one of the points of a celestial triangle, along with Venus and a very thin crescent Moon, the evening of February 22, 2023. This trio consists of the brightest objects in the sky – until the Sun rises! Binoculars may help you spot Jupiter's moons as small bright star-like objects on either side of the planet. A small telescope will show them easily, along with Jupiter's famed cloud bands. How many can you count? Keep watching Jupiter and Venus as the two planets will continue to get closer together each night until they form a close conjunction the night of March 1. Image created with assistance from Stellarium.

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