



PAStimes

Phoenix Astronomical Society

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Dr. Renu Malhotra to Speak at March 3rd Meeting

“Migratory planets and chaos in the young Solar system”

By Dr. Malhotra

Our understanding of the Solar system has undergone a revolution in recent decades, owing to new observational discoveries and new theoretical insights into its rich dynamical structure. The emerging picture is one of dramatic orbital migration of the giant planets in the early history of the Solar system, driven by interaction with the primordial Kuiper belt, which produced the Solar system architecture that we live in today. The evidence is all over the Solar system, as close as the Moon and as far

away as Pluto and the Kuiper belt. While this evidence is compelling, there is also tension with the observed properties of the inner solar system: the migration of the giant planets should have caused severe, potentially destabilizing, perturbations on the terrestrial planets’ orbits. I will describe these developments and some ideas under debate about how our solar system’s architecture came to be.

Renu Malhotra is Louise Foucar Marshall Science Research Professor and Regents Professor of Planetary Sciences at

See "March 3rd Meeting" on page 3



*Dr. Renu Malhotra will be the PAS March Guest Speaker.
Photo provided by Dr. Malhotra.*

Why are you Winking at Us?

Jan 20th Lecture Review

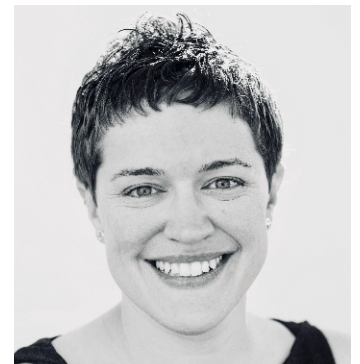
by Stu Brackney, President of PASAZ

That is the question many have been asking recently about an RSG (Red supergiant) star named Betelgeuse. This giant star has not really been winking at us but instead has been dimming and even has some dark spots appearing on it when viewed with a telescope. Our guest lecturer Dr. Emily Levesque, an astronomy professor from the University of Washington, is noted for her exploration of the most massive stars and she thinks she has an answer. Her presentation via ZOOM to our PAS members and guests on January 20, 2022 kept us spellbound as she laid the

groundwork on why we must study these giant stars and their behavior.

Dr. Levesque has observed for upwards of fifty nights on many of the planet’s largest telescopes and flown over the Antarctic stratosphere in an experimental aircraft for her research. Her academic accolades include the 2014 Annie Jump Cannon Award, a 2017 Alfred P. Sloan fellowship, a 2019 Cottrell Scholar award, and the 2020 Newton Lacy Pierce Prize. She earned a bachelor’s degree in physics from MIT and a PhD in astronomy from the University of Hawaii.

See "Winking at Us" on page 3



*Emily Levesque was the January Meeting Fantastic Guest Speaker.
Photo provided by Emily.*

PAS Guest Lecture Series Feb 3rd

By: Stu Brackney, President, PAS

I am sorry to report that Dr. Alex Woronow was not available to make his presentation to our group due to a scheduling conflict. However we were able to provide our viewers an excellent 57 minute lecture by professor Edward Murphy, University of Virginia titled “The Origin of the Elements”. This video can be found on

YouTube under that title. Dr. Edwards is a well known professor of astronomy and has entertained thousands on his lecture series found on the “The Great Courses” educational disks.

Dr. Edwards clarifies for all of us how we are truly made of stardust and how all of these elements, found on the Periodic Chart of Elements, came into existence. Well

worth your time to view this excellent presentation by Dr. Edwards on YouTube. If you missed Dr. Edwards’ presentation, please enjoy it here: <https://www.youtube.com/watch?v=ZJQjBR6PbY>.

PAS will make an attempt to have Dr. Alex Woronow rescheduled for a future PAS Meeting.

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Past PAS Recorded Presentations

By Terri Finch, Event Manager

Did you miss a PAS Meeting and wish you could see it? You can get to the link of Past Recorded PAS Meetings with Guest Speakers any time by going to the left hand navigation tool on the PASaz.org website and clicking on "PAS Monthly Meetings." From there a drop down item will appear

and please click on "Videos of Speaker Presentations." You will then find recordings of Past PAS Meetings for your viewing pleasure. The collection is in oldest to newest order. Please work your way to the bottom of the collection to find the most recently recorded PAS Guest Speaker Presentation.

As long as PAS can record the PAS Meetings, PAS will continue to add more recordings to this page. Here is the direct link to the recorded PAS Meetings collection: <https://www.pasaz.org/pas-monthly-meetings/videos-of-speaker-presentations>. Enjoy!

Spring 2022 PAS GUEST SPEAKERS

By Terri Finch, Event Manager

Events@pasaz.org

Due to the Covid-19 pandemic, PAS Meetings are being held via Zoom over the internet. The Zoom link has been added to the calendar listing for that night's meeting and in the Newsletter in the article about the next PAS Meeting. Please visit the PAS calendar at PASaz.org to find out more about these upcoming Meetings and Guest Speakers. If a Meeting will happen

In-Person, the Calendar Listing will give you that info. For a complete list of Guest Speakers, visit: <https://docs.google.com/document/d/1OO-UpaYNvw3p7JCRXCKSjDcbsK60DnvWOoifbqPrNp8/edit?usp=sharing>

Do you have an idea for a guest speaker? Email Paul Facuna VicePresident@pasaz.org the details and contact info for that possible Guest Speaker.

Here are the next scheduled guest speakers at PAS:

V = Virtual Meeting through Zoom

P = In Person at PVCC Main Campus

Apr 7: Mike Mackowski, Topic: National Space Society

May 5: Ted Blank, Topic: Mars Ingenuity Helicopter

Sept 1: TBA

What's Up For March?

By Don K. Boyd, PAStimes Editor

Name	Date	Rise	Set
Mercury	13-15-22	06:07	17:05
Venus	03/15/22	04:16	14:57
Mars	03-15-22	04:26	14:54
Jupiter	036-15-22	07:56	17:57
Saturn	03-15-22	05:08	15:48
Uranus	03-15-22	08:51	22:16
Neptune	03-15-21	06:39	18:23
Pluto	03-15-22	06:59	13:58

All Times Arizona Time

Bold means the object is "visible" in the evening

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March 15, 2022

Sunrise: 06:39

Sunset: 18:37

New: March 2 & 31

Q1: March 10

Full: March 18

Q3: March 24



Stu's VIEWS

President's Corner March 2022



President Stuart Brackney. Photo provided by Stu.

Hi everyone. I am Stu Brackney, president of this fine organization, the Phoenix Astronomical Society (PAS), since September 2021. I stand on the shoulders of the many stellar (pun intended) presidents of the club who served before me. Hopefully you have received a Press Release from our Acting Secretary Alex Vrenios regarding the February 3rd PAS monthly Lecture Series (meeting) which we hope you were able to attend. If you are not receiving our emails, please contact Alex at Secretary@pasaz.org.

What's new for PAS? Some of you may know by now, because of COVID 19

we are conducting all our events via ZOOM on the internet on the first Thursday of the month. Our lecture series provides us with speakers from around the country on topics related to what we love, the cosmos. You can watch videos of previous lectures on PAS website pasaz.org.

We even did some virtual Star Parties via ZOOM last Fall. To keep up with this meeting schedule, go to our website pasaz.org, look on the opening page for a link Press Release, click on that and you will get the latest info regarding meetings and other events.

Membership in this organization has been called "the best buy north of the equator" at \$25.00 per year, per family. With this money we pay our insurance bills, provide scholarships to college students studying astronomy and related fields, and pay for printed literature that we distribute at star parties and other in-person events. So, if you were or are a member and have not paid your annual dues, please take a minute or two to get that done. Just go on our website, Membership Application & Renewal Form for 2022, to complete the process.

What are you looking for?

That's the question I and your board of directors are asking you. What do you want from this organization? Understanding our limits under COVID, you may have topics for our monthly lecture series, or know of a fabulous speaker you can recommend. You may want more interaction amongst members, sharing topics for discussion. We want your ideas and suggestions. You can send them to me Stubrackney@pasaz.org and I will have our leadership team work on them.

Finally...YOUR leadership team needs your help. Our long time, devoted "go-to gal for everything", Terri Finch is wishing to give up some of her "all volunteer duties" so we are asking you to pay her back for all she has done, for over thirty years. How? We need volunteers to take up her duties as the Event Chair. We are looking for two or three people who have some time to lend a helping hand. For details contact Paul Facuna vicepresident@pasaz.org.

Have a great month everyone...remember before you go out to look up at our cosmos, have a plan on what you want to see!!

(Continued from page 1.)

The University of Arizona in Tucson, where she directed the Theoretical Astrophysics Program during 2011-2016. She was born in New Delhi and grew up in Hyderabad, India. She earned her M.S. in Physics from the Indian Institute of Technology in Delhi in 1983, and her Ph.D. in Physics from Cornell University in 1988. She did post-doctoral research at Cornell and at Caltech, and worked as a staff scientist at the Lunar and Planetary Institute in Houston. Her work in planetary dynamics has spanned a wide variety of topics, in-

cluding extra-solar planets and debris disks around nearby stars, the formation and evolution of the Kuiper belt and the asteroid belt, the orbital resonances amongst the moons of the giant planets, and the meteoritic bombardment history of the planets. She has revolutionized our understanding of the history of the solar system by using the orbital resonance between Pluto and Neptune to infer large-scale orbital migration of the giant planets and to predict the existence of the "Plutinos" and other small planets in resonance with Neptune. She is

an elected member of the National Academy of Sciences and of the American Academy of Arts and Sciences, and has been the recipient of honors and awards from the American Astronomical Society, the International Astronomical Union, the Harvard-Smithsonian Astrophysical Observatory, Cornell University, The University of Arizona, and the IIT-Delhi.

Renu lives in Tucson, AZ, with her husband, David Frenkel, and daughters Mira Frenkel and Lila Frenkel.

March 3rd Meeting

(Continued from page 1.)

Not only did she grab our attention with her "over the top" slide presentation, she spoke "science" so that all could understand the complicated issues related to RSGs.

By the way she is also an author, having recently released her first very popular science book *The Last Stargazers, The Enduring Story of Astronomy's Vanishing*

Winking at Us

Explorers, available at Amazon, Barnes & Noble and your local bookstore.

During her presentation, Dr. Levesque (prefers Emily) took us through the definitions of various star categories and ended up with one of our favorites, found in the Orion constellation, Betelgeuse. She methodically eliminates the various theories that attempt to explain these dark spots and

dimming phenomena and concludes with her discovery as to why this happens.

Do you want to know the answer? Click on "Betelgeuse is Pretty Cool" to see her excellent presentation and find out her conclusion on why Betelgeuse has these changes. Grab yourself a refreshing drink and enjoy science as it should be taught!

Lunar Eclipse of Nov 19, 2021

By Terri Finch, Assistant Editor

I requested that anyone in the club who wanted to, could send me a brief write-up about how they took the photos of the Lunar Eclipse you see here, and get their Lunar Eclipse photos included in the March 2022 issue of PAStimes Newsletter. So, below, in the order they were received, are the submissions by PAS members who took some very awesome photos to share with our readers. Please enjoy! Many, many thanks to those who submitted their articles and Lunar Eclipse photos for this article!

Richard Sauerbrun writes: I guess it was worth getting up at 1:30am after all ... I captured four different imaging sequences at various exposure and gain settings. All within 5-10 minutes of maximum eclipse. High clouds, but not a bad view ... here are the details:

Celestron C8 SCT

F6.3 focal reducer at 1280mm focal length

Celestron AVX mount

No guiding

ZWO ASI294MC-Pro

OptoLong UV/IR filter

SharpCap v4.0 image acquisition application

45ms exposures

570 gain

300 frames total data integration from Bortle 8-9 location (near Scottsdale's TPC Golf Course)

Pre Processing/Stacking in AutoStakert v3.1.4

No calibration frames

Best 150 frames stacked (50%)

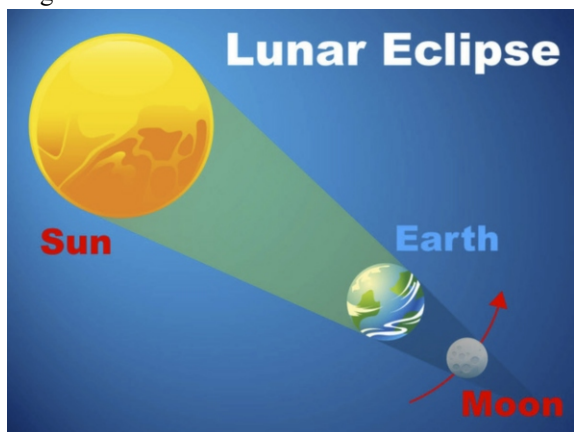
Post processing in Affinity Photo (thanks to Mark Johnson)

President **Stu Brackney** sends: These pictures of the partial eclipse were taken from my backyard here in Phoenix, AZ in a Bortle 8-9 sky using my Canon 70D DSLR

camera.. It was my first try using my Celestron NexStar 8se telescope with the Celestron f/6.3 Focal Reducer Corrector. Amazing what good equipment can do! But then again, the moon makes everyone look good!

By Greg Meyer: I got up on my roof at 2 a.m....this shot is part of a time-lapse showing my Canon Rebel with a Sigma 150-600 telephoto lens on a SkyWatcher Sky Tracker. Also pictured is My Esprit 120mm telescope. The eclipse photo is from the sigma telephoto lens.

By Mark Savan: I set up a "zero gravity" chair on my back porch and wandered out at the beginning of the eclipse with a blanket and a pair of binoculars. For several hours I alternated between naps and binocular viewing and got to see the eclipse in all of its phases. It started out gradually, of course, but I got a great view of the phases and the color change. My telescope was set up for deep sky so I didn't do any imaging; but the visual was great!



Data Provided by Stu Brackney



By Erin Reed



By Erin Reed



By Greg Meyer



By Greg Meyer



by Stu Brackney



By Erin Reed



by Stu Brackney



by Stu Brackney.



by Richard Sauerbrun



Hang Out with the Twins of Gemini

David Prosper

The night skies of February are filled with beautiful star patterns, and so this month we take a closer look at another famous constellation, now rising high in the east after sunset: Gemini, the Twins!

If you're observing Orion, as discussed in last month's article, then Gemini is easy to find: just look above Orion's "head" to find Gemini's "feet." Or, make a line from brilliant blue-white Rigel in the foot of Orion, through its distinct "Belt," and then on through orange Betelgeuse. Keep going and you will end up in between the bright stars Castor and Pollux, the "heads" of the Gemini Twins. While not actually related – these stars aren't bound to each other, and are almost a magnitude apart in brightness – they do pair up nicely when compared to their surrounding stars. Take note: more than one stargazer has confused Gemini with its next-door neighbor constellation, Auriga. The stars of Auriga rise before Gemini's, and its brightest star, Capella, doesn't pair up as strikingly with its second most brilliant star as Castor and Pollux do. Star-hop to Gemini from Orion using the trick above if you aren't sure which constellation you're looking at.

Pollux is the brighter of Gemini's two "head" stars - imagine it has the head of the "left twin" - and located about 34 light-years away from our Solar System. Pollux even possesses a planet, Pollux b, over twice the mass of Jupiter. Castor - the head of the "right twin" - by contrast, lies about 51 light-years distant and is slightly dimmer. While no planets have been detected, there is still plenty of company as Castor is actually a six-star system! There are several great deep-sky objects to observe as well. You may be able to spot one with your unaided eyes, if you have dark skies and sharp eyes: M35, a large open cluster near the "right foot" of Gemini, about 3,870 light-years away. It's almost the size of a full Moon in our skies! Optical aid like binoculars or a telescope reveals the cluster's brilliant member stars. Once you spot M35, look around to see if you can spot another open cluster, NGC 2158, much smaller and more distant than M35 at 9,000 light-years away. Another notable object is NGC 2392, a planetary nebula created from the remains of a dying star, located about 6,500 light-years distant. You'll want to use a telescope to find this intriguing faint fuzzy, located near the "left hip" star Wasat.

Gemini's stars are referenced quite often in cultures around the world, and even in the history of space exploration. NASA's famed Gemini program took its name from these stars, as do the appropriately named twin Gemini North and South Observatories in Hawaii and Chile. You can discover more about Gemini's namesakes along with the latest observations of its stars and related celestial objects at [nasa.gov](https://www.nasa.gov).



Castor and Pollux are Gemini's most prominent stars, and often referred to as the "heads" of the eponymous twins from Greek myth. In Chinese astronomy, these stars make up two separate patterns: the Vermillion Bird of the South and the White Tiger of the North. What do you see? The Night Sky Network's "Legends in the Sky" activity includes downloadable "Create Your Own Constellation" handouts so you can draw your own star stories: bit.ly/legendsinthesky. Image created with assistance from Stellarium.



Montage of Gemini North, located on Mauna Kea in Hawaii, and Gemini South, located on Cerro Pachón in Chile. These "twin" telescopes work together as the Gemini Observatory to observe the entire sky.

Image Credit: NOIRLab Source: <https://www.gemini.edu/gallery/media/gemini-north-south-montage>



Embracing the Equinox

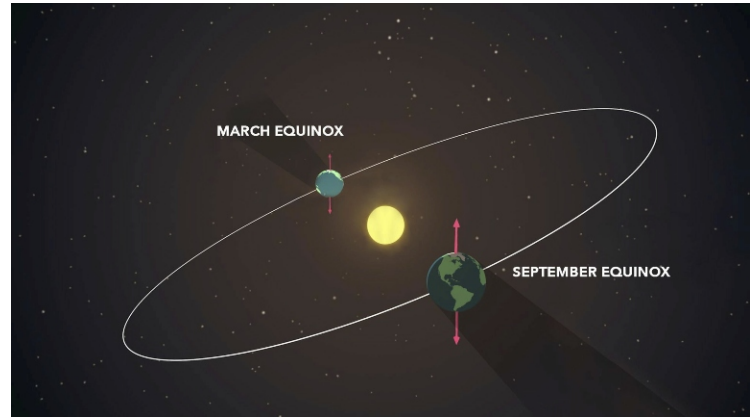
David Prosper

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?

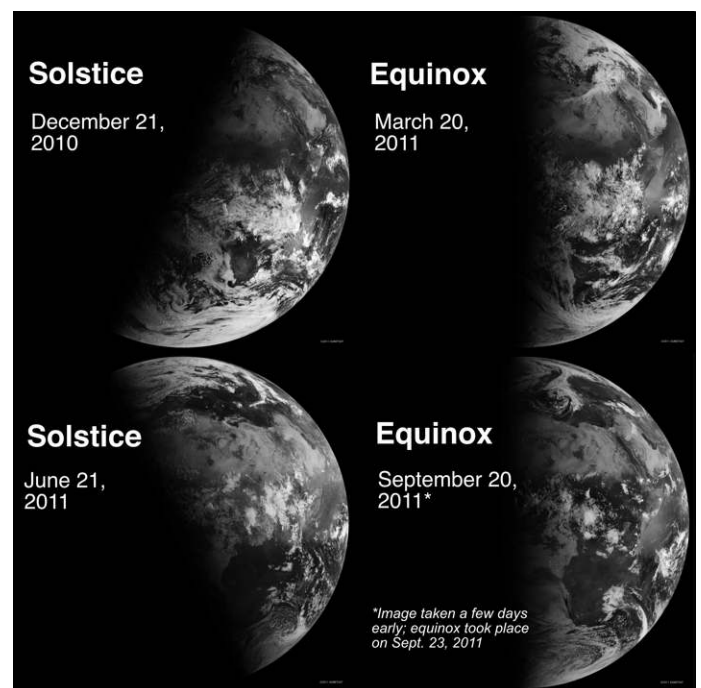
An **equinox** occurs twice every year, in March and September. In 2022, the equinoxes will occur on March 20, at exactly 15:33 UTC (or 11:33 am EDT), and again on September 23, at 01:04 UTC (or September 22 at 9:04 pm EDT). The equinox marks the exact moment when the center of the Sun crosses the plane 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.



Scenes of Earth from orbit from season to season, as viewed by EU-METSAT. 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

Fountain Hills Dark Sky Festival Public Star Party Mar 26

This is NOT a PAS event, but PAS members are invited to attend. If you have outreach experience, bring a scope or meteorites, and assist with public outreach and the solar viewing/evening star parties.

RSVP for this event at TedBlank@gmail.com. Please let Ted know you are attending in case of cancellation. Include the number in your party in your emailed RSVP.

This is a free public event, open to everyone. Invite everyone you know!

Location: Fountain Hills Library, 12901 N La Montana Dr, Fountain Hills, AZ 85268. Location will be at the circle in front of the Fountain Hills Library.

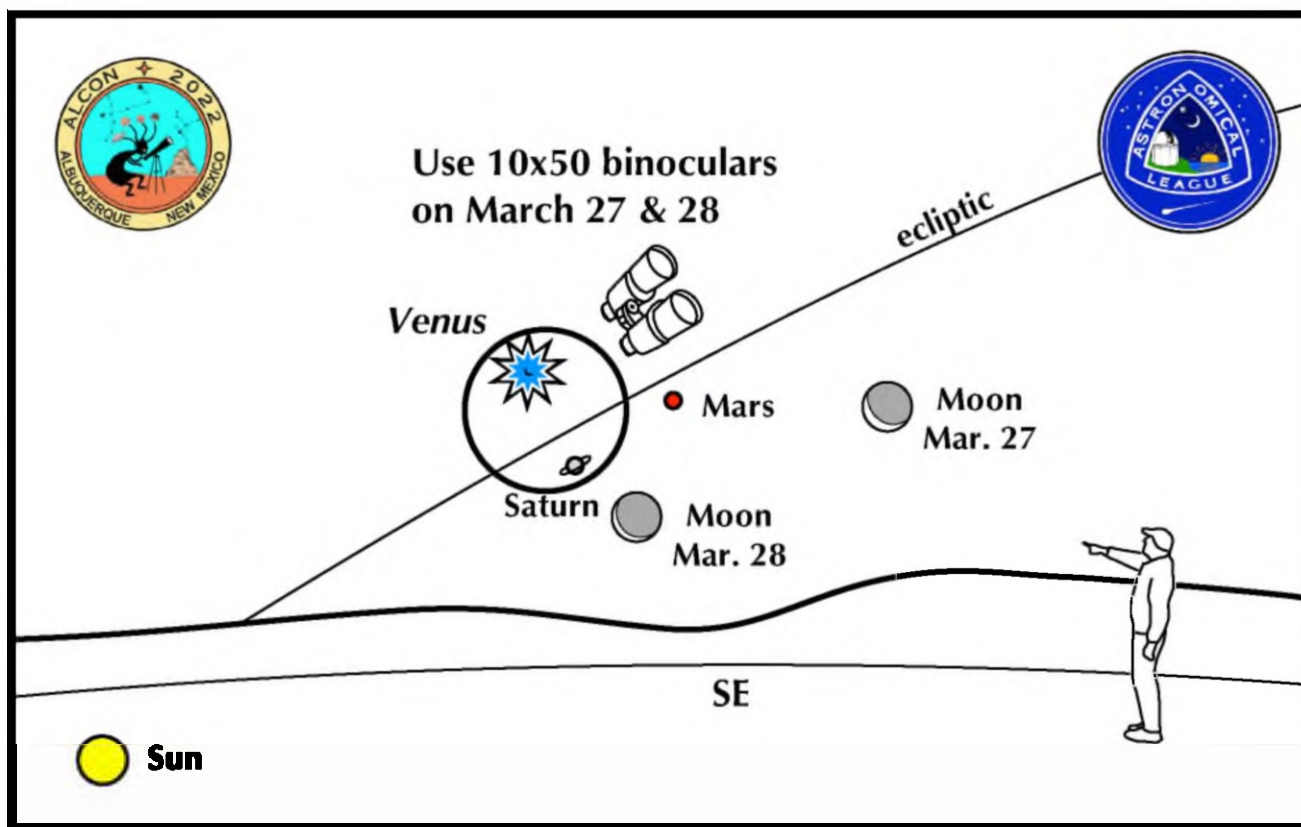
Time of event: 4pm for solar viewing, 7pm to 10pm for evening star party.

Ted writes:

On March 26 we are going to hold our Fountain Hills Dark Sky Festival again and I would like to invite PAS members to bring either solar or nighttime telescopes for our star party.

The event starts at 4 PM for solar observing and 7 PM for evening observing, running until 10pm. RSVP directly with Ted Blank at tetblank@gmail.com.

If you can see only one celestial event in the morning this March, see this one.



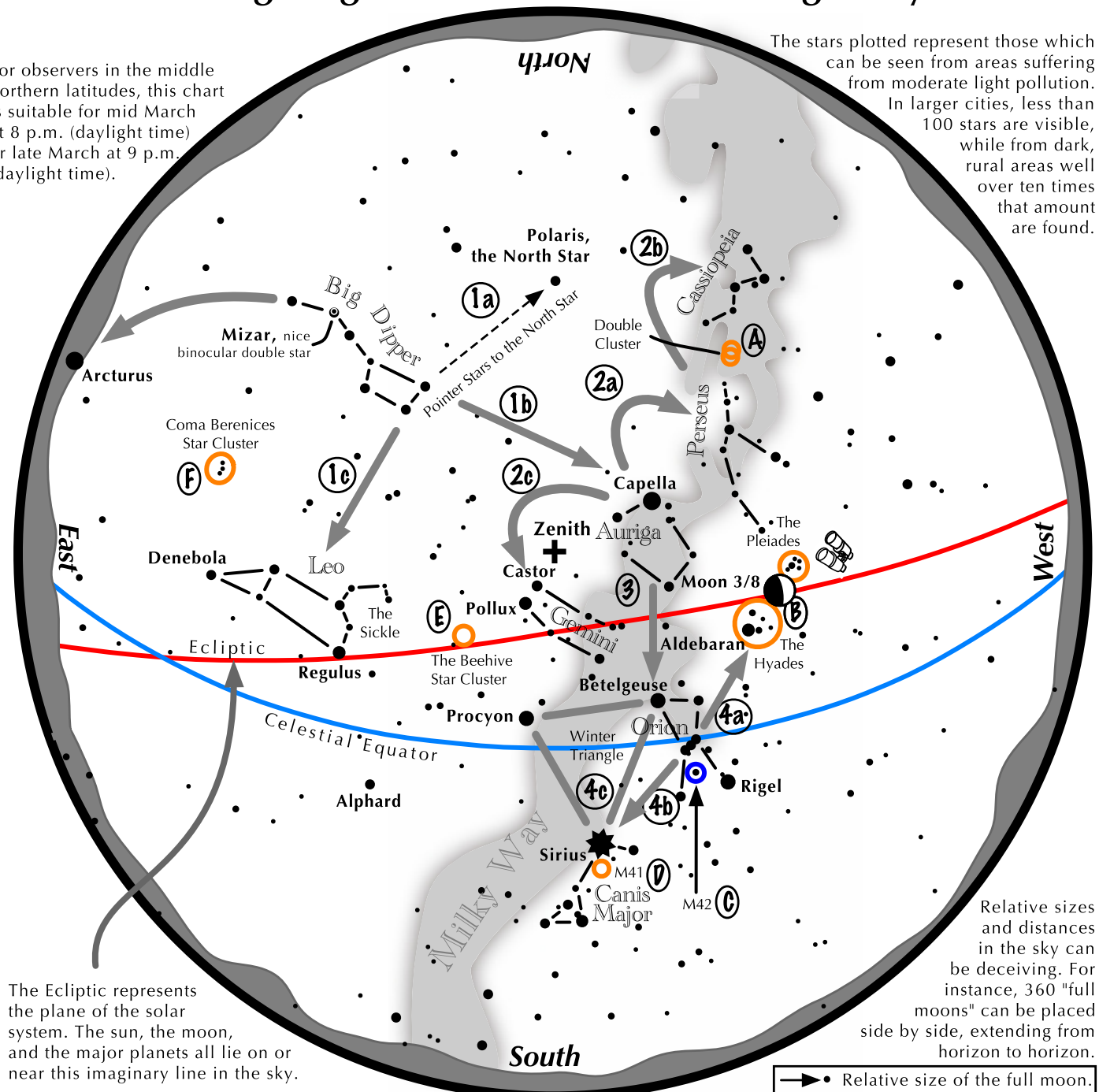
Crescent Moon passes Venus, Mars & Saturn

- Look in the east–southeast beginning 75 minutes before sunrise on March 27 & 28.
- Venus shines brightly low above the east–southeastern horizon.
- On Mar. 27, Mars lies about 1 binocular field to the right of Venus and Saturn lies in the same field as Venus, but to its lower right. The very thin crescent moon, full with earthshine, glows to the planetary trio's right.
- On the following morning, an even thinner moon floats below Saturn and Mars. Saturn should be slightly brighter than reddish Mars.

Navigating the mid to late March Night Sky

For observers in the middle northern latitudes, this chart is suitable for mid March at 8 p.m. (daylight time) or late March at 9 p.m. (daylight time).

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



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

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

→• Relative size of the full moon.

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

- 1 Above the northeast horizon rises the Big Dipper. Draw a line from its two end bowl stars upwards to the North Star. Its top bowl stars point west to Capella in Auriga, nearly overhead. Leo reclines below the Dipper's bowl.
- 2 From Capella jump northwestward along the Milky Way to Perseus, then to the "W" of Cassiopeia. Next jump southeastward from Capella to the twin stars of Castor and Pollux in Gemini.
- 3 Directly south of Capella stands the constellation of Orion with its three Belt Stars, its bright red star Betelgeuse, and its bright blue-white star Rigel.
- 4 Use Orion's three Belt stars to point northwest to the red star Aldebaran and the Hyades star cluster, then to the Pleiades star cluster. Travel southeast from the Belt stars to the brightest star in the night sky, Sirius. It is a member of the Winter Triangle.

Binocular Highlights

A: Between the "W" of Cassiopeia and Perseus lies the Double Cluster. **B:** Examine the stars of the Pleiades and Hyades, two naked eye star clusters. **C:** M42 in Orion is a star forming nebula. **D:** Look south of Sirius for the star cluster M41. **E:** M44, a star cluster barely visible to the naked eye, lies to the southeast of Pollux. **F:** Look high in the east for the loose star cluster of Coma Berenices.

