

Lewes Astronomical Society

Newsletter - November 2022

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Astronomy & Space News

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Universe is still expanding

- In 1998 astrophysics world shaken by news that universe expanding faster than ever
- Based on observations of type 1a supernovae
- Hubble Constant revised upwards
- New study (Pantheon+) of 1,500 supernovae some going back 10.7 billion years ago
- Universe is 66.2% dark energy and 33.8% dark and ordinary matter
- Hubble Constant = 73.4km/sec/megaparsec
- Standard Model of Cosmology lower constant



1a Supernova remnant – G299.2-2.9 in constellation Musca (16,000 light years)

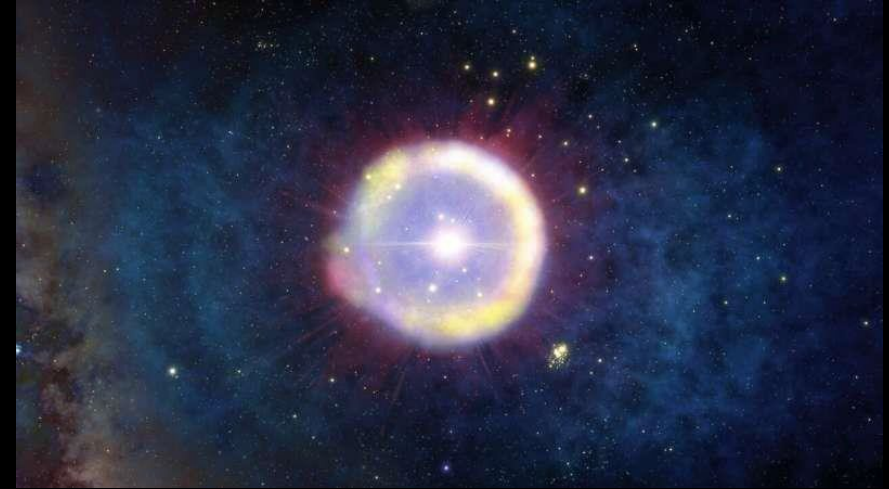
Credit:

X-ray: NASA/CXC/U.Texas/S. Post et al
Infrared: 2MASS/Umass/IPAC/Caltech/
NASA/NSF

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Earliest-known stars

- Earliest-known stars born 100-150 million years after Big Bang
- Almost totally hydrogen and helium which allowed them to grow to enormous sizes
- Lived only several million years and died in huge supernova explosions seeding heavier elements
- Leaves no remnant due to pair-instability
- Now detected through material ejected



Artists impression of giant Population III star
Credit: NOIRLab/NSF/AURA/J. da Silva/Spaceengine

- Studies of most distant quasars shows 10 times as much iron as magnesium than found in Sun

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Huge Gamma Ray Burst (GRB)

- October 9th 3 space telescopes (Neil Gehrels Swift, Fermi and Wind) picked up very bright and long-lasting GRB (GRB221009A)
- Origin – 2.4 billion light years in Sagitta
- Caused by formation of a black hole
- One of the most powerful GRBs ever recorded
- Caused long-wave communication disruption
- Photons carried 18 teraelectronvolts (18,000,000,000,000 electronvolts) energy

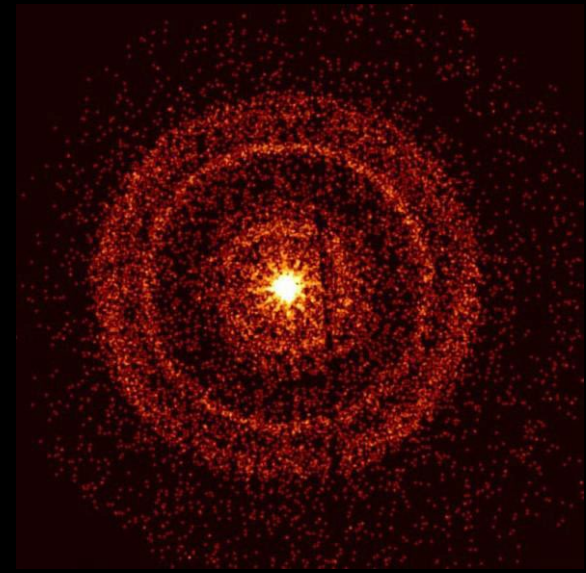


Image taken one hour after detection
Credit: NASA/Swift/A. Beardmore
(University of Leicester)



Image taken 5 days after detection

Credit: International Gemini Observatory/NOIRLab/NSF/AURA/B. O'Connor (UMD/GWU) & J. Rastinejad & W. Fong (NorthWestern University)

Image Processing: T.A. Rector (University of Alaska, Anchorage/NSF's NOIRLab, M. Zamani & D. de Martin (NSF's NOIRLab)

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Galaxies and Cosmic Web

- Cosmic Web has giant filaments
- Galaxies and galaxy clusters tend to sit on these filaments
- Galaxies with low masses and small bulges lie parallel to the filaments
- Large spiral galaxies with bigger central bulges are aligned perpendicularly to the filaments
- These larger galaxies are mergers and flip direction during merger

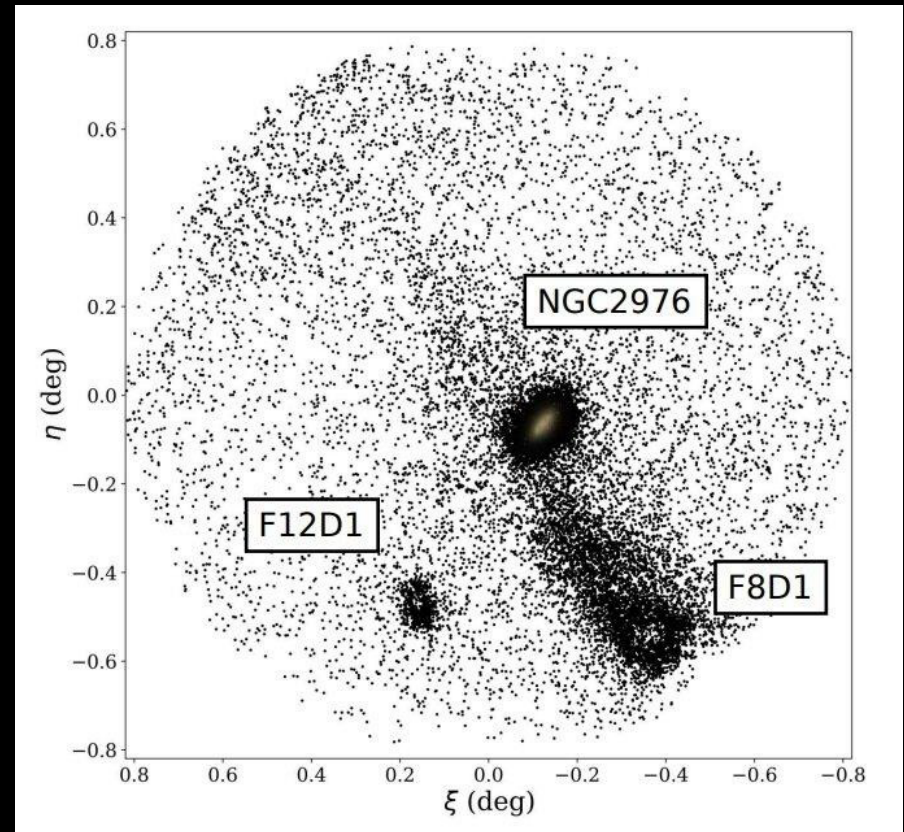


Credit: Hyper Suprime-Cam Subaru and Pan-STARRS

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Galaxy Tidal Disruption

- Ultra-diffuse galaxy F8D1 has been discovered with an enormous tail
- F8D1 is a dwarf satellite galaxy of M81 about 12 million light years away in Ursa Major & Camelopardalis
- Ultra-diffuse galaxies only have 1% stars of normal galaxy of same size
- F8D1 has a radius of 8,150 light years but tail stretches 195,000 light years. Disruption caused by M81



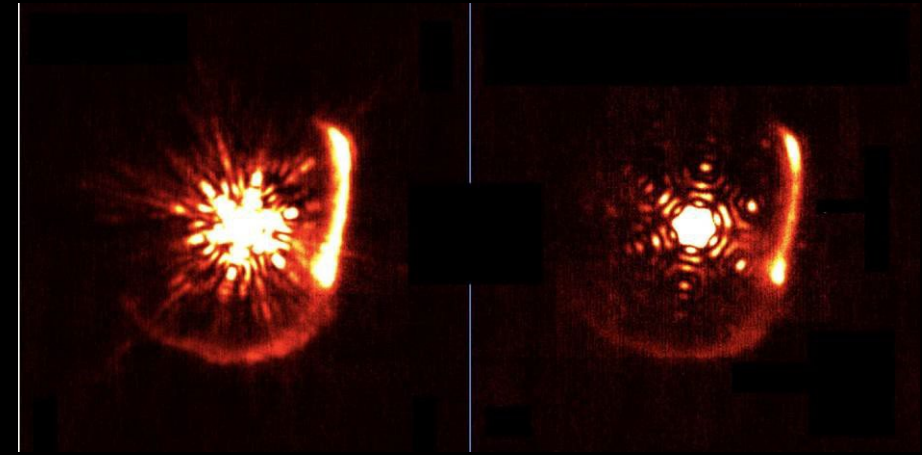
RBG Star Count Density across HSC Image
Credit: R. Zemaitis (University of Edinburgh) et al

HSC (Hyper Suprime-Cam on Subaru Telescope)

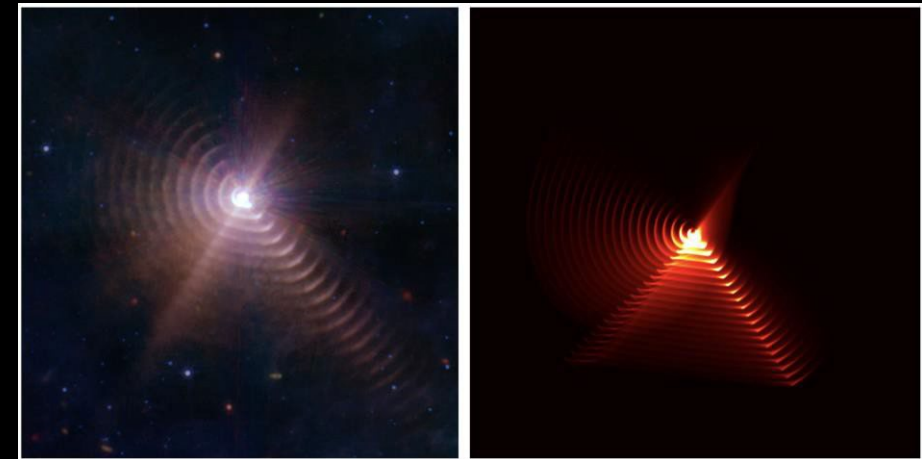
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Radiating Dust Plumes

- WR140 is a binary star system 5,000 light years away in constellation Cygnus
- One star – a huge Wolf-Rayet is orbiting an even larger Blue Supergiant once every 8 years in elliptical orbit
- Stars interact to produce sooty plumes which are concentrated in a cone-shaped shock front where the stars are closest
- Turning stars cause plumes to spiral appearing as expanding rings
- Observation by Webb confirms modelling



Credit: Yinuo Han (University of Cambridge) & Peter Tuthill (University of Sydney)

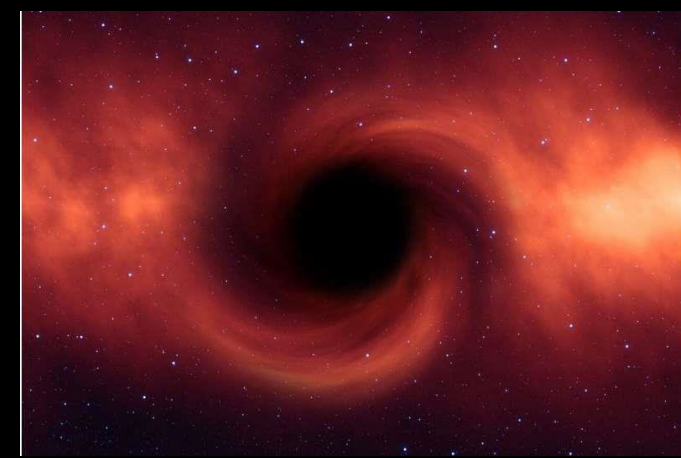


Credit:
Left – Webb: NASA/ESA/CSA/STScI/JPL/Caltech
Right – model: Yinuo Han/Peter Tuthill/Ryan Lau

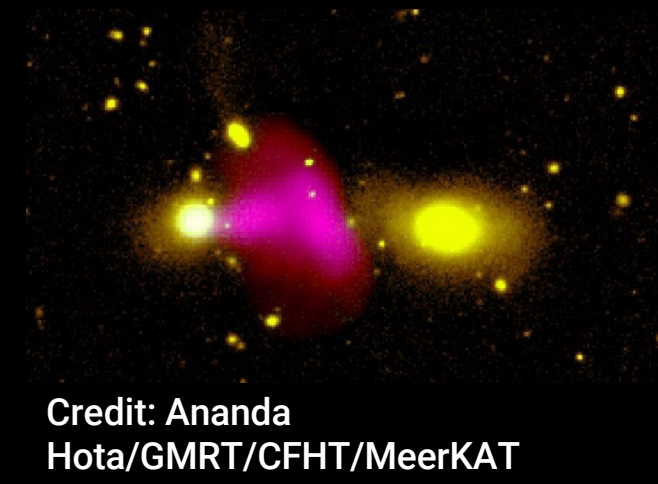
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Black Holes

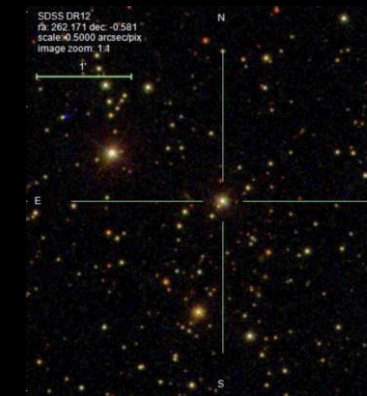
- Black hole GW200129 is precessing at fastest speed ever observed (several times a second) and wobbling like a spinning top
- Black hole in galaxy RAD12 is ejecting a unipolar jet of relativistic electrons at another galaxy (RAD12-B). Jet (440,000 light years) is far larger than galaxy
- Local black hole with size of 12 solar masses found 1,500 light years away (discovered by analysing Doppler Shift on bright visible star)



Credit: Pixabay/CC0 Public Domain



Credit: Ananda Hota/GMRT/CFHT/MeerKAT

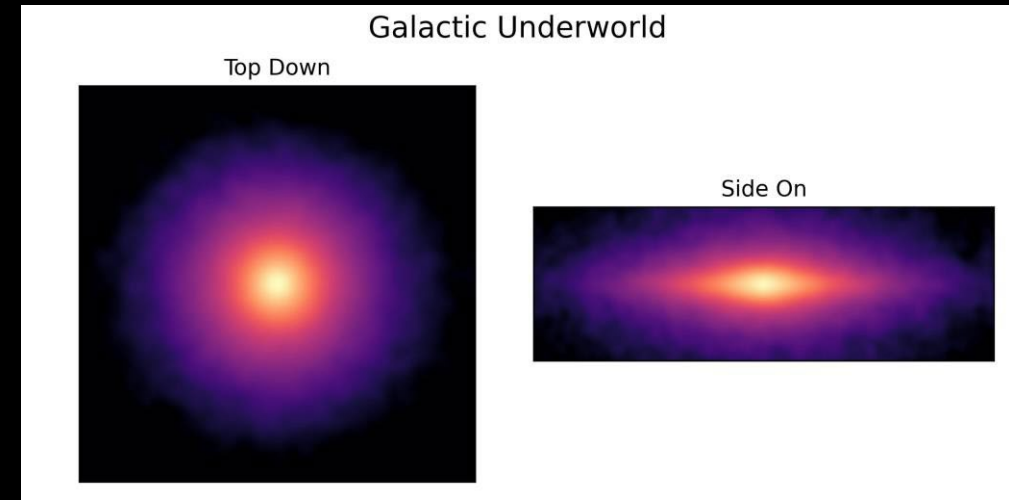
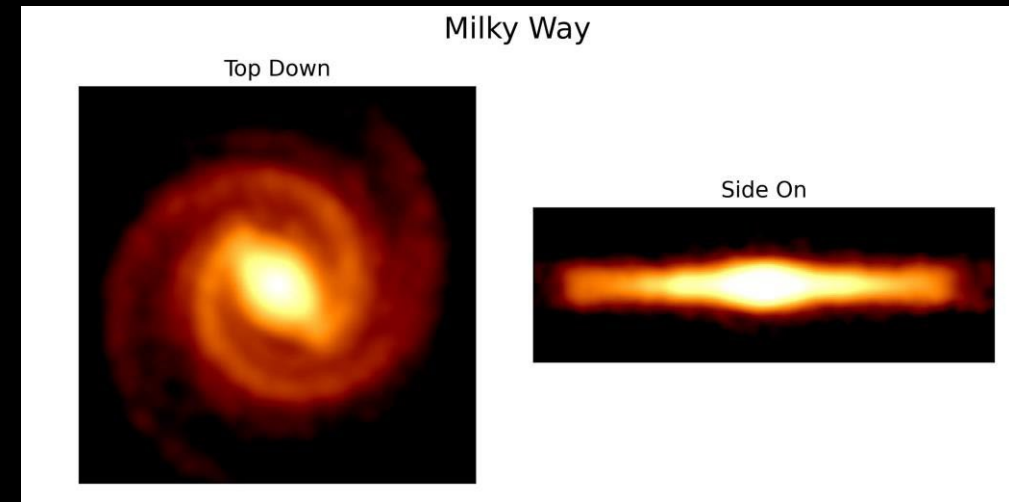


Credit: Sloan Digital Sky Survey/S. Chakrabarti (University of Arizona in Huntsville) et al

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Milky Way Graveyard

- Map of Galactic Underworld reveals graveyard of old black holes and neutron stars 3 times the height of Milky Way
- Up to 30% of the objects have been flung out of the galaxy by the supernovae that formed them
- Map created by modelling lifecycles of earlier stars when the galaxy was much younger and shaped differently



Top: Current Milky Way

Bottom: Galactic Underworld

Credit: Sydney Institute for Astronomy, University of Sydney

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Very Close Binary Stars

- The closest pair of orbiting binary stars (ZTF J1813+4251) has been found taking only 51 minutes to go around each other
- Known as a 'cataclysmic variable' where a sun-like star orbits a white dwarf. The process produces huge amounts of light; many centuries ago were thought to be an unknown cataclysm
- The white dwarf is half the mass of our Sun whilst the other star is one-tenth
- The white dwarf is stripping the other star of its hydrogen



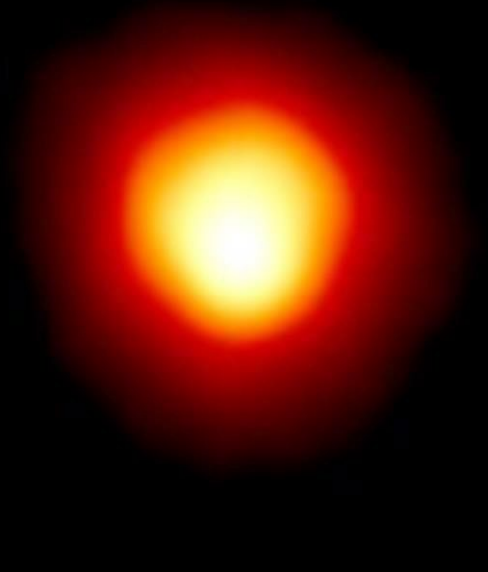
Credit: Pixabay/CC0 Public Domain

- What will be left is a dense core of helium allowing an even closer and shorter orbit – 18 minutes in 70 million years time
- They will then drift apart

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Red Giants going Supernova

- When Red Giants die they go supernova
- But, until now, no one knew when it would occur
- It now appears that in the final few months of a Red Giants life the apparent brightness diminishes by up to one hundred fold
- The Red Giant expels a huge amount of material which cools and forms a dense cloud around the star
- It was speculated that Betelgeuse was about to go supernova a couple of years ago but this was a false alarm!

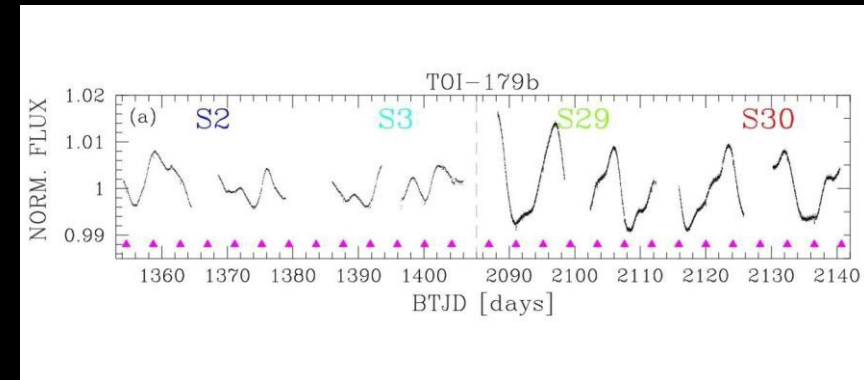
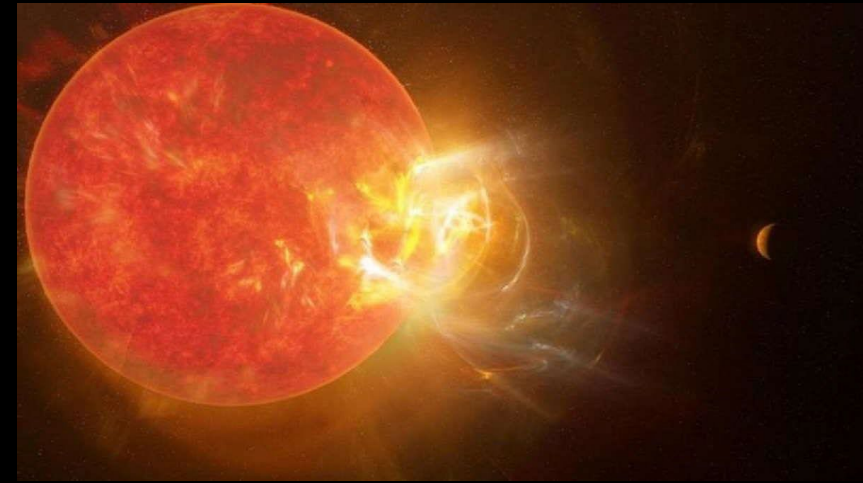


Betelgeuse
Credit: NASA/ESA/Andrea Dupree
(Harvard Smithsonian CfA), Ronald
Gilliland (STScI)

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Hot Neptune & Brown Dwarf?

- New star-exoplanet system investigated – TOI-179 (HD 18599)
- K-class dwarf star 125.8 light years away. Mass - 0.83 solar masses, size - 0.798 solar radii, surface temperature - 5,083K, 400 million years old
- Hot Neptune (TOI-179b) 2.62 x Earth-size, 24 x mass, orbits 0.048AU in 4.137 days
- Brown Dwarf (HD 18599b) 83 times mass of Jupiter, orbits 3.3AU (495 million kms)

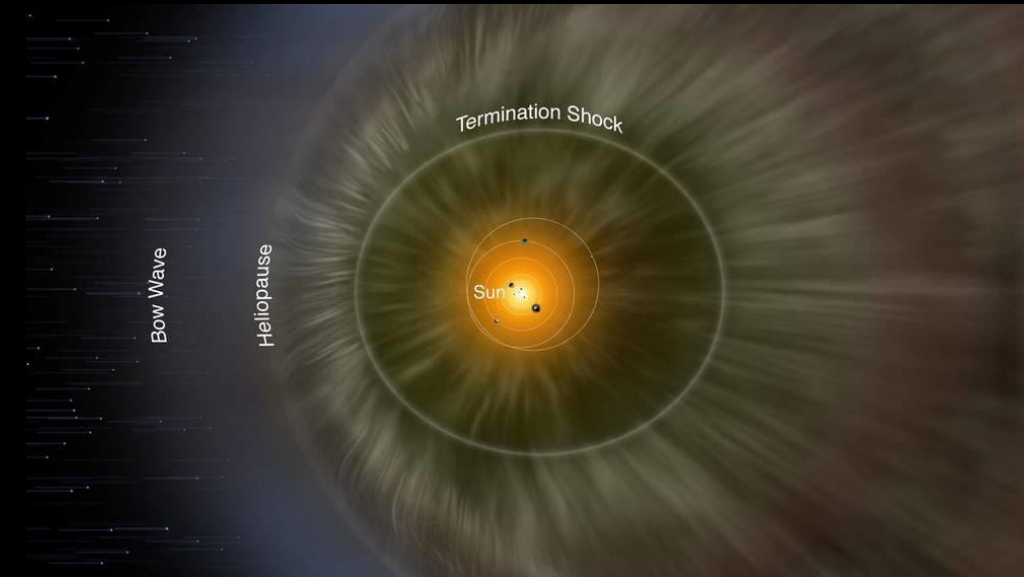


Credit: S. Desidera (Astronomical Observatory of Padua) et al, 2022

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Ripples at the edge of the Solar System

- Recent studies of data from the two Voyager probes as they left the Solar System has shown that the boundary is ragged and that the solar wind is variable in strength
- Pressure waves are driven by CMEs and cause changes in the Bow Wave
- Termination Shock – point where the solar wind slows down to the speed at which sound can travel (300 km/sec)
- Heliopause – point at which solar wind cannot make any headroom against pressure from interstellar space

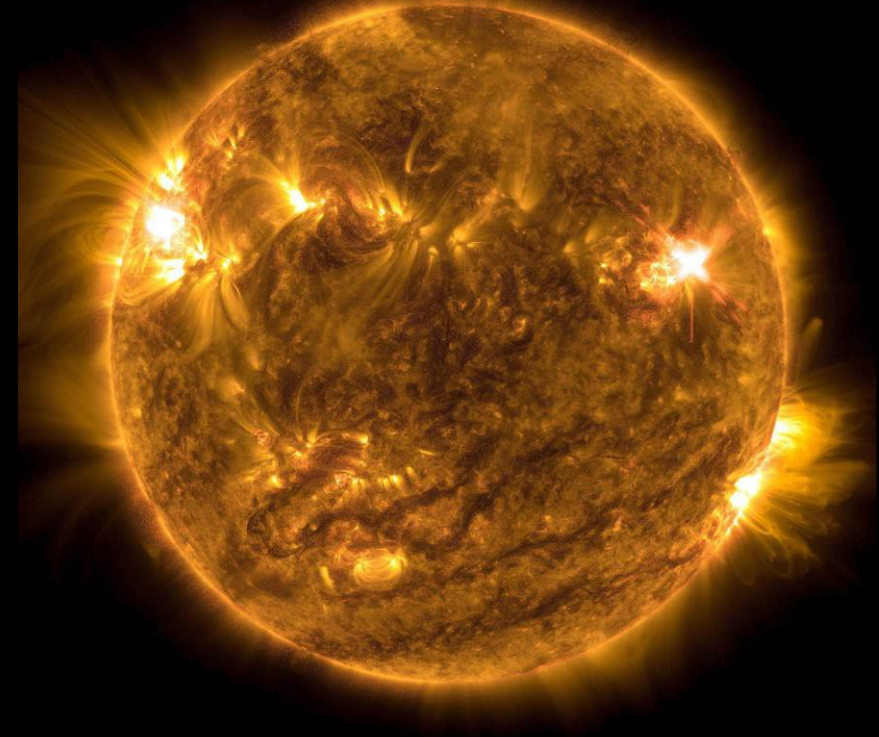


Credit: NASA/IBEX/Adler Planetarium

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Major Solar Flare

- October 2nd saw the Sun discharge an X1.0 Solar Flare
- The flare was captured by NASA's Solar Dynamics Observatory
- Flares are categorised from A (weak) to X (intense). High numbers indicate the strength of the flares. In 2003 an X28 flare was measured (any higher would have knocked out the sensors!)
- X-flares can cause major communication disruption

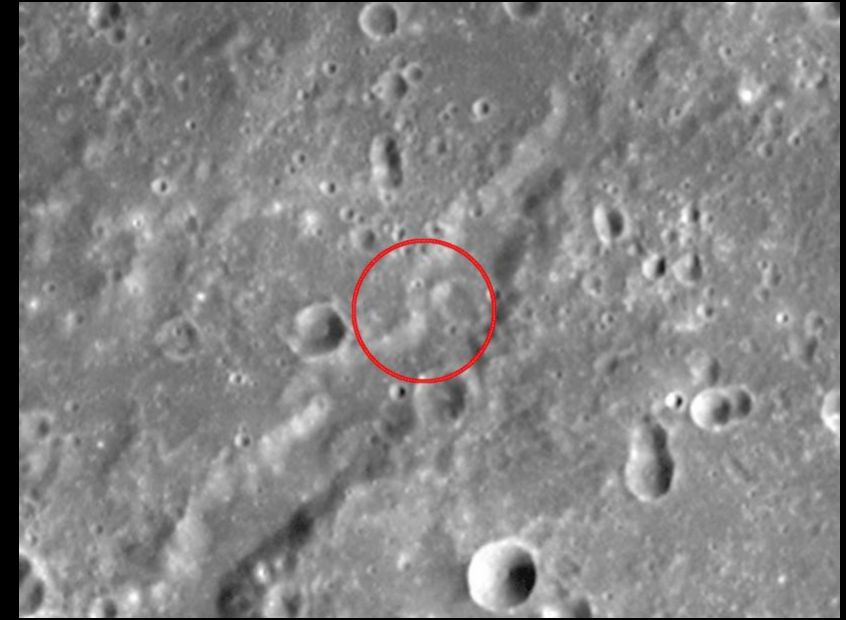


Credit: NASA/SDA

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Mercury's Changing Surface

- Messenger Spacecraft visited Mercury between 2011 and 2015
- It took tens of thousands of images
- New examination of some of the images suggests that Mercury is still being heavily bombarded
- However, it should be decreasing and certainly less than outer planets
- 19 new craters identified (400m to 1,900m)
- New hypothesis suggests that this is not impact but endogenic changes



Images taken 25th June 2012 and 11th June 2013. Credit: NASA

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Juno's encounter with Europa

- Juno has made the closest approach to Europa in over 20 years
- 352 km above the surface (Galileo – 351 km)
- Meanwhile a team from the University of Leicester have taken the best photos of both Europa and Ganymede from Earth, using the ESO Very Large Telescope in Chile



Top – image taken by Juno Spacecraft
Bottom – view from Earth using ESOs VLT

Credit: NASA/JPL-Caltech/SWRI/MSSS & ESO/O. King & L. Fletcher (University of Leicester)

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Uranus – the odd planet

- Why does Uranus spin in the opposite direction to all the other planets?
- Why is Uranus tilted by 98° ?
- New theory suggests that a large moon's migration could cause this
- Jupiter's tilt is increasing and Saturn is being affected by Titan
- Uranus's current moons do not have enough mass to cause the tilt



Credit: Unsplash/CC0 Public Domain

- BUT a large moon (half the size of the Moon) could
- It becomes unstable at angles above 80°
- And crashes into the planet!

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Ups and Downs

- NASA and SpaceX in discussion about extending life of Hubble by up to 20 years
- Modified SpaceX Dragon capsule could move Hubble into higher orbit
- Hubble currently likely to deorbit in 2037
- Meanwhile the National Science Foundation has announced that the badly-damaged Arecibo Radio Telescope will not be repaired



Credit: NASA



Credit: Ricardo Arduengo/AFP via Getty

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James McDivitt – 1929 - 2022

- USAF test pilot
- One of Astronaut Group 2 (following Mercury 7)
- Commander of Gemini 4 (first American spacewalk – Ed White)
- Commander of Apollo 9 (first flight and testing of Lunar Module in Earth orbit)
- Manager of Lunar Landing Program and Apollo Spacecraft Program (Apollo 12 – 16)



Credit: Aero-News Network

James A. McDivitt
10-06-1929 – 13-10-2022

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Finally – from last month

- DART – the spacecraft deliberately crashed into an asteroid in order to change its course
- Results better than expected
- Dimorphos (moonlet of Didymos) pushed into shorter, faster orbit
- Now 11 hrs 23 mins (was 11 hrs 55 mins)
- ARTEMIS 1 – new November launch dates:
- Monday 14th / Wednesday 16th / Saturday 19th
- All night time launch windows



Credit: NASA/ASI

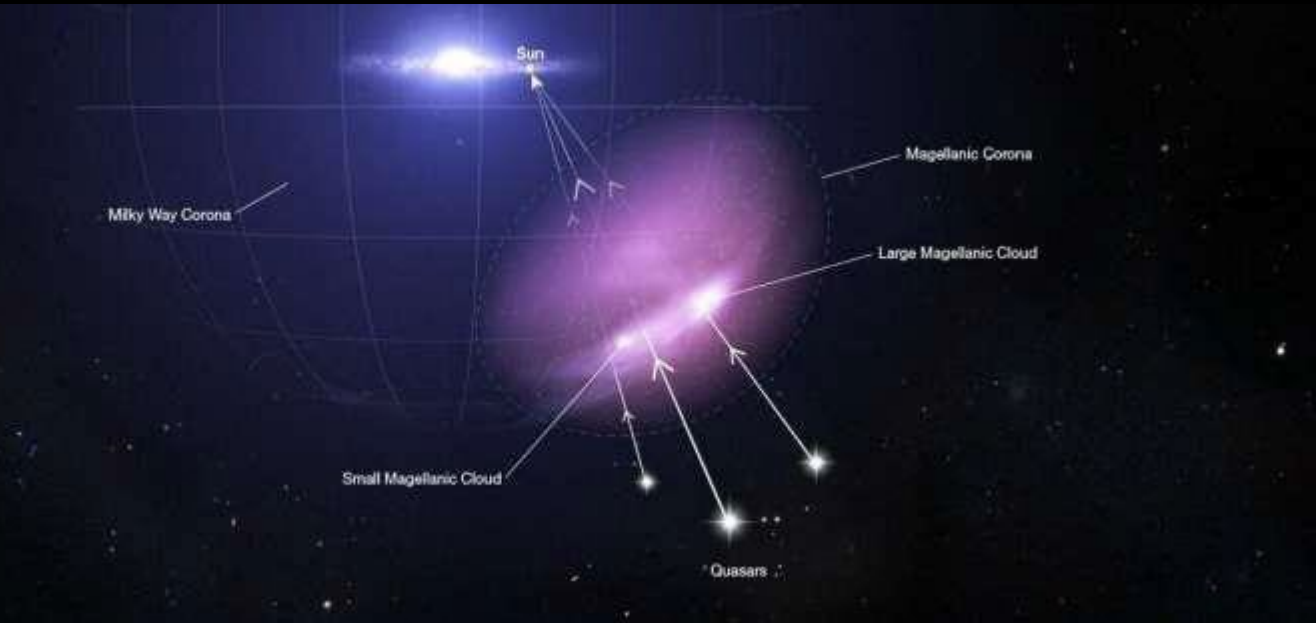


Credit: NASA/Kim Shiflett

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Webb and Hubble latest photos 1

- Large and Small Magellanic Clouds protected by corona from being stripped of gas
- Corona is made of super-heated gas and stretches for 100,000 light years
- Corona discovered by looking at distant quasars. It appears foggy as it absorbs the quasars' light

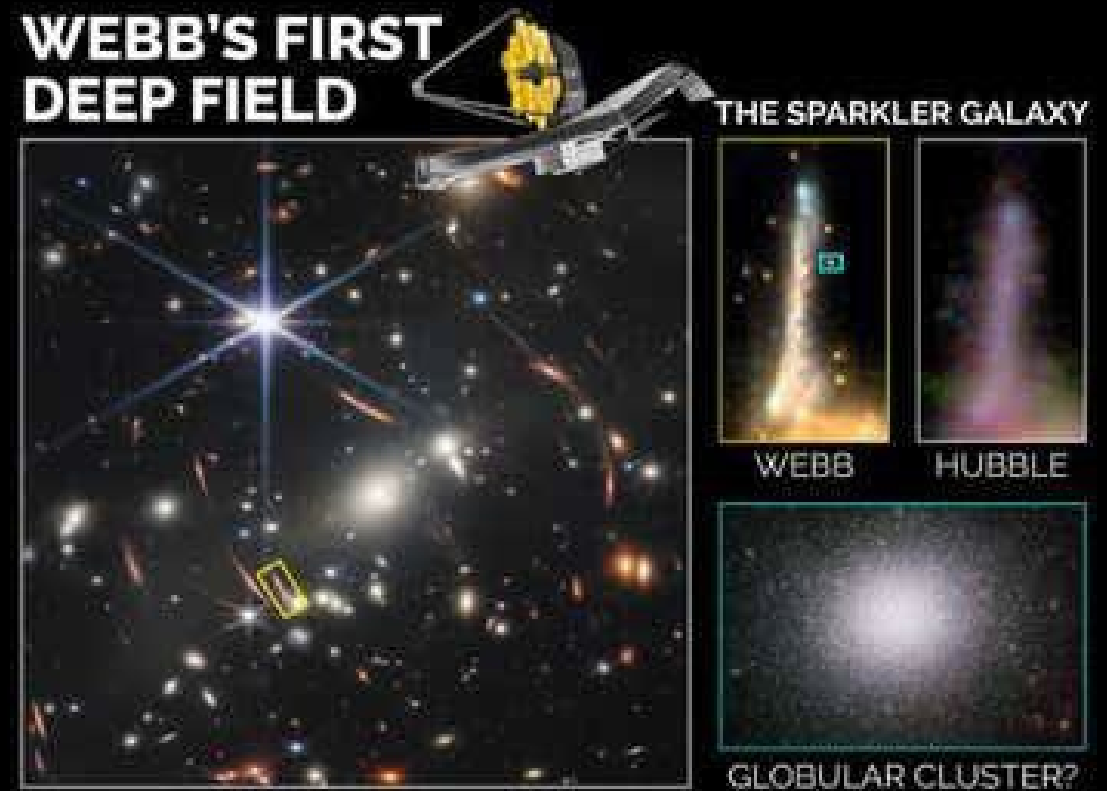


Hubble image Credit: NASA

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Webb and Hubble latest photos 2

- Analysis of Webb's First Deep Field Image identifies most distant globular clusters
- May contain first/oldest stars
- Research focussed on Sparkler Galaxy – 9 billion light years
- Surrounding red objects are oldest globular clusters
- Sparkler Galaxy image enhanced by gravitational lensing (one hundred fold)

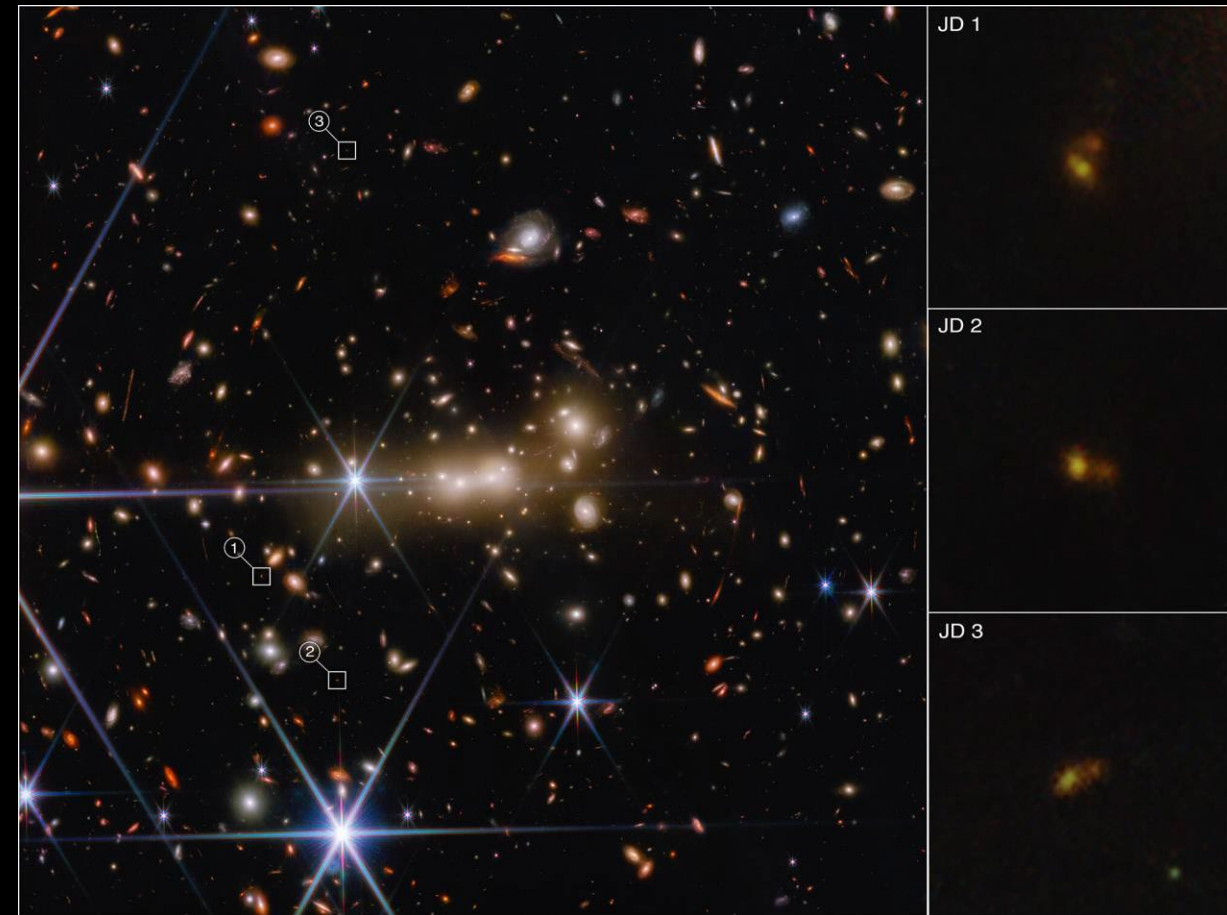


Credit: NASA/ESA/CSA/STScI/Lamiya Mowla, Kartheik G. Iyer, et al, Dunlap institute for Astronomy and Astrophysics, University of Toronto

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Webb and Hubble latest photos 3

- The gravity of galaxy cluster MACS0647 is acting as a gravitational lens to bend the light from the distant MACS0647-JD system
- The JD-system is triply-lensed causing it to appear in three different locations
- Webb has been able to resolve JD into two separate objects

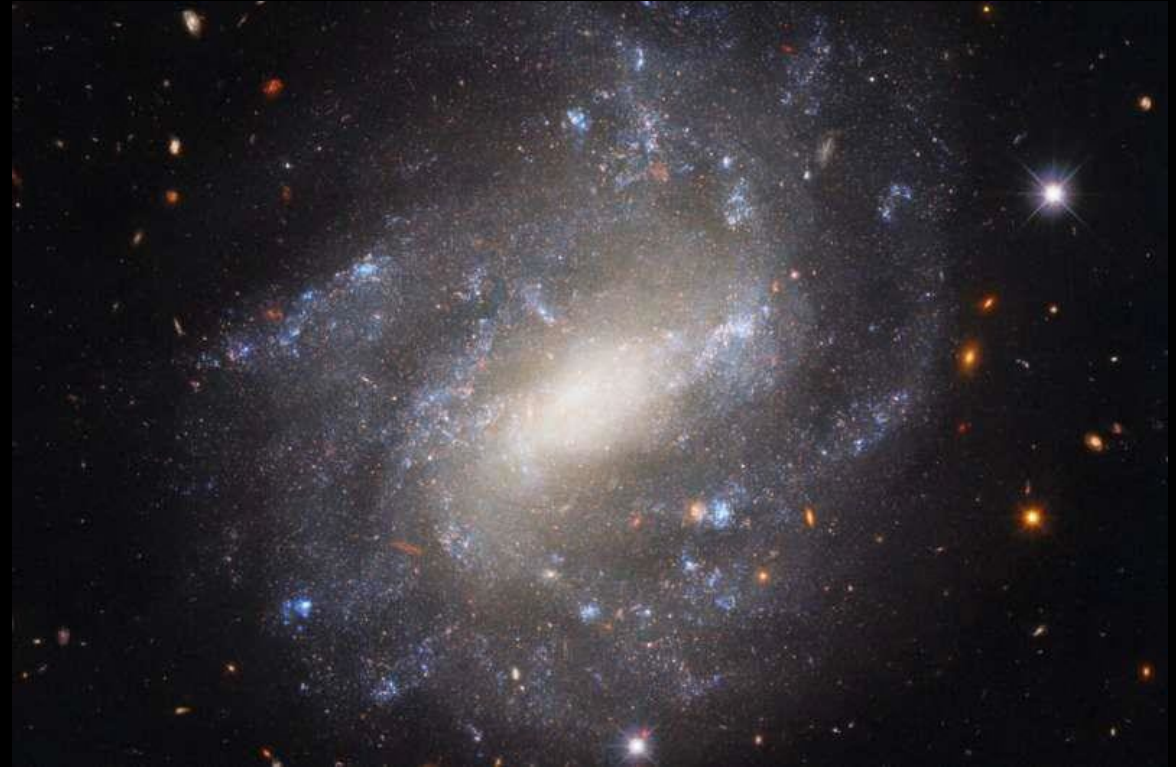


Credit: NASA/ESA/CSA/STScI/Tiger Hsiao, Alyssa Pagan

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Webb and Hubble latest photos 4

- Hubble image of spiral galaxy UGC 9391, 130 million light years distant in constellation Draco
- Being used as a new generation “Cosmic Distance Ladder” – via type 1 supernova explosions and Cepheid Variables

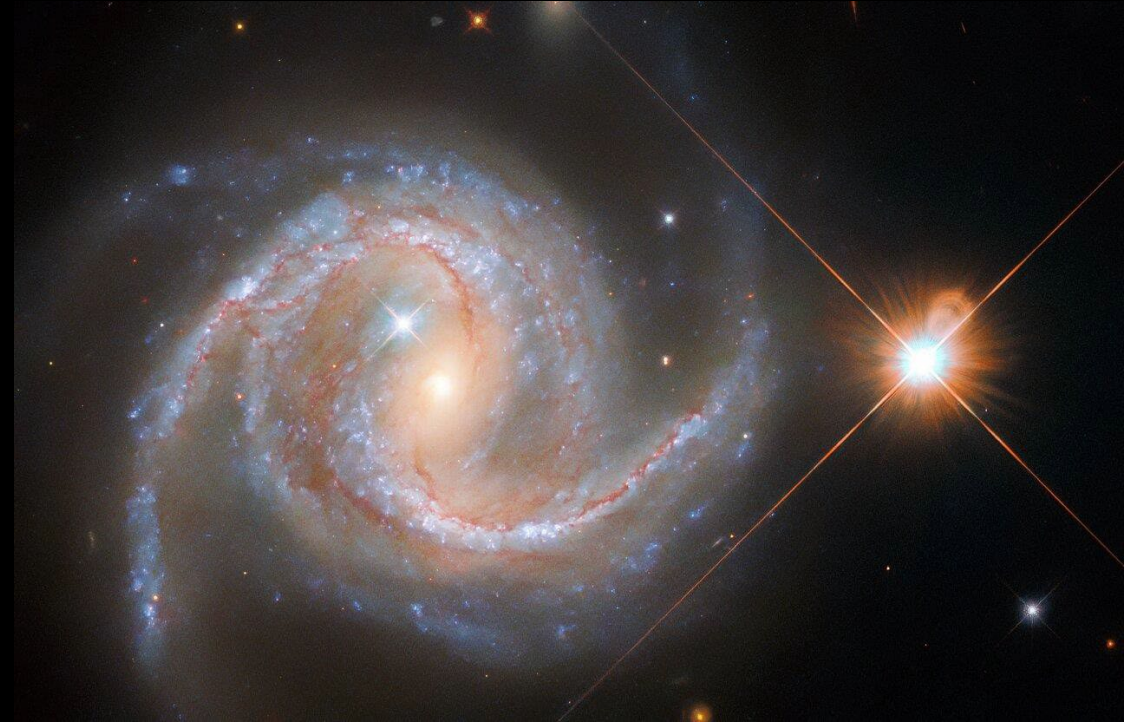


Credit: NASA/ESA/Hubble/A. Reiss et al

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Webb and Hubble latest photos 5

- Hubble image of spiral galaxy NGC 5495, 300 million light years away in constellation Hydra
- NGC 5495 is a Seyfert 2 Galaxy with an Active Galactic Nuclei (AGN)
- A supermassive black hole at the centre of the galaxy is actively feeding, creating an accretion disk
- Seyfert 2 are particularly strong in the far IR region



Credit: NASA/ESA/Hubble/J. Greene

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Webb and Hubble latest photos 6

- Pillars of Hercules in Eagle Nebula
- 6,500 light years from Earth
- Webb (right), viewing in Infra-red, can peer through the dust
- Hubble photo (left) taken in 2014



Credit: NASA/ESA/CSA/STScI/Hubble Heritage Project (STScI/AURA) – left image
NASA/ESA/CSA/STScI – right image
Image Processing: Joseph DePasquale, Anton M. Koekemoer, Alyssa Pagan
(all STScI)

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Webb and Hubble latest photos 7

- Stephan's Quintet
- The lefthand galaxy (NGC 7320) is only 39 million light years from Earth. The other four are 210-340 million light years away
- The blurry blue smudge across the centre is caused by a shockwave
- Combined image from Webb (infrared) and Chandra (x-ray)



Credit: NASA

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Observational Highlights

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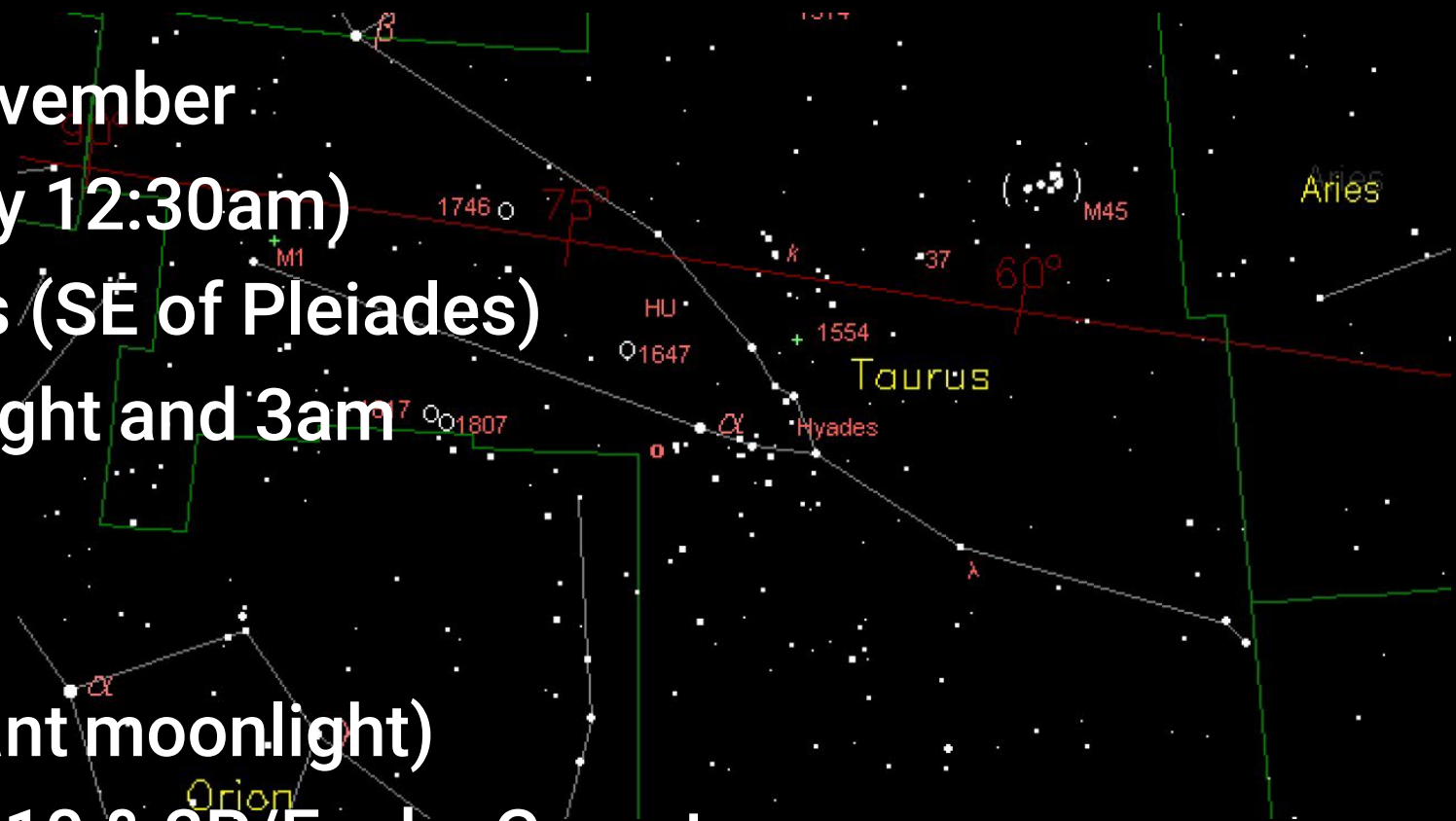
November 2022 dates

- 1st November – Saturn 4.2° north of the Moon
- 4th November – Neptune 3.2° and Jupiter 2.4° north of the Moon
- 5th November – Southern Taurid Meteor Shower
- 8th November – Mercury at superior conjunction
- 8th November – Uranus at opposition (mag: +5.7 but Full Moon)
- 11th November – Mars 2.5° south of the Moon (mag: -1.8 by 30th)
- 11th/12th November – Northern Taurid Meteor Shower
- 17th/18th November – Leonid Meteor Shower
- 23rd November – New Moon (Lunation 1236)

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Northern Taurid Meteor Shower

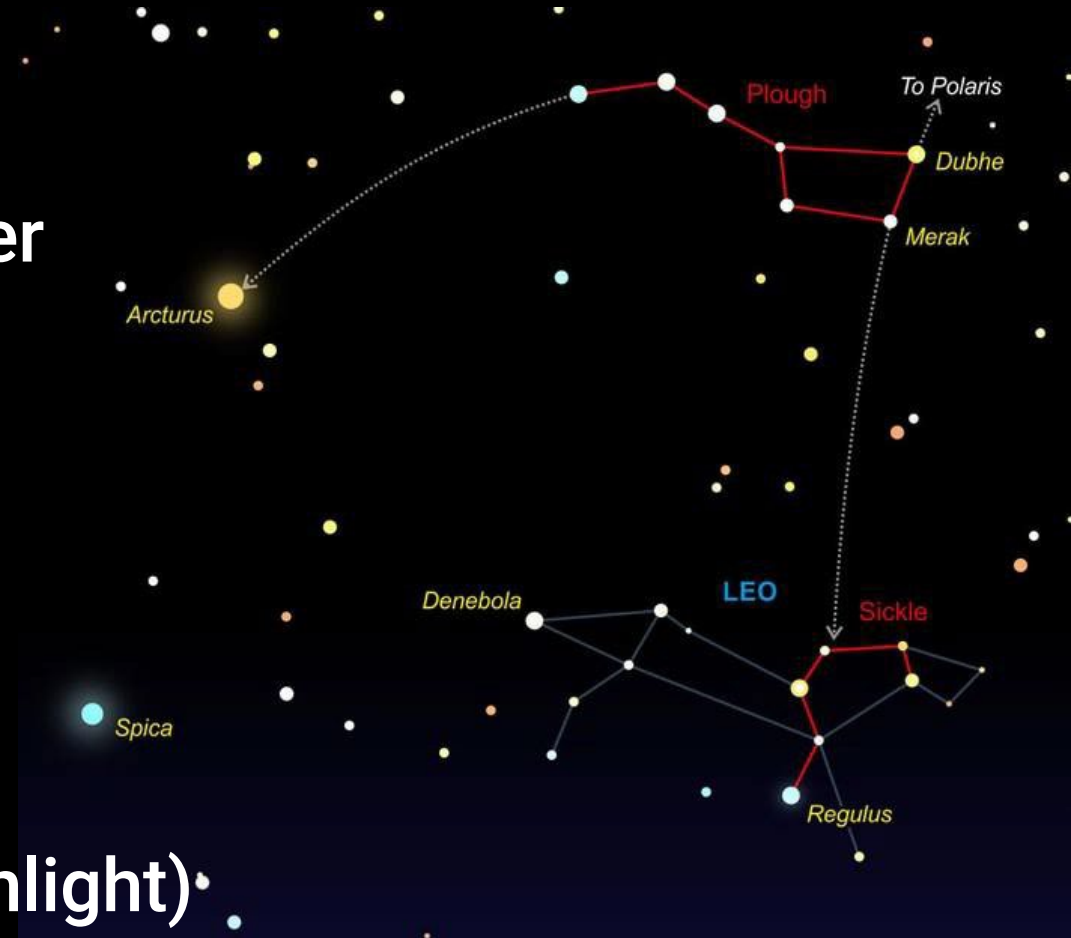
- Evenings of 11th/12th November
- East to South-east (60° by 12:30am)
- In constellation of Taurus (SE of Pleiades)
- Best seen between midnight and 3am
- Rate: 5 - 10 per hour
- Speed: slow
- Brightness: low (significant moonlight)
- Parent: Asteroid 2004 TG10 & 2P/Encke Comet



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Leonid Meteor Shower

- Night of 17th/morning of 18th November
- Eastern sky (late evening from 11pm)
- In constellation of Leo
- Best seen around 2am (up to dawn)
- Rate: up to 15 per hour
- Speed: fast (71 km/sec)
- Brightness: average (last quarter moonlight)
- Parent: 55P/Tempel-Tuttle Comet



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Planets (@ 01-11-2022)

<u>Planet</u>	<u>Rises</u>	<u>Sets</u>	<u>Highest</u>	<u>Direction</u>	<u>Altitude</u>	<u>Magnitude</u>	<u>Visible?</u>
Mercury	06:18	16:28	11:23			-1.2	NO
Venus	06:59	16:42	11:21			-3.9	NO
Mars	18:42	11:14	02:58	South	63°	-1.2	YES
Jupiter	15:20	03:11	21:16	South	37°	-2.8	YES
Saturn	14:02	23:19	18:41	South	22°	+0.6	YES
Uranus	16:48	07:47	00:17	South	55°	+5.7	YES
Neptune	15:07	02:34	20:50	South	35°	+7.8	YES

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Deep Sky Objects 1 (@ 01-11-2022)

[*** = circumpolar]

<u>Object</u>	<u>Name</u>	<u>Type</u>	<u>Rises</u>	<u>Sets</u>	<u>Highest</u>	<u>Direction</u>	<u>Alt</u>	<u>Mag</u>
M45	The Pleiades (Taurus)	Open Cluster	18:27	05:57	01:06	South	63°	+1.3
M44	The Beehive Cluster (Cancer)	Open Cluster	21:10	05:34	05:23 *	South	58°	+3.1
M31	Andromeda Galaxy (Andromeda)	Galaxy	***	***	22:02	East	78°	+3.4
M42	The Orion Nebula (Orion)	Open Cluster	23:23	05:29	02:54	South	33°	+4.0
NGC1981	Sword Cluster (Orion)	Open Cluster	23:20	05:29	02:54	South	34°	+4.2
NGC2232	Open Cluster (Monoceros)	Open Cluster	00:15	05:29	03:46	South	34°	+4.2
IC4665	Open Cluster (Ophiuchus)	Open Cluster	17:55	21:35	17:55 **	South-West	32°	+4.2
M47	Open Cluster (Puppis)	Open Cluster	02:45	05:29	04:55	South	24°	+4.4
NGC6633	Open Cluster (Ophiuchus)	Open Cluster	17:55	22:20	17:55 **	South-West	37°	+4.6
IC4756	Graff's Cluster (Serpens Cauda)	Open Cluster	17:55	22:26	17:55 **	South-West	39°	+4.6
NGC2244	"Rosette Nebula" (Monoceros)	Open Cluster	23:31	05:29	03:50	South	44°	+4.8
NGC869	H Persei (Double) (Perseus)	Open Cluster	***	***	23:34	North	83°	+5.3
M33	Triangulum Galaxy (Triangulum)	Galaxy	17:55	05:02	22:49	South	69°	+5.7
M13	Great Globular Cluster (Hercules)	Globular Cluster	17:55	00:30	17:55 **	West	46°	+5.8
NGC884	Chi Persei (Double) (Perseus)	Open Cluster	***	***	23:38	North	83°	+6.1
M3	Globular Cluster (Canes Venatici)	Globular Cluster	02:08	05:29	05:29 *	East	25°	+6.3

* = Highest point at Dawn (last visible sighting) ** = Highest point at Dusk (first visible sighting)

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Deep Sky Objects 2 (@ 01-11-2022)

<u>Object</u>	<u>Name</u>	<u>Type</u>	<u>Rises</u>	<u>Sets</u>	<u>Highest</u>	<u>Direction</u>	<u>Alt</u>	<u>Mag</u>
M15	Globular Cluster (Pegasus)	Globular Cluster	17:55	23:26	18:46	South	51°	+6.3
M92	Globular Cluster (Hercules)	Globular Cluster	17:55	21:53	17:55 **	West	55°	+6.5
M2	Globular Cluster (Aquarius)	Globular Cluster	17:55	22:19	18:49	South	38°	+6.6
M81	Bode's Galaxy (Ursa Major)	Galaxy	***	***	05:29 *	North-East	74°	+6.9
M103	Open Cluster (Cassiopeia)	Open Cluster	***	***	22:49	North	80°	+7.4
M101	Pinwheel Galaxy (Ursa Major)	Galaxy	***	***	05:29 *	North-East	39°	+7.9
M110	'Satellite' Galaxy - 1 (Andromeda)	Galaxy	17:55	05:05	21:56	South	80°	+8.1
M94	'Spiral' Galaxy (Canes Venatici)	Galaxy	03:02	05:29	05:29 *	East	42°	+8.2
NGC7009	The Saturn Nebula (Aquarius)	Planet'ry Nebula	17:55	20:27	18:20	South	27°	+8.3
M1	The Crab Nebula (Taurus)	S'nova Remnant	21:26	05:29	02:53	South	61°	+8.4
M51	Whirlpool Galaxy (Canes Venatici)	Galaxy	17:55	05:29	05:29 *	North-East	40°	+8.4
M57	The Ring Nebula (Lyra)	Planet'ry Nebula	17:55	01:49	17:55 **	South-West	63°	+8.8
M32	'Satellite' Galaxy - 2 (Andromeda)	Galaxy	17:55	05:03	21:58	South	80°	+9.0
IC342	'Spiral' Galaxy (Camelopardalis)	Galaxy	***	***	01:01	South-East	73°	+9.2
M74	The Phantom Galaxy (Pisces)	Galaxy	17:54	03:49	22:52	South	54°	+9.5

* = Highest point at Dawn (last visible sighting) ** = Highest point at Dusk (first visible sighting) *** = Circumpolar

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Phases of the Moon



Brown Lunation Number: 1235 (numbered from first New Moon in 1923)

New Moon **25th October** **11:48**

First Quarter **1st November** **06:37**

Full Moon **8th November** **11:02**

Last Quarter **16th November** **13:27**

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Friday 25th November 2022

A short talk followed by an evening of observing with telescopes
Arlington village hall, members only

Wednesday 7th December 2022

A couple of short talks by our members
Lewes town hall, guests welcome

Friday 20th January 2023

A short talk followed by an evening of observing with telescopes
Arlington village hall, members only

Wednesday 1st February 2023

"Satellite megaconstellations and their impact on astronomy today"
Dr Robert Massey, Lewes town hall, guests welcome

Wednesday 1st March 2023

"The rise and fall of an observatory at Herstmonceux"
Keith Brackenborough, Lewes town hall, guests welcome

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