New Zenith

The Monthly Newsletter of the Vectis Astronomical Society

Vol 31 Issue 4 — May 2023 *When Printed, this Newsletter costs VAS at least £1*

Society News

Items For Sale

VAS currently have a selection of telescopes available for sale.

These range from a Celestron 8" Cassegrain Tube through to a couple of cheaper reflecting telescopes.

They are all used but are in good condition and in full working order.

Viewing of these 'scopes at the Observatory can be arranged by contacting me on

07594 339950 or editor@wightastronomy.org

The Weather on Thursdays!

We haven't been able to do any observing for a few weeks now. Unfortunately that's been down to the weather! It seems that the recent spell of pleasant days has lead to some very cloudy nights after about 8 or 9pm. Frustratingly, viewing seems to improve again around midnight!

For the last couple of weeks I have been collecting dark sky measurements across in the West of the Island and they have all been pretty good.

In fact, from approx. 450 readings taken across 5 Sky Quality Meters (SQM), the highest reading has been **21.93** and the average reading is **19.96**.

The SQMs were placed in very rural locations and need to be plotted on a map to assist in the up and coming re-application for Dark Sky Status in the West of our Island.

Thanks to the farmers and residents who allowed the equipment to be installed on their properties. Everyone I spoke to whilst doing this set of measurements was extremely co-operative and very interested in the whole subject.

Brian Curd

VAS Website: wightastronomy.org

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

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Tel: 07594 339950 or email: **editor@wightastronomy.org**

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

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

Society News 1
May 2023 - Sky Map 3
May 2023 - Night Sky 4
Distant Supernovae May Impact the Life on Earth 5
Supernovae and Climate 6
Balloon-borne Telescope 6
NASA's Grand Plan for Human Exploration 8
Measurements of the Composition of Galaxies . . . 9
Astronomers Solve the 60-year Mystery 10
NASA Tweaks Voyager 2 11
What is the Fluidic Telescope? 12
The Science of the Cosmos 12
Hubble Spotlights Barred Spiral Galaxy 14
Chasing Shadows 14
The Back Page 16

2023 Monthly Meetings

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

Date	Subject	Speaker
26 May	The Ins and Outs of the Milky Way	Prof Sean Ryan
23 Jun	**ZOOM only** 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	**ZOOM Only** Celestial Hide and Seek Eclipses, Transits and Occultations	Martin Lunn
27 Oct	**ZOOM Only** The Great Debate (The Shapley-Curtiss Debate of 1920)	Nick Hewitt
24 Nov	EM-bridge technology and applications	Alan Thomson
2024 Monthly Meetings		
2024 26 Jan	GW Astronomy - Updates from the LIGI/Virgo/KAGRA 4th Observing Run	Dr Laura Nuttall

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 your contact details change

VAS Contacts 2023

President	Barry Bates president@wightastronomy.org
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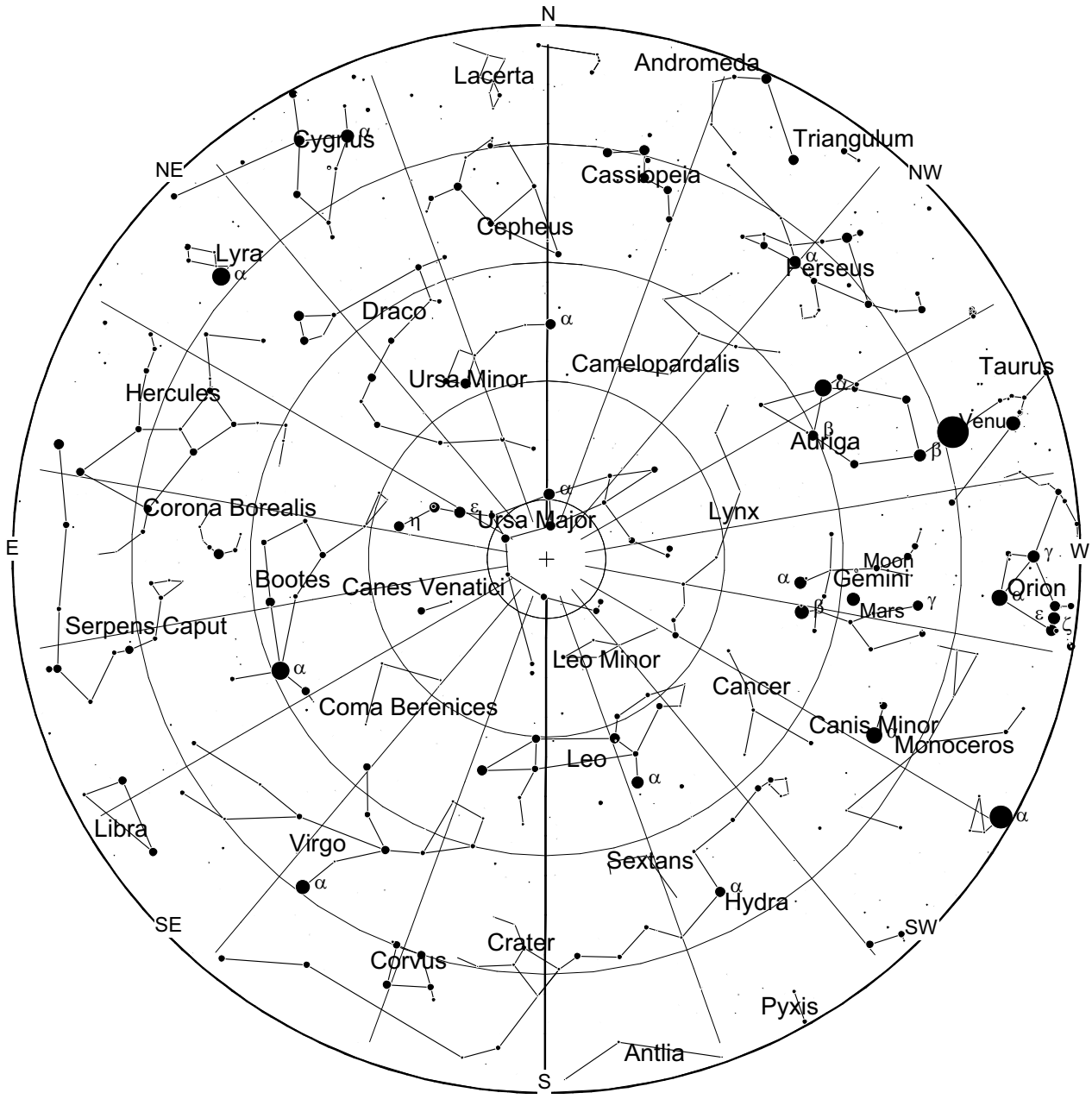
Important

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.

May 2023 - Sky Map



View from Newchurch Isle of Wight UK - 2200hrs - 20 May 2023

Messier 3 (M3; also NGC 5272) is a globular cluster of stars in the northern constellation of Canes Venatici.

It was discovered on May 3, 1764, and was the first Messier object to be discovered by Charles Messier himself. Messier originally mistook the object for a nebula without stars. This mistake was corrected after the stars were resolved by William Herschel around 1784. Since then, it has become one of the best-studied globular clusters. Identification of the cluster's unusually large variable star population was begun in 1913 by American astronomer Solon Irving Bailey and new variable members continue to be identified up through 2004.

May 2023 - Night Sky

Moon Phases

New	First Qtr	Full	Last Qtr
19th	27th	5th	12th
			

Planets

Mercury

Mercury begins a poor morning apparition during the later half of the month. It will be too close to the horizon to be visible before the sky becomes too bright. It may be observed telescopically during the day, but because of the potential danger of accidentally pointing the telescope at the Sun this should only be undertaken by experienced observers.

Venus

Look to the west just after sunset and Venus will be easily visible, it shines far brighter than any start and can be seen even against the still bright twilight sky. It can be seen for most f the evening setting a little before midnight. On the 23rd there is a photo opportunity with Venus sitting below the thin crescent moon.

Mars

As the earth draws further away from Mars it is getting to be a fainter object, still easily visible but not so prominent. Find the two twin stars Castor and Pollux and look to the left, the next bright star like object will be Mars, it is about the same brightness as Castor & Pollux, but with a distinctly ruddy hue.

On the 24th it sits just below the crescent moon.

Jupiter

Jupiter rises only shortly before the Sun and is not placed for observation this month.

Saturn

Saturn is just visible low down in the east-south-eastern sky before the sky becomes too bright; it will however be a very challenging object and very poorly placed for observation.

Uranus & Neptune

Uranus is too close to the Sun to be seen this month, and Neptune lying between Jupiter and Saturn in the sky is hidden in the bright twilight.

Deep Sky

M94 Cat's Eye Galaxy
RA 12 51m Dec 41° 4' mag 8.1

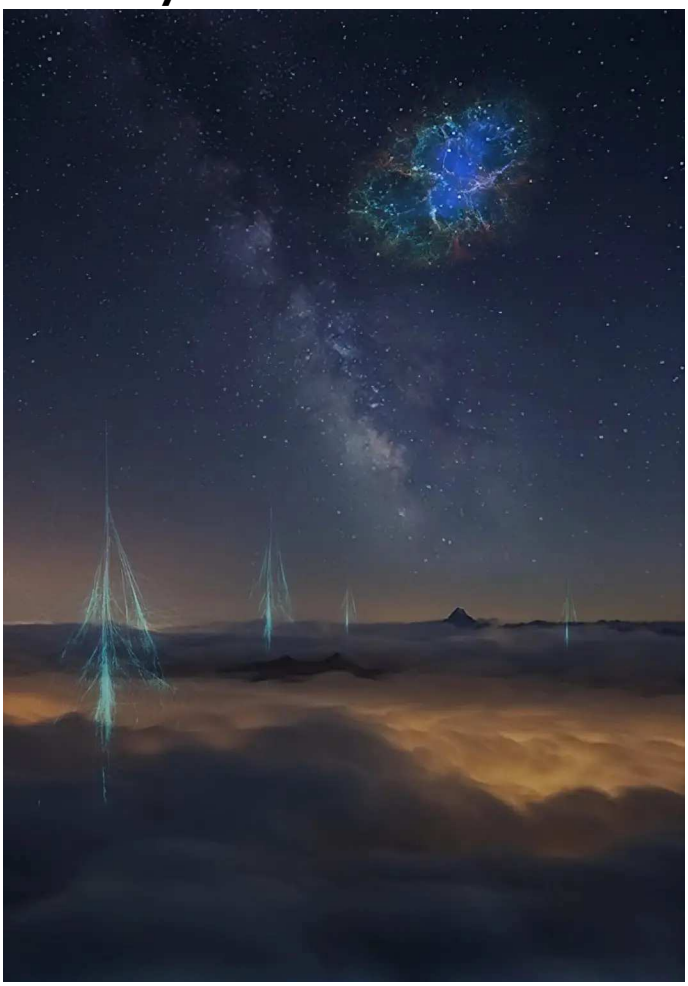
This is a face on spiral galaxy with tightly wrapped arms ringed by bright new stars. This indicates that this galaxy may have been in a collision in the astronomically recent past. The visual appearance is of a bright core surrounded by a faint evenly illuminated oval halo. The spiral arms are too tightly wound to show any detail in all but the very largest amateur telescopes.

M3 Globular Cluster
RA 13h 42m Dec 28° 22' mag 7

Messier's first original discovery, this is a showpiece globular cluster with stars extending across an area greater than that of the full Moon. M3 contains more variable stars than any other globular.

Peter Burgess

Trillions of Miles Away - Distant Supernovae May Impact the Diversity of Life on Earth



The extraterrestrial processes responsible for influencing the diversity of life forms are usually invisible to the human eye. The Milky Way is where large stars explode, leading to supernova remnants whose shock fronts accelerate cosmic ray particles to high energies. Cosmic rays find their way to the solar system, where some collide with the atmosphere producing cascades of secondary particles which ionize the atmosphere. Ions influence the formation of clouds which ultimately affect climate. Therefore, changes in supernova activity change climate, which is responsible for mixing and transporting life's essential nutrients to the ecosystems. Credit: Henrik Svensmark, DTU Space

A new study published in Ecology and Evolution by Henrik Svensmark of DTU Space has shown that the explosion of stars, also known as supernovae, has greatly impacted the diversity of marine life over the past 500 million years.

The fossil record has been extensively studied, revealing significant variations in the diversity of life forms throughout geological history. A fundamental question in evolutionary biology is identifying the processes responsible for these fluctuations.

The new research uncovers a surprising finding: the fluctuation in the number of nearby supernovae closely corresponds to changes in biodiversity of marine genera over the last 500 million years. This correlation becomes apparent when the marine diversity curve is adjusted to account for changes in shallow coastal marine regions, which are significant as they provide habitat for most marine life and offer new opportunities for evolution as they expand or shrink. Thus, alterations in available shallow marine regions play a role in shaping biodiversity.

"A possible explanation for the supernova-diversity link is that supernovae influence Earth's climate," says Henrik Svensmark, author of the paper and senior researcher at DTU Space.

"A high number of supernovae leads to a cold climate with a large temperature difference between the equator and polar regions. This results in stronger winds, ocean mixing, and transportation of life-essential nutrients to the surface waters along the continental shelves."The extraterrestrial processes responsible for influencing the diversity of life forms are usually invisible to the human eye. The Milky Way is where large stars explode, leading to supernova remnants whose shock fronts accelerate cosmic ray particles to high energies. Cosmic rays find their way to the solar system, where some collide with the atmosphere producing cascades of secondary particles which ionize the atmosphere. Ions influence the formation of clouds which ultimately affect climate. Therefore, changes in supernova activity change climate, which is responsible for mixing and transporting life's essential nutrients to the ecosystems. Credit: Henrik Svensmark, DTU Space

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The paper concludes that supernovae are vital for primary bioproductivity by influencing the transport of nutrients. Gross primary bioproductivity provides energy to the ecological systems, and speculations have suggested that changes in bioproductivity may influence biodiversity. The present results are in agreement with this hypothesis.

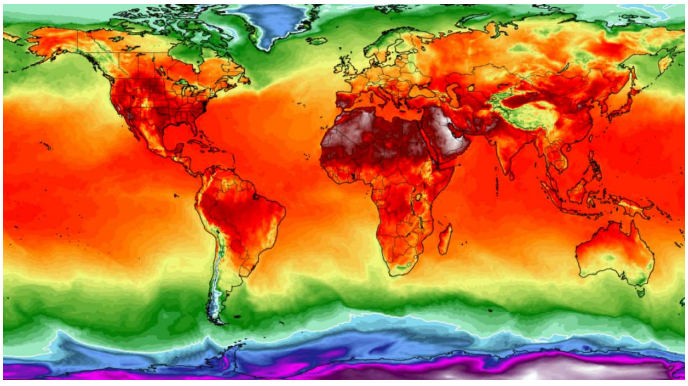
"The new evidence points to a connection between life on Earth and supernovae, mediated by the effect of cosmic rays on clouds and climate," says Henrik Svensmark.

Supernovae and Climate

When heavy stars explode, they produce cosmic rays, which are elementary particles with enormous energies. Cosmic rays travel to our solar system, where some end their journey by colliding with Earth's atmosphere. Previous studies by Henrik Svensmark and colleagues referenced below show that they become the primary source of ions help form and grow aerosols required in cloud formation.

Since clouds can regulate the solar energy reaching Earth's surface, the cosmic-ray-aerosol-cloud influences climate. Evidence shows substantial climate shifts when the intensity of cosmic rays changes by several hundred percent over millions of years.

More at: https://scitechdaily.com/



Balloon-borne Telescope Returns First Photos In Search For Dark Matter

Helium is way cheaper than rocket fuel, and the pictures are just as good if you get high enough.

The world's first wide-field, balloon-borne telescope has begun returning images to Earth, with scientists keen to begin months of imagery to help investigate the existence of dark matter.

The Super Pressure Balloon-Borne Imaging Telescope, or SuperBIT, has returned two publicly-shared images so far: The one of the Tarantula Nebula in the header of this article, and a second of a pair of colliding galaxies known as "the Antennae."

SuperBIT's main scientific objective is to measure the properties of dark matter, a term given to the invisible-yet-mathematically-required quarter of the matter in the universe that we're unable to see or detect in any way other than its interactions with gravity.

The telescope, a collaboration between the University of Toronto, Princeton University, Durham University and NASA, lifted off from New Zealand on April 16, and was carried to an altitude of 33.5 kilometers (20.8 miles) by one of NASA's stadium-sized super pressure balloons. At that altitude, SuperBIT is floating above all but the last half-percent of the Earth's atmosphere, giving it a level of visibility that ground-based telescopes can't match.

SuperBIT's image of a pair of colliding galaxies known as The Antennae

Because it sits outside of most of the atmosphere, SuperBIT isn't limited by anything but the laws of optics, and is able to take images with resolutions as high as the Hubble Space Telescope. It's also the first balloon-borne telescope to be able to capture wide-field images.

"SuperBIT will test whether dark-matter particles can bounce off each other, by mapping the dark matter around clusters of galaxies that are colliding with neighbouring galaxy clusters," said the University of Toronto.

SuperBIT is taking images via practice known as gravitational lensing, which takes advantage of how areas of dense gravity, like a pair of colliding galaxies or a massive stellar nursery, bend rays of light. Various theories suggest dark matter may slow down, spread or be chipped apart during a galactic collision, making the Antennae a particularly good observation point, according to the University of Toronto.

Balloons'll break, but not the budget

While it's in the air, SuperBIT will circumnavigate the southern hemisphere, taking images at night and using its array of solar panels to gather energy during the day. University of Toronto wasn't specific about the duration of the mission.

The University of Toronto adds that the telescope would be "carried by seasonally stable winds for about three months," which may point to its mission duration corresponding to how well its giant balloon keeps the 3,500 lb (1,587 kg) gondola in the air.

So, why put a 0.5m telescope with optical sensitivity from the near-infrared to the near-ultraviolet that's able to stabilize itself with sub-arcsecond precision on a balloon? That's SuperBIT's other scientific objective.

"One of SuperBIT's overarching science and technology development goals is to make rapidly-developed yet highly capable sub-orbital astronomical platforms more accessible to the astronomical community at a fraction of the cost of an equivalent space- or satellite-based system of equivalent capability," University of Toronto said.

One of the graduate students at UofT working on the project told The Reg: "The planned duration of the flight is 100 days. It is not a hard deadline, and if the balloon is healthy then we could even go longer."

When we asked if there was a plan for recovery of the satellite, they told us: "This would depend on if we are able to land safely on land. There may be circumstances where we may have to bring the balloon down over water, in which case we may not be able to recover SuperBIT. But in case we're able to have it land on land, then there is high chance we can have it recovered and that is something NASA has plans on how to accomplish."

They added: "Reusability and time to relaunch depends on how the landing and recovery went. The 2019 flight's landing was a bit rough since it landed amongst trees and a lot of electronics did get stripped so they had to be remade (especially those on the outside of the telescope), as well as our mirrors that had to be rebuilt to ensure we can get quality science images.

"However there was still a lot that could be reused (and was) as well, such as inner electronics and the structural frame of the gondola, and more. A lot of testing is done to ensure anything that has been flown before is capable of being flown again. Sometimes this can also be to our advantage since certain models of electronics can be tested in test flights to verify if they will work in subsequent flights or not as well."

SuperBIT only cost around $5 million, significantly less than the cost of an equivalent satellite, the university said. That includes the costs to get it into the air - just the price of helium instead of rocket fuel and associated ground equipment, man hours and launch fees.

SuperBIT and NASA's super pressure balloon prior to launch in New Zealand - Click to enlarge

That, and SuperBIT is able to be returned to Earth safely on a parachute when its mission ends so it can be upgraded and relaunched. One upgrade is already planned once the telescope returns in a few months: It's getting a replacement that'll upgrade its aperture from 0.5m to 1.6m.

Funding for the upgrade has already been secured, meaning for its next mission SuperBIT will have ten times the ability to collect light and help scientists learn just what exactly dark matter gets up to out there in the depths of space.

From: https://www.theregister.com/

From Moon to Mars: NASA's Grand Plan for Human Exploration

NASA has completed its first Architecture Concept Review, a process designed to align its Moon to Mars exploration strategy and define the supporting architecture. The analysis involved developing an Architecture Definition Document and six supporting white papers, addressing topics related to exploration architecture. The goal-based approach will ensure the long-term exploration of the Moon and Mars. Credit: NASA

NASA completed its first Architecture Concept Review to align its Moon to Mars exploration strategy, which includes yearly updates to incorporate new technologies and objectives. The agency aims to establish a long-term human presence on the Moon and explore Mars under the Artemis program.

As NASA builds a blueprint for human exploration throughout the solar system for the benefit of humanity, the agency released Tuesday the outcomes from its first Architecture Concept Review, a robust analysis process designed to align NASA's Moon to Mars exploration strategy and codify the supporting architecture.

"Our first Architecture Concept Review is a milestone that will help our Moon to Mars strategy unfold through the objectives in missions both near and long term," said NASA Deputy Administrator Pam Melroy. "We're aligned with partners toward a future of expanded economic opportunity, scientific discovery, and greater activity on and around the Moon, and with limitless possibilities deeper in the solar system."

NASA's Architecture Definition Document written for highly technical audiences, and an associated executive summary, provide a deep dive into NASA's Moon to Mars architecture approach and development process. Six supporting white papers also released address frequently discussed exploration architecture topics.

"NASA now has a goal-based foundation upon which to build our current and future exploration plans," said Cathy Koerner, deputy associate administrator for the Exploration Systems Development Mission Directorate at NASA Headquarters in Washington. "Our approach is designed to ensure exploration of the Moon and Mars has staying power."

NASA's process answers a call from Vice President Harris, as Chair of the National Space Council, to develop a plan for an initial lunar surface architecture which includes commercial and international partnerships. The agency's Moon to Mars architecture represents the hardware and operations needed for human missions to the Moon and Mars, and how they function together as system. The architecture is not a mission, a manifest, or a set of requirements, but defines the elements - rockets, spacecraft, rovers, spacesuits, communications relays, and more - that will be incrementally developed and delivered to the Moon and Mars for long-term, human-led scientific discovery in deep space.

NASA released its revised Moon to Mars Objectives in 2022 as guideposts in the agency's Moon to Mars exploration approach to help space NASA investments, as well as those of the agency's industry and international space agency partners, toward the Moon and beyond. They cover four broad areas: science; transportation and habitation; lunar and Martian infrastructure; and operations. The objectives were informed by input from U.S. industry, international space agencies, NASA's workforce, and others.

The agency began developing its Architecture Definition Document in late 2022 as a detailed look at how current objectives are distilled into specific architecture elements. The agency plans yearly Architecture Concept Reviews to incorporate new technological capabilities and evolving objectives.

Under Artemis, NASA has set a vision to explore more of the Moon than ever before. With the crew for Artemis II recently named, the agency plans to return humans to the Moon and establish a cadence of missions starting at the lunar South Pole region. These missions set up a long-term presence to inform future exploration of Mars and other potential destinations in the solar system.

From: https://scitechdaily.com/

Making Better Measurements of the Composition of Galaxies

A study using data from telescopes on Earth and in the sky resolves a problem plaguing astronomers working in the infrared and could help make better observations of the composition of the universe with the James Webb Space Telescope and other instruments. The work is published April 20 in Nature Astronomy.

"We're trying to measure the composition of gases inside galaxies," said Yuguang Chen, a postdoctoral researcher working with Professor Tucker Jones in the Department of Physics and Astronomy at the University of California, Davis.

Most elements other than hydrogen, helium and lithium are produced inside stars, so the composition and distribution of heavier elements -- especially the ratio of oxygen to hydrogen -- can help astronomers understand how many and what kinds of stars are being formed in a distant object.

Astronomers use two methods to measure oxygen in a galaxy, but unfortunately, they give different results. One common method, collisionally excited lines, gives a strong signal, but the results are thought to be sensitive to temperature changes, Chen said. A second method uses a different set of lines, called recombination lines, which are fainter but not thought to be affected by temperature.

The recombination line method consistently produces measurements about double those from collisionally excited lines. Scientists attribute the discrepancy to temperature fluctuations in gas clouds, but this has not been directly proven, Chen said.

Chen, Jones and colleagues used optical and infrared astronomy to measure oxygen abundance in dwarf galaxy Markarian 71, about 11 million light years from Earth. They used archived data from the recently retired SOFIA flying telescope and the retired Herschel Space Observatory, as well as making observations with telescopes at the W.M. Keck Observatory in Mauna Kea, Hawaii.

SOFIA (Stratospheric Observatory For Infrared Astronomy) was a telescope mounted in a Boeing 747 aircraft. By flying at 38,000 to 45,000 feet, the aircraft could get above 99% of the water vapor in Earth's atmosphere, which effectively blocks infrared light from deep space from reaching ground level. A joint project of NASA and the German space agency, SOFIA made its last operational flight in September 2022 and is now headed for a museum display in Tucson.

The Herschel Space Observatory, named after astronomers William and Caroline Herschel, was an infrared space telescope operated by the European Space Agency. It was active from 2009 to 2013.

A surprising result

With data from these instruments, Chen and Jones examined oxygen abundance in Markarian 71 while correcting for temperature fluctuations. They found that the result from collisionally excited infrared lines was still 50% less than that from the recombination line method, even after eliminating the effect of temperature.

"This result is very surprising to us," Chen said. There is no consensus on an explanation for the discrepancy, he said. The team plans to look at additional objects to figure out what properties of galaxies correlate with this variation, Chen said.

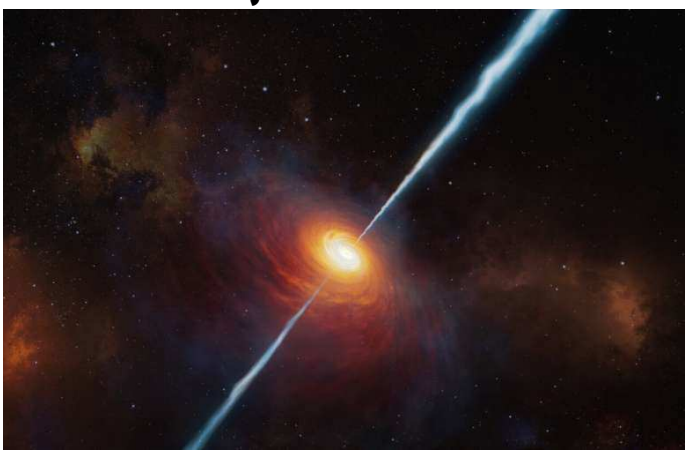
One of the goals of the James Webb Space Telescope, launched in 2022, is to make infrared observations of the composition of distant galaxies in the first billion years of the universe. The new results provide a framework for making these measurements with the JWST and the Atacama Large Millimeter Array in Chile.

Additional co-authors on the paper are: Ryan Sanders and Erin Huntzinger, UC Davis; Dario Fadder, Jessica Sutter and Robert Minchin, SOFIA Science Center, NASA Ames Research Center; Peter Senchyna, Observatories of the Carnegie Institute for Science, Pasadena; Daniel Stark and Benjamin Weiner, Steward Observatory, University of Arizona; Justin Spilker, Texas A&M University; and Guido Roberts-Borsani, UCLA. The work was financially supported in part by NASA. SOFIA was jointly operated by the Universities Space Research Association, Inc., and the Deutsches SOFIA Institut.

The W.M. Keck Observatory is operated as a scientific partnership among the California Institute of Technology, the University of California, and NASA, with financial support from the W.M. Keck Foundation. The researchers would like to thank the Hawaiian community for the privilege of allowing them to conduct observations on Mauna Kea, which plays a significant cultural and religious role.

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

Astronomers Solve the 60-year Mystery of Quasars, the Most Powerful Objects in the Universe



An artist's rendering of quasar P172+18.
Credit: ESO-M Kornmesser

Scientists have unlocked one of the biggest mysteries of quasars - the brightest, most powerful objects in the universe - by discovering that they are ignited by galaxies colliding.

First discovered 60 years ago, quasars can shine as brightly as a trillion stars packed into a volume the size of our solar system. In the decades since they were first observed, what could trigger such powerful activity has remained a mystery. New work led by scientists at the Universities of Sheffield and Hertfordshire has now revealed that it is a consequence of galaxies crashing together.

The collisions were discovered when researchers, using deep imaging observations from the Isaac Newton Telescope in La Palma, observed the presence of distorted structures in the outer regions of the galaxies that are home to quasars.

Most galaxies have supermassive black holes at their centers. They also contain substantial amounts of gas - but most of the time this gas is orbiting at large distances from the galaxy centers, out of reach of the black holes. Collisions between galaxies drive the gas towards the black hole at the galaxy center; just before the gas is consumed by the black hole, it releases extraordinary amounts of energy in the form of radiation, resulting in the characteristic quasar brilliance.

The ignition of a quasar can have dramatic consequences for entire galaxies - it can drive the rest of the gas out of the galaxy, which prevents it from forming new stars for billions of years into the future.

This is the first time that a sample of quasars of this size has been imaged with this level of sensitivity. By comparing observations of 48 quasars and their host galaxies with images of over 100 non-quasar galaxies, researchers concluded that galaxies hosting quasars are approximately three times as likely to be interacting or colliding with other galaxies.

The study has provided a significant step forward in our understanding of how these powerful objects are triggered and fueled.

Professor Clive Tadhunter, from the University of Sheffield's Department of Physics and Astronomy, said, “Quasars are one of the most extreme phenomena in the universe, and what we see is likely to represent the future of our own Milky Way galaxy when it collides with the Andromeda galaxy in about five billion years.

“It's exciting to observe these events and finally understand why they occur - but thankfully Earth won't be anywhere near one of these apocalyptic episodes for quite some time.”

Quasars are important to astrophysicists because due to their brightness, they stand out at large distances and therefore act as beacons to the earliest epochs in the history of the universe.

Dr. Jonny Pierce, Post-Doctoral Research Fellow at the University of Hertfordshire, explains, “It's an area that scientists around the world are keen to learn more about - one of the main scientific motivations for NASA's James Webb Space Telescope was to study the earliest galaxies in the universe, and Webb is capable of detecting light from even the most distant quasars, emitted nearly 13 billion years ago. Quasars play a key role in our understanding of the history of the universe, and possibly also the future of the Milky Way.”

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

NASA Tweaks Voyager 2 Power Supply to Avoid Another Sensor Shutdown

By redirecting energy from probe's voltage regulator, NASA buys itself another three years

NASA boffins seeking a way to postpone instrument shutdowns on the venerable Voyager spacecrafts have worked out a solution they say will get another three years of power to Voyager 2's five remaining scientific tools.

The trick involves repurposing Voyager 2's onboard voltage regulator, NASA said. That device is designed to trigger a backup circuit in the event electrical flow to Voyager's scientific instruments changes suddenly, which could damage them.

The regulator draws a small amount of power from Voyager's radioisotope thermoelectric generators and stores it for emergencies, but NASA was able to modify it from 12 billion miles away to shunt that power to the remaining scientific instruments, delaying the need to turn one off until 2026. Without the trick, NASA said an instrument would have had to go offline sometime this year.

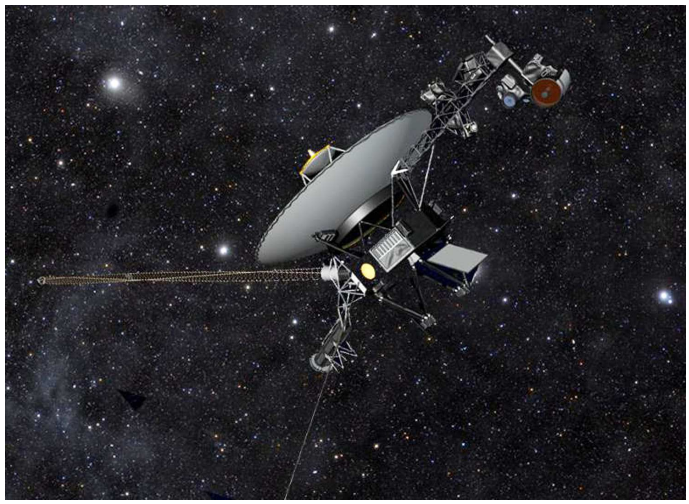
"The science data that the Voyagers are returning gets more valuable the farther away from the Sun they go, so we are definitely interested in keeping as many science instruments operating as long as possible," said Linda Spilker, a Voyager project scientist at NASA's Jet Propulsion Laboratory.

Of course, by repurposing the voltage regulator, the power to Voyager 2's systems won't be as tightly controlled, but NASA doesn't seem too bothered by that. "Even after more than 45 years in flight, the electrical systems on both probes remain relatively stable, minimizing the need for a safety net," the space agency said. Beyond that, Voyager mission control has the ability to tweak onboard voltage in the event of an emergency.

Voyager 1 isn't getting the regulator repurpose just yet, as it previously lost a scientific instrument due to equipment failure. With only four remaining instruments, Voyager 1 has another year until an instrument shutdown would be necessary. If NASA determines the change works well for Voyager 2, it may be implemented on Voyager 1 later.

Voyager project manager Suzanne Dodd described the move as low risk with a big reward, that being several more years of scientific data from the Voyager probes before they go dark. "We've been monitoring the spacecraft for a few weeks, and it seems like this new approach is working," Dodd said.

These are the Voyagers ...



Voyager 1 and 2 are identical craft that were launched in 1977 with an original mission duration of four years – just long enough to get the pair to Saturn and Jupiter. NASA extended the Voyager 1 and 2 missions to travel to Neptune and Uranus, and a second extension in 1990 set the craft on course to provide the first readings of the heliosphere, a giant bubble of solar winds that mark the edge of the Sun's magnetic influence on space.

Both of the Voyagers left with 11 onboard instruments, many of which have been shut down over the years to conserve power by eliminating unnecessary components. Along with instruments, NASA has also shut off heaters and other systems that aren't essential to the crafts' core scientific operations.

Voyager 1 reached and passed through the heliosphere in 2012, while Voyager 2 made the same trip in 2018, making the two craft Earth's first interstellar representatives. That's not to say the Voyagers have truly entered the interstellar void - the two craft still have around 300 years of traveling around a million miles a day to make it to the edge of the Oort cloud, the outermost limit of the Sun's gravitational influence.

The icy, comet-like objects that reside in the Oort Cloud will be the Voyagers' last impression of the Solar System as they coast for 30,000 years to reach its far side, long after the probes have exhausted their radioactive batteries and Earth has hopefully moved beyond operating legacy Fortran code.

From: https://www.theregister.com/

What is the Fluidic Telescope?

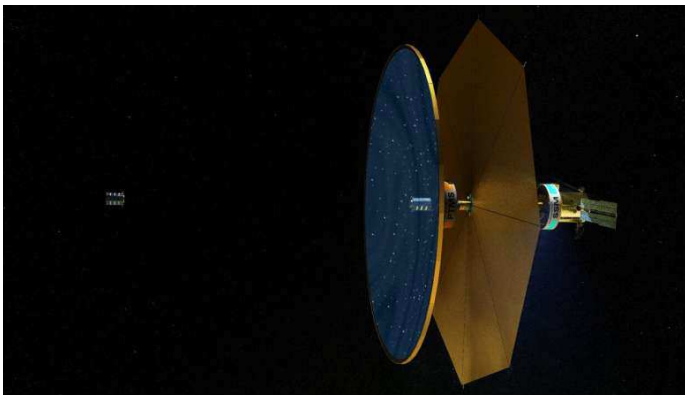


Illustration of the current Fluidic Telescope's concept for a next-generation large space observatory. Credit: NASA

The Fluidic Telescope (FLUTE) project team, jointly led by NASA and Technion–Israel Institute of Technology, envisions a way to make huge circular self-healing mirrors in-orbit. Larger telescopes collect more light, and they allow astronomers to peer farther into space and see distant objects in greater detail.

These next-generation large space observatories would study the highest priority astrophysics targets, including first generation stars, early galaxies, and Earth-like exoplanets. These observatories could help address one of humanity's most important science questions: "Are we alone in the universe?"

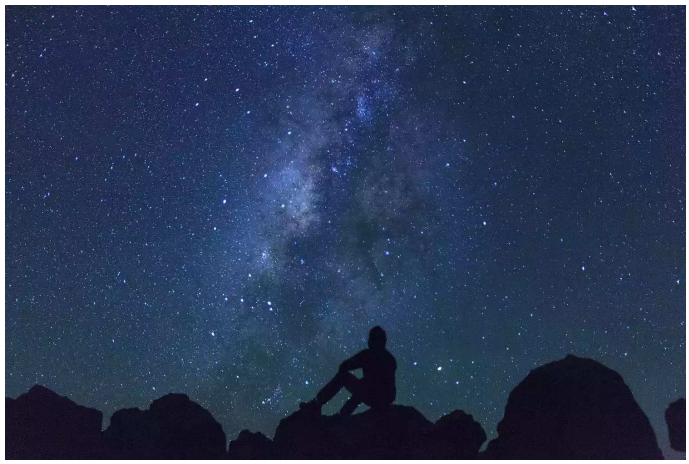
Like a carry-on suitcase, payloads launching to space need to stay within allowable size and weight limits to fly. Already pushing size limits, the state-of-the-art 6.5 m aperture James Webb Space Telescope needed to be folded up origami-style to fit inside the rocket for its ride to space. The aperture of an optical space observatory refers to the size of the telescope's primary mirror, the surface that collects and focuses incoming light.

Conventional technology for making optical components for telescopes involves an iterative process of sanding and polishing solid materials, such as glass or metal, to shape the precise curved surfaces of lenses and mirrors needed. Scaling up space telescopes to apertures larger than approximately 10m in diameter does not appear economically viable.

FLUTE's novel cost-effective technology approach, in contrast, takes advantage of the way fluids naturally behave in microgravity. All liquids have an elastic-like force that holds them together at their surface. This force is called surface tension. It's what allows some insects to glide across water without sinking and gives water droplets their shape.

https://phys.org/news/2023-04-fluidic-telescope.html

The Science of the Cosmos



Astronomy is one of humanity's oldest sciences. Its basic activity is to study the sky and learn about what we see in the universe. Observational astronomy is an activity that amateur observers enjoy as a hobby and pastime and was the first type of astronomy humans did. There are millions of people in the world who stargaze regularly from their backyards or personal observatories. Most aren't necessarily trained in the science, but simply love to watch the stars. Others are trained but do not make their living at doing the science of astronomy.

On the professional research side, there are more than 11,000 astronomers who are trained to do in-depth studies of the stars and galaxies. From them and their work, we get our basic understanding of the universe. It's such an interesting topic and raises many astronomy-related questions in people's minds about the cosmos itself, how it got started, what's out there, and how we explore it.

Astronomy Basics

When people hear the word "astronomy", they usually think of stargazing. That's actually how it got started — by people looking at the sky and charting what they saw. "Astronomy" comes from two old Greek terms astron for "star" and nomia for "law", or "laws of the stars". That idea actually underlies the history of astronomy: a long road of figuring out what objects in the sky are and what laws of nature govern them. To reach an understanding of cosmic objects, people had to do a lot of observing. That showed them the motions of objects in the sky, and led to the first scientific comprehension of what they might be.

Throughout human history, people have "done" astronomy and eventually found that their observations of the sky gave them clues to the passage of time. It should be no surprise that people began to use the sky more than 15,000 years ago. It provided handy keys for navigation and calendar-making thousands of years ago. With the invention of such tools as the telescope, observers began to learn more about the physical characteristics of the stars and planets, which led them to wonder about their origins.

The study of the sky moved from a cultural and civic practice to the realm of science and mathematics.

The Stars

So, what are the main targets that astronomers study? Let's start with stars — the heart of astronomy studies. Our Sun is a star, one of perhaps a trillion stars in the Milky Way Galaxy.The galaxy itself is one of countless galaxies in the universe. Each one contains huge populations of stars. Galaxies themselves are collected together into clusters and superclusters that make up what astronomers call the “large-scale structure of the universe”.

The Planets

Our own solar system is an active area of study. Early observers noticed that most stars did not appear to move. But, there were objects that seemed to wander against the backdrop of stars. Some moved slowly, others relatively quickly throughout the year. They called these “planetes”, the Greek word for “wanderers”. Today, we simply call them “planets.” There are also asteroids and comets “out there”, which scientists study as well.

Deep Space

Stars and planets aren't the only thing that populate the galaxy. Giant clouds of gas and dust, called “nebulae” (the Greek plural term for “clouds”) are also out there. These are places where stars are born, or sometimes are simply the remains of stars that have died. Some of the weirdest “dead stars” are actually neutron stars and black holes. Then, there are quasars, and weird “beasts” called magnetars, as well as colliding galaxies, and much more. Beyond our own galaxy (the Milky Way), lie an amazing collection of galaxies ranging from spirals like our own to lenticular-shaped ones, spherical, and even irregular galaxies.

Studying the Universe

As you can see, astronomy turns out to be a complex subject and it requires several other scientific disciplines to help solve the mysteries of the cosmos.To do a proper study of astronomy topics, astronomers combine aspects of mathematics, chemistry, geology, biology, and physics.

The science of astronomy is broken into separate sub-disciplines. For example, planetary scientists study worlds (planets, moons, rings, asteroids, and comets) within our own solar system as well as those orbiting distant stars. Solar physicists focus on the Sun and its effects on the solar system. Their work also helps forecast solar activity such as flares, mass ejections, and sunspots.

Astrophysicists apply physics to the studies of stars and galaxies to explain exactly how they work. Radio astronomers use radio telescopes to study the radio frequencies given off by objects and processes in the universe. Ultraviolet, x-ray, gamma-ray, and infrared astronomy reveals the cosmos in other wavelengths of light. Astrometry is the science of measuring distances in space between objects. There are also mathematical astronomers who use numbers, calculations, computers, and statistics to explain what others observe in the cosmos. Finally, cosmologists study the universe as a whole to help explain its origin and evolution across nearly 14 billion years of time.

Astronomy Tools

Astronomers use observatories equipped with powerful telescopes that help them magnify the view of dim and distant objects in the universe. Astronomy tools, like the armillary sphere, were used by early astronomers and new tools came about as the study of astronomy evolved. They also use instruments called spectrographs that dissect the light from stars, planets, galaxies, and nebulae, and reveal more details about how they work. Specialized light meters (called photometers) help them measure the varying stellar brightnesses. Well-equipped observatories are scattered around the planet. They also orbit high above Earth's surface, with such spacecraft as Hubble Space Telescope providing clear images and data from space. To study distant worlds, planetary scientists send spacecraft on long-term expeditions, Mars landers such as Curiosity, Cassini Saturn mission, and many, many others. Those probes also carry instruments and cameras that provide data about their targets.

Why Study Astronomy?

Looking at the stars and galaxies helps us understand how our universe came into being and how it works. For example, knowledge of the Sun helps explain stars. Studying other stars gives insight into how the Sun works. As we study more distant stars, we learn more about the Milky Way. Mapping our galaxy tells us about its history and what conditions existed that helped our solar system form. Charting other galaxies as far as we can detect teaches lessons about the larger cosmos.There is always something to learn in astronomy. Each object and event tells a tale of cosmic history.

In a very real sense, astronomy gives us a sense of our place in the universe. The late astronomer Carl Sagan put it very succinctly when he stated, “The cosmos is within us. We are made of star-stuff. We are a way for the universe to know itself.”

From: https://www.thoughtco.com/

Hubble Spotlights Barred Spiral Galaxy UGC 678

Credit: ESA/Hubble & NASA, C. Kilpatrick, R.J. Foley

The barred spiral galaxy UGC 678 takes center stage in this image from the NASA/ESA Hubble Space Telescope. The spectacular galaxy lies around 260 million light-years from Earth in the constellation Pisces and is almost face on, allowing its lazily winding spiral arms to stretch across this image. In the foreground, a smaller edge-on galaxy seems to bisect the upper portion of UGC 678.

Barred spiral galaxies have a bar-shaped structure of stars that extends from opposite sides of the galaxy's central bulge. Bars form in spiral galaxies when the orbits of stars near the galaxy's heart become unstable and stretched out. As their orbits lengthen, they create a bar.

The bar grows as their gravity captures more and more nearby stars. UGC 678's bar is faint. It is visible as a diagonal group of stars that stretches from the lower left (7 o'clock) to the upper right (1 o'clock) of the galaxy's core.

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

A barred spiral galaxy is a spiral galaxy with a central bar-shaped structure composed of stars. Bars are found in about two thirds of all spiral galaxies, and generally affect both the motions of stars and interstellar gas within spiral galaxies and can affect spiral arms as well.
The Milky Way Galaxy, where the Solar System is located, is classified as a barred spiral galaxy.

Chasing Shadows

A review of the April talk "Fun with the Sun: sundials for star-gazers" given by Peter Ransom, MBE

We astronomers are mostly creatures of the night, only truly happy when twilight turns astronomically dark. So, what truck would we have with those pretty garden ornaments on a bright summer afternoon, sundials? Well, the Sun is our closest star and for millennia people have carefully observed the path of the sun, and traced the progress of shadows cast, throughout the day and across the year. To truly appreciate a sundial requires a good astronomical knowledge, in terms of the dynamic geometry of the Earth's orbit around the Sun. Even reading the time from a common horizontal sundial requires a bit of know-how, as Peter explained.

There are 3 types of correction to get the time accurate:

1. longitude correction, because clock time is aligned with the sun at Greenwich;

2. the "equation of time" correction which accounts for the ellipticity of the Earth's orbit, which can make up to 15 minutes difference over the course of a year; and

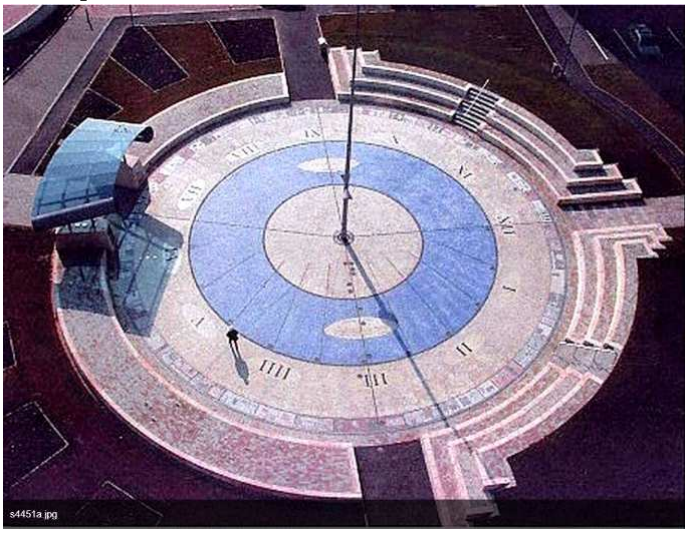
3. don't forget the hour difference for British Summer Time!

Peter began his excellent presentation with a Brief History of Time: not Hawking's book but a journey through the history of instruments constructed to estimate the time of day. His talk was richly illustrated by examples

of dials local to the Isle of Wight. He began with The Astronomer, the prominent figure in the mosaic at Brading Roman Villa, who appears to have a type of sundial behind him. Most of the early examples are found on churches, for it was village churches and religious communities which first ordered people's lives by the ringing of bells, summoning folk to prayer or to work. "Scratch" type sundials provided a way of estimating the time of 8 "tides" (e. g. "noontide"). In the Octaval type of dial, semi-circular designs, divided into four or eight sectors, are seen on church walls.

The sophistication of these devices grew with development of the understanding of the movements of the sun and planets, and the need for more accurate time-keeping, so that work could be fairly divided and rewarded in equal length hours, for example. The types of sundials proliferated over centuries, with the invention of horizontal and vertical designs, equatorial, spherical, cross and altitude types and many more.

We should look out for some interesting examples right on our doorstep. There is a 17th century rarity, a double horizontal type of 1678, which is now found inside All Saints at Newchurch. There is a vertical dial at St. George's Church, Arreton and other notable examples to be found at Brading, Godshill and Brighstone, the last two dating from the 18th century. [*If like me you are intrigued and would like to learn more, see the link to the IW History website below.*]



Peter's talk was entertaining and informative, and expertly delivered with humour and personal anecdotes. Several of his stories related to his involvement in designing and aligning some innovative sundial installations as part of Millennium projects, including "human" sundials and the beautiful Millennium Timespace on Gosport waterfront. For his talk, Peter sported a striking waistcoat which illustrated his family heritage of clock and watch-making. (He has previously given lectures in 18th century dress, turning a lesson on sundials into living history!) We could fully appreciate why his efforts to enrich the teaching of mathematics, with such enthusiasm and skill, earned him an MBE for services to education.

I certainly learned a lot, and will seek out some of those local sundial treasures. We learned how the direction of a well-set-up sundial's "gnomen" (the piece that casts the shadow) can be used to align a telescope with North, in the absence of other clues. We learned how sailors used to estimate the time to sunset using the angles projected from the palm or fingers, held at arm's length. But a mystery remained: whatever happened to the gleaming armillary sundial that used to be in St. James' Square in Newport? Does anyone know…?

Review by Simon Gardner

If you want to learn more about our local historical sundials on the Isle of Wight, I recommend the following IW History website "*Discovering Isle of Wight Sundials with Elizabeth Hutchings (http://www.iwhistory.org.uk/ehsundials/).*

The St. James' Square in Newport Sundial

THE BACK PAGE

LINKS, COMMENTS AND OBSERVATIONS

Other Science Links

Why are insects attracted to artificial lights?

Artificial lights can be deadly to the insects that fly around them, so why do these critters do it?

https://www.livescience.com/animals/insects/why-are-insects-attracted-to-artificial-lights

Mysterious, ultra low-frequency noises detected in Earth's atmosphere

Solar-powered balloons detected strange rumblings at a height of 70,000 feet above the Earth's surface. Scientists can't identify them.

https://www.livescience.com/space/astronomy/mysterious-ultra-low-frequency-noises-detected-in-earths-atmosphere-and-scientists-cant-explain-them

Welsh space firm devises 'shuttlecock' heatshield

A Welsh space start-up has developed a novel heatshield to enable it to re-use satellites brought back to Earth.

https://www.bbc.com/news/science-environment-65592872

Astronomers detect largest cosmic explosion ever seen

Astronomers have discovered what they believe to be the largest explosion ever detected.

https://www.bbc.com/news/science-environment-65571309

Perfection: The Enemy of Evolution

Freedom to miss the optimal mark opens a wide range of new designs over time

https://www.sciencedaily.com/releases/2023/05/230518172034.htm

Can't find your phone? There's a robot for that

Robots can help find objects you've lost, thanks to new 'artificial memory'

https://www.sciencedaily.com/releases/2023/05/230515132043.htm

What would happen if the Earth started to spin faster?

Even a mile-per-hour speed boost would make things pretty weird.

https://www.popsci.com/earth-spin-faster/

Looking back at Skylab, NASA's pioneering space station

Among the many lessons the observatory taught us 50 years ago: In orbit, bath wipes are better than showers.

https://www.popsci.com/science/skylab-nasa-space-station-50-years/

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

One million Earths could fit inside the Sun – and the Sun is an average-size star.

For years it was believed that Earth was the only planet in our solar system with liquid water. More recently, NASA revealed its strongest evidence yet that there is intermittent running water on Mars.

Comets are leftovers from the creation of our solar system about 4.5 billion years ago – they consist of sand, ice and carbon dioxide.

You wouldn't be able to walk on Jupiter, Saturn, Uranus or Neptune because they have no solid surface

By plane to Pluto, the trip would take more than 800 years!

An asteroid about the size of a car enters Earth's atmosphere roughly once a year – but it burns up before it reaches us.

The highest mountain known to man is on an asteroid called Vesta. Measuring 22km in height, it is three times as tall as Mount Everest!