Temecula Valley Astronomer

The monthly newsletter of the Temecula Valley Astronomers March 2022

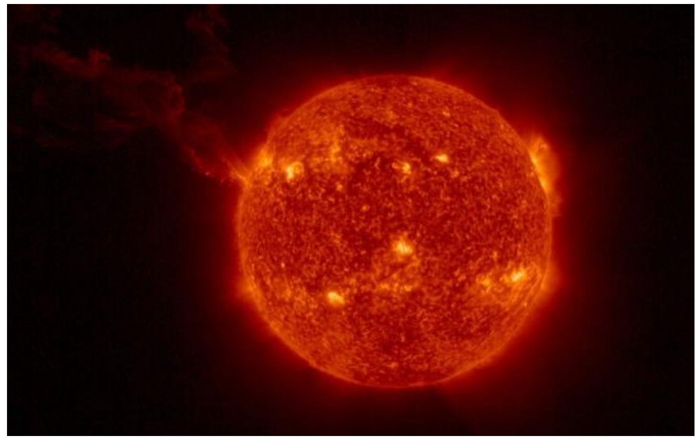
Events: General Meeting, Monday, March 7, 2021, at the Ronald H. Roberts Temecula Library, Room B, 30600 Pauba Rd, and/or ZOOM, at 6:00 PM.

- **IFI & Gallery by Clark Williams**
- **Near Earth Objects and Planetary Defense - part 1**
- **Refreshments by TBD- Volunteer?**

Star Parties at South Coast Winery every Friday evening in March.

For upcoming school Star Parties check the Calendar on the web page.

The European Space Agency's Solar Orbiter captured this huge solar prominence on Feb. 15, 2022. (Image credit ESA)



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).

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Cosmic Comments – March 2022
By Mark Baker

A year ago, I paraphrased…“MARS is Calling, So We Must Go”!!!

The successful landing of Perseverance and INGENUITY at Jezero Crater one year ago served to inspire people all over the world to Look Up… much more than even I imagined!!! Mars was a buzz word at many a Star Party until it was lost to the night sky…

But, like all things, the excitement has worn off over time, and only picks up again with the occasional flight of Ingenuity that is less than nominal. Still, 19 successful flights to date is quite a success story and something humanity can all be proud of… if they remember!!! Of course, the plethora of other current and exciting Missions does serve to distract us perhaps, and deservedly so maybe, but my heart belongs to Barsoom…

As always, I thank TVA for their contributions to promoting such a positive and healthy curiosity (no, that’s the previous rover – LOL!!!)… MY enthusiasm continues to boil over because of you all. Hopefully, you will all stay tuned in and keep the faith, as there is much, much more yet to come…fly on, Ginny, fly on!!!

Clear, Dark Skies my Friends…

RANDOM THOUGHT
By Chuck Dyson

What Are The Odds

What Are The Odds is the title of a statistics course that is available for purchase online and it lightly and gently goes over the basic tenets of statistical design and how to determine the quality of the generated data. In statistics the quality of the data usually means how likely are we to make a correct decision from our data set? That is statistics in a nutshell. It means that we can be a little sure, moderately sure, or extremely sure of something but never, ever know exactly what the object of our study is. But wait, it gets even worse. If we look at things that occur on a repeating basis and we take the average time between the events we can make a statement on how often an event is likely to occur; however, if we look at the actual timing things get a little awkward.

Now the reason that I start a column on astronomy with a little discussion of statistics is because those astronomers who study the little rocky bodies in our solar system (asteroids) are always saying things like this asteroid has a one in a million chance of hitting Earth in year XXXX. I do not know about you but for me I want the astronomer to say “In year XXXX the asteroid will hit, or miss, Earth”; however, that is never going to happen because there is always some error in the measurement. tTe first astronomer to really start to understand how much error there was in his measurements was Tycho Brahe as he would have two or three of his assistant astronomers measure the same object and then he would average the readings. Upon Brahe’s death (1601) Johannes Kepler inherited the data sets and by 1623 had organized them into tables that showed the positions of the fixed stars and movements of the planets. These tables, the Rudolphine tables, were used for many years to predict planets’ solar transits, stellar occultations by planets, and as a navigation aid for sailors. Tycho Brahe also contributed one more piece to our little tale of asteroids because in 1577 he observed a bright comet and made parallax measurements of it. Prior to 1577 it was assumed that comets were objects in the Earth’s atmosphere and were warning signs, sent by the gods or God (depending on which holy person you talked to), of dire things to come. Brahe’s parallax measurements clearly showed that the comet was far, far out of the Earth’s atmosphere and showed, for the first time, that there were Heavenly objects outside the Earth’s atmosphere that moved at a fast speed too.

Parallax measurements had been first used by the Greek astronomer Hipparchus in 150 BC to measure the distance to the Moon so Brahe’s methodology was well accepted by 1577. We now know that objects in the Heavens do move but almost no-one believes that they come to the Earth. In 1794 Ernst Chladni suggests that some rocks he calls meteorites come from outer space. We are starting to move religion out and science into the conversation here, and he is laughed out of the academy of science meeting. Just nine years later in 1803 a meteor fall is observed by people in the town of L’Aigle in France and “rocks” then fall on the observers, The French Academy of Science investigates and yep “rocks” do fall from the Heavens. How big do the “rocks” get and how often do they hit Earth?

In the 1800’s the estimates for the age of the earth ranged from 20 million to 400 million years so not much time for things to hit the earth. Have any really big objects hit Earth in its 400 million years of existence? In Europe there are numerous large craters, all of them associated with volcanoes. In the early 20th century when the Barringer crater became known and studied the large majority of geologists felt that it was a volcano/steam eruption. The island of Tonga has just given us a great example of how violent a volcanic/steam eruption can be. The story for the Moon was the same, lots and lots of volcanic craters and maybe, just maybe, a few meteor impacts. As the 20th century dragged on the earth got older and older. In 1913 Arthur Holmes, using the new technique of radiometric dating (measuring the different amounts of Uranium isotopes in a rock to determine its age), claimed at a meeting that the earth was, wait for it, 1.6 billion years old. This claim was immediately attacked by everyone in the meeting. As Holmes later recalled "I instantly became a committee of one". In the 1940s age of the earth was still being questioned because geologists now believed the age of the earth was 4.5 billion years old, plenty of time for rocks to hit the old girl.

How do you prove that a crater is of meteoritic origin and not volcanic origin? Enter Eugene Shoemaker and Edward Chao. In 1960 these two geologists went back to Barringer crater and took a deep critical look at the area. What they found were several types of shocked quartz. Shocked quartz is formed by sudden violent impact on already formed quartz crystals not by any known cooling process of volcanic lava. They also found tektites. Tektites are glass like objects that are formed when rocks are super-heated to a liquid state and then ejected into the air where they rapidly cool into raindrop shapes and they are generally found around craters. The temperatures required to create a tektite is hotter than any known lava found to date. The shocked quartz and tektites could only be formed by the pressures and temperatures generated by the hyper velocity impact of a large meteorite. Shoemaker also studied some of the atomic bomb blast craters in Nevada and noted that the Barringer crater more closely resembled the bomb craters than any volcanic crater. It was not until the Apollo astronauts, given basic training in geology by Shoemaker, brought back samples from Lunar craters in the 70's that everyone finally agreed that the Lunar craters were impact craters too.

If the earth has been hit by at least as many large asteroids, and comets, as the moon then where have all the craters gone? Unlike the moon that is airless and has a solid mantle, no tectonic movement, the Earth has an atmosphere with wind and rain that erodes craters and a molten mantle that permits tectonic plates to move around. When the earth's tectonic plates bump into each other craters can be lifted to the tops of mountains, dropped into the sea, ground into rubble, or subducted back into the mantle for reprocessing. All of these processes destroy the craters we are looking for. To give you an idea of just how destructive and extensive these processes can be in 1997 Eugene Shoemaker was killed and his wife Carolyne was severely injured in a car crash in the Australian outback. The reason they were in the outback is Australia is a geologically very inactive area and the surface of Australia is the same as the geologic strata that lies at the bottom of the Grand Canyon of Arizona, 4000 to 6000 feet below the current surface. If you are looking for old craters Australia is the place you want to be. To date geologists have discovered over 190 Earth impact sites of greater than 12.5 miles in diameter. Yes, Virginia, the earth does get hit.

If the earth does get hit just how bad could it get? In 1994 the Shoemakers, David Levy, the American people, and a few interested members of Congress got to watch comet Shoemaker-Levy 9 break apart and hit Jupiter. Not one but several of the impact scars on the surface of

Jupiter were larger than the earth. As Carolyn Shoemaker would say in a TV interview years later “Before the Shoemaker-Levy impact there was a large giggle factor by Congress when we asked for funding to identify and track potentially hazardous objects in space; after Shoemaker-Levy impact, no giggles”. In 1998 Congress funded the Near Earth Object (NEO) project to find and track all objects that are one kilometer or greater in diameter. Congress may have been encouraged to do this by the fact the Carolyn, using the Palomar 18 inch telescope on a part time shoestring budget, had discovered 32 comets and 500 asteroids. There is really a lot of Earth whopping stuff out there folks.

Will the NEO project be a find them, categorize them, and then forget them project? For three reasons NO! The first reason is that there are always new, unannounced comets coming into the inner solar system and we would like to find them before they hit Earth and not after. The second reason is called the three body problem. When calculating the orbit of one body around another long term positions of the orbiting bodies is possible but with three or more bodies, all orbiting each other, long term predictions become much more difficult. Long term is more than 100 years. An example of how uncertain orbit predictions can become with multiple bodies the Jupiter satellite Galileo was deorbited into Jupiter rather than take the chance of it impacting one of the moons and introducing the possibility of earth based life, bacteria, there. When you have millions of small bodies looping around planets and each other you really need to check on those orbits every so often or be ready for a surprise visit by one. The third reason is called the Yarkovsky effect and to understand it you need to go stand on your sidewalk on a fairly hot day, say just over a 100*F, around 2 PM and put the back of your hand on the sidewalk. The sidewalk will be around 120*F. Now place the back of your hand on the asphalt of the road. It will be around 150*F (really hot). The reason we do this experiment at 2PM is because even though the solar intensity is greatest at local noon the is a two or three hour lag to the highest temperature. All bodies rotate and unless the axis of rotation is directly pointed at the sun there is a light side and a dark side and the light side absorbs sunlight and the dark side radiates it back. Even though photons are massless they still have momentum and the photons leaving the dark side gives the body (asteroid) just a little push that is at its maximum when the dark area is just past the meridian. This results in a very small sideways push. Even though the Yarkovsky push and gravitational tugs are small, over time they add up, 1999RQ36 a 0.5 kilometer asteroid has had its orbit shifted 100 miles in 12 years.

Is there anything else we need to worry about? Well, yes. We spot asteroids and comets mainly by the light they reflect off of their surfaces and not to be outdone by our asphalt roads and their 8% reflectivity comet Haley only reflects 4% of its incident light and comet Borrelly reflects a meager 3% of the light that falls on its surface. The first time a small, five to ten mile diameter, comet with very low surface reflectivity enters our solar system it can be exceedingly difficult to spot until it is inside of the orbit of Jupiter. Once our comet is less than 5 AU from the sun’s UV radiation will start to sublimate (sublimate: to go directly from a solid state to a gas, think dry ice) the volatile elements and astronomers can then spot the glowing and growing tail of the comet. If that comet is headed directly for our planet then you have six to eight months to “encourage” it to miss our planet.

The astronomers who love to calculate probabilities estimate that a 100 meter object will strike earth every 1,000 years (city killer), a 1 kilometer object will strike earth every 600,000 years (small country killer), and a 10 kilometer object every 50 to a 100 million years (global extinction event). Two things you need to consider: first; if the object hitting earth is a NEA it will be traveling at 15 kilometers per second; but if the object is a comet it will be traveling at 54 kilometers per second (way bigger bang): second; a 100 meter object traveling at NEA speed will release 10 times the energy as the recent Tonga island volcanic explosion. The reason that the time estimation for a global extinction event is so broad is that there are only 6 events in 440 million years and the average time between them is 73 million years but the actual times between the events is as short as 40 million years to as long as 145 million years and by this reckoning as the last one was 65 million years ago we are either 25 million years overdue or we can relax for the next 80 million years, I recommend that we do not relax.

Now that we have established that our little planet will be taking hits in the future and we have no idea how far into the future just what do we plan to do about it? NASA's DART probe was launched from Vandenberg with three mission goals. One: Test out a new ion engine, more thrust. Two: Hit asteroid Dimorphos's moon Didymos, and not Dimorphos, using a completely autonomous AI navigation system. Three: Change the orbital period of the asteroid moon Didymos by about 10 minutes (Change the speed of the asteroid and you change the date it arrives at earth orbit and hopefully we will not be there to greet it). To do this the 480 kilogram DART will hit the 4.8 billion kilogram Didymos at 6.6 kilometers/sec. This asteroid pair was chosen because it is not a NEA and no matter what we do to it will not become a hazard to Earth. The 170-meter Didymos represents the most probable threat size object that we could face in the next 1,000 years. The asteroid pair is close enough to Earth to have the change in orbital speed monitored from Earth.

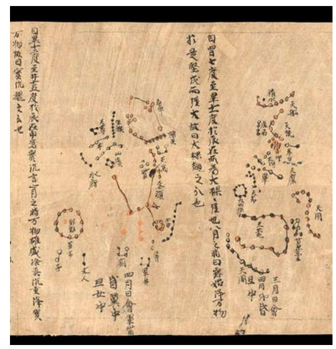
Dart is a small step but a very important first step for the defense of Earth from asteroid or cometary impact.

Cheers Chuck

Another Look

By Dave Phelps

New moon March 2 and April 1
Full moon March 18
American Indian names are Crow or Crust Moon, also Sap (maple) Moon.
Typically called the Worm moon; but also called in Old English the Lenten Moon
Spring Solstice: Sunday, March 20, 2022 at 8:33 am PDT



To my mind the most famous asterism in the night sky has to be the belt of Orion, apologies to Ursa Major. The three stars, Alnitak ζ, Alnilam ε and Mintaka δ are all about 2nd magnitude and well matched in color and luminosity visually. Also, the etymology of the names has a complex history with different names from throughout time and from all over the world; an example being our featured image from the **Dunhuang Star Atlas** over a thousand years old. Alniham (middle) has the prettiest name, derived from the Arabic for String of Pearls. Alnitak(left) appears to be the Girdle and Mintaka(right) the Belt. Zeta and Delta are multiple star systems for you to search and Epsilon is a really big supergiant.

Years ago I had license plates made with B33 and IC 434. These are the names for the Horsehead and the reflection nebula the Horsehead lives in. My truck was B33 and the trailer that held my telescope was IC 434. Of course I nicknamed my 17.5" Dob the "Horse". What I remember struck me most was how large the Horsehead was in my eyepiece. The first time I looked it filled the view of my old timey orthoscopic. Nowadays you astrophotograhers out there do a wide field image of the Horse,434 and Sigma Orionis. WIYN Observatory Kitt Peak

I tried to find an image of the Flame (NGC 2024) that would match what you will see in your eyepiece. We are fortunate that one of our local astrophotographers has allowed us to use one of his. I massaged it only slightly. Thank you **Alex Douvas**.

This **ESO** of the Flame is nothing like you'll see in your eyepiece. *ESO / Th. Stanke & ESO / Digitized Sky Survey 2 background*

Now would ba a good time to take your binoculars out again. The area of the Belt, centered around Alniham, is Collinder 70. The three brilliant belt stars center a loose sprinkling of white, blue-white, yellowish and orangish stars that may or may not be part of its own association. Pretty to look at. Inside Col 70 are three nebulae- IC's 423, 424 and 426; very diffuse objects, not per the atlases especially small, but if I ever saw them I don't remember. I could not find any magnitude estimates so if you decide to challenge yourself, I suggest remembering the Rubic…DADS. Dark adapted, Dark skies.

M78-NGC 2068 is the brightest of a group of reflection nebula Including NGC's 2064, 2067 and 2071. They are between the Belt and the Loop and reasonably visible at 8th magnitude. Check the APOD archives for several image of M78. You will see the rather large black divide, LND (Lynd's) 1627, between the two main lobes of M78 in the image I cut from the Sinbad database of the catalog of Lynd's Nebula. We can see why Messier wanted to add M78 to his list of look likes but ain't comets. If you would like to see for yourself what is the official image of LND 1627 the link is:

http://simbad.u-strasbg.fr/simbad/sim-id?Ident=%40826264&Name=LDN%201627

So, who are the stars that make up the skeleton, as it were, of Orion: Betelgeuse, Rigel, Belatrix and Saiph. Let's not forget the head star: Meissa. Betelgeuse is not the brightest star in Orion, that honor goes to Rigel, but its orangeish color, size, slight variability and scientific interest makes it very interesting. Just staying with the Arabian literature, Betelgeuse is either the hand or the arm. Opposite from Betelgeuse is Rigel, a multi-star, blue-white system whose name is derived from the Arabic for foot (maybe knee). There are nearly a dozen listed references to Rigel in countries throughout history and the world from Australia, New Zealand to Norway. It is another star with great scientific interest.

Bellatrix is the other shoulder of Orion, another huge blue-white star with a diameter of 12 times our sun. I have always thought of her as a real beauty, and Bellatrix can be loosely translated to Amazons... not the etailer, the female warriors. You will also find that Bellatrix has histories from around the world, from Inuit to Chinese.

The last star of the Orion quadrangle is Saife, commonly referring to the right knee or maybe Simitar?, although one Arabian etymology gives a meaning of the Saif of the Giant.
My favorite, I think, is from the Wardaman people of northern Australia who regard Saiph as the Guman digging stick used to make a canyon by Black Headed Python. (Wikipedia)

Meissa is the head of Orion, also in Chinese the "beak of the turtle". It is big, it is associated with what might be a supernova remnant. And is surrounded by nebulosity. Worth a look.

I hadn't expected to discuss Herbig-Haro objects so soon, but it happens that NGC 1999, that mass of nebula just south of M42, contains the first two HH objects cataloged. The dark spot is that little thing in the center of the white splotch, not dark nebula but (unproven) open space. Your atlas will plot IC's 427 and 428 as well as close at hand IC's 429 and 430. Once again, I wasn't aware that I was seeing such an interesting object, though only grayish and faint.
Be sure to check **APOD** for January 27, 2022 for a closer look. This is a grand month to point your telescope at the area south of the Orion Nebula.

I am going to leave M42, M43 and the half dozen or more NGC's and IC's all around them to your own study. Have a happy time.

Let's slip back down into Lepus and check out M79. It was discovered over 300 years ago in early 1780 by Mechain, then added to Messier's list of comet-like nebula later that year. A nice globular, use a bigger scope to open it up a little. What's most interesting about it, however, is that it's an extragalactic globular cluster, resting in the dark of space all by its lonesome. If you are into supernova hunting Lepus is rich ground with dozens of galaxies to search.

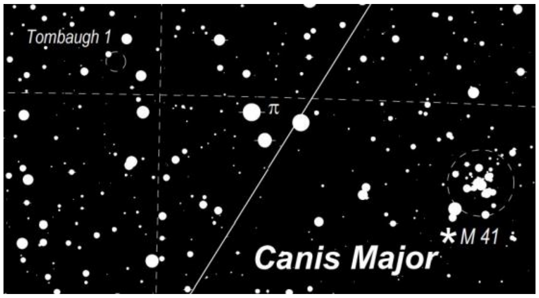
I am going to quote from a book by Martha E. Martin (1907) "The Friendly Stars" which I copied from "Burnham's Celestial Handbook".

> He comes richly bright in many colors, twinkling fast and changing with each motion from tints of ruby to sapphire and emerald and amethyst. As he rises higher and higher in the sky he gains composure and his beams now sparkle like the most brilliant diamond- not a pure white, but slightly tinged with iridescence.

Wow, I have never waxed lyrical about Sirius myself, and I admit I have never seen any colors except a brilliant white that is hard to look at in an eyepiece. The one time I saw the Pup, back in the 80's; we had to move Sirius just out of the field of view to pick up the speck of light that is his companion. The Romans apparently saw a red/brass color to Sirius eliciting a number of studies and some fanciful theories. The different colors are probably poorly figured achromatic doublets.

Sitting as it does in the Milky Way, it's not surprising that Canis Major is loaded with open clusters and a few nebulae. Look for M41 just south of Sirius, big Cr 132 and smaller Cr140 down between the feet and Cr 121 between M41 and Epsilon, Adhara or the First of the Young Women.

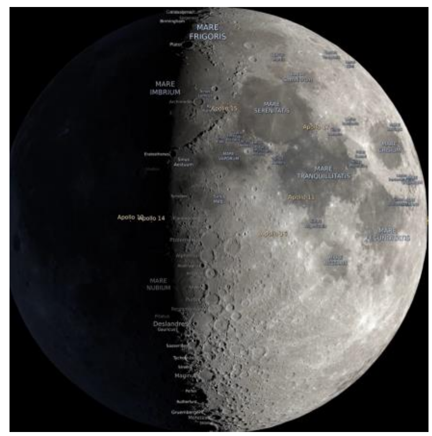
I first met Clyde Tombaugh back in the 80's at RTMC. He was accorded semi-legendary status back then when he was still in his vibrant 70's. My friend John had him autograph his Sky-Atlas 2000, he was friendly, affable and easily approachable. He was a lovely man who still observed from his backyard 16".



Just as I found Barnard to be an interesting guy, so also I found Tombaugh. For that reason alone I spent my time searching for the 5 Tombaugh open clusters that he found on his astrograph's plates.

Fortunately, Tombaugh 1 is close at hand, if, perhaps, a little difficult to find on your atlas. Along the line from Α το Δ (α το δ) Canis Majoris is a small triangular asterism which includes π. Put the left reticle of your telrad on π and M41 will be on the right edge. Put the right edge of your telrad on π and locate a line of four stars curving slightly south to north. Tombaugh 1 is right there, just to the left of the top two stars. Easy, huh, or you can use your Go-To. Choice is yours. Tombaugh 2 is only a few arc-minutes away. RA and Dec can be found at **www.stellar-journeys.org/TombaughTour.htm.** I cut the chart from <u>Deep Sky Hunter.</u>

Back in 1955 an Australian astronomer named Colin Gum working out of Mt. Stombo Observatory published a catalog of H-alpha regions in the Southern Hemisphere. We are fortunate that the first three Gum objects are close at hand, spanning the line demarcating the constellations Monocerous and Canis Major. I refer, of course to NGC 2177, cutely named the Seagull Nebula. Gum 1 is the head of the bird, Gum 3 is the bright tip of the leading wing, NGC 2343 is a nice open cluster off the left wing, Cr 466 is also observable. I still have not identified Gum 2 to my satisfaction, maybe you can. This area is a treasure trove of nebulae, clusters, emission nebulae and HII regions. **APOD** has published NGC 2177 often, my favorite, I think, is October 21, 2018.



This image snatched from the video published on February 1 by **APOD** shows the moon 9 days after new on March 11.

Dark Skies
Dave Phelps

Embracing the Equinox

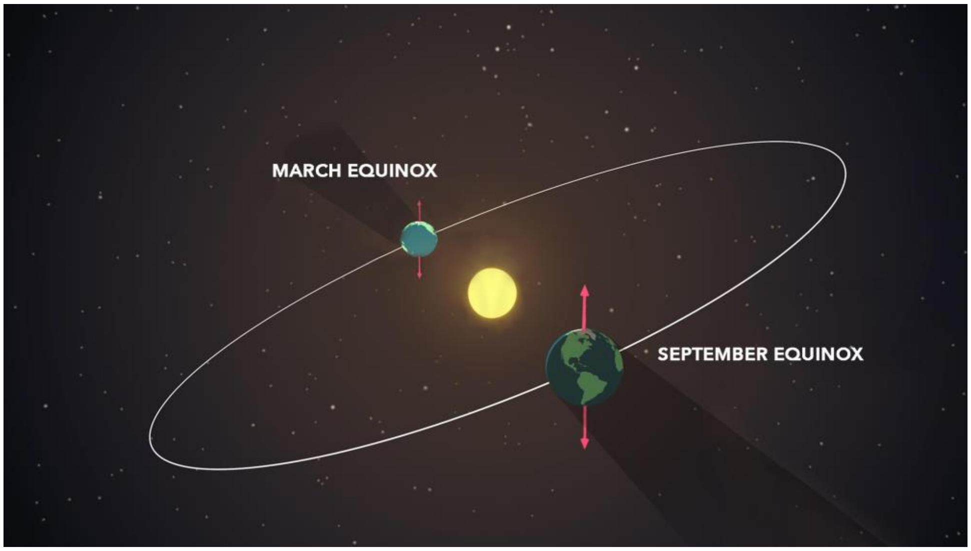
By David Prosper – NASA – JPL Night Sky Network

Depending on your locale, equinoxes can be seen as harbingers of longer nights and gloomy weather, or promising beacons of nicer temperatures and more sunlight. Observing and predicting equinoxes is one of the earliest skills in humanity's astronomical toolkit. Many ancient observatories around the world observed equinoxes along with the more pronounced solstices. These days, you don't need your own observatory to know when an equinox occurs, since you'll see it marked on your calendar twice a year! The word "equinox" originates from Latin, and translates to **equal** (equi-) **night** (-nox). But what exactly *is* an equinox?

An **equinox** occurs twice every year, in March and September. In 2022, the equinoxes will occur on March 20, at exactly 15:33 UTC (*or 11:33 am EDT*), and again on September 23, at 01:04 UTC *(or September 22 at 9:04 pm EDT)*. The equinox marks the exact moment when the center of the Sun crosses the plane of our planet's equator. The day of an equinox, observers at the equator will see the Sun directly overhead at noon. After the March equinox, observers anywhere on Earth will see the Sun's path in the sky continue its movement further north every day until the June solstice, after which it begins traveling south. The Sun crosses the equatorial plane again during the September equinox, and continues traveling south until the December solstice, when it heads back north once again. This movement is why some refer to the March equinox as the **northward equinox**, and the September equinox as the **southward equinox**.

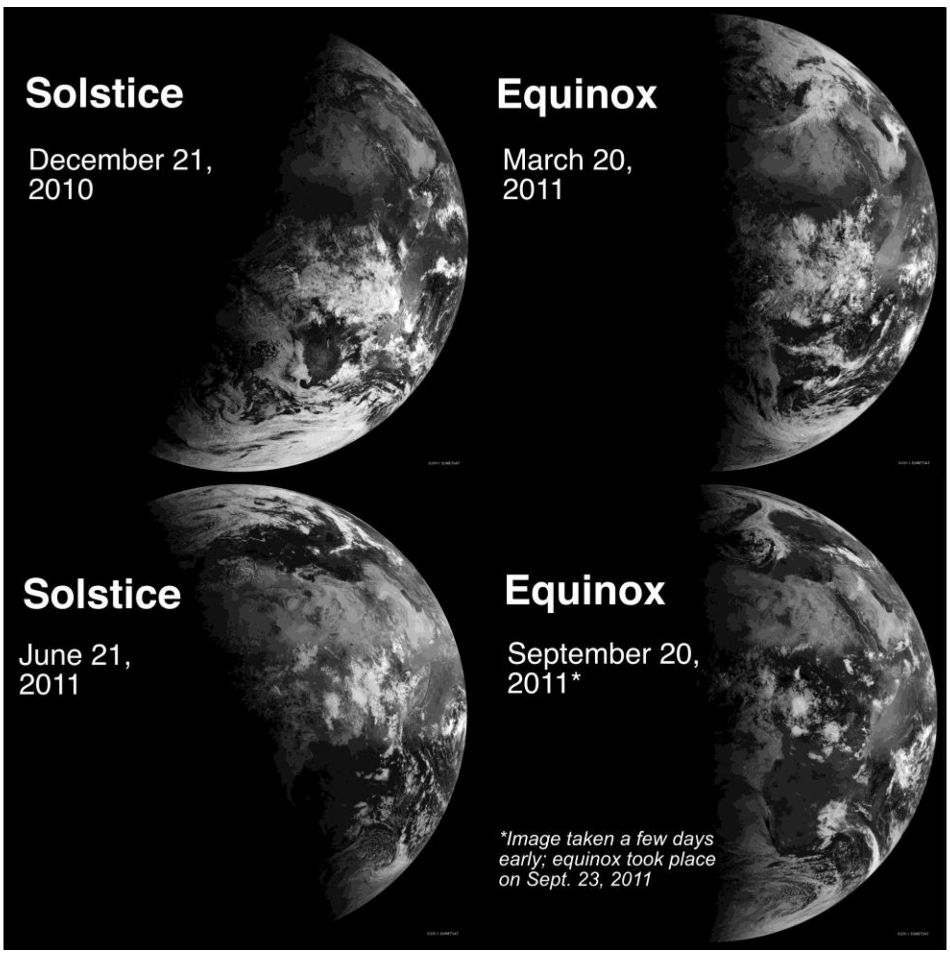
Our Sun shines equally on both the Northern and Southern Hemispheres during equinoxes, which is why they are the only times of the year when the Earth's North and South Poles are simultaneously lit by sunlight. Notably, the length of day and night on the equinox aren't precisely equal; the date for that split depends on your latitude, and may occur a few days earlier or later than the equinox itself. The complicating factors? Our Sun and atmosphere! The Sun itself is a sphere and not a point light source, so its edge is refracted by our atmosphere as it rises and sets, which adds several minutes of light to every day. The Sun doesn't neatly wink on and off at sunrise and sunset like a light bulb, and so there isn't a *perfect* split of day and night on the equinox - but it's very close.

Equinoxes are associated with the changing seasons. In March, Northern Hemisphere observers welcome the longer, warmer days heralded by their **vernal**, or spring, equinox, but Southern Hemisphere observers note the shorter days – and longer, cooler nights - signaled by their **autumnal**, or fall, equinox. Come September, the reverse is true. Discover the reasons for the seasons, and much more, with NASA at nasa.gov



This (not to scale) image shows how our planet receives equal amounts of sunlight during equinoxes.

Credit: NASA/GSFC/Genna Duberstein



Scenes of Earth from orbit from season to season, as viewed by EUMETSAT. Notice how the terminator - the line between day and night - touches both the North and South Poles in the equinox images. See how the shadow is lopsided for each solstice, too: sunlight pours over the Northern Hemisphere for the June solstice, while the sunlight dramatically favors the Southern Hemisphere for the December solstice.
*Source: bit.ly/**earthequinox** Images: NASA/Robert Simmon*

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The TVA is a member club of The Astronomical League