# NWASNEWS

Volume28 Issue 1

September 2022

**Newsletter for the Wiltshire, Swindon, Beckington, Bath Astronomical Societies**


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## Hall meetings now the norm...

Firstly it will be great to have a full season of speakers and based at the common meeting ground at the Lye Pavilion Hall in Seend (Rusty Lane). A narrow entrance to the hall doors but parking is available.

While tonight's speaker is in person (Mark Radice, who used to be a member when he lived and worked closer to us), and a regular speaker too, we hope to connect with some some speakers by Zoom, but also hold these in the hall, though some may be able to access these talks by sign in process, especially those who are abroad (Mike Alexander for one).

But I would like some helping setting up a remote wifi unit we can use as a hub to connect in, and I'll need to do this for the October meeting when Paul Money is our speaker.

Zooming in is one way to keep our costs down with some more distant speakers, and our hall costs at the moment are staying the same but may have to go up part way through the year as expenses for electricity increase. Hopefully this will be covered by meeting fees, but Sam is working on online payment methods for meetings to BUT for fire regulations you will still have to sign in.

Our treasurers are changing over during the year and Bob will be taking a back seat after 29 years in that role. Thank you very much for your service, though you are absent tonight.

I must confess I am trying to retire from chairman role if anyone would like to step in. I thought I had ducked out five years ago, but it was not to be. We do need the younger members to take hold of the society and move it in the direction they want it to go now we are through the Covid issues. It has not gone away, but at least we have vaccines to help.

In the Bath Society section you will see an announcement for an online event, Go Stargazing, and I am giving one of the opening talks. It is on 2nd October beginning at 4:00pm for two hours.

You are welcome to join in. It has been put together by a consortium of Societies from Cardiff, Bristol and Bath and they will be advertising our viewing evenings in their pages online.

They are still discussing various details (as committees are apt to do but it should be a worthy session, especially for beginners.

Chris Brookes has put together a list of dates for monthly observing sessions including alternative dates for cloudy postponements, but these proved very successful last year and most months got some observing done.

Thank you again Peter for your efforts setting up speakers, and Sam for the Web site and taking on treasurer duties. Hopefully Rebecca will syep in for hall monitor duties and we have volunteers for tea and coffee making (I have milk and coffee for tonight… plus biscuits and tea)...

Andy

The Milky Way from Alton Barnes/Pewsey Downs car park.
The summer brought us so many clear warm nights and the Milky Way will be with us through to October as the darkness matches the progression of the season for a for months at least.
But Orion and Sirius ) the opposite side of our galaxy centre are all ready in our pre dawn skies.
10mm Fish eye, 30 seconds exposure, tripod mount only.
Andy Burns.

# Wiltshire Society Page


**Wiltshire Astronomical Society**

**Web site: www.wasnet.org.uk**

**Facebook members page:** https://www.facebook.com/groups/wiltshire.astro.society/

**Meetings 2020/2021.**

**HALL VENUE the Pavilion, Rusty Lane, Seend**

**Some Speakers have requested Zoom Meetings we will try to hold these at the hall**

**Meet 7.30 for 8.00pm start**

**SEASON 2022/23**

6 Sep Mark Radice Observing the Deep Sky
4 Oct Paul Money The Trials & Tribulations of Voyager (zoom meeting)
1 Nov Chris Hooker The planet Mercury
6 Dec Martin Griffiths How the Moon was formed

**2023**

3 Jan Mike Alexander Heaven's on Earth (zoom meeting)
7 Feb Prof. David Southwood TBN
7 Mar Mary McIntyre Shadows in Space & the stories they tell
4 Apr Chris Starr Heavy Metal World
2 May Dr Paul A Daniels TBN
6 Jun Andrew Lound TBN

Mark Radice.

I am Mark Radice and I live near Salisbury Wiltshire, a few miles from the ancient site of Stonehenge. I have been active in Astronomy since watching Comet Hykutake cross the sky while working in Canada in 1996. This sparked off an interest that led me across the moon, through the solar system and out into deep space.

I enjoy visual observing, sketching, lunar and planetary imaging, solar observing and widefield photography. I am a generalist as I enjoy observing anything that is in the sky!

Most of my observing is done with a C11 on an EQ6 (a 280mm f10 Schmidt-Cassegrain) and a pair of 100mm APM binoculars from my roll off roof observatory. A 60mm Lunt H-alpha solarscope is also used in the daytime.

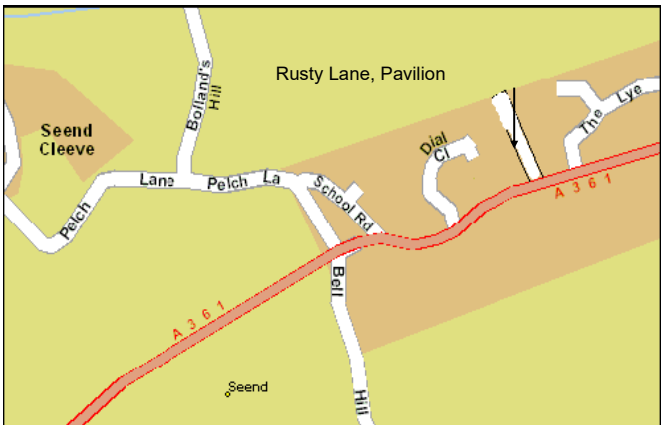
I am available to give Astronomy talks to schools, clubs etc. I have presented a number of talks to Astronomy clubs throughout the UK and the Kielder and Salisbury Star Parties. Please email me if you are interested: mark at refreshingviews dot com.

**Membership Meeting nights £1.00 for members £3 for visitors**

Members can renew or new members sign up online via https://wasnet.org.uk/membership/ and also remind them they can pay in cash too on the door.

**Wiltshire AS Contacts**

Andy Burns Chair, anglesburns@hotmail.com
Andy Burns Outreach and newsletter editor.
Bob Johnston (Treasurer)
Philip Proven (Hall coordinator)
??? (Teas and Projector)
Peter Chappell (Speaker secretary)
Nick Howes (Technical Guru)
Observing Sessions coordinators: Chris Brooks, Jon Gale,
Web coordinator: Sam Franklin
Contact via the web site details.

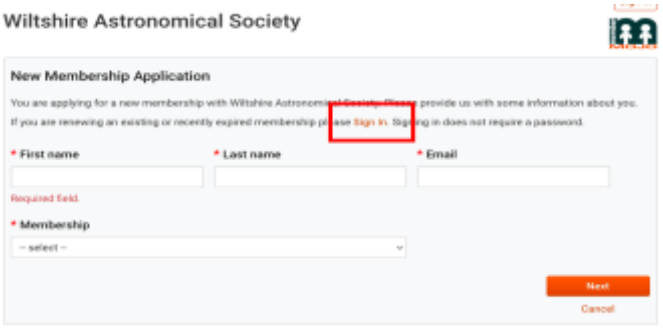



## Observing Sessions see back page

An email reminder will be sent out early in the week of the first meeting opportunity with a second 'go/no-go' email sent by 4pm on the observing day. If its a 'no-go' we will try the second opportunity date a week later using the same notification method so keep an eye for them in your inbox each month.
However, sometimes the weather beats us, in which case we have to defer to the first observing opportunity in following month.

We have members who enjoy simple visual observing with very little equipment to others who have lots of 'toys', as well as those who just like to chat among fellow enthusiasts. If you have your own equipment then do feel free to bring it along. If you would like to learn how to set equipment up then let us know in advance and we can meet up a little earlier and take you through it.

Sessions do vary in length due to the weather and sometimes enthusiasm, but the stalwarts tend to be the last to leave making sure everything is tidied up and nobody has left anything behind.



# Swindon Stargazers

## Swindon's own astronomy group

**Physical meetings continuing!**

Following the relaxation of the Covid rules we are continuing physical meetings.

**Next meeting: Kate Earl**

Secret stowaways: From the poignant to the peculiar, a history of hidden objects on planetary spacecraft

Humans have become so technologically advanced that we can send spacecraft off to the far reaches of the solar system, retrieve samples from asteroids and comets, and design small helicopters that can fly in the tenuous Martian atmosphere. These craft are adorned with equipment that show our technical prowess and capabilities, but interestingly we seem unable to leave our jocular and sentimental natures behind, and have a habit of tucking away secret objects into the deep, dark recesses of spaceships. Some are poignant, such as dedications to lost crew members; some are fun, such as Lego models and hidden codes; and some are even a little risqué! Maybe it is these profoundly human afterthoughts that demonstrate more about who we are as a species than the primary scientific equipment sent to perform cutting-edge technological feats.

To find out more, join Kate for this light-hearted talk on hidden away secrets, and the reasons why scientists and explorers simply can't resist such personal additions.

Kate is a geologist who has a passion for astronomy, and endeavours to make astronomy more accessible to the general public.

**Ad-hoc viewing sessions**
Regular stargazing evenings are organised near Swindon. The club runs a WhatsApp group to notify members in advance of viewing sessions, usually at short notice. Anyone can call a meeting. To join these events please visit our website on the link below.

Membership of Swindon Stargazers is required for insurance purposes (PLI)

Lately we have been stargazing at Blakehill Farm Nature Reserve near Cricklade, a very good spot with no distractions from car headlights.

We often meet regularly at a lay-by just outside the village of Uffcott, near Wroughton. Directions are also shown on the website link below.

Information about our evenings and viewing spots can be found here:

http://www.swindonstargazers.com/noticeboard/noticeboard06.htm

**Meetings at Liddington Village Hall, Church Road, Liddington, SN4 0HB – 7.30pm onwards**

The hall has easy access from Junction 15 of the M4, a map and directions can be found on our website at:

http://www.swindonstargazers.com/clubdiary/directions01.htm

**Friday, 16 September 19.30 onwards**

Programme: Kate Earl - Secret Stowaways

**Friday, 21 October 19.30 onwards**

Programme: Mark Radice - Deep Sky Observing

**Friday, 18 November 19.30 onwards**

Programme: Richard Fleet - The Winchcombe Meteorite

**Friday, 9 December 19.30 onwards**

Programme: Christmas Social

**Website:**

**http://www.swindonstargazers.com**

Chairman: Robin Wilkey

Tel No: 07808 775630
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Address: 61 Northern Road
Swindon, SN2 1PD

Secretary: Hilary Wilkey

Tel No: 01793 574403
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## BECKINGTON ASTRONOMICAL SOCIETY

Society Details & Speakers programme can be found on our Website www.beckingtonas.org

General enquiries about the Society can be emailed to chairman@beckingtonas.org.

**Our Committee for 2016/2017 is**

Chairman: Steve Hill (email chairman@beckingtonas.org)
Treasurer: John Ball
Secretary: Sandy Whitton
Ordinary Member: Mike Witt

People can find out more about us at www.beckingtonas.org

Meetings take place in Beckington Baptist Church Hall in Beckington Village near Frome.

See the location page for details of how to find us on our website……

Post Code for Sat Nav is BA11 6TB.

Our start time is 7.30pm No hall meetings.

## STAR QUEST ASTRONOMY CLUB

This young astronomy club meets at the
Sutton Veny Village Hall.
Second Thursday of the Month.
Meet at Sutton Veny near Warminster.

## BATH ASTRONOMERS

# Free online event: Stargazing for Beginners

Sunday 2nd October 2022 from 16:00pm to 18:00pm

Have you ever looked up at the night sky and wanted to find out more but weren't sure where to start?

The Bristol, Cardiff, and Bath Astronomical Societies are here to help! They've teamed up to give aspiring stargazers the best possible start with a fascinating series of talks aimed at absolute beginners.

Over just two hours, you'll discover how to see constellations of stars using nothing but your eyes, receive tips on choosing and using telescopes to explore further, learn how to take your photos of the night sky and find out the best targets for stargazers to observe over the coming months.

Attendance is online, free of charge, and open to all (recommended age 10+). Please reserve your space via the Eventbrite website.

In addition, the online event will be followed up by a series of practical stargazing events hosted by the three collaborating Societies, which will be featured here when dates have been announced.

# Programme

**Eyes to the skies!**
*Taking your first steps into the world of stargazing, by Andy Burns*

Join experienced stargazer Andy Burns for a session helping you discover the wonderful hobby of astronomy. If you've ever wanted to track down a constellation, see a meteor shower, or just understand a little more about what's out there, then this talk will be perfect for you.

**So, you want a telescope?**
*Top tips for choosing one that's right for you, by Ryan Parle*

Most stargazers want a telescope sooner or later, but with a dizzying array on offer, where to start? Telescope guru Ryan Parle will outline the different types of telescopes, what to look out for, and how to choose an instrument that will give you years of enjoyment — whatever your budget!

**Astrophotography 101**
*How you can take photos of the night sky, by Lee Pullen*

Camera technology is now more advanced than ever, and beginners can take stunning astrophotos. Urban Astrophotographer Lee Pullen will talk through how to take your very first photo of the stars, and outline the next steps if you get bitten by the astrophotography bug!

**Journey through the night sky**

*Highlights for the year ahead (autumn and early winter), by Jane Clark*

Seasoned stargazer Jane Clark will be your guide to the night sky, giving a tour of the best things to see over the coming months. Discover where and when to see the planets Mars, Jupiter, and Saturn, as well as bright constellations of stars and exciting cosmic marvels in deep space.

# SPACE NEWS TO SEPTEMBER 22

## Remember That Rocket That was Going to Crash Into the Moon? Scientists Think They've Found the Crater

The Lunar Reconnaissance Orbiter (LRO) – NASA's eye-in-the-sky in orbit around the Moon – has found the crash site of the mystery rocket booster that slammed into the far side of the Moon back on March 4th, 2022. The LRO images, taken May 25th, revealed not just a single crater, but a double crater formed by the rocket's impact, posing a new mystery for astronomers to unravel.

Why a double crater? While somewhat unusual – none of the Apollo S-IVBs that hit the Moon created double craters – they're not impossible to create, especially if an object hits at a low angle. But that doesn't seem to be the case here. Astronomer Bill Gray, who first discovered the object and predicted its lunar demise back in January, explains that the booster "came in at about 15 degrees from vertical. So that's not the explanation for this one."

Before and after photos at the location of the newly formed craters. Before image acquired 2022-02-28; after image acquired 2022-05-21. Credit: NASA/GSFC/Arizona State University.

The impact site consists of an 18-meter-wide eastern crater superimposed on a 16-meter-wide western crater. Mark Robinson, Principal Investigator of the LRO Camera team, proposes that this double crater formation might result from an object with distinct, large masses at each end.

"Typically a spent rocket has mass concentrated at the motor end; the rest of the rocket stage mainly consists of an empty fuel tank. Since the origin of the rocket body remains uncertain, the double nature of the crater may help to indicate its identity," he said.

So what is it?

It's a long story. The unidentified rocket first came to astronomers' attention earlier this year when it was identified as a SpaceX upper stage, which had launched NASA's Deep Space Climate Observatory (DSCOVR) to the Sun-Earth L1 Lagrange Point in 2015. Gray, who designs software that tracks space debris, was alerted to the object when his software pinged an error. He told the Washington Post on January 26th that "my software complained because it couldn't project the orbit past March 4, and it couldn't do it because the rocket had hit the Moon."

Gray spread the word, and the story made the rounds in late January – but a few weeks later, he received an email from Jon Giorgini at the Jet Propulsion Lab (JPL). Giorgini pointed out that DSCOVR's trajectory shouldn't have taken the booster anywhere near the Moon. In an effort to reconcile the conflicting trajectories, Gray began to dig back into his data, where he discovered that he had misidentified the DSCOVR booster way back in 2015.

SpaceX wasn't the culprit after all. But there was definitely still an object hurtling towards the Moon. So what was it?

Wide view of the double crater and its surroundings. Image width: 1100 meters. Credit: NASA/GSFC/Arizona State University.

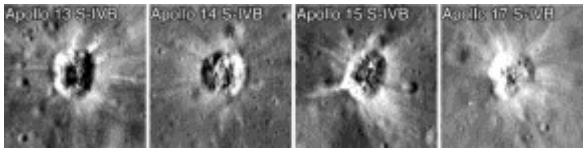
A bit of detective work led Gray to determine it was actually the upper stage of China's Chang'e 5-T1 mission, a 2014 technology demonstration mission that lay the groundwork for Chang'e 5, which successfully returned a lunar sample to Earth in 2020 (incidentally, China recently announced it would follow up this sample return mission with a more ambitious Mars sample return project later this decade). Jonathan McDowell offered some corroborating evidence that seemed to bolster this new theory for the object's identity.

The mystery was solved.

Except, days later, China's Foreign Minister claimed it was not their booster: it had deorbited and crashed into the ocean shortly after launch.

As it stands now, Gray remains convinced it was the Change 5-T1 booster that hit the Moon, proposing that the Foreign Minister made an honest mistake, confusing Chang'e 5-T1 with the similarly named Chang'e 5 (whose booster did indeed sink into the ocean).

As for the new double crater on the Moon, the fact that the LRO team was able to find the impact site so quickly is an impressive feat in itself. It was discovered mere months after impact, with a little help from Gray and JPL, who each independently narrowed the search area down to a few dozen kilometers. For comparison, The Apollo 16 S-IVB impact site took more than six years of careful searching to find.




LRO images of Apollo-era S-IVB impact sites, none of which feature the double crater features seen at the March 4 2022 impact site. Credit: NASA/GSFC/Arizona State University.

Bill Gray's account of the booster identification saga is here, as well as his take on the double crater impact. The LRO images can be found here.

Feature Image Credit: NASA/GSFC/Arizona State University.

**The first image taken by the James Webb Space Telescope**, Credit: NASA, ESA, CSA, and STScI

**POSTED ONJULY 11, 2022 BY MATT WILLIAMS**

Behold, the James Webb Space Telescope's First Image! On December 25th, 2021, the *James Webb Space Telescope* launched on an Ariane 5 rocket bound for space. After many years of delays, retesting, and cost overruns, the next-generation observatory made it to orbit without any hiccups or complications. What followed was several weeks of deployment as Webb unfolded its arms, sunshield, primary mirror (consisting of eighteen gold-coated beryllium segments), and secondary mirror. By late January, the space telescope had flown to the Sun-Earth L2 Lagrange Point, where it will remain for the entirety of its mission.

For the past six months, Webb has been collecting its "first light," which consisted of the deepest field images ever taken, galaxies, the Carina Nebula, and a nearby exoplanet and its atmosphere. The majority of these images will be released starting tomorrow morning (Tuesday, July 12th). To give us a taste of what we are in for, President Joe Biden, Vice President Kamala Harris, NASA Administrator Bill Nelson, and other officials revealed the first of these images today during a White House press conference. The entire event was live-streamed by NASA TV and (as promised) was mind-blowing!

The event kicked off shortly after 06:00 PM EDT (03:00 PDT), with VP Harris – who is also the head of the National Space Council (NSC) – providing a historical recap. This included how the deployment of the first orbiting observatory, the Hubble Space Telescope, had provided new views into the Universe and how international cooperation had made the *James Webb* possible. Things then transitioned to Biden thanking Administrator Nelson and lauding the accomplishments of the space agency.
Things then culminated with Nelson presenting the "highest-resolution image of the Universe ever taken by the most powerful telescope ever taken." Amid applause, Nelson explained how the image was a "tiny speck of the Universe" that featured galaxies and gravitational lensing contained within the space of "a grain of sand held at arm's length." This phenomenon occurs when massive objects in space (such as galaxies and galaxy clusters) alter the curvature of spacetime and cause light to bend and become amplified around them.
The number of gravitational lenses in this image is (quite frankly) amazing and can be identified by looking for sections that appear to be "warped." As Nelson explained, the galaxies in this image appear as they did 13 billion years ago, making them some of the oldest light in the Universe. He added that *Webb* would be looking even farther back to study the earliest galaxies that existed just a few hundred million years after the Big Bang. Nelson also remarked that Webb would obtain spectra from exoplanet atmospheres (like the images of WASP-96 b, to be released tomorrow) and how this will aid in the search for life beyond our Solar System.
As he stated in summary, the potential for scientific discovery that *Webb* will provide is immeasurable. "We will be able to answer questions where we don't even know what the questions are," he said. But of course, it will answer questions that astronomers have been pondering for decades, such as the role played by the elusive Dark Matter and Dark Energy, what the center of our galaxy looks like, how star systems form, and whether or not humanity is alone in the Universe.
The other first images will be released starting at 09:45 AM EDT (06:45 AM PDT) tomorrow. These were first shared during a conference with NASA officials on Saturday, July 2nd. According to a NASA statement released shortly thereafter, the experience of witnessing these images for the first time was so powerful that Thomas Zarbuchen – Associate Administrator for NASA's Science Mission Directorate (SMD) – and others were ]almost "brought to tears"!
This event will also be live-streamed via NASA TV and shared via Facebook, Twitter, YouTube, Twitch, and Daily Motion.

Stay tuned! Things are about to get seriously astronomical in here! And you can check out the briefing recap on NASA TV's Youtube channel.
*Further Reading: NASA*

## Astronomers Have Digitized 94,000 Photographic Plates of the Night sky, Going Back 129 Years

Since the early days of the internet, and even computers more generally, there has been a push to collect all of the world's information, built up over thousands of years, into a digital form so it can at least theoretically latest indefinitely. It also makes that information much more accessible to people interested in it. That was the motto of the original Google search engine, and specialists in various historical fields have been making slow but steady progress in doing just that over the past few decades. Now astronomy has gained one of its largest hauls of historical data as the Friedrich-Alexander University of Erlangen-Nuremberg has digitized 40,000 of its historical astronomical plates, along with 54,090 plates from other sources.

## A Satellite had to Dodge Space Junk as it was Raising its Orbit to Avoid Solar Activity

The phrase "when it rains, it pours" is commonly used in the US to denote that bad things usually happen simultaneously. And it doesn't only have to apply to things that happen where it can physically rain. Recently an ESA satellite had a series of bad things happen that could potentially have happened to it, but quick action from the team responsible for the satellite avoided two what could have been catastrophic

events.
Swarm, the satellite system that had a terrible day recently, is actually composed of three satellites A (Alpha), B (Bravo), and C (Charlie). To perform their mission of studying Earth's magnetic field, the three satellites must fly in close coordination and maintain distance from one another. So there was a bit of panic when the Swarm team got notice that Alpha had a very high likelihood of getting hit by an unknown piece of space debris in less than eight hours.
Avoiding space debris is common among all satellites – on average, an ESA satellite has to dodge about two pieces per year, with many, many more potential warnings coming down the pipeline from ESA's Space Debris Office and the US Space Surveillance Network. Usually, those warnings come with at least 24-hour notice, so an eight-hour timeline was much tighter than usual.
Part of the reason that time crunch matters is how difficult it is to pick where and how to dodge. Considerations like other potential collisions, fuel consumption, the safe distance needed from the debris, and many other factors are all included in the decision-making process. Making those decisions in a few hours would be stressful for anybody.
On top of that already shortened timeline, Swarm was already undergoing a series of orbital correction maneuvers to avoid another potential hazard – Earth's own atmosphere. Swarm has been residing in an orbit that is exceptionally responsive to differences in solar activity. When there are more sunspots, the atmosphere around Swarm gets "thicker," slowing the craft down.
Right now, the Sun is undergoing an increase in solar activity as part of one of the spikes in its solar cycle, creating more drag for Swarm than it had previously been affected by. Over the medium term, this could have caused Alpha and Charlie to switch places in their orbits, effectively stopping the mission from being able to collect data. Even worse, if left unchecked, the satellites themselves could have been slowed enough to a point where they were wholly dragged out of the sky.

Artist's depiction of Swarm is in its multi-satellite configuration. Credit – ESA – P. Carril
One of the 25 maneuvers planned to avoid this fate for Alpha was to take place only a few hours after the satellite was forced to dodge this incoming debris. The impeding dodge put a hold on that step in the process, but holding off for too long would cause issues in maintaining satellite formation.
So the ESA engineers and scientists did what engineers and scientists occasionally have to do when projects are threatened – they "got to work with a reaction time to rival an Olympic sprinter," according to a press release. They had planned and executed an orbital change within four hours to avoid the debris. Less than twenty-four hours later, they performed an updated maneuver to put Swarm back on track to get out of the slowly thickening atmosphere.
Avoiding space debris will only grow in importance to satellites, lest we become a civilization affected by Kessler syndrome. The technology and resources are in place to ensure that that doesn't happen. Now we must continue to utilize them correctly, no matter how bad the weather is.

James Webb's first images! Credit: NASA/ESA/CSA/STScI

**POSTED ON AUGUST 4, 2022 BY MATT WILLIAMS**

## Did you Want More Scientific Information About the First set of Images From JWST? Fill Your Boots

On July 12th, 2022, NASA and its partner agencies released the first *James Webb Space Telescope* (JWST) observations to the public. These included images and spectra obtained after Webb's commissioning phase, which included the most-detailed views of galaxy clusters, gravitational lenses, nebulae, merging galaxies, and spectra from an exoplanet's atmosphere. Less than a month after their release, a paper titled "The JWST Early Release Observations" has been made available that describes the observations and the scientific process that went into making them.

The EROs is a set of public outreach products created to mark the end of JWST's commissioning and the beginning of science operations. These products were chosen by the ERO Selection Committee, an international body formed in 2016 composed of members from NASA, the Canadian Space Agency (CSA), and the European Space Agency (ESA), with support provided by the Space Telescope Science Institute (STScI). The paper that describes the ERO was authored by researchers from the STScI, the Association of Universities for Research in Astronomy (AURA), and the Department of Physics & Astronomy at John Hopkins University.

As noted in a previous article (concurrent with the release), the first observations from the *Webb* mission included a deep field image of the SMACS J0723.3-7327 galaxy cluster and distant lensed galaxies, the merging galaxy group known as Stephan's Quintet, the Carina Nebula (NGC 3324), the Southern Ring planetary nebula (NGC 3132), and spectra obtained from the transiting hot Jupiter WASP 96b. The ERO describes how these targets were selected, which of Webb's instruments were used to study them, and what they revealed.

### Target Selection

In the first section of the paper, the authors state how these targets were selected in 2017 by the ERO Committee based on solicitations from the American Astronomical Society (AAS) and the JWST Science Working Group (SWG). From this, the ERO Committee selected a superset of targets based on existing data, particularly color images taken by the *Hubble* and *Spitzer Space Telescopes*. These, in turn, were evaluated based on their relevance to the JWST's four scientific themes: observations of the first galaxies that formed during the "Cosmic Dawn" period, how these galaxies have since evolved, the lifecycle of stars, and extrasolar planets.

The final targets were selected from these, with additional consideration for the major observation modes of JWST's four science instruments. These instruments make up the Integrated Science Instrument Module (ISIM) and in-

clude:
Near-Infrared Camera (NIRCam) provided by the University of Arizona
Near-Infrared Spectrograph (NIRSpec) provided by ESA, with components provided by NASA/GSFC.

Mid-Infrared Instrument (MIRI) provided by the European Consortium with the ESA and NASA Jet Propulsion Laboratory (JPL)

Fine Guidance Sensor/Near InfraRed Imager and Slitless Spectrograph (FGS/NIRISS) provided by the CSA

*"Finally, in early 2022, representatives from STScI's Office of Public Outreach joined the ERO Production Team to contribute expertise in graphics design, science writing, and news production," they write. "The JWST First Images and Spectra were created by Space Telescope Science Institute (STScI) staff between June 3 and July 10, 2022, from the first observation to the final delivery to NASA. In total, more than 30 people were involved in the production team, supported by the full commissioning and operations system for the JWST observatory."*

**SMACS J0723.3-7327**

This massive galaxy cluster is located about 4 billion light-years from Earth within the southern Volans constellation. This galaxy was observed many times by Hubble because of how it acts as a strong gravitational lens that magnifies the light of more distant, high-redshift galaxies in the background. From June 7th to 30th, the JWST conducted multi-object and wide-field slitless spectroscopy using its NIRSpec and NIRISS instruments, which were supported by multi-mode observations of the cluster and the surrounding field with NIRCam and MIRI.

*Deep Field Galaxy cluster SMACS J0723.3-7327, imaged by Hubble (left) and the JWST (right). Credit: NASA/ESA/CSA/STScI*

According to the paper, the aim of these observations was to demonstrate the ability of JWST to rapidly image high-redshift galaxies (those that are farthest from us) at a depth rivaling the most sensitive images acquired by the Hubble Deep Fields campaign. While Hubble could capture galaxies over 13 billion light-years distant, the improved sensitivity of the JWST allowed it to see very high-redshifted galaxies and fainter, redder galaxies that contain significant dust (which obscures their light). As the authors summarize:
*"The gravitationally lensed arcs both increase the richness of the background field, as well as offer a science narrative related to the use of gravitational lensing to magnify and enhance distant galaxies. The multi-object spectroscopy was intended to demonstrate emission-line signatures of star-forming galaxies, and illustrate to the public how redshifts (look-back time) can be measured to high precision by JWST. The NIRCam imaging was also used to create a catalog from which the NIRSpec MSA configuration could be constructed, following a workflow similar to that which future science programs would use."*

**Stephan's Quintet**

This collection of galaxies takes its name from French astronomer Édouard Stephan, who made the first recorded observation from the Marseille Observatory in 1877. It consists of at least four individual large galaxies at an average distance of 288.9 million light-years (which appear to be actively merging). The fifth galaxy (NGC7320) is not interacting and is instead in an apparent chance alignment with the group – where they look like they are merging relative to the observer but are actually very far apart. This galaxy group was viewed multiple times between June 11th and 20th using multiple instruments – including NIRCam, MIRI, and NIRSpec.

According to the paper, these observations aimed to illustrate the energetic interactions that occur in a compact group of merging galaxies. This same group was previously imaged by *Spitzer* using its IR instruments, but Webb's improved sensitivity provided images that were far more detailed. In particular, mid-infrared observations showed how Stephan's Quintet is characterized by large-scale shock waves at the point where two of the galaxies (NGC 7318 and NGC 7319) are interfacing. Furthermore, they showed that AGC 7319 harbors a bright Seyfert 2 Active Galactic Nucleus (AGN) associated with a strong, extended radio jet emanating from its poles.

*Stephan's Quintet, as imaged by Hubble (left) and the JWST (right). Credit: NASA/ESA/CSA/STScI*

**Carina Nebula**

Next up, there's the image of the "Cosmic Cliffs," an ionized bubble formed by hot young stars near the easter edge of the star-forming Carina Nebula (NGC 3324). Located approximately 8,500 light-years from Earth in the Carina–Sagittarius Arm of the Milky Way galaxy, this feature is one of several that became iconic thanks to previous images acquired by Hubble. Once again, the JWST provided images of superior quality thanks to its advanced IR suite, which provided a more detailed view of this star-forming region.
The JWST focused on the eastern edge because it was expected to show the sharpest ionization boundary and the greatest brightness and color contrast (based on images previously provided by *Spitzer*). Webb observed this area twice on June 3rd with its NIRCam and three times on June 11th with its MIRI camera. The combined image captures a landscape view of the bubble in near- and mid-infrared, highlighting the contrast between the ionized (hotter) and molecular (cooler) gas. It also revealed previously-unseen newborn stars and the interaction between solar wind and gas clouds.

*The "Cosmic Cliffs" feature in the Carina Nebula, as imaged by Hubble (top) and the JWST (bottom). Credit: NASA/ESA/ CSA/STScI*

**Southern Ring**

The "Southern Ring" (NGC 3132), a young planetary nebula located about 2,000 light-years from Earth, was another target of the ERO. It contains a visual binary star consisting of a bright, main-sequence A (blue-white) star and a young white dwarf. The latter star is the source of the nebula, which it created after experiencing gravitational collapse and shedding its outer layers, and is also the ionizing source. This nebula was selected to demonstrate the JWST's ability to observe the full lifecycle of stars. To this end, the JWST observed the nebula twice on June 3rd using its NIRCam and again on June 12th using its MIRI instrument.

These images offered a much-improved look at the Nebula (compared to a previous image obtained by *Spitzer*). In the NIRCam image, the main-sequence star appears brighter, while the white dwarf is partially hidden by a diffraction spike. In the MIRI image, the white dwarf appears brighter, larger, and redder due to a visual effect caused by the thick layers of dust surrounding it (which absorb heat from the star and radiate it in the mid-infrared). This way, the combined near- and mid-infrared data reveals a great deal more about the structure of the nebula and the interaction between binaries and nebular gases.

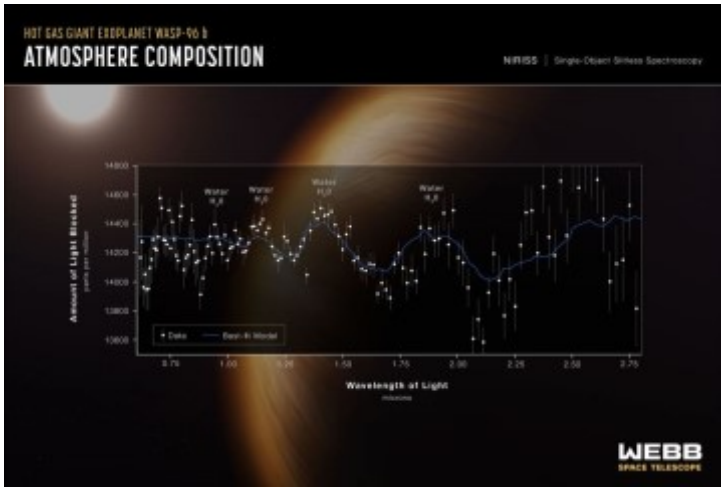
As indicated in the paper, the two images also revealed spectra, which tells us more about the composition of the nebula. "[T]he NGC3132 nebula is characterized by hydrogen recombination lines, lines from highly ionized atomic species ([Ar III], [S IV], [Ne II], and [S III]), and $H_2$ rovibrational and rotational lines," they wrote. "The intrinsic morphology of the nebula is likely bipolar, but viewed close to pole-on."

*The Southern Ring Nebula in near-infrared light (left) and mid -infrared light (right) from NASA's James Webb Space Telescope. Credit: NASA/ESA/CSA/STScI*

**WASP-96b**

As noted, one of the JWST's main objectives is the characterization of exoplanet atmospheres, which will help astronomers place tighter constraints on their habitability. Located about 1,000 lights away, this hot gas giant was selected as a target because of its mass, orbital period, and that it routinely transits its parent star relative to Earth. The purpose of these observations was to obtain a transmission spectrum of the planet that would investigate the presence of water, which was previously detected by Hubble. This was further intended to show how *Webb* can gather transmission spectra that will lead to the characterization of atmospheres.

During a transit that took place on June 21st, 2022, the JWST conducted Single Object Slitless Spectroscopy (SOSS) observations using its NIRISS instruments. This time-series observation mode is optimized to obtain spectra of transiting exoplanet systems that require extremely high precision and spectrophotometric stability. Instrumental stability is especially important because the spectrum of the exoplanet atmosphere must be separated from the spectrum of the host star, which is done by subtracting or dividing spectra obtained at different orbital phases. As expected, the JWST's observations revealed a significant presence of water vapor in this exoplanet's atmosphere.




*A transmission spectrum based on data acquired by Webb's Near-Infrared Imager and Slitless Spectrograph (NIRISS). Credit: NASA, ESA, CSA, STScI*

**Data Processing and Visuals**

The authors also detail how the ERO observations were processed and calibrated, depending on the instrument and image. All observations were processed using the JWST Pipeline5 – a Python-based library used to share Webb's observations with the scientific, academic, and citizen scientist communities. As the authors explain, this pipeline consists of three stages, "starting from the raw uncalibrated files, through to fully calibrated exposures, and ending with full combined mosaics."

A few steps were customized to improve the quality of the resulting images and data products. These include correcting for low-level electronic noise that the then-current version of the pipeline (version 1.5.2) didn't account for. Similarly, many of NIRCam's observations needed to be corrected to take into account the positions and proper motion (astrometry) of its targets. In the case of stars captured in Webb's image field, Gaia's Third Data Release (DR3) was used to correct for uncertainties caused by star catalog errors and roll uncertainty.

For some images, a small number of extra processing steps had to be applied to improve the quality of the final mosaics, like correcting for instrumental background noise and subtracting artifacts caused by very bright sources. The process of producing color images from the JWST data was similar to that used with other observatories (like *Hubble*). But as the paper notes, the capabilities of the JWST offered a wider range of color options due to its broad IR imaging capabilities:

*"A key objective was to develop a striking translation of infrared colors to the visible color space, using physical and chemical tracers not available in the Hubble range. While previous infrared telescopes, such as Spitzer, made great strides in this direction, JWST offers many more filters, resulting in a much greater number of potential color combinations. The final color images represent one option out of many possible, for a wide range of different types of object, from the deep universe, where more distant or dusty galaxies naturally appear red using a range of broadband filters, to a planetary nebula entirely dominated by non-thermal line emission from molecular, atomic, and ionized gas."*

They also describe how scaling was achieved using fitsliberator12 and PixInsight software and how noise suppression and artifact removal were accomplished through PixelClip.js image-processing algorithms. They also applied "chromatic ordering" – where color was assigned to represent different wavelengths of light – to achieve a color balance that offered the "best trade-off between science and aesthetics." In short, this means that shorter wavelengths were prescribed a bluer color while longer wavelengths were represented in a redder color. They also used star cores in the images to perform "white balancing," a technique that ensures the colors correspond to the proper wavelength.

All of the information regarding the ERO and the process of bringing the first JWST images to the public can be found here. Once all the necessary calibration files are available, these data sets will be made available as high-level science products (HLSPs) through the STScI's Mikulski Archive for Space Telescopes (MAST). The ERO and subsequent images have already led to numerous breakthroughs, including more detailed views of M74, the Cartwheel Galaxy, the most distant galaxy ever observed, greatly-improved mass calculations of early galaxies, and new insight into bodies in the Solar System.

Who knows what inspiring images and scientific breakthroughs *Webb* will provide tomorrow, the day after that, and so on? Countless researchers, citizen scientists, and regular people worldwide are all eager to find out!

The galaxy cluster SMACS 0723 as seen by NIRCam on JWST. It's gravitational lensing properties are helping astronomers identify 88 distant galaxies in this field of view for further study. Courtesy NASA, ESA, CSA, STScI

## Astronomers List 88 Distant Galaxies They Want to Look at With JWST. Some Are Less Than 200 Million Years Old.

Way back in the earliest ages of the universe, the first galaxies were born. Astronomers want to know more about them. They're especially interested to know exactly when these distant galaxies formed and what their stars were like. Now that JWST is a working observatory, astronomers are excited to use its data to explore those early epochs. They're eager to see the most distant objects, and—as seems likely—do a rejiggering of the cosmic timeline after the Big Bang.

July 13, 2022, was a momentous day. It marked the first images released from the telescope, a set called the Early Release Observations. Many call it the first day in a new era of astronomy. They're not wrong, even if it does sound grandiose. Since then, astronomers have been digging into the images and data to learn more about the Universe.

JWST will answer a lot of questions astronomers have been asking about the earliest epochs of the Universe. In particular, they want to know more about the distant galaxies that exist "out there." Thanks to its infrared sensitivity, the telescope will look beyond what the venerable and highly productive Hubble Space Telescope reveals about the early Universe. And, a group of astronomers in the U.S., Israel, and China proposes to use JWST data to search for early galaxies. They want to look out at objects existing at redshifts beyond z~11. That's when the newborn Universe was about 420 million years old.

**Using NIRCAM to study 88 Distant Galaxies out to z~20**

Their instrument of choice onboard JWST is the Near-infrared Camera (NIRCam) and the images of very distant objects that it produces. It should be able to extend our view out to a time only tens of millions of years after the Big Bang. That would be when the first galaxies (if they existed) started to take shape. They'd look as they did when the Epoch of Reionization began. That's a period after the Cosmic Dark Ages when light could travel freely through the infant Universe.

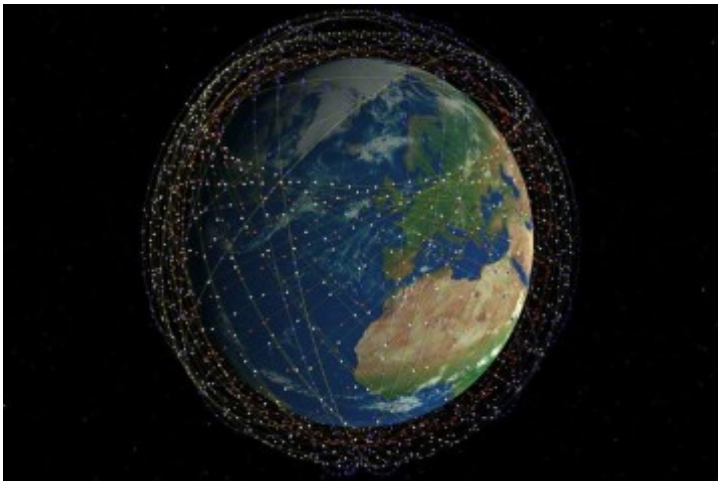
Of course, NIRCam can't do this observing all by itself. It gets cosmic assistance. In particular, the telescope relied on gravitational lensing to capture images of the earliest possible galaxies. That target is the nearby galaxy cluster SMACS 0723-73, and it's part of the ongoing Early Release Observations program on JWST. This cluster is massive. Thanks to the gravitational influence of its high mass, it's recognized as a good cosmic "magnifying glass". It's a gravitational lens that amplifies the view of the faraway galaxies populating the distant Universe. Luckily, the NIRCam field-of-view is large enough that it was able to study both the cluster and a flanking field not boosted by gravitational lensing. It's so sensitive that the flanking field also sees far beyond what HST could do.

**Making a Galaxies List and Checking it Twice**

The international team has searched out a field of candidate galaxies, using ERO data from the SMACS 0723-73 observations. They've identified 88 candidate galaxies at very great distances (redshift z>11). They are hoping that some could lie as far as z~20. That could be a time less than 100 million years after the Big Bang. If these galaxies are confirmed to lie at such early epochs of cosmic time, that would be amazing. It would mean that the timeline of the Universe after the Big Bang may have to be changed. For one thing, it would mean that the beginning of the Epoch of Reionization would be much earlier than we expected.

Currently, astronomers think it began about 370,000 years after the Big Bang. Before that, the Universe was in a hot, dense state, populated with a soup of ionized gas. Eventually, it cooled enough for protons and neutrons to combine and form neutral atoms. And, that's when light from the earliest galaxies and their stars was finally able to move freely across the expanding Universe.

However, if, as expected, the first galaxies can be seen only a few tens of millions of years after the Big Bang, then perhaps the Cosmic Dark Ages didn't last as long as everyone thought. NIRCam and spectroscopic observations of those early galaxies will eventually confirm their ages, which will help further refine the timeline of the early Universe.



An artist's conception of the Starlink constellation encircling the Earth. Credit: SpaceX

**POSTED ONAUGUST 12, 2022 BY DAVID DICKINSON**

## Starlink Satellites Are Still Bright

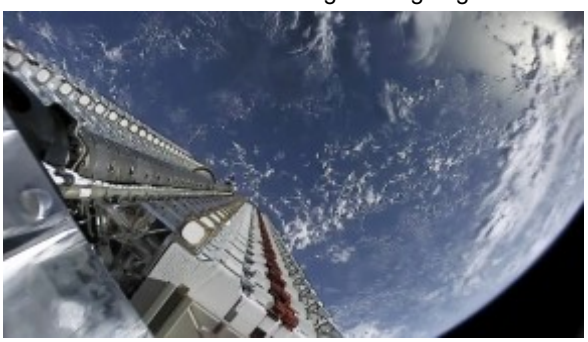
*The new generation of Starlink satellites remain above the accepted brightness threshold.*

It's one of the stranger sights of the modern Space Age. Recently, we found ourselves under the relatively dark skies of southern Spain. Sure enough, within a few minutes, we caught sight of a chain of flashing 'stars' winking in and out of view in quick succession.

Starlink trains are now a familiar sight, the boon and bane of the modern era. While SpaceX's mega-satellite promises to become a true disruptor in the worldwide internet game, it also has the potential to add to the burden of light pollution in the night sky. Will there soon come a time in the not too distant future when moving artificial 'stars' outnumber real ones?

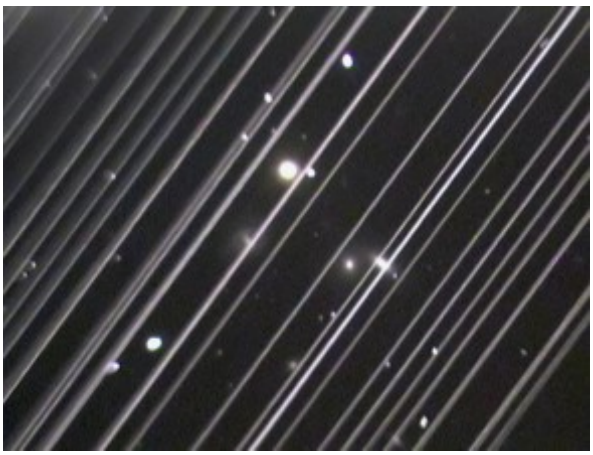
**The Rise of Starlink**

The problem for astronomers didn't really become apparent until the first launch of 60 Starlink satellites in May 2019. To date, SpaceX has launched Starlink batches at a breakneck pace, with over 2,900 total deployed and 2,286 still in orbit and in service as of early August 2022. SpaceX ultimately wants to put 12,000 Starlinks in low Earth orbit (as currently approved by the FCC) with provisions for a possible 30,000 more. The Starlink internet service went live in late 2020. Unlike the nascent Iridium constellation—which really only found niche applications—Starlink is already proving its worth. For example, Starlink is currently keeping the internet on in Ukraine during the ongoing Russian invasion.



Starlink satellites awaiting deployment shortly after launch. Credit: SpaceX

The main concern in professional astronomy is the impact on current and upcoming all-sky surveys, such as the Vera C. Rubin telescope. This survey will scour the sky nightly down to a faint +22nd magnitude. A recent article in *Nature* notes that the 1.5-meter Zwicky Transient Facility (ZTF) telescope at Palomar sees Starlink streaks on 18% of its deep-sky images. A recent International Astronomical Union statement called for operational Starlinks to fall below +7th magnitude.



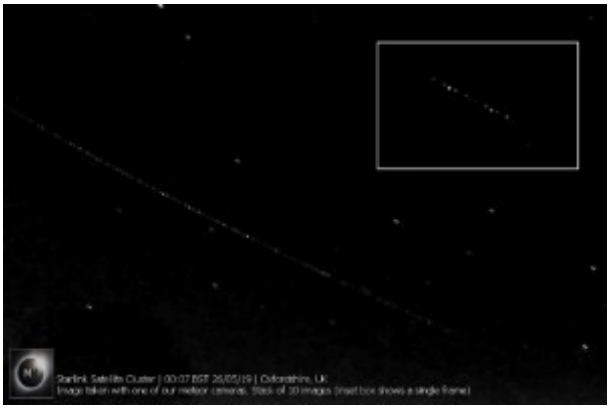
An image of the NGC 5353/4 galaxy group made with a telescope at Lowell Observatory, showing Starlink streaks through the image. Credit: Victoria Gurgis/Lowell Observatory

SpaceX has attempted to address the issue, with varying degrees of success. This has included painting the coffee table-sized satellites black, adding visors, stickers, and angling them edge-on to the Sun during twilight passes. 'VisorSat' helped to lower Starlinks down by about a magnitude… but the newer generation of Starlinks do not incorporate this feature, as a visor would interfere with the new line-of-sight laser communications between satellites.

A Starlink train over Arizona. Credit: Rob Sparks

Of course, light pollution isn't really anything new, and the problem predates Starlink. The current problem many a stargazer has noticed is that despite mitigation efforts, the Starlink trains are still bright, especially on initial orbital deployment before they're placed in higher operational altitudes. Also, the attrition rate for Starlink seems pretty high: already, 218 satellites have reentered, including most of the Group 4-7 batch that fell prey to space weather shortly after launch in February 2022. SpaceX has carried a breakneck launch cadence in 2022, launching an amazing 21 batches thus far this year alone.

And there's more to come. OneWeb has already deployed 218 satellites for its own constellation, though the Ukraine War has also stalled the worldwide launch campaign to get it operational by the end of 2022. Amazon's Kuiper constellation will also begin deployment in late 2022/early 2023. Also, SpaceX has recently acquired Swarm's Internet-of-Things satellites and filed to use 2Ghz band technology in the near future… expect to see future Starlink terminals to shrink and become more mobile, and possibly even become a built-in feature on future smartphones.



A Starlink satellite train crossing the sky. Credit: Mary McIntyre

A recent report out of a Black Hat Security conference in Las Vegas also alerted users and SpaceX in to the possibility of hacking Starlink, though the company is already hard at work on patching this vulnerability.

Hopefully, Starlink won't give any companies that have long wanted to place 'ads in space' any ideas. We've already seen attempts to put artwork in space, courtesy of Orbital Reflector. Perhaps, the U.S. Department of Defense could lend a hand, and reveal how the classified Lacrosse-5 satellite pulls a 'vanishing act' on occasion. Or perhaps, AI (Artificial Intelligence) will simply find a way to identify and erase Starlink streaks in images (astrophotographers have already pioneered a similar technique to erase satellite streaks).

To be sure, our personal opinion on the rise of the Starlink satellite constellation is nuanced. As an avid stargazer, I've seen the troubling trend of a brighter night sky lengthen drives to find dark sites long before the advent of mega-satellite constellations… but if I can live and work in remote rural Spain thanks to a mobile Starlink hookup, I see a definite advantage to those strange-moving satellite trains overhead.

## Brand New Stars in the Orion Nebula, Seen by Hubble

The Orion Nebula is a giant cloud of gas and dust that spans more than 20,000 times the size of our own solar system. It one of the closest active star-forming regions to Earth, and is therefore one of the most observed and photographed objects in the night sky. The venerable Hubble Space Telescope has focused on the Orion Nebula many times, peering into giant cavities in the hazy gas, and at one point, Hubble took 520 images to create a giant mosaic of this spellbinding nebula.

Now, Hubble has captured new views of a wispy, colorful region in the Orion Nebula surrounding the Herbig-Haro object HH 505.

Herbig-Haro objects can be found around newborn stars, and are bright regions that form after the gravitational collapse of interstellar gas clouds which create protostars. When stellar winds or jets of gas spew from these infant stars, this creates shockwaves that collide

Scientists at ESA say that for HH 505, the star IX Ori is responsible for creating the outflows seen here. This star lies on the outskirts of the Orion Nebula around 1,000 light-years from Earth. "The outflows themselves are visible as gracefully curving structures at the top and bottom of this image," they wrote. "Their interaction with the large-scale flow of gas and dust from the core of the nebula distorts them into sinuous curves."

Our lead image image was captured with Hubble's Advanced Camera for Surveys (ACS), by astronomers studying the properties of outflows and protoplanetary disks. The image shows bright shockwaves formed by the outflows as well as slower moving currents of stellar material. One of Hubble's specialties is observing ultraviolet light, and since the Orion Nebula is awash in intense ultraviolet radiation from bright young stars, this allows astronomers to directly observe these high-energy outflows and learn more about their structures.

*The Orion Nebula, one of the most studied objects in the sky. Astronomers used 520 Hubble images, taken in five colors, to make this picture.Image: NASA/ESA, M. Robberto (Space Telescope Science Institute/ESA) and the Hubble Space Telescope Orion Treasury Project Team.*

Sources: ESA, NASA

## Problem Solved! Voyager 1 is no Longer Sending Home Garbled Data!

Earlier this year, the teams attached to the Voyager 1 mission noticed that the venerable spacecraft was sending weird readouts about its attitude articulation and control system (called AACS, for short). The data it's providing didn't really reflect what was actually happening onboard. That was the bad news. The good news was that it didn't affect science data-gathering and transmission. And, the best news came this week: team engineers have fixed the issue with the AACS and the data are flowing normally again.

The AACS is an important part of Voyager 1. It's the machinery that keeps the spacecraft's antenna pointed at Earth. Without it, all that valuable science data would get lost in space. The issue was really with the AACS's data—it was garbled, and that left the team in the dark (so to speak) about the exact nature of the spacecraft's health and activities.

**Sussing out the Voyager 1 Problem**

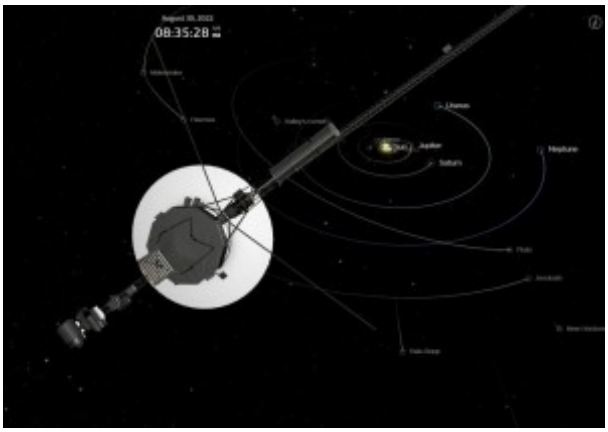
It turns out that it was a "networking problem" similar in spirit to something IT professionals might face here on Earth. Essentially, the AACS was sending telemetry data all right, but it was routing it to the wrong computer. Worse, it was a computer that had failed years ago. That actually corrupted the data, which led to the strangely garbled messages the ground-based crew received. It took a while for the team to figure out the problem, and it wasn't clear why AACS suddenly began routing data to the wrong computer. Chances are, it received a faulty command from another computer. That implies there's a problem somewhere else that they'll have to solve. But, so far, the issues are not a threat to the spacecraft.

According to Suzanne Dodd, Voyager's current project manager, once the engineers figured out that the old, dead computer might have been part of the problem, they had a way forward. They simply told the AACS to switch over sending to the correct computer system. "We're happy to have the telemetry back," said Dodd. "We'll do a full memory readout of

the AACS and look at everything it's been doing. That will help us try to diagnose the problem that caused the telemetry issue in the first place. So we're cautiously optimistic, but we still have more investigating to do."
The ongoing issue with AACS didn't set off any fault protection systems onboard the spacecraft. If it had, Voyager 1 would have gone into "safe mode" while engineers tried to figure out what happened. During the period of garbled signals, AACS continued working, which indicated that the problem was either upstream or downstream of the unit. The fact that data were garbled provided a good clue to related computer issues.

**Solar System Explorations**

This aging and still-valuable spacecraft has been exploring the outer parts of the solar system since its launch in 1977, along with its twin sibling, Voyager 2. They each traveled slightly different trajectories. Both went past Jupiter and Saturn, but Voyager 2 continued on to Uranus and Neptune. They're both now outside the solar system, sending back data about the regions of space they're exploring.




Where is Voyager 1? As of August 30, 2022, it is well outside of and above the plane of the Solar System. It will cross the Oort Cloud and head out to the stars. Courtesy NASA/JPL.
Voyager 1 flew past Jupiter in March 1979, and Saturn in November 1980. After its close approaches to those two gas giants, it started a trajectory out of the solar system and entered interstellar space in 2013. That's when it ceased to detect the solar wind and scientists began to see an increase in particles consistent with those in interstellar space.
These days, Voyager 1 is more than 157.3 astronomical units from Earth and moving out at well over 61,000 km/hour. It's busy collecting data about the interstellar medium and radiation from distant objects. If all goes well and it doesn't whack into anything that could destroy it, the spacecraft should continue sending back data for nearly a decade. After that, it should fall silent as it travels beyond the Oort Cloud and out to the stars.

## NASA Will Try Again on September 3 For First Launch of Artemis (Now October 16th Earliest)

After reviewing the data from Monday's scrubbed launch attempt for the Space Launch System/Artemis- 1 test flight, NASA's Mission Management Team feels the rocket and the launch team will be ready for another try at the program's maiden launch on Saturday, September 3. The two-hour launch window starts at 2:17 pm EDT (18:17 UTC).
"We got a good nights' sleep and we reviewed all the data," NASA's Artemis mission manager Mike Sarafin told reporters today (Tuesday). "We agreed to move launch date to Saturday, September 3, but we will continue to review and evaluate all the data," and make a final determination by September 1, Sarafin said.
If the launch does not occur Saturday, officials said the scrub turnaround could be as soon as 48 hours, or Monday September 5. But that would be the case only if the launch would be called off due to weather. Any technical issues would likely delay the launch even further.
During the launch attempt on August 29, the main problem was due to an "engine bleed" issue, which effectively means that one of the four main engines could not be properly chilled to temperatures needed for ignition at launch. However, after reviewing the data, the team feels that the SLS rocket's engine number 3's temperature issue was very likely due to a faulty sensor, rather than the engine not reaching its desired chilldown temperature.

*NASA's Space Launch System (SLS) rocket with the Orion spacecraft aboard at Launch Pad 39B, Monday, Aug. 29, 2022 during the first launch attempt of the Artemis program. Credit: NASA/Keegan Barber.*
SLS program manager John Honeycutt said they needed to get the temperatures to about -420 F (-251 C) . While engines 1, 2 and 4 had reached about -410 F (-245 C), engine 3 was about 30-40 degrees warmer.
"We did see that we had one engine that was reading a little out of family from the others," said launch director Charlie Blackwell-Thompson. "We did some troubleshooting to try to bring that back, but that was not successful, and it was outside the bounds of launching."
Even though they feel the problem came in the instrumentation, the teams will start engine chill earlier in the countdown in an attempt to have the RS-25 engines ready for ignition. This will replicate a timeline that was used successfully during a previous test of the engines.
If they still get the low temperature readings during Saturday's countdown, Honeycutt said they will rely on other factors to determine if they will go ahead with the launch.
"We will have a plan for a go-no go that day," he said, "but I'm anticipating we are not going to get any better results on the temperature bleed sensor on engine 3."
Another factor on Saturday's launch attempt might be the weather. Launch Weather Officer Mark Berger said the weather forecast favors showers and thunderstorms moving into the morning and early afternoon, but he's optimistic there will be some "clear air" for parts the launch window. Morning storms could delay filling the fuel tanks. we' will have some clear air for window, but have showers in the area and that could delay tanking.
"The probability of weather violation at any point in the countdown still looks to me rather high," Berger said, and it would be somewhere in the neighborhood of 60%. Berger said while that's high, he expects showers to be sporadic, and feels there will be a good opportunity to launch.
The Artemis-1 flight will be the first full integrated test of the super heavy-lift SLS launch vehicle and the Orion capsule. The flight will last several weeks, and go further into space than all the Apollo missions. This will test out not only the rocket and spacecraft but also the supporting ground systems and teams. If all goes well, NASA will announce the crew and schedule for a crewed Artemis 2 flight around the Moon, likely in 2024 and the crewed Ar-

temis 3 Moon landing mission would follow, perhaps in 2025.

## JWST Takes Its First Image of an Exoplanet

The James Webb Space Telescope has taken its first direct image of an exoplanet, a planet outside our Solar System. The exoplanet, HIP 65425 b is a gas giant that orbits an A-type star, has a mass of about nine times that of Jupiter and is about 355 light-years from Earth. While the planet has virtually no chance of being habitable, the data from these observations show just how powerful a tool JWST will be for studying exoplanets.

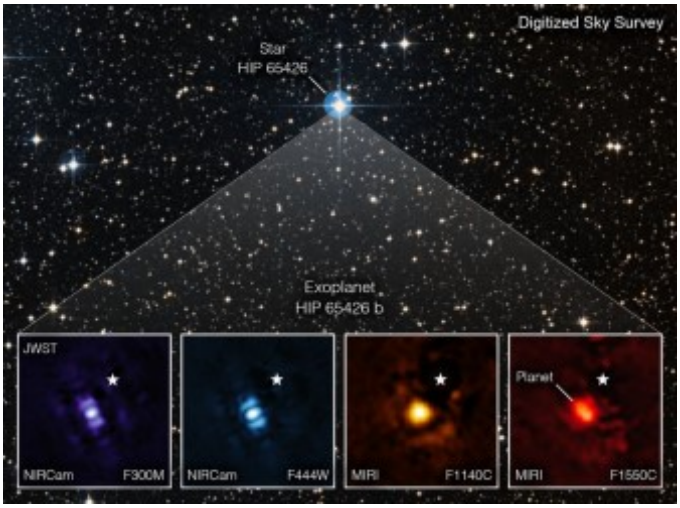
"This is a transformative moment, not only for Webb but also for astronomy generally," said Sasha Hinkley in a NASA blog post. Hinkley is associate professor of physics and astronomy at the University of Exeter in the United Kingdom, who led these observations with a large international collaboration. The team's preliminary science paper has been posted on arXiv.

The planet was originally discovered in 2017 by the Very Large Telescope in Chile, which took images of it using short infrared wavelengths of light. Astronomers were interested in looking at this planet with JWST, as the telescope's ability to view in longer infrared wavelengths can reveal new details that ground-based telescopes wouldn't be able to detect.

This is not the first direct image of an exoplanet taken from space. Over 20 exoplanets have been imaged previously by the Hubble Space Telescope and ground-based telescopes like the Gemini Planet Imager. But this first exoplanet image from JWST showcases the upcoming possibilities for studying distant worlds.

The new observations of this planet were part of JWST's Early Release Science Program, which allows astronomers – and the public – to have immediate access to early data from specific science observations by JWST. The public can see and understand the amazing array of science that this telescope is capable of, and astronomers around the world will have the opportunity to analyze the data and plan follow-up observations.

Additionally, these first observations with the new telescope allows astronomers to understand how this telescope performs and what they can achieve with their observations. In their pre-preprint paper, the team writes that their observations with JWST, HIP 65425b is clearly detected in all seven observational filters, and this represents the first ever direct detection of an exoplanet beyond 5 microns. In fact, the team made observations at 11.4 and 15.5 microns, which is an enormous technological leap.




*This image shows the exoplanet HIP 65426 b in different bands of infrared light, as seen from the James Webb Space Telescope: purple shows the NIRCam instrument's view at 3.00 micrometers, blue shows the NIRCam instrument's view at 4.44 micrometers, yellow shows the MIRI instrument's view at 11.4 micrometers, and red shows the MIRI instrument's view at 15.5 micrometers. These images look different because of the ways the different Webb instruments capture light. A set of masks within each instrument, called a coronagraph, blocks out the host star's light so that the planet can be seen. The small white star in each image marks the location of the host star HIP 65426, which has been subtracted using the coronagraphs and image processing. The bar shapes in the NIRCam images are artifacts of the telescope's optics, not objects in the scene. Credit: NASA/ESA/CSA, A Carter (UCSC), the ERS 1386 team, and A. Pagan (STScI).*

The team also wrote that these first observations provide a variety of insights into the performance and best practices of JWST. They found that JWST is "exceeding its anticipated contrast performance for both NIRCam and MIRI" and that the "photometric observations of HIP 65426 b provide exquisite sensitivity" … demonstrating "that JWST provides a transformative opportunity to study exoplanets through high contrast imaging."

Taking direct images of exoplanets is challenging because stars are so much brighter than planets. But JWST carries coronagraphs to enable direct imaging of exoplanets near their stars. The image of this exoplanet is just a "spot," not a grand panorama, but by studying that spot, astronomers can learn a great deal about it. That includes its color, differences between the seasons, its rotation and if there might be different seasons and weather.

HIP 65426 b planet is more than 10,000 times fainter than its host star in the near-infrared, and a few thousand times fainter in the mid-infrared. Astronomers said that in each filter image, the planet appears as a slightly differently shaped blob of light. That is because of the particulars of Webb's optical system and how it translates light through the different optics.

"Obtaining this image felt like digging for space treasure," said Aarynn Carter, a postdoctoral researcher at the University of California, Santa Cruz, who led the analysis of the images. "At first all I could see was light from the star, but with careful image processing I was able to remove that light and uncover the planet."

One of the keys for JWST's observations is its ability for spectroscopy, which is the science of measuring the intensity of light at different wavelengths. When a planet passes in front of a star, the starlight passes through the planet's atmosphere. Astronomers explained that if, for example, the planet has sodium in its atmosphere, the spectrum of the star, added to that of the planet, will have what is called an "absorption line" in the place in the spectra where sodium would be expected to be seen. This is because different elements and molecules absorb light at characteristic energies; and this is how we know where in a spectrum we might expect to see the signature of sodium (or methane or water) if it is present.

One of the main uses of the James Webb Space Telescope will be to study the atmospheres of exoplanets, to search for the building blocks of life elsewhere in the Universe. The benefit of making infrared observations is that it is at infrared wavelengths that molecules in the atmospheres of exoplanets have the largest number of spectral features. The ultimate goal, of course, is to find a planet with a similar atmosphere to that of Earth.

While HIP 65426 b is not like Earth at all – a gas giant that takes 630.7 years to complete one orbit of its star, and is 92 AU from its star – it does give astronomers their first 'hands-on' experience with imaging and observing exoplanets with JWST.

As the team wrote in their paper, "In totality, these observations confirm that JWST presents a powerful and exciting opportunity to characterize the population of exoplanets amenable to direct imaging in greater detail."

## Yeast Will Fill in for Humans on Artemis I, Soaking up a Lunar Mission's Worth of Radiation

A full Moon looms over NASA's Space Launch System and its Orion capsule containing yeast cells bound for an epic trip. (NASA Photo / Ben Smegelsky)

When Artemis 1 finally takes flight (possibly this Saturday), twelve bags of baker's yeast will go along for the ride. Millions of these cells of *Saccharomyces cerevisiae* will experience deep space as it grows and reproduces. The yeast is a stand-in for actual people. The idea is to see what threat the radiation environment in deep space poses to living cells. The data from the experiment will point to how genetic engineering might help reduce damage to astronauts.

## Legendary Astronomer Frank Drake has Passed Away

Frank Drake by the Green Bank Telescope. Credit: NRAO/ NSF/AUI

**POSTED ONSEPTEMBER 3, 2022 BY NANCY ATKINSON**

Legendary Astronomer Frank Drake has Passed Away
Legendary astronomer Frank Drake has passed away at the age of 92. Known primarily for his Drake Equation — an estimate of the probability of intelligent extraterrestrial life — he pioneered the field of SETI, the Search for Extraterrestrial Intelligence, and was a noted astronomer and astrophysicist. His work and life have left an indelible mark on humanity and given hope and wonder to all our hearts.


*Drake Equation (image credit: Colin A Houghton)*

I remember the first time I saw the Drake Equation. It was a revelation. While all the different variables can be perplexing at first glance, to me it gave order to an unordered cosmos: the idea that we could actually – one day – plug genuine numbers into the equation meant we don't have to be haphazard in thinking about the possibility life elsewhere.

While the Drake Equation is more of a thought experiment, it gives us an outline or framework for seriously considering the likelihood of other life in the cosmos. And it gives us all hope that one day we can actually plug in some definite numbers to all the variables.

SETI Institute's Jill Tarter has called the equation "a great way to organize our ignorance." I like to phrase it that Drake's unique insights gave us a new way to look at the Universe.

When radio stations started broadcasting in the 1920's, it didn't take for scientists long to realize radio waves were disseminating our radio –and later — TV transmissions out into space at the speed of light, potentially traveling long distances across the galaxy. They also wondered if the reverse were true: if another civilization from a faraway world was also creating similar transmissions, could we hear them?

*Frank Drake writing his famous equation on a white board. Credit: SETI.org*

In 1959, Drake came up with the idea for what would eventually become SETI, and designed an experiment to detect signals from intelligent life on planets that might be orbiting two nearby sunlike stars, Tau Ceti and Epsilon Eridani. He named the experiment Project Ozma, and for three months, he aimed the Green Bank Observatory's Tatel Telescope at those two stars. This was before we knew for certain that other stars hosted planets, and nearly a half century later planets were discovered orbiting both those stars.

Drake's experiment didn't detect any transmissions, but Project Ozma attracted so much attention that in 1961, the National Academy of Sciences asked Drake to hold a meeting at Green Bank to discuss how a scientific search for extraterrestrial intelligence could be organized. He came up with his equation as a "conversation starter" for the meeting.

While so far, the search has come up empty, we now can plug in at least one of the numbers: the fraction of stars with planets in our galaxy. Because of the Kepler planet hunting mission, we know that that almost all stars have planets, and there could be as many as 300 million Earth-sized rocky worlds in the Milky Way that orbit sunlike stars.
But, there's another way to look at the this equation.
Drake's daughter Nadia Drake is a noted space and science journalist. Last year she wrote, "If anything, the Drake Equation's most enduring legacy is not a numerical solution, but a mirror: It asks us to think about Earth, and about humankind, from a cosmic perspective—to consider the fragility of our existence in this galactic sea."
As wonderful of a scientist Drake was, he was also an exemplary human. You can read the Drake's family's thoughts on Nadia's website.

**POSTED ONSEPTEMBER 3, 2022 BY ANDY TOMASWICK**

## You'll Soon be Able to Access Starlink Directly With Your Cellphone, From Anywhere in the US, and Eventually the World

The future of satellite communications is almost upon us. SpaceX has signed a deal with T-Mobile to provide the carrier's customers with text services from its Starlink satellites anywhere in the US starting next year.
It was only a matter of time before SpaceX turned its attention to the cellular industry. The company has recently ramped up its deployment of internet connectivity, allowing everyone from van lifers to remote outposts to be connected to the internet. But cell connectivity is an entirely different thing.
Most people that go to the most remote parts of the world, which amounts to half a million square miles in the US alone, have to lug around expensive satellite phones if they need to reach someone. But T-Mobile and SpaceX have developed a system whereby Starlink can provide services to customers on existing T-Mobile networks, using the phones they already have in their pockets.
That is not the same as providing internet, and the system roll-out will start slowly, with only text messaging being the first of the three major cell services users expect from their carriers to roll out. Voice calls, and eventually data, will follow in the future, with no specified date for when that might be.
Starlink itself has come under plenty of scrutiny lately, as it has continued to infringe upon astronomers' images of the early night sky. The FCC is undergoing a legal battle involving SpaceX, the parent company of the Starlink system, to determine whether or not it should be eligible for an $800 million prize pool promised to the entity that provides internet to rural communities in the US.
Even with all the legal frustrations SpaceX has to face, it still has to deal with technical challenges as well. Supporting this new cellular infrastructure will require modifications to its existing Starlink 2.0 satellites, which were announced in June. Launching those satellites will require Starship to be operational, which still doesn't have a timeline other than potentially some time in the next few months.
Fraser discusses some of the challenges Starlink is facing.
That will give the company and its new cellular partner plenty of time to flesh out the technical details of their agreement. And even some time to coax other cellular providers into joining their collaboration. T-Mobile's network only reaches the US – to become a genuinely global cell provider, the two companies will have to expand their Coverage Above And Beyond framework to other cell operators. So far, no one has stepped up to the plate, but there are undoubtedly conversations going on behind closed doors.
Ultimately this all leads to the future of seamless internet and cellular connectivity throughout the world, which has been the dream of technologists since the dawn of the internet. SpaceX and T-Mobile have taken another step in that direction. It remains to be seen what others will join them.

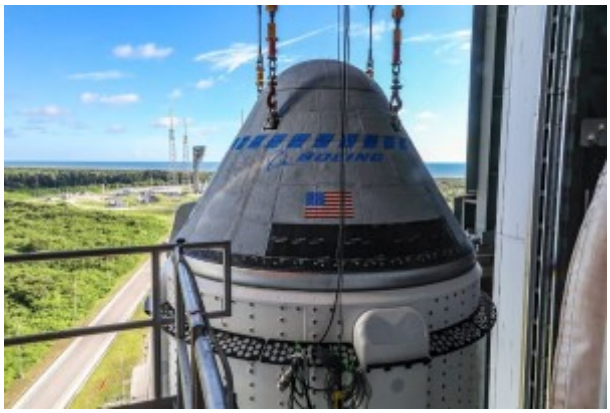
## Even Short Flights to Space Cause Cell Mutations That Could Lead to Cancer and Heart Disease

Spaceflight can be dangerous – and not just because astronauts are strapped to an ongoing massive explosion for their ascent into orbit. Its long-term effects on the human body are starting to come more clearly into focus, and so far, none of the answers have been good. Now a new study from Mount Sinai Medical Hospital has found that, even on relatively short duration spaceflights, astronauts suffer potentially damaging DNS mutations.
The study, published in the August edition of *Nature Communications Biology,* was conducted on 14 astronauts that flew on shuttle flights from 1998 to 2001. These astronauts, the overwhelming majority of whom were men, with an average age of 42, had their blood drawn before their shuttle flights and then again right after. Scientists have used these blood samples for the last twenty years, and this new study utilizes them and the dramatically improved DNA sequencing technology that the previous two decades have brought us.
What the researchers found in these old blood samples are known as somatic mutations in the hematopoietic system, where blood cells are formed. Somatic mutations are mutations that happen to a person during their life, but don't affect their egg or sperm cells, meaning they won't be passed on to the next generation. In this particular

instance, the mutations they found were associated with a disorder called clonal hematopoiesis (CH), where more blood cells come from one specific clone.
UT video on how make a novel radiation shield.
That isn't necessarily cause for immediate alarm – in fact, CH doesn't usually have symptoms associated with it. However, it indicates an increased risk factor for cardiovascular disease and blood cancer. And the somatic mutations the researchers found in the astronaut's DNA were similar to those caused by ultraviolet radiation or specific chemicals.
Even more concerning, the most frequently changed gene was one responsible for producing a tumor-suppressing protein and is commonly associated with acute myeloid leukemia. However, even this change was below a standard threshold that doctors use to actually diagnose someone with CH.
However, these astronauts were only in space for an average of 12 days. Longer missions, such as those to Mars or even a permanent based on the Moon, could lead to much more damaging effects that have yet to be studied. There have already been plenty of studies of Mark and Scott Kelly, two twin astronauts who acted as a controlled pair to study microgravity and spaceflight's effects on the human body. The effects do not appear to be good.
NASA video discussing the health limits of radiation.
Credit – NASA Video YouTube Channel
And the CH gene change wasn't the only problem found in the shuttle astronauts either. There was a surprisingly high amount of mitochondrial DNA floating in their bloodstreams, which can lead to inflammation problems. All of these issues point to the difficulty of the human body in dealing with spaceflight. None so far are red flags, but they certainly seem worth keeping an eye on while we restart our human exploration of the solar system.

## Starliner Needs Even More Fixes, and Probably won't Carry Astronauts Until 2023

Private spaceflight is taking off, though some are going faster than others. As SpaceX preps for its sixth crewed launch on a NASA contract, their rival Boeing has announced that they will be delaying the first crewed flight of their Starliner spacecraft until February 2023.
This setback is the latest in a string of problems for Starliner. It results directly from repairs from a mission back in May where, while the capsule was able to dock successfully with the International Space Station, it suffered from problems that caused two of its thrusters to fail.
The thruster problem appeared to be caused by a drop in pressure that caused two thrusters to shut off during its orbital insertion burn. While this didn't stop it from docking, it was similar to a problem that caused the failure of the first Starliner test flight almost three years before.
UT video discussing the private crewed capsules.
In that effort, the spacecraft again miscalculated its position and burned more fuel than was allotted to it to make it to the ISS. Despite failing to reach the station, it was successfully deorbited and returned to the ground safely, though it suffered a "dire flight anomaly" during the descent. NASA's administrator a the time even suggested that astronauts could potentially ride on Boeing's next Starliner effort.
As we reported in that instance, history is full of test flights that go wrong, and most of the time, people forget about them. But that first failure seemed particularly costly to Boeing, causing over three years of delays to the project and essentially forcing them to lose the race to be the first private provider to launch American personnel to the ISS to SpaceX.
Despite all the setbacks, the company is plowing forward. Mark Nappi, Boeing's program manager for the Starliner, believes debris might have caused the thruster problems this time around. However, the culpable part of the craft was discarded on reentry, so "we will never know exactly what was the issue," Nappi said.




Starliner perched on top of an Atlas V.
Credit – Boeing
For engineers, those are the worst kind of problems, and it's certainly not something you want to hear if you're one of the astronauts planning on riding this capsule into space. During the first failed mission, there was some hope, even from NASA's administrator, that astronauts would have been able to fix the problems manually if they were onboard during the flight. But that is not the kind of safety control that a company that hopes to win repeated NASA contracts should have.
Ultimately, Boeing is sure to successfully launch its crew capsule into orbit with people on it. The company is deep-pocketed and has the support of NASA. But the question remains – will it be a viable part of the aircraft maker's business? Or will the newer, seemingly more effective companies that have surpassed it while it fixes its problems make the Starliner a dead end for a company that has been a mainstay of space exploration for decades?

# E Mails Viewings Logs and Images from Members.

**Viewing Log for 20th August**

This was the third time of trying to get my first viewing session in the new season, the previous ones I had gone out to Uffcott only for the cloud cover to increase which forced me to pack up and go home! While doing the set-up of the second session which started off with hardly any clouds in the sky to most of the sky being covered once set up had been completed, I waited for about 20 minutes before calling it a day only to find once everything has been put away I could see stars again!

It was a late call for me to go out as I had played golf in the late afternoon/early evening and did not get home from the course until 20:45. I had my Meade LX90 GOTO telescope set up and ready by 22:29, I would be using a Pentax XW14 mm eye piece. With little wind and a temperature of 17 °C it sounds like good summer weather for viewing, there was patchy cloud around which could affect some of my planned viewing during the evening?

First target for the evening was Saturn in the south eastern sky, I could see Titan (the second largest moon in the solar system clearly and thought I could make out another two?), checking Stellarium once I got home I might have seen the moons Rhea and Dione? Could not make out the Cassini division in the rings, this is something I have hardly ever seen before? On to Jupiter, still low in the eastern sky I made out two moons either side of this giant planet, namely Io and Ganymede to the east and Europa and Callisto to the west of Jupiter, the Great Red Spot was on view but I could not make it out, again like the Cassini division it is something I have hardly seen even though I have looked at these planets many times! Unfortunately I had trouble viewing Jupiter as it was in and out of clouds, looking at the sky in general the sky had clouded over much more! The area around Cassiopeia was clear, so I went hunting for Messier (M) 52, a nice open cluster in this constellation. I could see it clearly and then it disappeared, yes the clouds had covered this object. Back to Jupiter for a while before the clouds covered this planet again. Lyra was clear, so I headed off to M 57, the Ring Nebula this planetary nebula was good to look at. Still in Lyra I had a look at M 56, a small globular cluster which looked like a fuzzy blob to view.

By now the clouds had filled the sky, I gave it about another 20 minutes with no real change in the conditions I decided to pack up at 23:31 and go home.

Nice to get out again after the summer lay off from viewing (about three months), hopefully I can get out again soon while the moon is around the new phase (actually it was a waning crescent which would not rise until 23:44 that evening, info from Virtual Moon Atlas).

Clear skies.

Peter Chappell

**Viewing Log for 29th of August**

After finishing work early, I thought I would have some time to go out and try and find a few objects in the constellation of Sagittarius, this required me to move to a different place along the Uffcott back road, about 600 yards from the usual layby I use?

I had my Meade LX90 GOTO telescope set up and ready by 21:47 as usual I would be using my Pentax WX14 mm eye piece giving a magnification of about 143. With a temperature of 16 °C and a moderate wind for company I would need a jacket on this this viewing session. While setting up which takes about 15 minutes, three cars went past me, hopefully there will not be too many while I am looking at the sky?

I tried to get Saturn but this planet was in cloud, so I started off with Jupiter, the moons were on the eastern side of the planet with Io, followed by Europa, Ganymede and final Callisto being the furthest out from the planet. Could also make out the two main weather belts but no Great Red Spot (GRS), on other side of the planet at that time. By now Saturn had cleared the cloud, so I slewed to this planet, seeing was not that good, could just make out Titan but no Cassini division in the rings? For the first time in ages I managed to find Neptune, the outermost known planet showed no colour or detail, probably too low and the sky conditions did not help? Tried for Messier (M) 4 in Scorpius but this was behind a hedge and too low to see! So it was on to Sagittarius before this constellation gets too low to see. I would be using my Sky & Telescope 'Pocket Sky Atlas' as a guide and not the hand controller for information. Started off with M 24, the Star Cloud. This object was better to see with the finderscope and not the eyepiece, a wide open cluster (O C). Near the 'Teapot' base is M 69 and 70, both faint fuzzy blobs (F F B) to look at, had to use adverted vision to see these globular clusters (G C). M 54 was a bit better to look at, a faint blob (F B) which was small but had a bright core, again another G C. Going a bit higher and onto M 22, a fairly large G C, manage to see some stars on the edge of this object. Another car went past me while I was viewing M 8, the Lagoon nebula, this emission nebula (E N) was an F B to look at, nearby was an O C which I think is embedded with this nebula? Next was the Trifid nebula, known as M 20, this was a F F B to look at which could be easy to miss if not using GOTO kit? While viewing this object I noticed two satellites go thru the area of sky. M 21 was a small dim O C with not many stars in it. M 23 was a large loose O C to look at. The Omega or Swan nebula (M 17) had a dust lane which makes up the body of the Swan which I think I have never seen before? M 18 is a small and very loose O C, I counted about 11 stars in this cluster? Another car just went past me while viewing this object. M 25 is a loose O C which could be easy to miss with the back ground stars in the area. Over to the extreme eastern boundary of the constellation we find M 75, a small G C which had a bright core. A bit south we find M 55 but I could not see it, might have been in clouds or just too low at 8 ° above the horizon at the time? That was the last Messier object I would look at in Sagittarius, I managed to find 14 of the 15 listed, turns out later on I had missed M 28 which was just above the Teapot but I did not see it in the atlas at the time!

Staying in Sagittarius I went to New General Catalogue (NGC) 6818 which was known as the 'Little Gem', turns out this was a planetary nebula (P N) but only could make out a point of light? NGC 6822 or Caldwell 57 or Bernard's galaxy is an irregular galaxy was an F F B to look at and easy to miss? The sky must have got better as I could see the Milky Way going thru Cygnus to the horizonJ. Saturn was much higher and clearer now, so I went back to the ringed planet and could make out Titan much easier now but still no Cassini division? On to Jupiter again, since I was last there, some of the moons had moved a bit, Ganymede had got a bit closer to Europa and this planet was bright to look at! Still no GRS as it was still on the other side? On to Neptune again, still no better than before? By now Uranus had just cleared the hedge but no colour could be made out. Final object of the evening was M 27, the best P N in the sky, could make out the 'Apple Core' structure very well.

Time was now 23:31 and time to pack up as it had been a long day with work earlier in the day, yet another car went pass me while packing the equipment away! No need to dry the kit used overnight as there was no dew around, the strong wind at times probably kept that away?

Clear skies.

Peter Chappell

## Seeing where the James Webb Space Telescope is Looking

*JWST Infrared Image Published*

Last week I got around to trying these galaxy groups in Pegasus, partly to make a bit of a fun comparison with the James Webb Space Telescope photo recently released! I reckon astrophotography is not a cheap hobby, but amazingly you CAN take pictures of some of what the JWST takes, and get something like recognisable results, even with an 80mm refractor!

The relatively large, foreground galaxy is NGC7331, about 40 million LY away. The four galaxies just above it are known as "The Fleas" and together they constitute the so-called Deer Lick group. The more distant galaxies lie around 290 - 365 million LY from us, but are NOT a true grouping of galaxies, lying far away from each other in reality, although seen in the same line of sight from here.

By contrast, Stephan's Quintet (lower left in the widefield photo) is a true group of gravitationally associated galaxies, and the James Webb photo shows some of the star forming regions resulting from the tidal forces going on between them. My "zoomed" photo is just a crop from the widefield. They lie around 280 million LY from us, and their proximity to the Deer Lick group is pure coincidence.

My photos are the result of 2 hours of 180 second exposures with a ZWO ASI533 MC pro camera/IR cut filter at -10C, on a SW Evostar 80ED Pro scope, mounted on HEQ5 Pro.

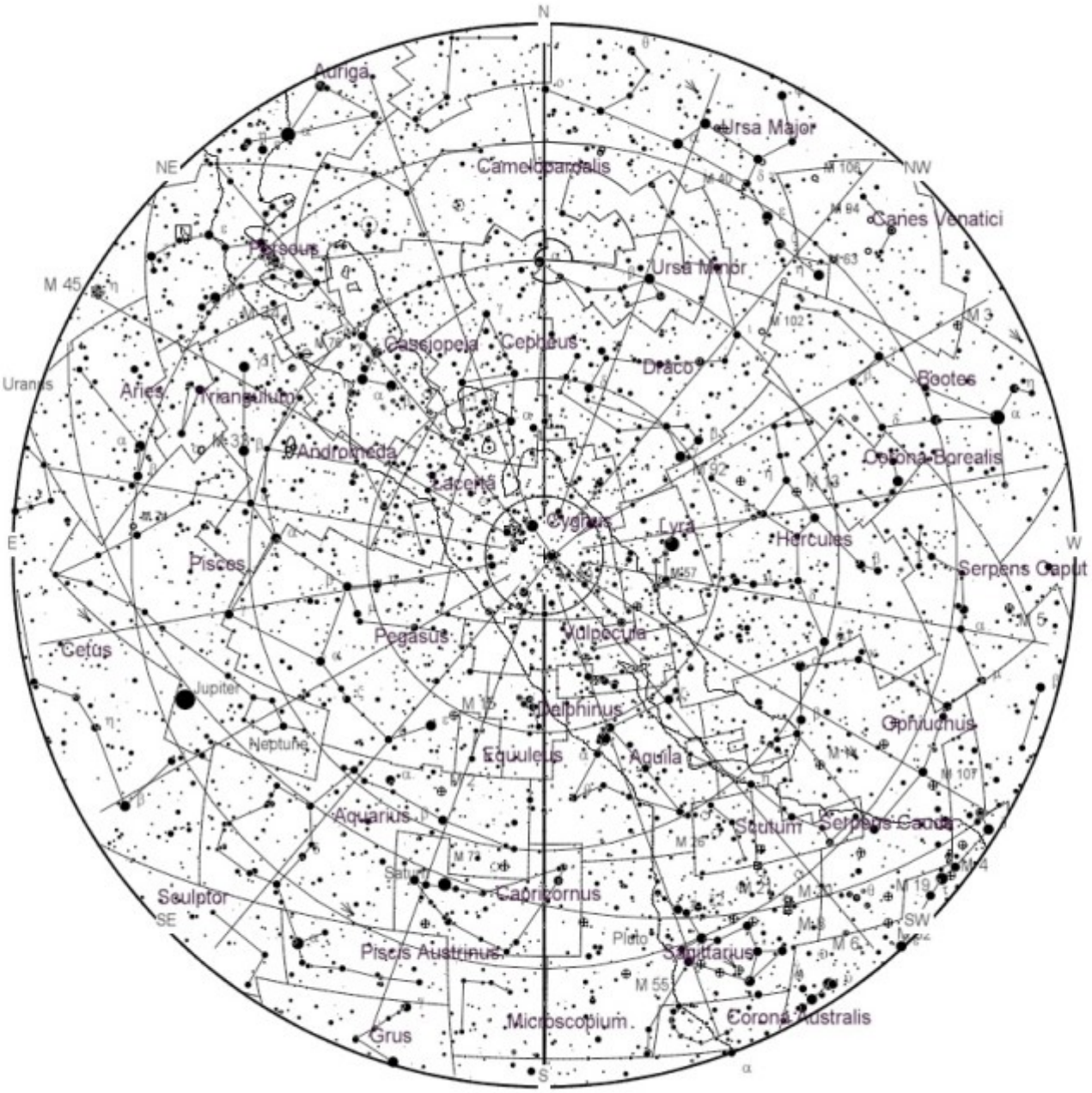
Paul Richardson

As Cepheus is our constellation of the Month here is the Iris Nebula from member Steve Allen.

The Iris nebula from last night. The full moon put paid to much else but at least it was low in the sky.

Thank you members for your submissions via the members Face Book pages.

# WHATS UP, SEPTEMBER 2022




**September 10** - **Full Moon.** The Moon will be located on the opposite side of the Earth as the Sun and its face will be will be fully illuminated. This phase occurs at 09:58 UTC. This full moon was known by early Native American tribes as the Corn Moon because the corn is harvested around this time of year. This moon is also known as the Harvest Moon. The Harvest Moon is the full moon that occurs closest to the September equinox each year.

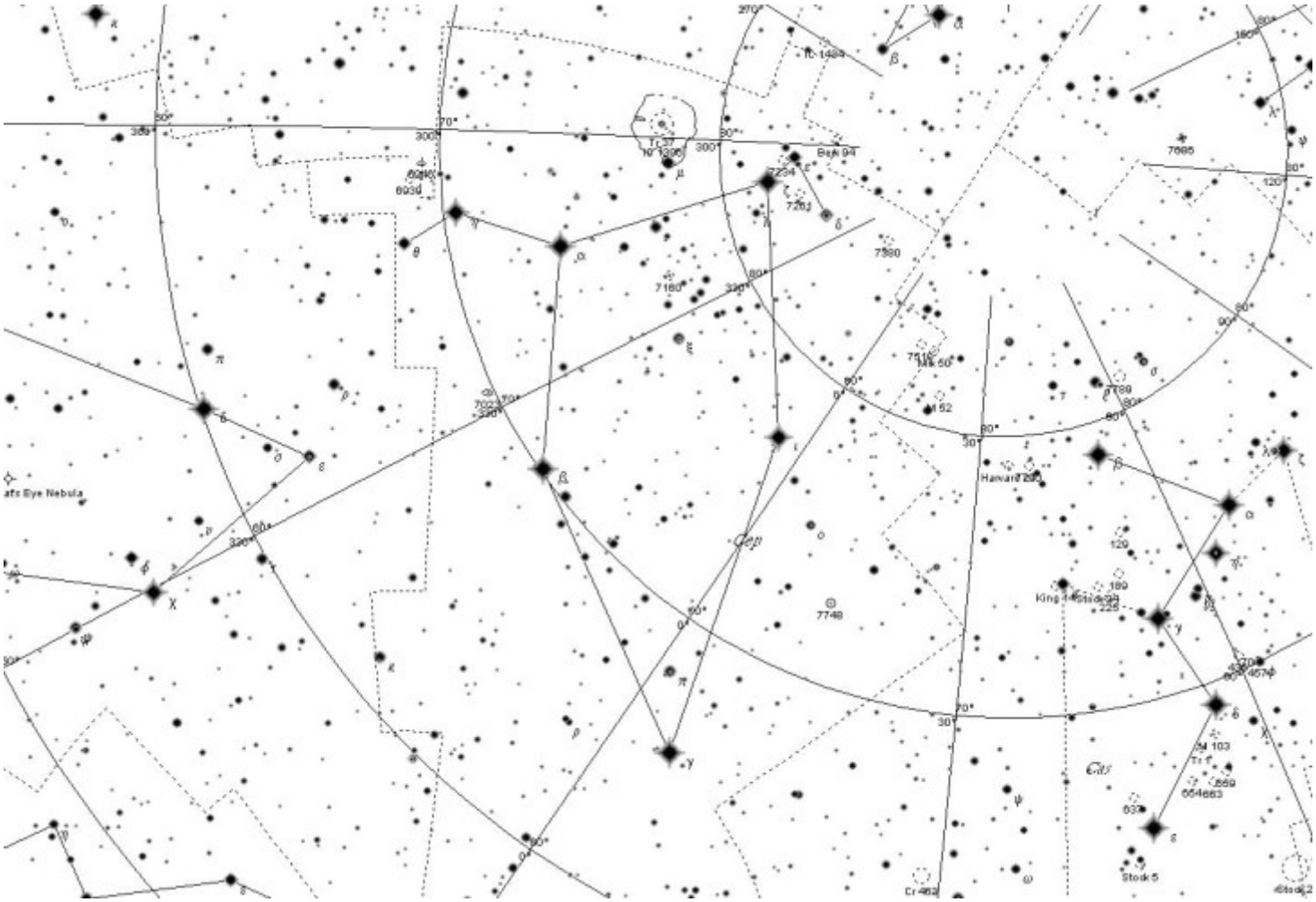
**September 16** - **Neptune at Opposition.** The blue giant planet will be at its closest approach to Earth and its face will be fully illuminated by the Sun. It will be brighter than any other time of the year and will be visible all night long. This is the best time to view and photograph Neptune. Due to its extreme distance from Earth, it will only appear as a tiny blue dot in all but the most powerful telescopes.

**September 23** - **September Equinox.** The September equinox occurs at 00:55 UTC. The Sun will shine directly on the equator and there will be nearly equal amounts of day and night throughout the world. This is also the first day of fall (autumnal equinox) in the Northern Hemisphere and the first day of spring (vernal equinox) in the Southern Hemisphere.

**September 25** - **New Moon.** The Moon will located on the same side of the Earth as the Sun and will not be visible in the night sky. This phase occurs at 21:55 UTC. This is the best time of the month to observe faint objects such as galaxies and star clusters because there is no moonlight to interfere.

**September 26** - **Jupiter at Opposition.** The giant planet will be at its closest approach to Earth and its face will be fully illuminated by the Sun. It will be brighter than any other time of the year and will be visible all night long. This is the best time to view and photograph Jupiter and its moons. A medium-sized telescope should be able to show you some of the details in Jupiter's cloud bands. A good pair of binoculars should allow you to see Jupiter's four largest moons, appearing as bright dots on either side of the planet.

# CONSTELLATIONS OF THE MONTH: CEPHEUS



*Welcome back to Constellation Friday! Today, in honor of the late and great Tammy Plotner, we will be dealing with the King of Ethiopia himself, the Cepheus constellation!*

In the 2nd century CE, Greek-Egyptian astronomer Claudius Ptolemaeus (aka. Ptolemy) compiled a list of all the then -known 48 constellations. This treatise, known as the ***Almagest***, would be used by medieval European and Islamic scholars for over a thousand years to come, effectively becoming astrological and astronomical canon until the early Modern Age.

One of these is the northern constellation of Cepheus, named after the mythological king of Ethiopia. Today, it is one of the 88 modern constellations recognized by the IAU, and is bordered by the constellations of Camelopardalis, Cassiopeia, Cygnus, Draco, Lacerta, and Ursa Minor.

Name and Meaning:

In Greek mythology, Cepheus represents the mythical king of Aethiopia – and husband to the vain queen Cassiopeia. This also makes him the father of the lovely Andromeda, and a member of the entire sky saga which involves jealous gods and mortal boasts. According to this myth, Zeus placed Cepheus in the sky after his tragic death, which resulted from a jealous lovers' spat.

*Cepheus as depicted in Urania's Mirror, a set of constellation cards published in London c. 1825. Credit: Library of Congress/Sidney Hall*

It began when Cepheus' wife – Cassiopeia – boasted that she was more beautiful than the Nereids (the sea nymphs), which angered the nymphs and Poseidon, god of the sea. Poseidon sent a sea monster, represented by the constellation Cetus, to ravage Cepheus' land. To avoid catastrophe, Cepheus tried to sacrifice his daughter Andromeda to Cetus; but she was saved by the hero Perseus, who also slew the monster.

The two were to be married, but this created conflict since Andromeda had already been promised to Cepheus brother, Phineus. A fight ensued, and Perseus was forced to brandish the head of Medusa to defeat his enemies, which caused Cepheus and Cassiopeia (who did not look away in time) to turn to stone. Perhaps his part in the whole drama is why his crown only appears to be seen in the fainter stars when he's upside down?

History of Observation:

As one of the 48 fabled constellations from Greek mythology, Cepheus was included by Ptolemy in his 2nd century tract, *The Almagest*. In 1922, it was included in the 88 modern constellations recognized by the International Astronomical Union (IAU).

Notable Features:

Bordered by Cygnus, Lacerta and Cassiopeia, it contains only one bright star, but seven major stars and 43 which have Bayer/ Flamsteed designations. It's brightest star, Alpha Cephei, is a white class A star, which is located about 48 light years away.

Its traditional name (Alderamin) is derived from the Arabic "*al-dira al-yamin*", which means "the right arm".

*This Hubble image shows RS Puppis, a type of variable star known as a Cepheid variable. Credit: NASA/ESA/STScI/AURA/ H. Bond/STScI/Penn State University*

Next is Beta Cephei, a triple star systems that is approximately 690 light years from Earth. The star's traditional name, Alfirk, is derived from the Arabic "*al-firqah"* ("the flock"). The brightest component in this system, Alfirk A, is a blue giant star (B2IIIev), which indicates that it is a variable star. In fact, this star is a prototype for Beta Cephei variables – main sequence stars that show variations in brightness as a result of pulsations of their surfaces.

Then there's Delta Cephei, which is located approximately 891 light years from the Solar System. This star also serves as a prototype for Cepheid variables, where pulsations on its surface are directly linked to changes in luminosity. The brighter component of the binary is classified as a yellow-white F-class supergiant, while its companion is believed to be a B-class star.

Gamma Cephei is another binary star in Cepheus, which is located approximately 45 light years away. The star's traditional name is Alrai (Er Rai or Errai), which is derived from the Arabic *ar-r?'?*, which means "the shepherd." Gamma Cephei is an orange subgiant (K1III-IV) that can be seen by the naked eye, and its companion has about 0.409 solar masses and is thought to be an M4 class red dwarf.

Cepheus is also home to many notable Deep Sky Objects. For example, there's NGC 6946, which is sometimes called the Fireworks Galaxy because of its supernovae rate and high volume of star formation. This intermediate spiral galaxy is located approximately 22 million light years distant. The galaxy was discovered by William Herschel in September 1798, and nine supernovae have been observed in it over the last century.

*The Fireworks Galaxy (NGC 6946). Credit: Simon Driver (University of St. Andrews)*

Next up is the Wizard Nebula (NGC 7380), an open star cluster that was discovered by Caroline Herschel in 1787. The cluster is embedded in a nebula that is about 110 light years in size and roughly 7,000 light years from our Solar System. It is also a relatively young open cluster, as its stars are estimated to be less than 500 million years old.

Then there's the Iris Nebula (NGC 7023), a reflection nebula with an apparent magnitude of 6.8 that is approximately 1,300 light years distant. The object is so-named because it is actually a star cluster embedded inside a nebula. The nebula is lit by the star SAO 19158 and it lies close to two relatively bright stars – T Cephei, which is a Mira type variable, and Beta Cephei.

Discovered by Sir William Herschel on October 18, 1794, Herschel made the correct assumption of, "A star of 7th magnitude. Affected with nebulosity which more than fills the field. It seems to extend to at least a degree all around: (fainter) stars such as 9th or 10th magnitude, of which there are many, are perfectly free from this appearance."

So where did the confusion come in? It happened in 1931 when Per Collinder decided to list the stars around it as a star cluster Collinder 429. Then along came Mr. van den Berg, and the little nebula became known as van den Berg 139. Then the whole group became known as Caldwell 4! So what's right and what isn't?

*The Wizard Nebula (NGC 738). Credit: NASA/JPL-Caltech/ WISE Team*

According to Brent Archinal, "I was surprised to find NGC 7023 listed in my catalog as a star cluster. I assumed immediately the Caldwell Catalog was in error, but further checking showed I was wrong! The Caldwell Catalog may be the only modern catalog to get the type correctly!"

Finding Cepheus:

Cepheus is a circumpolar constellation of the northern hemisphere and is easily seen at visible at latitudes between +90° and -10° and best seen during culmination during the month of November. For the unaided eye observer, start first with Cepheus' brightest star – Alpha. It's name is Alderamin and it's going through stellar evolution – moving off the main sequence into a subgiant, and on its way to becoming a red giant as its hydrogen supply depletes.

What's very cool is Alderamin is located near the precessional path traced across the celestial sphere by the Earth's north pole. That means that periodically this star comes within 3° of being a pole star! Keeping that in mind, head off for Gamma Cephei. Guess what? Due to the precession of the equinoxes, Errai will become our northern pole star around 3000 AD and will make its closest approach around 4000 AD. (Don't wait up, though… It will be late).

However, you can stay up late enough with a telescope or binoculars to have a closer look at Errai, because its an orange subgiant binary star that's also about to go off the main sequence and its accompanied by a red dwarf star. What's so special about that? Well, maybe because a planet has been discovered floating around there, too!

*The location of the northern Cepheus constellation. Credit: IAU/Sky & Telescope magazine (Roger Sinnott & Rick Fienberg)*

Now let's have some fun with a Cepheid variable star that changes enough in about 5 days to make watching it fun! You'll find Delta on the map as the figure 8 symbol and in the sky you'll find it 891 light-years away. Delta Cephei is binary star system and the prototype of the Cepheid variable stars – the closest of its type to the Sun.

This star pulses every 5.36634 days, causing its stellar magnitude to vary from 3.6 to 4.3. But that's not all! Its spectral type varies, too – going from F5 to G3. Try watching it over a period of several nights. Its rise to brightness is much faster than its decline! With a telescope, you will be able to see a companion star separated from Delta Cephei by 41 arc seconds.

Are you ready to examine two red supergiant stars? If you live in a dark sky area, you can see these unaided, but they are much nicer in binoculars. The first is Mu Cephei – aka. Herschel's Garnet Star. In his 1783 notes, Sir William Herschel wrote: "a very fine deep garnet colour, such as the periodical star omicron ceti" and the name stuck when Giuseppe Piazzi included the description in his catalog.

Now compare it to VV Cephi, right smack in the middle of the map. VV is absolutely a supergiant star, and it is of the largest stars known. In fact, VV Cephei is believed to be the third largest star in the entire Milky Way Galaxy! VV Cephei is 275,000-575,000 times more luminous than the Sun and is approximately 1,600–1,900 times the Sun's diameter.


*Artist's impression of VV Cep A, created using Celestia, with Mu Cephei (Garnet Star) in the background. Credit: Wikipedia Commons/Rackshea*

If placed in our solar system, the binary system would extend past the orbit of Jupiter and approach that of Saturn. Some 3,000 light years away from Earth, matter continuously flows off this bad boy and into its blue companion. Stellar wind flows off the system at a velocity of approximately 25 kilometers per second. And some body's Roche lobe gets filled!

For some rich field telescope and binocular fun from a dark sky site, try your luck with IC1396. This 3 degree field of nebulosity can even be seen unaided at times! Inside you'll find an open star cluster (hence the designation) and photographically the whole area is criss-crossed with dark nebulae.

For a telescope challenge, see if you can locate both Spiral galaxy NGC 6946 – aka. the Fireworks Nebula – and galactic cluster NGC 6939 about 2 degrees southwest of Eta Cepheus. About 40 arc minutes northwest of NGC 6946 – is about 8th magnitude, well compressed and contains about 80 stars.

More? Then try NGC 7023 – The Iris Nebula. This faint nebula can be achieved in dark skies with a 114-150mm telescope, but larger aperture will help reveal more subtle details since it has a lower surface brightness. Take the time at lower power to reveal the dark dust "lacuna" around it reported so many years ago, and to enjoy the true beauty of this Caldwell gem.

*The Iris Nebula (NGC 7023). Credit: Hewholooks*

Still more? Then head off with your telescope for IC1470 – but take your CCD camera. IC1470 is a compact H II region excited by a single O7 star associated with an extensive molecular cloud in the Perseus arm!

Yes, Cepheus has plenty of viewing opportunities for the amateur astronomer. And for thousands of years, it has proven to be a source of fascination for scholars and astronomers.

We have written many interesting articles about the constellation here at Universe Today. Here is What Are The Constellations?, What Is The Zodiac?, and Zodiac Signs And Their Dates.

Be sure to check out The Messier Catalog while you're at it!

For more information, check out the IAUs list of Constellations, and the Students for the Exploration and Development of Space page on Canes Venatici and Constellation Families.

# ISS PASSES For SEPTEMBER 2022

from Heavens Above website maintained by Chris Peat.

| Date | Brightn | Start | Highest point | End | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | (mag) | Time | Alt. | Az. | Time | Alt. | Az. | Time | Alt. | Az. |
| 05 Sep | -0.8 | 02:56:21 | 13° | E | 02:56:21 | 13° | E | 02:56:47 | 10° | E |
| 05 Sep | -3.8 | 04:29:16 | 45° | W | 04:30:11 | 86° | N | 04:33:34 | 10° | E |
| 06 Sep | -2.5 | 03:42:54 | 38° | E | 03:42:54 | 38° | E | 03:45:07 | 10° | E |
| 06 Sep | -3.7 | 05:15:48 | 15° | W | 05:18:28 | 63° | SSW | 05:21:48 | 10° | ESE |
| 07 Sep | -0.6 | 02:56:36 | 10° | E | 02:56:36 | 10° | E | 02:56:41 | 10° | E |
| 07 Sep | -3.9 | 04:29:31 | 58° | W | 04:30:04 | 78° | SSW | 04:33:26 | 10° | ESE |
| 08 Sep | -1.9 | 03:43:23 | 26° | E | 03:43:23 | 26° | E | 03:45:00 | 10° | E |
| 08 Sep | -3.1 | 05:16:18 | 19° | W | 05:18:13 | 37° | SSW | 05:21:20 | 10° | SE |
| 09 Sep | -3.3 | 04:30:20 | 45° | S | 04:30:20 | 45° | S | 04:33:06 | 10° | SE |
| 10 Sep | -0.9 | 03:44:35 | 11° | ESE | 03:44:35 | 11° | ESE | 03:44:46 | 10° | ESE |
| 10 Sep | -2.3 | 05:17:33 | 20° | SW | 05:17:46 | 20° | SW | 05:20:16 | 10° | SSE |
| 11 Sep | -1.2 | 04:32:05 | 12° | SSE | 04:32:05 | 12° | SSE | 04:32:21 | 10° | SSE |
| 15 Sep | -1.9 | 21:11:08 | 10° | SSW | 21:12:29 | 19° | S | 21:12:29 | 19° | S |
| 16 Sep | -2.1 | 20:23:14 | 10° | S | 20:25:37 | 18° | SE | 20:26:28 | 17° | ESE |
| 16 Sep | -1.3 | 21:58:34 | 10° | WSW | 21:59:25 | 17° | WSW | 21:59:25 | 17° | WSW |
| 17 Sep | -3.4 | 21:10:10 | 10° | SW | 21:13:10 | 45° | S | 21:13:10 | 45° | S |
| 18 Sep | -3.0 | 20:21:52 | 10° | SW | 20:24:56 | 34° | SSE | 20:26:46 | 19° | E |
| 18 Sep | -1.8 | 21:58:06 | 10° | W | 21:59:41 | 25° | WSW | 21:59:41 | 25° | WSW |
| 19 Sep | -3.9 | 21:09:34 | 10° | WSW | 21:12:55 | 74° | SSE | 21:13:08 | 70° | SE |
| 20 Sep | -3.7 | 20:21:03 | 10° | WSW | 20:24:22 | 59° | SSE | 20:26:31 | 20° | E |
| 20 Sep | -1.8 | 21:57:42 | 10° | W | 21:59:24 | 27° | W | 21:59:24 | 27° | W |
| 21 Sep | -3.9 | 21:09:06 | 10° | W | 21:12:28 | 87° | N | 21:12:41 | 77° | ENE |
| 22 Sep | -3.8 | 20:20:29 | 10° | WSW | 20:23:51 | 85° | S | 20:25:56 | 22° | E |
| 22 Sep | -1.6 | 21:57:15 | 10° | W | 21:58:49 | 25° | W | 21:58:49 | 25° | W |
| 23 Sep | -3.7 | 19:31:54 | 10° | WSW | 19:35:15 | 72° | SSE | 19:38:37 | 10° | E |
| 23 Sep | -3.9 | 21:08:38 | 10° | W | 21:12:00 | 87° | N | 21:12:00 | 87° | N |
| 24 Sep | -3.8 | 20:19:59 | 10° | W | 20:23:22 | 85° | N | 20:25:12 | 25° | E |
| 24 Sep | -1.4 | 21:56:45 | 10° | W | 21:58:04 | 21° | W | 21:58:04 | 21° | W |
| 25 Sep | -3.7 | 19:31:21 | 10° | W | 19:34:43 | 88° | N | 19:38:06 | 10° | E |
| 25 Sep | -3.6 | 21:08:06 | 10° | W | 21:11:14 | 70° | WSW | 21:11:14 | 70° | WSW |
| 26 Sep | -3.8 | 20:19:27 | 10° | W | 20:22:50 | 87° | SSW | 20:24:23 | 29° | E |
| 26 Sep | -1.0 | 21:56:17 | 10° | W | 21:57:16 | 17° | W | 21:57:16 | 17° | W |
| 27 Sep | -3.7 | 19:30:47 | 10° | W | 19:34:10 | 86° | N | 19:37:33 | 10° | E |
| 27 Sep | -3.0 | 21:07:34 | 10° | W | 21:10:26 | 44° | SW | 21:10:26 | 44° | SW |
| 28 Sep | -3.6 | 20:18:52 | 10° | W | 20:22:12 | 62° | SSW | 20:23:37 | 30° | SE |
| 28 Sep | -0.7 | 21:56:05 | 10° | W | 21:56:30 | 12° | WSW | 21:56:30 | 12° | WSW |
| 29 Sep | -3.7 | 19:30:11 | 10° | W | 19:33:33 | 77° | SSW | 19:36:50 | 10° | ESE |
| 29 Sep | -2.1 | 21:07:07 | 10° | W | 21:09:43 | 26° | SW | 21:09:43 | 26° | SW |
| 30 Sep | -2.6 | 20:18:17 | 10° | W | 20:21:25 | 36° | SSW | 20:22:59 | 23° | SSE |
| 01 Oct | -3.1 | 19:29:33 | 10° | W | 19:32:49 | 50° | SSW | 19:36:04 | 10° | SE |
| 01 Oct | -1.2 | 21:07:13 | 10° | WSW | 21:08:57 | 13° | SW | 21:09:11 | 13° | SW |
| 02 Oct | -1.5 | 20:17:57 | 10° | W | 20:20:27 | 20° | SW | 20:22:35 | 12° | S |
| 03 Oct | -2.0 | 19:28:59 | 10° | W | 19:31:54 | 28° | SSW | 19:34:49 | 10° | SSE |

## END IMAGES, AND OBSERVING

*The Sun and the Moon. The Sun has been increasing its activity throughout this year and is producing some nice Sunspots but also coronal hole ejections that have been sending some powerful plasma streams towards the Earth. Indeed , last Sunday yielded some very good displays of aurora seen to low latitudes, but we were clouded out! But we should be ready for last minute calls to view these phenomena which seem to increase around equinox so September and October are peak months. Get ready to look north.*

**Observing Sessions**

**Proposed Observation Sessions for 2022-2023**

**Planned observing evenings will be on a Friday night in the Lacock playing fields behind the Red Lion pub at 19:00 or an Hour after sunset depending on the time of year.**
**With the New Moon being around the beginning of the month and the full moon generally around the middle, the following dates for observing are proposed:**

**a ad-hoc session for other reasons and at other locations, such as astro-photography, solar observing etc, with other like-minded members then they can do so through the Society Members Facebook Page or through the WAS contact page on the website.**

| Opportunity | Day | Date | Month | Set-up | Observe |
|---|---|---|---|---|---|
| First | Friday | 16th | September | 20:00 | 20:30 |
| Second | Friday | 23rd | September | 20:00 | 20:30 |
| First | Friday | 21st | October | 19:00 | 19:30 |
| Second | Friday | 28th | October | 19:00 | 19:00 |
| First | Friday | 18th | November | 18:30 | 19:00 |
| Second | Friday | 25th | November | 18:30 | 19:00 |
| First | Friday | 16th | December | 18:30 | 19:00 |
| Second | Friday | 23rd | December | 18:30 | 19:00 |
| First | Friday | 13th | January | 18:30 | 19:00 |
| Second | Friday | 20th | January | 18:30 | 19:00 |
| First | Friday | 10th | February | 18:30 | 19:00 |
| Second | Friday | 17th | February | 19:00 | 19:30 |
| Third | Friday | 24th | February | 19:00 | 19:30 |
| First | Friday | 17th | March | 19:00 | 19:30 |
| Second | Friday | 24th | March | 19:30 | 20:00 |
| First | Friday | 14th | April | 20:00 | 20:30 |
| Second | Friday | 21st | April | 20:30 | 21:00 |
| First | Friday | 12th | May | 20:30 | 21:00 |
| Second | Friday | 19th | May | 20:30 | 21:00 |