Temecula Valley Astronomer

The monthly newsletter of the Temecula Valley Astronomers May 2021

Events:

Virtual meeting via Zoom on 3 May at 7PM. Join your fellow astronomers for What's Up, an IFI and Gallery assembled by Clark Williams. Watch your club email for meeting ID and password.

Until we can resume our monthly meetings, you can also interact with your astronomy associates on Facebook or by posting a message to our mailing list.

For Early Birds or Night Owls: Total Lunar Eclipse May 26th

Time	Phase	Event
1:47 am Wed, May 26		Penumbral Eclipse begins — The Earth's penumbra start touching the Moon's face.
2:44 am Wed, May 26		Partial Eclipse begins — Partial moon eclipse starts - moon is getting red.
4:11 am Wed, May 26		Total Eclipse begins — Total moon eclipse starts - completely red moon.
4:18 am Wed, May 26		Maximum Eclipse — Moon is closest to the center of the shadow.
4:25 am Wed, May 26		Total Eclipse ends — Total moon eclipse ends.
5:50 am Wed, May 26	Setting	Moonset — Setting

May 26 Lunar Eclipse Timing for Murrieta
Courtesy of timeaanddate.com

"Blood Moon" anyone?

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.

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

President: Mark Baker 951-691-0101
<shknbk13@hotmail.com>
Vice President: Sam Pitts <sam@samsastro.com>
Past President: John Garrett <garrjohn@gmail.com>
Treasurer: Curtis Croulet <calypte@verizon.net>
Secretary: Deborah Baker <geedeb@gmail.com>
Club Librarian: Vacant
Facebook: Tim Deardorff <tim-deardorff@yahoo.com>
Star Party Coordinator and Outreach: Deborah Baker
<geedeb@gmail.com>

Address renewals or other correspondence to:
Temecula Valley Astronomers
PO Box 1292
Murrieta, CA 92564

Members' Mailing List:
<tvastronomers@googlegroups.com>
Website: http://www.temeculavalleyastronomers.com/

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Cosmic Comments
by President Mark Baker

Ingenuity 1, Mars atmosphere 0…

Whenever Humanity manages to eke out a victory over Nature, it's worth noting and yes, celebrating…!!!

But what do such accomplishments have to do with Astronomy?? Simply put, it's BECAUSE people have Looked Up through the ages and wondered that we are pursuing the understanding of what's out there…

Can you imagine the absolute joy the ancient giants upon whose shoulders we now stand would experience if they could see what their work has wrought?? And just think, through our Outreach efforts, we may be instrumental in inspiring the next giants that come along…
That is why I am such a huge proponent of Star Parties… TVA provides an opportunity for so many that they normally wouldn't have, or even think about perhaps. There's more to our efforts than Ooh's and Aah's… but I'll take them!!!

Again, as always, I thank TVA for their contributions to promoting such a positive and healthy desire to take on Nature and eke out small wins that become huge Victories in the long run… you may be tiny, but you are not insignificant!!! You do make a difference…

Clear, Dark Skies my Friends…

Editor's Note
by Paul Kreitz

After many years Mark DiVecchio has ended his role as Editor of the Temecula Valley Astronomer. I have agreed to attempt to pick up where Mark left off, starting with this May 2021 edition. Thank you Mark for your diligence over those many years in keeping the Newsletter going. Having assembled my first edition, I appreciate more than ever what you have given to the club.

Mark Baker, Clark Williams, and Chuck Dyson have continued their contributions to the TVA Newsletter. I thank them for their continued support!

We have many knowledgeable members who have thought provoking articles stashed in the back of their heads, just waiting for an opportunity to see the light of day. NOW would be an excellent time to bring one forth! How about something on "Using a DSLR In Astrophotography"? Or "What We Expect To Find On Titan"? Or whatever is in the back of YOUR mind? Send your submission to pkreitz@sbcglobal.net, and see it in print next month!
Paul Kreitz

Looking Up Redux – May 2021
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 (PDT / PST) 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:

Wednesday	**the 26th**	**@ 0415 FULL in SCORPIUS**
Monday	**the 3rd**	**@ 1251 THIRD QTR in CAPRICORNUS**
Tuesday	**the 11th**	**@ 1201 NEW in ARIES**
Wednesday	**the 19th**	**@ 1213 First QTR in LEO**

Apogee comes on 2021-05-11 @ **1455 – 406,511 km (252,594 mi)**
Perigee comes on 2021-05-25 @ **1853 – 357,309 km (222,022 mi)**

2021 has: (12) new moons, (13) 1st Qtr moons, (13) Full moons, (12) 3rd Qtr moons
(1) Blue moon and (0) Black moons

Daylight Savings: Starts: 2021-Mar-14 : Ends: 2021-Nov-07

Luna: Luna is waning gibbous on the first of the month, headed for 3rd quarter on the 3rd rising at **0004**, transiting at **0502** and setting by **1001**. Luna by mid-month is 16% illuminated. Rising at **0830** and

transiting late afternoon at **1601** setting at **2332**. By the-end-of-the-month Luna is once again in waning gibbous, 70% illuminated rising at **0029** transiting at **0545** and setting by **1102**.

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

May 6, 7 - Eta Aquarids Meteor Shower. The Eta Aquarids is an above average shower, capable of producing up to 60 meteors per hour at its peak. Most of the activity is seen in the Southern Hemisphere. In the Northern Hemisphere, the rate can reach about 30 meteors per hour. It is produced by dust particles left behind by comet Halley, which has been observed since ancient times. The shower runs annually from April 19 to May 28. It peaks this year on the night of May 6 and the morning of the May 7. The second quarter moon will block out some of the faintest meteors this year. But if you are patient, you should still should be able to catch quite a few good ones. Best viewing will be from a dark location after midnight. Meteors will radiate from the constellation Aquarius, but can appear anywhere in the sky.

May 11 - 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 **1201**. 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.

May 17 - Mercury at Greatest Eastern Elongation. The planet Mercury reaches greatest eastern elongation of 22 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 evening sky. Look for the planet low in the western sky just after sunset.

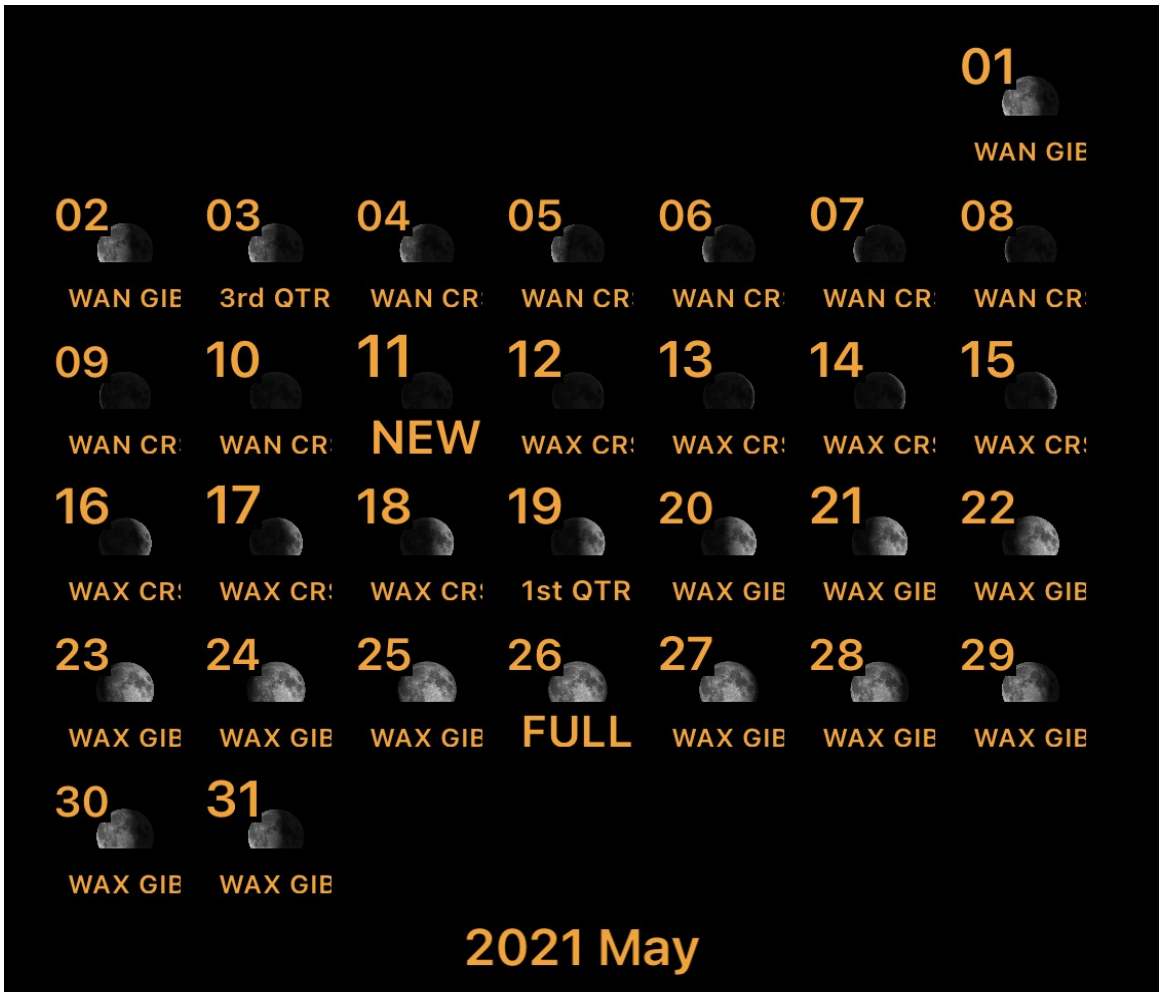
May 26 - Full Moon, Supermoon*. The Moon will be located on the opposite side of the Earth as the Sun and its face will be will be fully illuminated. This phase occurs at **0414**. This full moon was known by early Native American tribes as the Flower Moon because this was the time of year when spring flowers appeared in abundance. This moon has also been known as the Corn Planting Moon and the Milk Moon. This is also the second of three supermoons* for 2021. The Moon will be near its closest approach to the Earth and may look slightly larger and brighter than usual.

May 26 - Total Lunar Eclipse. A total lunar eclipse occurs when the Moon passes completely through the Earth's dark shadow, or umbra. During this type of eclipse, the Moon will gradually get darker and then take on a rusty or blood red color. The eclipse will be visible throughout the Pacific Ocean and parts of eastern Asia, Japan, Australia, and western North America. (See timing chart for Temecula on Page 1 of this Newsletter)

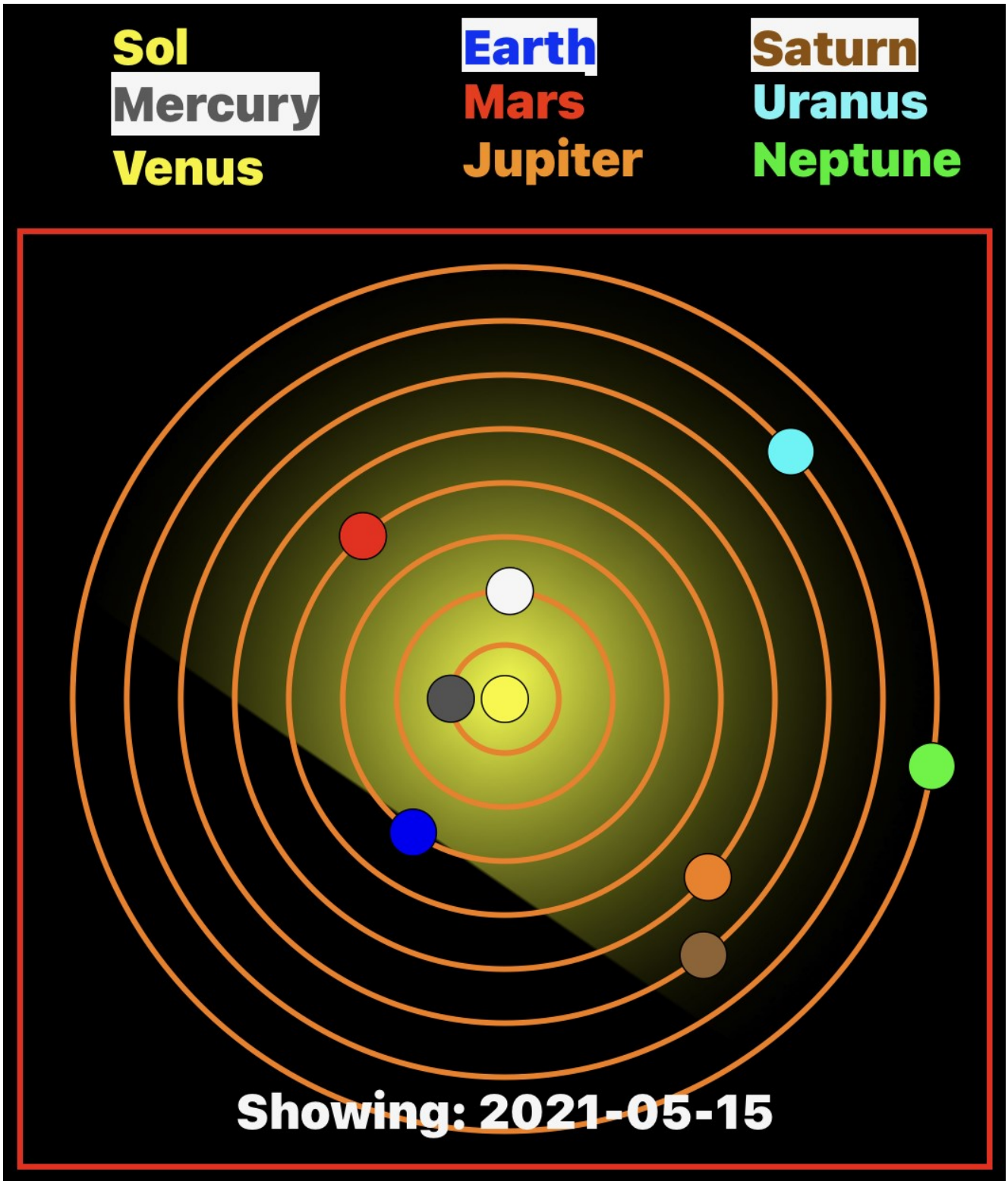
*Supermoon is an “astrological” term and has no meaning in astronomical terms.

Algol minima: (All times Pacific Time)

05/02/2021	0234
05/03/2021	2323
05/06/2021	2012
05/09/2021	1701
05/12/2021	1350
05/15/2021	1039
05/18/2021	0728
05/21/2021	0417
05/24/2021	0756
05/26/2021	0910
05/29/2021	0559



Planets:
Planetary Positions May 2021: (from TVA App iOS version)



- **Mercury:** Mercury is a evening object in the beginning of the month. It is illuminated at 80% and -1.04 apparent magnitude. Mercury rises at **0637** with the sun preceeding at **0558**. Mercury by mid-month is a possible visual evening object setting at **2134**. With Sol setting 2 hours and 50 minutes earlier at **1944**. **DO NOT LOOK DIRECTLY AT THE SUN!** By the 31st Mercury has passed greatest elongation and is falling back toward the Sun. Mercury is still visible setting at **2055** preceded by sunset at **1954**.
- **Venus:** Is the evening star on the first of the month, setting by **2018**, preceeded by sunset at **1934**. By mid-month Venus is setting at **2047** preceded by sunset at **1944**. By the 3st Venus is setting at **2116** preceded by sunset at **1955**.
- **Mars:** Mars is back in the sky on the first, not setting until **2347**. By mid-month Mars is transiting at **1613** but there is a waxing crescent Moon sitting just under 1° to the west along the ecliptic at 16% illumination. Should be a good visual and binocular view. End-of-month finds the Warrior transiting at **1552** and not setting until **2301**.
- **Jupiter:** Jupiter is a morning object on the first of the month rising at **0244** and preceding sunrise at **0558**. By mid-month Jove is rising at **0154** the sun follows at **0546.** Come the end of the month Jupiter is peeking above the horizon by **0055** with sunrise at **0538**.
- **Saturn:** Saturn rises about **0157** on the 1st while sunrise is at **0558**. Saturn by mid month is rising by **0103** preceding sunrise at **0546**. By the end-of-the-month Saturn is rising at **0001** followed by the sun at **0538**. There is a 70% illuminated moon obscuring the view sitting just 5° 33' to the East.
- **Uranus:** On the first of the month Uranus is lost to the Sun**.** By the ides Uranus has moved slightly ahead of the sun rising at **0506**, followed by sunrise at **0548**. End-of-month finds Uranus rising at **0406** followed by sunrise at **0538**.
- **Neptune:** Neptune is rising at **0350** in the beginning of the month. By the 15th Neptune is rising at **0256**. By the end of the month Neptune is rising at **0154**.
- **Pluto:** Pluto rises by **0105** on the first of the month, with a 76% illuminated moon obliterating Pluto's lovely self.. By mid-month Pluto is rising by **0010**. By the 31st Pluto is rising at **2307** with a 70% illuminated moon once again obscuring Pluto.

Asteroids:

- Still a dearth of asteroids. I searched for asteroids in 2021 with a reasonable magnitude; say less than or equal to +10 in May 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=2021**

Meteors:

- Eta Aquarids Meteor Shower. (see Highlights May 6-7 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 May 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.

One comet of interest this month. Comet **5D/Brosen**., a comet in Ursa Major; 70% illuminated, visual magnitude +7.7 on the 15th of May 2021 at 2100. It is always up so you should have a shot at imaging it if you want the practice.

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 May 2021 at 2100 PDT and you will have about 20 minutes of viewing time total.

It's galaxy season and The Virgo Diamond is high in the sky so let's look for some less familiar objects:

Box Galaxies:

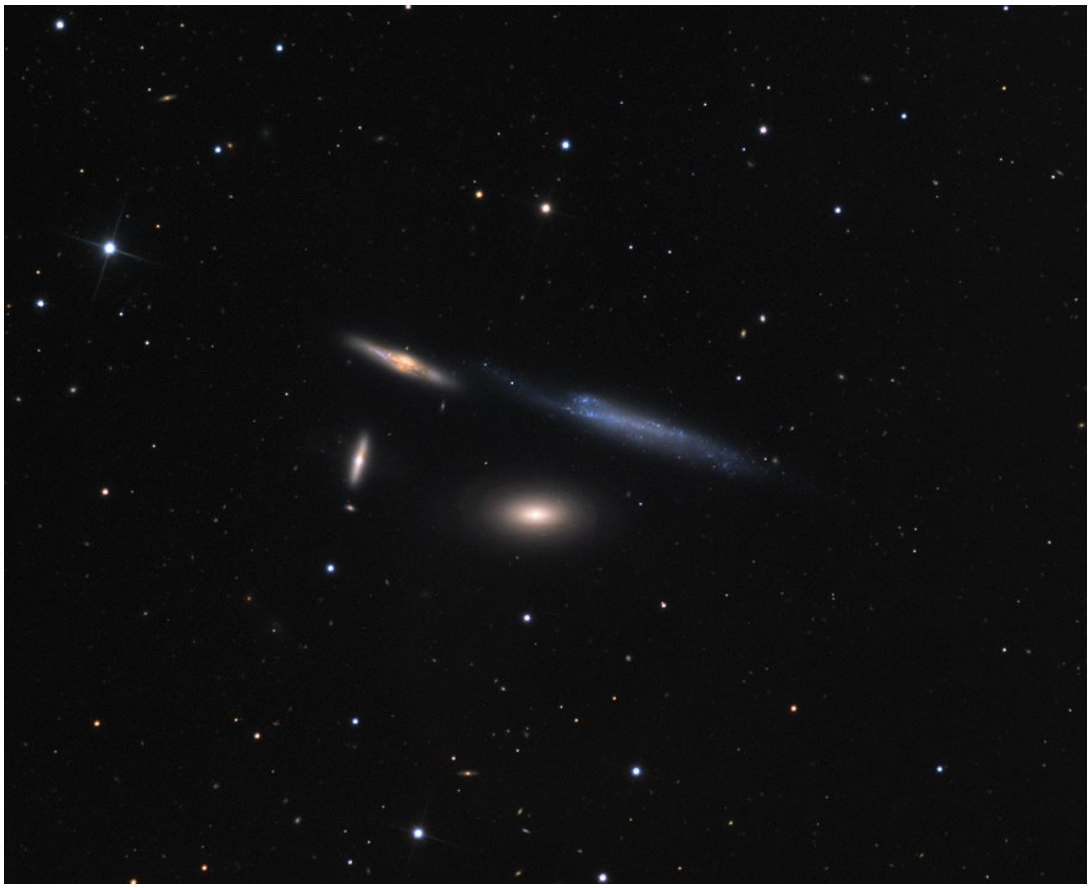
- 

Illustration 1: By Credit Line and Copyright Adam Block/Mount Lemmon SkyCenter/University of Arizona - http://www.caelumobservatory.com/gallery/box.shtml, CC BY-SA 3.0 us, https://commons.wikimedia.org/w/index.php?curid=20526659

Hickson 61: A collection of 4 galaxies: **NGC 4169, NGC 4173, NGC 4174 and NGC 4175.** Located in the constellation Coma Berenices A fun image to do and a satisfying image to hang on the wall or post on line. A Hickson Compact Group (abbreviation: HCG) is a collection of galaxies designated as published by Paul Hickson in 1982. According to Hickson: "Most compact groups contain a high fraction of galaxies having morphological or kinematical peculiarities, nuclear radio and infrared emission, and starburst or active galactic nuclei (AGN) activity. They contain large quantities of diffuse gas and are dynamically dominated by dark matter. They most likely form as subsystems within looser associations and evolve by gravitational processes. Strong galaxy interactions result, and merging is expected to lead to the ultimate demise of the group. Compact groups are surprisingly numerous and may play a significant role in galaxy evolution.

- **NGC 3132:**

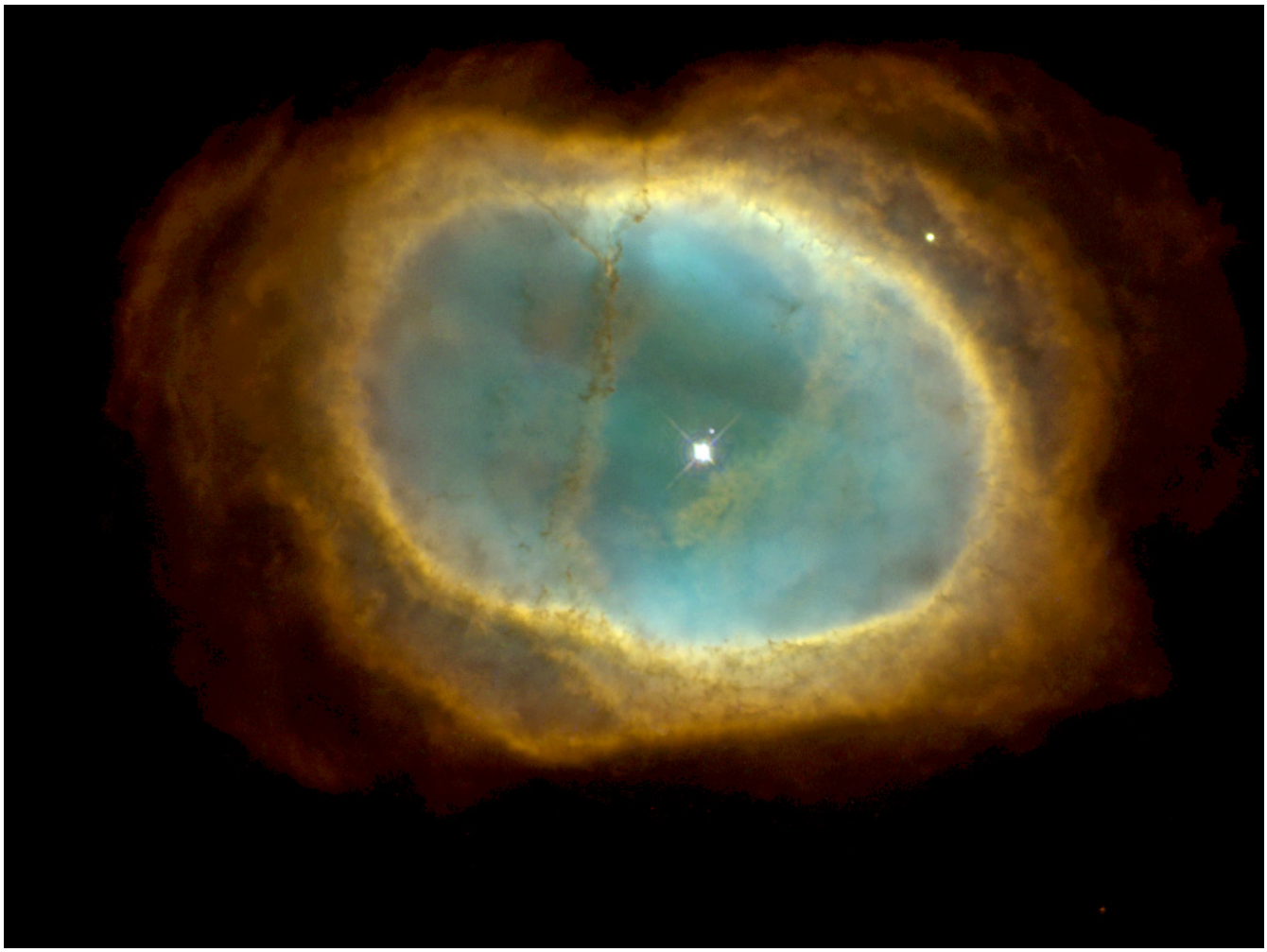


Illustration 2: By Hubble Heritage Team (STScI/AURA/NASA/ESA) - http://www.spacetelescope.org/images/opo9839a/ (direct link), Public Domain, https://commons.wikimedia.org/w/index.php?curid=2097879

NGC 3132 (also known as the Eight-Burst Nebula, the Southern Ring Nebula, or Caldwell 74) is a bright and extensively studied planetary nebula in the constellation Vela. Its distance from Earth is estimated at about 613 pc. or 2,000 light-years. (Wikipedia)

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

For now – Keep looking up.

RANDOM THOUGHTS – Mr. SUN – "HOW OLD ARE YOU?"
By Chuck Dyson

Every astronomy book and online web site tells us that the sun is 4.5 billion years old, but it is a little difficult to find the astronomer to tell us how they know this. As if this wasn't confusing enough every couple of years news outlets breathlessly announce that astronomers have found another star that is older than the age of the universe. Honestly! What gives?

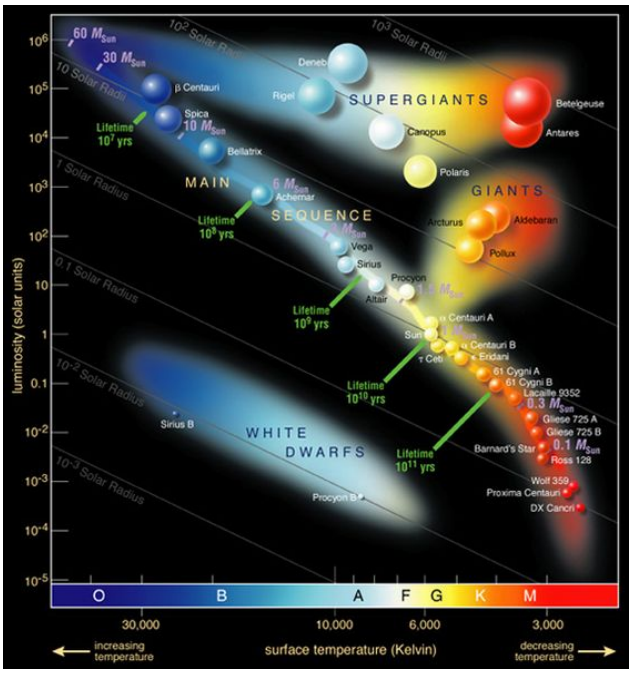
First let us tackle the age of the sun. That story starts in a geology lab around 1910 with a young geologist by the name of Norman Bowen. Bowen wanted to know how and when crystals were formed in liquid rock called magma when it is under ground and lava when it is on the surface. Bowen goes and gets himself a really great kiln and starts heating all manner of rocks to specific temperatures and then holding that temperature for long periods of time so that minerals could form and then quenching the whole thing quickly so that he got minerals and glass. After years of work and accumulating huge gas bills Bowen had a good understanding of what minerals formed at what temperature. In one of his series of minerals, minerals that are related by their atomic composition, Calcium containing compounds had a very high crystallization temperature; so, when magma cools these suckers form first. When this data came out and was verified astronomers jumped for joy because now they could tell which minerals were the oldest minerals in the meteorites they were collecting.

OK you know which minerals are the oldest but exactly how old are they? Fortunately, a group of physicists that didn't mind exposing themselves to radiation had been exploring the nature of radioactive decay and had discovered that not only does each radioactive element have a unique decay pattern and half-life time but each isotope of that element has a unique pattern and half-life. For example, Uranium (U) 238 has a half-life of 4.5 billion years and decays into Lead (Pb) 206 while Uranium (U) 235 has a half-life of 700 million years and decays into Lead (Pb) 207. The oldest minerals are called Calcium-Aluminum Rich inclusions (CAI) so all we have to do is find some CAIs with Uranium in them measure the amount of U235, U238 and the amount of Pb 207 a d Pb 206 and we can work out how much U235 and U238 we started with and how long it took to get the present levels of Pb 206 and Pb 207 and we have the age of the

sun. That is assuming that the sun and the chondrites formed at the same time. Although the exact process of chondrite formation is not known the general process is agreed to be the sun's core becomes hot and dense enough to start nuclear fusion and the combination of the heat and shock wave creates the chondrites.

There you have it, chondrites were created at the time the sun first turned on, the CAI's were the first to solidify, some of the CAI's had the U235/U238 "clocks" in them and presto we know the age of the sun. Now all we have to do to find the age of any other sun is to hop into our interstellar spaceship zip over to the sun we are interested in and collect some local CAI's and do our U235/U238 analysis on them. Trouble is we actually do not have an interstellar spaceship and have no way of getting to other suns.

If we do not have an interstellar spaceship, and we don't, then we must use indirect methods to determine the ages of our stars. The first thing we need is to determine the distance to stars by triangulation. This was done by measuring the stars parallax shift over the period of six months. Prior to satellites the farthest star whose parallax could be measured was 326 light years and although this seems to be quite the distance, when you compare it to the size of the galaxy, 100,000 light years, it represents a small sample size of galactic stars. With the Hipparcos and GAIA satellites astronomers are able to measure stellar parallax out to 1600 light years. The reason for wanting to measure the distance to so many stars is each star becomes a data point, after additional work that determines the mass, temperature, and total luminosity of each star, on the Hertzsprung-Russell Diagram, H-R Diagram for short. In the H-R Diagram the X axis, horizontal, is the star's temperature and the Y axis, vertical, is the star's luminosity, usually expressed as percent of or times our sun's luminosity. When each studied star is placed in its proper place in the H-R chart several patterns develop. This is the reason for wanting as many stars plotted as possible, because the more stars the more precise our graph at showing us the star cluster's populations of O B A F G K M stars. I also need to give a big shout out to all of those guys and gals in the lab who worked out the rates at which the different groups of stars burn their hydrogen fuel. The people in the labs informed the people at the telescopes that even though the giant O and B stars were 20 to 30 times bigger than our sun they were burning their fuel 10,000 to 20,000 times faster and would not live very long.



H R Diagram
(Universetoday.com)

With knowing a star's fuel burn rate and from our H-R pattern we can now predict how old each group of stars are by the populations of stars that are not present. There are three types of star clusters that we are

interested in: **imbedded**, stars in gas/dust clouds, **galactic or open** clusters, groups of stars with no or little gas around them, and **globular** clusters, that circle the galaxy but are not inside of it.

The imbedded clusters almost all have type O and B stars, these are the biggest and shortest lived stars in them, so we know that they are less than 100 million years old. A good example of an imbedded cluster is M 42 or the Orion nebula. The stars that form the Trapezium are mostly O and B with one “little” A class star this gives confidence that this is a just forming star cluster less the 100 million years old, that and infrared studies have shown that there are stars still forming inside the nebula.

Older clusters, the galactic or open clusters, with no gas present a greater challenge because the stars are spread out and need to be identified by their similar proper motion, a star’s three dimensional motion through the galaxy, and their metallic content. Stars borne in the same cosmic cloud have very similar composition of the heavy elements. Once the actual stars of a cluster have been identified and because each star’s proper motion is known astronomers can wind the clock backwards and see just where these stars formed and when they were formed.

Arguably the most studied stars of an open cluster are the Hyades. At 153 light years away it is our closest cluster, of the constellation Taurus. Because the stars of the Hyades cluster have a very high metallic content they are easy to identify and then the velocity and direction of the stars can be determined. After a lot of number crunching astronomers determined where the Hyades originated and the time, which was about 650 million years ago. Another group of stars that have been extensively studied is M44, the Beehive cluster, in the constellation of Cancer. As luck would have it the Beehive stars turn out to be high metallicity stars with very similar chemical composition to the Hyades and to be about 650 million years old and originate very close to the origination spot of the Hyades. Astronomers now believe that these two galaxy type open clusters originated in the same really big cosmic cloud and were just far enough apart for each to go their own way from the cloud.

The last galaxy cluster that I want to look at is M67. It is the other cluster in the constellation Cancer that no one looks at because they are looking at M44. M67 is much dimmer than M44 not because it is smaller or has only small stars but because at 2600 light years it is almost four times farther away from us than M44. At 2600 light years we cannot measure the distance to these stars by parallax but must rely on the indirect method of determining a star’s intrinsic brightness from where stars like it are on the H-R Diagram and then work out how far away it must be to appear as dim as it does. When M67’s distance and location was worked out it was found to be above the galactic plane and this meant that M67 was not interacting gravitationally with the stars of the galactic plane, it is these interactions that cause the star cluster to eventually completely disperse. Looking at the stellar populations in M67 it was determined that all of the O, B, and A stars had evolved off the main sequence and the cluster must then be over three billion years old. Only two galactic clusters older than this have been found to date.

NGC6397 at 7800 light years is the closest globular cluster to earth and this is well beyond the 1600 light year cutoff for measuring distance by parallax; so, much of what we know about globular clusters comes from fitting stars in the H-R Diagram, but because globular clusters are

old enough to have a particular type of Cepheid variable stars astronomers can also use this standard candle to gage the distance to the cluster. When all or most stars of a particular population have evolved off the H-R main sequence line we say that that is the H-R cut off for that cluster and that indicates the age of the cluster. Using the H-R cut off technique astronomers have determined that all globulars are old, some as old as 13 billion years. The reasons for their formation and age is still a mystery.

BREAKING NEWS!! HD140283 (the Methuselah star) has been found to be 16 billion years old while the known universe is only 13.8 billion years old. Not to get excited over this little bit of news because just a few years before this announcement HD140283 was 20 billion years old. As equipment and techniques expand and evolve the numbers keep changing. At any given time astronomers are doing the best they can with the equipment they have. Even the age of the universe is being hotly debated today because different methods give different ages. At this time HD140283's age overlaps the age of the universe, but that could change with the very next study. Can you say click bait material?

Finally, there are two expressions that are used to describe all three types of clusters that you should know about. The first is the term "evaporated". In young clusters gravitational encounters between stars are frequent and strong compared to our stellar encounter rate here on earth. Just like NASA using planets to give a velocity boost to satellites large stars in clusters will accelerate the smaller stars they encounter and some of these stars will be shot out of the cluster completely and when this happens the stars are said to have evaporated. The second term is "relaxed". Over time larger stars increase the velocity of smaller stars but remember the total energy of a system stays the same, it just gets redistributed. So, the larger stars lose energy and tend to concentrate in the center of the cluster while the lighter stars, the ones that are not evaporated, concentrate in the periphery. Any cluster that displays this pattern of stellar mass distribution, and globulars are famous for it, are said to be, deep breath, slowly exhale, relaxed.

Using the terms evaporated and relaxed in a room full of astronomy people will mark you as a person who is of the "one who knows" class, cool.

Cheers, Chuck

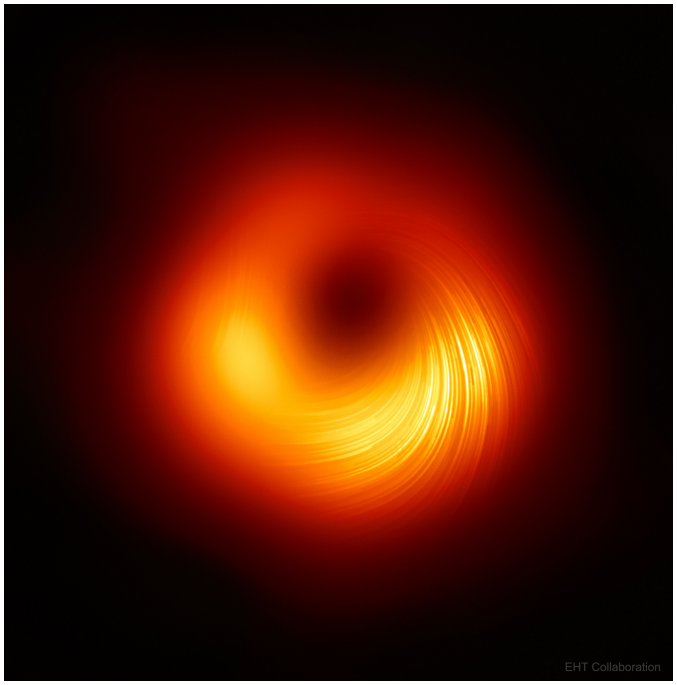
Virgo's Galactic Harvest
By David Prosper

May is a good month for fans of galaxies, since the constellation Virgo is up after sunset and for most of the night, following Leo across the night sky. Featured in some ancient societies as a goddess of agriculture and fertility, Virgo offers a bounty of galaxies as its celestial harvest for curious stargazers and professional astronomers alike.

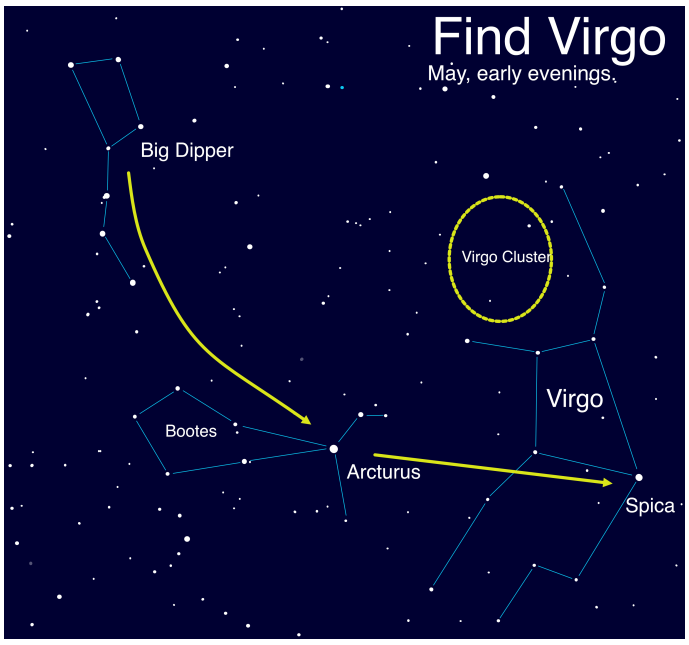
Virgo is the second-largest constellation and largest in the Zodiac, and easily spotted once you know how to spot Spica, its brightest star. How can you find it? Look to the North and start with the Big Dipper! Follow the general curve of the Dipper's handle away from its "ladle" and towards the bright orange-red star Arcturus, in Boötes – and from there continue straight until you meet the next bright star, Spica! This particular star-hopping trick is summed up by the famous phrase, "arc to Arcturus, and spike to Spica."

This large constellation is home to the Virgo Cluster, a massive group of galaxies. While the individual stars in Virgo are a part of our own galaxy, known as the Milky Way, the Virgo Cluster's members exist far beyond our own galaxy's borders. Teeming with around 2,000 known members, this massive group of galaxies are all gravitationally bound to each other, and are themselves members of the even larger Virgo Supercluster of galaxies, a sort of "super-group" made up of groups of galaxies. Our own Milky Way is a member of the "Local Group" of galaxies, which in turn is *also* a member of the Virgo Supercluster! In a sense, when we gaze upon the galaxies of the Virgo Cluster, we are looking at some of our most distant cosmic neighbors. At an average distance of over 65 million light years away, the light from these galaxies first started towards our planet when the dinosaurs were enjoying their last moments as Earth's dominant land animals! Dark clear skies and a telescope with a mirror of six inches or more will reveal many of the cluster's brightest and largest members, and it lends itself well to stunning astrophotos.

Virgo is naturally host to numerous studies of galaxies and cosmological research, which have revealed much about the structure of our universe and the evolution of stars and galaxies. The "Universe of Galaxies" activity can help you visualize the scale of the universe, starting with our home in the Milky Way Galaxy before heading out to the Local Group, Virgo Cluster and well beyond! You can find it at bit.ly/universeofgalaxies. You can further explore the science of galaxies across the Universe, along with the latest discoveries and mission news, at nasa.gov.



The first image of a black hole's event horizon was taken in the center of one of the most prominent galaxies in Virgo, M87! This follow up image, created by further study of the EHT data, reveals polarization in the radiation around the black hole. Mapping the polarization unveils new insights into how matter flows around and into the black hole - and even hints at how some matter escapes! More details: apod.nasa.gov/apod/ap210331.html
Credit: Event Horizon Telescope Collaboration



Find Virgo by "arcing to Arcturus, then spiking on to Spica." Please note that in this illustration, the location of the Virgo Cluster is approximate - the borders are not exact.

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