

# STRATFORD ASTRONOMY GROUP

DECEMBER 12<sup>TH</sup>, 2023



# AGENDA

- Meet and Greet
- Club NEWS and Activities
- Club Q & A
- Equipment Lessons
- Software and Imaging Information
- Latest Astronomy NEWS
- What's UP this Month
- Show and Tell
- Astronomy Lessons
- Cosmology Lessons
- Conclusion

# MEET AND GREET

Welcome  
New Visitors

Regrets

# PREVIOUS MEETING REVIEW

## Meeting attended by 20:



Nick Assiouras  
Paul Bartlett  
Michael Burns  
Colleen Devine  
Doug Fyfe  
Bob Greer  
Patrick Hayes  
Alex Huddleston  
Derek Huddleston  
Wolfgang Keller  
Tom Kimber  
Michael Maranger  
Mary Montizambert  
Jim Nafziger  
David Orr  
Richard Rosenthal  
Richard Skevington  
Rena Spevack  
Bill Thompson  
Peter Tinitis



## CLUB NEWS AND ACTIVITIES

## Group Funds

**Total = \$1447.48**

- If you would like to contribute to the group, then please e-transfer Tim at:

[timannemariepauli@gmail.com](mailto:timannemariepauli@gmail.com)

or by cheques:

Tim Pauli  
96 Front Street  
Stratford, ON  
N5A4H2

# CLUB NEWS AND ACTIVITIES

## EQUIPMENT:

### STRATFORD ASTRONOMY CLUB EQUIPMENT

### CLUB EQUIPMENT LOCATION:

Paul Bartlett is now storing all the group's equipment. If you wish to borrow an item, then please contact him at:

[1948paul.bartlett@gmail.com](mailto:1948paul.bartlett@gmail.com)

519-274-2010

**New Equipment Donation: Tim**

# UPCOMING MEETINGS

## NEXT MEETING DATES

Date	Start	End	Facility and Spaces
<del>September 12, 2023</del>	<del>7:00 PM</del>	<del>9:00 PM</del>	<del>St. Michael's CSS, Room 104</del>
<del>October 3, 2023</del>	<del>7:00 PM</del>	<del>9:00 PM</del>	<del>St. Michael's CSS, Room 104</del>
<del>November 7, 2023</del>	<del>7:00 PM</del>	<del>9:00 PM</del>	<del>St. Michael's CSS, Room 104</del>
<del>December 12, 2023</del>	<del>7:00 PM</del>	<del>9:00 PM</del>	<del>St. Michael's CSS, Room 104</del>
January 9, 2024	7:00 PM	9:00 PM	St. Michael's CSS, Room 104
February 6, 2024	7:00 PM	9:00 PM	St. Michael's CSS, Room 104
March 5, 2024	7:00 PM	9:00 PM	St. Michael's CSS, Room 104
April 2, 2024	7:00 PM	9:00 PM	St. Michael's CSS, Room 104
May 7, 2024	7:00 PM	9:00 PM	St. Michael's CSS, Room 104
June 4, 2024	7:00 PM	9:00 PM	St. Michael's CSS, Room 104

# CLUB NEWS AND ACTIVITIES

- **New Web site:** (<https://stratfordastronomy.com/>)
  - Tim Pauli - Owner/Administrator
  - Ken Roberts - technical contact
  - Tom Kimber - Administrator/Editor
  - Doug Fyfe - Administrator
  - Michael Burns- Administrator
  - Tom will build it on WordPress.
  
- **Post Christmas Get together:** Tim

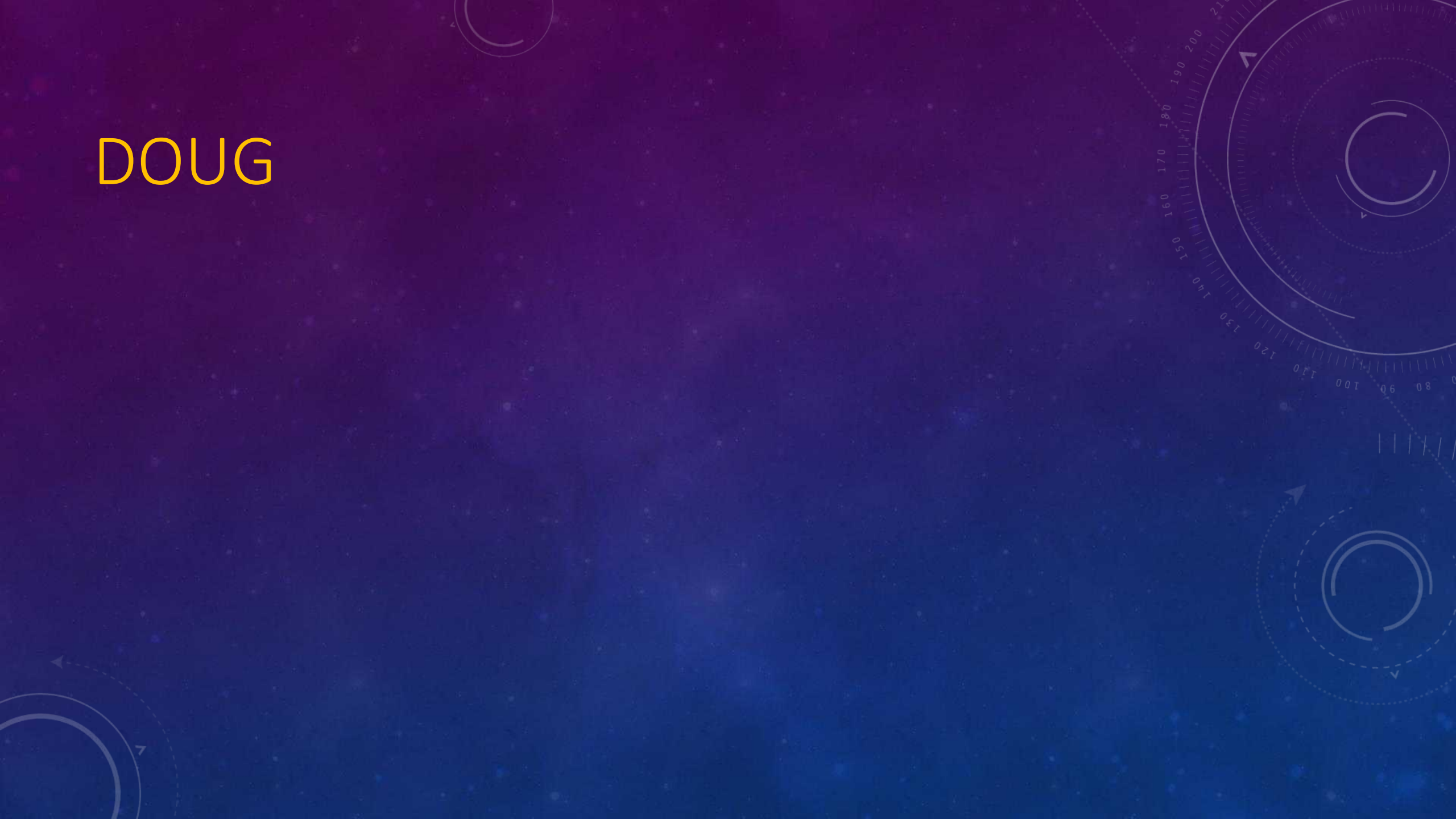




## CLUB Q & A



DOUG

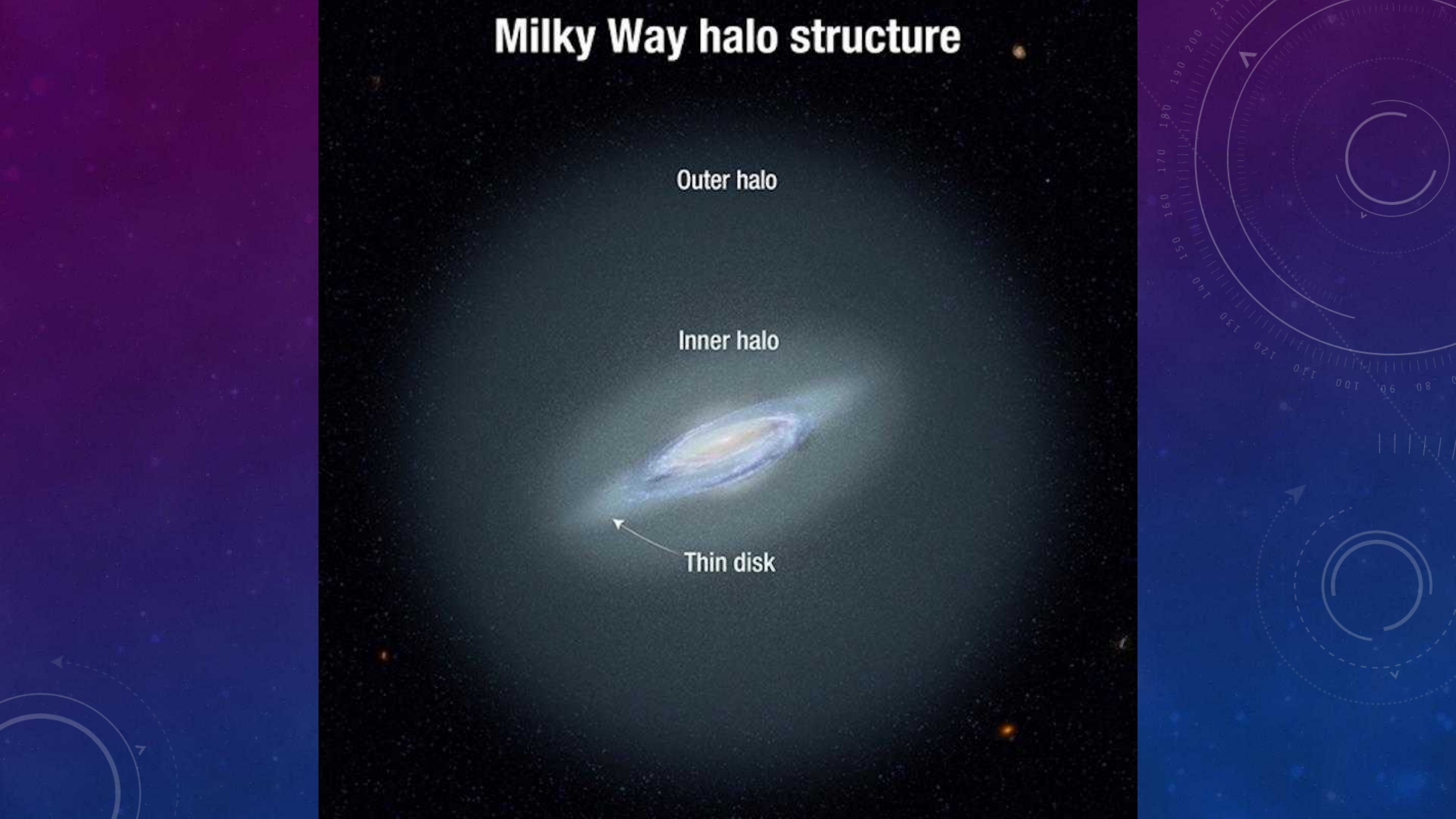


# Milky Way halo structure

Outer halo

Inner halo

Thin disk









## What do we know about...

- other stars : constellations, nebulae, galaxies ?



Doug Fyfe, Stratford Astronomy Group, Ontario, Canada





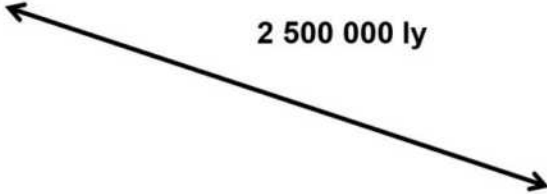


# What do we know about ... - the Milky Way and Andromeda



Andromeda

2 500 000 ly



Milky Way



120 000 ly



LATEST ASTRONOMY NEWS

OCTOBER





# NOV 11<sup>TH</sup> OLDEST BLACK HOLE DISCOVERED DATING BACK TO 470 MILLION YEARS AFTER THE BIG BANG

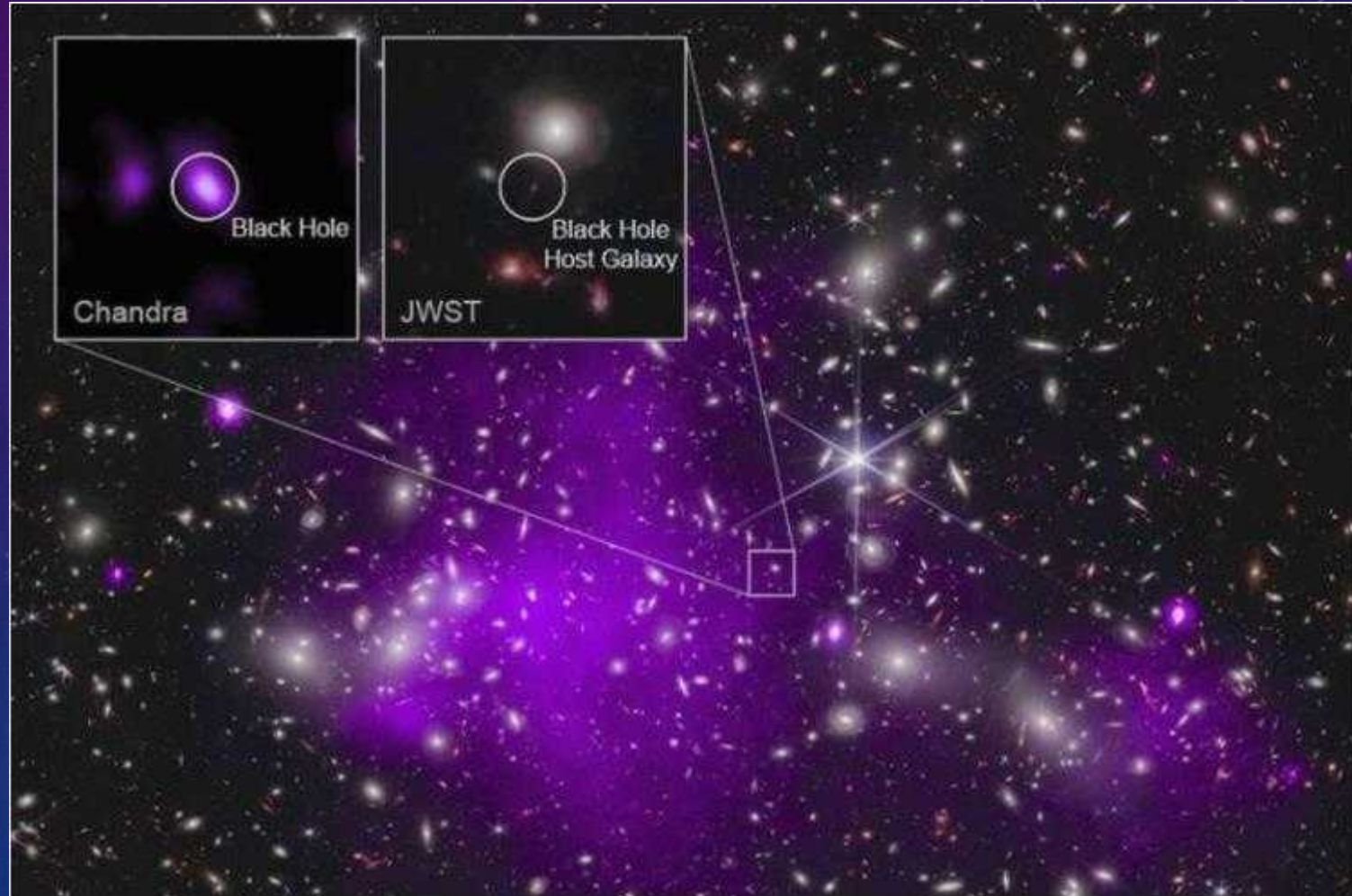
Scientists have discovered the oldest black hole yet, a cosmic beast formed a mere 470 million years after the Big Bang.

The findings, published Monday, confirm what until now were theories that supermassive black holes existed at the dawn of the Universe. NASA's James Webb Space Telescope and Chandra X-Ray Observatory teamed up over the past year to make the observations.

Given the universe is 13.7 billion years old, that puts the age of this black hole at 13.2 billion years.

Even more astounding to scientists, this black hole is a whopper—10 times bigger than the black hole in our own Milky Way (ours is 4.3 million solar masses).

- It's believed to weigh anywhere from 10% to 100% the mass of all the stars in its galaxy, said lead author Akos Bogdan of the Harvard-Smithsonian Center for Astrophysics.



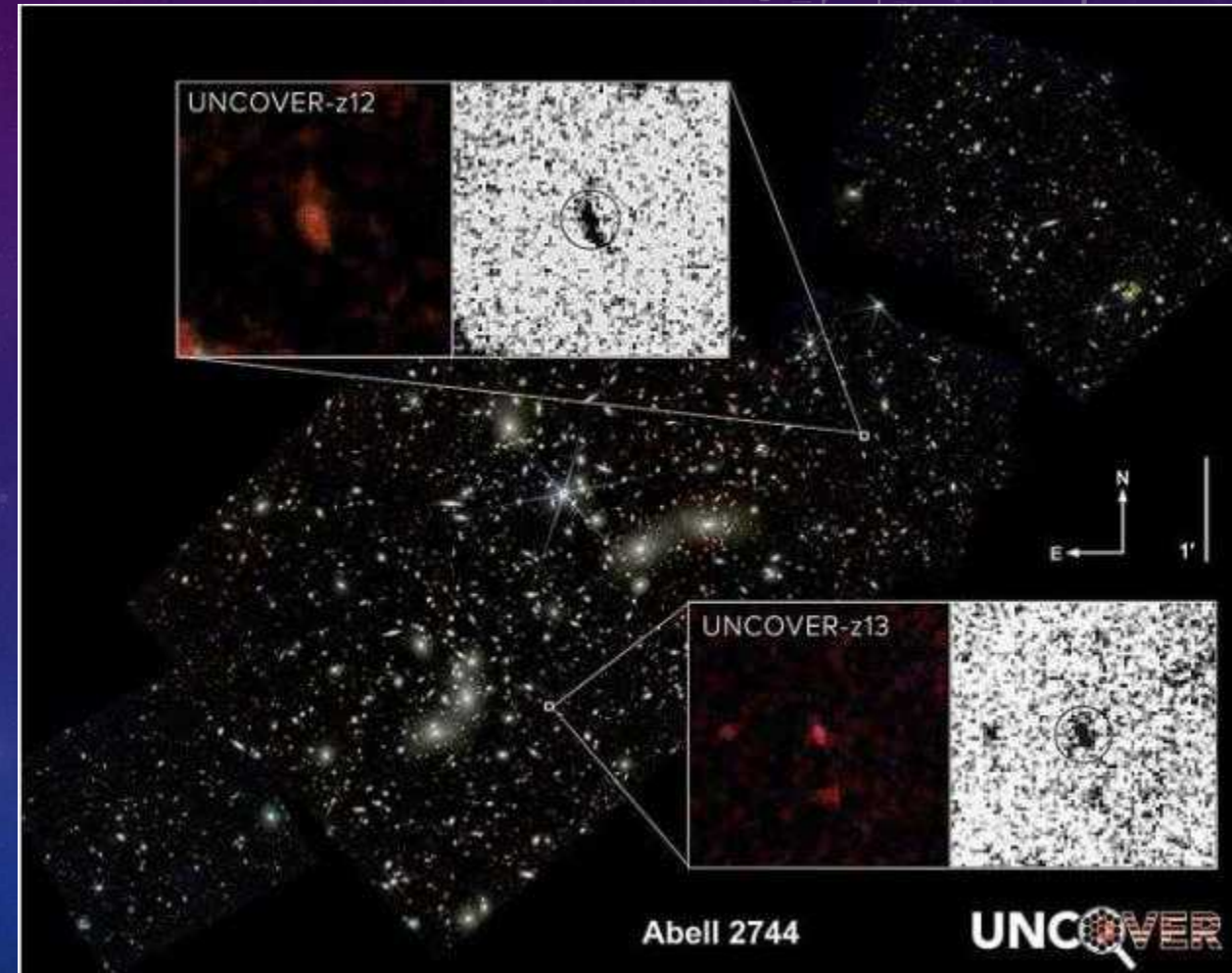


## NOV 13TH: SECOND-MOST DISTANT GALAXY DISCOVERED USING JAMES WEBB SPACE TELESCOPE

The second- and fourth-most distant galaxies ever observed have been discovered in a region of space known as Pandora's Cluster, or Abell 2744, using data from NASA's James Webb Space Telescope (JWST).

Following up on a deep field image of the area, an international team led by Penn State researchers confirmed the distance of these ancient galaxies and inferred their properties using new spectroscopic data—information about light emitted across the electromagnetic spectrum—from JWST. At nearly 33 billion light years away, these incredibly distant galaxies offer insights into how the earliest galaxies might have formed.

Unlike other galaxies confirmed at this distance that appear in images as red dots, the new galaxies are larger and appear like a peanut and a fluffy ball, according to the researchers. A paper describing the galaxies appears in the journal *Astrophysical Journal Letters*. orbit (LEO).

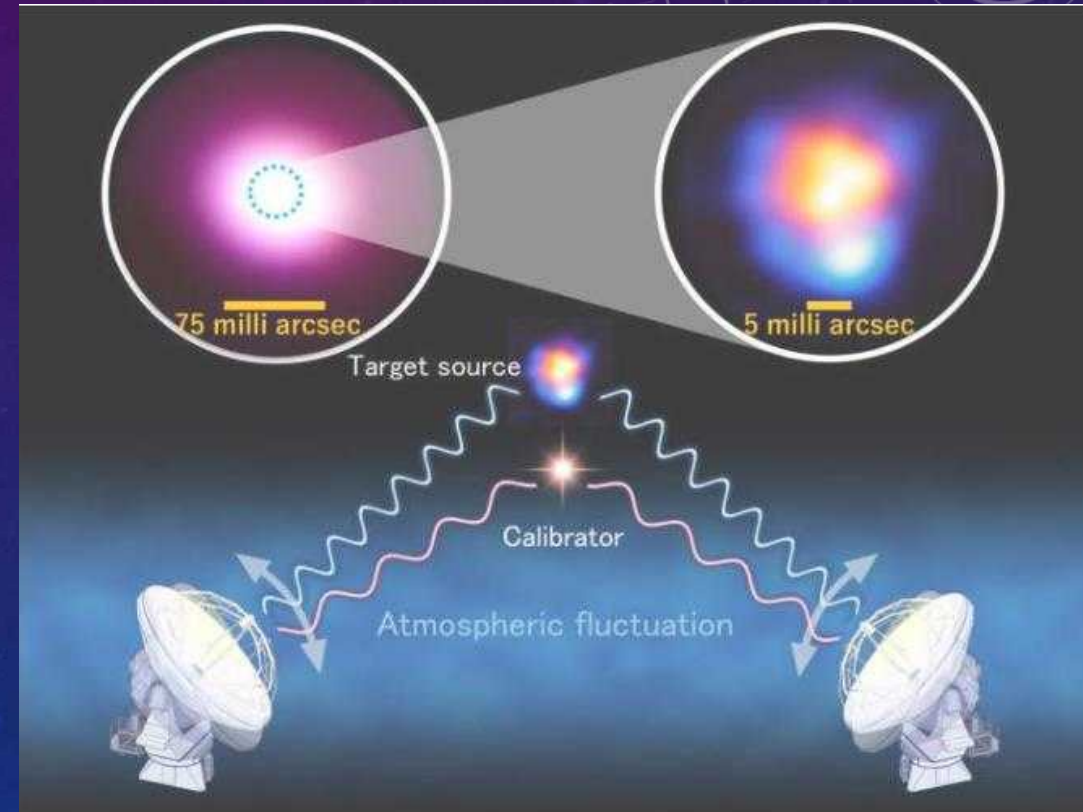


## NOV 15TH: ALMA DEMONSTRATES HIGHEST RESOLUTION YET

ALMA (Atacama Large Millimeter/submillimeter Array) has demonstrated the highest resolution yet with observations of an old star. The observations show that the star is surrounded by a ring-like structure of gas and that gas from the star is escaping to the surrounding space. Future observations with the newly demonstrated high resolution are expected to elucidate not only the end of a star's life but also the beginning, when planets are still forming.

ALMA is a radio interferometric array telescope, in which individual antennas work together to observe a celestial object. ALMA's resolution, the ability to see small details, is determined by the maximum separation between the antennas and the frequency of the observed radio waves.

In this research, an international team composed mainly of astronomers from the Joint ALMA Observatory, National Astronomical Observatory of Japan (NAOJ), National Radio Astronomy Observatory, and European Southern Observatory used ALMA's maximum antenna separation of 16 km and highest frequency receivers (known as Band 10, up to 950 GHz) to achieve the best resolution possible. This work resulted in two papers published in *The Astrophysical Journal* and *The Astrophysical Journal Supplement Series*.

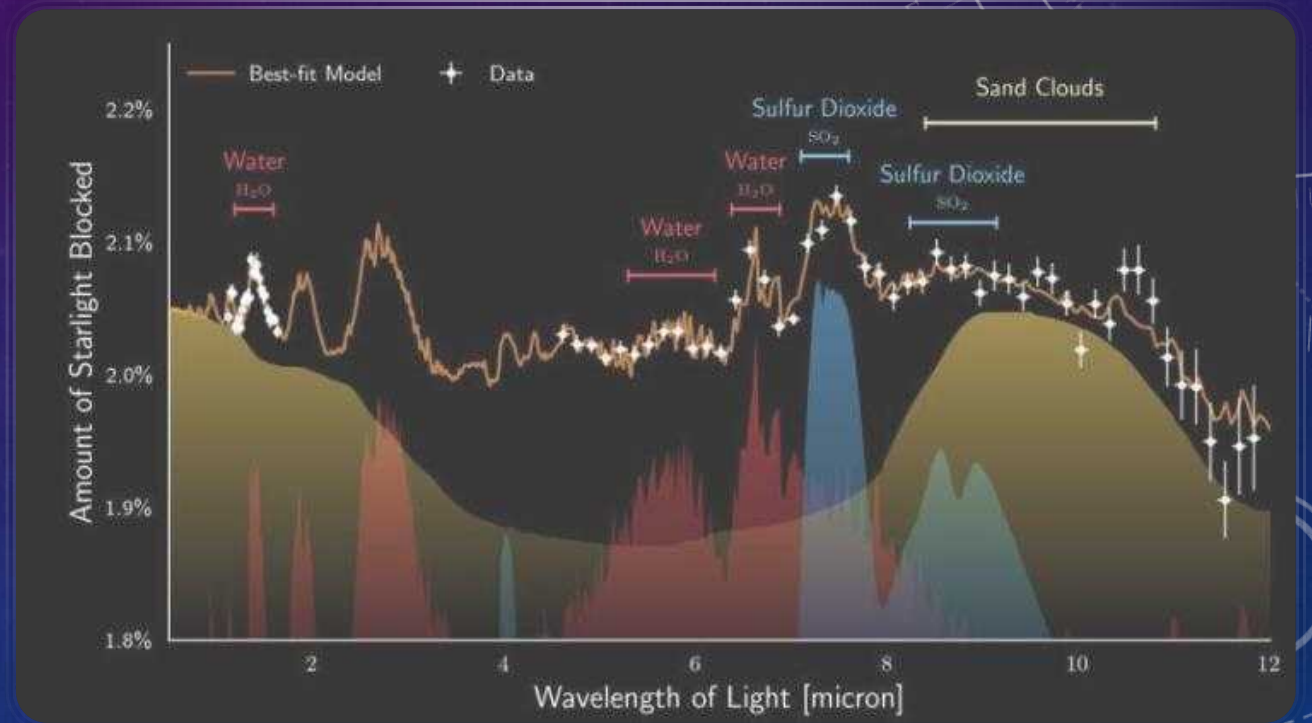




# NOV 15TH: JWST DETECTS WATER VAPOR, SULFUR DIOXIDE AND SAND CLOUDS IN THE ATMOSPHERE OF A NEARBY EXOPLANET

- A team of European astronomers, co-led by researchers from the Institute of Astronomy, KU Leuven, used recent observations made with the James Webb Space Telescope to study the atmosphere of the nearby exoplanet WASP-107b. Peering deep into the fluffy atmosphere of WASP-107b they discovered not only water vapor and sulfur dioxide, but even silicate sand clouds. These particles reside within a dynamic atmosphere that exhibits vigorous transport of material.

- The mass of the planet is similar to that of Neptune but its size is much larger than that of Neptune, almost approaching the size of Jupiter. This characteristic renders WASP-107b rather 'fluffy' when compared to the gas giant planets within our solar system. The fluffiness of this exoplanet enables astronomers to look roughly 50 times deeper into its atmosphere compared to the depth of exploration achieved for a solar-system giant like Jupiter.





## NOV 18<sup>TH</sup>: SPACEX LAUNCHED ITS GIANT NEW ROCKET BUT EXPLOSIONS END THE SECOND TEST FLIGHT

- SpaceX launched its mega rocket Starship but lost both the booster and the spacecraft in a pair of explosions minutes into Saturday's test flight.

The rocketship reached space following liftoff from South Texas before communication suddenly was lost. SpaceX officials said it appears the ship's self-destruct system blew it up over the Gulf of Mexico.

Minutes earlier, the separated booster had exploded over the gulf. By then, though, its job was done.

Saturday's demo lasted eight or so minutes, about twice as long as the first test in April, which also ended in an explosion. The latest flight came to an end as the ship's six engines were almost done firing to put it on an around-the-world path.

At nearly 400 feet (121 meters), Starship is the biggest and most powerful rocket ever built, with the goal of ferrying people to the moon and Mars.

"The real topping on the cake today, that successful liftoff," said SpaceX commentator John Insprucker, noting that all 33 booster engines fired as designed, unlike last time. The booster also separated seamlessly from the spaceship, which reached an altitude of 92 miles (148 kilometers).

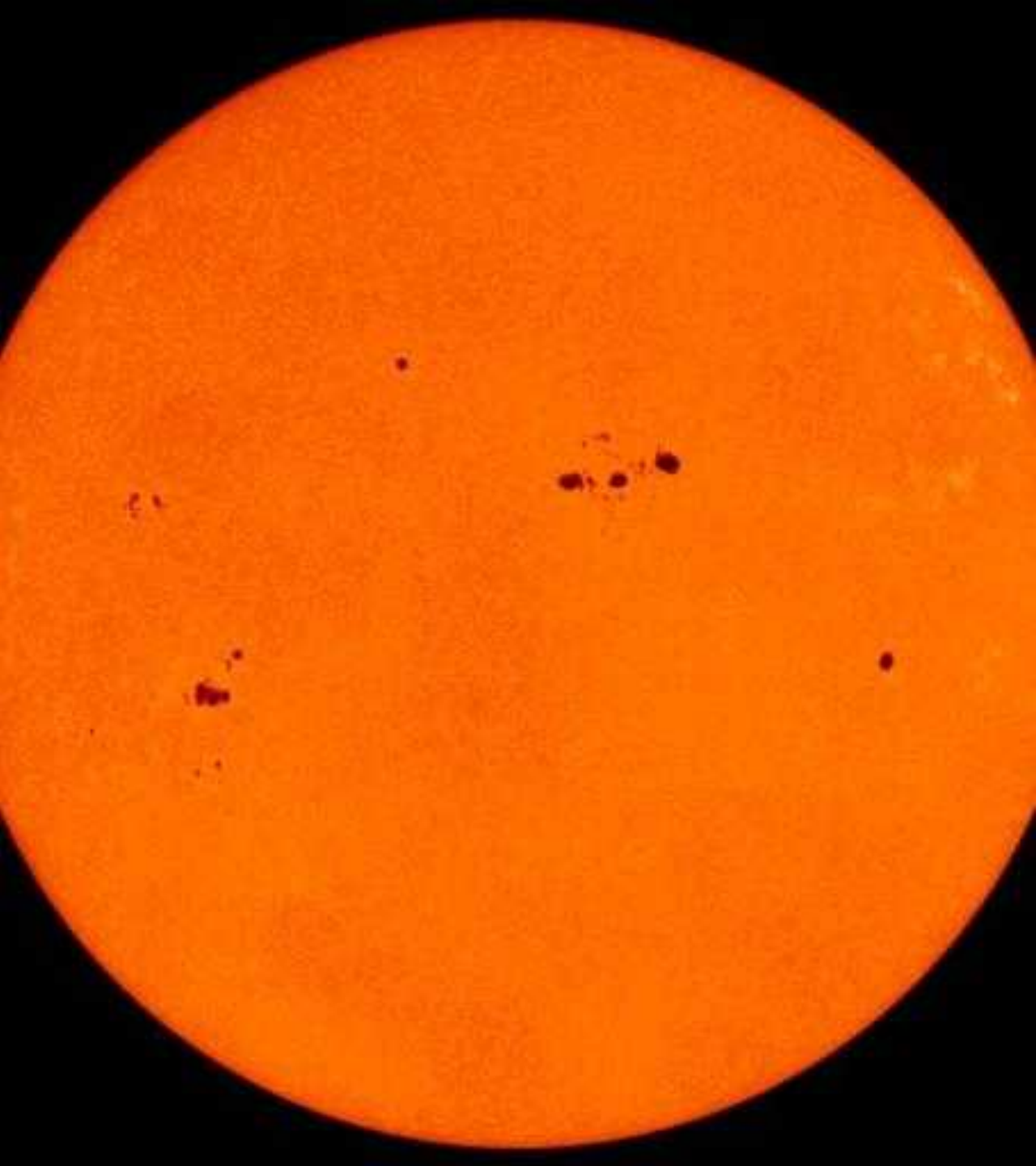




## NOV 27<sup>TH</sup>: VERA RUBIN OBSERVATORY WILL FIND BINARY SUPERMASSIVE BLACK HOLES:

- A When galaxies merge, we expect them to produce binary black holes (BBHs.) BBHs orbit one another closely, and when they merge, they produce gravitational waves that have been detected by LIGO-Virgo. The upcoming Vera Rubin Observatory should be able to find them before they merge, which would open a whole new window into the study of galaxy mergers, supermassive black holes, binary black holes, and gravitational waves.
- The Vera Rubin Observatory (VRO) will perform a massive, multi-year time-domain survey that repeatedly images the sky looking for changes. It's called the LSST: the Legacy Survey of Space and Time. It'll detect everything from asteroids to supernovae explosions. But new research shows how the VRO can also detect binary black holes.
- The paper is titled "Reliable Identification of Binary Supermassive Black Holes from Rubin Observatory Time-Domain Monitoring." It's been submitted to The Astrophysical Journal and is currently in pre-print on the arXiv server. The lead author is Megan Davis from the Department of Physics at the University of Connecticut.





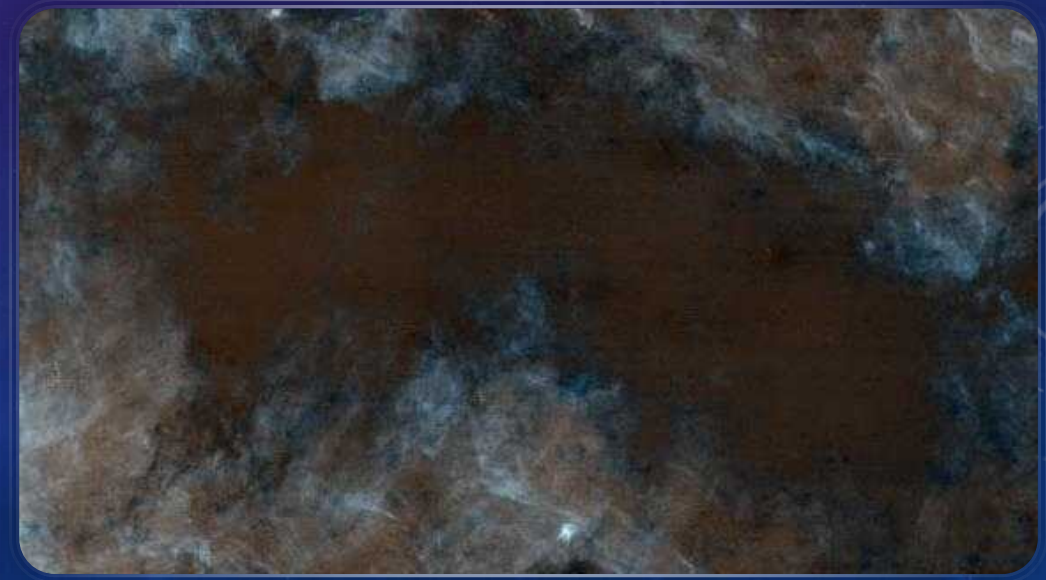
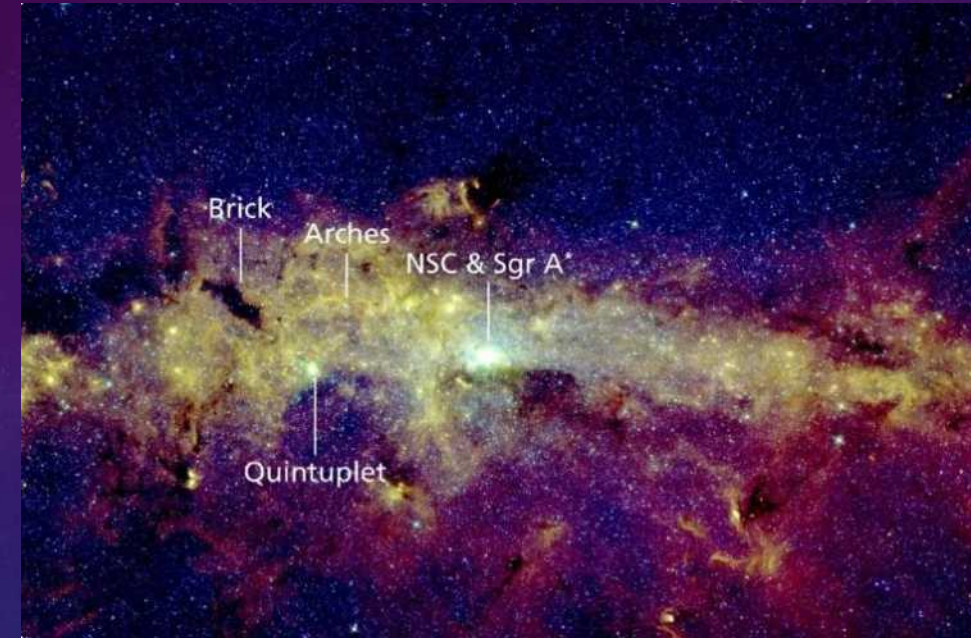
## NOV 28<sup>TH</sup>: RESEARCHERS HAVE DISCOVERED A NEW RELATIONSHIP BETWEEN THE SUN'S MAGNETIC FIELD AND ITS SUNSPOT CYCLE:

- Researchers at the Center of Excellence in Space Sciences India at IISER Kolkata have discovered a new relationship between the Sun's magnetic field and its sunspot cycle, that can help predict when the peak in solar activity will occur. Their work indicates that the maximum intensity of solar cycle 25, the ongoing sunspot cycle, is imminent and likely to occur within a year. The new research appears in Monthly Notices of the Royal Astronomical Society: Letters.
- Huge plasma flows and convection conspire together to form magnetic fields inside the Sun which manifest on the surface as dark spots. These sunspots are comparable to the size of the Earth and are seats of intense magnetism, about 10,000 times stronger than the Earth's magnetic field.
- Sometimes the sunspot magnetic fields are disrupted in violent events which result in the birth of solar magnetic storms such as flares or coronal mass ejections.
- These storms release high energy radiation and hurl vast amounts of magnetized plasma into outer space.



## DEC 4TH: WEBB OBSERVES MYSTERIOUS DARK MOLECULAR CLOUD IN MILKY WAY'S CENTRAL REGION

• Jupiter [G0.253+0.016](#), nicknamed 'the Brick' due to its opacity, is among the best-studied infrared dark clouds in our Milky Way Galaxy. It is well-known for being dense and turbulent while showing few signs of star formation, much less than is typical for such a massive cloud. Using the NASA/ESA/CSA James Webb Space Telescope, University of Florida astronomer Adam Ginsburg and his colleagues peered into the Brick, discovering a substantial presence of frozen carbon monoxide there. It harbors a significantly larger amount of carbon monoxide ice than previously anticipated, carrying profound implications for our understanding of star formation processes. The Brick, officially known as G0.253+0.016 is a rectangular shaped, turbulent, near-opaque cloud of gas with a mass equivalent to around 100,000 suns in an estimated length of around 50 light-years and width of around 20 light-years, making it incredibly dense. Part of a complex of gas called the Central Molecular Zone, which is 1,000 to 2,000 light-years wide, the Brick has long fascinated astronomers because, despite being replete with cool, dense gas — the building blocks of stars — stellar birth is unexpectedly low in the region.

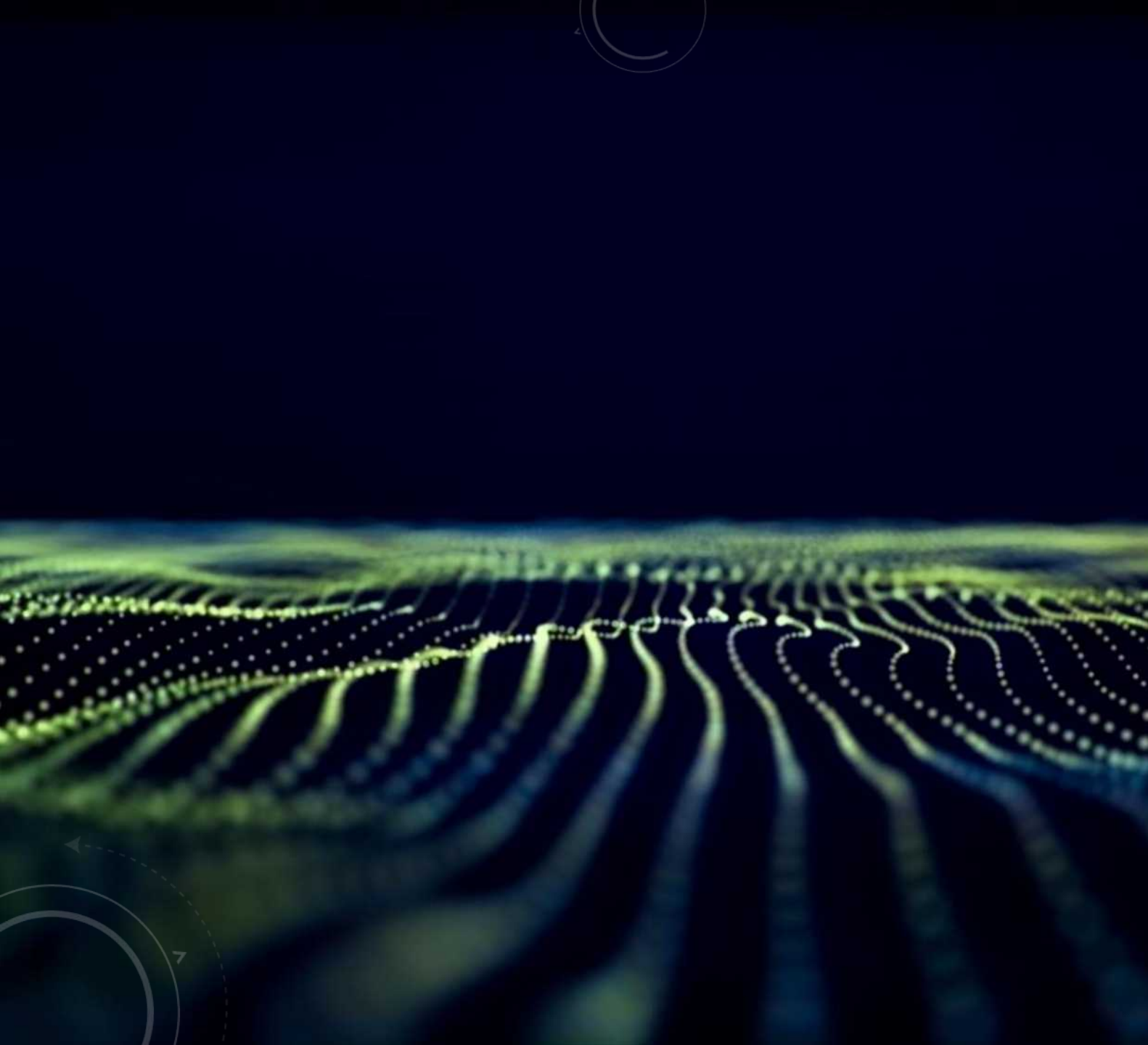




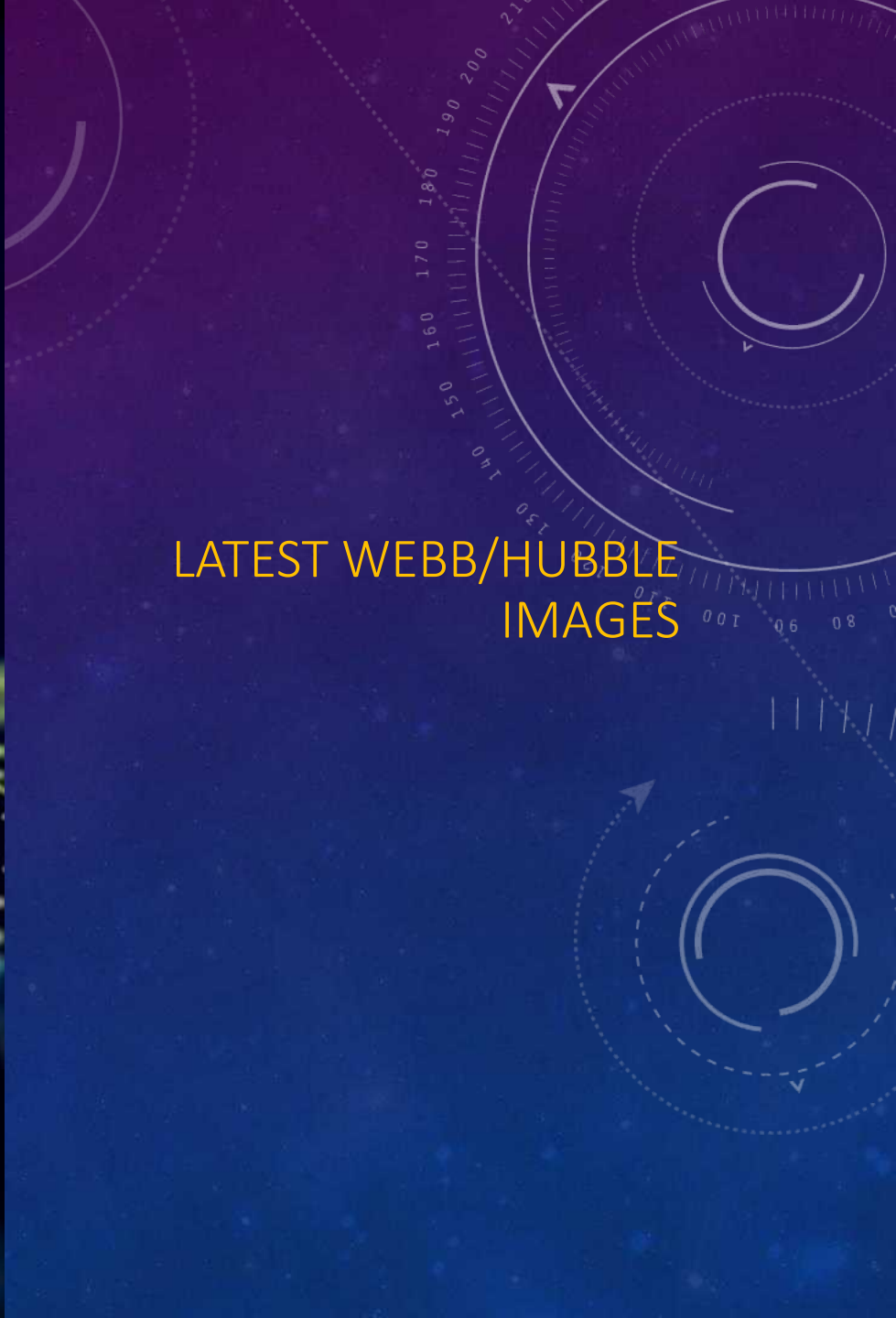


## DEC 7TH: FAMED HALLEY'S COMET PASSES APHELION THIS WEEKEND

- It's lonely out there in the frozen outer solar system. On Saturday, December 9th, that most famous of all comets 1P/Halley reaches a hallmark point on its 75-year journey through the solar system, reaching aphelion or its most distant point from the sun.
- You could say that December 2023 represents a midpoint between the last 1986 and the next 2061 apparition for the comet. No one has seen Halley's Comet since the European Southern Observatory's Very Large Telescope imaged it a generation ago in 2003. At the time, it was 28 Astronomical Units (AU) distant at magnitude +28.
- The exact moment of aphelion occurs at 1:00 Universal Time (UT) on December 9th, (8:00 PM EST on Friday night on the 8th). At that point, Halley's Comet will be 35.14 AU (almost 3.3 billion miles or 5.3 billion kilometers) from the sun. This puts the comet out beyond the orbit of Neptune, shining at +35th magnitude in the southern constellation of Hydra the Sea Serpent. The comet will also be moving at its slowest velocity, at 0.91 kilometers per second or 2,000 miles per hour respective to the sun.



LATEST WEBB/HUBBLE  
IMAGES





# WEBB REVEALS NEW FEATURES IN HEART OF MILKY WAY



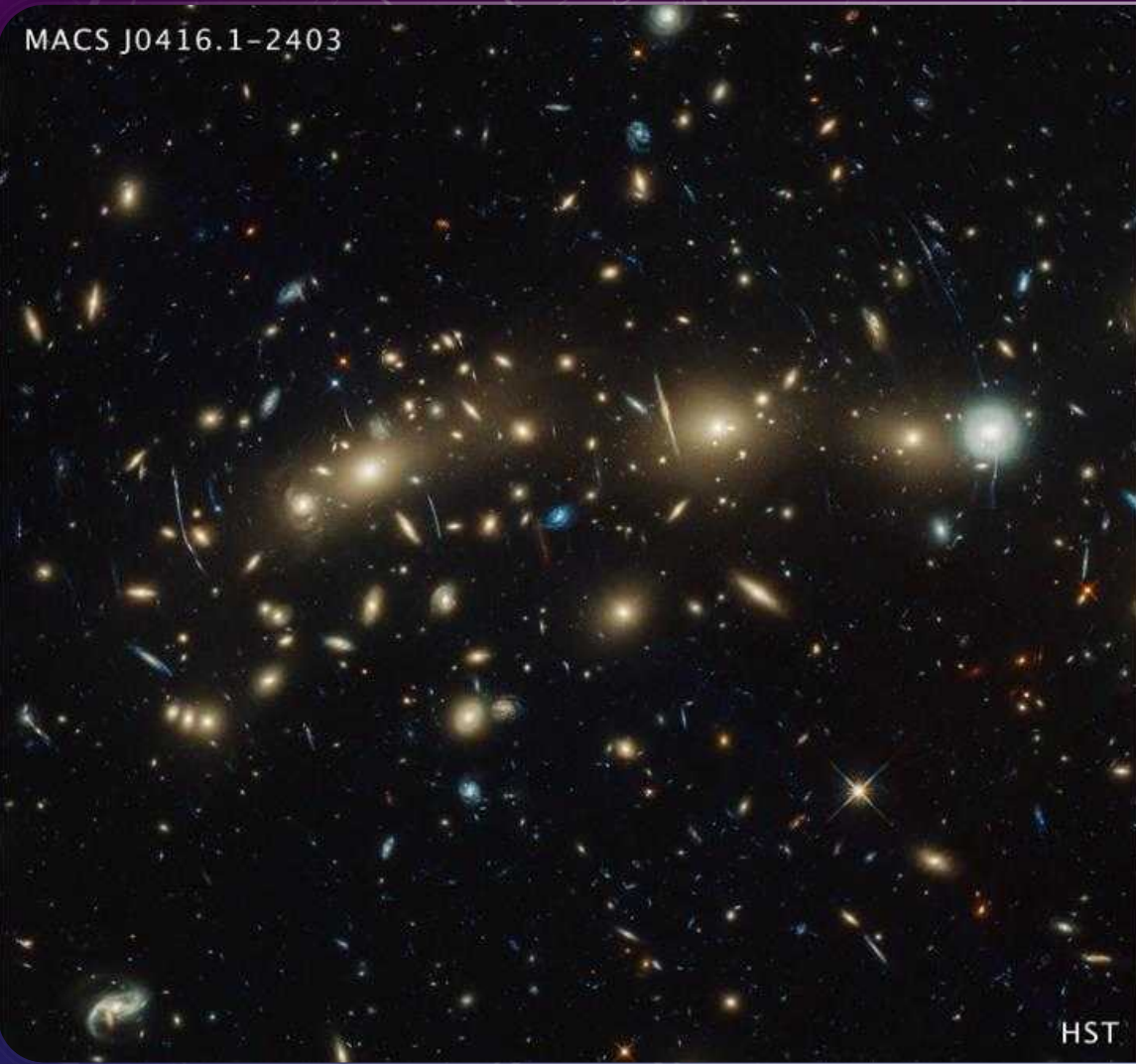




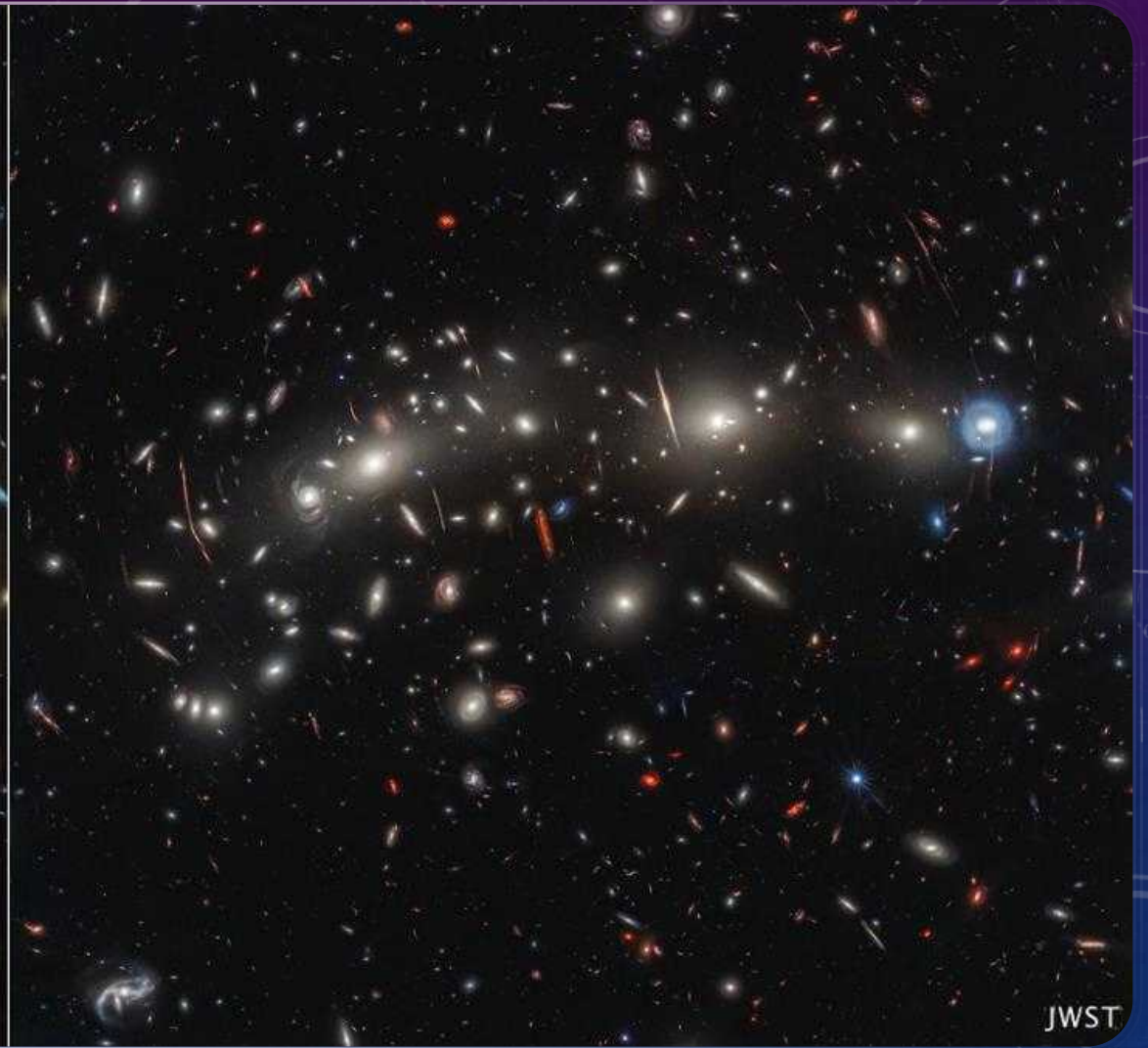
•This striking Hubble Space Telescope image shows the densely packed globular cluster known as NGC 2210, which is situated in the Large Magellanic Cloud (LMC).



MACS J0416.1-2403



HST



JWST

**HUBBLE AND WEBB COMBINE TO SHOW MACS0416, A GIGANTIC GALAXY CLUSTER LOCATED ABOUT 4.3 BILLION LIGHT-YEARS FROM EARTH.**

# WHAT'S UP

## STRATFORD ASTRONOMY GROUP

### WHAT'S UP FOR NOVEMBER



This is a month of "Almost for us"



Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
26 	27 	28 	29 	30 	1  Waning gibbous Visible: 83% ↓ Age: 18.78 days	2  Waning gibbous Visible: 76% ↓ Age: 19.70 days
3  Waning gibbous Visible: 67% ↓ Age: 20.59 days	4  Last quarter Visible: 58% ↓ Age: 21.48 days	5  Last quarter Visible: 48% ↓ Age: 22.37 days	6  Last quarter Visible: 39% ↓ Age: 23.26 days	7  Waning crescent Visible: 30% ↓ Age: 24.16 days	8  Waning crescent Visible: 21% ↓ Age: 25.08 days	9  Waning crescent Visible: 14% ↓ Age: 26.02 days
10  Waning crescent Visible: 8% ↓ Age: 26.99 days	11  Waning crescent Visible: 3% ↓ Age: 27.99 days	12  New Visible: 1% ↓ Age: 29.02 days	13  New Visible: 1% ↑ Age: 0.55 days	14  Waxing crescent Visible: 3% ↑ Age: 1.63 days	15  Waxing crescent Visible: 9% ↑ Age: 2.72 days	16  Waxing crescent Visible: 16% ↑ Age: 3.81 days
17  Waxing crescent Visible: 26% ↑ Age: 4.91 days	18  First quarter Visible: 36% ↑ Age: 5.99 days	19  First quarter Visible: 47% ↑ Age: 7.07 days	20  First quarter Visible: 59% ↑ Age: 8.14 days	21  Waxing gibbous Visible: 69% ↑ Age: 9.20 days	22  Waxing gibbous Visible: 79% ↑ Age: 10.24 days	23  Waxing gibbous Visible: 87% ↑ Age: 11.27 days
24  Waxing gibbous Visible: 94% ↑ Age: 12.29 days	25  Waxing gibbous Visible: 96% ↑ Age: 13.29 days	26  Full moon Visible: 100% Age: 14.27 days	27  Full moon Visible: 100% Age: 15.23 days	28  Full moon Visible: 98% ↓ Age: 16.18 days	29  Waning gibbous Visible: 94% ↓ Age: 17.10 days	30  Waning gibbous Visible: 89% ↓ Age: 18.01 days
31  Waning gibbous Visible: 82% ↓ Age: 18.91 days	1 	2 	3 	4 	5 	6 

# HEY, THERE BE A MOON OVERHEAD

MOON PHASES FOR THE  
MONTH OF DECEMBER



## « December 2023 »

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
					1	2 <a href="#">Pheonid meteor shower 2023</a>
3	4 <a href="#">Mercury at greatest elongation east</a> <a href="#">The Moon at apogee</a>	5 <a href="#">Moon at Last Quarter</a>	6 <a href="#">Neptune ends retrograde motion</a> <a href="#">December <math>\phi</math>-Cassiopeid meteor shower 2023</a>	7 <a href="#">Puppilid-Velid meteor shower 2023</a>	8 <a href="#">Mercury at dichotomy</a>	9 <a href="#">Close approach of the Moon and Venus</a> <a href="#">Monocerotid meteor shower 2023</a> <a href="#">Conjunction of the Moon and Venus</a> <a href="#">Mercury at highest altitude in evening sky</a>
10	11	12 <a href="#"><math>\sigma</math>-Hydrid meteor shower 2023</a> <a href="#">New Moon</a> <a href="#">The Large Magellanic Cloud is well placed</a>	13 <a href="#">The Moon at perihelion</a>	14 <a href="#">Conjunction of the Moon and Mercury</a> <a href="#">Geminid meteor shower 2023</a>	15 <a href="#">The Running Man cluster is well placed</a> <a href="#">The Orion Nebula is well placed</a>	16 <a href="#">Comae Berenicid meteor shower 2023</a> <a href="#">The Moon at perigee</a>
17 <a href="#">Conjunction of the Moon and Saturn</a> <a href="#">Close approach of the Moon and Saturn</a>	18	19 <a href="#">Lunar occultation of Neptune</a> <a href="#">Moon at First Quarter</a>	20 <a href="#">December Leonis Minorid meteor shower 2023</a> <a href="#">Mercury at perihelion</a>	21 <a href="#">Asteroid 4 Vesta at opposition</a> <a href="#">December solstice</a>	22 <a href="#">Close approach of the Moon and Jupiter</a> <a href="#">Conjunction of the Moon and Jupiter</a> <a href="#">Mercury at inferior solar conjunction</a> <a href="#">Asteroid 9 Metis at opposition</a>	23 <a href="#">Ursid meteor shower 2023</a>
24 <a href="#">Close approach of the Moon and M45</a>	25 <a href="#">Comet 62P/Tsuchinshan passes perihelion</a> <a href="#">Lunar occultation of Beta Tauri</a>	26 <a href="#">The Moon at aphelion</a> <a href="#">Full Moon</a>	27 <a href="#">Asteroid 5 Astraea at opposition</a>	28 <a href="#">Comet 62P/Tsuchinshan reaches peak brightness</a>	29 <a href="#">The cluster NGC 2232 is well placed</a>	30 <a href="#">The Rosette Nebula is well placed</a> <a href="#">Jupiter ends retrograde motion</a>
31						



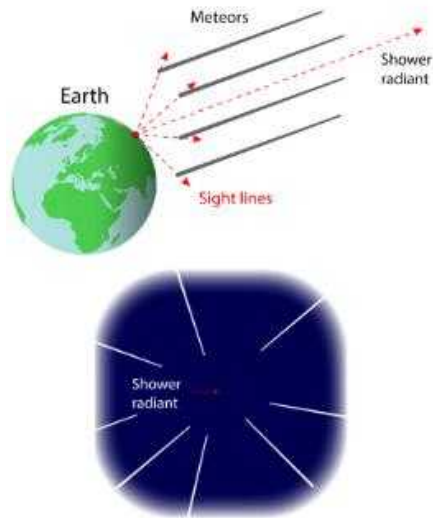
# THU, 14 DEC 2023 AT 00:20 EST (05:20 UTC) CONJUNCTION OF THE MOON AND MERCURY

- The Moon and Mercury will share the same right ascension, with the Moon passing  $4^{\circ}21'$  to the south of Mercury. The Moon will be 2 days old.
- From Stratford, the pair will be visible from soon after it rises, at 09:00, until soon before it sets at 17:52. Always take extreme caution when trying to make daytime observations of the Moon while the Sun is above the horizon.
- The Moon will be at mag -8.6, and Mercury at mag 0.5, both in the constellation Sagittarius.
- The pair will be too widely separated to fit within the field of view of a telescope, but will be visible to the naked eye or through a pair of binoculars.



THE SKY ON 14 DECEMBER 2023																														
Sunrise	07:46	 Waxing Crescent 3% 2 days old																												
Sunset	16:47																													
Twilight ends	18:31																													
Twilight begins	06:02																													
		Planets																												
		<table border="1"><thead><tr><th></th><th>Rise</th><th>Culm.</th><th>Set</th></tr></thead><tbody><tr><td>Mercury</td><td>08:59</td><td>13:25</td><td>17:52</td></tr><tr><td>Venus</td><td>04:18</td><td>09:30</td><td>14:43</td></tr><tr><td>Moon</td><td>09:51</td><td>14:02</td><td>18:17</td></tr><tr><td>Mars</td><td>07:13</td><td>11:42</td><td>16:12</td></tr><tr><td>Jupiter</td><td>14:14</td><td>21:05</td><td>03:55</td></tr><tr><td>Saturn</td><td>11:52</td><td>17:07</td><td>22:22</td></tr></tbody></table>		Rise	Culm.	Set	Mercury	08:59	13:25	17:52	Venus	04:18	09:30	14:43	Moon	09:51	14:02	18:17	Mars	07:13	11:42	16:12	Jupiter	14:14	21:05	03:55	Saturn	11:52	17:07	22:22
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All times shown in EST.																														

# THU, 14-15 DEC 2023 PEAK OF THE GEMINIDS



The sky at 19:26 EST on 14 Dec 2023

- The Geminid meteor shower will be active from 4 December to 17 December, producing its peak rate of meteors around 14 December.
- Over this period, there will be a chance of seeing Geminid meteors whenever the shower's radiant point – in the constellation Gemini – is above the horizon, with the number of visible meteors increasing the higher the radiant point is in the sky.
- Seen from Stratford, the shower will not be visible before around 17:44 each night, when its radiant point rises above your eastern horizon. It will then remain active until dawn breaks around 07:13.
- The shower is likely producing its best displays in the hours around 02:00 EST, when its radiant point is highest in the sky.
- At this time, the Earth's rotation turns Stratford to face optimally towards the direction of the incoming meteors, maximizing the number that rain vertically downwards, producing short trails close to the radiant point. At other times, there will be fewer meteors burning up over Stratford, and they will tend to enter the atmosphere at an oblique angle, producing long-lived meteors that may traverse a wide area of the sky before completely burning up.
- The shower is expected to reach peak activity at around 14:00 EST on 14 December 2023.



# SUN, 17 DEC 2023 AT 17:01 EST (22:01 UTC) CONJUNCTION OF THE MOON AND SATURN

- The Moon and Saturn will share the same right ascension, with the Moon passing  $2^{\circ}28'$  to the south of Saturn. The Moon will be 5 days old.
- At around the same time, the two objects will also make a close approach, technically called an appulse.
- From Stratford , the pair will be visible from soon after it rises, at 11:40, until soon before it sets at 22:11.
- The Moon will be at mag -11.5, and Saturn at mag 0.7, both in the constellation Aquarius.
- The pair will be too widely separated to fit within the field of view of a telescope, but will be visible to the naked eye or through a pair of binoculars.



THE SKY ON 17 DECEMBER 2023

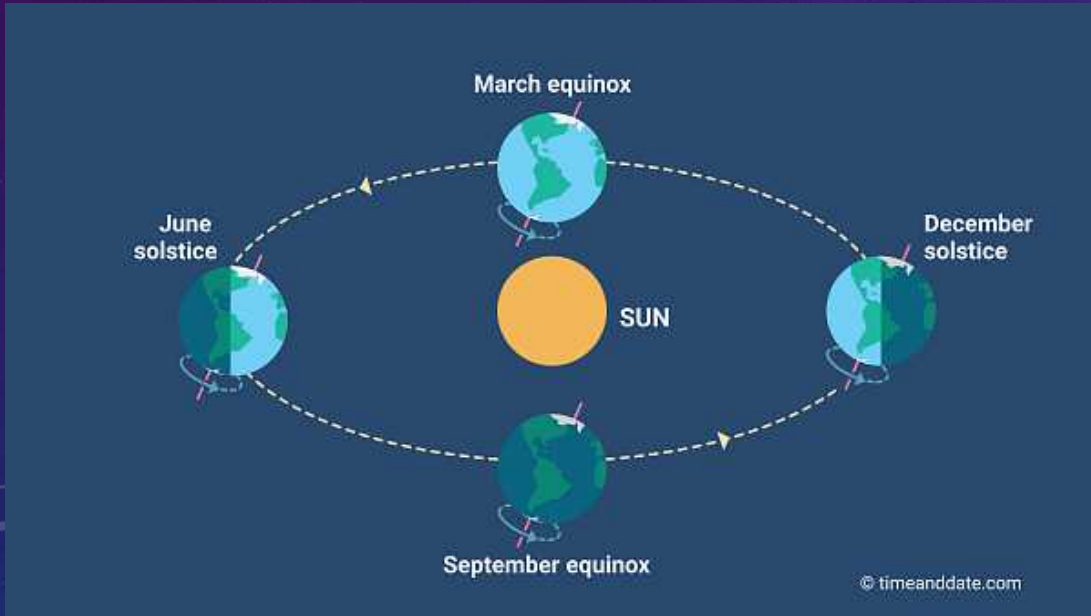
Sunrise	07:48	 Waxing Crescent 34% 5 days old	Planets				
Sunset	16:48			Rise	Culm.	Set	
Twilight ends	18:32			Mercury	08:36	13:06	17:37
Twilight begins	06:04			Venus	04:24	09:32	14:40
			Moon	11:48	16:55	22:13	
			Mars	07:12	11:40	16:08	
			Jupiter	14:02	20:52	03:43	
			Saturn	11:40	16:56	22:11	

All times shown in EST.

# Winter Solstice: When Does Winter Start?

In Stratford, Ontario, Canada: **Thursday, December 21, 2023 at 10:27 pm EST**

According to the **astronomical definition**, winter begins with the **winter solstice**. In the Northern Hemisphere, it's the December solstice;



Earth spins once a day on its axis of rotation, an imaginary line running through the North and South Poles. The spinning Earth orbits the Sun once a year, tracing out an imaginary disk called the orbital plane or ecliptic plane.

For six months of the year, the North Pole is tilted toward the Sun, and the Sun lies somewhere above the Northern Hemisphere. For the other six months, the South Pole is tilted toward the Sun, and the Sun lies somewhere overhead the Southern Hemisphere.

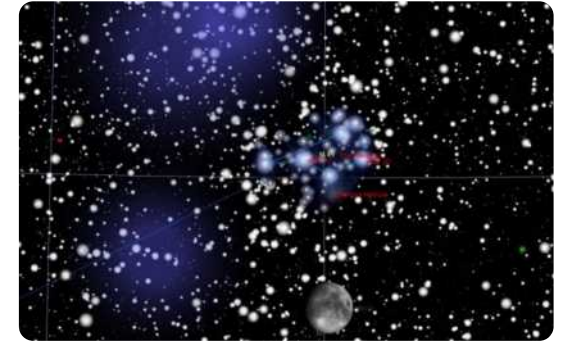
Compared to its orbital plane, Earth's axis of rotation is tilted by about 23.4 degrees. This is referred to as Earth's axial tilt or obliquity.

Earth's axial tilt remains the same throughout the year. The North Pole always points toward the star Polaris, while the South Pole points toward the much dimmer star Polaris Australis. However, as Earth travels along its orbit, its tilt changes with respect to the Sun.



## SUN, 24 DEC 2023 AT 03:56 EST (08:56 UTC) CLOSE APPROACH OF THE MOON AND M45

- The Moon and M45 will make a close approach, passing within a mere 57.2 arcminutes of each other. The Moon will be 12 days old.
- From Stratford, the pair will be visible from soon after it rises, at 14:13, until soon before it sets at 05:41.
- The Moon will be at mag -12.6; and M45 will be at mag 1.3. Both objects will lie in the constellation Taurus.
- They will be a little too widely separated to fit comfortably within the field of view of a telescope, but it will be visible to the naked eye or through a pair of binoculars.



### THE SKY ON 24 DECEMBER 2023

Sunrise

07:52

Sunset

16:51

Twilight ends

18:35

Twilight begins

06:08



Waxing  
Gibbous

95%

12 days old

Planets

Rise Culm. Set

Mercury 07:22 12:02 16:41

Venus 04:40 09:38 14:36

Moon 14:41 22:42 06:53

Mars 07:09 11:35 16:01

Jupiter 13:34 20:24 03:14

Saturn 11:14 16:30 21:46

All times shown in EST.

# SHOW AND TELL

The background is a dark blue gradient with a field of small white stars. On the right side, there are several technical diagrams. One is a large circular gauge with a scale from 0 to 210 and a white arrow pointing to approximately 190. Below it is another circular diagram with a dashed outer ring and a solid inner ring, with a white arrow pointing to the right. In the bottom left corner, there is a partial circular diagram with a dashed outer ring and a solid inner ring, with a white arrow pointing to the left.



# COSMOLOGY TALK