

The Newsletter for Keene Amateur Astronomers

Vol. 2025 No. 2

February 2025

James Webb Space Telescope, Stephan's Quintet



The new image of galaxy group "Stephan's Quintet" from NASA's James Webb Space Telescope shows in rare detail how interacting galaxies trigger star formation in each other and how gas in galaxies is being disturbed. The image also shows outflows driven by a black hole in Stephan's Quintet in a level of detail never seen before. Credit: NASA, ESA, CSA, and STScI

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Editor's Message

I hope you saw the crescent Moon and Venus on February 1st. The Moon will continue to have several spectacular engagements this month as it joins the Pleiades on the 5th and Jupiter on the 6th. On the 9th, the Moon and Mars will be visible in the East at sunset in the constellation Gemini.

This month, Venus will be dazzling in the night sky. Venus will reach its peak brightness with a magnitude of -4.9 on the 16th and can be found in the constellation Pisces. Only the Moon will be brighter than Venus this month.

If you have clear skies to the west, you should have a spectacular view at the end of the month to see Venus, Mercury, and the Moon just after sunset. The three objects will appear close together. You don't have to wait until the end of the month to enjoy Venus. You can find Saturn and Venus in the west just after dusk, with Saturn appearing closer to the horizon. Saturn will be leaving the evening sky late this month. Be sure to check out the Astronomical League's charts to learn more about viewing Venus. You can find the charts and links to their website at the end of this newsletter

The planetary parade continues this month and is spectacular as the planets Saturn, Venus, Jupiter, and Mars glimmer like jewels in the sky after sunset. On the 24th, Mercury will join Saturn in the West and will boast a spectacular magnitude of -1.2, almost as bright as Sirius. You will need to step outside shortly after sunset to see it because Mercury will set an hour and a half later. Both Uranus and Neptune will also be present but both of these are difficult to impossible to see without a telescope. Uranus will be in Taurus and Neptune will be in Pisces. If it's a pleasant night, it might be worthwhile to try to find these elusive planets with a telescope.

This month's NASA Night Sky Notes addresses the issue of light pollution. I highly recommend reading about this important issue and considering reducing the amount of light on your property after dark.

Here's to turning off the porch light and looking up at the planets this month.

- Susan Rolke

Monthly Business Meeting

Our next meeting will take place in March.

Black Holes In The Early Universe And Now

By Susan Rolke

As I was considering what to write about this month, articles about LRDs and black holes kept popping up. There is a wealth of new research on black holes that has recently been published, which I find intriguing and, at the same time, has raised a multitude of new questions for me. As with all new research, we'll have to wait and see where these findings take us and how they refine our understanding of the universe.

In 2022, when images from the James Webb Space Telescope (JWST) were released, showing a young universe, the scientific community was surprised to find that much more galaxy formation had occurred than anticipated. The news media was abuzz with reports that scientists had found galaxies older than expected, and that these findings 'broke' our understanding of cosmology. The new data from JWST revealed galaxies that were much brighter than anticipated.

The images taken by JWST were of a new type of galaxy that had not been observed before at lower redshifts (closer distances). These galaxies were dubbed 'little red dots' and subsequently became known as LRD galaxies. The issue with these LRDs was that the light observed pointed to much more rapid stellar formation than our models predicted, which led to the 'universe-breaking' problem that gained so much media attention.

One of the most intriguing aspects of astronomy is that we are looking back in time when we peer through a telescope. JWST can collect more light than previous telescopes, allowing it to capture photons from some of the most distant objects, which means we are imaging objects further back in time. This provides us with an opportunity to study the early universe and how it has evolved.

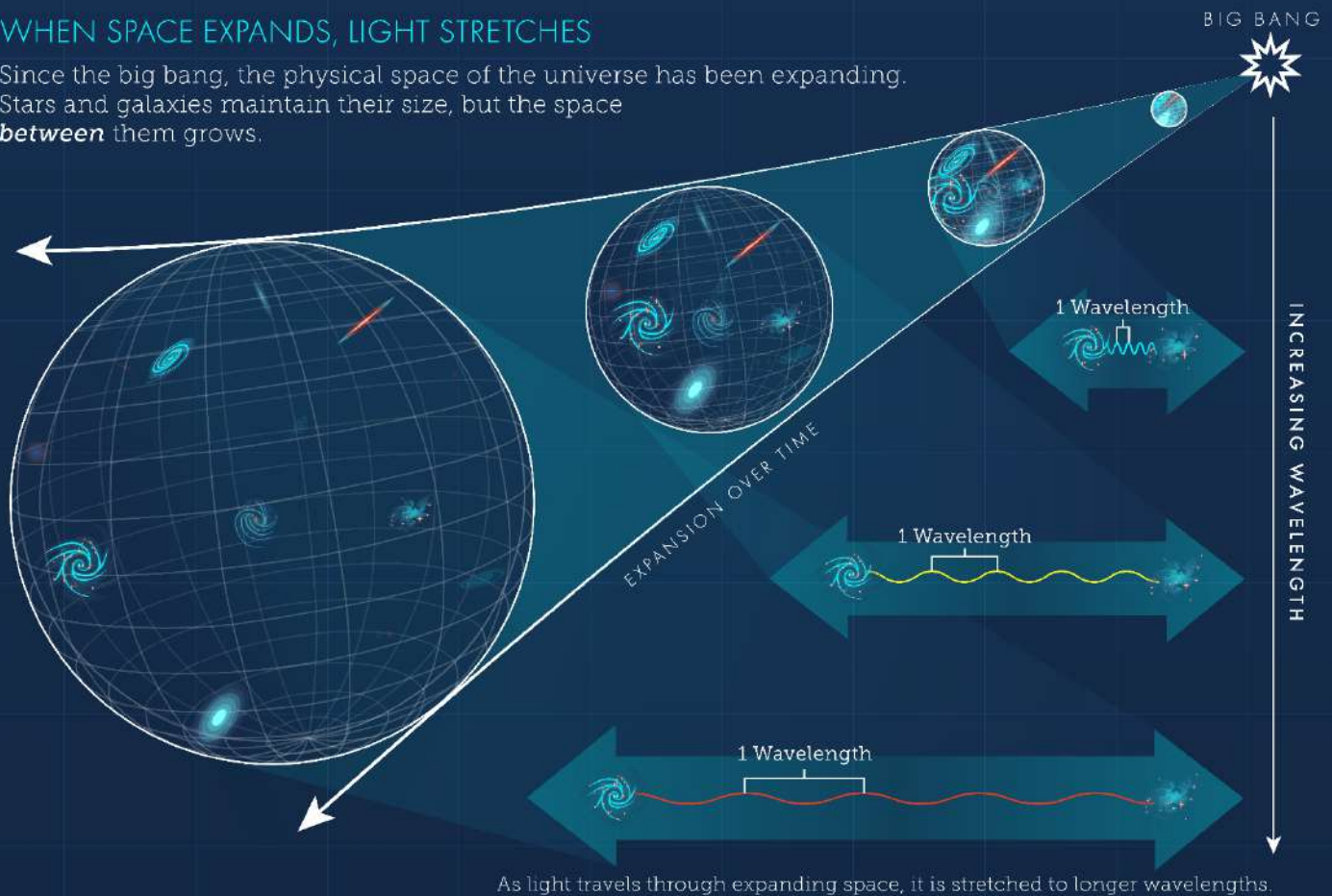
It might be helpful to take a brief excursion here to discuss JWST and cosmological redshift. There are two types of redshift in astronomy. The first type looks at how fast a star or planet is moving relative to us. The second type, cosmological redshift, is a result of cosmic expansion. Astronomers use this to measure the distance to distant galaxies. Due to the expansion of the universe, the light traveling to us from these galaxies has been stretched to longer wavelengths, or redshifted.

This can be seen in the graphic on the next page.

WHAT IS COSMOLOGICAL REDSHIFT?

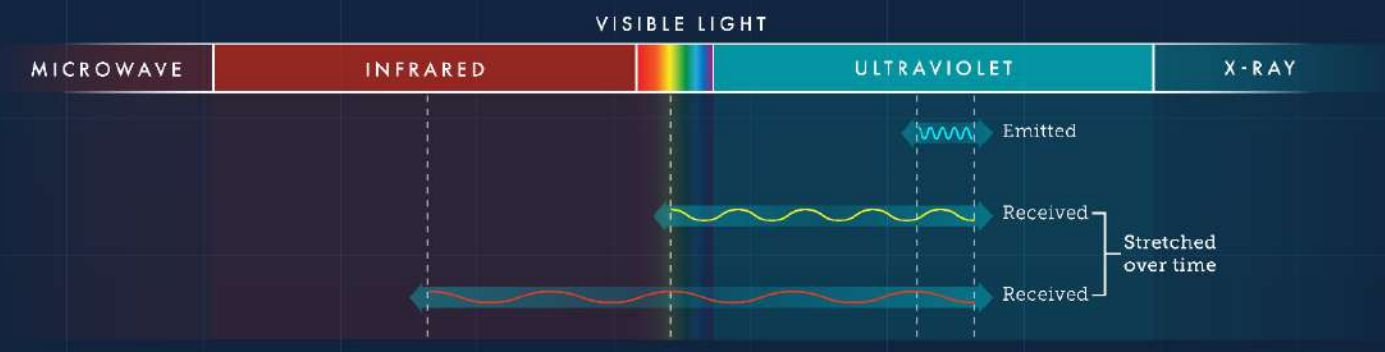
WHEN SPACE EXPANDS, LIGHT STRETCHES

Since the big bang, the physical space of the universe has been expanding. Stars and galaxies maintain their size, but the space **between** them grows.



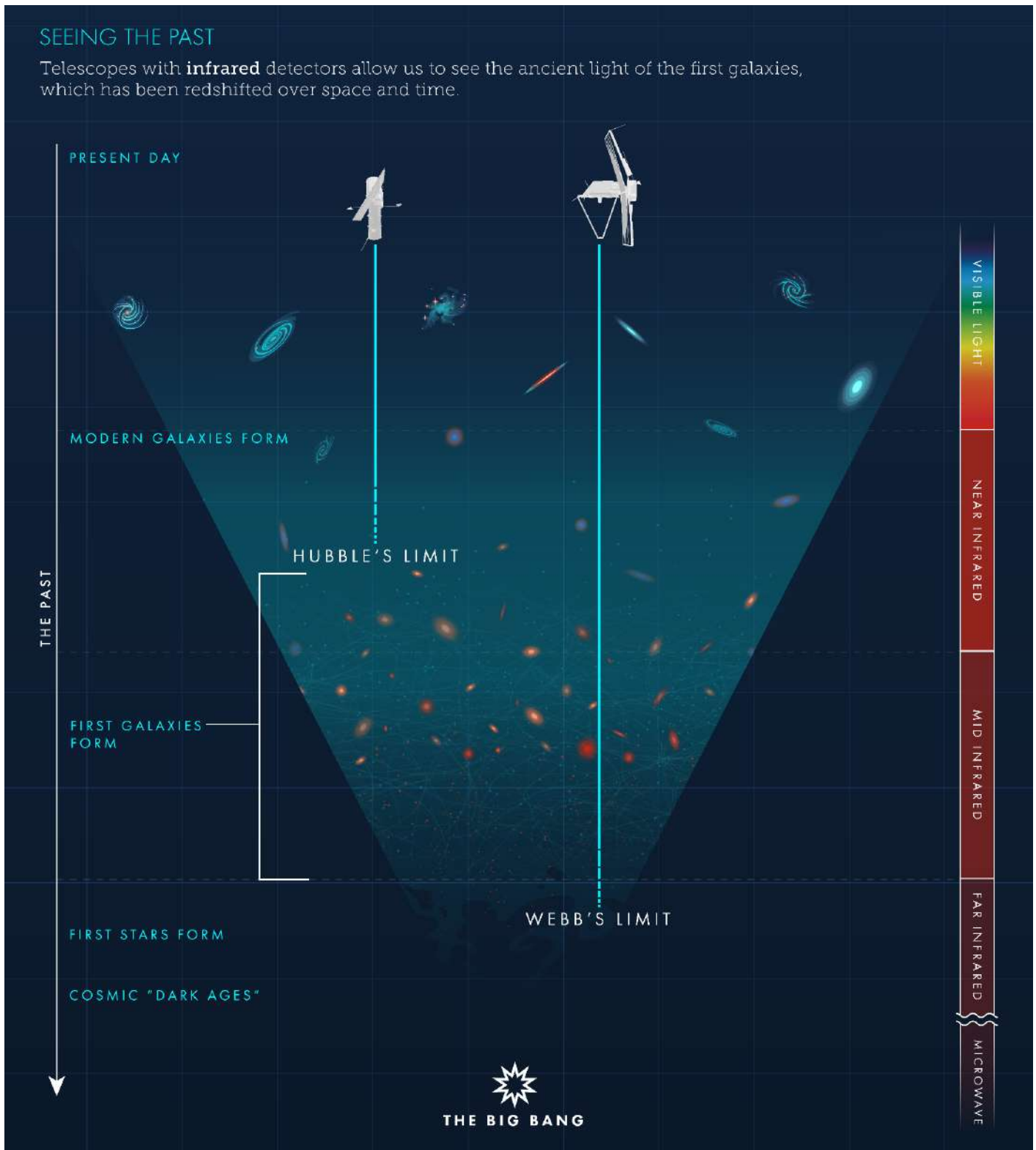
REDDER THAN RED

The longest visible wavelength is red. Beyond red are longer wavelengths that we can't see, starting with infrared. When light is stretched by the expansion of space, we say that it is **redshifted**—from its original wavelength to a longer, redder one.



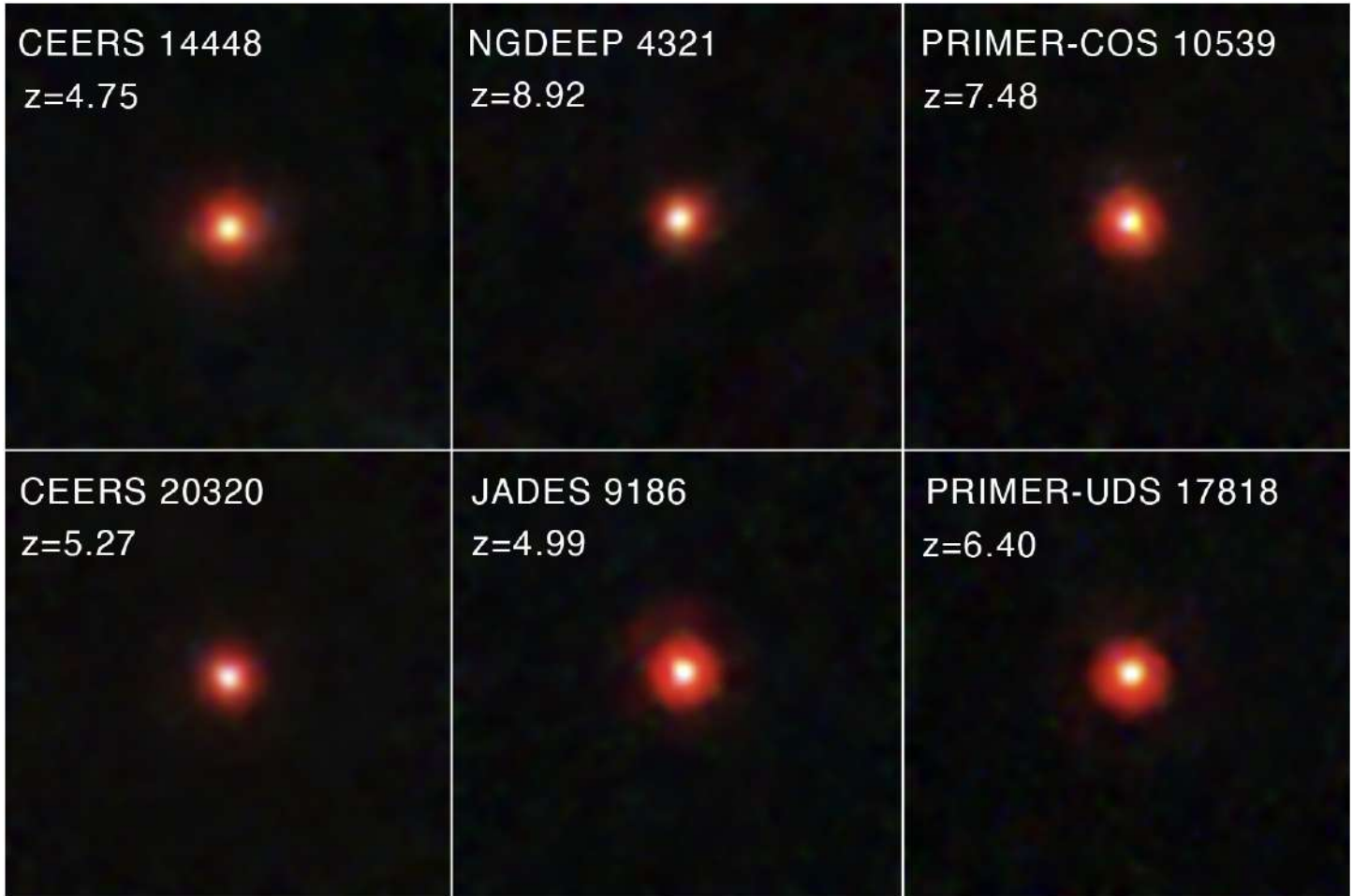
Credit: Illustration created by NASA, ESA, Leah Hustak (STScI)

The JWST is equipped with infrared sensors, allowing it to detect ancient light that has been redshifted into the mid- to far-infrared range. The discovery of LRD galaxies is a result of our recent ability to observe distant objects at these wavelengths. The light from these objects was emitted over 12 billion years ago.



Credit: Illustration created by NASA, ESA, Leah Hustak (STScI)

LRDs emerged approximately 600 million years after the Big Bang. The population of these galaxies rapidly declines after 1.5 billion years after the Big Bang.



Little Red Dots NIRCam image. Courtesy: NASA, ESA, CSA, STScI, Dale Kocevski (Colby College)

The z value in the images above provides us with information on how much this light has been redshifted, and as a result, how long the light has been traveling. A z value of 4 indicates that the light has been traveling for 12.094 billion years, while a value of 9 corresponds to 13.110 billion years.

Using a series of surveys from JWST, researchers determined that 70% of the LRDs showed evidence of gas rapidly orbiting at 2 million miles per hour. These speeds correspond to those of gas being accelerated in the accretion disk of an actively feeding supermassive black hole. As giant black holes 'feed' on matter, they emit massive amounts of electromagnetic energy from a very compact, bright region known as an active galactic nuclei (AGN).

AGNs are extremely bright. This new evidence helps explain much of the early light observed in LRD galaxies, which is coming from accreting black holes rather than stars. As a result, the lower rate of star formation aligns with current models of smaller, lighter galaxies, which can be explained by existing theories.

However, the formation of supermassive black holes in LRDs in the early universe raises more questions, such as why we don't see these objects closer to us and how they formed so quickly. The existing model doesn't support the formation of supermassive black holes within the first billion years after the Big Bang.

Research on a small handful of LRDs plotted the location of these galaxies in three-dimensional space to determine where they were situated in the early universe. The seven LRDs selected have light that has been traveling for 12.5 billion years and are all located in a region of space known as the cosmic web of galaxies.

The positions of galaxies within the cosmic web are influenced by their type. Larger, more developed galaxies are typically found in denser areas, where the web's strands intersect. In contrast, younger and less massive galaxies are generally located in lower-density regions, along the strands themselves. Researchers determined that the LRDs resemble low-mass galaxies based on their position.

This information suggests that supermassive black holes were forming in low-mass galaxies with a mass 100 million times that of our Sun. Prior models indicated that supermassive black hole formation was the result of mergers between increasingly massive black holes over a timescale of a billion years.

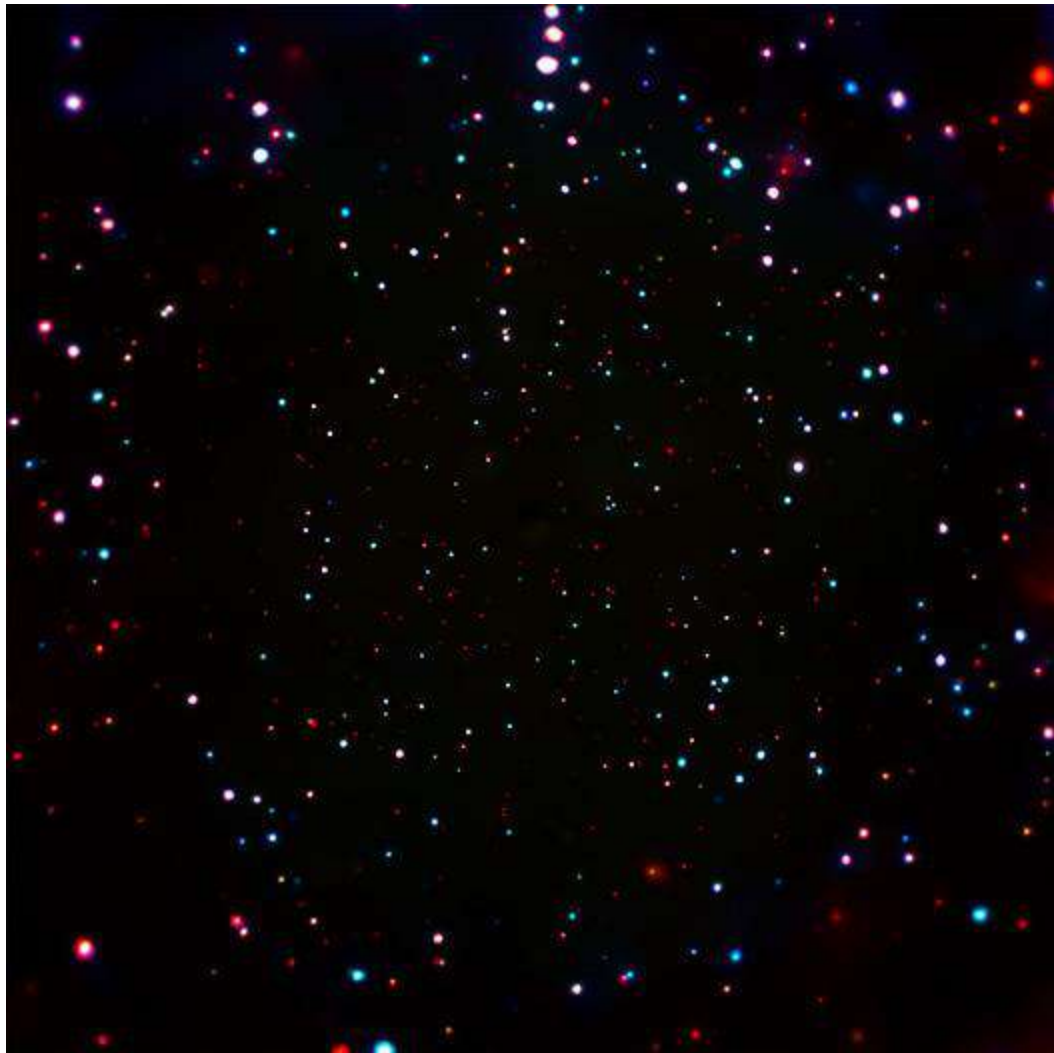
One possible explanation is that the high gas density present in LRD galaxies created an environment that allowed for much more rapid black hole growth. In turn, the higher density of gas led to the formation of massive stars, which eventually formed black holes. The result of the formation of a multitude of black holes was runaway black hole mergers, leading to the formation of supermassive black holes.

Currently, researchers need more data to analyze competing theories and determine more about the nature of LRDs, as well as uncover the insights they provide into the early universe.

However, LRDs are not the only exciting news about black holes.

Peter Boorman, a researcher at the California Institute of Technology in Pasadena and lead author of a recent article published in *The Astrophysical Journal*, said, 'If our eyes were able to detect X-rays, the sky would be full of dots. And every single one of those dots would be an accreting supermassive black hole.'

At the 245th meeting of the American Astronomical Society last month in National Harbor, Maryland, Boorman presented his team's findings on black holes. His research results indicate that the universe contains far more supermassive black holes that are actively consuming material than previously thought. Estimates suggest that 35 to possibly as high as 50% of these cosmic titans have been overlooked because they are hidden in clouds of dust, a phenomenon known as obscuration. Previous estimates indicated that as much as 15% of AGNs were hidden from view.



The deepest X-ray image of space captured by NASA's Chandra X-ray space observatory contains 5,000 feeding supermassive black holes. That number may actually be as high as 10,000; Chandra just can't see all of them. (Image credit: NASA/CXC/Penn State/B.Luo et al.)

Using data from NASA's Nuclear Spectroscopic Telescope Array (NuSTAR) spacecraft, researchers were able to detect infrared light coming from dust clouds that surround supermassive black holes. Even when obscured, the surrounding dust captures and re-emits this light as infrared radiation, indicating the presence of the black holes. As a result, these black holes are undetectable at other wavelengths.

Hunting for these hidden black holes can help researchers understand how black holes grow and provide clues about how they influence stellar formation in galaxies. Without the presence of a supermassive black hole, our own galaxy might be populated with more stars.

I believe that as we gain further insight into existing black holes, we will be able to better understand LRDs and their nature.

Resources:

[Newfound Galaxy Class May Indicate Early Black Hole Growth, Webb Finds - NASA Science](#)

[Supermassive black holes in ‘little red dot’ galaxies are 1,000 times larger than they should be - Space.com](#)

[Feeding supermassive black holes are more common than thought across the universe - Space.com](#)

[Redshift - Las Cumbres Observatory](#)

Night Sky Network Online Webinar

NASA [Night Sky Network](#) on Tuesday, February 25, at 9:00 PM Eastern along with Joseph DePasquale, to learn about the James Webb Space Telescope and the two-plus years of exciting results we’ve received here on Earth.

In this talk, Joseph DePasquale, Principal Science Visuals Developer, will discuss the process of creating these captivating images and the role of both art and science in revealing the beauty of the infrared universe.

Joe DePasquale serves as the Principal Science Visuals Developer in the Office of Public Outreach at the Space Telescope Science Institute in Baltimore, MD. His role combines both scientific knowledge and artistic skills to transform data from the Hubble and James Webb Space Telescopes into vibrant, high-quality images of the universe. Prior to joining STScI in 2017, Joe spent 16 years as the Science Imager for NASA’s Chandra X-ray Observatory at the Smithsonian Astrophysical Observatory, following his studies in Astronomy & Astrophysics at Villanova University. With a strong foundation in astronomy, art, and photography, Joe has the expertise to create visually captivating representations of complex astronomical data.

If you want a reminder of when this will be live, you can visit the website and set up a notification alert.

NASA Night Sky Notes, February 2025



This article is distributed by NASA's Night Sky Network (NSN).

The NSN program supports astronomy clubs across the USA dedicated to astronomy outreach. Visit nightsky.jpl.nasa.gov to find local clubs, events, and more!

February's Night Sky Notes: How Can You Help Curb Light Pollution?

By Dave Prosper
Updated by Kat Troche



Before and after pictures of replacement lighting at the 6th Street Bridge over the Los Angeles River. The second picture shows improvements in some aspects of light pollution, as light is not directed to the sides and upwards from the upgraded fixtures, reducing skyglow. However, it also shows the use of brighter, whiter LEDs, which is not generally ideal, along with increased light bounce back from the road. Image Credit: [The City of Los Angeles](https://www.cityoflosangeles.org/)

Light pollution has long troubled astronomers, who generally shy away from deep sky observing under full Moon skies. The natural light from a bright Moon floods the sky and hides views of the Milky Way, dim galaxies and nebula, and shooting stars. In recent years, human-made light pollution has dramatically surpassed the interference of even a bright full Moon, and its effects are now noticeable to a great many people outside of the astronomical community. Harsh, bright white LED streetlights, while often more efficient and long-lasting, often create unexpected problems for communities replacing their older streetlamps. Some notable concerns are

increased glare and light trespass, less restful sleep, and disturbed nocturnal wildlife patterns. There is increasing awareness of just how much light is too much light at night. You don't need to give in to despair over encroaching light pollution; you can join efforts to measure it, educate others, and even help stop or reduce the effects of light pollution in your community.

Amateur astronomers and potential citizen scientists around the globe are invited to participate in the [Globe at Night \(GaN\)](#) program to measure light pollution. Measurements are taken by volunteers on a few scheduled days every month and submitted to their database to help create a comprehensive map of light pollution and its change over time. GaN volunteers can take and submit measurements using multiple methods ranging from low-tech naked-eye observations to high-tech sensors and smartphone apps.

Globe at Night citizen scientists can use the following methods to measure light pollution and submit their results:

- Their own smartphone camera and dedicated app
- Manually measure light pollution using their own eyes and detailed charts of the constellations
- A dedicated light pollution measurement device called a Sky Quality Meter (SQM).
- The free GaN [web app](#) from any internet-connected device (which can also be used to submit their measurements from an SQM or printed-out star charts)

Night Sky Network members joined a telecon with Connie Walker of Globe at Night in 2014 and had a lively discussion about the program's history and how they can participate. The audio of the telecon, transcript, and links to additional resources can be found on their [dedicated resource page](#).



Light pollution has been visible from space for a long time, but new LED lights are bright enough that they stand out from older streetlights, even from orbit. Astronaut Samantha Cristoforetti took the above photo from the ISS cupola in 2015. The newly installed white LED lights in the center of the city of Milan are noticeably brighter than the lights in the surrounding neighborhoods. Image Credit: [NASA/ESA](#)

The [International Dark-Sky Association \(IDA\)](#) has long been a champion in the fight against light pollution and a proponent of smart lighting design and policy. Their website provides many resources for amateur astronomers and other like-minded people to help communities understand the negative impacts of light pollution and how smart lighting policies can not only help bring the stars back to their night skies but also make their streets safer by using smarter lighting with less glare. Communities and individuals find that their nighttime lighting choices can help save considerable sums of money when they decide to light their streets and homes "smarter, not brighter" with shielded, directional lighting, motion detectors, timers, and even choosing the proper "temperature" of new LED light replacements to avoid the harsh "pure white" glare that many new streetlamps possess. Their pages on [community advocacy](#) and on [how to choose dark-sky-friendly lighting](#) are extremely helpful and full of great information. There are even [local chapters of the IDA](#) in many communities made up of passionate advocates of dark skies.

The IDA has notably helped usher in "[Dark Sky Places](#)", areas around the world that are protected from light pollution. "[Dark Sky Parks](#)", in particular, provide visitors with incredible views of the Milky Way and are perfect places to spot the wonders of a meteor shower. These parks also perform a very important function, showing the public the wonders of a truly dark sky to many people who may have never before even seen a handful of stars in the sky, let alone the full glorious spread of the Milky Way.

More research into the negative effects of light pollution on the [health of humans](#) and the [environment](#) is being conducted than ever before. Watching the nighttime light slowly increase in your neighborhood, combined with reading so much bad news, can indeed be disheartening! However, as awareness of light pollution and its negative effects increases, more people are becoming aware of the problem and want to be part of the solution. There is even an episode of PBS Kid's [SciGirls](#) where the main characters help mitigate light pollution in their neighborhood!

Astronomy clubs are uniquely situated to help spread awareness of good lighting practices in their local communities to help mitigate light pollution. Take inspiration from [Tucson, Arizona](#), and other dark sky-friendly communities that have adopted good lighting practices. Tucson even reduced its skyglow by 7% (as of 2018) after its own [citywide lighting conversion](#), proof that communities can bring the stars back with smart lighting choices.

Originally posted by Dave Prosper: November 2018

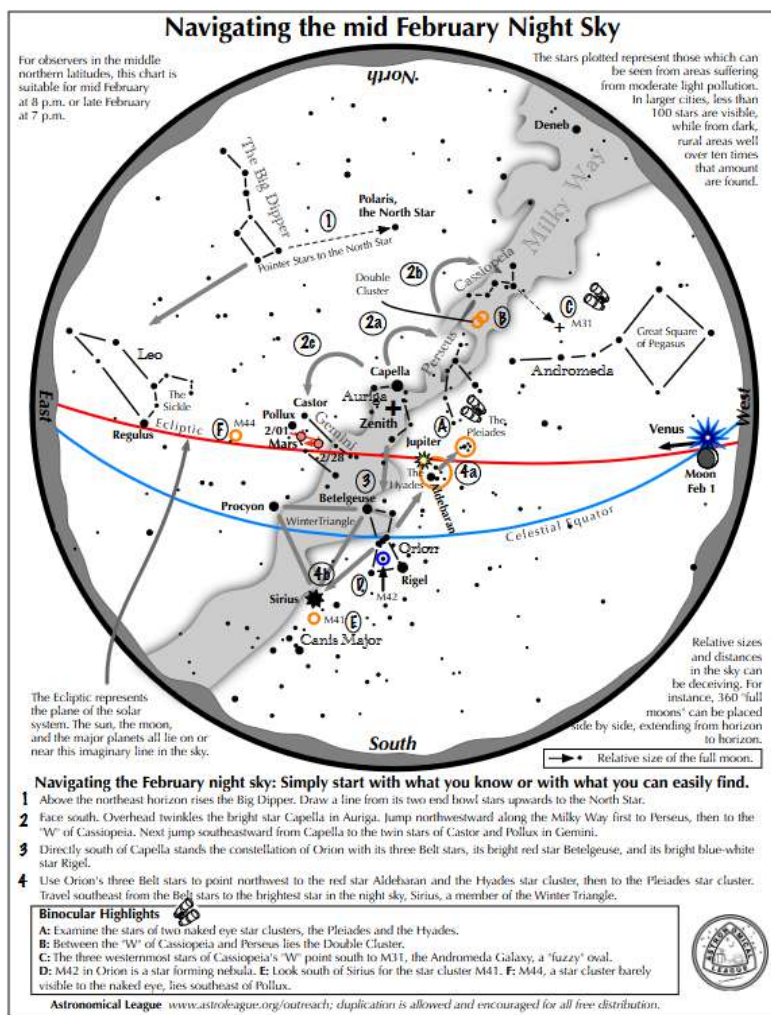
Last Updated by Kat Troche: January 2025

Observing

To find out skywatching tips for this month, click on the following links (in blue and underlined) to learn more.

Video: [What's Up February 2025 Sky Watching Tips from NASA](#)

Click link for a larger image [February 2025](#)



You may find past issues of the Astronomical League charts [here](#).

Astronomical League Observing this Month

This is a slight change from prior newsletter's due to the inability to locate this information on the NSN website this month. Instead, I urge you to go to the Astronomical League's website and view their monthly resources.

This month be sure to see [Mercury, Venus, and the Moon](#).

Mercury, Venus, and the young moon in the evening twilight

View through 10x50 binoculars on February 28

Mercury

Crescent Moon

Mercury

Mercury appears about "1 fist width on a fully extended arm" above the true western horizon forty minutes after sunset.

West

**February 28 and March 1, 2025:
Mercury and the young crescent moon
forty minutes after sunset in the west**

- Using binoculars, look on February 28 for the very thin crescent Moon floating above Mercury. Can you see Earthshine on the Moon's dark side or is the twilight too bright?
- On the next evening, Mercury is in the same place, but the moon has moved to higher and closer to brilliant Venus. Earthshine should be more easily visible.

The young moon & Mercury in the evening twilight

Have you ever spotted Mercury? Many stargazers have not. The early evening on February 28 presents a good opportunity to catch the elusive little planet. Look low into the western twilight forty minutes after sunset.

Be sure to check out the [crescent of Venus this month](#).

