New Zenith

The Monthly Newsletter of the Vectis Astronomical Society

Vol 27 Issue 10 — November 2019 *When Printed, this Newsletter costs VAS at least £1*

Society News

Redecorating

Visitors will no doubt notice redecorating has started in our observatory.

For those who don't know, VAS was recently awarded a grant to update the main classroom by replacing the old notice board with interactive displays. This means a complete redecoration of the classroom.

The plans have been made and the work has in fact started. There will be four large monitor screens mounted along the longest side wall. To cable all this and maintain a clean finished look will require some time and thought.

It would be much appreciated if members visiting the observatory in the next month or so could ensure the main room is kept as clear of equipment as possible.

Please take care when coming in to the observatory! The corridor will also be redecorated within the next month or so. The decoration will include repainting the floor which means that whole are will have to be locked off until the paint dries.

Please Take Extra Care when visiting!

New Equipment

Numerous additional computers are being installed at the Observatory.

These machines will all be setup with an **admin** account and a normal **user** account. The **user** account will allow normal use but will be restricted to prevent stem changes.

Software installation and updates will only be available via the **admin** account and access to that will be restricted.

If you think you will need an **admin** account please contact either Mark Williams or myself.

Brian Curd
Observatory Director and NZ Editor

VAS Website: wightastronomy.org

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

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Carpenter's Cottage
Dennett Road
Bembridge
Isle of Wight PO35 5XF
Tel: **01983 872875** 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. Please contact Martyn Weaver 07855 116490
Thursday	Members (19.30hrs) and Public (20.00hrs). Informal meeting and observing

VAS Website: wightastronomy.org

Contents this Month

2019 Monthly Meetings

Date	Subject	Speaker
Check *http://www.wightastronomy.org/meetings/* for the latest information		
25 Oct	**IW Dark Sky Park Update** Bryn Davis (VAS)/ Joel Bateman (AONB)/John Langley (CPRE)	
22 Nov	How (on Earth) did Life Start?	James Fradgley

2020 Monthly Meetings

Date	Subject	Speaker
24 Jan	TBA	TBA
28 Feb	Dark Skies Event with AONB and CPRE	
27 Mar	Hoys-Caps Citizen Science Project	Dirk Froebrich
24 Apr	TBA	TBA
22 May	James Webb Space Telescope	Dr Stephen Wilkins
26 Jun	Space Traffic Control	Dr Stuart Eves
24 Jul	Young Astronomer's Event	
28 Aug	AGM	
25 Sep	TBA	TBA
22 Oct	Dark Skies Event VAS with AONB and CPRE	
27 Nov	TBA	TBA

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.

Important

Could all VAS members please ensure they notify the Membership Secretary of any change of address.

To ensure our compliance with GDPR rules, we must maintain accurate membership records.

VAS Contacts 2018/19

President	Barry Bates president@wightastronomy.org
Chairman	Bryn Davis chairman@wightastronomy.org
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Membership Secretary	Mark Williams members@wightastronomy.org
NZ Distribution	Graham Osborne distribution@wightastronomy.org
Others	Dudley Johnson

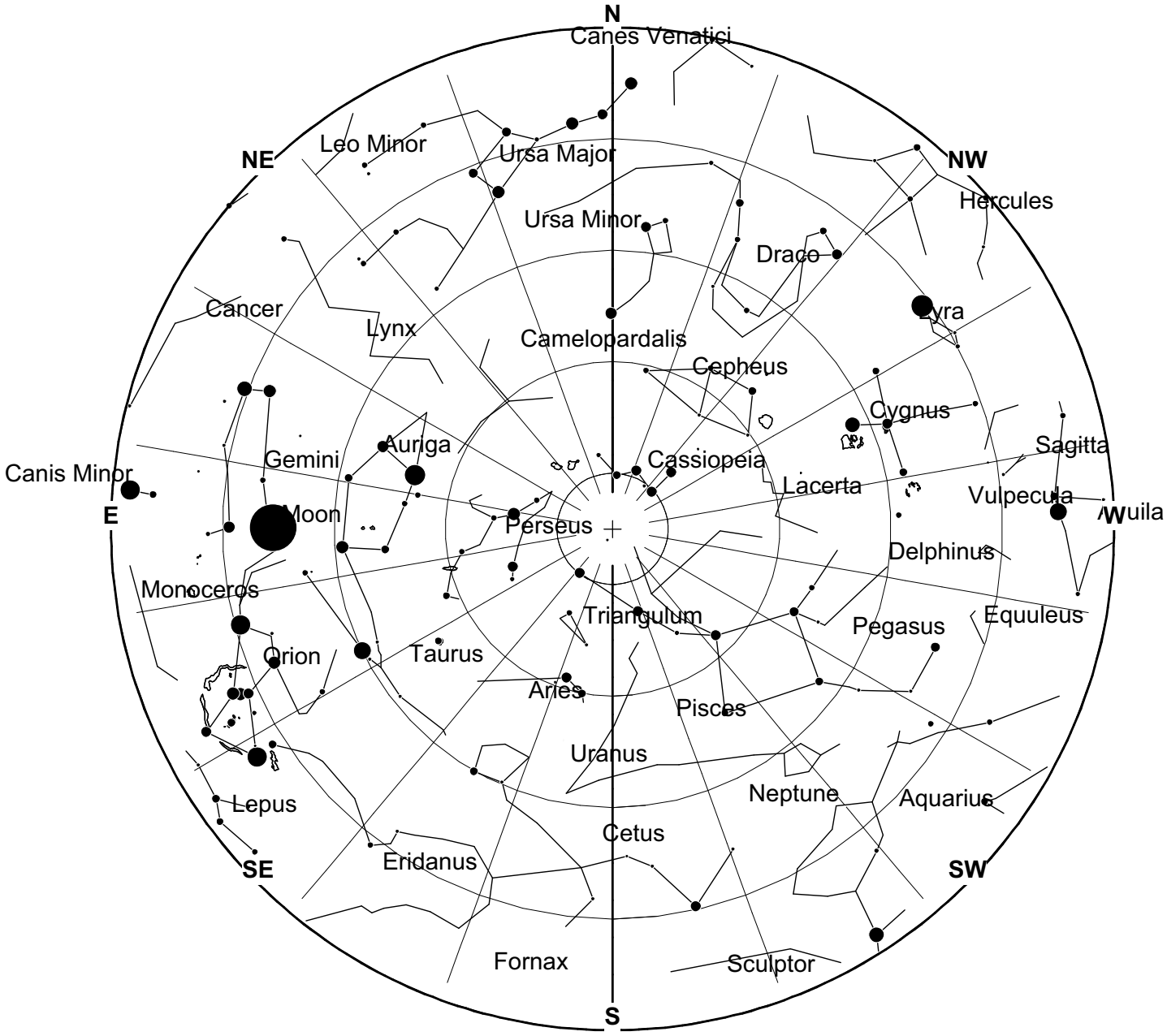
Important

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.

November 2019 Sky Map



View from Newchurch Isle of Wight UK - 2200hrs - 15 November 2019

The Pleiades also known as the Seven Sisters and Messier 45, are an open star cluster containing middle-aged, hot B-type stars located in the constellation of Taurus. It is among the nearest star clusters to Earth and is the cluster most obvious to the naked eye in the night sky.

The cluster is dominated by hot blue and luminous stars that have formed within the last 100 million years. Reflection nebulae around the brightest stars were once thought to be left over material from the formation of the cluster, but are now considered likely to be an unrelated dust cloud in the interstellar medium through which the stars are currently passing.

November 2019 Night Sky

Moon Phases

New	First Qtr	Full	Last Qtr
			
26th	4th	12th	19th

Planets

Mercury

Mercury continues its poor evening apparition, setting about 30 mins after the Sun. During the last week of the month it reappears in the morning sky and can be seen low in the southeast for about an hour before sunrise.

Venus

Venus may be glimpsed low in the west-south-west just after sunset. As the month progresses it drifts further towards the south, but still sets just after the Sun making it difficult to spot.

Mars

Mars can be seen low in the southeast before sunrise. It is quite faint and is hard to see against the brightening sky.

Jupiter

At sunset Jupiter can be found low in the South-south-west. It is the first object to become visible as the sky darkens, but is now rather too close to the horizon for serious observation. For a few days either side of the 24th Jupiter and Venus are in close conjunction. With the Sun setting just after 5pm and Venus setting at about 6:30 there is not much time to see this event. On the 28th there is a photo opportunity when Jupiter and Venus are to be found either side of the thin crescent moon.

Saturn

As the sky darkens Saturn becomes visible low in the southwest. It is only visible in the very early evening, setting by about 19:00.

Uranus

Uranus is currently not close to any bright guide stars, it lies on a line between the fourth magnitude star Mesarthim in Aries and the slightly fainter Xi2 Ceti. It is about 8° south of Mesarthim and 5° north of Xi2. It also forms a right angled triangle with 4th magnitude Omicron Piscium about 5° to the west.

Neptune

Neptune is also in a part of the sky devoid of easily seen guide stars, but is closer to those that are there, it can be found about midway between Phi Aquarii and 81 Aquarii, with a separation of about 3 moon diameters from each.

Deep Sky

M33 Galaxy
RA 1h 34m Dec 45° 8' mag 7

M33 in Triangulum is one of a number of galaxies that shares the common name Pin Wheel. It is another member of our local group of galaxies, but somewhat smaller than the Milky Way being only 1/7 its size. This galaxy despite its relatively bright apparent magnitude its large size, about that of the full moon makes it very difficult to see. It can be glimpsed in our skies with a pair of 10x50 binoculars as a slight brightening of the background sky. A telescope of at least 8" diameter is needed to see any structure in the spiral arms, and then it can be difficult. Don't be put off by the difficulties it is a worthwhile object for observation.

Stock 2 Open Cluster
RA 2h 15m Dec 59° 20' mag 4.4

From the double cluster follow the curved chain of stars toward Cassiopeia; for about 2.5°, about half a 10x50 binocular field. To the left is a group of stars making a rather crooked H shape, sometimes called the strongman cluster. This is Stock 2, another open cluster that needs low magnification, this is a rather sparse cluster about 1° in diameter. A telescope shows chains of stars and dark areas in the cluster.

NGC1499 California Nebula
RA 4h 1m Dec 36° 21' mag 5.0

This very large nebula can be found just to the north of Menkib, Xi Persei. Although it may have a magnitude of 5 this light is spread out over an area of some 2 x 1 degrees making the surface brightness very low. It can be seen in large aperture binoculars and rich field telescopes, but when using a telescope the magnification must be kept to the minimum

Peter Burgess

My 100 Best Night Sky Sights

Double Star

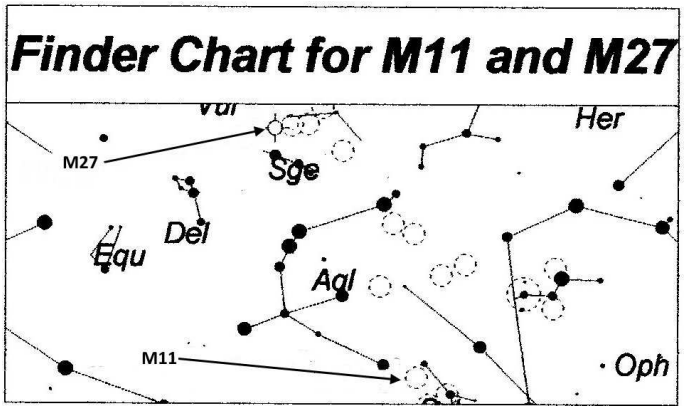
***Coordinates**: Albireo, RA 19h 30m 42s, Dec +27° 58'*

As this is the penultimate article in the series of my top 100 deep sky objects it will come as no surprise that its subjects rank among the universally agreed most celebrated cosmic delights. Few will dispute that the first of these is the most glorious of all double stars, dazzling in its brilliant display of contrasting colours. I am of course referring to ***Beta Cygnii***, the star representing the beak of the swan and it's fitting that this most beautiful of constellations should contain two of the loveliest sights in the universe (you'll have to wait for the last article for the second one).

Albireo puts on its display during summer and autumn for everyone with a telescope, no matter how small (the telescope, that is). The primary is a brilliant mag 3.1 orange-yellow star, gleaming like a golden beacon but its companion, although a full two magnitudes less, refuses to be outshone, its dazzling blue radiance making it seemingly hardly less bright. Some double stars have both members bright but widely separated, others are too close to be easily split. Some have well contrasted colours but also large magnitude differences. Albireo has got it just right – not only is it one of the brightest of binaries, the separation of its two components of 34" makes it easy to view in all its glory by any telescope and with low powers, and the gold and blue colours are simply beautiful.

If you have never gazed upon it I urge you to do so at the earliest opportunity, but be warned. Once you have savoured the delights of Albireo, subsequent visits to the Cygnus neighbourhood will not be complete without at least one glimpse of this lovely pair.

Galactic Cluster

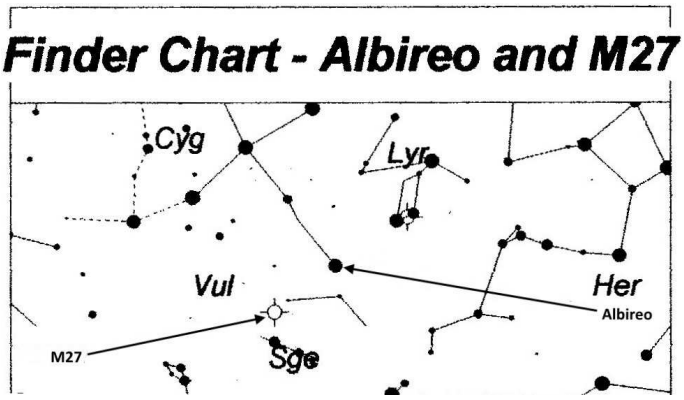


***Coordinates:** M11, RA 8h 51m 06s, Dec -06° 16'*

Recognising the potential for this to appear like a bird sanctuary tour, almost due south of the swan is a duck. The showpiece open cluster M11 in Scutum is visible in binoculars as a small misty patch but through any telescope its true identity is revealed. Two dozen uniformly bright stars in a seemingly fan-shaped arrangement with a significantly brighter star near the apex are surrounded by a host of others. It's from this that it derived its nickname The Wild Duck as the roughly V formation was likened to a flight of such birds.

Whether you see this as fan, ducks or neither, the cluster is a spectacle not to be missed. Although sited within the realm of the Milky Way its 200 or so stars stand out magnificently from the glowing backdrop. With low powers this compact cluster is seen in its entirety, the dimmer stars appearing like stardust in small telescopes and like tiny diamonds in larger instruments. Zooming in with higher powers brings other rewards when the bright central stars are seen in all their glory, now appearing as gleaming jewels against an inky background.

Planetary Nebula



***Coordinates:** M27, RA 19h 59m 36s, Dec +22° 43'*

M27 in ***Vulpecula*** is at once the easiest of planetary nebulae to see and one of the largest on view. This is because it lies exactly 3º due north of the star at the tip of the constellation's arrowhead asterism and is also a mere 1000 light years away – only half the distance of its nearby illustrious neighbour, the Ring Nebula in Lyra.

The Dumbbell Nebula as it's known occupies a massive 45 square arc minutes of sky compared with the Ring Nebula's puny 1.4 – over 30 times as large. Fortunately it's also nearly two magnitudes brighter and so is capable of being seen through any telescope. Despite its name M27 is much more reminiscent of the core of a partially eaten apple than a dumbbell, its material being concentrated in arcs to the north and south with dark areas either side of its waist. As it has such a high surface brightness it takes magnification well and you can employ just about any power that your telescope will support. High powers will

reveal more of the stars that are in our line of sight whereas lower powers will generally give brighter and sharper views of the nebula itself.

Again, as with most such nebulae, an Olll filter will provide a startling improvement to the detail that can be seen, at the expense of significantly dimming the stars, particularly the progenitor at the centre of the planetary whose outer layers have been expelled to provide us with this spectacle. This is a mag 13.5 star that can just be identified with a 10" telescope.

It's a happy coincidence that all three magnificent objects in this article reside in the same relatively small area of sky and therefore are presented for our delectation on the same night as each other. This not only makes for heightened enjoyment but also ease of location as only small movements of the telescope are necessary to hop from one to another. This is a grand trio of spectacular objects with which to impress anyone looking through a telescope for the first time.

Here's a picture to whet your appetite.

Originally published April 2000
Bert Paice

Heating the Solar Corona

The hot outer layer of the sun, the corona, has a temperature of over a million degrees Kelvin, much more than the surface temperature of the Sun which is only about 5500 degrees Kelvin. Moreover, the corona is very active and ejects a wind of charged particles at a rate equivalent to about one-millionth of the moon's mass each year. Some of these particles bombard the Earth, producing auroral glows and occasionally disrupting global communications. There are two important, longstanding, and related questions about the corona that astronomers are working to answer: how is it heated to temperatures that are so much hotter than the surface? And how does the corona produce the wind?

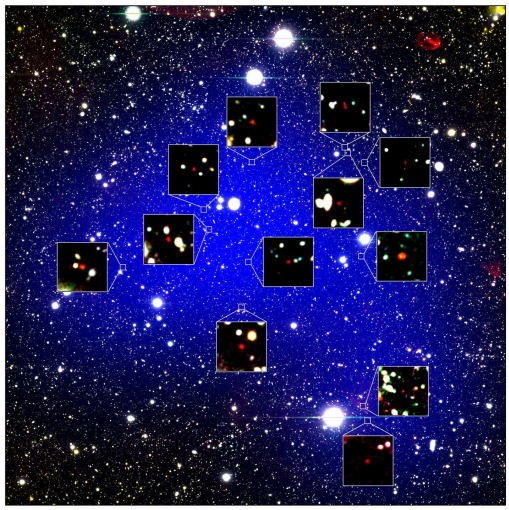
The role of impulsive events is thought to be key to unravelling this problem. Flares are the most prominent such events, but it is believed that flaring also scales down to much smaller levels of activity - so-called nanoflares. The origins and properties of the energy release mechanisms in flares are often obscured by local heating effects, and instruments need to have good sensitivity, rapid response time, and some luck to retrieve useful data on flares amidst the complex seething cauldron of activity, while nanoflares are faint and elusive. Intermediate scale events are therefore thought to offer important ways to probe the energy release processes.

CfA astronomer Paola Testa is a member of a team of astronomers studying flares using IRIS (the Interface Region Imaging Spectrograph), an instrument on the Solar Dynamics Observatory, a NASA small explorer spacecraft that was launched in 2013 (the telescope for IRIS was provided by SAO). Recently, IRIS observed intermediate scale flaring events that were detected through brightenings at the footpoints of coronal loops and characterized by having high velocity, upward motions caused by impulsive heating. IRIS measured the ultraviolet line of highly ionized silicon to reveal highly variable activity over timescales of twenty to sixty seconds, implying the presence of magnetic loops of activity.

The clear correspondence between the brightening seen by IRIS and these coronal loops prompted the scientists to undertake a systematic study of the events. The scientists report that the localized brightenings found at the base of very hot coronal loops can indeed be treated as systems of interacting loops, and argue that the loop interactions determine the characteristic high temperatures and other behaviours that flag the production of intermediate-sized flares.

More at: *https://phys.org/*

Record-breaking Observations Find Most Remote Protocluster of Galaxies



The blue shading shows the calculated extent of the protocluster, and the bluer color indicates higher density of galaxies in the protocluster.
CREDIT: NAOJ/Harikane et al.

An international team of astronomers with participation by researchers from DAWN, Niels Bohr Institute, University of Copenhagen has discovered a protocluster of galaxies 13.0 billion light years away using the Subaru, Keck, and Gemini Telescopes in Hawaii. A protocluster is a structure of galaxies still in the process of forming a cluster. This protocluster is the most distant protocluster ever found. The discovery suggests that a large structure such as a protocluster already existed at a time when the universe was only about 800 million years old or 6 percent of its present age. Finding a protocluster this far away makes finding the needle in the haystack seem an easy task, but more importantly, it holds important information on the history of the Universe. The result is now published in Astrophysical Journal.

The formation of the largest structures in the Universe is a longstanding problem

In the present universe, there are clusters of galaxies that have hundreds of member galaxies including tens of massive galaxies. Clusters of galaxies are the largest astronomical objects in the Universe. They are connected with each other and make up a huge network of galaxies called the "large-scale structure" of the Universe. Thus, clusters of galaxies are essential parts of the structure of the universe, and it is a major area of astronomy research how these clusters of galaxies formed and evolved through the 13,8 billion years long history of the universe.

Far away is also far back in time in astronomy

To understand the formation of clusters of galaxies, astronomers have searched for protoclusters of galaxies that are thought to be ancestors to todays cluster of galaxies. A protocluster is a dense system of tens of galaxies in the early universe, which is in the process of growing to a cluster. Finding and analyzing protoclusters in the early Universe is a crucial step to understanding formation and growth of galaxies in overdense regions. This is one of the outstanding problems in galaxy evolution. Professor Sune Toft from DAWN explains: "Searching the sky for structures like this protocluster is not actually about the record, even though it is rather impressive even to be able to find it. That is an accomplishment in itself. But finding the most distant protocluster is all about moving the limits for what we are able to see - how far back in time are we able to establish a continuous baseline for our understanding of the development of the Universe? When we look far away, we also look back in time. That's why the record is scientifically significant".

The cosmic dawn

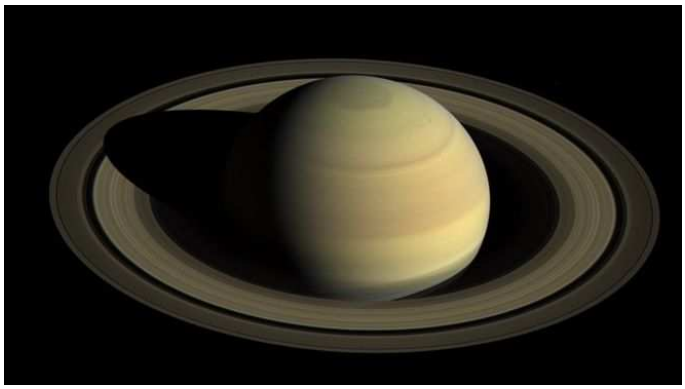
In this particular period in the history of the Universe, the cosmic dawn, a period of only half a billion years after the big bang, an enormous amount of activity is going on in the Universe. Galaxy formation can be studied closely, as the limited time frame reduces the amount of events that could influence galaxy formation. In other words, the array of possibilities for events forming galaxies is less wide. "We can basically limit our focus to fewer elements of the underlying physics taking place", Says Sune Toft. "If I were a detective investigating a murder, I'd want to find the body as soon as possible after the crime has been committed, in order to have fresh clues and unspoiled evidence. That's more or less the same situation here. Enormous astrophysical activity distributed over a short period of time, gives us a whole lot of observational material to work with, and not as many ifs and buts, as when we look at galaxy formation over a longer period of time".

The connection between dark matter and matter emitting light can be studied observationally

"Another very important aspect of the study, which to me is extremely fascinating, is that here, we can study the distribution of galaxies in the cosmic web, and relate what we see - the light from the stars - to the underlying distribution of dark matter. Dark matter really drives everything in the development of galaxies. We just can't see it. But if we become able to place the galaxies in the cosmic web and track the developments, then in turn we can see how dark matter impacts what we can see. That is really the big, unanswered question here. We actually don't know the precise relation between dark matter and matter that emits light at the moment. But studies like this provide us with tools to tackle this problem observationally", professor Sune Toft explains. "Unveiling the dark skeleton of the Universe is really the ultimate goal we have before us with this".

https://www.eurekalert.org/

Saturn Overtakes Jupiter as Planet With Most Moons



Roll over Jupiter, Saturn is the new moon king

Saturn has overtaken Jupiter as the planet with the most moons, according to US researchers.

A team discovered a haul of 20 new moons orbiting the ringed planet, bringing its total to 82; Jupiter, by contrast, has 79 natural satellites.

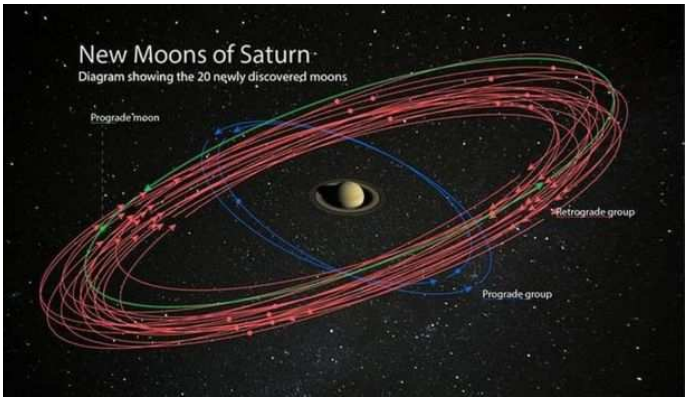
The moons were discovered using the Subaru telescope on Maunakea, Hawaii.

Each of the newly discovered objects in orbit around Saturn is about 5km (three miles) in diameter; 17 of them orbit the planet "backwards".

This is known as a retrograde direction. The other three moons orbit in a prograde direction - the same direction as Saturn rotates.

Two of the prograde moons take about two years to travel once around the ringed planet.

The more-distant retrograde moons and one of the prograde moons each take more than three years to complete an orbit.



"Studying the orbits of these moons can reveal their origins, as well as information about the conditions surrounding Saturn at the time of its formation," said Dr Scott Sheppard, from the Carnegie Institution for Science in Washington DC, who led the team.

Dr Sheppard told BBC News that Jupiter had been the planet with most known moons since the late 1990s.

The outer moons in the new haul appear to be grouped into three distinct clusters, based on the inclinations of the angles at which they orbit the planet.

Scientists think the retrograde and prograde moons are the broken up remnants of at least three larger bodies. These bigger objects were smashed up by collisions, either between distinct moons or with outside objects such as passing asteroids.

One of the newly discovered retrograde objects is the furthest known saturnian satellite.

"These moons have fairly inclined orbits to Saturn and are pretty far out, so we don't think they formed with the planet, we think they were captured by the planet in the past. If an asteroid happens to be passing by, you can't capture it today because you can't dissipate its energy," Dr Sheppard told BBC News.

However, in the Solar System's youth, when Saturn was in the process of forming, a cloud, or "disc", of dust and gas surrounded the planet. This helped dissipate the energy of passing objects. But in most cases, these bodies ended up spiralling into the planet and becoming part of it.

The observations that led to the discovery were made with the Subaru telescope

"We think these moons interacted with that gas and dust. These were comets or asteroids that happened to be passing by," Dr Sheppard explained.

"Most objects would spiral into the planet and help form the planet itself. But we think these objects were captured right when the gas and dust started dissipating. So they were captured into orbits around the planet rather than falling into the planet. We think these are the last remnants of what formed [Saturn]."

The finds were made by applying new computing algorithms to data gathered between 2004 and 2007 with the Subaru telescope. These algorithms were able to fit orbits to potential moons identified in the old data.

"We thought they were moons of Saturn, but we weren't able to get full orbits to determine this," said Dr Sheppard.

"By using this new computer power, I was able to link these 20 objects that we thought were moons to officially find orbits for them."

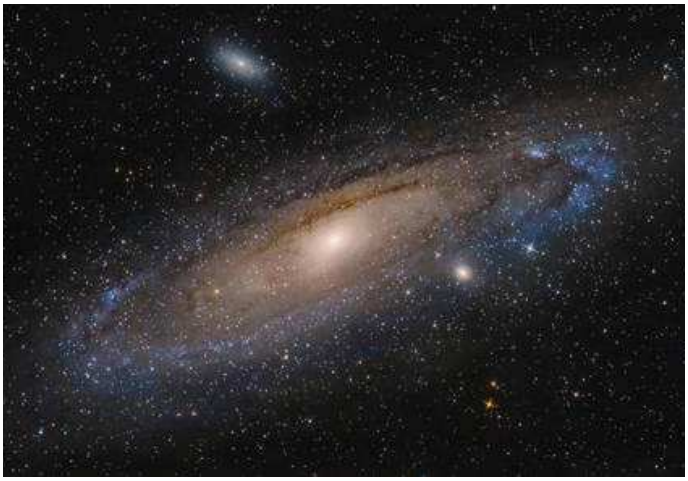
The original observing team included Dr Sheppard, David Jewitt of University of California, Los Angeles (UCLA), and Jan Kleyna of the University of Hawaii.

Dr Sheppard said more moons were probably waiting to be found around Saturn. But astronomers would need larger telescopes - such as those set to come online in coming decades - to discover these smaller satellites of around 1km in size.

The team has initiated a contest to *name the moons.* They have to be named after giants from Norse, Gallic or Inuit mythology, corresponding to the three different clusters.

More at: https://www.bbc.co.uk/

Watch Out! Andromeda, The Giant Spiral Galaxy Colliding With Our Own Milky Way, Has Devoured Several Galaxies Before



Andromeda, a massive spiral galaxy, has swallowed several galaxies within the last few billion years before setting its sights on the Milky Way.

"The Milky Way is on a collision course with Andromeda in about four billion years," said Dougal Mackey, co-author of a new study published in Nature and a research fellow at the Australian National University. "So knowing what kind of a monster our galaxy is up against is useful in finding out the Milky Way's ultimate fate."

Andromeda will be formidable opponent from the looks of it. The researchers found that the hefty galaxy - measuring about 1.2 billion solar masses - contains two giant globular clusters of stars that are rotating perpendicular to each other. These different blobs hint at a past, where Andromeda went through two major accretion events as it sucked up new galaxies.

"Andromeda has a much bigger and more complex stellar halo than the Milky Way, which indicates that it has cannibalised many more galaxies, possibly larger ones." Mackey added.

Observations made from the wide-field camera on the Canada-France-Hawaii-Telescope showed that the globular clusters are on the same rotation axis as a plane of dwarf galaxies that orbit Andromeda.

More surprising is the discovery that the direction of the ancient feeding is the same as the bizarre 'plane of satellites', an unexpected alignment of dwarf galaxies orbiting Andromeda.

Previous research found that these galaxies could be easily ripped apart by Andromeda within a few billion years. "This deepens the mystery as the plane must be young, but it appears to be aligned with ancient feeding of dwarf galaxies," said Geraint Lewis, co-author of the study and an astrophysics professor at the University of Sydney.

The researchers hope that by studying how these smaller dwarf galaxies integrate themselves with Andromeda's star clusters, it will reveal how the larger spiral galaxy pulled them in and engulfed them. It could help scientists piece together what happens when Andromeda and the Milky Way finally collide with each other.

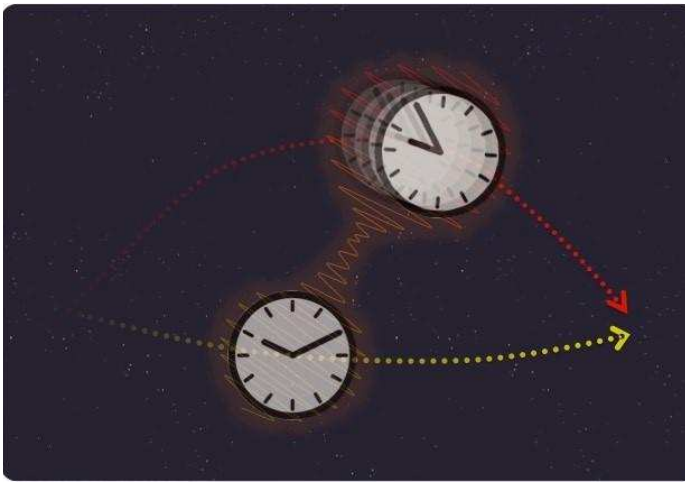
Andromeda is a good specimen to study the evolution of spiral galaxies like the Milky Way, Mackey explained. "One of our main motivations in studying astronomy is to understand our place in the Universe. A way of learning about our galaxy is to study others that are similar to it, and try to understand how these systems formed and evolved."

"Sometimes this can actually be easier than looking at the Milky Way, because we live inside it and that can make certain types of observations quite difficult."

Read More: https://www.theregister.co.uk/

Quantum Paradox Experiment May Lead to More Accurate Clocks and Sensors

University of Queensland



A clock moving in superposition of different speeds would measure a superposition of different elapsing times - in a quantum version of the famous 'twin paradox' of special relativity

More accurate clocks and sensors may result from a recently proposed experiment, linking an Einstein-devised paradox to quantum mechanics.

University of Queensland physicist Dr Magdalene Zych said the international collaboration aimed to test Einstein's twin paradox using quantum particles in a 'superposition' state.

“The twin paradox is one of the most counterintuitive predictions of relativity theory,” Dr Zych said.

“It says that time can pass at different speeds for people at different distances to an enormous mass or travelling with different velocities.”

“For example, relative to a reference clock far from any massive object, a clock closer to a mass or moving at high speed will tick slower.”

“This creates a 'twin paradox', where one of a pair of twins departs on a fast-speed journey while the other stays behind.”

“When the twins reunite, the travelling twin would be much younger, as different amounts of time have passed for each of them.”

“It's a mind-blowing effect - featured in popular movies like Interstellar - but it's also been verified by real world experiments, and is even taken into consideration in order for everyday GPS technology to work.”

The team included researchers from the University of Ulm and Leibniz University Hannover and found how one could use advanced laser technology to realise a quantum version of the Einstein's twin paradox.

In the quantum version, rather than twins there will be only one particle travelling in a quantum superposition.

“A quantum superposition means the particle is in two locations at the same time, in each of them with some probability, and yet this is different to placing the particle in one or the other location randomly,” Dr Zych said.

“It's another way for an object to exist, only allowed by the laws of quantum physics.”

“The idea is to put one particle in superposition on two trajectories with different speeds, and see if a different amount of time passes for each of them, as in the twin paradox.”

“If our understanding of quantum theory and relativity is right, when the superposed trajectories meet, the quantum traveller will be in superposition of being older and younger than itself.”

“This would leave an unmistakeable signature in the results of the experiment, and that's what we hope will be found when the experiment is realised in the future.”

“It could lead to advanced technologies that will allow physicists to build more precise sensors and clocks - potentially, a key part of future navigation systems, autonomous vehicles and earthquake early-warning networks.”

The experiment itself will also answer some open questions in modern physics.

“A key example is, can time display quantum behaviour or is it fundamentally classical?” Dr Zych said.

“This question is likely crucial for the 'holy grail' of theoretical physics: finding a joint theory of quantum and gravitational phenomena.”

“We're looking forward to helping answer this question, and tackling many more.”

More at: https://www.eurekalert.org/Spitzer

Track the Movement of the Milky Way with this DIY Radio Telescope

How big a radio antenna would you need to observe anything interesting? It turns out the answer is a half meter across. For less than US$150 I built one that size, and it can easily detect the motions of the spiral arms of the Milky Way galaxy. Wow!

Some research revealed that amateur radio astronomers were having success with modest horn antennas. So I copied the example of many in an online group called Open Source Radio Telescopes and purchased some aluminized foam-board insulation as antenna construction material. But I was troubled when my multimeter showed no evidence that the aluminized surface could conduct electricity.

The board was abandoned and for $13 I purchased a roll of 20-inch-wide (51-cm-wide) aluminum flashing—the thin sheet metal used to weatherproof tricky spots on roofs.

The width of my roll determined the aperture of my horn's wide end. The roll was 10 feet (3 m) long, which limited the length of the four sides to 75 cm. An online calculator showed that a horn of those dimensions would have a respectable directional gain of 17 decibels. Some hours with snips and aluminized HVAC tape ($8) resulted in a small horn antenna. Attaching a square of ordinary foam board (not the aluminized kind) to the open end made it plenty robust.

I also purchased a 1-gallon can of paint thinner ($9) and gave away its contents. The empty can serves as a waveguide feed at the base of the horn antenna. A handy online waveguide calculator told me this feed would have an operating range that nicely brackets the neutral-hydrogen line frequency of 1420 megahertz.

Some folks contributing to Open Source Radio Telescopes were using similar cans. But none of the projects' documentation showed exactly how to construct the feed's "pin": the part that picks up signals inside the waveguide and passes them to the telescope's receiver. Many cantenna tutorials say to make the pin a quarter of a wavelength long, which in this case works out to 53 millimeters. The tricky part is figuring out where to place it in the can—it needs to be a quarter of a wavelength from the base. However, in this case the relevant wavelength isn't 21 cm but what's called the guide wavelength, which corrects for the difference between how the signal propagates in free space versus inside the waveguide. An online tutorial and another calculator showed the appropriate distance from the base to be 68 mm. So that's where I drilled a hole to accommodate an N-type coaxial bulkhead connector that I had purchased on Amazon.com for $5, along with an N-to-SMA adapter ($7).

For my receiver, I went with a USB dongle that contains a television tuner plus a free software-defined radio application called HDSDR. (The software was chosen on the basis of a report from two amateur radio astronomers in Slovenia who had used it to good effect.)

I purchased the dongle from Nooelec.com ($37) because that company had also recently started selling a gizmo that seemed perfect for my application: It contains two low-noise amplifiers and a surface-acoustic-wave (SAW) filter centered on 1420 MHz ($38). The dongle itself provides power for the amplifier through the coaxial cable that connects them, a 30-cm (12- inch) length of coax purchased on Amazon.com ($9). The dongle just sits on the ground next to my horn and is attached to a Windows laptop through a USB extension cable.

At my instrument's "first light," I was able to detect the neutral hydrogen line with just a little squinting. After getting more familiar with the HDSDR software, I figured out how to time-average the signal and focus on the spectral plot, which I adjusted to display average power.

This plot distinctly showed a hydrogen "line" (really a fat bump) when I pointed my horn at the star Deneb, which is a convenient guide star in the constellation of Cygnus. Point at Cygnus and you'll receive a strong signal from the local arm of the Milky Way very near the expected 1420.4-MHz frequency. Point it toward Cassiopeia, at a higher galactic longitude, and you'll see the hydrogen-line signal shift to 1420.5 MHz—a subtle Doppler shift indicating that the material giving off these radio waves is speeding toward us in a relative sense. With some hunting, you may be able to discern two or more distinct signals at different frequencies coming from different spiral arms of the Milky Way.

Don't expect to hear E.T., but being able to map the Milky Way in this fashion feels strangely empowering. It'll be $150 well spent.

Loads more info at: https://spectrum.ieee.org/

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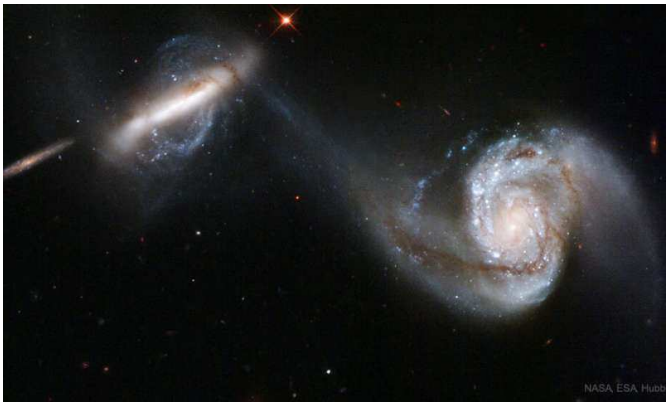
LINKS, COMMENTS AND OBSERVATIONS

Galaxy Mergers Ignite Star Bursts



Two galaxies in the process of merging. Credit: NASA/ESA/ Hubble

When two galaxies merge, there are brief periods of stellar baby booms. A group of astronomers led by Lingyu Wang (SRON Netherlands Institute for Space Research) has now used a sample of over 200,000 galaxies to confirm that galaxy mergers are the driving force behind star bursts. It is the first time that scientists have used artificial intelligence in a galaxy merger study. The results are published in Astronomy & Astrophysics on October 21st.

One of the most pressing questions in astronomy is how and when stars formed in galaxies. The universe contains hundreds of billions of galaxies, and they come in many shapes and forms. Take, for example, the Sombrero Galaxy, the Black Eye Galaxy, the Whirlpool Galaxy or our own Milky Way, stretching across the entire sky. Each harbors hundreds of billions of stars. How and when did all those stars emerge on the cosmic stage?

A popular hypothesis among astrophysicists is that galaxy mergers go hand-in-hand with short starburst phases and an increase of around a factor two in star formation over the whole duration of the merger. Mergers would produce shock waves in the interstellar gas, igniting significant baby booms of stars. The astronomers, including first author William Pearson and co-author Floris van der Tak, have now confirmed this theory by analyzing a record number of over 200,000 galaxies. They found up to twice the number of star bursts in merging galaxies compared to single galaxies.

Deep learning

Because their database was so large, the team built a deep-learning algorithm that taught itself to identify merging galaxies. Pearson says, "The advantage of artificial intelligence is that it improves the reproducibility of our study because the algorithm is consistent in its definitions of a merger. Also, it's a good preparation for upcoming surveys that will image billions of galaxies. Then you inevitably need AI. Even citizen science projects such as Galaxy Zoo cannot deal with those numbers."

It is the first time that astronomers have used AI in a merger study. "This is a milestone in the sense that AI will play an increasingly large role in our field," says Wang. "But we have to keep in mind that the power of AI is limited to how it is trained. If we feed it a flawed definition of a galaxy merger, then it won't do its job correctly."

Read More: https://phys.org/

At The Observatory

For your own safety, please bring a torch.
Make sure you close and lock the car park gate if you are the last to leave (if you need the combination to the lock, please contact a member of the committee)

Articles Needed

NZ needs letters, articles, reviews or pictures related to astronomy.

"We live in a society exquisitely dependent on science and technology, in which hardly anyone knows anything about science and technology"
Carl Sagan

"Everyone you will ever meet knows something you don't"
Bill Nye

"If we knew what it was we were doing, it would not be called research, would it?"
Albert Einstein

"It's still magic even if you know how it's done"
Terry Pratchett

"We are stuck with technology when what we really want is just stuff that works"
Douglas Adams

"Science is the poetry of reality"
Richard Dawkins