New Zenith

The Monthly Newsletter of the Vectis Astronomical Society

Vol 30 Issue 6 — July 2022 *When Printed, this Newsletter costs VAS at least £1*

Society News

Annual General Meeting

Yes, it's that time again! Please try to make an effort to attend this year. The Committee has worked hard to keep things on an even keel during the Covid period and things seem to, albeit slowly, be coming back to normal.

It would be great to see a really good turnout of members for the AGM as there are positions waiting to be filled:

I, for one need to take a break from producing the New Zenith newsletter (this is my 163rd edition!). Simon Gardner would like to get somebody else for the Programme Organiser and Richard Flux would like to hand over the Secretary post.

Please consider stepping forward to help with these positions. The current incumbents have all said they'll help a new volunteer to get going so yes, it does take a bit of time each month, but the members need you and you may be surprised how much you'd enjoy trying something new!

Please consider taking on a position as VAS cannot continue without an active Committee.

Observatory

I will be attending an NPS&CA (*our landlords*) meeting this week and will raise the issue of observatory modifications (*rough drawings on the Back Page*) and possible planning permissions etc.

As far as I can see we are not currently using all the space allocated to us in our lease with them so things should be pretty straightforward. Let's hope so.

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.

The Vectis Astronomical Society and the Editor of the New Zenith accept no responsibility for advice, information or opinion expressed by contributors.

Registered Charity No 1046091

Observatory Diary

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

VAS Website: wightastronomy.org

Contents this Month

2022 Monthly Meetings

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

Date	Subject	Speaker
22 Jul	**James Webb Space Telescope THIS IS A ZOOM MEETING**	**Dr Stephen Wilkins**
26 Aug	AGM	No Speaker
23 Sep	Kristian Birkeland - The story of the father of Northern Lights knowledge	Jonathan Clough
21 Oct	Outreach Event	
25 Nov	The UK National Space Strategy	Adam Amara

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 2022

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
Membership Secretary	Mark Williams members@wightastronomy.org
NZ Editor	Brian Curd editor@wightastronomy.org
NZ Distribution	Brian Curd distribution@wightastronomy.org
Others	Dudley Johnson

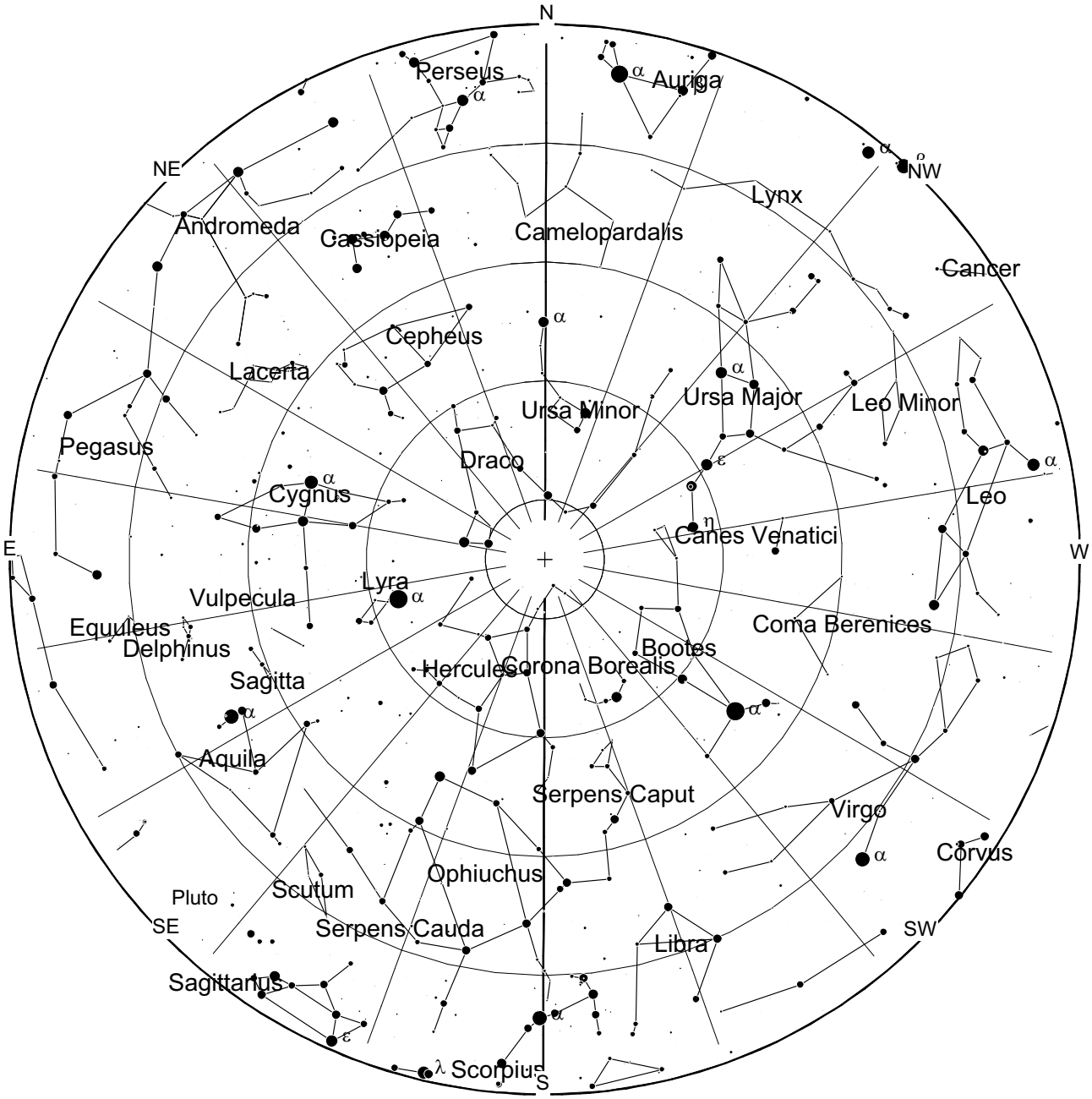
Important

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

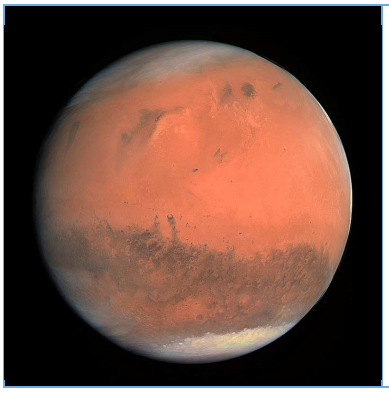
On several occasions, lights, heaters and the Meade LX200 have been left on!

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

July 2022 - Sky Map



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



Mars is the fourth planet from the Sun and the second-smallest planet in the Solar System, being larger than only Mercury. In English, Mars carries the name of the Roman god of war. Mars is a terrestrial planet with a thin atmosphere, and has a crust primarily composed of elements similar to Earth's crust, as well as a core made of iron and nickel. Mars has surface features such as impact craters, valleys, dunes, and polar ice caps. It also has two small and irregularly shaped moons, Phobos and Deimos.

Mars can easily be seen from Earth with the naked eye, as can its striking reddish coloring. This appearance, due the iron oxide prevalent on its surface, has led to Mars often being called the Red Planet. It is among the brightest objects in Earth's sky, with an apparent magnitude that reaches -2.94, comparable to that of Jupiter and surpassed only by Venus, the Moon and the Sun

This article is licensed under the GNU Free Documentation License.
It uses material from the Wikipedia article "Mars".

July 2022 - Night Sky

Moon Phases

New	First Qtr	Full	Last Qtr
28th	7th	13th	20th
			

Planets

Mercury

During the first week of the month Mercury ends the rather poor morning apparition it started in June. At 4:30 it is only about 3° above the horizon and quite close to the soon to be rising sun. follow a line between the much brighter Venus and the point at which the Sun will rise to help spot this elusive little world.

Venus

By about 4am Venus can be seen low down in the east northeast, it is very bright and can be easily seen against the bright pre-dawn sky.

Mars

Looking about twenty degrees above the eastern horizon at 3am Mars can be easily seen. Though not yet very bright it outshines all the stars in that part of the sky, It has a distinctive reddish hue in contrast to the blue-white stars that surround it.

Jupiter

Jupiter is very bright and can be seen from when it rises at about 1am until the sky brightens at sunrise. The last quarter moon passes just below the planet on the morning of the 19th.

Saturn

Saturn is approaching opposition, and as such is visible for most of the night. It rises before midnight and is suitable placed for observation from about 1am, but even at its best is quite low in the sky and will be subject to significant atmospheric turbulence.

Uranus & Neptune

Both the outer ice giants are not well paced for observation this month. Neptune is visible for a short time low in the south east during the darkest hours of the night towards the end of the month. A telescope will be needed and at this time of year the sky will still be rather too bright for easy observation.

Noctilucent Clouds

Mid summer is the prime time to spot these 'night shining' clouds of ice crystals close to the edge of space. They are best seen in the northern sky during the hour or two after sunset or before sunrise. They have a distinctive wispy appearance and can be seen against a dark sky with stars visible in the background.

Deep Sky

Melotte 186 Open Cluster
RA 18h 38m Dec 2° 56' mag 4

This is a large cluster about 3° in diameter centred on the magnitude 4 star 67 Ophiuchi. It is visible to the unaided eye but best appreciated using binoculars. Its brightest members form a tick mark and with stars that do not form part of the cluster form an equilateral triangle. Look for it about 5° to the east of the star Cebalrai.

M24 Sagittarius Star Cloud
RA 18h 16m Dec 18° 43'

Probably the densest mass of stars you will ever see is contained within this 2 x 1° patch of sky towards the centre of our galaxy. A slight thinning in the density of gas and dust allows us a small peek towards the galactic core. This is an object for all instruments from a small pair of binoculars to a large telescope.

M14 Globular Cluster
RA 17h 38m Dec -3° 15' mag 7.6

Despite its magnitude this is quite a difficult binocular object, it is quite large but does not have a particularly well condensed core. This means that the available light is spread out rather thinly. Lager aperture telescopes are needed to resolve some of the cluster stars.

Peter Burgess

Astronomers Identify 116,000 New Variable Stars

An ASAS-SN telescope helps astronomers discover new stars. Credit: ASAS-SN

Ohio State University astronomers have identified about 116,000 new variable stars, according to a new paper.

These heavenly bodies were found by The All-Sky Automated Survey for Supernovae (ASAS-SN), a network of 20 telescopes around the world that can observe the entire sky about 50,000 times deeper than the human eye. Researchers from Ohio State have operated the project for nearly a decade.

Now in a paper published on arXiv, an open-access preprint server, researchers describe how they used machine learning techniques to identify and classify variable stars - celestial objects whose brightness waxes and wanes over time, especially if observed from our perspective on Earth.

The changes these stars undergo can reveal important information about their mass, radius, temperature and even their composition. In fact, even our sun is considered a variable star. Surveys like ASAS-SN are an especially important tool for finding systems that can reveal the complexities of stellar processes, said Collin Christy, the lead author of the paper and an ASAS-SN analyst at Ohio State.

“Variable stars are sort of like a stellar laboratory,” he said. “They're really neat places in the universe where we can study and learn more about how stars actually work and the little intricacies that they all have.”

But to locate more of these elusive entities, the team first had to bring in previously unused data from the project. For years, ASAS-SN gazed at the sky using V-band filters, optical lenses that can only identify stars whose light falls into the spectrum of colors visible to the naked eye. But in 2018, the project shifted to using g-band filters - lenses that can detect more varieties of blue light - and the network went from being able to observe about 60 million stars at a time to more than 100 million.

But unlike ASAS-SN's citizen science campaign, which relies on volunteers to sift through and classify astronomical data, Christy's study required the help of artificial intelligence.

“If you want to look at millions of stars, it's impossible for a few humans to do it by themselves. It'll take forever,” said Tharindu Jayasinghe, co-author of the paper, a doctoral student in astronomy and an Ohio State presidential fellow. “So we had to bring something creative into the mix, like machine learning techniques.”

The new study focused on data from Gaia, a mission to chart a three-dimensional map of our galaxy, as well as from 2MASS and AllWISE. Christy's team used a machine learning algorithm to generate a list of 1.5 million candidate variable stars from a catalog of about 55 million isolated stars.

Afterward, researchers whittled the number of candidates down even further. Of the 1.5 million stars they studied, nearly 400,000 turned out to be real variable stars. More than half were already known to the astronomy community, but 116,027 of them proved to be new discoveries.

Although the study needed machine learning to complete it, Christy's team says there is still a role for citizen scientists. In fact, volunteers with the citizen science campaign have already started to identify junk data, he said. “Having people tell us what our bad data looks like is super useful, because initially, the algorithm would look at the bad data and try to make sense of it,” Christy said.

But using a training set of all that bad data allows the team to modify and improve the overall performance of their algorithm. “This is the first time that we're actually combining citizen science with machine learning techniques in the field of variable star astronomy,” said Jayasinghe. “We're expanding the boundaries of what you can do when you put those two together.”

From: https://phys.org/

NASA Assembling a Team to Gather Data on Unidentifiable Events in the Sky

NASA is putting a team together to study unidentified aerial phenomena, popularly known as UAPs or UFOs, the US space agency said Thursday.

The team will gather data on "events in the sky that cannot be identified as aircraft or known natural phenomena - from a scientific perspective," the agency said.

NASA said it was interested in UAPs from a security and safety perspective. There was no evidence UAPs are extraterrestrial in origin, NASA added. The study will begin this fall and is expected to take nine months.

"NASA believes that the tools of scientific discovery are powerful and apply here also," said Thomas Zurbuchen, the associate administrator of the Science Mission Directorate at NASA Headquarters in Washington, DC.

"We have access to a broad range of observations of Earth from space - and that is the lifeblood of scientific inquiry. We have the tools and team who can help us improve our understanding of the unknown. That's the very definition of what science is. That's what we do."

NASA said the limited number of observations of UAPs made it difficult to draw scientific conclusions about the nature of such events.

"Given the paucity of observations, our first task is simply to gather the most robust set of data that we can," said Spergel, professor emeritus and formerly chair of the department of astrophysical sciences at Princeton University in New Jersey. "We will be identifying what data - from civilians, government, non-profits, companies - exists, what else we should try to collect, and how to best analyze it."

A first step for the team would be to attempt to establish which UAPs are natural, NASA said.

In May, lawmakers held the first congressional public hearing on UFOs in decades. The hearing was a high-profile moment for a controversial topic that has long been relegated to the fringes of public policy. Government officials warned that UAPs must be investigated and taken seriously as a potential threat to national security. And a report about UAPs released last year by the US intelligence community has drawn lots of attention.

The search for life

NASA has long been tasked with finding life elsewhere, which is why astrobiology programs are part of the agency's focus, Zurbuchen said. The Perseverance rover is currently searching for signs of ancient life that may have once existed on Mars while future missions are being developed to seek signs of life on ocean worlds in our solar system. The agency seeks to explore the unknown in air and space, Zurbuchen said.

Given the national security and air safety issues that have been raised with UAPs, scientists want to look at the observations and establish if these are natural or need to be explained otherwise.

While talking about UAPs in a traditional science environment may be looked down on or regarded as something not related to science, Zurbuchen "vehemently opposes that."

NASA officials have been thinking about how to study UAPs in a formal way for a long time, but they wanted to ensure that they approached it in the right way. The quality of the science investigation must be the same, no matter the subject.

This study will be entirely unclassified and within in the public domain, and NASA's Science Mission Directorate is leading the charge. The intent of the study is to make a proposal for a research program that can be implemented once the researchers assess the data that exists and should be reviewed.

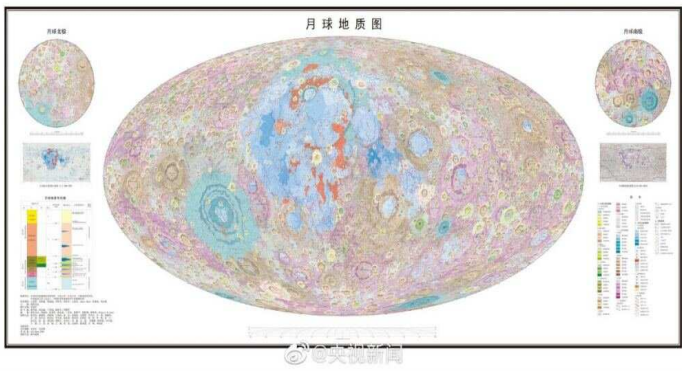
The full report will be made available to the public, and the research team will hold a public meeting to discuss the findings, said Daniel Evans, NASA Science Mission Directorate assistant deputy associate administrator for research, during the news conference. Like NASA's other standard grant review panels, the budget estimated for this project is between a few tens of thousands of dollars and no more than $100,000, Evans said.

While it's difficult to anticipate what the study will reveal, Spergel said "we should be open to the idea that we're looking at several different phenomena."

"I think we have to approach all these questions with a sense of humility," Spergel said. "I've spent most of my career as a cosmologist. I can tell you, we don't know what makes up 95% of the universe. So there are things we don't understand. I hope this study moves us forward to understand these phenomena better. But at the end of the day, we may conclude that we still don't understand many aspects of them and perhaps have a road map on how to make progress."

More at: https://edition.cnn.com/

Geologic Map of the Entire Moon at 1:2,500,000 scale



Chinese scientists have created the most detailed map of the moon yet. It took them 10 years and involved hundreds of researchers. The new map will be a boon to lunar exploration and for anyone who just wants to study our natural satellite in more detail. Up until now, the USGS map of the moon has been the standard. But that map has a resolution of 1:5,000,000. The new map supersedes that with a resolution of 1:2,500,000.

The new map from Chinese scientists is also based on the latest findings on the moon. China began its lunar exploration program in 2004 and has sent its own orbiters, landers, and rovers there. Those missions gathered data that fed into the map.

The Institute of Geochemistry of the Chinese Academy of Sciences led the project and other Chinese institutions took part. The map shows 12,341 impact craters, 81 impact basins, 17 rock types and 14 types of structures.

It's difficult to overstate how detailed the map is. The tighter you zoom in the more detail there is.

Other maps of the moon were created with data from space-faring nations, and while they've been effective, there were different standards and capabilities behind all that data. But this map is all built to the same standard.

Researchers started by dividing the moon into 30 quadrangles. Each of the quadrangles was mapped to the same standards and the quadrangles were stitched together into one map. The data from the map came from China's own lunar program and from exploration by other space-faring nations, as well. The result is a synthesis of knowledge captured over decades.

“As syntheses of current knowledge on lunar geology and evolution history, lunar geologic maps are fundamental resources in science research, exploration planning, and landing site selection,” the paper presenting the map says.

This map is a fantastic resource for anyone who wants to understand the Moon in more detail. It is downloadable at the reference below, but be warned! The file is 150 Mb.

Download:
https://www.scidb.cn/en/detail?dataSetId=972277454573928448

From: https://phys.org/

Balancing Rock Spotted on Mars

Don't Martians know that stone stacking is bad for the environment? NASA's Perseverance rover on Mars captured this image of what appears to be a small stone balanced atop a large rock. How odd. Or maybe not. James Rice of Arizona State University's School of Earth and Space Exploration and here's his take on it:

Balancing rocks (sometimes called Precariously Balanced Rocks PBRs) of various sizes, ranging from small rock sizes (inches) to formations hundreds of feet high, are naturally occurring and not really that unusual. Often a balancing rock is in fact connected to the larger underlying rock by a stem or pedestal. The Martian balancing rock shown is found at the Rockytop outcrop near the base of the delta and was most likely formed after extensive aeolian (wind) and/or chemical erosion carved it out from the local bedrock.

These types of features are more than just geologic curiosities; in fact they have been called “reverse seismometers” because the existence of PBRs makes it possible to measure earthquakes/marsquakes that didn't happen. If these rocks are still balanced, then the ground hasn't moved enough to knock them over. So we can use these features to learn about a region's seismic history.

From: https://boingboing.net/

Did a Giant Radio Telescope in China Just Discover Aliens?

The intriguing 'BLC1' signal detected at the Murriyang radio telescope turned out to have its origin on Earth. Credit: CSIRO / AAP

"Extraordinary claims require extraordinary evidence," said Carl Sagan. This phrase is the standard that astronomers will be applying to a curious signal captured with China's "Sky Eye" telescope that might be a transmission from alien technology.

An article reporting the signal was posted on the website of China's state-backed Science and Technology Daily newspaper, but was later removed. So have astronomers finally found evidence of intelligent found life beyond Earth? And is it being hushed up?

We should be intrigued, but not too excited (yet). An interesting signal has to go through a lot of tests to check whether it truly carries the signature of extraterrestrial technology or is just the result of an unexpected source of terrestrial interference.

And as for the deletion: media releases are normally timed for simultaneous release with peer-reviewed results - which are not yet available - so it was likely just released a bit early by mistake.

An eye on the sky

Sky Eye, which is officially known as the Five-hundred-meter Aperture Spherical Telescope (FAST), is the largest and most sensitive single-dish radio telescope in the world. A engineering marvel, its gargantuan structure is built inside a natural basin in the mountains of Guizhou, China.

The telescope is so huge it can't be physically tilted, but it can be pointed in a direction by thousands of actuators that deform the telescope's reflective surface. By deforming the surface, the location of the telescope's focal point changes, and the telescope can look at a different part of the sky.

FAST detects radiation at radio wavelengths (up to 10 cm) and is used for astronomical research in a wide range of areas. One area is the search for extraterrestrial intelligence, or SETI.

SETI observations are mainly done in "piggy-back" mode, which means they are taken while the telescope is also running its primary science programs. In this way, large swaths of the sky can be scanned for signs of alien technology - or "technosignatures" - without getting in the way of other science operations. For special targets like nearby exoplanets, dedicated SETI observations are still carried out.

The hunt for alien technology

Technosignature searches have been ongoing since the 1960s, when the American astronomer Frank Drake pointed the 26-meter Tatel telescope toward two nearby Sun-like stars and scanned them for signs of technology.

Over the years, technosignature searches have become far more rigorous and sensitive. The systems in place at FAST are also able to process billions of times more of the radio spectrum than Drake's experiment. Despite these advances, we haven't yet found any evidence of life beyond Earth.

FAST sifts through enormous amounts of data. The telescope feeds 38 billion samples a second into a cluster of high-performance computers, which then produces exquisitely detailed charts of incoming radio signals. These charts are then searched for signals that look like technosignatures.

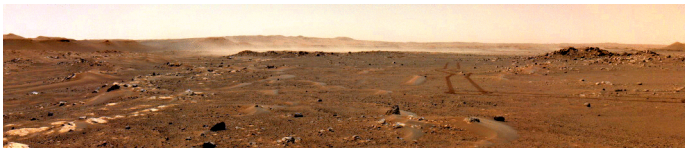
With such a large collecting area, FAST can pick up incredibly faint signals. It is about 20 times more sensitive than Australia's Murriyang telescope at the Parkes Radio Observatory. FAST could easily detect a transmitter on a nearby exoplanet with a similar output power to radar systems we have here on Earth.

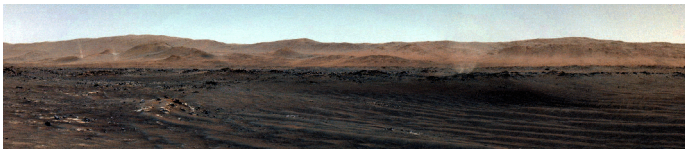
Stay intrigued

As for right now: Stay intrigued, but don't get too excited.

More at: https://phys.org/

Perseverance Watches Wild Winds on Mars





Since the arrival of NASA's Perseverance on Mars on February 18, 2021, the rover has surveyed its home in Jezero Crater, deployed the Ingenuity helicopter, and begun to analyze and cache samples for a future sample-return mission.

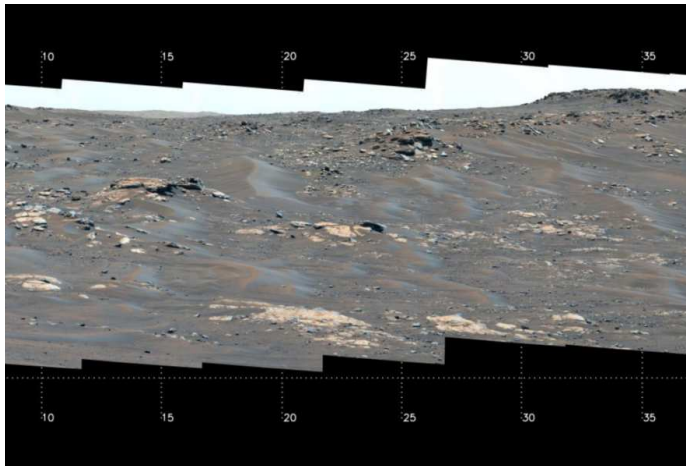
But while geology and astrobiology feature in its primary mission, Perseverance is also proving to be a first-rate interplanetary meteorologist. Recently, researchers have revealed some of the amazing dust storm activity the rover is capturing in Jezero Crater, including videos of some of the most intense dust devil activity seen on Mars.

The findings, published in Science Advances, come from the rover's first 216 sols on Mars. The images come primarily from the rover's main navigation camera, while radiation and dust sensors, part of the Mars Environmental Dynamics Analyzer (MEDA) mounted on the rover's mast, provide additional data.

Astronomers have witnessed dust storms cover Mars for almost as long as they've been observing the planet. Global storms obscure surface features and give the Red Planet a saffron-yellow hue; smaller storms, both regional and local, can also occur. But scientists haven't fully understood how so much dust can make its way off the surface and into the air.

Winds must play an important role. One of the new videos shows a gust of wind lifting a massive cloud of dust, the first time such an event has been seen on Mars. The rover witnessed two other massive gust-lifting events, the biggest of which formed a huge dust cloud covering 4 square kilometers (1.5 square miles).

"Every time we land in a new place on Mars, it's an opportunity to better understand the planet's weather," says Claire Newman (Aeolis Research) in a recent press release. "We think these gust-liftings are infrequent but could be responsible for a large fraction of the background dust that hovers all the time in the Martian atmosphere."



The rover wasn't able to traverse the Séítah sand dunes in Jezero Crater, though it photographed them from afar. NASA / JPL

Jezero's a good place to watch this process in action because it sits near the dust storm track that runs north to south across the planet. Perseverance has witnessed hundreds of dust devils cross the crater, at a rate of four per sol and a peak rate of one per hour around local noon. The rough surface of the crater floor — including the treacherous Séítah dunes — make it an ideal source for dust-lifting events. Indeed, large gust-lifting events, rare as they are, kick far more dust into the air than the smaller daily whirlwinds.

Whirlwinds actually come in handy for solar-powered missions because they can clear dust off solar panels, as happened for the Insight lander in Elysium Planitia. Fine dust clings to solar panels, though, and power inevitably begins to drop, as it is doing now for both Insight and Ingenuity.

Whirlwinds can also be downright destructive. The winds at Jezero are so intense that they, or rather the sand grains they carried, have damaged MEDA's two wind sensors. (These sensors are vulnerable to the wind precisely because they have to be exposed to it to measure it.) In addition to the science the sensors return, they also play a crucial role in monitoring winds prior to Ingenuity's flights. Researchers hope a software upgrade could restore the wind sensors.

More wind and dust activity is likely in the works. "We had a regional dust storm right on top of us in January," says Newman. "We're still in the middle of dust season, so we're very likely to see more dust storms."

For now, it's the robots that deal with the consequences. But one day human explorers, too, may have to deal with the dust storms of the Red Planet.

Videos & Links at: https://skyandtelescope.org/

How the Universe Got Its Magnetic Field

One of the most profound mysteries in cosmology is the origin of vast cosmic magnetic fields, which have a dramatic effect on the dynamics of the universe, despite being relatively weak. Now, new research may have finally found the basic processes at the origin of these mysterious cosmological magnetic fields.

When we gaze out into space, all of the astrophysical objects that we see are surrounded by magnetic fields. This is true not only in the neighborhood of stars and planets, but also in the deep space between galaxies and galactic clusters. These fields are weak - typically much weaker than those of a refrigerator magnet - but they are dynamically significant in the sense that they have profound effects on the dynamics of the universe. Despite decades of intense interest and research, the origin of these cosmic magnetic fields remains one of the most fundamental mysteries in cosmology.

In previous research, scientists came to understand how turbulence, the churning motion common to fluids of all types, could amplify preexisting magnetic fields through the so-called dynamo process. But this remarkable discovery just pushed the mystery one step deeper. If a turbulent dynamo could only amplify an existing field, where did the "seed" field come from in the first place?

We wouldn't have a complete and self-consistent answer to the origin of astrophysical magnetic fields until we understood how the seed fields arose. New work carried out by MIT graduate student Muni Zhou, her advisor Nuno Loureiro, a professor of nuclear science and engineering at MIT, and colleagues at Princeton University and the University of Colorado at Boulder provides an answer that shows the basic processes that generate a field from a completely unmagnetized state to the point where it is strong enough for the dynamo mechanism to take over and amplify the field to the magnitudes that we observe.

Magnetic Fields Are Everywhere

Naturally occurring magnetic fields are seen everywhere in the universe. They were first observed on Earth thousands of years ago, through their interaction with magnetized minerals like lodestone, and used for navigation long before people had any understanding of their nature or origin. Magnetism on the sun was discovered at the beginning of the 20th century by its effects on the spectrum of light that the sun emitted. Since then, more powerful telescopes looking deep into space found that the fields were ubiquitous.

And while scientists had long learned how to make and use permanent magnets and electromagnets, which had all sorts of practical applications, the natural origins of magnetic fields in the universe remained a mystery. Recent work has provided part of the answer, but many aspects of this question are still under debate.

The Dynamo Effect

Scientists started thinking about this problem by considering the way that electric and magnetic fields were produced in the laboratory. When conductors, like copper wire, move in magnetic fields, electric fields are created. These fields, or voltages, can then drive electrical currents. This is how the electricity that we use every day is produced. Through this process of induction, large generators or "dynamos" convert mechanical energy into the electromagnetic energy that powers our homes and offices. A key feature of dynamos is that they need magnetic fields in order to work.

But out in the universe, there are no obvious wires or big steel structures, so how do the fields arise? Progress on this problem began about a century ago as scientists pondered the source of the Earth's magnetic field. By then, studies of the propagation of seismic waves showed that much of the Earth, below the cooler surface layers of the mantle, was liquid, and that there was a core composed of molten nickel and iron. Researchers theorized that the convective motion of this hot, electrically conductive liquid and the rotation of the Earth combined in some way to generate the Earth's field.

Eventually, models emerged that showed how the convective motion could amplify an existing field. This is an example of "self-organization" - a feature often seen in complex dynamical systems - where large-scale structures grow spontaneously from small-scale dynamics. However, just like in a power station, you needed a magnetic field to make a magnetic field.

A similar process is at work all over the universe. However, in stars and galaxies and in the space between them, the electrically conducting fluid is not molten metal, but plasma - a state of matter that exists at extremely high temperatures where the electrons are ripped away from their atoms. On Earth, plasmas can be seen in lightning or neon lights. In such a medium, the dynamo effect can amplify an existing magnetic field, provided it starts at some minimal level.

Making the First Magnetic Fields

Where does this seed field come from? That's where the recent work of Zhou and her colleagues, published on May 5. 2022, in PNAS, comes in. Zhou developed the underlying theory and performed numerical simulations on powerful supercomputers that show how the seed field can be produced and what fundamental processes are at work. An important aspect of the plasma that exists

between stars and galaxies is that it is extraordinarily diffuse - typically about one particle per cubic meter. That is a very different situation from the interior of stars, where the particle density is about 30 orders of magnitude higher. The low densities mean that the particles in cosmological plasmas never collide, which has important effects on their behavior that had to be included in the model that these researchers were developing.

Calculations performed by the MIT researchers followed the dynamics in these plasmas, which developed from well-ordered waves but became turbulent as the amplitude grew and the interactions became strongly nonlinear. By including detailed effects of the plasma dynamics at small scales on macroscopic astrophysical processes, they demonstrated that the first magnetic fields can be spontaneously produced through generic large-scale motions as simple as sheared flows. Just like the terrestrial examples, mechanical energy was converted into magnetic energy.

An important output of their computation was the amplitude of the expected spontaneously generated magnetic field. What this showed was that the field amplitude could rise from zero to a level where the plasma is "magnetized" - that is, where the plasma dynamics are strongly affected by the presence of the field. At this point, the traditional dynamo mechanism can take over and raise the fields to the levels that are observed. Thus, their work represents a self-consistent model for the generation of magnetic fields at a cosmological scale.

Professor Ellen Zweibel of the University of Wisconsin at Madison notes that "despite decades of remarkable progress in cosmology, the origin of magnetic fields in the universe remains unknown. It is wonderful to see state-of-the-art plasma physics theory and numerical simulation brought to bear on this fundamental problem."

Zhou and co-workers will continue to refine their model and study the handoff from the generation of the seed field to the amplification phase of the dynamo. An important part of their future research will be to determine if the process can work on a time scale consistent with astronomical observations. To quote the researchers, "This work provides the first step in the building of a new paradigm for understanding magnetogenesis in the universe."

From: https://scitechdaily.com/unlocking-one-of-the-most-profound-cosmological-mysteries-how-the-universe-got-its-magnetic-field/

J

easyfundraising
feel good shopping

Thank you to everyone for raising donations for Vectis Astronomical Society with #easyfundraising! If you haven't signed up yet, it's easy and completely FREE. 6,900 shops and sites will donate to us when you use easyfundraising to do your everyday online shopping - at no extra cost to you! Every donation you raise makes a difference to us so please sign up & share today.

https://www.easyfundraising.org.uk/causes/vectisastronomicalsociety/?invite=5IZ28B%26referral-campaign=c2s%26utm_campaign=admin-trigger%26utm_content=srt

THE BACK PAGE

LINKS, COMMENTS AND OBSERVATIONS

This Month's meeting is a ZOOM Only Event

Sorry but we have to make this month's meeting a Zoom only event as our speaker cannot attend in person.

Exploring the Universe with the James Webb Space Telescope

July 22, 2022 19:30

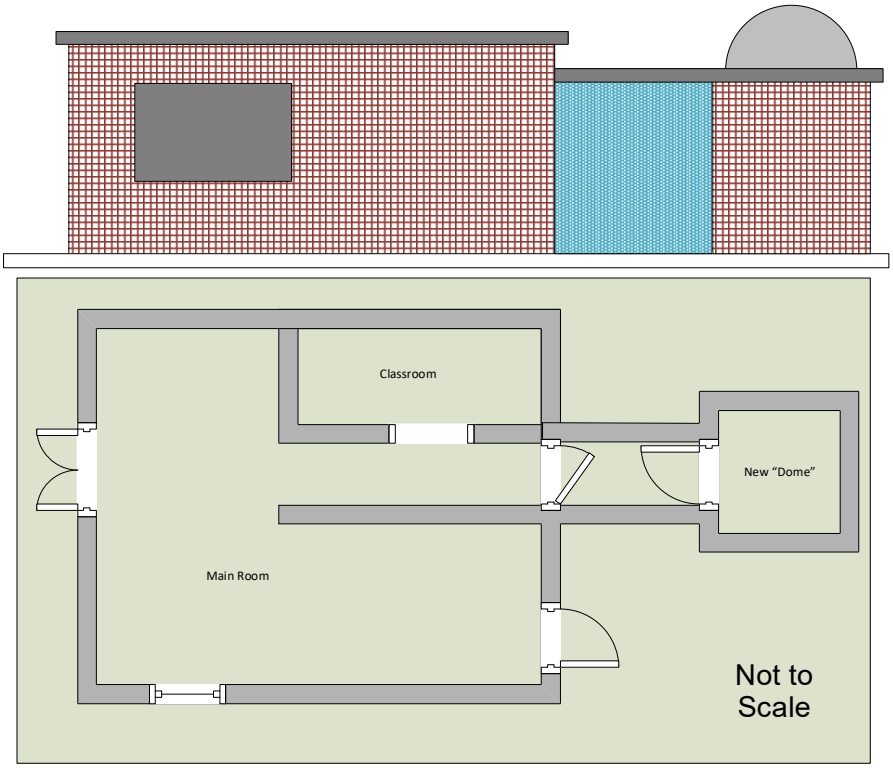
Zoom Meeting link

https://us02web.zoom.us/j/88042469956?pwd=T1VWckJ1OEFxY0tQR1d4SzU2K2h1Zz09

Meeting ID: 880 4246 9956

Passcode: P5u98mLmX5

Drawings of Planned Observatory Changes



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

The Sun is 400 times larger than the Moon but is 400 times further away from Earth making them appear the same size.

The star Lucy in the constellation Centaurus is a huge cosmic diamond of 10 billion trillion trillion carats.

Seasons last 21 years on Uranus while each pole has 42 years of sunlight followed by 42 years of darkness.

90-99% of all normal matter in the universe is hydrogen.

Every year, the Moon is moving away from Earth by 3.8 centimeters.

Only half a billionth of the energy released by the Sun reaches Earth.

The odds of being killed by falling space debris is 1 in 5 billion.

Helium is the only substance in the universe that cannot be in solid form.It can't be cold enough.

All the solar sytems planets are the same age: 4.544 billion years.

VAS Officers and Committee Nominations 2022/23

For those wishing to stand for election at the AGM of the Society to be held on Friday 26th August 2022 at 7.00pm.

Name and Address of Nominee:

.....
.....
.....
.....
.....
.....

Standing For

- Chairman .....❒
- Treasurer .....❒
- Secretary .....❒
- Observatory Director .....❒
- Membership Secretary .....❒
- Programme Organiser .....❒
- General Committee .....❒

Proposed by: .....

Seconded by: .....

Signature of Nominee: .....

Notes

- The Committee meets once each month usually on a Thursday eveningat 18.30 before the usual club night.
- No person can be elected to more than one position.
- Only adult fully paid-up members may stand for election (or proposeor second).
- All completed nomination forms to be received by the Secretary atleast 14 days before the AGM.