



Temecula Valley Astronomer

The monthly newsletter of the Temecula Valley Astronomers October 2022

Events: General Meeting, Monday, October 3, 2022, at the Ronald H. Roberts Temecula Library, Room B, 30600 Pauba Rd, and/or ZOOM, at 6:00 PM.

- IFI & Gallery by Clark Williams
 - "Speckle Interferometry... Can Amateurs Do It?" by Rick Wasson
 - Refreshments by Chuck Dyson
- Star Parties at South Coast Winery every Friday evening in October. For upcoming school Star Parties check the Calendar on the [web page](#).

WHAT'S INSIDE THIS MONTH:

Cosmic Comments
by President Mark Baker

Looking Up Redux
compiled by Clark Williams

Random Thought – SPACE JUNK to Space Gold
by Chuck Dyson

Another Look
by Dave Phelps

Fomalhaut: Not So Lonely After All
by David Prosper (NASA/JPL)

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

DART Mission last look at Dimorphos two seconds before impact:



General membership (regular members) donation (\$9 student; \$35 family).

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Cosmic Comments – October 2022

By Mark Baker

I grew up as a Rocket Boy... in those days, we made our own, using stock materials and the shop tools available to us – drill presses, lathes, table saws, etc. We even tinkered with fuels in spite of the dangers...sadly, one of us lost his hand and then his life doing so though. It was an addictive obsession...

Nothing thrilled us more than watching our meager efforts launch skyward... at least most of the time!!! We even experimented with stages and payloads, my favorite being my sisters Barbie dolls... until Mom found out!!!

That being said, I also understood that such exciting events were still quite Neanderthal in that we were burning things as is the nature of chemical combustive fuels... and so I sought remedies in hard Sci-Fi that I read voraciously, hoping to find an advancement, not just an enhancement. Decades later I'm still searching...

I appreciate the enhancement that Ion drives brought to the table, such as used by the Dawn probe... slow maybe, but much more thrust over time in relation to fuel mass. And the new plasma drives soon to be utilized by the end of the year are exciting in their own right... the miniscule fuel mass needed for optimal thrust allows for larger payloads. And the second evolution utilizes METAL for fuel... and can be increased in size and thrust exponentially while again adding little mass!!! Such drives can be utilized throughout the Solar System, but especially in and through the asteroid belt. Why?? Because the main resource to be acquired after water from those objects are metal ores... which then can be used for refueling the plasma drives!!! It only takes a little bit after all...

None of these help in getting us off planet any better, but are wonderful additions to moving around LEO and beyond... and will be an awesome resource for satellite orbital maintenance and correction. As things get more and more crowded in LEO, consumption of chemical fuel for avoidance controls and thrusters will increase dramatically... plasma drives can add much greater longevity to an orbiting body's contribution, at much lower mass.

What's this got to do with TVA?? EVERYTHING...!!! If we didn't inspire young and old alike to wonder and ponder "what if?", these kinds of enhancements would not be happening. And who knows... maybe my long awaited advancement is even in the offing as well. So, keep them Looking Up...

Clear, Dark Skies



Looking Up Redux – October 2022

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)

yyymmddThmmss (Full date as: year month day Time separator hours minutes seconds)

Moon Phases for the month by date:

Sunday	the 9th	@ 1356 FULL in PISCES
Monday	the 17th	@ 1016 THIRD QTR in GEMINI
Tuesday	the 25^h	@ 0349 NEW in VIRGO
Sunday	the 2nd	@ 1715 First QTR in SAGITTARIUS
Monday	the 31st	@ 2338 First QTR in CAPRICORNUS

Apogee comes on 2022-10-17 @ **0322** – 404,329 km (251,239 mi)

Perigee comes on 2022-10-04 @ **1002** – 369,334 km (229,494 mi)

Perigee comes on 2022-10-29 @ **0749** – 368,287 km (228,843 mi)

2022 has: (13) new moons, (13) 1st Qtr moons, (12) Full moons, (12) 3rd Qtr moons
(0) Blue moon and (2) Black moons

Daylight Savings: Starts: 2022-Mar-13 : Ends: 2022-Nov-06

Luna: Luna is waxing crescent on the first of the month, headed for 1st quarter on the 2nd rising at **1252**,



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transiting at **1747** and setting by **2241**. Luna by mid-month is 63% illuminated. Rising at **2217** and transiting at **0555+** setting at **1332+**. By the-end-of-the-month Luna is rising at **1344** transiting at **1849** and setting by **2353**.

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

October 7 - Draconids Meteor Shower. The Draconids is a minor meteor shower producing only about 10 meteors per hour. It is produced by dust grains left behind by comet 21P Giacobini-Zinner, which was first discovered in 1900. The Draconids is an unusual shower in that the best viewing is in the early evening instead of early morning like most other showers. The shower runs annually from October 6-10 and peaks this year on the night of the 7th. The first quarter moon will block out all but the brightest meteors this year. If you are patient, you may still be able to catch a few good ones. Best viewing will be in the early evening from a dark location far away from city lights. Meteors will radiate from the constellation Draco, but can appear anywhere in the sky.

October 8 - Mercury at Greatest Western Elongation. The planet Mercury reaches greatest western elongation of 18 degrees from the Sun. This is the best time to view Mercury since it will be at its highest point above the horizon in the morning sky. Look for the planet low in the eastern sky just before sunrise.

October 9 - 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 20:55 UTC. This full moon was known by early Native American tribes as the Hunters Moon because at this time of year the leaves are falling, and the game is fat and ready to hunt. This moon has also been known as the Travel Moon and the Blood Moon.

October 21, 22 - Orionids Meteor Shower. The Orionids is an average shower producing up to 20 meteors per hour at its peak. It is produced by dust grains left behind by comet Halley, which has been known and observed since ancient times. The shower runs annually from October 2 to November 7. It peaks this year on the night of October 21 and the morning of October 22. The thin, crescent moon will leave mostly dark skies for what should be a good show. Best viewing will be from a dark location after midnight. Meteors will radiate from the constellation Orion, but can appear anywhere in the sky.

October 25 - New Moon. The Moon will be located on the same side of the Earth as the Sun and will not be visible in the night sky. This phase occurs at 10:49 UTC. 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.

October 25 - Partial Solar Eclipse. A partial solar eclipse occurs when the Moon covers only a part of the Sun, sometimes resembling a bite taken out of a cookie. A partial solar eclipse can only be safely observed with a special solar filter or by looking at the Sun's reflection. This partial eclipse will be best seen in parts of western Russia and Kazakhstan. It will be best seen from central Russia with over 80% coverage.

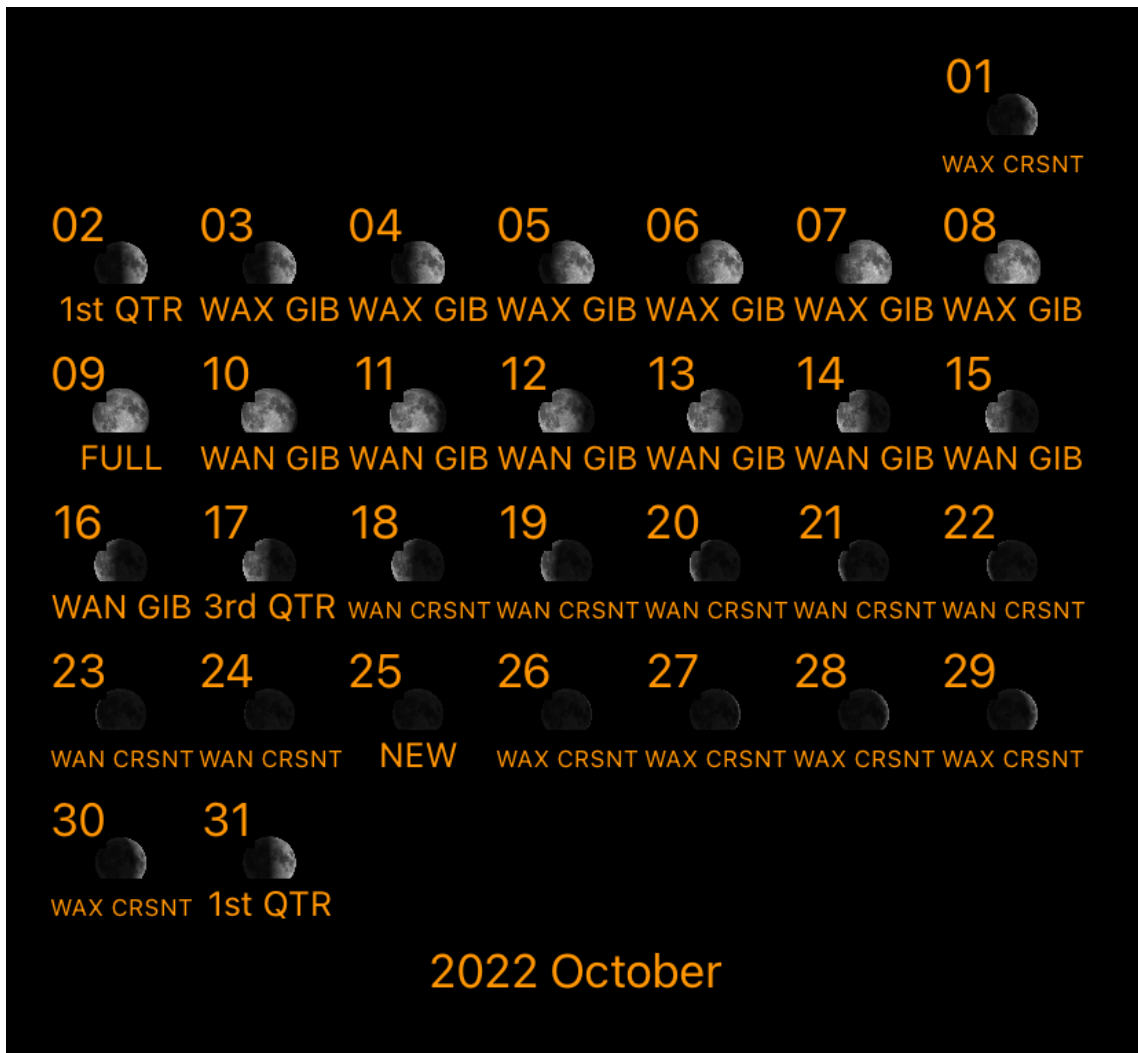


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Algol minima: (All times Pacific Time)

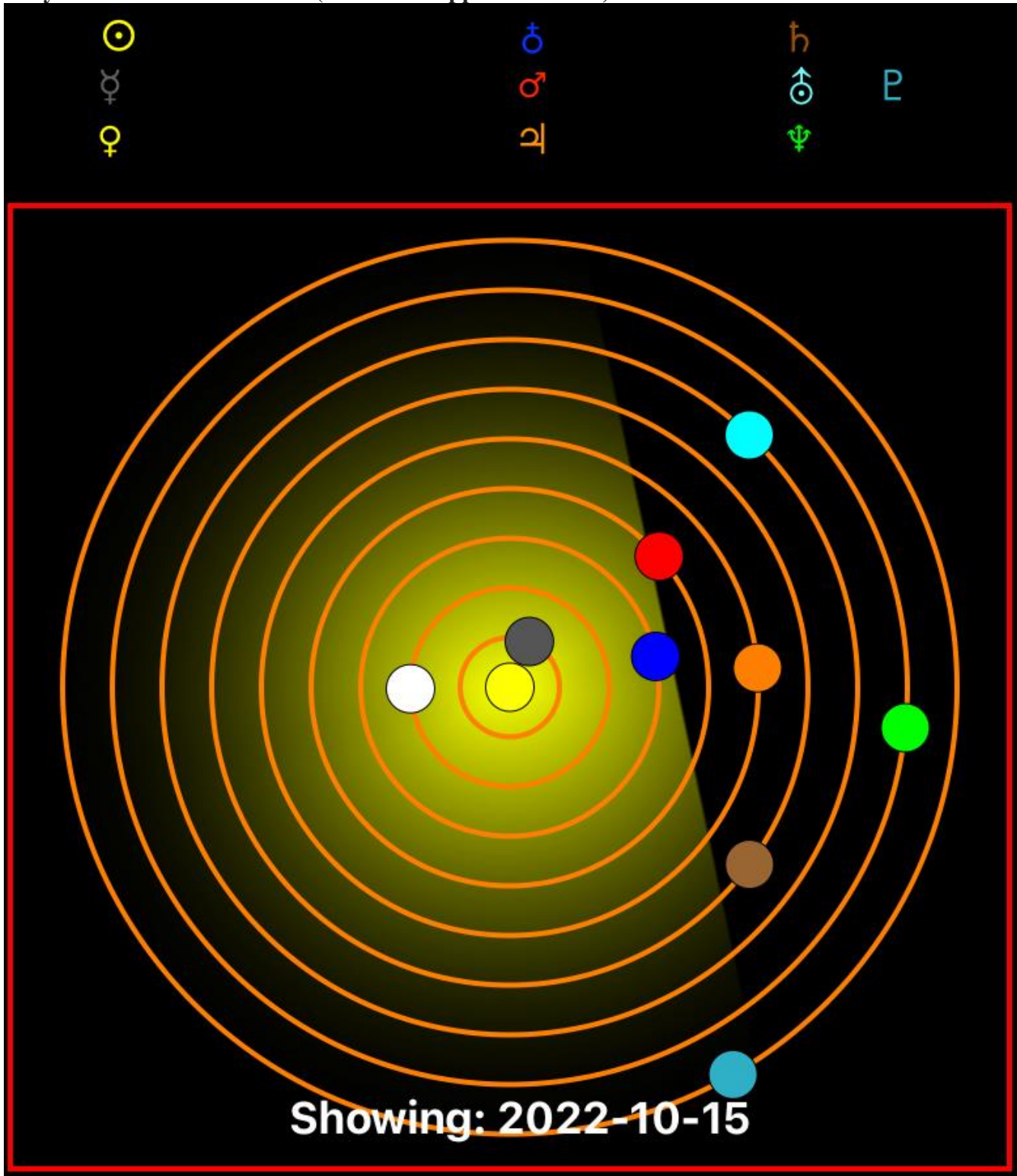
10/02/2022	0234
10/04/2022	2323
10/07/2022	2012
10/10/2022	1700
10/13/2022	1349
10/16/2022	1038
10/19/2022	0727
10/22/2022	0416
10/25/2022	0104
10/27/2022	2153
10/30/2022	1846





Planets:

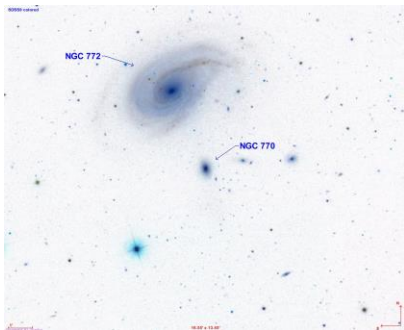
Planetary Positions October 2022: (from TVA App iOS version)



- **Mercury:** Mercury is a morning object in the beginning of the month. It is illuminated at 18% and 1.21

apparent magnitude. Mercury rises at **0536** with the sun following at **0642**. Mercury transits at **1145** and sets at **1754**. Mercury by mid-month is still a morning object rising at **0536**, transiting at **1139** and setting at **1741**. By the 31st Mercury rises at **0641** and sets at **1747**.

- **Venus:** Is the morning star on the first of the month, rising by **0615**, with sunrise at **0642**. Venus is rapidly approaching the sun. By mid-month Venus is rising at **0643** followed by sunrise at **0652**. By the 31st Venus is rising at **0716** followed by sunrise at **0705**.
- **Mars:** Mars is back in the sky as an evening object; on the first rising at **2215**. By mid-month Mars is rising at **2134**. End-of-month finds the Warrior rising at **2034**.
- **Jupiter:** Jupiter is an evening object on the first of the month rising at **1816**, transiting at **0018+**. By mid-month Jove is rising at **1716**, transiting at **2316**. Come the end-of-month Jupiter is peaking above the horizon by **1609**, transiting at **2208**.
- **Saturn:** Saturn rises at **1614** on the 1st. Saturn transits at **2132** and doesn't set until **0251+**. Saturn by mid-month rises at **1518** and transits at **2036**. By the end-of-the-month Saturn is easily visible by the time it transits by **1933**.
- **Uranus:** On the first of the month Uranus is an evening object rising at **2018**, transiting at **0308+**. By the ides Uranus is rising at **1921** and transiting at **0211+**. End-of-month finds Uranus rising at **1817**. and transiting at **0106+**. This month is a good time to try your hand at imaging Uranus.
- **Neptune:** Neptune is rising at **1750** in the beginning of the month. Neptune transits at **2343**. By the 15th Neptune rises at **1654**. Neptune transits at **2247**. By the end of the month Neptune is rising at **1550** and transits at **2143**. This month is a good time to try your hand at imaging Neptune.
- **Pluto:** Pluto on the first of the month is at 14.42 apparent magnitude and rising at **1502**. It won't be truly visible until well after sunset at **1834**. Pluto transits at **2000**. By mid-month Pluto is rising at **1407** but again the sun will interfere with viewing until around **2000**. Pluto transits at **1905**. By the 31st Pluto is probably not visible because of the sun and the First Quarter moon.



Asteroids:

- Still a dearth of asteroids. I searched for asteroids in 2022 with a reasonable magnitude; say less than or equal to +10 in October there is nothing except the regulars: Juno, Vesta, Hebe, Eros and Herculina. So consult your local planetarium software or try: <https://www.asteroids near.com/year?year=2022>
- **There is one asteroid you might try finding and/or imaging this month: (216) Kleopatra asteroid in Pegasus Visual Magnitude is +9.9. Its size is only 0.1 arcsecond. It is 99.5% illuminated on the 15th at 2100. Rising 1727, transiting at 0003+ and not setting until 0634+.**

Meteors:

- Delta Aquarids Meteor Shower. (see Highlights October 28-29 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 October have a near circular orbit or an elliptical orbit. The latter being far



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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.



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1. One comet of interest this month. Comet C/2022 E3 (ZTF), a comet in **CORONA BOREALIS**, visual magnitude +11.7 on the 15th of October 2022 at **2100**. It rises at **0745** but doesn't set until **2221**. 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 October 2022 at 2100 PDT and you will have about 20 minutes of viewing time total.

Let's take a look at some favorite objects (at least for me):



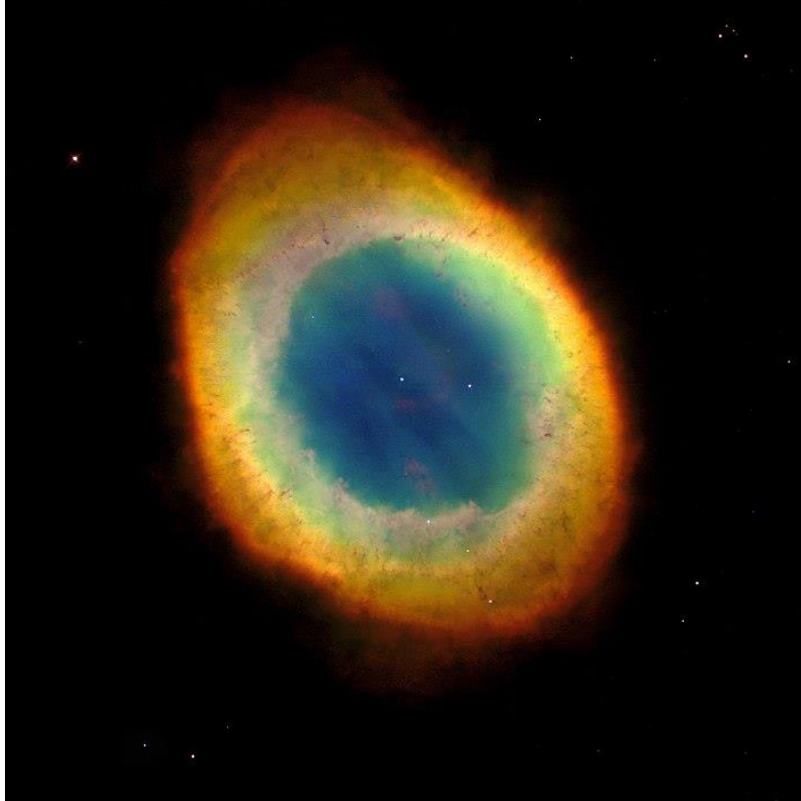
- Albireo:

Albireo /æɪˈbɪrɪoʊ/ is a double star designated Beta Cygni (β Cygni, abbreviated Beta Cyg, β Cyg). The International Astronomical Union uses the name "Albireo" specifically for the brightest star in the system. Although designated 'beta', it is fainter than Gamma Cygni, Delta Cygni, and Epsilon Cygni and is the fifth-brightest point of light in the constellation of Cygnus. Appearing to the naked eye to be a single star of magnitude 3, viewing through even a low-magnification telescope resolves it into its two components. The brighter yellow star, itself a very close binary system, makes a striking color contrast with its fainter blue companion.

[\(Wikipedia\)](#)

Illustration 1: By Hewholooks - Own work, CC BY-SA 3.0,

<https://commons.wikimedia.org/w/index.php?curid=5060>



◦ **The Ring Nebula:**

The Ring Nebula (also catalogued as Messier 57, M57 and NGC 6720) is a planetary nebula in the mildly northern constellation of Lyra. Such a nebula is formed when a star, during the last stages of its evolution before becoming a white dwarf, expels a vast luminous envelope of ionized gas into the surrounding interstellar space. ([Wikipedia](#))

*Illustration 2: By The Hubble Heritage Team
(AURA/STScI/NASA) -
<http://hubblesite.org/newscenter/archive/releases/1999/01/image/a/> (direct link), Public Domain,
<https://commons.wikimedia.org/w/index.php?curid=401569>*

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

For now – Keep looking up.

RANDOM THOUGHT

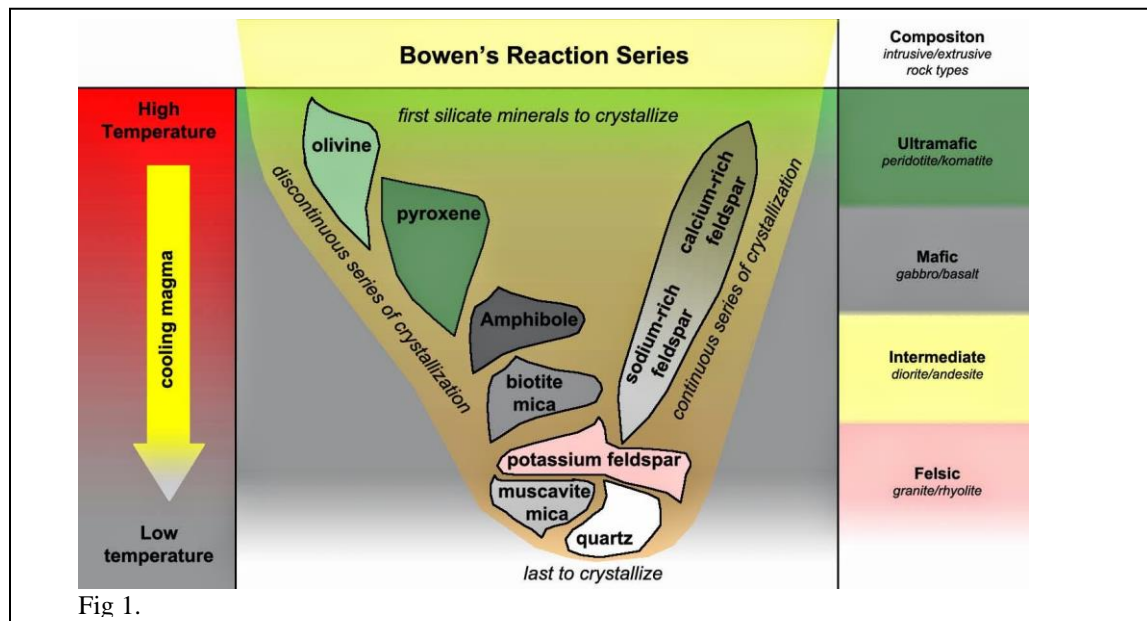
By Chuck Dyson

SPACE JUNK TO SPACE GOLD

Volcanoes are both fascinating and terrifying things if you are not a geologist. But, if you are a geologist they are really fascinating things and only terrifying if you are in the area when one goes off. In 1922 Norman Levi Bowen published a paper on how and under what conditions minerals, rocks, were formed inside of volcanoes. In 1928 Bowen published his book "The Evolution of Igneous Rocks" that is still used today. This book explained in detail how rocks were heated, melted, and transformed into new and different minerals from the original rocks that made up Earth. With an incredible amount of laboratory work that demonstrated how the system worked Bowen was able to produce a graph: Bowen's Reaction Series (Fig. 1) that demonstrated how this whole melt and recrystallize system worked. This graph is the H-R Diagram of geology. Many geologists cheered because they could now understand and explain much of the features found today; however, there were a few geologists that cried because they now knew that the original crust was gone forever and whatever minerals were in the rocks that formed the Earth and thus made up the early solar system were gone forever.

With the discovery of plate tectonics and the subduction of parts of the Earth's surface all hope of ever

finding some original solar material vanished for our poor Astro geologists.



Before our sobbing Astro geologists could have any hope of finding bits of the early solar system three things had to change. First the Earth must be older than the 6026 years old that was calculated by Archbishop James Ussher in 1650 (Ussher actually said that the Earth was created in 4004 B.C. and if you add 2022 years A.D. to that date you get 6026). Second The Earth, and by extension our galaxy and solar system too, must be created by natural processes and not by direct and total divine intervention. Third the solar system and galaxy cannot be



perfect, unchanging, and never interact with the Earth; but rather both must have material that over long periods of time interacts with Earth. The solar system material interacts with Earth rather more often than the galactic material. Our sobbing geologists are at a disadvantage too because unlike religious cannon they cannot just claim that their version of the workings of the solar system is correct; they must show and explain. Science requires that this be done.

James Hutton was a Scottish educated individual who took over his father's farms in the 1750's and became fascinated with soil erosion, soil composition, and the ultimate fate of the eroded soil. Hutton reasoned that there was a steady process that laid down the eroded soil in horizontal bands over time one on top of another. At Siccar Point on the Scottish coast Hutton was able to see and show where horizontal bands of sedimentary rock had been turned vertically and then had new horizontal bands of rock on top of them, this is known as Hutton's unconformity, and it takes a very long time to form.

Hot on Hutton's heels was William Smith, a surveyor and canal digger. Canals and canal barges were the semi-trucks for moving freight and agricultural products in the 1800's. As he dug more and more canals Smith realized that he was seeing the same types of soil and sandstone bands. The geologic name for these bands is strata, over and over and they were always in the same relationship to one another. Smith also noticed that the same strata always had the same types of fossils in them. At this time fossils were considered interesting rock formations and not mineralized animal remains. It is not until 1813 when Georges Cuvier published the "Essay on the Theory of the Earth" that the debate over the nature of fossils is started. Cuvier argued that fossils were the remains of extinct animals that had been wiped out by a series, over long time periods, of global catastrophic floods, perhaps as a friendly nod to the flood mentioned in the bible.

The upshot of all of this playing in the mud, digging canals, and understanding fossils are a series of geologic principles. The principles are as follows. Original Horizontality or mud gets laid down in flat sheets. Superposition or new mud goes on top of old mud. Lateral Continuity or rock layers that are not connected today were once contiguous. Intrusive Relationships rocks that have igneous, magma, dykes (vertical intrusions) or igneous sills (horizontal intrusions) are always older than the igneous rocks that intrude. Intrusive Relationships or how igneous rocks pick up other rocks as they move through them including rocks from the crust/mantel interface. With these understandings geologists can understand and explain many of the things they see in the rocks; however, they still have no idea how long of a time span is necessary to create the layered rocks they are looking at: are the rocks 1 million years old or 100 million years old we have no idea. We desperately need a clock.

Enter Henri Becquerel. Becquerel was interested in elements that glowed (were fluorescent). In 1896 Becquerel is studying his fluorescent elements by having them fog photographic plates. Becquerel thinks the plates are being fogged by the light coming from the elements but one night he stores some low grade, non-glowing, uranium ore with an unexposed plate and the next day the plate is completely fogged. Becquerel has discovered radioactive elements. Further research by Becquerel, the Curie's, and Arthur Holmes identifies different radioactive elements and each had a very specific rate of decay, half-life, and always decay to a specific element or better yet a stable isotope of that element. Arthur Holmes, being a geologist, recognizes that when crystals form they are incredibly discriminatory when it comes to the elements that they

will permit into their crystalline structure. Uranium's radioactive isotopes all decay to stable isotopes of lead. When a Zircon crystal forms it welcomes uranium but absolutely not lead; so, at the start of the crystal's life there is only uranium. Over time the uranium decays to lead and if one is able to determine the ratio of uranium to lead and know the uranium's half-life one can accurately determine the age of the Zircon crystal. In 1929 Holms publishes his book describing how the process works and Houston we have our clock.

However, our problems still are not over if we want to know the age of both our solar system and earth, as we have firmly established that the original crust with its age containing crystals has been remelted and reformed at least one time and maybe more. At the start of the 1700's everyone just knows that the only objects in the heavens, space, are the planets and stars and there is nothing else. According to Shakespeare the gods announce great events on earth with heavenly displays.

Julius Caesar Act 2 Scene 2

When beggars die there are no comets seen;

The Heavens themselves blaze forth the death of princes.

Other than these divinely inspired announcements there is nothing out there despite the occasional ranting by obviously deranged peasants of actually seeing falling rocks from the skies. By chance in 1791 Ernst Florens Fredrich Chladni has a conversation with his respected colleague Gregory Christoph Lichtenberg (are these a couple of great names or what?). Lichtenberg tells Chladni that he personally has witnessed the fall of fiery rocks from the sky (Note: Witnessing a meteor fall is not the same as seeing one light up the sky. When you witness a fall you actually see the rocks hitting the ground and even today this occurs only 6 to 8 times a year) and he, Lichtenberg, thinks the peasant's stories are true. In 1794 Chladni publishes a book that proposes that meteoroids are of extraterrestrial origin. The book and Chladni get hammered from all sides for such an idiotic idea. The critics are certain that rocks that fall from the sky are volcanic in origin or have some other plausible earthly explanation. Enter the fickle finger of fate because in 1795 just outside of the town of Wold in Yorkshire England a meteor fall was seen and the meteorite recovered. Parts of the Wold Cottage meteor were sent to an English chemist and a French mineralogist for analysis, both concluded that the rocks were not of terrestrial origin. We can now look for clues to the origin of the solar system in sky rocks that in some cases have not undergone mineral transformations.



Fig. 2

Thanks to atomic bombs that give us some plausible understanding of how the sun could produce the energy to melt the original solar disk dust grains and thanks to Bowen and his reaction series on how and at what temperature minerals form we can have some idea of what to look for. We also have an understanding of what not to look for. A pallasite meteorite Fig. 2 is beautiful but has undergone melting and differentiation just like the earth. Carbonaceous chondrites on the other hand have round objects, chondrules, in them ranging in size from less than a millimeter to as large as one centimeter that appear to

have minerals that melted and resolidified very quickly and have remained unchanged from the start of the solar system to now Fig. 3. Some of Carbonaceous chondrites also have in them calcium-aluminum rich inclusions (CAI's). These CAI's are what geologists call refractory material this means it solidifies at very high temperatures and represents the earliest of minerals after the sun turned on and because CAI's also love to have uranium in them they represent the first clocks in our solar system. It is these CAI clocks that have turned asteroids from space junk to pure space gold.



Fig. 3

Not willing to just sit on the earth and wait for random meteorites to land, usually at inconvenient places, and retrieve them for study, both the Japan Aerospace Exploration Agency (JAXA) and our National Aeronautics and Space Administration (NASA) have sent probes to intercept and sample different asteroids. In 2005 JAXA landed Hayabusa1 on the small near earth asteroid 25143 Itokawa, a small rubble pile with rocks of different origins, and returned samples. In 2010 then JAXA landed its Hayabusa2 probe on Ryugu, a near earth C1 (carbon rich) asteroid and in 2020 it returned those samples that are being studied now. NASA has two probes, OSIRIS-Rex has sampled the near earth asteroid Bennu and will return the samples to Earth in September of 2023. If the mission is extended it will then go on and study the near earth asteroid Apophis, no samples. All of these probes have studied potentially hazardous, as in they could hit us, near earth asteroids but the Lucy NASA probe will study, but sadly not sample, six different asteroids in the main asteroid belt and then go to Jupiter's leading and then trailing Trojan asteroids to study several bodies in each location. Trojan asteroids are in incredibly stable orbit locations and have the greatest chance of showing us what the first minerals in our solar system were. At this time NASA's other planned main asteroid belt probe, Psyche, is on hold due to software issues with a new possible launch date in 2023.

You can expect more missions and more discoveries from studies done on our space junk turned space gold.

CHEERS,
CHUCK

Another Look September, 2022

By Dave Phelps

Full moon October 9, called the Hunter's Moon; New Moons Sunday Sept 25 and Tuesday Oct. 25 Native Americans named this Full Moon after Autumn, including Drying Rice Moon, Falling Leaves Moon, and Freezing Moon. The Celts used Seed Fall Moon to describe this moon. Also, the Pagan Blood Moon or Sanguine Moon.

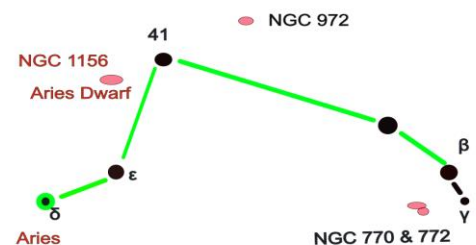
On Oct 25 is a partial solar eclipse. At max the Moon covers 82.11% of Sun's surface somewhere east of the Urals and north of Novosibersk. The partial phase is visible into Spain, Africa; the southern tip of India will see a tiny notch taken out.

When you take into account that Aries is one of the puny constellations surrounded by Triangulum and Pisces it is a wonder why it is so famous. That being said, Aries could be one of the oldest constellations identified. If we accept that the constellations as we know them, excluding India and China, were first named several thousands of years ago in and around the region of the Euphrates River, it is probable, 3500 years ago, that the stars were not named because they looked like anything but because they identified with a certain significance in their daily lives. It is also probable that star configurations were pin-pointed by civilizations preceding the Euphratean era. One thing is likely, however, that many of the names given any particular star grouping meandered all over the ancient world and influenced civilizations from Greece and Mesopotamia down to Egypt and the Nile valley; and as we know, the Romans incorporated Grecian culture into their own, Latinizing their names.

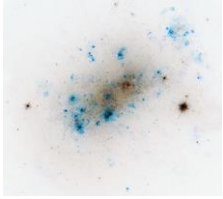


(Aries and Musca Borealis as depicted in Urania's Mirror, a set of constellation cards published in London c.1825)

Thus, 3500 years ago the Chaldeans, who named the sun after their flocks, put a name to the stars where the sun shone as the seasons changed. Through the centuries the names stuck. Now, as the seasons change the vernal equinox is in Pisces while 3500 years ago, it was in Aries. Now, the First Point in Aries is slightly below the circlet of Pisces.



I think one of the more fun myths associated with Aries was that of Helles and Phrixus, who were given a ram to escape their evil stepmother. Racing across the Adriatic up into Asia Minor, Helles fell off, thus naming that narrow strait, near the Dardanelles, between Greece and Turkey the Hellespont. The ram raced across the Black Sea bringing the brave young man to safety in Colchis, now modern Georgia. The Ram magically changed its fleece to gold, was sacrificed in thanks to the gods, (I wonder if the ram thought it was such a great honor) and the fleece placed in a grove guarded by a dragon, ready to be stolen by Jason and the Argonauts.



Near Beta and Gamma Arietis is NGC 772 and its satellite galaxy 770. NGC 772 is big and bright at 11th magnitude and you can find NGC 770 at 14th. It is interesting that NGC 772 is also number 78 in Arp's **Atlas of Peculiar Galaxies**. Image courtesy of *Image créée à l'aide du logiciel Aladin Sky Atlas du Centre de Données astronomiques de Strasbourg et des données de SDSS (Sloan Digital Sky Survey)*.

Aries also has its own dwarf galaxy NGC 1156. NGC 1156 is interesting. It has no structure because of interaction with other galaxies. Those bright spots are star forming regions. NGC 1156 is 12th magnitude so you will find it in your 8" backyard telescope.



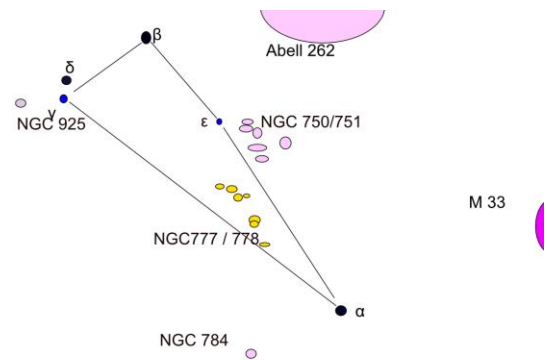
NGC 1156

Up at the top of Aries is NGC 972, another interesting galaxy. Images of it from Hubble show what looks like at first glance an irregular galaxy, but closer study finds its spiral structure hidden by the knots of star nurseries gas and dust. It is 12th magnitude but only 10 arcmin in size. Still if you compare it to the moon at 31 arcmin, you can get a good idea of the relative size of NGC 972. Both images **Credit: Hubble Image of the Week**

While up at the top of Aries find 41 Arietis. It is a triple star system with components of 4th, 11th and 11th magnitudes. 41 Ari has an official name from the Hindu, Bharani, it means 2nd lunar mansion. 41 Ari is also a part of the obsolete constellation of Musca Borealis, first introduced on a globe of 1612 by the Dutchman Petrus Plancius and shown above the Ram in our clipping from Urania's Mirror.

It being that time of year, Triangulum is galaxies, galaxies and more galaxies.

Near each other just off the line from delta to alpha are NGC's 777 and 778. NGC 777 is a bright 12th magnitude nearly textbook elliptical. It's beautifully formed, an oval gradually getting denser and brighter from the edges of the galaxy to its star-like nucleus. NGC 778 is not too far off and can be seen in wide angle images much smaller than its companion. NGC 778 visual magnitude is 14 in the blue range so it will be a properly difficult object to locate. If you can spread out its 8x4 arcsec image you will see a tilted spiral with some unusual knots and clumps.



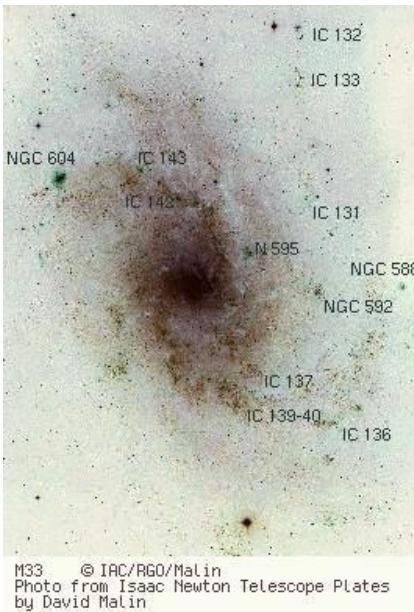
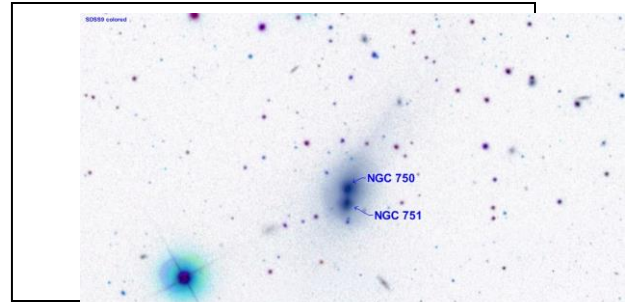
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<https://www.drewexmachina.com/2021/06/27/a-century-of-progress-telescopic-views-of-the-triangulum-galaxy/>
 /andhttps://www.messier.seds.org/more/m033_map.html

Moving over to the other side of Triangulum, there is another knot of interacting galaxies comprised of NGC 750 and NGC 751, number 166 on Arp's "Atlas of Peculiar Galaxies". Near delta δ and gamma γ Ttrianguli is **N925** a nice loose spiral. It is named the Almatha Galaxy: Quite pretty and at 10' by 5', should be fairly easy to see, though a little low in surface brightness.



NGC 598 or better known as M33 is one of the brightest we have. So, why is it so hard to see? It's 70x41moa, but that size compared with its low surface brightness has given it the reputation of being a difficult object. Its 5th magnitude so we should be able to see it visually under dark enough skies, and we can. I have a homemade collimation eyepiece, a 1.25" round piece of aluminum with a 1/8" hole bored through it. It works as a great eye focuser, eliminating extraneous light around the edge of your eye. With it on a mountain in Utah I saw M33 and even resolved a few knots.

The Malin image shows four NGC's and 8 IC's. Then trick is to try to identify them visually using a map like this as your guide. The four H II star forming regions identified in the image are NGC 595, NGC 588, NGC 592 and NGC 604.

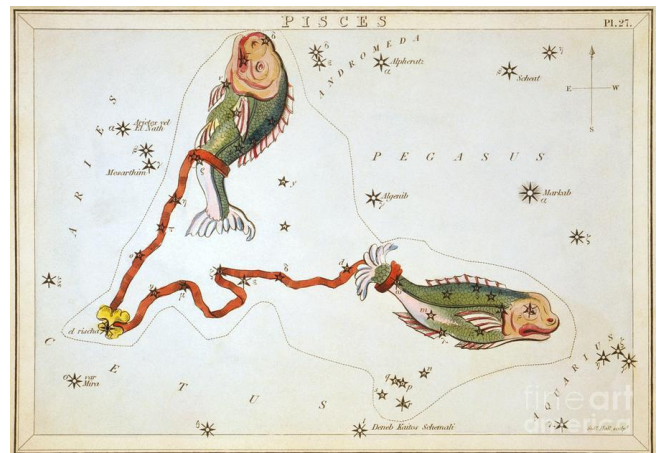
In antiquity Triangulum was seen as a triangle and the Greeks even called it Deltaton because it resembled the capital letter delta in their alphabet. It resembled the Nile delta and the Island of Sicily because of three peaks on the island. Sicily is the legendary home of Ceres, the goddess of agriculture and our minor planet. Ceres apparently loved the island so much she asked Zeus to place it in the heavens.

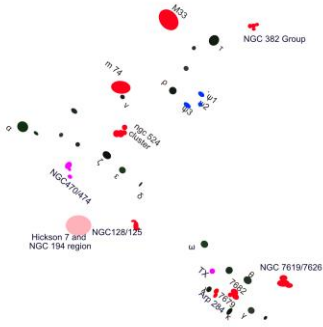
Pisces Urania's Mirror, Second Edition

Pisces

*"The Fishes shine one higher than the other,
from each of them extends as 'twere a band
that fastens tail to tail, as wide it floats, and one star
large and brilliant clasps its ends"*

The Heavenly Knot 'tis called" Frothingham's Aratos





The asterisms that make up Pisces, the Northern Fish and the Western Fish are a part of Ptolemy's original 48, but are thousands of years more ancient. The Babylonians and other civilizations up to and including the Romans regarded the star group as two fishes tied together by a cord or ribbon. The star at the base of the ribbons is Alpha α Piscium. It is a named star, Al Rescha, meaning the knot. In one of my references, it is posited that the dual nature of the constellation contributed to or was in turn contributed to by the addition of an extra month every six years of the Babylonian calendar. That's how ancient this constellation is. Due to the precession of the equinoxes, the vernal equinox is close to the circlet.

The Greeks had the most fun with this constellation. They wove into it the Titan's war with the gods, the birth of the most dangerous Titan of all, an escape and a stellar honor. Typhon was supposedly the fiercest monster ever created. He had serpentine feet, many heads and could breathe fire. His story easily goes back to the Egyptians and we can trace its origin back millennia, as far as the civilizations that grew along the Euphrates. In the Greek saga, Typhon, our monster, attacked the gods, seeking to give the Titans rule over the world. The gods escaped by turning themselves into animals. Aphrodite and her son Eros escaped into the river (either the Euphrates or the Nile depending on the narrator,) by changing themselves into fish. Minerva honored this pretense by placing the fish in the heavens.

So, what happened to Typhon? Zeus defeated him thus cementing his authority over the heavens. He then buried him under Mt. Etna, making it the largest volcano in Europe. The single Messier in Pisces is M74, a big beautiful face on spiral. M74, also known as NGC 628 is a large, $10' \times 10'$, 9th magnitude galaxy that is usually the bane of the Messier Marathoner. It all has to do with its surface brightness. M74 doesn't have much in the way of bright star forming regions. Its face is uniform from the nucleus out to the spiral arms.



M74 courtesy of:
ESO PESSTO



My observing plan was to choose a particular constellation and learn it. I figured that I would never be able to find out everything that a constellation had to offer and doing a constellation a month would ensure that I would have a lifetime's work ahead of me. Pisces is a great example of that. I was first interested because it is faint and had an interesting circlet of stars. I decided to search for and identify every galaxy within reach of my 17.5 inch mirror. I never came close. In the circlet neighborhood alone there are three clusters of galaxies within reach of your 12 inch and detectable in your 8 inch. The rough chart I made shows eight reachable clusters.

<https://esahubble.org/images/heic1503a/>

Near the circlet are 12th magnitude NGC's 7714 and 7715 also known as Apr 284. A pair of interacting galaxies discovered by John Herschel in 1830.



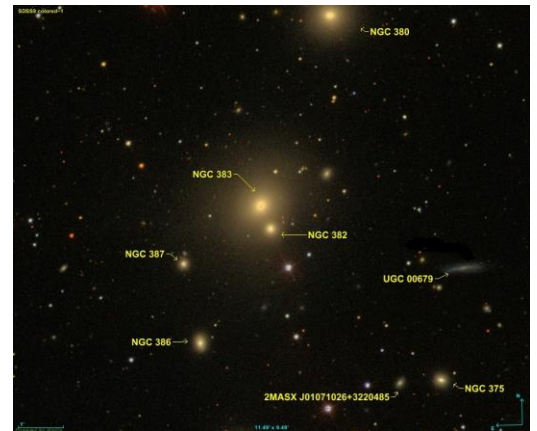
This wide field image of N524 was taken by Gregg L. Ruppel on <http://greggsastronomy.com/ngc524.html>

Next to the circlet is 19 Piscium, better known as TX Piscium. 19 Piscium is one of the reddest stars known. The star has an apparent magnitude that varies between 4.9 and 5.5 magnitudes. It is a variable carbon star, which is to say a late type star that contains clouds of carbon circulating in the atmosphere. That's kinda wowsery to imagine, isn't it.

In the center of Pisces near the cusp is another group dominated by the 10th

magnitude NGC 524. It's going to look like an elliptical, in fact early observers described it as a dense E1 galaxy. Actually, N524 is a tightly wound face on galaxy. It will be tough to see it however.

The NGC 383 group is up north against Andromeda, not too far from τ Piscium. It is another "string of pearls" and quite beautiful as I remember. Arp put it into his *Atlas of Peculiar Galaxies* as number 331. The credit for this image belongs to: *Ngc 382 Image créée à l'aide du logiciel Aladin Sky Atlas du Centre de Données astronomiques de Strasbourg et des données de SDSS (Sloan Digital Sky Survey)*



The "Webb Deep-Sky Society" also cataloged this cluster. A finders and identifier chart is on-line at <https://www.webbdeepsky.com/images/galaxies/ngc383.pdf>

NGC 474/470 are found off the southern fish between α and ζ , another tough cluster to find. I reckoned its magnitude at 11-12. I never saw the faint swirls around N474. I guess it's being disrupted by N470. This group is also Arp 227 and can be found on-line at the Webb Society.

Galaxy NGC 474: Cosmic Blender Credit & Copyright: Mischa Schirmer APOD 2007 Oct 8

So, Aries, Triangulum and Pisces, bundled together beneath Andromeda and Pegasus and maybe passed over a little bit by their more famous neighbors. Still, they are a significant part of the realm of galaxies. I hope you enjoy finding and observing them.



Dark Skies

Dave Phelps



Fomalhaut: Not So Lonely After All

by David Prosper (NASA/JPL)



This article is distributed by NASA's Night Sky Network (NSN). The NSN program supports astronomy clubs across the USA dedicated to astronomy outreach. Visit nightsky.jpl.nasa.gov to find local clubs, events, and more!

Fall evenings bring a prominent visitor to southern skies for Northern Hemisphere observers: the bright star **Fomalhaut**! Sometimes called "The Autumn Star," Fomalhaut appears unusually distant from other bright stars in its section of sky, leading to its other nickname: "The Loneliest Star." Since this star appears so low and lonely over the horizon for many observers, is so bright, and often wildly twinkles from atmospheric turbulence, Fomalhaut's brief but bright seasonal appearance often inspires a few startled UFO reports. While definitely out of this world – Fomalhaut is about 25 light years distant from us – it has been extensively studied and is a fascinating, and very identified, stellar object.

Fomalhaut appears solitary, but it does in fact have company. Fomalhaut's entourage includes two stellar companions, both of which keep their distance but are still gravitationally bound. Fomalhaut B (aka TW Piscis Austrini, not to be confused with former planetary candidate Fomalhaut b*), is an orange dwarf star almost a light year distant from its parent star (Fomalhaut A), and Fomalhaut C (aka LP 876-10), a red dwarf star located a little over 3 light years from Fomalhaut A! Surprisingly far from its parent star – even from our view on Earth, Fomalhaut C lies in the constellation Aquarius, while Fomalhaut A and B lie in Piscis Australis, another constellation! – studies of Fomalhaut C confirm it as the third stellar member of the Fomalhaut system, its immense distance still within Fomalhaut A's gravitational influence. So, while not truly "lonely," Fomalhaut A's companions do keep their distance.

Fomalhaut's most famous feature is a massive and complex disc of debris spanning many billions of miles in diameter. This disc was first detected by NASA's IRAS space telescope in the 1980s, and first imaged in visible light by Hubble in 2004. Studies by additional advanced telescopes, based both on Earth's surface and in space, show the debris around Fomalhaut to be differentiated into several "rings" or "belts" of different sizes and types of materials. Complicating matters further, the disc is not centered on the star itself, but on a point approximately 1.4 billion miles away, or half a billion miles further from Fomalhaut than Saturn is from our own Sun! In the mid-2000s a candidate planetary body was imaged by Hubble and named Fomalhaut b. However, Fomalhaut b was observed to slowly fade over multiple years of observations, and its trajectory appeared to take it out of the system, which is curious behavior for a planet. Scientists now suspect that Hubble observed the shattered debris of a recent violent collision between two 125-mile wide bodies, their impact driving the remains of the now decidedly non-planetary Fomalhaut b out of the system! Interestingly enough, Fomalhaut A isn't the only star in its system to host a dusty disc; Fomalhaut C also hosts a disc, detected by the Herschel Space Observatory in 2013. Despite their distance, the two stars may be exchanging material between their discs - including comets! Their co-mingling may help to explain the elliptical nature of both of the stars' debris discs. The odd one out, Fomalhaut B does not possess a debris disc of its own, but may host at least one suspected planet.

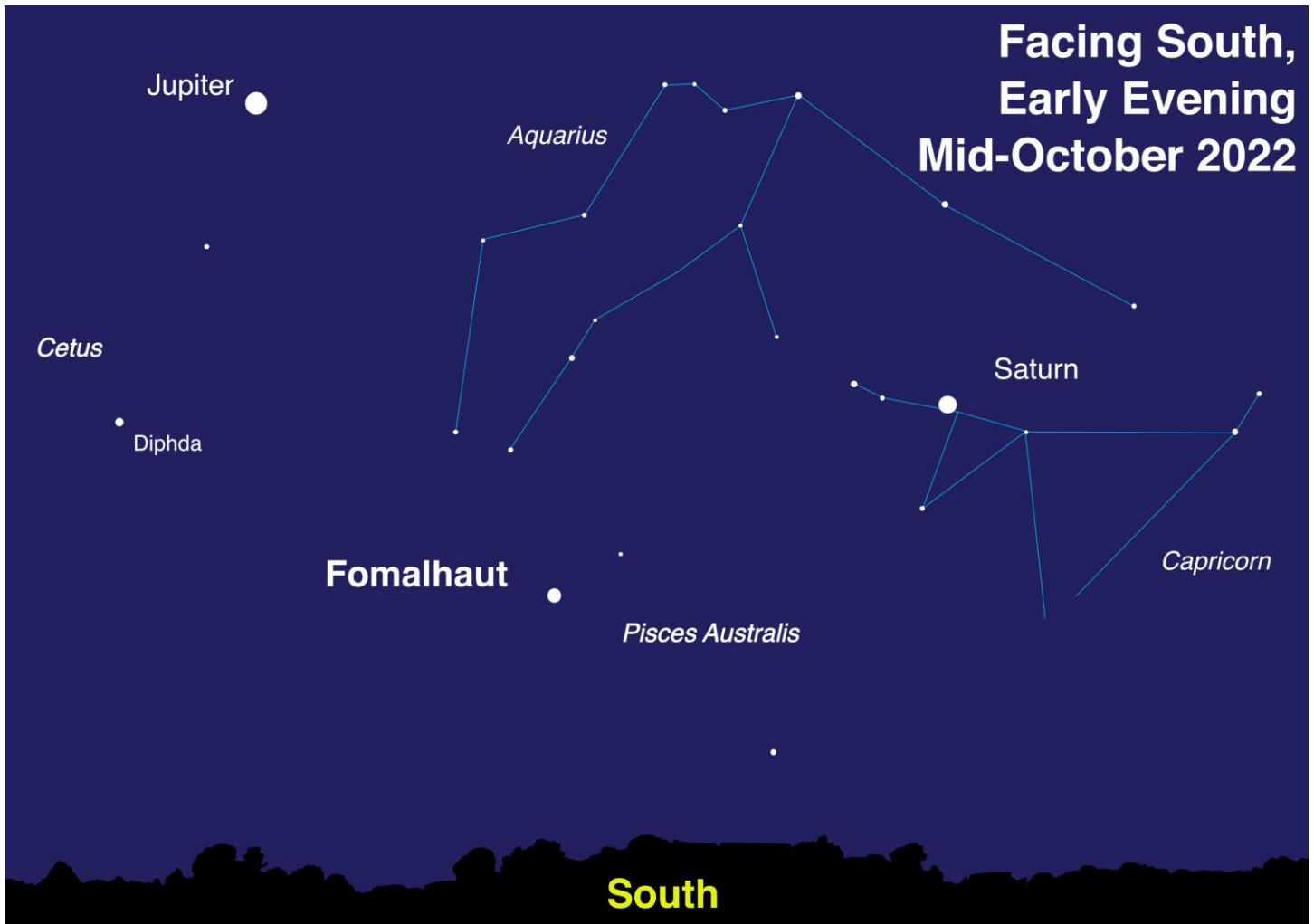


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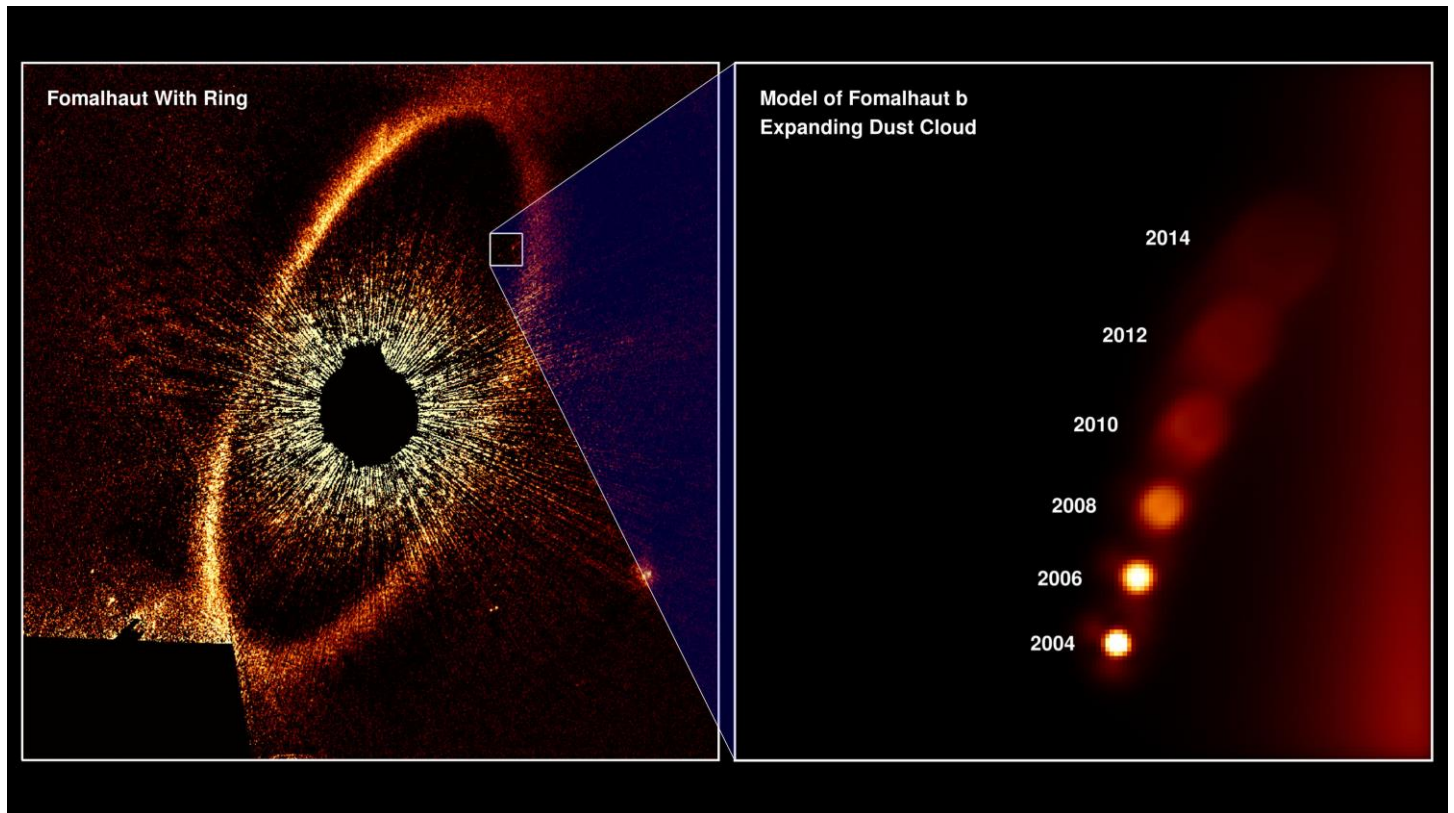
While Hubble imaged the infamous “imposter planet” of Fomalhaut b, very few planets have been directly imaged by powerful telescopes, but NASA’s James Webb Space Telescope will soon change that. In fact, Webb will be imaging Fomalhaut and its famous disc in the near future, and its tremendous power is sure to tease out more amazing discoveries from its dusty grains. You can learn about the latest discoveries from Webb and NASA’s other amazing missions at [nasa.gov](https://www.nasa.gov).

**Astronomers use capital letters to label companion stars, while lowercase letters are used to label planets.*



Sky map of the southern facing sky for mid-latitude Northern Hemisphere observers. With Fomalhaut lying so low for many observers, its fellow member stars in the constellation Piscis Australis won’t be easily visible for many without aid due to a combination of light pollution and atmospheric extinction (thick air dimming the light from the stars). Fomalhaut is by far the brightest star in its constellation, and is one of the brightest stars in the night sky. While the dim constellations of Aquarius and Capricorn may also not be visible to many without aid, they are outlined here. While known as the “Loneliest Star,” you can see that Fomalhaut has two relatively close and bright visitors this year: Jupiter and Saturn!

Illustration created with assistance from Stellarium



The magnificent and complex dust disc of the Fomalhaut system (left) with the path and dissolution of former planetary candidate Fomalhaut b displayed in detail (right).

Image credits: NASA, ESA, and A. Gáspár and G. Rieke (University of Arizona) Source: <https://www.nasa.gov/feature/goddard/2020/exoplanet-apparently-disappears-in-latest-hubble-observations>



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