New Zenith

The Monthly Newsletter of the Vectis Astronomical Society

Vol 30 Issue 11 — December 2022 *When Printed, this Newsletter costs VAS at least £1*

Society News

Merry Christmas!

Another year over and time for a month off! Please don't forget there will be **no monthly meeting in December** and **no New Zenith next month.**

The Observatory will be **closed from the 22nd -29th December**.

We start again on Thursday 5th January 2023.

In the meantime I hope you all have a very Merry Christmas and look forward to a more normal New Year.

Thanks

Many thanks to all those who have helped VAS this year. Without our members we would really struggle to keep things, particularly our public outreach events, operating normally.

There are still two Committee posts open for you to volunteer for:

- A Committee Secretary
- An Editor/Compiler for this NZ Newsletter

If you can help with either, please contact any Committee member.

Brian Curd

VAS Website: wightastronomy.org

Submissions or letters to New Zenith are always welcome and should be sent to:

The Editor, New Zenith
Belvedere
St John's Crescent
Sandown
Isle of Wight
PO36 8EE
Tel: 07594 339950 or email: **editor@wightastronomy.org**

Material for the next issue by the 6th of the month please.

Registered Charity No 1046091

Observatory Diary

Monday, 19.30hrs	Members Only and by arrangement Telescope and night sky training.
Thursday	Members (19.30hrs) and Public (20.00hrs). Informal meeting and observing

VAS Website: wightastronomy.org

Contents this Month

2023 Monthly Meetings

Check *http://www.wightastronomy.org/meetings/* for the latest information

Date	Subject	Speaker
27 Jan	Eclipses	Richard Flux
24 Feb	**ZOOM only** - Astronomical Spectroscopy	Steve Broadbent
24Mar	Not Booked	
28 Apr	Sundials	Peter Ransom
26 May	Not Booked	
23 Jun	**Possibly ZOOM** Stellar Evolution - the life cycle of a star and its implications for life in our Solar System	Dr Elizabeth Cunningham
28 Jul	Variable Stars	Bryn Davis
25 Aug	AGM	**Meeting in the Observatory**
22 Sep	Not Booked	
27 Oct	Not Booked	
24 Nov	EM-bridge technology and applications	Alan Thomson

Observatory Visits Booked

No bookings so far

Please phone me for the current situation (number on the front page)

It would be appreciated if members could avoid using the observatory at these times.

GDPR rules mean we must maintain accurate membership records, please tell us if any of your contact details changes

VAS Contacts 2022

President	Barry Bates president@wightastronomy.org
Chairman	Bryn Davis chairman@wightastronomy.org
Secretary	**Vacant** secretary@wightastronomy.org
Treasurer	Stewart Chambers treasurer@wightastronomy.org
Observatory Director	Brian Curd director@wightastronomy.org
Programme Organiser	Simon Gardner progorg@wightastronomy.org
Astro Photography	Simon Plumley ap@wightastronomy.org
Outreach	Elaine Spear outreach@wightastronomy.org
Membership Secretary	Mark Williams members@wightastronomy.org
NZ Editor	**Help Wanted** editor@wightastronomy.org
NZ Distribution	Brian Curd distribution@wightastronomy.org
Others	Dudley Johnson

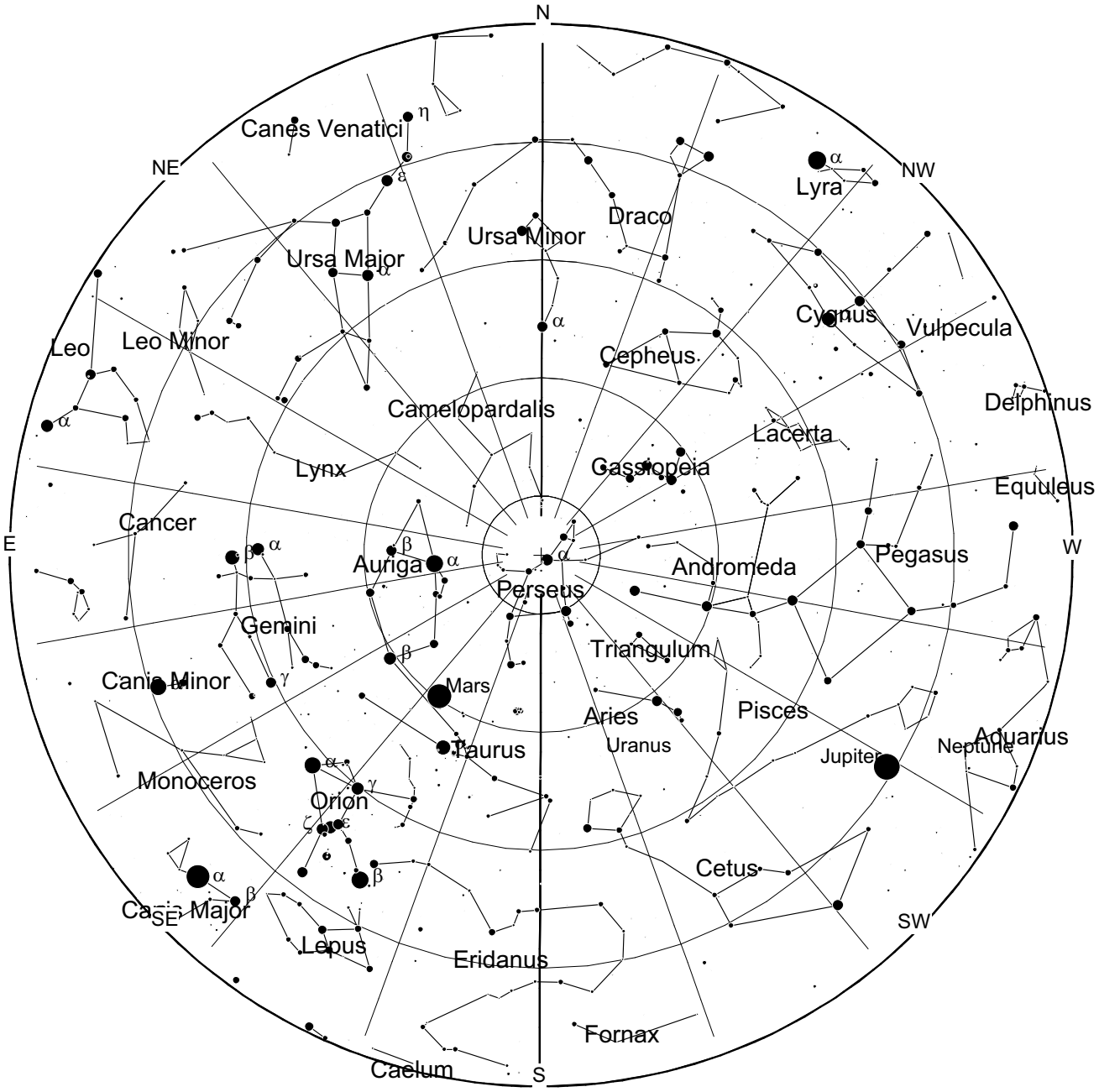
Important

Members using the observatory MUST enter a line or two in the Observatory Log Book.

On several occasions, lights, heaters and the Meade LX200 have been left on!

When leaving, please ensure all is secure and all lights, heaters and telescopes are TURNED OFF.

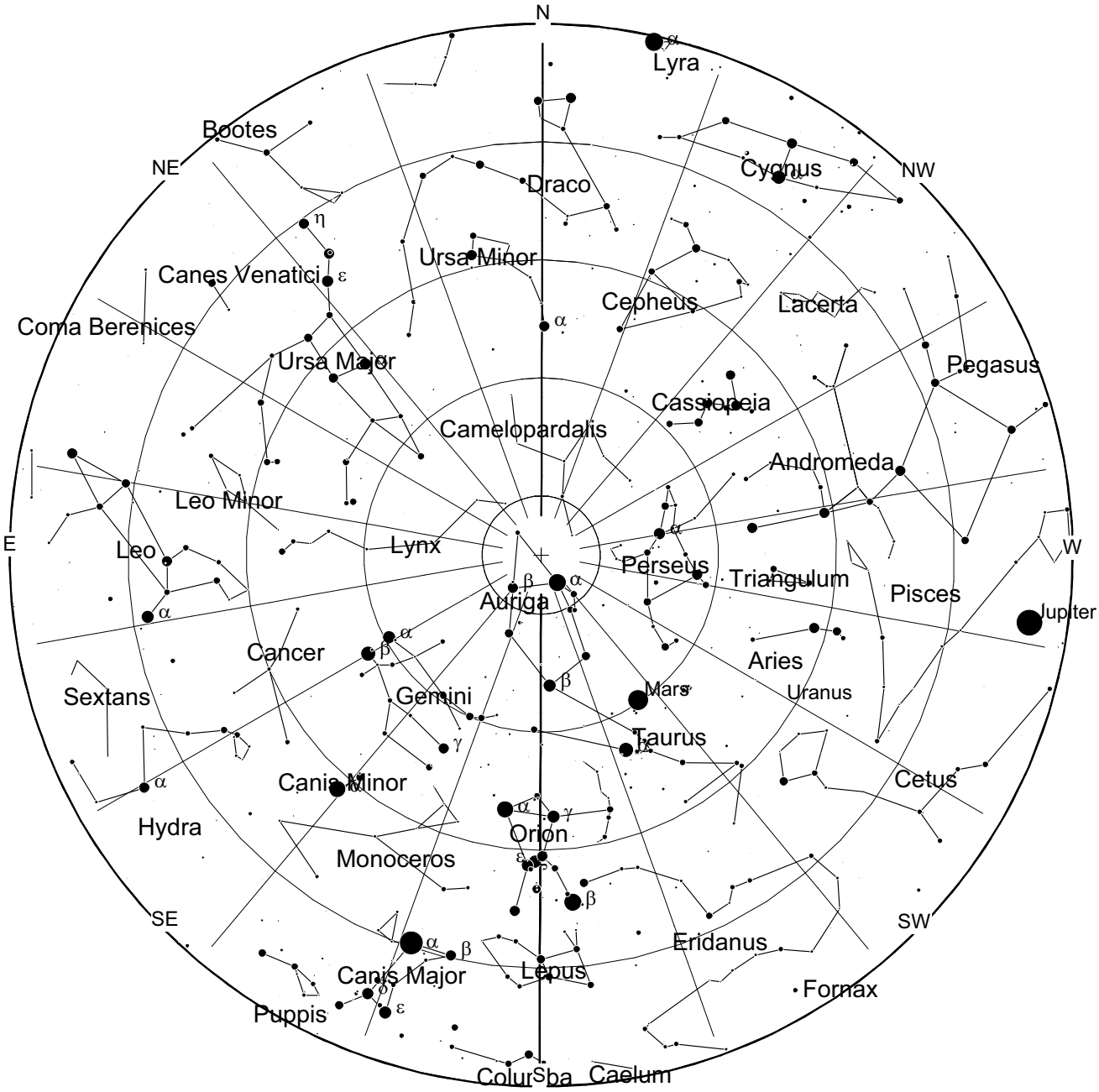
December 2022 - Sky Map



View from Newchurch Isle of Wight UK - 2200hrs - 15 December 2022

The Little Dumbbell Nebula, also known as Messier 76, NGC 650/651, the Barbell Nebula, or the Cork Nebula, is a planetary nebula in northern constellation Perseus. It was discovered by Pierre Méchain in 1780 and included in Charles Messier's catalog of comet-like objects as number 76. It was first recognised as a planetary nebula in 1918 by the astronomer Heber Doust Curtis. However, there is some contention to this claim, as Isaac Roberts in 1891 did suggest that M76 might be similar to the Ring Nebula (M57), being instead as seen from the side view. The structure is now classed as a bipolar planetary nebula denoting two stars which have burst, leaving neutron star or white dwarf remnants and luminous envelopes. Distance to M76 is currently estimated as 780 parsecs or 2,500 light years, making the average dimensions about 1.23 ly across.

January 2023 - Sky Map



View from Newchurch Isle of Wight UK - 2200hrs - 15 December 2022

The Orion Nebula (also known as Messier 42, M42, or NGC 1976) is a diffuse nebula situated in the Milky Way, being south of Orion's Belt in the constellation of Orion. It is one of the brightest nebulae and is visible to the naked eye in the night sky with apparent magnitude 4.0. It is 1,344 ± 20 light-years (412.1 ± 6.1 pc) away and is the closest region of massive star formation to Earth. The M42 nebula is estimated to be 24 light-years across (so its apparent size from Earth is approximately 1 degree). It has a mass of about 2,000 times that of the Sun. Older texts frequently refer to the Orion Nebula as the Great Nebula in Orion or the Great Orion Nebula.

December 2022/January 2023 - Night Sky

Winter Solstice

The winter solstice, the time at which the Sun is at its most southerly point in the sky occurs this year on December 21 at 21:48 UTC. After this time the Sun starts to return to the north and the hours of daylight start to increase

Moon Phases Dec

New	First Qtr	Full	Last Qtr
23rd	30th	8th	16th
			

Moon Phases Jan

New	First Qtr	Full	Last Qtr
21st	28th	6th	15th
			

Planets

Mercury

During the last fortnight of the year Mercury makes a very poor evening apparition. Look very low down, just a few degrees above the horizon to the south west after sunset. On the 28th and 29th it is just above the very much brighter Venus, with a bright guide to help this is the last chance to spot this elusive world this year.

During the last fortnight of January it makes another appearance, this time in the morning sky. Again it is poor apparition, being very close to the horizon before sunrise it will be difficult tot spot. Look low in the south east during the hour before sunrise.

Venus

Venus makes a re-appearance as the Evening Star during this month. It should start to become visible from about the12th as it moves away from the Sun. Look to the south west after sunset and as the sky starts to darken it will become visible. Until around the end of the year, because it will be so close to the horizon, it will probably look more red than the normal brilliant white.

On the 29th of December it will be in close conjunction with the much fainter Mercury, and on the 22nd of January it will be in very close conjunction with Saturn.

Mars

Mars it at opposition and is at its closest to the Earth on December 8th. This is the best opportunity to observe this world for the next two years. A few weeks after opposition its apparent size starts to reduce quite dramatically, so make the most of this short observing window. Mars is in the constellation of Taurus and can be seen all night rising in the east as the Sun sets and being high overhead during the late evening. It is brighter than any nearby star and has a distinctly red hue. Any reasonable telescope will show surface markings. As Mars rotates at about the same rate as the Earth so the surface features that are visible change by the hour.

Jupiter

For most of the period Jupiter remains well placed for observation during the early to mid evening. Jupiter is easily identified it is brighter than any stars and is conspicuous in the southern sky during twilight. As we move into January it will be found in the south western sky and will be starting to slip towards the horizon where the atmospheric haze will degrade observations somewhat.

Saturn

Saturn is now well past its best for observation. It can be found in the south west after sunset, and being brighter than any nearby star is easily identified among the stars of Capricorn. It is in very close conjunction with the much brighter Venus on January 22nd, but the sky will still be quite bright and the planets will be close to the horizon making this a difficult event to observe.

Uranus

Uranus is currently in the constellation of Ares. In our skies it is usually just below naked eye visibility, but still an easy binocular object. The main difficulty is locating it against the star background; there being no nearby brighter guide stars. Use the finder chart given in New Zenith for September or a computerised star chart to assist in finding this ice giant.

For those who like a challenge there is a lunar occultation of Uranus on December 5th starting at 16:43 as Uranus slips behind the eastern side of the almost full moon and ending at 1717 as it re-appears on the other side. The sky will be quite bright at the start of the occultation, and with the brightness of the moon it will be challenging to observe.

Neptune

Similar to Uranus, Neptune is also in a part of the sky devoid of good guide stars. It is between Aquarius and Pisces, but at about magnitude 8 is much fainter than Uranus making it more difficult to find; it is however still well within the range of a pair of 10x50 binoculars. Use the finder chart in August New Zenith or a computerised star chart.

Meteor Showers

Geminids

The night of December 13 -14 sees the peak of the Geminids meteor shower. This shower can produce good numbers of bright meteors; it will however be somewhat subdued this year in the later evening or early morning because of the waning gibbous moon.

Quadrantids

The Quadrantids is a long lasting shower, from December 28 to January 12, with a short sharp peak lasting only about 5 hours or so; the predicted peak time is at 03:00 in the morning of January 4th. Unfortunately this year the peak coincides with an almost full moon so observing conditions are far form ideal. The best time to observe will be in the early morning from just before moonset until dawn.

The constellation of the Quadrant, after which this shower is named, is one that is now obsolete. It was located in the area between Bootes, Hercules, Draco and Ursa Major.

Deep Sky

M45 Pleiades
RA 3h 47m Dec 24° 13' mag 1.4

Known since ancient times as a herald of the wet season, the Pleiades is probably the most famous of all star clusters. It is an object that has something for all observers whether they are using naked eye, binoculars or a telescope.

M76 The Little Dumbbell Nebula
RA 1h 43m Dec 51° 37' mag 12

Just under one degree in the direction of Cassiopeia from Phi Persei lies one of the faintest of the Messier objects; a small bipolar planetary nebula that, as its name implies looks like a miniature version of the famous Dumbbell Nebula. At magnitude 12 it is beyond the reach of all but the largest binoculars, however in medium sized telescopes, with averted vision the two halves of the dumbbell can be seen. It was once considered to be two distinct objects and was given two NGC numbers NGC651 & 651.

M52 The Scorpion Cluster
RA 23h 25m Dec 61° 37' mag 8.0

Follow the line from Schedar through Caph for 6 degrees beyond Caph and you will find this fine open cluster. It is large, almost half the size of the full moon and the density of stars makes it relatively bright such that it stands out from the background Milky Way. A telescope will resolve many of the cluster members. A chain of 11th magnitude stars form a hook shape that bears a passing resemblance to the tail and sting of Scorpius. Two other stars of similar brightness mark out the claws. The brightest star in the cluster, a red tinged eighth magnitude star is not actually a cluster member but a line of sight coincidence

NGC1647 Open Cluster
RA 4h 46m Dec 19° 7'

Scanning with a pair of 10x50 binoculars from Aldebaran towards Elnath, (the star often shown shared with Auriga) just as Aldebaran is leaving the field of view there in the centre should be a fuzzy triangular patch of stars about the same size as the full moon. This is NGC1647. Like many galactic clusters aperture is more important than magnification, an increased aperture will show more members of the cluster and allow them to be resolved whereas magnification will lessen the visual impact of the overall cluster.

Peter Burgess

easyfundraising

Please remember to use easyfundraising every time you shop online! Over 6,000 shops and sites will donate, so you can raise FREE donations for us no matter what you're buying. These donations really help us out, so please sign up if you haven't yet. It's easy and FREE! You can get started at:

https://www.easyfundraising.org.uk/causes/vectisastronomicalsociety/?utm_campaign=raise-more&utm_content=en-n2

New Metric Prefixes Voted In

The Earth's mass can now be expressed as six ronnagrams after scientists voted to add new metric prefixes.

Say hello to ronnagrams and quettameters: International scientists gathered in France voted on Friday for new metric prefixes to express the world's largest and smallest measurements, prompted by an ever-growing amount of data.

It marks the first time in more than three decades that new prefixes have been added to the International System of Units (SI), the agreed global standard for the metric system.

Joining the ranks of well-known prefixes like kilo and milli are ronna and quetta for the largest numbers - and ronto and quecto for the smallest.

The change was voted on by scientists and government representatives from across the world attending the 27th General Conference on Weights and Measures, which governs the SI and meets roughly every four years at Versailles Palace, west of Paris.

The UK's National Physical Laboratory, which led the push for the new prefixes, confirmed that the resolution had passed in a statement.

The prefixes make it easier to express large amounts - for example, always referring to a kilometer as 1,000 meters or a millimeter as one thousandth of a meter would quickly become cumbersome.

Since the SI was established in 1960, scientific need has led to a growing number of prefixes. The last time was in 1991, when chemists wanting to express vast molecular quantities spurred the addition of zetta and yotta.

A yottameter is a one followed by 24 zeroes.

But even the mighty yotta is not enough to handle the world's voracious appetite for data, according to Richard Brown, the head of metrology at the UK's National Physical Laboratory.

“In terms of expressing data in yottabytes, which is the highest prefix currently, we're very close to the limit,” Brown told AFP.

“At the bottom end, it makes sense to have a symmetrical expansion, which is useful for quantum science, particle physics - when you're measuring really, really small things.”

New weight of the world

The new prefixes can simplify how we talk about some pretty big objects.

“If we think about mass, instead of distance, the Earth weighs approximately six ronnagrams,” which is a six followed by 27 zeroes, Brown said.

“Jupiter, that's about two quettagrams,” he added - a two followed by 30 zeros.

Brown said he had the idea for the update when he saw media reports using unsanctioned prefixes for data storage such as brontobytes and hellabytes. Google in particular has been using hella for bytes since 2010.

“Those were terms that were unofficially in circulation, so it was clear that the SI had to do something,” he said.

However metric prefixes need to be shortened to just their first letter - and B and H were already taken, ruling out bronto and hella.

“The only letters that were not used for other units or other symbols were R and Q,” Brown said.

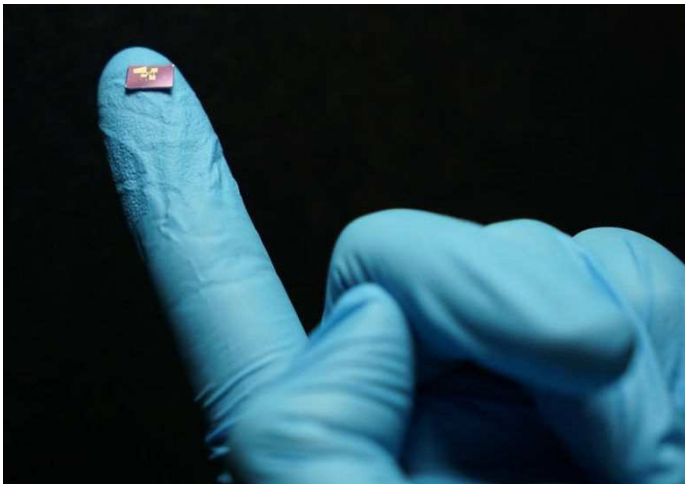
Convention dictates that the larger prefixes end in an A, and the smaller ones in an O.

And “the middle of the words are very, very loosely based on the Greek and Latin for nine and 10,” Brown said.

The new prefixes should “future proof the system” and satisfy the world's need for higher numbers - at least for the next 20 to 25 years, he added.

From: https://phys.org/news/

Scientists Have Created a Powerful, Ultra-Tiny Spectrometer



Researchers in the field of optical spectrometry have created a better instrument for measuring light. This advancement could improve everything from smartphone cameras to environmental monitoring.

The study used a relatively new class of super-thin materials known as two-dimensional semiconductors, and the result is a proof of concept for a spectrometer that could be easily integrated into a number of technologies such as quality inspection platforms, security sensors, biomedical analyzers, and space telescopes.

"We've demonstrated a way of building spectrometers that are far more miniature than what is typically used today," said Ethan Minot, a professor of physics at the Oregon State University College of Science. "Spectrometers measure the strength of light at different wavelengths and are super useful in lots of industries and all fields of science for identifying samples and characterizing materials."

Minot claimed that the new spectrometer could fit on the end of a human hair, in contrast to conventional spectrometers that need large optical and mechanical components. According to the new study, such components could be replaced with novel semiconductor materials and artificial intelligence, enabling spectrometers to be drastically scaled down in size from the smallest ones currently available, which are around the size of a grape.

"Our spectrometer does not require assembling separate optical and mechanical components or array designs to disperse and filter light," said Hoon Hahn Yoon, who led the study with Aalto University colleague Zhipei Sun Yoon. "Moreover, it can achieve a high resolution comparable to benchtop systems but in a much smaller package."

The device is 100% electrically controllable regarding the colors of light it absorbs, which gives it massive potential for scalability and widespread usability, the researchers say.

"Integrating it directly into portable devices such as smartphones and drones could advance our daily lives," Yoon said. "Imagine that the next generation of our smartphone cameras could be hyperspectral cameras." Those cameras could capture and analyze information not just from visible wavelengths but also allow for infrared imaging and analysis.

"It's exciting that our spectrometer opens up possibilities for all sorts of new everyday gadgets and instruments to do new science as well," Minot said.

In medicine, for example, spectrometers are already being tested for their ability to identify subtle changes in human tissue such as the difference between tumors and healthy tissue.

For environmental monitoring, Minot added, spectrometers can detect exactly what kind of pollution is in the air, water or ground, and how much of it is there.

"It would be nice to have low-cost, portable spectrometers doing this work for us," he said. "And in the educational setting, the hands-on teaching of science concepts would be more effective with inexpensive, compact spectrometers."

Applications abound as well for science-oriented hobbyists, Minot said.

"If you're into astronomy, you might be interested in measuring the spectrum of light that you collect with your telescope and having that information identify a star or planet," he said. "If geology is your hobby, you could identify gemstones by measuring the spectrum of light they absorb."

Minot thinks that as work with two-dimensional semiconductors progresses, "we'll be rapidly discovering new ways to use their novel optical and electronic properties." Research into 2D semiconductors has been going on in earnest for only a dozen years, starting with the study of graphene, carbon arranged in a honeycomb lattice with a thickness of one atom.

"It's really exciting," Minot said. "I believe we'll continue to have interesting breakthroughs by studying two-dimensional semiconductors."

From: https://scitechdaily.com/

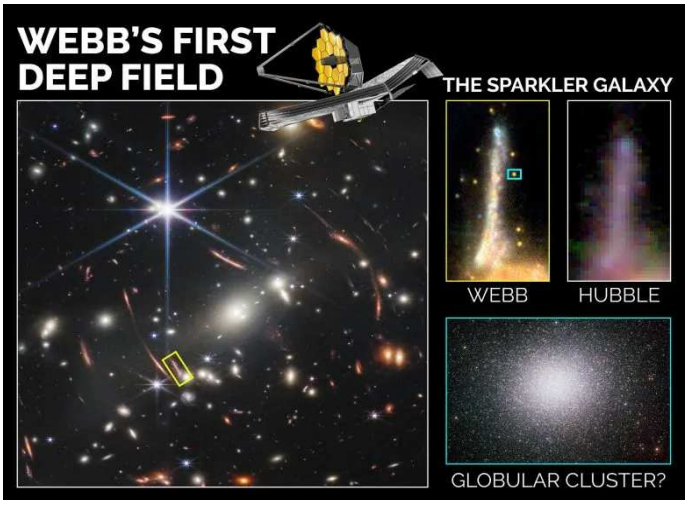
James Webb Space Telescope Reveals Oldest Star Clusters in the Universe

Thousands of galaxies flood this near-infrared, high-resolution image of galaxy cluster SMACS 0723. Credit: NASA, ESA, CSA, STScI

A team of astronomers used the James Webb Telescope (JWST) to identify the most distant globular clusters ever discovered. These dense groups of millions of stars may be relics containing the first and oldest stars in the universe.

The early analysis of Webb's First Deep Field image, which depicts some of the universe's earliest galaxies, was published recently in The Astrophysical Journal Letters. The work was conducted by a team of Canadian astronomers, including experts from the Dunlap Institute for Astronomy & Astrophysics in the University of Toronto's Faculty of Arts & Science.

"JWST was built to find the first stars and the first galaxies and to help us understand the origins of complexity in the universe, such as the chemical elements and the building blocks of life," says Lamiya Mowla, a post-doctoral researcher at the Dunlap Institute for Astronomy & Astrophysics and co-lead author of the study, which was carried out by the CAnadian NIRISS Unbiased Cluster Survey (CANUCS) team.



"This discovery in Webb's First Deep Field is already providing a detailed look at the earliest phase of star formation, confirming the incredible power of JWST."

In the finely detailed Webb's First Deep Field image, the astronomers quickly zeroed in on what they've dubbed "the Sparkler galaxy." Located nine billion light years away, this galaxy got its name from the compact objects appearing as small yellow-red dots surrounding it, referred to by the researchers as "sparkles." The research team determined that these sparkles could either be young clusters actively forming stars – born three billion years after the Big Bang at the peak of star formation – or old globular clusters. Globular clusters are ancient collections of stars from a galaxy's infancy and contain clues about its earliest phases of formation and growth.

From an initial analysis of 12 of these compact objects, the researcher team determined that five of them are not only globular clusters but among the oldest ones known.

"Looking at the first images from JWST and discovering old globular clusters around distant galaxies was an incredible moment – one that wasn't possible with previous Hubble Space Telescope imaging," says Kartheik G. Iyer, a post-doctoral researcher at the Dunlap Institute for Astronomy & Astrophysics and co-lead author of the study.

"Since we could observe the sparkles across a range of wavelengths, we could model them and better understand their physical properties – like how old they are and how many stars they contain. We hope the knowledge that globular clusters can be observed at from such great distances with JWST will spur further science and searches for similar objects."

The Milky Way galaxy is known to have about 150 globular clusters, but how and when exactly these dense clumps of stars formed is not well understood. Astronomers know that globular clusters can be extremely old, but it is incredibly challenging to measure their ages. Using very distant globular clusters to age-date the first stars in distant galaxies has not been done before and is only possible with JWST.

"These newly identified clusters were formed close to the first time it was even possible to form stars," says Mowla. "Because the Sparkler galaxy is much farther away than our own Milky Way, it is easier to determine the ages of its globular clusters. We are observing the Sparkler as it was nine billion years ago, when the universe was only four-and-a-half billion years old, looking at something that happened a long time ago. Think of it as guessing a person's age based on their appearance – it's easy to tell the difference between a five- and 10-year-old, but hard to tell the difference between a 50- and 55-year-old."

Until now, astronomers could not see the surrounding compact objects of the Sparkler galaxy with the Hubble Space Telescope. This changed with JWST's increased resolution and sensitivity, unveiling the tiny dots surrounding the galaxy for the first time in Webb's First Deep Field image. The Sparkler galaxy is special because it is magnified by a factor of 100 due to gravitational lensing – where the SMACS 0723 galaxy cluster in the foreground distorts what is behind it, much like a giant magnifying glass. The lensing produces three separate images of the Sparkler, allowing astronomers to study the galaxy in greater detail.

"Our study of the Sparkler highlights the tremendous power in combining the unique capabilities of JWST with the natural magnification afforded by gravitational lensing," says CANUCS team lead Chris Willott from the National Research Council's Herzberg Astronomy and Astrophysics Research Centre. "The team is excited about more discoveries to come when JWST turns its eye on the CANUCS galaxy clusters next month."

The researchers combined new data from JWST's Near-Infrared Camera (NIRCam) with Hubble Scape Telescope archival data. NIRCam detects faint objects using longer and redder wavelengths to observe past what is visible to the human eye and even the Hubble Space Telescope.

The Canadian-made Near-Infrared Imager and Slitless Spectrograph (NIRISS) instrument on the JWST provided independent confirmation that the objects are old globular clusters because the researchers did not observe oxygen emission lines – emissions with measurable spectra given off by young clusters that are actively forming stars. NIRISS also helped unravel the geometry of the triply lensed images of the Sparkler.

"JWST's NIRISS helped us understand how the three images of the Sparkler and its globular clusters are connected," says Marcin Sawicki, a professor at Saint Mary's University who is Canada Research Chair in Astronomy and co-author of the study. "Seeing several of the Sparkler's globular clusters imaged three times made it clear that they are orbiting around the Sparkler galaxy rather than being simply in front of it by chance."

JWST will observe the CANUCS fields starting in October 2022, leveraging its data to examine five massive clusters of galaxies, around which the researchers expect to find more such systems. Future studies will also model the galaxy cluster to understand the lensing effect and execute more robust analyses to explain the star formation histories.

From: https://scitechdaily.com/

Mars was once covered by 300m deep oceans

Mars is called the red planet. But once, it was actually blue and covered in water, bringing us closer to finding out if Mars had ever harboured life. Most researchers agree that there has been water on Mars, but just how much water is still debated.

Now a study from the University of Copenhagen shows that some 4.5 billion years ago, there was enough water for the entire planet to be covered in a 300-metre-deep ocean. "Mars was bombarded with asteroids filled with ice. It happened in the first 100 million years of the planet's evolution. The asteroids also carried organic molecules that are important for life," says Professor Martin Bizzarro from the Centre for Star and Planet Formation.

In addition to water, the icy asteroids also brought biologically relevant molecules such as amino acids to the Red Planet. Amino acids are used when DNA and RNA form bases that contain everything a cell needs.

Mars may have had the conditions for life before Earth

The new study indicates that the oceans that covered the entire planet in water were at least 300 metres deep. They may have been up to one kilometre deep. In comparison, there is actually very little water on Earth.

"This happened within Mars's first 100 million years. After this period, something catastrophic happened for potential life on Earth. It is believed that there was a gigantic collision between the Earth and another Mars-sized planet. It was an energetic collision that formed the Earth-Moon system and, as the same time, wiped out all potential life on Earth," says Martin Bizzarro.

Researchers have strong evidence that conditions allowing life were present on Mars long before Earth.

Billion-year-old meteorite

A meteorite that is billions of years old enabled researchers to look into Mars's history. The meteorite was once part of Mars's original crust and offers an insight into what happened when the solar system was formed.

"Plate tectonics on Earth erased all evidence of what happened in the first 500 million years of our planet's history. The plates constantly move and are recycled back and destroyed into the interior of our planet. In contrast, Mars does not have plate tectonics such that planet's surface preserves a record of the earliest history of the planet," explains Martin Bizzarro.

From: https://www.sciencedaily.com/

Elevating the Risk of Satellite Collision: Climate Change To Increase Lifetime of Space Debris

The reduced atmosphere in the upper atmosphere will increase satellites' risk of collision with space pollution.

According to a recent study from the British Antarctic Survey, rising CO2 levels in the Earth's atmosphere will cause a long-term drop in air density at high altitudes. This reduced density will lessen the drag on objects orbiting between 90 and 500 km in the upper atmosphere, prolonging the lifespan of space debris and increasing the possibility of debris collisions with satellites.

Collisions might result in serious issues if satellites, which cost billions of dollars, are destroyed since society is becoming more and more reliant on satellites for navigation systems, mobile communications, and monitoring Earth.

The study, which was recently published in the journal Geophysical Research Letters, offers the first realistic estimate of climate change in the upper atmosphere over the next 50 years. Although several studies have examined the changes that would occur in the lower and middle atmosphere, there has been far less research into situations that occur at higher altitudes.

A Scientific Reports study found that there were about 5,000 active and defunct satellites in low Earth orbit - up to 2,000km altitude - as of March 2021, and this number had increased by 50% over the previous two years. There are various companies planning to add thousands more in the next decade. Once decommissioned, satellites continue to orbit but gradually slow due to atmospheric drag, lowering their orbital altitude until they burn up in the lower atmosphere. Current guidelines set by the Inter-Agency Space Debris Coordination Committee advise that satellite operators make sure that decommissioned satellites deorbit within 25 years but the reduced atmospheric density will introduce errors in planning and calculations.

In contrast to the lower atmosphere, the middle and upper atmosphere has been cooling. This leads to a decline in density with practical implications for the drag on objects such as derelict satellites and space mission-related debris at those altitudes. With reduced drag the lifetime of these objects is extended, objects remain in orbit for longer and there is a greater risk of collision with active satellites as well as with other space debris.

Ingrid Cnossen, a NERC independent research fellow at the British Antarctic Survey, used a global model of the whole atmosphere up to 500 km altitude to simulate changes in the upper atmosphere up to 2070. She compared her projections to the last 50 years of data and found that even under a moderate future emissions scenario the predicted average cooling and decline in upper atmosphere density is about twice as strong as has been seen in the past.

Cnossen says: "The changes we saw between the climate in the upper atmosphere over the last 50 years and our predictions for the next 50 are a result of CO2 emissions. It is increasingly important to understand and predict how climate change will impact these regions, particularly for the satellite industry and the policymakers who are involved with setting standards for that industry."

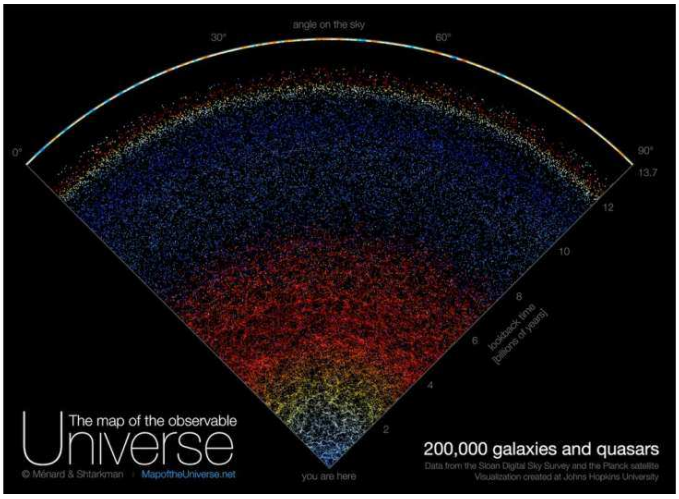
She continues, "Space debris is becoming a rapidly growing problem for satellite operators due to the risk of collisions, which the long-term decline in upper atmosphere density is making even worse. I hope this work will help to guide appropriate action to control the space pollution problem and ensure that the upper atmosphere remains a useable resource into the future."

There are over 30,000 trackable debris pieces in low Earth orbit larger than 10 cm in diameter and 1 million debris objects greater than 1 cm according to the European Space Agency.

The ionosphere – the charged part of the upper atmosphere – is also expected to change, in part as a result of increasing CO2 concentrations but also because of changes in the Earth's magnetic field. Understanding the distribution of electrons in the ionosphere is important to correct for errors that they introduce into satellite-based sea level measurements used for climate monitoring. The largest changes in electron count are found to be expected over South America, the southern Atlantic Ocean, and western Africa. The study recommends that further studies monitor these changes and build up a picture in order to control for effects on satellite-based data applications.

From: https://scitechdaily.com/

Scroll through the universe with a new interactive map



Credit: Visualization by B. MéNard & N. Shtarkman

A new map of the universe displays for the first time the span of the entire known cosmos with pinpoint accuracy and sweeping beauty.

Created by Johns Hopkins University astronomers with data mined over two decades by the Sloan Digital Sky Survey, the map allows the public to experience data previously only accessible to scientists.

The interactive map, which depicts the actual position and real colors of 200,000 galaxies, is available online, where it can also be downloaded for free.

"Growing up I was very inspired by astronomy pictures, stars, nebulae and galaxies, and now it's our time to create a new type of picture to inspire people," says map creator Brice Ménard, a professor at Johns Hopkins.

"Astrophysicists around the world have been analyzing this data for years, leading to thousands of scientific papers and discoveries. But nobody took the time to create a map that is beautiful, scientifically accurate, and accessible to people who are not scientists. Our goal here is to show everybody what the universe really looks like."

The Sloan Digital Sky Survey is a pioneering effort to capture the night sky through a telescope based in New Mexico. Night after night for years, the telescope aimed at slightly different locations to capture this unusually broad perspective.

The map, which Ménard assembled with the help of former Johns Hopkins computer science student Nikita Shtarkman, visualizes a slice of the universe, or about 200,000 galaxies - each dot on the map is a galaxy and each galaxy contains billions of stars and planets. The Milky Way is simply one of these dots, the one at the very bottom of the map.

The expansion of the universe contributes to make this map even more colorful. The farther an object, the redder it appears. The top of the map reveals the first flash of radiation emitted soon after the Big Bang, 13.7 billion years ago.

"In this map, we are just a speck at the very bottom, just one pixel. And when I say we, I mean our galaxy, the Milky Way which has billions of stars and planets," Ménard says. "We are used to seeing astronomical pictures showing one galaxy here, one galaxy there or perhaps a group of galaxies. But what this map shows is a very, very different scale."

Ménard hopes people will experience both the map's undeniable beauty and its awe-inspiring sweep of scale.

"From this speck at the bottom," he says, "we are able to map out galaxies across the entire universe, and that says something about the power of science."

From: https://phys.org/

Subaru Telescope can now analyze 2,400 galaxies simultaneously

First light is an exciting time for astronomers and engineers who help bring new telescopes up to speed. One of the most recent and significant first light milestones recently occurred at the Subaru Telescope in Hawai'i. Though it has been in operation since 2005, the National Astronomical Observatory of Japan's (NAOJ) main telescope recently received an upgrade that will allow it to simultaneously observe 2,400 astronomical objects at once over a patch of sky the size of several moons.

Those 2,400 objects will be observed by the Prime Focus Spectrograph (PFS), which itself has multiple subcomponents and was developed by around a dozen universities and companies on four continents. Its major components consist of a Prime Focus Instrument, which contains 2,400 individual fibers and lets it concentrate on

various parts of the sky. Data from those fibers is then fed to a Spectrograph System (SpS), which analyzes it to produce the data used in scientific papers.

The SpS consists of four separate spectrographs, covering spectra from the ultraviolet to the near-infrared, much more than a human eye can take in alone. Or, as a press release from NAOJ puts it more poetically, it covers "one and a half rainbows."

Unfortunately, these sensitive instruments won't usually be used to capture rainbows, but theoretically, the Wide Field Corrector could. It is a seven-lens optical system developed specifically for this upgrade that allows Subaru's operators to correct for errors in image collection before they become a problem.

There are also some supporting systems to enable the actual data collection to take place. n addition to the SpS, the PFS utilizes a giant 8960 x 5778 pixel CMOS camera known as the Metrology Camera System to track where precisely the fibers collecting the data are located. If any are out of place, it could throw off the data the system collects.

All of these upgrades come with high hopes - the goal of the PFS upgrade is literally to understand where the universe came from and where it's going. It will coordinate with the Hyper Suprime-Cam already installed in an effort to "reveal the nature of dark matter and dark energy, structure formation in the universe, and the physical processes of galaxy formation and evolution.

That's a lot for one telescope upgrade, but it will surely have lots of data to analyze. Maybe the team could implement an eyepiece to attach to the PFS before it starts collecting data like it did when the telescope was first commissioned back in 2005. Potentially, the team that worked so hard on it could even actually see some rainbows then.

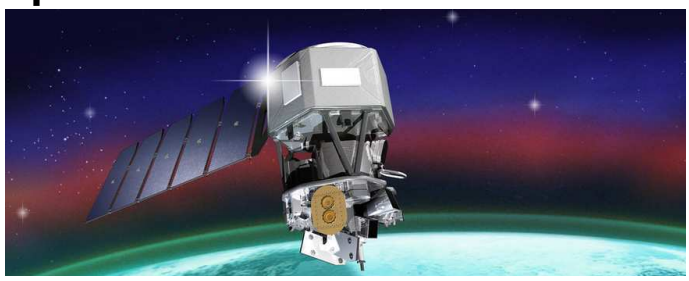
From: https://phys.org/

Did You Know?

The Subaru (car company) Logo is an image based on the Pleiades star cluster (M45).

In Japan, the cluster is mentioned under the name Mutsuraboshi ("6 stars") in the 8th-century Kojiki. The cluster is now known in Japan as Subaru.

NASA Loses Contact With Icon Spacecraft



A NASA space science spacecraft launched three years ago has been out of contact with controllers for nearly two weeks after suffering some kind of technical problem.

NASA announced Dec. 7 that the Ionospheric Connection Explorer (ICON) spacecraft has not communicated with ground stations since Nov. 25. The spacecraft, launched in October 2019, had not experienced any major issues reported by NASA before this incident.

The loss of contract would have triggered an eight-day "command loss timer" on the spacecraft, causing it to reset its systems after eight days. NASA said that it has yet to restore contact with the spacecraft even after completing that power cycle.

The agency said engineers believe the problem is with the spacecraft's avionics or communications subsystems, but have little information to support troubleshooting. "The team is currently unable to determine the health of the spacecraft, and the lack of a downlink signal could be indicative of a system failure," it stated.

NASA said it has ruled out damage to the spacecraft from an explosion of debris impact, noting that observations of the low Earth orbit spacecraft by the Defense Department's Space Surveillance Network concluded that ICON is intact.

The $252 million ICON mission was designed to study the interaction of space weather with terrestrial weather in the Earth's ionosphere to better understand what drives variations in the ionosphere. That included measurements that showed the Hunga Tonga-Hunga Ha'apai volcanic eruption in January 2022 in the Pacific had effects extending into the ionosphere, where it disrupted electrical currents.

ICON completed its two-year primary mission in late 2021 and was in an interim extended mission. ICON will be part of NASA's next senior review of heliophysics missions in 2023 to determine if its mission should be extended. NASA projected spending $6.7 million on ICON operations in fiscal year 2023.

From: https://spacenews.com/

BlueWalker 3 is Genuinely Alarming Astronomers

The night sky is a shared wilderness. On a dark night, away from the city lights, you can see the stars in the same way as your ancestors did centuries ago. You can see the Milky Way and the constellations associated with stories of mythical hunters, sisters and journeys.

But like any wilderness, the night sky can be polluted. Since Sputnik 1 in 1957, thousands of satellites and pieces of space junk have been launched into orbit.

For now, satellites crossing the night sky are largely a curiosity. But with the advent of satellite constellations – containing hundreds or thousands of satellites – this could change.

The recent launch of BlueWalker 3, a prototype for a satellite constellation, raises the prospect of bright satellites contaminating our night skies. At 64 square metres, it's the largest commercial communications satellite in low Earth orbit – and very bright.

Pollution of the night sky

While spotting satellites in the night sky has been a curiosity, the accelerating number of satellites in orbit means pollution of the night sky could become a serious problem.

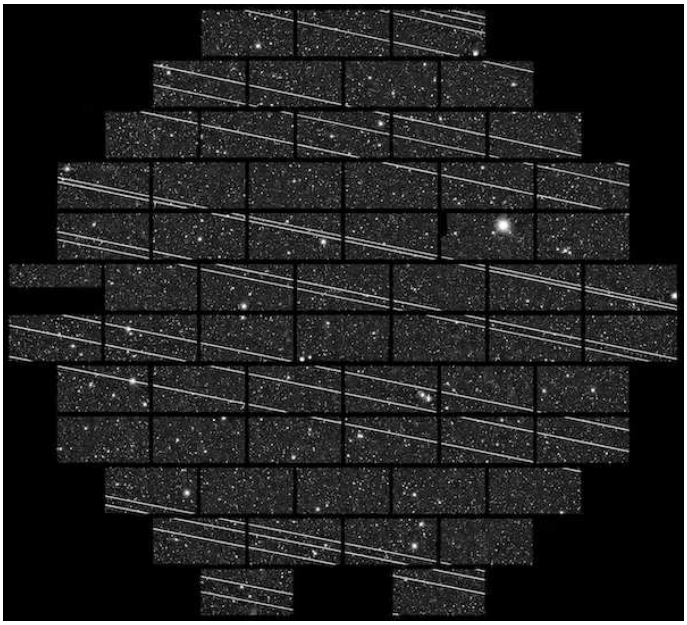
On a clear night, particularly near twilight, you can see satellites travelling across the night sky. These satellites are in low Earth orbit, just a few hundred kilometres above Earth and travelling almost 8 kilometres every second.

Apps and websites allow you to identify or predict the arrival of particular satellites overhead. And it is genuinely fun to see the International Space Station travelling by, realising that on that speck of light there's a crew of astronauts.

But in the past few years, the pace of satellite launches has accelerated. SpaceX has made satellite launches cheaper, and it has been launching thousands of Starlink satellites that provide internet services.

Roughly 50 Starlink satellites are launched into orbit by each Falcon 9 rocket, and initially produce a bright train of satellites. These initially produced UFO reports, but are now sufficiently common to not be particularly newsworthy.

Once the Starlink satellites disperse and move to their operational orbits, they are near the limit of what can be seen with the unaided eye.



An image from the Blanco 4-meter Telescope with 19 trails from Starlink satellites. CTIO/NOIRLab/NSF/AURA/ DECam DELVE Survey

However, such satellites are bright enough to produce trails in images taken with telescopes. These trails overwrite the stars and galaxies underneath them, which can only be remedied by taking additional images. Short transient phenomena, such as a brief flash from a gamma ray burst, could potentially be lost.

BlueWalker 3

While Starlink is the largest satellite constellation in service, with thousands of satellites in orbit, others are planned.

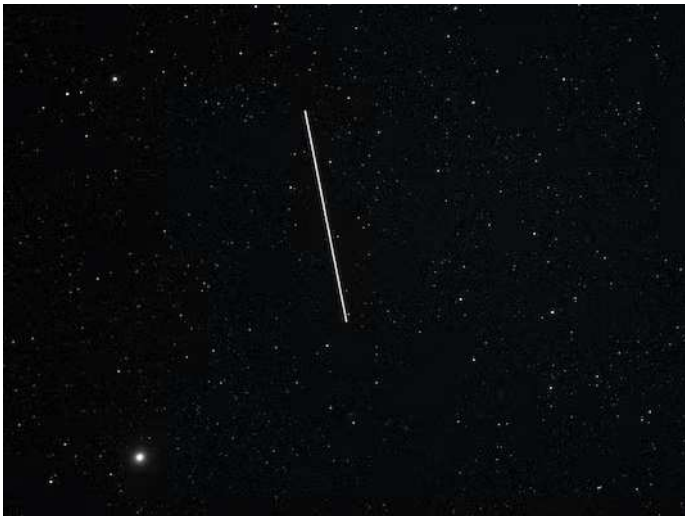
Amazon's Blue Origin plans to launch more than 3,200 Project Kuiper satellites, and AST SpaceMobile plans to launch 100 BlueBird satellites (and perhaps more).

The recently launched BlueBird prototype, BlueWalker 3, has produced genuine alarm among astronomers.

While BlueWalker 3 was initially quite faint, it unfolded a 64 square metre communications array – roughly the size of a squash court. This vast surface is very good at reflecting sunlight, and BlueWalker 3 is now as bright as some of the brightest stars in the night sky.

It's possible the operational BlueBird satellites could be even bigger and brighter.

Large numbers of satellites this bright could be bad – very bad. If there were thousands of satellites this bright, sometimes you would be unable to look at the night sky without seeing bright satellites.



BlueWalker 3 passing over Oukaimeden Observatory on November 16 2022. At its brightest, BlueWalker 3 is brighter than all but a few stars in the night sky. CLEOsat/ Oukaimeden Observatory/IAU CPS/A.E. Kaeouach

We would lose that sense of wilderness, with an almost constant reminder of technology in our sky.

There could be a big impact on professional astronomy. Brighter satellites do more damage to astronomical images than faint satellites.

Furthermore, many of these satellites broadcast at radio frequencies that could interfere with radio astronomy, transmitting radio waves above remote sites where radio observatories observe the heavens.

A precipice?

What happens next is uncertain. The International Astronomical Union has communicated its alarm about satellite constellations, and BlueWalker 3 in particular.

However, the approval of satellite constellations by the US Federal Communications Commission has had relatively little consideration of environmental impacts.

This has recently been flagged as a major problem by the US Government Accountability Office, but whether this leads to concrete change is unclear.

We may be on the edge of a precipice. Will the night sky be cluttered with bright artificial satellites for the sake of internet or 5G? Or will we pull back and preserve the night sky as a globally shared wilderness?

From: https://theconversation.com/

Christmas Fun Quiz

1. Ariel, Umbriel, Miranda, Titania and Oberon are all moons of which planet?
2. Which is the largest planet in the Solar system?
3. What is the brightest object in the night sky?
4. The Sun being the centre of the Solar System was first proposed by which astronomer?
5. Vesta is the third largest what?
6. Which present day country was the launch site for manned Soviet Union space flights?
7. Which planet did space probe Mariner 9 visit in 1971?
8. Name the Russian space station that operated in low Earth orbit from 1986 to 2001?
9. Name the comet that completes an orbit of the Sun once every three years — the shortest period of any known comet?
10. Which planet is nearest the earth: Mars or Venus?
11. Name the nearest known star to the Sun?
12. Which rare astronomical event occurs when a high-mass star reaches the end of its life?
13. The Shoemaker-Levy 9 comet smashed into which planet in July 1994?
14. Name the brightest star in the constellation Ursa Minor?
15. Which astronomer is best known for his laws of planetary motion?
16. In 1610, who discovered the four largest moons of Jupiter using a telescope?
17. The Sun is composed primarily of which chemical element?
18. Which astronomer proposed an equation to work out how many civilizations there could be in our galaxy?
19. Name the galaxy that contains the Solar System?
20. What unit of length is equal to about 3.26 light-years?

Answers on the Back Page

The Nature of the Universe: A Series of Broadcast Lectures *by Fred Hoyle (Basil Blackwell, 1950)*

"I think that within 100 years it may indeed be possible to leave the Earth, or at any rate for rockets containing radio-operated cameras to do so."

Fred Hoyle (1950)

1950. Seventy-two years ago. That is just within living memory for someone we know, maybe even ourselves. In a thousand ways the world has changed not just beyond recognition, but beyond the imaginations of the most progressive minds of the age.

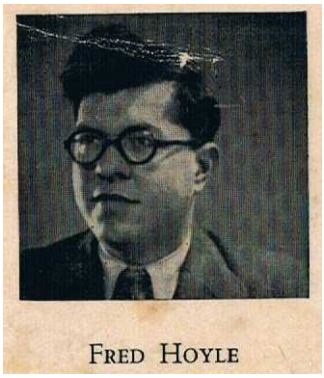


Figure 1 "... he finds his best ideas often occur to him in the most unlikely places, such as waiting on a draughty railway station"

A young astrophysicist was invited by the BBC to give a series of talks on The Wireless about what was then called the "New Cosmology". And so, the 34-year-old Yorkshireman Fred Hoyle stepped up to the microphone to speak about the huge advances in understanding of the universe which had taken place since the work of pioneer British cosmologists Jeans and Eddington. Sir James Jeans was a mathematician who had proposed how stars and planetary systems had formed out of clouds of dust and gas, while also in the 1920s, Sir Arthur Eddington had laid the groundwork for understanding the nuclear processes in the inner working of stars. This little book is a transcript of those lectures, and it makes for fascinating reading. Hoyles' words brought, to a general audience, these new and exciting ideas which had emerged in the preceding 3 decades. We can stand at that moment in time and share the sense of excitement from the cutting edge of science, but also experience the view from the other end of the telescope: this is a snapshot of what was not known then, that we are learning now.

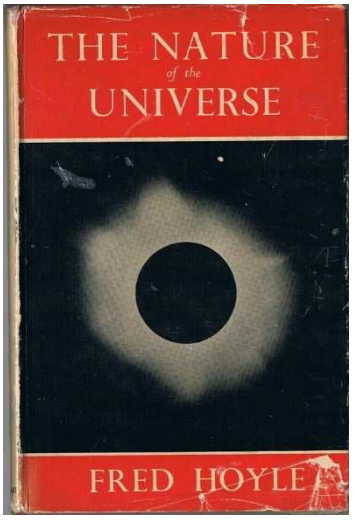


Figure 2 - Small book; big ideas

The author starts with a description of the Earth, Moon and planets. In 1950 the "Space Age" was still 7 years in the future (to the launch of Sputnik 1) so we have to be reminded that all we knew about our Solar system was based on observations from the surface of the Earth. Even the origin of the craters on the Moon was a subject of debate. Hoyle favoured the Bombardment Theory (in which impact craters were formed by the collision of asteroids etc.) over the Volcanic Theory. We may be surprised that Hoyle was in the minority at the time, but often in his career he would find himself arguing for ideas against those of the Establishment. At least in this one he was proven right.

The lectures proceed through the emerging theories of the origin of elements within stars and supernovae, much of the detail Hoyle himself with fellow physicists and astronomers would develop in brilliant work throughout the 1950s. I was surprised at the clarity with which he was able to speak about the knowledge that we are recycled star dust from dead stars that exploded long before our Sun was born! He expands the scope of his vision beyond the Galaxy and our Solar System's place in it, out to the billions of Galaxies beyond.

But when it comes to the origin and development of the expanding Universe, Fred nails his colours to the mast of a "continuous creation" hypothesis, like that of Jeans, and he famously argues here against the concept of the Cosmos having begun with a great explosion from some origin in time. It is in this context of opposing the theory that he coins the phrase "Big Bang", almost to ridicule the idea. Fred may have been in a minority on this but was not alone in holding out against the prevailing view. It would be another 16 years when the Cosmic Microwave Background (CMB) radiation was discovered that the argument was settled once and for all.

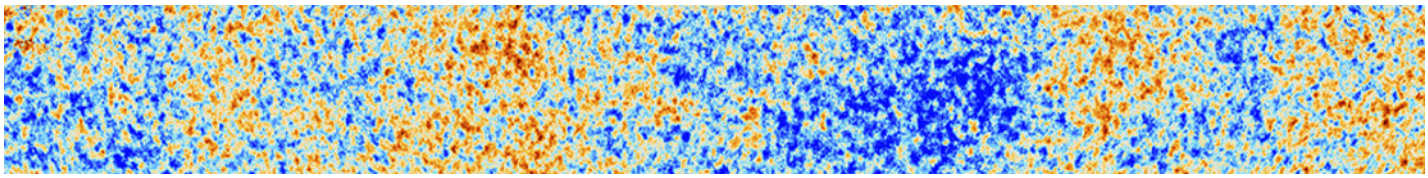


Figure 3 - Ripples from the "Big Bang" (CMB image; credit ESA & Planck Collaboration)

Other parts of Hoyle's cosmology were less familiar to me: he describes how an idle conversation about wanting to understand historical climate changes led him and a collaborator to expound the theory of stars (including the Sun) having variable temperature because of the different rate at which they gather additional hydrogen fuel as they "tunnel" through the Galactic gas and dust clouds, at various rates. This aspect gets a lot of attention in his talks, though once again I don't think it has stood the test of time. He would be in a camp with the environmentalists today, given his support for alternative (but not nuclear) energy to make human life sustainable in the long term. Hoyle was also convinced that there was life elsewhere in the Universe, just from consideration of the vast numbers of stars and potentially planetary bodies, although it would be 1992 before one was detected. And he was developing his own calculus of the possibilities of and conditions for life, a decade before Frank Drake formulated the famous equation that bears his name.

Fred Hoyle is entertaining to read, because he is never short of an opinion, and seems perfectly at ease to being the "odd one out" if he disagrees with the most popular theories. His language is lively and direct: he was a fine science communicator. I think of him as like a Fred Truman or Geoffrey Boycott, if they'd taken up physics instead of cricket! One favourite and quintessentially English illustration that Hoyle used is an explanation of how the cosmology theories were deduced from limited information available (the measurements from ground-based telescopes) and allows knowledge of the universe to advance. The example was devised by Arthur Eddington in 1938 and consists in reconstructing the complete ball-by-ball story of a cricket match just from the scorecard. It has to be seen (and attempted) to be believed. It is eccentric and brilliant, like Fred Hoyle's remarkable career, most of which still lay ahead of him.

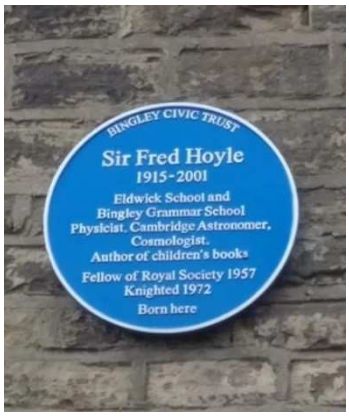


Figure 4 - Unjustly denied a Nobel prize, and he never did finish writing his opera!

"With upwards of 1,000,000 planetary systems per galaxy the combined total for the parts of the Universe that we can see comes out at more than a hundred million million. I find myself wondering whether somewhere among them there is a cricket team that could beat the Australians."

Fred Hoyle (1950)

This book is a great document in the "history of ideas" and is a good example of what Science really is about: it is NOT a fixed textbook of unchangeable laws, but a process. It is the constant open-minded round of discovery, reassessment, imagination, testing and questioning. What will our understanding of the Universe look like from the standpoint of someone 50 or 100 years from now? Looking out at the stars and trying to make sense of what we find there will continue to delight and surprise us.

Review article by Simon Gardner

Monthly Talks - a Preview of 2023

There is so much to look forward to in space and astronomy in the New Year. Looking at the schedule for launching all kinds of space missions reveals the huge variety of satellites and exploratory craft due to go up in 2023. The suspension of the Russian Soyuz launch programme (for obvious reasons) has changed many plans, but the arrival of new launchers (Ariane 6 and Falcon Heavy) will provide new possibilities. And the increasing use of commercially re-usable launch vehicles has changed space technology forever. Professor Adama Amara, our speaker in November, explained to us how the much-anticipated Euclid space telescope was delayed, but should be on its way to the Earth Sun L2 Lagrange point later next year.

For us with our feet on the ground, there is still the ever-changing spectacle of the night sky. Let's hope it is not too much of a hide-and-seek between the clouds and we get good observing conditions. We anticipate progress in refurbishment of the Observatory and the instruments available. We should also have our fingers firmly crossed for developments towards a Dark Sky status on the Isle of Wight. And, of course, we hope to be able to bring to our membership, as well as to the general public, a full programme of monthly talks. Do please support the Society's events - here are a few highlights to look forward to:

January - Richard Flux Eclipses

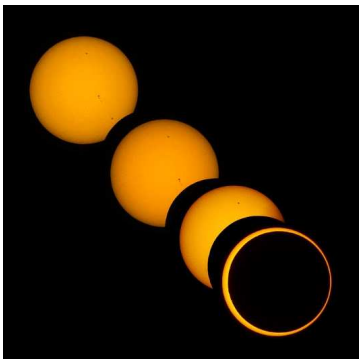


Figure 1 - Partial and annular phases of the solar eclipse of May 20, 2012 (Credit: Brocken Inaglory/wikimedia.org)

Richard gave us a very fine talk last year on "Watching the Moon", something that is always rewarding, but of particular interest next Autumn: a glance at an almanac for the coming year shows that there will be a Lunar Eclipse in October 2023, as well as a Solar Eclipse in April. No doubt Richard will explain to us why almost everyone will be able to see the (partial) lunar eclipse, whereas you would need to book your holidays in Indonesia or Australia to glimpse the solar eclipse event. I am hoping to learn what a "hybrid" eclipse is (in which you may see a total eclipse, but only for a short time), for that's what is predicted for April 2023. There's rather a long time to wait for a total solar eclipse in England however, because the next one is in 2090. That's one for the grandchildren to look forward to!

February - Steve Broadbent Astronomical Spectroscopy

About 5 years ago Vectis Astronomical Society had a visit from Steve Broadbent, who gave a talk called "The Colour of Light". He has since revised and updated his talk on the fascinating technique of spectroscopy, which allows us to peer inside stars, planets, nebulae and galaxies to investigate their composition, motion and structures. His presentation will be given online (using Zoom) rather than us having to make a dash for the last ferry to Portsmouth. But this has advantages not only in making access available to a wider audience than might be comfortable coming out on a cold February night, but if the sky is clear Steve hopes to be able to include a live demonstration from one of the Hampshire Astronomical Group's domes.

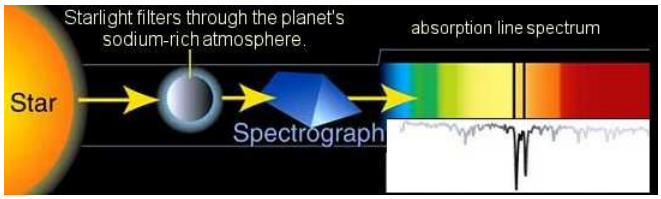


Figure 2 - The first direct detection and chemical analysis of the atmosphere of an exoplanet (HD 209458), in 2001. (Credit: NASA [John M. Horack]/HubbleSite Newscenter/ wikimedia.org)

April - Peter Ransom Sundials

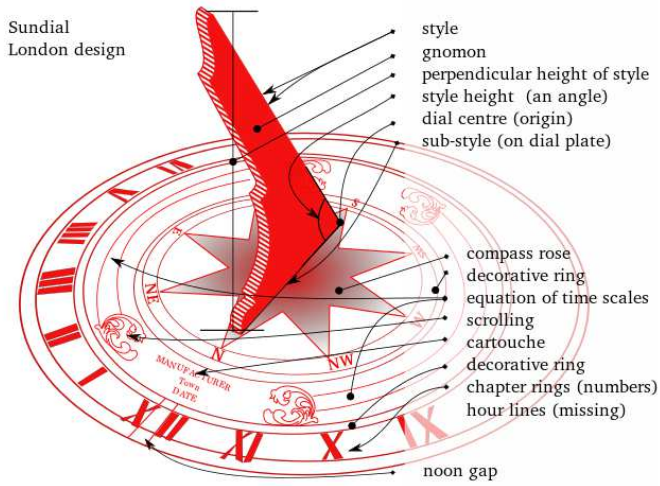


Figure 3 - A London Type horizontal sundial (Credit: Clem Rutter/wikimedia.org)

One of the most ancient ways in which humans have interacted with heavenly bodies is noticing the apparent course of the sun through the sky, and measuring shadows as they change, on a daily and seasonal basis. These observations led to the invention and perfection of sundials to measure time, clocks with no moving parts! Peter Ransom has retired from various University teaching posts; he's a past president of The Mathematical Association and is active within the British Sundial

Society. He plans to bring over examples to show us and deliver what promises to be an interesting and interactive talk. From today's vantage point of a cold and gloomy December day, the contemplation of sunshine is a warming prospect.

June - Dr Elizabeth Cunningham Stellar Evolution - the life cycle of a star and its implications for life in our Solar System

Stellar evolution is the process by which a star changes over the course of its lifetime. A collapsing cloud of dust and gas (a nebula) becomes a protostar, which then settles down into some form of equilibrium. Later the nuclear engine in the core of any star may change with time, and depending on conditions, the star may evolve into a white dwarf or a red giant, or it can explode in a supernova and collapse into a black hole or a neutron star. But the timescales involved vary hugely according to the mass, from a few million years to many billions - for the smallest stars on a slow burn, even longer than the age of the Universe! But how do we know? And what determines the fate of this star or that one?

To guide us through this galactic zoo, Elizabeth Cunningham will be a welcome guest, returning after a few years' break from speaking and teaching duties. In previous years she has brought us a wide variety of subjects from protecting astronauts from the hazards of radiation, to photographing aurorae.

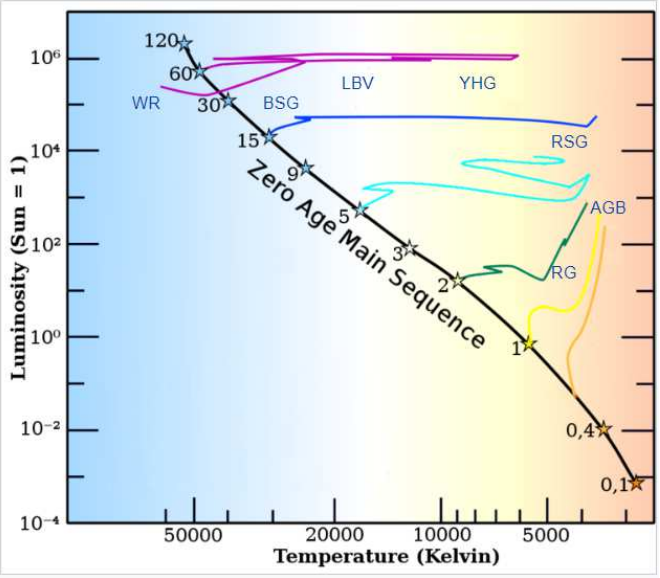


Figure 4 - The Hertzsprung-Russell Diagram is one of the most iconic diagrams in astrophysics: it's a roadmap to stellar evolution

July - Bryn Davies Variable Stars

And I am delighted that we get to enjoy more our home team expertise again in July, as VAS Chairman Bryn Davies will give us his talk on Variable Stars. In ancient times, people believed that the stars were fixed and unchanging, except for the "wandering" ones (the planets). But more careful observations and the appearance of comets the occasional supernova showed that there was more going on than most people notice. There are many different mechanisms that give rise to stars varying in brightness. Some are as regular and predictable as a clock, which others are irregular, mysterious even. For example, what did happen to Betelgeuse in 2019/2020, when it was visibly dimmer than usual? Back in 2021, Martin Lunn (via Zoom from Yorkshire) introduced us to the "Fathers of Variable Star Astronomy", Goodricke and Pigott. We shall look forward to learning more from Bryn about this fascinating branch of astronomy and what it tells us about the stars.

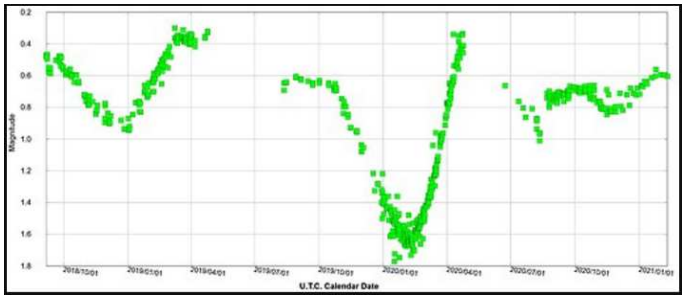


Figure 5 - a light curve for Betelgeuse from late 2018 to early 2021 (credit: AAVSO - AAVSO Light Curve Generator 2 (LCG2) & STEREO)

There are still some gaps in the programme of monthly talks (March, May and in the Autumn) which I hope to fill soon. So if you know of a speaker you would like to recommend, or perhaps you have a subject you would be prepared to talk about yourself, please come forward!

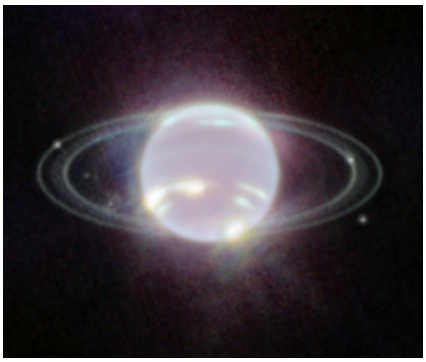
I wish us all clear skies, and a Happy New Year!

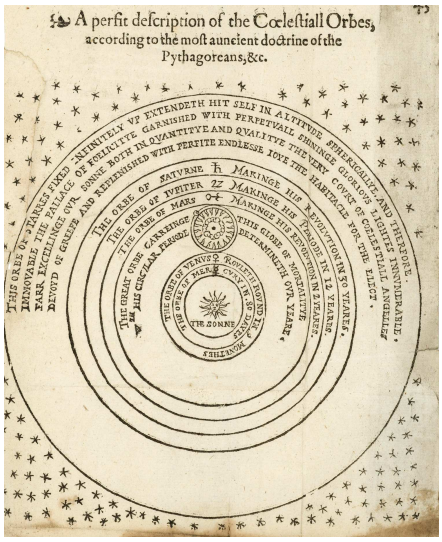
Simon Gardner (progorg@wightastronomy.org)

THE BACK PAGE

LINKS, COMMENTS AND OBSERVATIONS

Top space images of all time?





More at: https://www.sciencenews.org/article/favorite-top-space-images-of-all-time

Quiz Answers from Page 15

1. Uranus
2. Jupiter
3. Venus
4. Copernicus
5. Asteroid
6. Kazakhstan
7. Mars
8. Mir
9. Encke's Comet
10. Venus
11. Proxima Centauri
12. A supernova
13. Jupiter
14. Polaris (Pole or North Star)
15. Johannes Kepler
16. Galileo Galilei
17. Hydrogen
18. Frank Drake
19. The Milky Way
20. A parsec

At The Observatory

1. **Please bring a torch.**
2. **Make sure you close and lock the car park gate if you are the last to leave.**

Articles Needed

NZ needs relevant content. Contact details on page 1.

Strange Facts

Albert Einstein refused the job of president of Israel? Einstein was asked to be the president when the Israeli president died in 1952

Pure gold is so soft that it can be moulded with your bare hands

The only letter not used in the periodic table is J

Women blink nearly twice as often as men

The technical name for each of the two same-length sides of an isosceles triangle is a 'leg'

The French word for Pie Chart is Camembert

It's impossible to hum while you hold your nose

Our Sun sheds around 1.3 trillion trillion trillion particles every second. This equates to roughly one billion kg of matter per second, or one Earth every 185 million years

Not all planets have moons. Mercury and Venus are the only two planets in the solar system that do not have moons with them