nightwatch

Newsletter of the Pomona Valley Amateur Astronomers

Looking out into it the universe at night,
we make no comparisons between right and wrong stars,
nor between well and badly arranged constellations.
Alan Watts

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Volume 45 Number 6 *nightwatch* **June 2025**

Club Events Calendar

Jun 4	**Board Meeting 6:15 PM**
Jun 13	**General Meeting 6:30 PM Jeff Rich "About the Past, Present, and Future of What We do at Carnegie."**
Jun 21	**Star Party – White Mountain**
July 2	**Board Meeting 6:15 PM**
July 11	**General Meeting 6:30 PM**
July 26	**Star Party – GMARS**
July 30	**Board Meeting**
Aug 8	**General Meeting 6:30 PM**
Aug 23	**Star Party – GMARS**
Aug 27	**Board Meeting**
Sep 5	**General Meeting 7:30 PM**
Sept 20	**Star Party – GMARS**
Oct 1	**Board Meeting 6:15 PM**
Oct 10	**General Meeting 7:30 PM**
Oct 18	**Star Party – GMARS**
Oct 29	**Board Meeting 6:15 PM**
Nov 7	**General Meeting 7:30 PM**
Nov 22	**Star Party – GMARS**
Dec 3	**Board Meeting 6:15 PM**
Dec 6	**Holiday Party**

PVAA Officers and Board

Officers

President ….....	Mathew Wedel	909-767-9851
Vice President ..	Joe Hillberg	909-949-3650
Secretary	position is currently open	
Treasurer	Gary Thompson	909-935-5509

Board

Jim Bridgewater (2026)........................	909-599-7123
Richard Wismer(2026)	
Ron Hoekwater (2025).........................	909-706-7453
Howard Maculsay (2025)…………………	909-913-1195

Directors

Membership / Publicity....	Gary Thompson .	909-935-5509
Outreach	Jeff Schroeder	909-758-1840
Programs	Ron Hoekwater	909-391-1943

May 9 2025 General Meeting

PVAA President Matt Wedel opened the meeting greeting everyone and with dates of May's star party. It is now time to renew your yearly dues. $30 for an individual and $40 for a family.

Ken Elchert gave his now monthly presentation of "Astronomical & Aerospace Events (May 9 to June 13)." We learned that an appulse is like a conjunction, but further away – about one degree or more. May 14^{th} was the 90th anniversary of Griffith Observatory. He then covered most of the rocket launches that happened from April 12^{th} to April 29^{th}. He also mentioned the upcoming lunar lander Hakuto-R Mission 2. Scheduled to land on June 6^{th}. It was launched on January 15^{th}.. Don Pettit returned to Earth after a 6 month stay on the International Space Station. He landed on his 70th birthday. China has also been busy – sending up another crew to their space station, relieving the crew that was there. NASA's Lucy spacecraft flew by the Donaldjohanson Asteroid and tried out its instruments. Lucy took several thousand images of the asteroid and made a short video from them. Ken then displayed an image compiled from the James Webb Space Telescope, and the Hubble Space Telescope, showing tens of thousands of galaxies.

Ken was also the main speaker of the night. His presentation was titled: "Gravitation and the Moons in the Solar System." Numerous theories have been proposed over the last 2300 years. Aristotle (4^{th} century BC) proposed that objects fall due to a tendency to reach their "natural place" and fall at speeds proportional to their mass. Galileo Galilei ~1590 determined that objects fall at the same rate, regardless of their mass. In 1687 Isaac Newton developed the law of universal gravitation: It is an attractive force between all particles proportional to the product of their masses and inversely proportional to the square of the distance between them. In 1915 Albert Einstein developed the general relativity that gravitation is the curvature of spacetime caused by mass and energy.

During the Apollo Program, and even today, engineers used Newton's Laws of Motion rather than Einstein's, as they were simpler, easier to use and verify, and accurate enough for spaceflight. There are a few different ways to get to the moon. One way is called the Homann Transfer. This involves an elliptical orbit that takes you to just beyond the Earth-moon Lagrange point where the Earth's and moon's gravity equal each other, then falling into orbit around the moon with a final retro burn so you do not swing back to Earth. Another method is called Low-Energy Transfer. This allows spacecraft to use significantly less fuel but takes longer due to the higher elliptical orbit around the moon. The third type is called Ballistic Capture Transfer. This allows spacecraft to fall into orbit without using fuel to slow it down. On a mission to Mars, it could take up to a year instead of the nine months for a Homann Transfer. Good for non-perishable supplies, not for humans. Several missions have used the Ballistic Capture Transfer including the GRAIL, CAPSTONE, and SMART-1 missions.

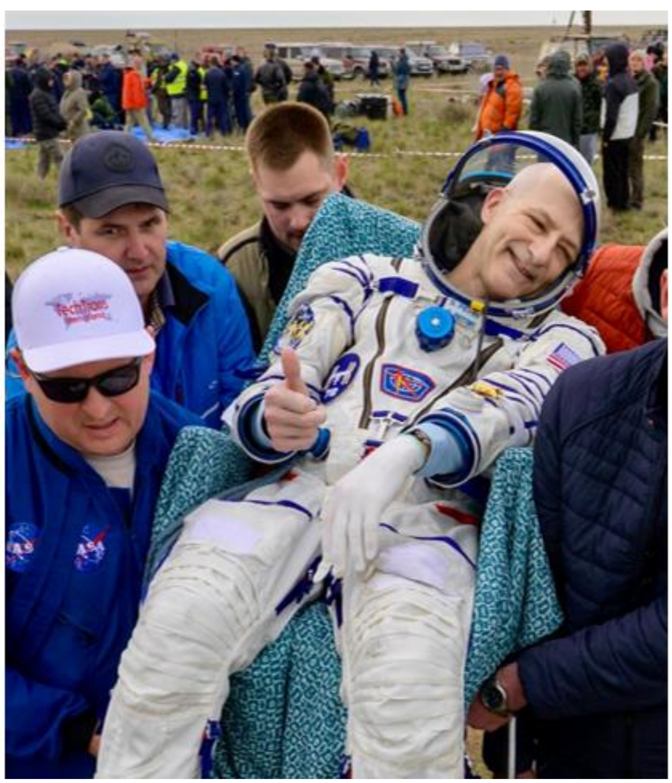
As for the moons in our solar system: 416 known moons are orbiting planets. 600 moons are orbiting asteroids. 7 moons are larger than Pluto and 2 moons – Jupiter's Ganymede and Saturn's Titan, are larger than Mercury. 4 moons have an atmosphere: Titan, Triton, Io, and Callisto.

There are several Hypotheses/Theories for the origin of the moon: Condensation/Accretion, Fission, Capture, Giant Impact, and Nuclear Explosion. Based on moon rocks, the moon is thought to be about 47 million years younger than the Earth.

Gary Thompson

Don Pettit

Completed the MS-26 mission on his 70^{th} birthday; NASA's oldest active astronaut; has accumulated 590 days in space, more than any other American man



52246 Donaldjohanson Asteroid Imaged by the Lucy Spacecraft

Easter Sunday, April 20, 2025

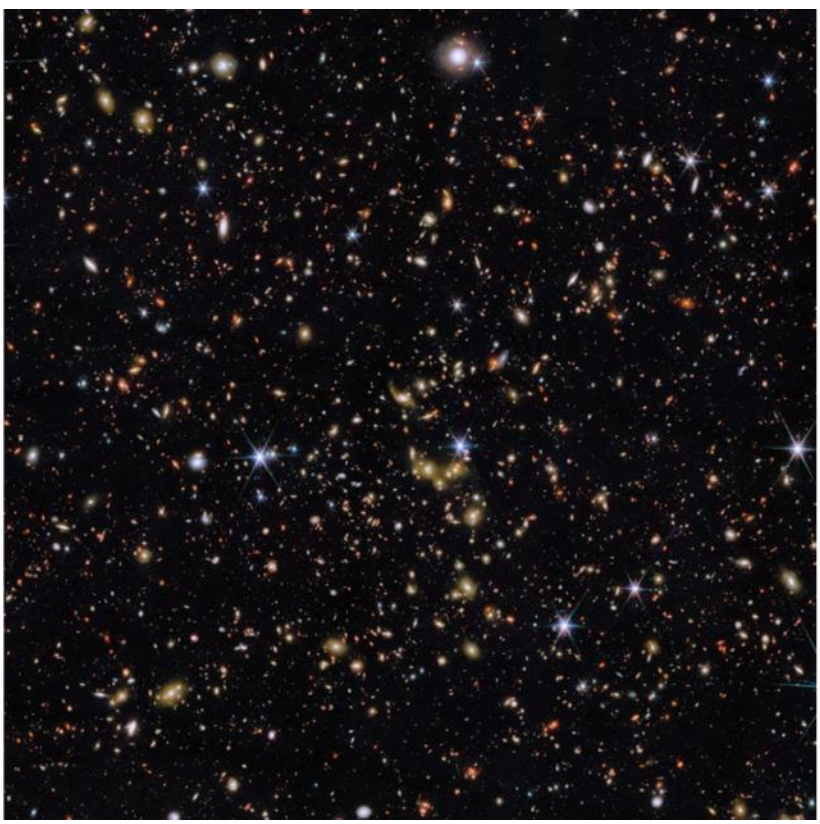
8 km long × 3.5 km wide at its largest point

viewed from a distance of 1100 km = 683 mi

Full image of the latest JWST and Hubble deep field May 1, 2025

Part of the Cosmic Evolution Survey (COSMOS-Web).
This main galaxy group is the most massive in the survey. Tens of thousands of galaxies are visible in this patch, stretching for tens of billions of light-years. Everything that has six bright spokes is a star in the Milky Way Galaxy

image combines data collected by JWST's Near-InfraRed Camera (NIRCam) and HST



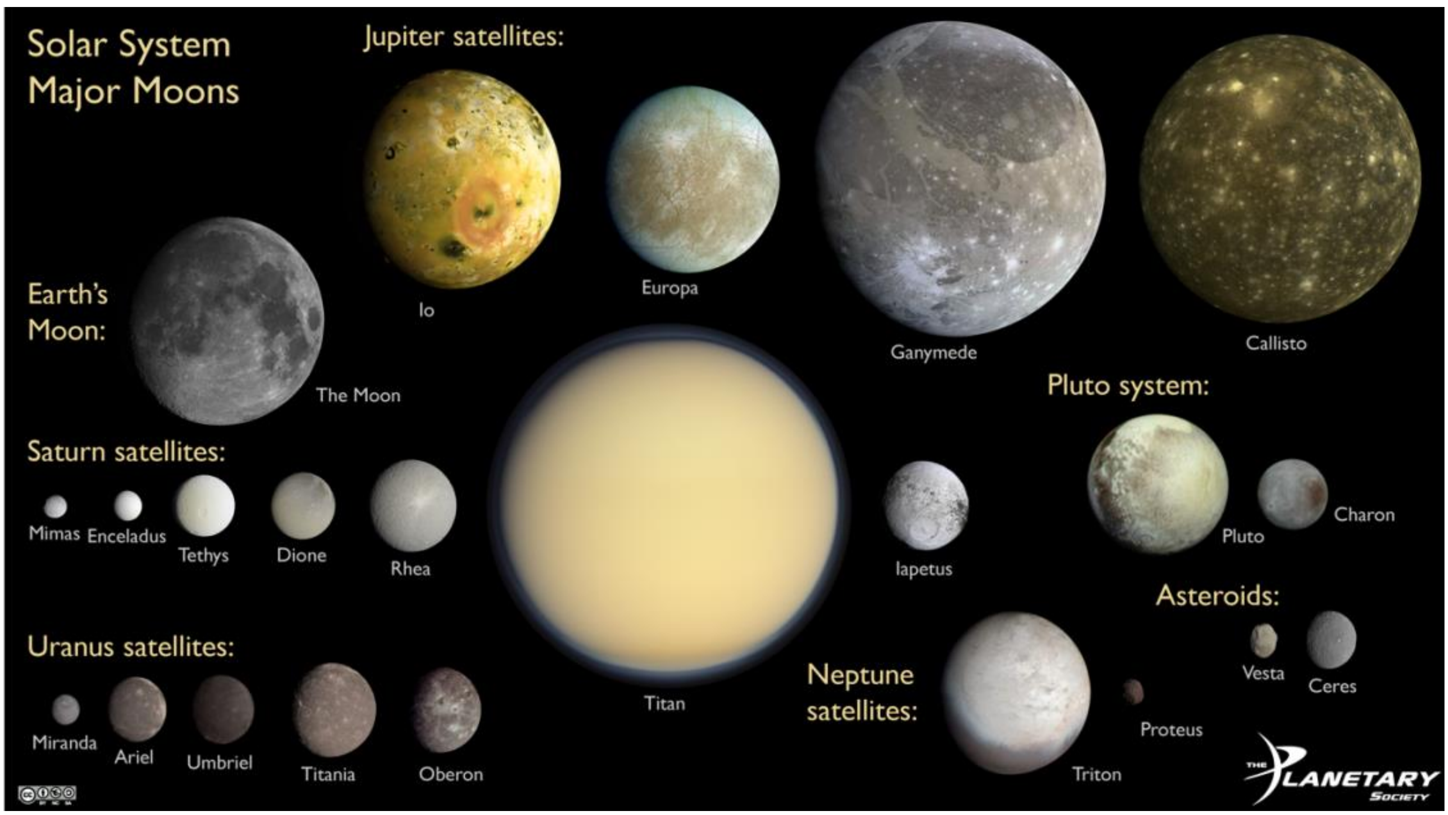
The star of this image is a group of galaxies, the largest concentration of which can be found just below the center of this image. These galaxies glow with white-gold light. We see this galaxy group as it appeared when the Universe was 6.5 billion years old.

Comparison of Newton's and Einstein's Gravitational Equations

Newton		Einstein	
Newton's field equations	$\bar{g} = -\nabla U_{sphere} = -(GM/r^2)\,\bar{r}$	Einstein's field equations*	$G_{\mu\nu} + \Lambda g_{\mu\nu} = \kappa T_{\mu\nu}$
Universal law of gravitation	$F_{g(sphere)} = -(GM\,m/r^2)\,\bar{r}$	the EFE reduce to Newton's law of gravitation in the limit of a weak gravitational field and speeds that are much less than the speed of light	
Gravitational potential (J/kg)	$U_{sphere} = -GM/r$	Einstein tensor	$G_{\mu\nu} = R_{\mu\nu} - ½ R g_{\mu\nu}$
		Stress-energy tensor	$T_{\mu\nu}$
Gravitational constant	$G = 6.67430 \times 10^{-11}\ m^3/kg\ s^2$	Einstein gravitational const.	$\kappa = 8\pi G/c^4 = 2.076647 \times 10^{-43} / N$
		Speed of light in a vacuum	$c = 299{,}792{,}458\ m/s$
		Cosmological constant	$\Lambda \sim 1.4657 \times 10^{-52}/m^2$

Philosophiæ Naturalis Principia Mathematica (English: *The Mathematical Principles of Natural Philosophy)*

***Quoting physicist John A. Wheeler, "Space tells matter how to move; matter tells spacetime how to move."**



Hypotheses/Theories for the Origin of Moons

Mechanism	Year	Originator	Description
Condensation/Accretion	1873	Edouard Roche	Formed with the planet from protoplanetary disk by accretion
Fission	1879	George Howard Darwin	Thrown off by the fast-spinning planet
Capture	1909	Thomas Jefferson Jackson	Formed elsewhere and gravitationally captured by planet
Giant Impact	1974	Wm. Hartmann & Donald Davis	Formed from debris created by a large object impacting the planet
Nuclear Explosion	1997	Vladimir Anischkin	Formed from debris from nuclear explosion in the planet

Mechanism	Some Candidates
Condensation/Accretion	Galilean moons (Jupiter), Titan (Saturn)
Fission	--
Capture	Phobos (Mars), Himalia (Jupiter), Phoebe (Saturn), Triton (Neptune)
Giant Impact	the Moon (impactor: Theia), Charon (Pluto)
Nuclear Explosion	the Moon

The Moons in the Solar System

- There are
  - 416 known moons orbiting the planets in the solar system
  - 600 known moons orbiting asteroids
  - 18 or 19 moons large enough to be gravitationally round
    - Neptune's moon, Proteus, is borderline
  - 7 moons larger than Pluto
    - Jupiter's Ganymede, Callisto, Io, Europa
    - Saturn's Titan
    - Earth's Moon
    - Neptune's Triton
  - 2 moons larger than Mercury
    - Jupiter's Ganymede
    - Saturn's Titan
  - 4 moons that have an atmosphere
    - Saturn's Titan
    - Neptune's Triton
    - Jupiter's Io and Callisto
- Earth has
  - 7 known quasi-moons
  - An unknown number of minimoons
  - 2 ghost moons (Kordylewski clouds?)

Peculiar Galaxies

New moon in April found an early arrival of May gray, our annual overcast season. Weather did not look good for the weekend, so we stayed home to catch up on errands after a long stay in New York. New moon for May turned out to be Memorial Day weekend. By the time I looked at booking the campground, it was fully booked! Just as well, since if we had gotten a site, I'm sure the neighboring campers would be lighting up the night sky to "help us out". Needless to say, I imaged from home again but had to dodge the overcast weather.

I'm trying a new format for the write-up this time. I've titled the sections; focusing on describing the content of the images in the TARGETS section and the details of how the images were obtained in the IMAGING AND PROCESSING section. The second section might be too detailed for most, but I do have some people that will find it helpful. Let me know if you like the new format.

TARGETS

I started shooting the first target on May 7, five nights before the full moon, and ended on May 15, three nights after the full moon. A terrible time to image, especially in broadband, but I hadn't imaged in so long, I just had to get some practice in. It's galaxy season, so the first target for the month is Arp 286. The Arp catalog lists "peculiar" galaxies, those that are distorted. The three main galaxies in the image are interacting and distorting their shapes. This is most obvious in the right-most galaxy, NGC 5560. The largest galaxy is NGC 5566 and the left-most galaxy is NGC 5569. NGC 5566 is a very large galaxy and is reportedly about 150 thousand light years across, about 50% larger than the Milky Way. Arp 286 is about 90 million light years away in Virgo, while the two very bright stars by comparison are only 169 light years away for the left one and 66 light years for the right one.

May 16 and 17 were overcast so the next imaging session began on May 18 and lasted until the marine layer rolled back in on May 22. Arp 286 was starting to set too early, so rather than add more data to what I had, a new target was chosen. I found another set of three galaxies that looked nice, but one seemed like it might be a little faint in the outer regions. NGC 5965 is the edge-on galaxy near the top of the image. It lies about 150 million light years away in Draco. The galaxy is most likely a barred spiral and shows some disturbance as the edges appear to bend out of the plane of the galaxy. To the right of center is a rather loose galaxy, NGC 5963. It's reportedly relatively close at about 42 million light years away, but it is very faint for being so close. It was pretty difficult to pull the arms out of the background, especially given the local light pollution. The third galaxy is NGC 5971 in the lower left of the image. It, too, is a spiral in Draco, but no distance to it is listed.

IMAGING AND PROCESSING

Both targets this month were processed as LRGB images. Both images were taken with the same set-up of telescope and camera – an 8-inch TPO Ritchey-Chrétien telescope operating at f/7 and ZWO ASI294MM-Pro camera. Accessories included a TS-Optics flattener, Moonlite automatic focuser, ZWO filter wheel with Astrodon 5nm filters, and Starlight Xpress Super Slim off axis guider. The setup was driven remotely though a Mele Quieter3 mini PC riding on top of the telescope.

The Arp 283 image is a combination of 167 4-minute luminance frames, 55 8-minute red frames, 52 8-minute green frames, and 53 8-minute blue frames all calibrated with 15 dark, flat, and dark flat frames. All frames were taken at -10C and the camera was set to low gain. The total integration time was 32 hours, 28 minutes. For some reason, the flat frames did not work well and I ended up with a lot of "dust donuts" in the background that were difficult to remove. There may be some leftover artifacts from "fixing" them.

The second image is a combination of 128 4-minute luminance frames, 43 8-minute red frames, 39 8-minute green frames, and 40 8-minute blue frames all calibrated with 15 dark, flat, and dark flat frames. All frames were taken at -10C and the camera was set to unity gain. The total integration time was 24 hours, 48 minutes. I had trouble with the flats not working well with this image, too, but solved the problem without resorting to "fixing" techniques. It turned out that the acquisition software somehow reset the camera to unity gain without me realizing it. I use dark frames from earlier since they last about a year before needed to be refreshed and used the low gain darks since that's what I thought light frames were using. Once I used the proper darks, the flats worked as expected.

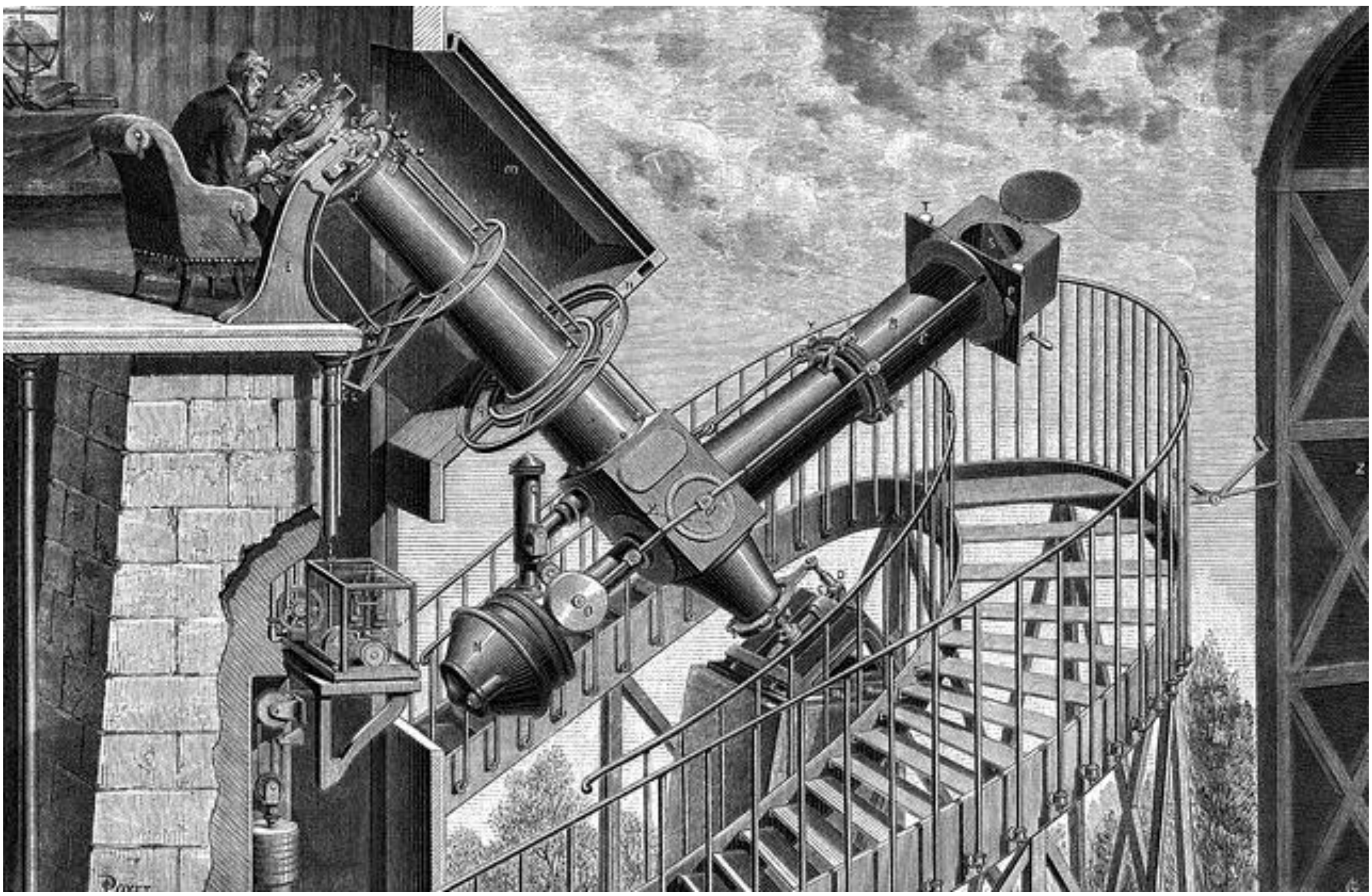
Processing of both images was done entirely in PixInsight. I've been following a slightly different workflow lately but I'm not convinced it's better, at least not yet. I use *WBPP* in PixInsight to calibrate and stack all the frames. Once complete, the stacks are imported into PixInsight and the color RGB image is created. From this point onward, the L and RGB frames follow the same processing steps with only a couple of differences related to color. First, *BlurXterminator* is used in correct only mode to clean up any guiding issues. In the past, at this point I'd correct light pollution gradients, however, this time I ran *StarXterminator* to extract the stars from the images before correcting for gradients. Both L and RGB stars were simply stretched using *STF* and *Histogram* in PixInsight and *curves* was used to bump up the color saturation in the RGB stars. Next, a mild application of *NoiseXterminator* was used and the starless images had the gradients cleaned up using *DBE*. At this point, the starless RGB frame was color corrected using *SPCC* to get the proper colors into the galaxies. The starless images were stretched using *GHS* and *NoiseXterminator* was used to keep the noise level under control while stretching.

At this point, most of the rest of the workflow was done using the *ImageBlend* script. First, the L frame was imported as both the base image and the blend image. The filter for the blend image was set to high pass and the blend mode was set to overlay. The filter radius was adjusted to get the right amount of sharpening. Now, the L stars and RGB stars, as well as the sharpened L starless and RGB starless frames were combined into LRGB stars and starless frames. The sharpened L frame was set as the base image in *ImageBlend* and the RGB frame was the blend image. The blend mode was set to color and the frames were combined to produce LRGB stars and LRGB starless images. Finally, the LRGB starless image was loaded as the base image and the LRGB stars as the blend image. The blend mode was set to screen and the mid-tones of the blend image (stars) was adjusted to moderate how strongly the stars would appear. The resultant LRGB image was adjusted using the *curves* and *histogram* processes to adjust the background level and contrast.

I'm really looking forward to getting out under dark skies again soon. I can't believe the last time was back in October. Clear skies until next time.

Ron Ugolick

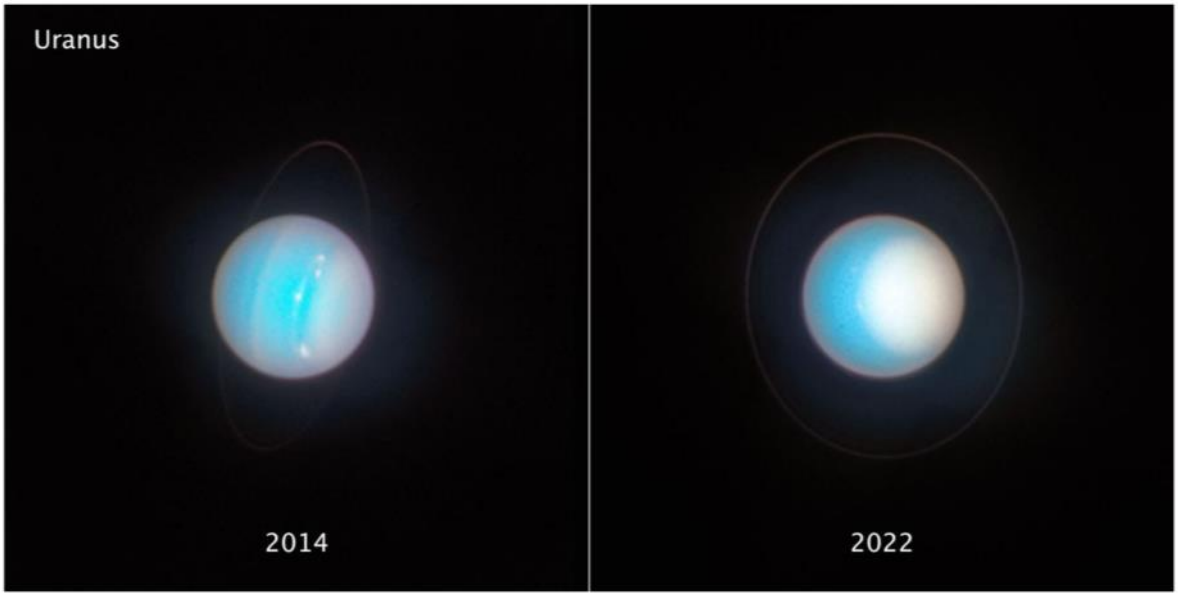
https://www.astrobin.com/users/ruccdu/



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 go.nasa.gov/nightskynetwork to find local clubs, events, and more!

June's Night Sky Notes: Seasons of the Solar System

By: Kat Troche

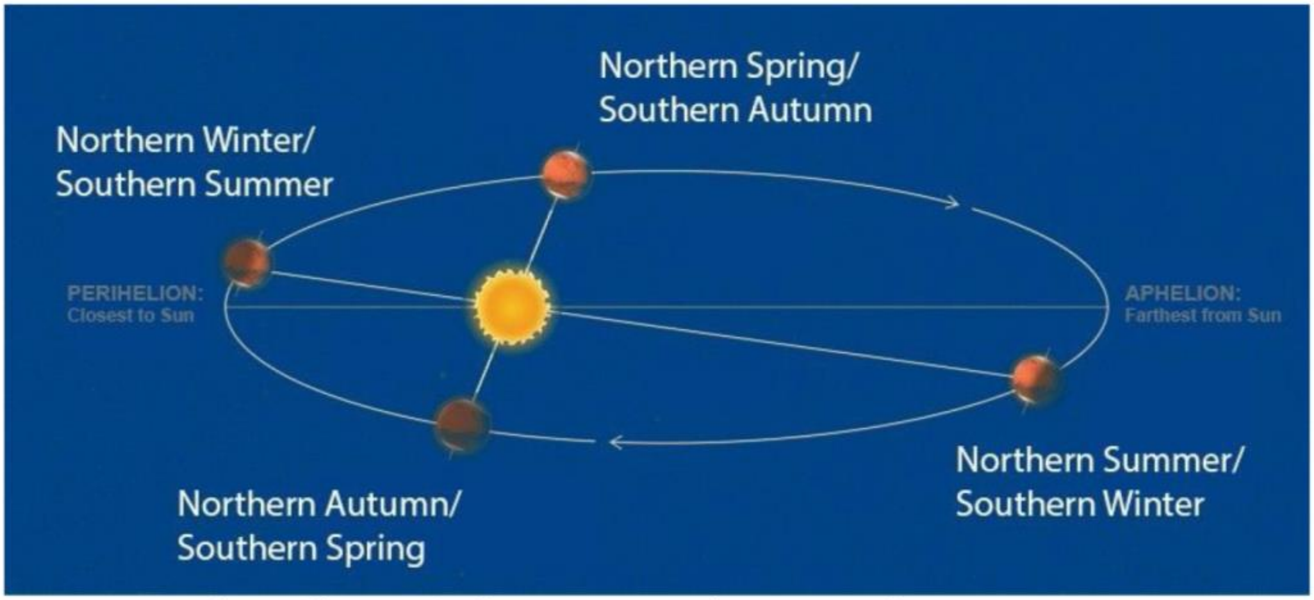


Uranus rolls on its side with an 84-year orbit and a tilt just 8° off its orbital plane. Its odd tilt may be from a lost moon or giant impacts. Each pole gets 42 years of sunlight or darkness. Voyager 2 saw the south pole lit; now Hubble sees the north pole facing the Sun. Credit: NASA, ESA, STScI, Amy Simon (NASA-GSFC), Michael Wong (UC Berkeley); Image Processing: Joseph DePasquale (STScI)

Here on Earth, we undergo a changing of seasons every three months. But what about the rest of the Solar System? What does a sunny day on Mars look like? How long would a winter on Neptune be? Let's take a tour of some other planets and ask ourselves what seasons might look like there.

Martian Autumn

Although Mars and Earth have nearly identical axial tilts, a year on Mars lasts 687 Earth days (nearly 2 Earth years) due to its average distance of 142 million miles from the Sun, making it late autumn on the red planet. This distance and a thin atmosphere make it less than perfect sweater weather. A recent weather report from Gale Crater boasted a high of -18 degrees Fahrenheit for the week of May 20, 2025.

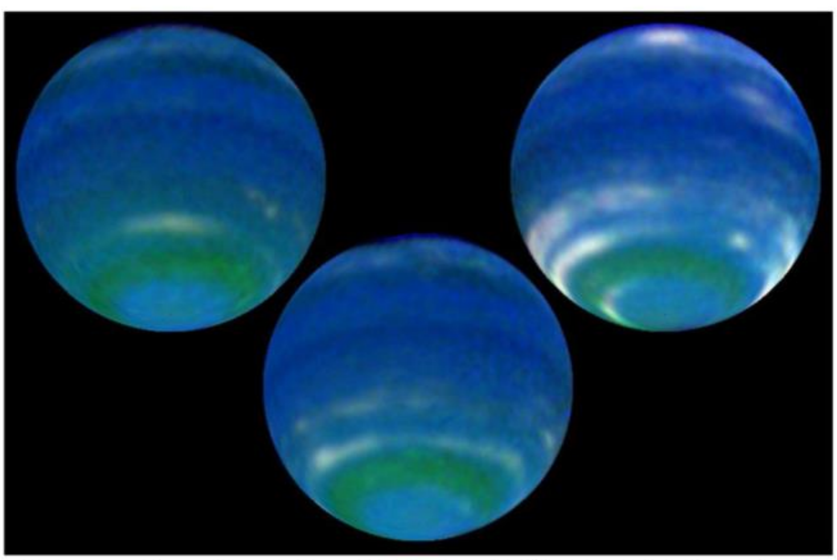


An artist's rendition of Mars' orbit around the Sun, and its seasons. Credit: NASA/JPL-Caltech

Seven Years of Summer

Saturn has a 27-degree tilt, very similar to the 25-degree tilt of Mars and the 23-degree tilt of Earth. But that is where the similarities end. With a 29-year orbit, a single season on the ringed planet lasts seven years. While we can't experience a Saturnian season, we can observe a ring plane crossing here on Earth instead. The most recent plane crossing took place in March 2025, allowing us to see Saturn's rings 'disappear' from view.

A Lifetime of Spring



NASA Hubble Space Telescope observations in August 2002 show that Neptune's brightness has increased significantly *since 1996. The rise is due to an increase in the amount of clouds observed in the planet's southern hemisphere. Credit: NASA, L. Sromovsky, and P. Fry (University of Wisconsin-Madison)*

Even further away from the Sun, each season on Neptune lasts over 40 years. Although changes are slower and less dramatic than on Earth, scientists have observed seasonal activity in Neptune's atmosphere. These images were taken between 1996 and 2002 with the Hubble Space Telescope, with brightness in the southern hemisphere indicating seasonal change.

As we welcome summer here on Earth, you can build a Suntrack model that helps demonstrate the path the Sun takes through the sky during the seasons. You can find even more fun activities and resources like this model on NASA's Wavelength and Energy activity.