New Zenith

The Monthly Newsletter of the Vectis Astronomical Society

Vol 29 Issue 4 — May 2021 *When Printed, this Newsletter costs VAS at least £1*

Society News

Unfortunately, the Observatory and Pavilion remain Closed

Online Virtual Meetings

There seems to have been some confusion about the online monthly meetings. The link given on the back page of this newsletter (and those previously) has the correct information. **The same link will be used for all meetings unless alternative information is provided**.

PLEASE USE THE LINK ON THE BACK PAGE

Observatory News

We will not be opening the observatory anytime really soon. Social distancing still applies and the space available in the building is restricted.

Of course re-opening of all facilities will be discussed and checked at upcoming committee meetings but we cannot make announcements yet.

On a better note, the vaccination programme appears to be an exceptional success and there appears to be light at the end of this year+ situation. That said it is still vital that we obey social distancing measures which make the opening of the observatory difficult.

Even a 1m social distance rule distance would not allow us to have more than say 6 persons in the observatory at one time and even that assumes they all entered one at a time through the narrow corridors! The dome itself would be off limits for all but 2, or maybe, at a push 3 persons.

The level of on-site enforcement of such restrictions would put too big a load on the members supervising visitors.

We therefore cannot reopen until the obvious dangers/risks are completely over.

Brian Curd

VAS Website: wightastronomy.org

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

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

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

Observatory Diary

The diary is currently empty!

VAS Website: wightastronomy.org

Contents this Month

2021 Monthly Meetings

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

Date	Subject	Speaker
26 Mar	Space Traffic Control	Dr Stuart Eves
23 Apr	HOYS	Dirk Froebrich
28 May	Can we live on Mars?	Greg Smye-Rumsby
25 Jun	The Astronomy of Robert Hooke in Context	Paul Bingham

All Monthly Meetings are ONLINE ONLY
Members will receive sign in details by email

Please DO NOT attend the Observatory or Pavilion

ONLINE ONLY

Sorry but we are still unable to hold face-to-face meetings during the Covid-19 virus pandemic.

Details of how to join the Online meetings will be emailed to members.

Please see the Back Page

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.

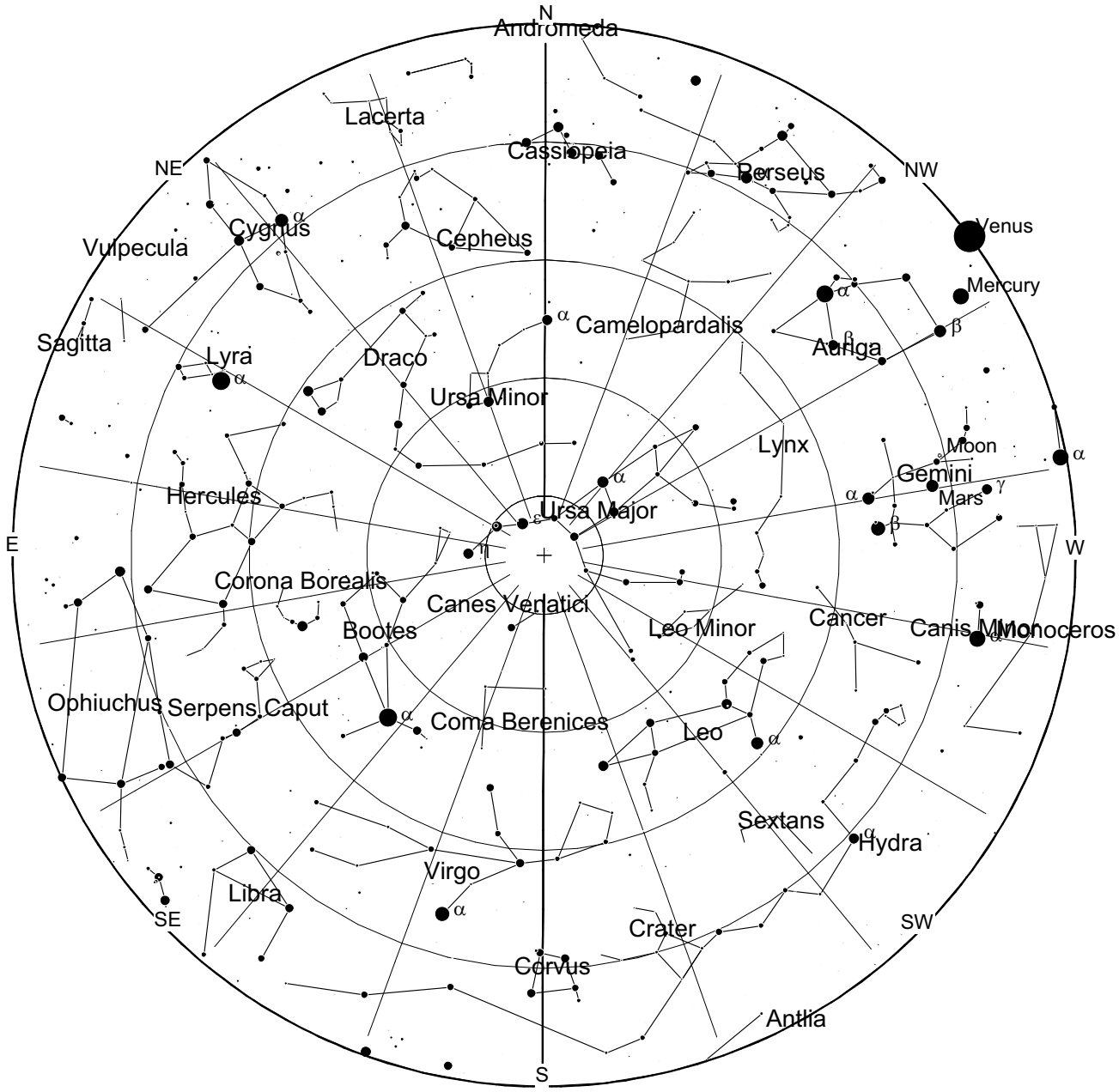
VAS Contacts 2021

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

Important

Sorry, but the Observatory is still closed to all members and visitors until further notice

May 2021 - Sky Map



View from Newchurch Isle of Wight UK - 2200hrs - 15 May 2021

The **Black Eye Galaxy** (also called Sleeping Beauty Galaxy or Evil Eye Galaxy and designated, M64, or NGC 4826) is a relatively isolated spiral galaxy 17 million light-years away in the mildly northern constellation of Coma Berenices. It was discovered by Edward Pigott in March 1779, and independently by Johann Elert Bode in April of the same year, as well as by Charles Messier the next year. A dark band of absorbing dust partially in front of its bright nucleus gave rise to its nicknames of the "Black Eye", "Evil Eye", or "Sleeping Beauty" galaxy. M64 is well known among amateur astronomers due to its form in small telescopes and visibility across inhabited latitudes.

May 2021- Night Sky

Moon Phases

New	First Qtr	Full	Last Qtr
11th	19th	26th	3rd
			

Planets

Mercury

Mercury completes the evening apparition started at the end of last month. The table below shows the altitude and azimuth every two days at 21:00.

Spotting Mercury is always a compromise between how close to the Sun and bright horizon it is and how faint it becomes as it gets higher in the sky.

For a few days a the start of the month Mercury and Venus are quite close together, but they are very close to the horizon and Mercury may only be visible using binoculars. Look about 5° above Venus for a bright pin prick of light against the bright background.

On the 3rd and 4th Mercury is about 2 degrees below the Pleiades star cluster, it is quite low and the sky will be bright making this a challenging observation.

On the 13th the thin crescent moon will be about 2 degrees below and to the left of Mercury acting as a guide. Venus is also visible very low down towards the already set Sun, the trio making an elongated triangle in the evening sky.

Mercury at 21:00 May 2021							
Date	Az	Alt	Mag	Date	Az	Alt	Mag
1	295	6	-1.1	13	292	14	0.1
3	294	8	-0.9	15	292	14	0.3
5	294	10	-0.7	17	291	15	0.7
7	293	11	-0.5	19	291	15	0.8
9	293	13	-0.3	21	291	15	1.0
11	292	14	-0.1	23	292	14	1.3

Venus

Venus starts its apparition as the Evening Star this month. At the start of the month it is very close to the Sun and may be glimpsed just after sunset. After a few days it will be much easier to see as it clears the horizon. It is so bright that it is an unmistakable object in the sunset sky and often reported a a UFO.

Mars

At about 1030pm look to the west northwest and do a 'thumbs up' sign with your arm outstretched. The rather unremarkable red star like object above your thumb is Mars. Its position relative to the horizon does not change much, but as the days pass you will notice the stars drifting by. By mid month it will be below the twin stars of Castor and Pollux in Gemini and joined by the crescent moon. On the 15th it will be above the Moon and on the 16th below it.

Jupiter

About an hour before sunrise Jupiter can be found low down in the south-eastern sky. Even though it is moving to the west each day, the sun is also rising earlier each day, so Jupiter does not get any easier to observe remaining too close to the horizon for serious viewing.

Saturn

Although Saturn rises a little before Jupiter it is not significantly better placed for observation this month.

Uranus & Neptune

Both the outer planets are poorly placed for observation until later in the year

Deep Sky

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.

M53 Globular Cluster
RA 13h 13m Dec 18° 7' mag 8.5

Lying some 60,000 light years away very few stars can be resolved in this cluster without the use of a large telescope. Through smaller instruments and binoculars it looks like a tailless comet.

M64 Black Eye Galaxy
RA 12 57m Dec 21° 38' mag 9

The black eye galaxy gets its name from the dark dust lane that crosses its centre. It will need a dark sky and high magnification to spot the 'eye'.

Peter Burgess

The Universe has a Hubble Constant Problem

Differences in the way that the Hubble constant - which measures the rate of cosmic expansion - are measured have profound implications for the future of cosmology.

- The Hubble constant is used to estimate the rate of expansion of the universe.
- There are two different ways to calculate its value, but they give different results.
- The difference may give physicists an opening to find new cosmic laws, but there is huge uncertainty about which path to take in finding them.

There's something wrong with the universe. Okay, it's not the universe that's the problem; it's our understanding of the universe. The problem lies with cosmology - the branch of science that studies cosmic evolution - and it's only getting worse. But that may, or may not, turn out to be a good thing.

Talk to an astronomer or a physicist about the state of the art in understanding the universe and they'll tell you we've entered the "Precision Age" of cosmology. The data relevant to cosmic evolution have gotten so good we know all the relevant parameters – things like the universe's age and average density – down to a few decimal places. That's a pretty impressive achievement.

One of the most important of these cosmic parameters is what's known as the Hubble constant (cosmologists write it as Ho). Modern cosmology tells us the universe has been expanding since its beginning in the Big Bang. The Hubble constant specifies the rate of that expansion. It's also related to the age of the universe. Larger values of Ho mean a younger universe. Smaller values of Ho mean an older universe.

Back when Edwin Hubble first discovered that the universe was expanding, his crude data gave H_o = 500 (we'll ignore the units). This value was so large it gave an age of the universe that was shorter than the age of the sun or the earth. Better measurements soon gave much lower values of Ho, resolving this conflict. But the idea of conflicts with measured values of H_o didn't go away. A conflict between different ways of measuring Ho is now making big news in cosmology, and no one is sure what's the right next step.

More constants, more problems

There are basically two modern ways to measure the Hubble constant. The first is based on looking at what cosmologists call the "late" universe. Astronomers try to make direct measurements of how fast distant objects are moving away from us (i.e., their redshift). There are two parts to these kinds of observations. First, astronomers need an accurate measurement of an object's distance. Then they need to obtain an accurate measurement of its redshift. Using supernovae as "standard candles" for getting distances to far away galaxies, this late universe method gives a value of the Hubble constant of H_o = 74.03.

The other method relies on data from the "early" universe, i.e., right after the Big Bang. Microwave radiation emitted by matter about 300,000 years after the cosmic beginning provides astronomers with a rich source of early universe measurements. The best data from this cosmic microwave background comes from the Planck satellite launched back in 2009. And the best analysis of the Planck data yields H_o = 67.40, which is clearly not the same value as supernova data. Hence the two methods produce conflicting results. Not knowing which value is right, we can't pin down other properties like, for example, the exact age of the universe.

The conflict between the two approaches is itself not news. People have been playing this game for a while, and during all that time, there was always some difference between the early and late universe approaches. But everyone thought it was just a matter of time until new and better data resolved the conflict. Eventually, it was believed, the final value would lie between H_o = 74.03 and H_o = 67.40. But things haven't worked out that way and that is news.

Over the last few years, measurements of the late universe approach have been getting better and better. This means the inherent "errors" or "uncertainty" in this value of Ho are getting so small there's no chance for a reconciliation with the early universe methods. The gold standard for a measurement is when it achieves the "5 sigma" level, which basically means the confidence in the measured value reaches astronomical (no pun intended) levels. With measurements announced in 2019, the late universe value of H_o was close, or had crossed, the 5 sigma threshold.

So, if the late universe measurement is solid, then what's going on? What are cosmologists missing? The most exciting possibility is that the conflict is not about errors in measurement or analysis but instead point us towards the holy grail of new physics.

To make their early universe measurements of H_o, cosmologists must heavily rely on their dominant cosmological model. This is something called the "Lambda Cold Dark Matter" model or Lambda-CDM. It is based on the universe being made mainly of dark energy (lambda) and a slow moving form of dark matter. This model (or theory) makes predictions that have been very, very well tested. In other words, it works. But the tension between the two methods of determining H_o has some cosmological theorists ready to make changes to Lambda-CDM that could have big consequences for our understanding of the universe. These changes range from just fiddling with the nature of dark energy all the way up to changing Einstein's theory of relativity.

The problem is Lambda-CDM works so well, in so many ways, that it's not something one throws out lightly. Any change to any of its components will have consequences that can mess up the places that it already does work in explaining what we see in the cosmos. What all this means is that the tension in Hubble's constant offers us a lesson in how science progresses. Cosmologists have a paradigm they love and it mostly works. But along comes this problem and, as philosopher of science Thomas Kuhn pointed out, there are typical ways scientists will respond to the problem. At first everyone thinks the problem will go away. But then it doesn't. So what should they do? They could tinker with the old theory in a way that looks jury-rigged. They could abandon the old theory entirely at enormous cost. They could also keep poking around and hope things work themselves out. So what should they do? What would you do?

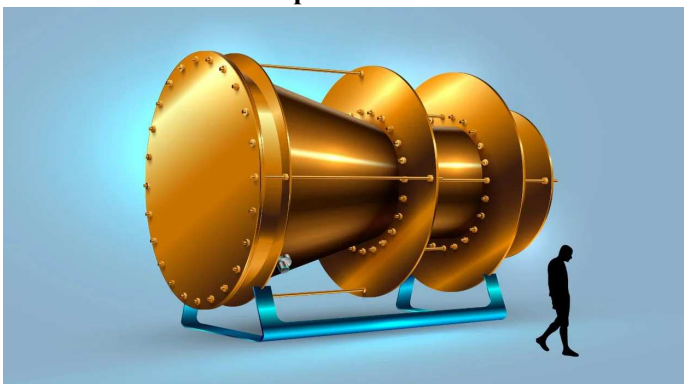
More with links: https://bigthink.com/

For more information about the Hubble Constant H_o see the Link given below:

https://lambda.gsfc.nasa.gov/education/graphic_history/hubb_const.cfm

Sorry the EmDrive Doesn't Work

The EmDrive turns out to be the "um..." drive after all, as a new study dubs any previous encouraging EmDrive results "false positives."



The proposed EmDrive captured the public's imagination with the promise of super-fast space travel that broke the laws of physics.

Some researchers have detected thrusts from the EmDrive that seemed to prove its validity as a technology.

A new, authoritative study says, no, those results were just "false positives."

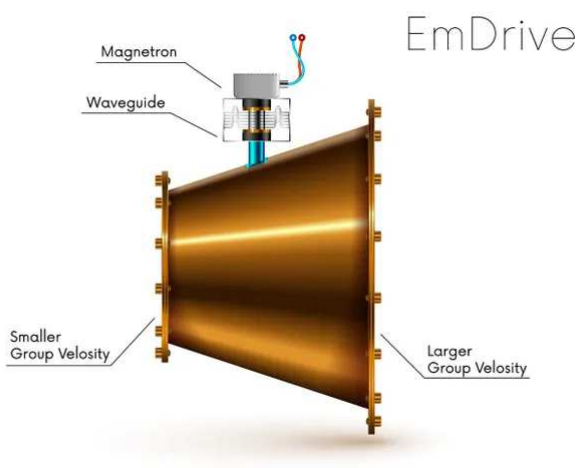
When Roger Shawyer's EmDrive was first proposed in 2001, it seemed too good to be true. The proposed electromagnetic drive ("Em" for short) needed no fuel, and therefore was so lightweight that it promised to let travellers zip across the cosmos at unprecedented speeds. Never mind that the EmDrive's workings seemed to violate Newton's Third Law of Motion, the one about every action producing an equal and opposite reaction.

Now it seems that, yep, it was too good to be true. Scientists at Dresden University of Technology (TU Dresden) appear to have conclusively proven that the EmDrive does not, in fact, produce any thrust. They provide some compelling evidence that small indications of thrust in previous research were simply false positives produced by outside forces.

How the EmDrive is supposed to work

In the EmDrive, says the company that owns rights to the invention, "Thrust is produced by the amplification of the radiation pressure of an electromagnetic wave propagated through a resonant waveguide assembly." In simpler words, trapped microwaves bounce around a specially shaped enclosed container, producing thrust that pushes the whole thing forward.

They also assert that while the EmDrive is not exactly on speaking terms with Newton's Third Law, the company says it's perfectly in line with the second one:



"This relies on Newton's Second Law where force is defined as the rate of change of momentum. Thus, an electromagnetic (EM) wave, travelling at the speed of light has a certain momentum which it will transfer to a reflector, resulting in a tiny force."

Interest in the EmDrive has been understandable considering what it was supposed to do. Speaking to Popular Mechanics last year, Mike McCulloch, the leader of DARPA's EmDrive investigation, describes how the engine could "transform space travel and see craft lifting silently off from launchpads and reaching beyond the solar system." He mentioned his excitement at being able to get from here to Proxima Centauri — 4.2465 light years away — in just 90 human years.

It doesn't work. Yes it does. No, it doesn't.

DARPA, part of the U.S. Department of Defence, is only one of the organizations investigating the claims made for the EmDrive. In 2018 the agency invested $1.3 million to study the device in research that will be wrapping up this May barring any significant last-minute breakthroughs.

Teams from all over the world have been testing Shawyer's idea since it was introduced and releasing often contradictory test results. This may have to do with the fact that teams detecting any EmDrive thrust at all have reported vanishingly small amounts of it, measured in milliNewtons (mN). A mN equals about 0.00022 pounds of force.

As Paul Sutter wrote for Space.com:
"Ever since the introduction of the EmDrive concept in 2001, every few years a group claims to have measured a net force coming from its device. But these researchers are measuring an incredibly tiny effect: a force so small it couldn't even budge a piece of paper. This leads to significant statistical uncertainty and measurement error."

For a sense of how minuscule these results are, consider that the possible thrust force reported by NASA in 2014 of 30-50 micro-Newtons is roughly equivalent to the weight of a big ant. Chinese researchers have claimed detection of 720 mN in their tests. That would be 72 grams of thrust. An iPhone 11 with a case weights 219 grams.

Too small to stand out against background noise

These tiny amounts of EmDrive thrust lie at the heart of what the TU Dresden researchers are saying: The effects are simply too small to rule out effects that don't really come from the EmDrives at all. The researchers have just published three papers. The title of one "High-Accuracy Thrust Measurements of the EmDrive and Elimination of False-Positive Effects" tells the story. The other two studies are here and here.

When the UT Dresden team turned on their EmDrive based on NASA's EmDrive, they, too witnessed tiny amounts of apparent thrust.

However, says Martin Tajmar of UT Dresden to German media outlet GreWi, they soon realized what was going on: "When power flows into the EmDrive, the engine warms up. This also causes the fastening elements on the scale to warp, causing the scale to move to a new zero point. We were able to prevent that in an improved structure."

Putting the kibosh on other researchers' results, the authors of the studies write:
"Using a geometry and operating conditions close to the model by White et al. that reported positive results published in the peer-reviewed literature, we found no thrust values within a wide frequency band including several resonance frequencies. Our data limits any anomalous thrust to below the force equivalent from classical radiation for a given amount of power. This provides strong limits to all proposed theories and rules out previous test results by more than three orders of magnitude."

This would seem to be the definitive end of the EmDrive story.

More with links: https://bigthink.com/

Further Link: http://www.emdrive.com/DresdenTU2021notes.pdf

NASA's Webb Telescope Packs its Sunshield for a Million Mile Trip

Engineers working on NASA's James Webb Space Telescope have successfully folded and packed its sunshield for its upcoming million-mile (roughly 1.5 million kilometre) journey, which begins later this year.

The sunshield was specially engineered to fold up around the two sides of the telescope and fit within the confines of its launch vehicle, the Ariane 5 rocket. Now that folding has been completed at Northrop Grumman in Redondo Beach, California, the sunshield will remain in this compact form through launch and the first few days the observatory will spend in space.

Designed to protect the telescope's optics from any heat sources that could interfere with its sight, the sunshield is one of Webb's most critical and complex components. Because Webb is an infrared telescope, its mirrors and sensors need to be kept at extremely cold temperatures to detect faint heat signals from distant objects in the universe.

In space, one side of the sunshield will always reflect light and background heat from the Sun, Earth and Moon. Thermal models show that the maximum temperature of the outermost layer is 383° K, or about 230° F. Meanwhile, the other side of the sunshield will always face deep space, with the coldest layer having a modelled minimum temperature of 36° K, or about minus 394° F.

Fully deployed, the telescope's sunshield measures almost 21m by 14m. When stowed inside the rocket for launch, the folded sunshield will be packaged in a very confined area in between other structures of the observatory to accommodate the limited space inside the 5.4m) diameter rocket fairing.

The month-long process of folding the sunshield began with laying the five layers as flat as possible. In its deployed state, the sunshield resembles a multilayered silver ship, so its inherently curved surfaces added a degree of complexity to this step. Afterwards, the layers were lifted vertically and propped onto special support equipment so that they could be properly restrained for folding. A team of technicians then carefully folded each layer in a zigzag pattern to create accordion-like stacks of membranes on either side of the telescope.

The first layer of the sunshield is two-thousandths of an inch thick, while the other four layers are only one-thousandth of an inch thick. For the team, a built-in challenge was the delicacy of folding such thin layers. The folding process also had to account for components such as the sunshield's 90 different tensioning cables, which must be stowed in a specific manner to ensure the sunshield deploys smoothly.

“Think of it backwards; we want the deployed sunshield to achieve a specific shape so we get the performance we need. The whole folding process was designed with that in mind. We have to fold cleanly and carefully the same way each time, to ensure the unfolding occurs exactly the way we want it,” said James Cooper, lead sunshield engineer at NASA's Goddard Space Flight Center in Greenbelt, Maryland.

For instance, one of the most intricate aspects of the folding process involved aligning the membrane stacks. Each of the sunshield's layers has hundreds of intentional holes, which are deliberately arranged to avoid light and heat from passing to the optical elements of the telescope when the sunshield is fully deployed. These holes must be lined up during folding so that Webb technicians can insert “pins” through the holes in each membrane stack. The 107 “pins,” or membrane release devices, will help restrain the layers for launch, but release to unfold the sunshield once the telescope is in space.

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

Continuing Arecibo's Legacy

The Arecibo Observatory, UCF, TACC, the University of Puerto Rico, EPOC, Globus, CICoE Pilot partner to move telescope data to Ranch system.

TACC's Ranch supercomputer, a long-term data mass storage system, is safely preserving over three petabytes of data from the Arecibo radio telescope. Ranch is an allocated resource of the Extreme Science and Engineering Discovery Environment (XSEDE) funded by the National Science Foundation (NSF). Credit: TACC

Millions of people have seen footage of the famed Arecibo radio telescope's collapse in December 2020. What they would not have seen from those videos was Arecibo's data center, located outside the danger zone. It stores the 'golden copy' of the telescope's data -- the original tapes, hard drives, and disk drives of sky scans since the 1960s.

Now, a new partnership will make sure that about 3,000 terabytes, of telescope data is securely backed up off-site and made accessible to astronomers around the world, who will be able to use it to continue Arecibo Observatory's legacy of discovery and innovation.

Working Together

Within weeks of Arecibo's collapse, the Texas Advanced Computing Center (TACC) entered into an agreement with the University of Central Florida (UCF), the Engagement and Performance Operations Center (EPOC), the Arecibo Observatory, the Cyberinfrastructure Center of Excellence Pilot (CICoE Pilot), and Globus at the University of Chicago. Together, they're moving the Arecibo radio telescope data to TACC's Ranch, a long-term data mass storage system. Plans include expanding access to over 50 years of astronomy data from the Arecibo Observatory, which up until 2016 had been the world's largest radio telescope.

"I'm thrilled that UT Austin will become the home of the data repository for one of the most important telescopes of the past half-century," said Dan Jaffe, Interim Executive Vice President and Provost of The University of Texas at Austin.

"As a young radio astronomer, I saw Arecibo as an amazing symbol of the commitment of our country to the science I loved," Jaffe said. "Arecibo made important contributions across many fields -- studies of planets, setting the scale for the expansion of the universe, understanding the clouds from which stars form, to name a few. Preserving these data and making them available for further study will allow Arecibo's legacy to have an ongoing impact on my field."

"Arecibo data has led to hundreds of discoveries over the last 50 years," said Francisco Cordova, Director of the Arecibo Observatory. "Preserving it, and most importantly, making it available to researchers and students worldwide will undoubtedly help continue the legacy of the facility for decades to come. With advanced machine learning and artificial intelligence tools available now, and in the future, the data provides opportunity for even more discoveries and understanding of recently discovered physical phenomena."

NSF Vision

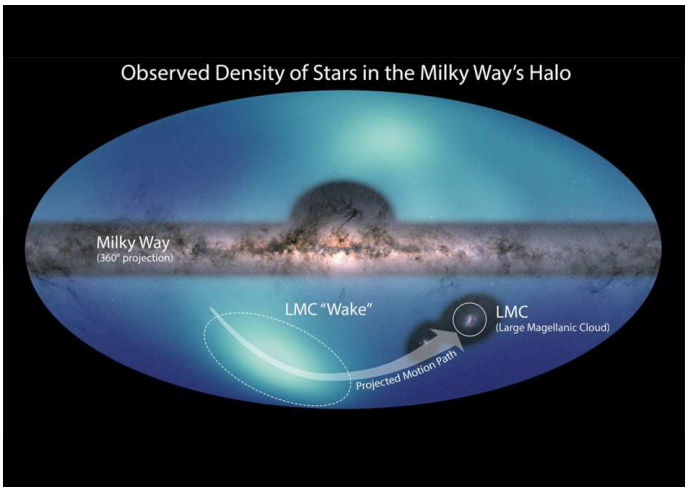
Since 2018, UCF has led the consortium that manages the Arecibo Observatory, which is owned and funded by the National Science Foundation (NSF). EPOC, a collaboration between Indiana University and the Energy Sciences Network (ESnet) funded by the U.S. Department of Energy's Office of Science (SC) and managed by Lawrence Berkeley National Laboratory, had itself partnered with UCF in profiling their scientific data movement activities a year prior to the collapse.

"NSF is committed to supporting Arecibo Observatory as a vital scientific, educational, and cultural center, and part of that will be making sure that the vast amounts of data collected by the telescope continue to drive discovery," says NSF Program Officer Alison B. Peck. "We're gratified to see that this partnership will not only safely store copies of Arecibo Observatory's data but also provide enhanced levels of access for current and future generations of astronomers."

The data storage is part of the ongoing efforts at Arecibo Observatory to clean up debris from the 305-meter telescope's 900-ton instrument platform and reopen remaining infrastructure. NSF is supporting a June 2021 workshop that will focus on actionable ways to support Arecibo Observatory's future and create opportunities for scientific, educational, and cultural activities.

Much more at: https://www.eurekalert.org/

Astronomers Release New All-Sky Map of Milky Way's Outer Reaches



Images of the Milky Way and the Large Magellanic Cloud (LMC) are overlaid on a map of the surrounding galactic halo. The smaller structure is a wake created by the LMC's motion through this region. The larger light-blue feature corresponds to a high density of stars observed in the northern hemisphere of our galaxy. Credit: NASA/ESA/ JPL-Caltech/Conroy et. al. 2021

Astronomers using data from NASA and ESA (European Space Agency) telescopes have released a new all-sky map of the outermost region of our galaxy.

Known as the galactic halo, this area lies outside the swirling spiral arms that form the Milky Way's recognizable central disk and is sparsely populated with stars. Though the halo may appear mostly empty, it is also predicted to contain a massive reservoir of dark matter, a mysterious and invisible substance thought to make up the bulk of all the mass in the universe.

The data for the new map comes from ESA's Gaia mission and NASA's Near Earth Object Wide Field Infrared Survey Explorer, or NEOWISE, which operated from 2009 to 2013 under the moniker WISE. The study makes use of data collected by the spacecraft between 2009 and 2018.

The new map reveals how a small galaxy called the Large Magellanic Cloud (LMC) has sailed through the Milky Way's galactic halo like a ship through water, its gravity creating a wake in the stars behind it. The LMC is located about 160,000 light-years from Earth and is less than one-quarter the mass of the Milky Way.

Though the inner portions of the halo have been mapped with a high level of accuracy, this is the first map to provide a similar picture of the halo's outer regions, where the wake is found - about 200,000 light-years to 325,000 light-years from the galactic center. Previous studies have hinted at the wake's existence, but the all-sky map confirms its presence and offers a detailed view of its shape, size, and location.

This disturbance in the halo also provides astronomers with an opportunity to study something they can't observe directly: dark matter. While it doesn't emit, reflect, or absorb light, the gravitational influence of dark matter has been observed across the universe. It is thought to create a scaffolding on which galaxies are built, such that without it, galaxies would fly apart as they spin. Dark matter is estimated to be five times more common in the universe than all the matter that emits and/or interacts with light, from stars to planets to gas clouds.

Although there are multiple theories about the nature of dark matter, all of them indicate that it should be present in the Milky Way's halo. If that's the case, then as the LMC sails through this region, it should leave a wake in the dark matter as well. The wake observed in the new star map is thought to be the outline of this dark matter wake; the stars are like leaves on the surface of this invisible ocean, their position shifting with the dark matter.

The interaction between the dark matter and the Large Magellanic Cloud has big implications for our galaxy. As the LMC orbits the Milky Way, the dark matter's gravity drags on the LMC and slows it down. This will cause the dwarf galaxy's orbit to get smaller and smaller, until the galaxy finally collides with the Milky Way in about 2 billion years. These types of mergers might be a key driver in the growth of massive galaxies across the universe. In fact, astronomers think the Milky Way merged with another small galaxy about 10 billion years ago.

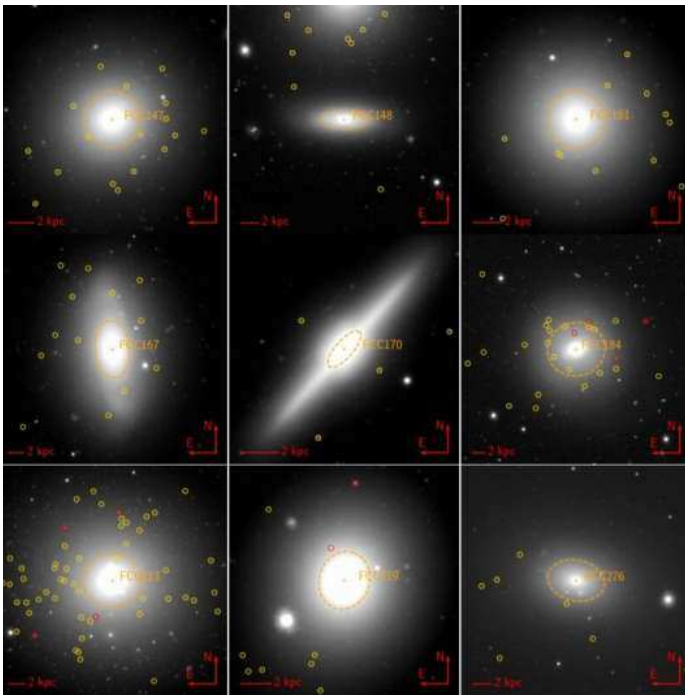
A Rare Opportunity

The authors of the paper also think the new map - along with additional data and theoretical analyses - may provide a test for different theories about the nature of dark matter, such as whether it consists of particles, like regular matter, and what the properties of those particles are.

"You can imagine that the wake behind a boat will be different if the boat is sailing through water or through honey," said Charlie Conroy, a professor at Harvard University and an astronomer at the Center for Astrophysics | Harvard & Smithsonian, who coauthored the study. "In this case, the properties of the wake are determined by which dark matter theory we apply."

Lots more at: http://spaceref.com/

Dozens of Ultra-compact Dwarf Galaxies Detected



UCD/GCs around the brightest galaxies in the Fornax cluster. Credit: Saifollahi et al., 2021.

Astronomers from the University of Groningen and elsewhere have identified 44 new ultra-compact dwarf galaxies (UCDs). The newly found objects most likely belong to the Fornax Cluster. The discovery is reported in a paper published March 31 on the arXiv pre-print server.

UCDs are very compact galaxies with high stellar populations, containing about 100 million stars. They display masses, colors and metallicities between those of globular clusters and early-type dwarf galaxies. These ultra-compact stellar systems could provide important insights on the formation and evolution of galaxies in the universe.

Located some 65 million light years away from the Earth, the Fornax Cluster is the second-richest cluster of galaxies nearby. Due to its relatively close proximity, it is a valuable source of information about galaxy clusters in general. Previous observations of Fornax Cluster have detected 61 member UCDs in total.

Now, a group of astronomers led by Teymoor Saifollahi of the University of Groningen, the Netherlands, reports the finding of dozens of new potential UCDs that may be associated with the Fornax Cluster. By analyzing the data from the Fornax Deep Survey (FDS), Vista Hemisphere Survey (VHS) and archival datasets from the Visible and Infrared Survey Telescope for Astronomy (VISTA), they identified 44 candidate UCDs in the outskirts of this cluster.

"With the deep optical images of the Fornax Deep Survey, combined with public near-infrared data, we revisit the UCD population of the Fornax cluster and search for UCD candidates, for the first time, systematically, out to the virial radius of the galaxy cluster," the researchers wrote in the paper.

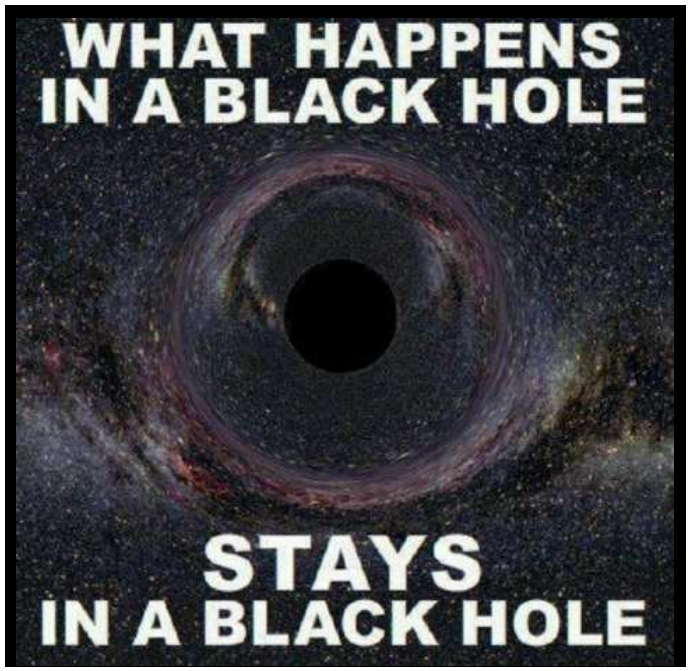
The team initially selected 220 UCD candidates, and from this broad sample, they chose 44 that have a higher probability of being real UCDs. Almost all of the newly detected UCD candidates are located outside the core of the Fornax Cluster (more than 1,170 light years away from the cluster's center).

According to the paper, almost half of the newfound ultra-compact dwarf galaxies in the outskirts of the Fornax Cluster appear to be intra-cluster UCDs, further away than 650,000 light years from any galaxy in this cluster brighter than -18 mag. The astronomers noted that this group of UCDs may be formed in low-density environments and represent in-falling UCD populations into the cluster.

The study also identified two over-densities of UCDs outside the core of the Fornax Cluster in the northern and western sides, which appear to overlap the enhancements in the densities of dwarf galaxies in this cluster. This finding suggests that the population of UCDs follow the dwarf galaxies in the Fornax Cluster and may form in low-density, pre-processed group environments, what challenges our current models of UCD formation.

The authors of the paper added that follow-up spectroscopy and radial velocity studies are required in order to confirm the membership of the new UCD candidates. Such measurements would also shed more light on the origin of these UCDs.

Link: https://phys.org/



THE BACK PAGE

LINKS, COMMENTS AND OBSERVATIONS

Virtual Monthly Meetings

See page 2 for meeting details.

All these meetings are ONLINE ONLY

Please do not visit the Observatory or Pavilion as both are closed

We use the Zoom platform. **The same link is used for all meetings** so please make sure you store the following, you can join using this link:

https://us02web.zoom.us/j/87183717129?pwd=NXU4b1IjWit2aXJqTTZsYWN5bTIaQT09

Meeting ID: 871 8371 7129

Passcode: 821137

You can join us from 18.45 - the meeting starts at 19.00

If you possibly can, please join us for the next one. Our speakers (and club committee) give their time and effort to make the presentations as interesting as possible and they deserve our support.

Wine Matured Aboard ISS Expected to Sell for $1m

If a bottle of Petrus 2000 that Christie's is selling tastes out of this world it might be because it aged for 14 months aboard the International Space Station.

Christie's hopes the bottle, now up for private sale, will fetch $1 million, which would make it the most expensive wine ever sold.

The bottle is one of a batch of 12 that Space Cargo Unlimited sent into orbit as part of research into how food and drink matures in space.It spent almost 440 days in space, or the equivalent of 300 trips to the Moon.

It left for the ISS on 2/11/2019 in a Cygnus capsule and returned on 14/1/2021 aboard a SpaceX Dragon capsule.

Tests carried out in March by a wine science institute in Bordeaux found that the bottles "positively endured all the constraints of preparation, travel, and storage on the ISS," Christie's said in its press release.

At the end of a blind tasting, the researchers noted "remarkable differences in the colour, aroma and taste components," between the celestial bottles and equivalents which had remained on earth. "The wines sampled were commended for their complexity and considered to be great wines," Christie's added.

The sale is expected to smash the record price for a standard bottle of wine - a 1945 Romanee-Conti Burgundy which sold in New York for $558,000 in 2018.

The private sale means the buyer and price will remain confidential unless the buyer chooses to identify themselves publicly. Proceeds will go towards funding future space missions focused on agricultural research.

Petrus is considered one of the world's finest wines. A classic bottle of Petrus 2000 currently sells for around $5,400.

https://www.spacedaily.com/

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 astronomy related content. Contact details on page 1.

"Well done is better than well said"
Benjamin Franklin

"The only thing that interferes with my learning is my education"
Albert Einstein

"Have no fear of perfection, you'll never reach it"
Salvador Dali

"I don't care that they stole my idea… I care that they don't have any of their own"
Nikola Tesla

"You miss 100 percent of the shots you never take"
Wayne Gretzky

"Those who believe in telekinetics, raise my hand"
Kurt Vonnegut

"I know the sky is not the limit because there are footprints on the Moon — and I made some of them!"
Buzz Aldrin