New Zenith

The Monthly Newsletter of the Vectis Astronomical Society

Vol 26 Issue 9 — October 2018 *When Printed, this Newsletter costs VAS at least £1*

Society News

Here We Are Again

It's time to think of star gazing - and renewing VAS Subscriptions.

Existing subscriptions expire at the end of September.

At the AGM it was announced that although subscription income was down, due to donations and tight budgetary control the VAS Accounts were declared as stable. Your Committee therefore proposed that Subscriptions should remain unchanged for a further year and this was agreed by the members present.

The rates for 2018/19 and due to be paid by 1st October:	
Ordinary membership	**£30:00 pa**
Senior (60+)	**£24:00 pa**
Student (under 18 or in full time education)	**£12:00 pa**
Family (2 Adults and 2 children)	**£50:00 pa**

Payment may be made by Cash or Cheque payable to Vectis Astronomical Society at the Observatory or the month end talk.

Cheques may be sent to

The Membership Secretary
Foxgloves, 23 Woodland Grove
Bembridge
PO35 5SG.

If you have a Standing Order please check the amount as some members did not change their Standing Orders when the rates were changed in 2015.

If you prefer to pay by Bank Transfer the Account details are:

Vectis Astronomical Society
Sort Code 30 95 99
Account No 00037505

Brian Curd
Editor New Zenith

VAS Website: wightastronomy.org

Submissions or letters to New Zenith are always welcome and should be sent to:
The Editor, New Zenith
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.

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

Monthly meetings are held at the Newchurch Pavilion next to the Observatory and start at 19.30 unless stated.

2018 Monthly Meetings

Date	Subject	Speaker
Check *http://www.wightastronomy.org/meetings/* for the latest information		
28 Sep	How Old is the Universe?	Stephen Tonkin
26 Oct	Dark Skies Stargazing Night	VAS/AONB
23 Nov	Noise Effects in Astronomical Processes	Dudley Johnson

2019 Monthly Meetings

Date	Subject	Speaker
Check *http://www.wightastronomy.org/meetings/* for the latest information		
25 Jan	TBA	TBA
22 Feb	Imaging the Sun	John Slinn
22 Mar	TBA	TBA
26 Apr	The Rise and fall of the Herstmonceux Observatory	Keith Brackenborough
24 May	Can we Live on Mars?	Greg Smye-Rumsby
28 June	Nuclear Physics - Life, the Universe and Everything!	Dr Elizabeth Cunnigham
26 July	Young Astronomers' Event	
23 Aug	AGM and Social Evening	
27 Sept	A transportable/deployable radio telescope for hydrogen line observation	Alan and Martin Thompson
25 Oct	Dark Skies Event	
22 Nov	TBA	TBA

Observatory Visits Booked

Oct 17	Carisbrooke Brownies
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.	

VAS Contacts 2018/19

President	Barry Bates president@wightastronomy.org
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Membership Secretary	Norman Osborn members@wightastronomy.org
NZ Distribution	Graham Osborne
Others	Mark Williams, Nigel Lee, Stewart Chambers, Elaine Spear

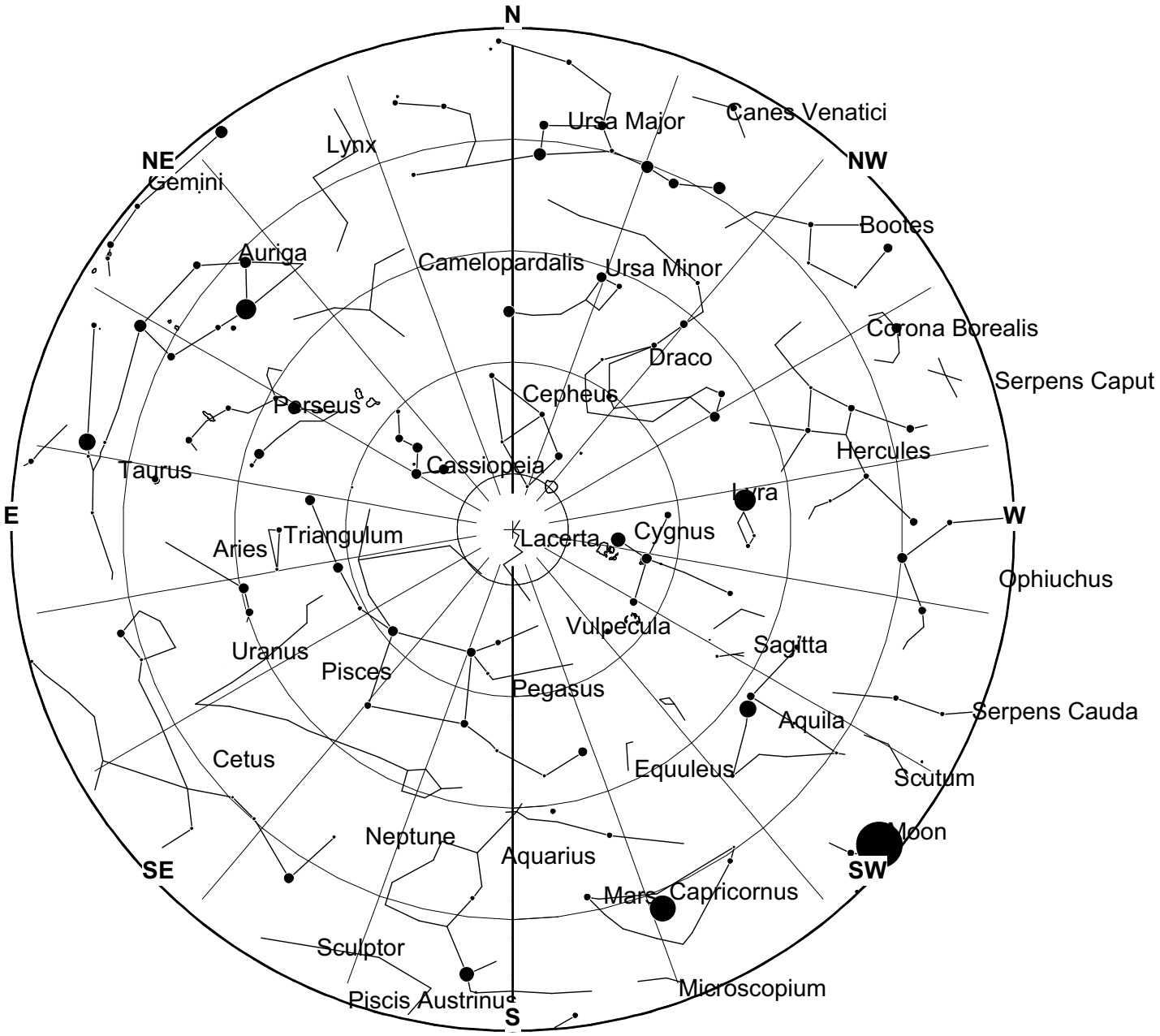
Important

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.

October 2018 Sky Map



View from Newchurch Isle of Wight UK - 2200hrs - 15 October 2018

NGC 7331 (also known as Caldwell 30) is an unbarred spiral galaxy about 40 million light-years (12 Mpc) away in the constellation Pegasus.

It was discovered by William Herschel in 1784. NGC 7331 is the brightest member of the NGC 7331 Group of galaxies. The other members of the group are the lenticular or unbarred spirals NGC 7335 and 7336, the barred spiral galaxy NGC 7337 and the elliptical galaxy NGC 7340.

These galaxies lie at distances of approximately 332, 365, 348 and 294 million light years, respectively. In both visible light and infrared photos of the NGC 7331, the core of the galaxy appears to be slightly off-center, with one side of the disk appearing to extend further away from the core than the opposite side.

October 2018 Night Sky

Moon Phases

New	First Qtr	Full	Last Qtr
			
9th	16th	24th	2nd/31st

Planets

Mercury

Mercury continues its unfavourable evening apparition. At sunset it is at best about 7° above the horizon setting only 30 minutes after the Sun.

Venus

Venus is not visible this month as it passes in front of the Sun; it will re-appear in the morning sky next month.

Mars

Mars appears almost stationary in the south as darkness falls. As the month progresses it rises gradually higher in the sky fading as it does. Mars is still worthy of observation, but the surface markings are progressively more difficult to observe.

Jupiter

Now a very unfavourable object, Jupiter can be glimpsed very low down on the southwestern horizon in the hour after sunset.

Saturn

Saturn can be found low down in the south-southwest as the sky darkens after sunset. It is not well placed, but if the seeing is good enough the shadow of the planet may be seen on the rings.

Uranus

Uranus is in 'uncharted space' about 3° to the east of Omicron Piscium on the border of Aries. The close by stars are either of the same or lesser brightness than Uranus. To find the planet either use a planetarium program or the finder chart in September's NZ.

Neptune

At mid evening Neptune can be found about a half a moon diameter below the 6th magnitude star 81 Aquarii, about half way between Lambda and Phi Aquarii.

Deep Sky

NGC7331 Galaxy
RA 22h 37m Dec 34° 24' mag 9.5

This magnitude 9.5 galaxy is like a miniature version of the nearby Andromeda Nebula, an almost edge on spiral galaxy that is adjacent to a galaxy group called Stephan's quintet. These other members of the group are a challenge for small telescopes being just a faint haze in smaller apertures. A good CCD target.

NGC7000 North America Nebula
RA 20h 59m Dec 44° 28' mag 4.0

Located 3° to the east of Deneb in Cygnus is this large misty patch in the Milky Way that can be seen with the naked eye. Unless the sky is very dark this nebulosity is the light from the myriad of background stars, if conditions are suitable the darker rift of the 'Gulf of Mexico' can be visualised. Large aperture binoculars or a rich field telescope will help reveal the nebulosity. Most of the light emitted is the deep red of hydrogen alpha, to which our eyes lack sensitivity. A nebula filter can help to increase the contrast with the background sky glow. This is a rewarding area for long exposure photography.

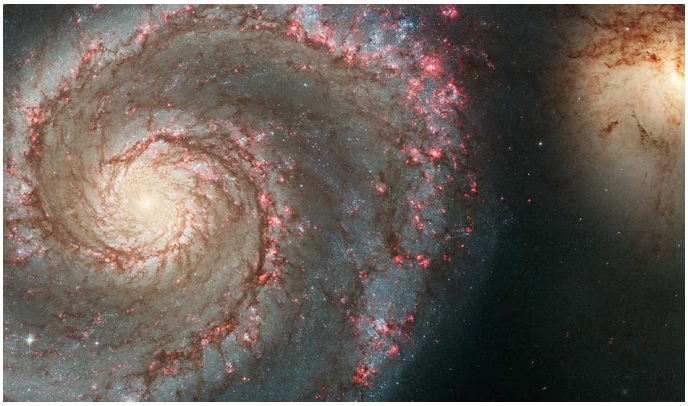
Melotte 20 Open Cluster
RA 3h 20m Dec 49° 2' mag 1.2

Centred on Mirfack, Alpha Persei and easily visible to the naked eye this magnificent cluster is best observed using binoculars. The view is that of a multitude of dazzlingly bright blue stars centred on the bright Mirfack. This cluster is rather too large for a telescope but ideal for binoculars.

Peter Burgess

Is the Universe a Graveyard? This Theory Suggests Humanity may be Alone

Ever since we've had the technology, we've looked to the stars in search of alien life. It's assumed that we're looking because we want to find other life in the universe, but what if we're looking to make sure there isn't any?



Here's an equation, and a rather distressing one at that:

$$N = R^* \times f_P \times n_e \times f_l \times f_i \times f_c \times L$$

It's the Drake equation, and it describes the number of alien civilizations in our galaxy with whom we might be able to communicate. Its terms correspond to values such as the fraction of stars with planets, the fraction of planets on which life could emerge, the fraction of planets that can support intelligent life, and so on. Using conservative estimates, the minimum result of this equation is 20. There ought to be 20 intelligent alien civilizations in the Milky Way that we can contact and who can contact us. But there aren't any.

The Drake equation is an example of a broader issue in the scientific community - considering the sheer size of the universe and our knowledge that intelligence life has evolved at least once, there should be evidence for alien life. This is generally referred to as the Fermi paradox, after the physicist Enrico Fermi who first examined the contradiction between high probability of alien civilizations and their apparent absence. Fermi summed this up rather succinctly when he asked, ***"Where is everybody?"***

But maybe this was the wrong question. A better question, albeit a more troubling one, might be ***"What happened to everybody?"*** Unlike asking where life exists in the universe, there's a clearer potential answer to this question: the Great Filter.

Why the Universe is Empty

Alien life is likely, but there is none that we can see. Therefore, it could be the case that somewhere along the trajectory of life's development, there is a massive and common challenge that ends alien life before it becomes intelligent enough and widespread enough for us to see - a great filter.

This filter could take many forms. It could be that having a planet in the Goldilocks' zone - the narrow band around a star where it is neither too hot nor too cold for life to exist - and having that planet contain organic molecules capable of accumulating into life is extremely unlikely. We've observed plenty of planets in the Goldilocks' zone of different stars (there's estimated to be 40 billion in the Milky Way), but maybe the conditions still aren't right there for life to exist.

The Great Filter could occur at the very earliest stages of life. When you were in high school bio, you might have the refrain drilled into your head "mitochondria are the powerhouse of the cell". I certainly did. However, mitochondria were at one point a separate bacteria living its own existence. At some point on Earth, a single-celled organism tried to eat one of these bacteria, except instead of being digested, the bacterium teamed up with the cell, producing extra energy that enabled the cell to develop in ways leading to higher forms of life. An event like this might be so unlikely that it's only happened once in the Milky Way.

Or, the filter could be the development of large brains, as we have. After all, we live on a planet full of many creatures, and the kind of intelligence humans have has only occurred once. It may be overwhelmingly likely that living creatures on other planets simply don't need to evolve the energy-demanding neural structures necessary for intelligence.

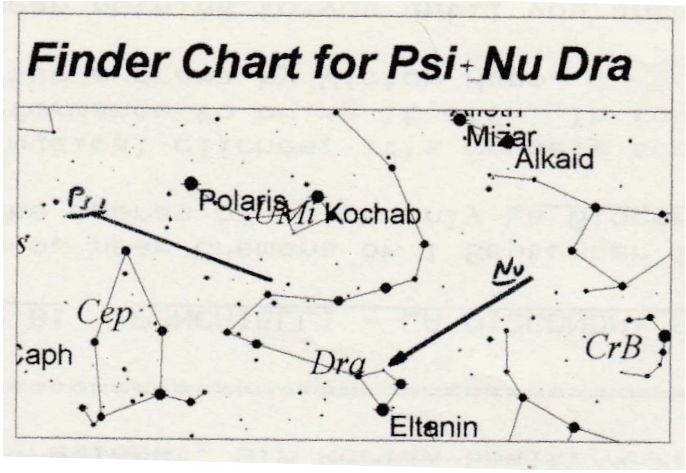
More at: https://bigthink.com/

The Very Large Array in New Mexico consists of 27 radio dishes designed to capture information from cosmic phenomena, like galactic collisions, the birth of stars, and others. It was also the point of the first contact from the movie "Contact" (ROBYN BECK/AFP/Getty Images)

My 100 Best Night Sky Sights

Double Stars

For those who prefer to concentrate their attention in small areas of sky rather than wander all over the place here's your chance to capture two double stars with little effort, as they both inhabit the same neighbourhood. You'll also have plenty of opportunity to view them as they're well positioned in the sky below the pole star from June to September.



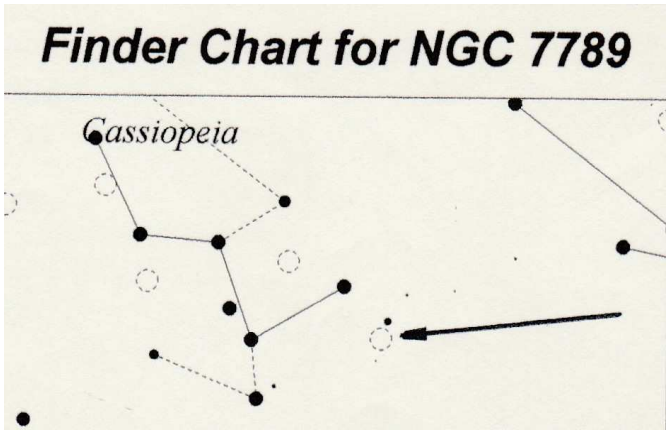
Psi Draconis, (RA 17h 41m 54s, Dec +72' 09") also known as Dziban, is a twin yellow double whose primary, shining at mag 4.6 is nicely set off by its mag 5.8 companion just half an arc minute away. There are in fact two other components to ψ Dra but at mags 11.4 and 12.9 they require a large telescope to reveal their presence.

Nu Draconis Kuma, (RA 17h 32m 12s, Dec +55' 11"), consists of white twins, both mag 4.9 and separated by twice the distance of their Psi cousins.

Both pairs are bright enough to see with the naked eye and ν Dra is certainly capable of being split in ordinary binoculars whilst ψ Dra is a good test. Telescopes of any aperture give excellent views of both, probably the most pleasing with low to moderate magnification – I prefer to use around 100x. It also gives me pleasure to move from one pair to the other and back again when the contrasts of colour and separation become pronounced.

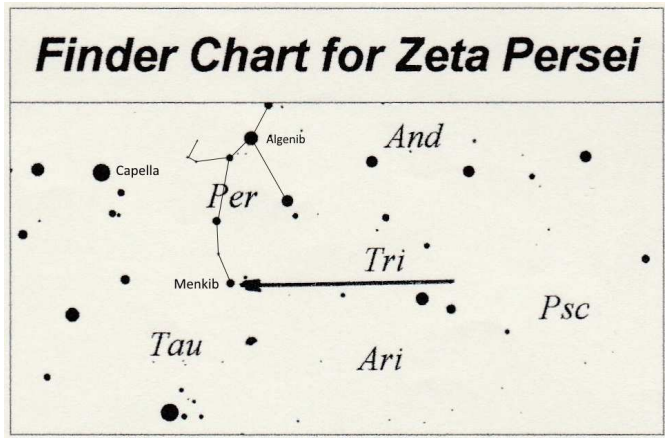
Open Cluster
RA 23h 57m 00s, Dec +56' 44"

One of the most underrated of all galactic clusters is ***NGC7789*** in Cassiopeia. Few stellar atlases mention it at all and, with one notable exception those that do tend to dismiss it as unworthy of attention. ***Don't believe them***! In two respects this cluster is almost unique. Firstly it appears to masquerade as a globular cluster, containing as it does around 1000 stars of which some 300 are visible in modest telescopes – far more than almost any other open cluster. Secondly although not one of these is brighter than a dim mag 10.7, the whole cluster succeeds in shining at a bright integrated magnitude of 6.7.



Through my 10″ many dozen stars are displayed evenly distributed looking just like a massive loose globular with one red star to the NE. It completely fills a 40mm field (63x) although a 13.8mm (180x) shows most of the central region. However undoubtedly the best view is with a 26mm when the 100x magnification encompasses most of the cluster and gives the distinct impression of an infinite number of faint stars shyly hiding behind their brighter family members. NGC7789 is so different from most other open clusters it just has to be on everyone's list. The best months for viewing are September to December.

Multiple Star
RA 03h 54m 06s, Dec +31' 53"

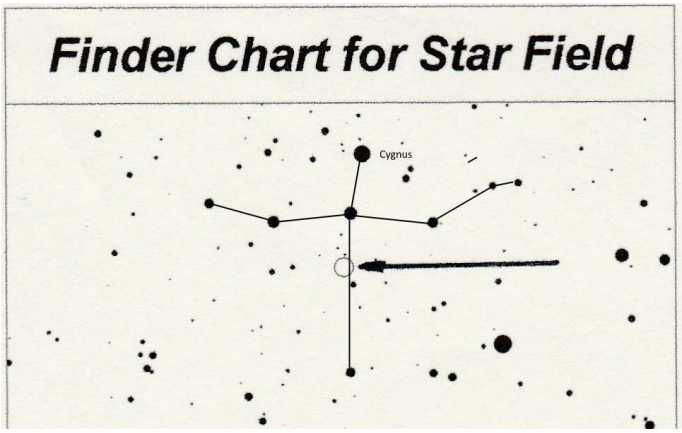


High in early to midwinter skies is the excellent multiple star ***Zeta Persei***, Atik, boasting no fewer than five components. What also makes ζ Per special is that for once ***all*** the family can be seen with modest telescopes, and what an attractive sight they make. At powers of up to 130x or so the primary, at mag 2.9 is a brilliant beacon accompanied by three of the junior family members strung out in a curving chain, looking for all the world as if they are trailing along dutifully behind their parent.

The brightness contrast is large, the trio of little ones glimmering at magnitudes of only 9 and 10 though all are

clearly seen - but where is the fifth? This bashful member of the family hides behind the bright raiment of its parent and to discover it you must look closer. Increase power to around 180x and the little one shyly reveals its presence, glimmering at mag 11 and huddling close to the side of its parent, away from the other family members. Menkib and its offspring are easy to locate as they live 7.5º due north of the Pleiades.

Star Field



Scanning the Milky Way with binoculars on a clear midsummer night is one of the great pleasures in which everyone can indulge. Doing the same through a telescope can be a less rewarding experience as although much dimmer and therefore more numerous stars are visible, the field of view is restricted and the overall effect correspondingly reduced. In addition, each adjacent part of the sky seems similar to the previous one and the novelty can quickly wane. Some areas however provide stellar spectacles through a telescope that most binoculars cannot hope to show. Unfortunately most of these reside 'down south', but there are a few in our skies and one of the very best displays its glories from the heart of Cygnus.

In my humble opinion this star field ranks among the most beautiful of galactic splendours and has to be viewed to be appreciated – no photograph can show its true glory and it's far too big for a CCD chip. Countless stars crowd the scene including many doubles and triples, one trio forming a perfect isosceles triangle right at the centre of the field. As a diversion from the more typical fare of the deep sky enthusiast this sight is highly recommended.

If your telescope is computer controlled or equipped with setting circles, centre it on RA 20h 05m, DEC +34º 45', otherwise use the accompanying finder chart but note that for clarity I've depicted the field much larger than it really is.

Bert Paice
Originally published in NZ - May 1999

How Do You Build on the Moon? Start with Lunar Dust

To learn how to build with moon dust, researchers are turning to volcanic powder here on Earth.

Several countries are planning lunar missions over the next decade, and some may choose to send human settlements to the moon's surface.

Many programs have recently tested out the habitability of lunar bases. In May 2018, Chinese student volunteers in Beijing completed a one-year test living in a simulated lunar lab. In October 2017, the International MoonBase Summit (IMS) convened in Hawaii to discuss building a mock structure to examine how a human settlement on the moon would work. And for two weeks in August 2017, six mock astronauts lived inside a simulated moon base in Poland.

But how would you build a base in the first place?

A 1.5 ton building block produced as a 3D-printing demonstration of lunar soil. Credit: ESA

The rough, fine dust that covers the moon's surface, known as regolith, may have structural potential. And researchers with the European Space Agency (ESA) recently announced their "lunar masonry" studies to see how it would fare.

Their idea is to try to break reliance on earthy construction materials, according to an Aug. 20 statement issued by ESA.

To get an idea of how one might make bricks from moon dust, researchers analyzed volcanic material near Cologne, Germany, where eruptions happened 45 million years ago. This volcanic powder is a good match for what lunar dust might be like, according to ESA officials, because the moon's surface is made of basaltic material called silicates that are common near planetary volcanoes.

More at: https://www.space.com/

The Rise of Machine Learning in Astronomy

When mapping the universe, it pays to have some smart programming. Experts share how machine learning is changing the future of astronomy.

Astronomy is one of the oldest sciences and the f*irst science to incorporate maths and geometry*. It sits at the centre of humankind's search for its place in the universe.

As we delve deeper into the space surrounding our planet, the tools we use become more complex. Astronomers have come a long way from tracking the night sky with the naked eye or cataloguing the stars with a pen and paper.

Modern astronomers use advanced computer programming techniques in their work - from programming satellites to teaching computers to analyse data like a researcher. *So what do astronomers do with their computers?*

Mo' Data, Mo' Problems

Big data is a big problem in astronomy. The next generation of radio and optical telescopes will be able to map huge chunks of the night sky. The Square Kilometre Array (SKA) will push data processing to its limits.

Built in two phases, the SKA will have over 2000 radio dishes and 2 million low-frequency antennas once finished. These antennas combined will produce over an exabyte of data each day - more than the world's internet usage per day. The data is then processed to be made manageable, meaning the size of the data that astronomers have to deal with will be smaller.

Project scientist for the Australian SKA Pathfinder Dr. Aidan Hotan explains.

"Data from a radio telescope array is very much like the flow of water through an ecosystem. The individual antennas each produce data, which is then transmitted over some distance and combined with other antennas in various stages - like smaller tributaries combining into a larger river," says Aidan.

"The largest data rate you can consider is the total raw output from each individual antenna, but in reality, we reduce that total rate to more manageable numbers as we flow through the system. We can combine the signals in ways that retain only the information we want or can make use of."

While the SKA will be the biggest project of its kind, many modern telescopes are capable of collecting data faster than humans are able to use it.

How to Find an Explosion

The SKA will be a game-changing tool for astronomers once complete. Already, astronomers are preparing their work for phase one of the SKA. To do this, they're working on ways to make their jobs quicker and easier by automating the recording and processing of data. *So what sort of work can astronomers automate?*

Dr. Gemma Anderson is a research associate at the International Centre for Radio Astronomy Research in Perth. There, she has programmed Australian radio telescopes to automatically monitor explosions in space.

"We have a telescope in space designed to look for explosions. The space telescope sends information back to Earth, and I have two of the big radio telescopes in Australia set up to receive that signal. When they get the signal, these telescopes stop what they're doing and try to observe the explosion as quickly as possible," Gemma says.

Gemma uses the Swift observatory, currently orbiting Earth, to find gamma ray bursts in space. The bursts are the short-lived, incredibly energetic by-product of dying stars.

Gemma and her team have programmed Australia's Murchison Widefield Array and Australia Telescope Compact Array to receive alerts from Swift and point to the source of the gamma ray burst.

In the past, telescope data like this was small enough for astronomers to work through themselves. Now, Gemma uses software that automates much of this process.

Data processing is such a big task that it needs to be done on supercomputers. Supercomputers are powerful computers that can often process vast amounts of data in hours instead of the months or years it would take on a standard laptop. The end product is an image that Gemma can use for research without needing to process the data herself.

"For those people interested in being an astronomer, it's very important to get experience in computer programming. We need to become more proficient in processing and analysing large amounts of data", Gemma says.

More at: https://phys.org

The Almighty Tussle Over Whether we Should Talk to Aliens or Not

Credit: David Clapp/Barcroft Images/Barcroft Media via Getty Images

Astronomers can't decide whether messaging ET would bring interstellar chaos or a new era of galactic collaboration. And what would we say?

In November 1962, at a radar station overlooking the Black Sea at the western edge of Crimea, humankind sent its first message to extraterrestrials. It consisted of just three Russian words in Morse code, bounced off of Venus and ultimately headed towards HD 131336, a star almost 2,160 light years away. The first word, Mir, can be variously translated as 'world' or 'peace'. The other words, Lenin, and SSSR, (the Latinised Russian acronym for the Soviet Union), were a little less ambiguous.

Unsurprisingly, we have not heard back from any extraterrestrial intelligence just yet. But since the Morse message, a handful of projects have sent messages beyond the confines of Earth. Some are ambitious attempts to condense human knowledge into a message decipherable by ET. The 1974 Arecibo message, composed by Frank Drake and Carl Sagan, sent graphics of DNA, humans and the solar system to a star cluster 25,000 light years away. In 1972 the Pioneer 10 spacecraft launched, carrying with it a plaque etched with a schematic of hydrogen and the spacecraft's trajectory around Jupiter and out of the solar system. Five years later, Voyager 1 carried its own interstellar missive, in the form of a golden record carrying images of humans, maps and music by Bach, Mozart, Blind Willie Johnson and Chuck Berry.

Other messages, if they are ever intercepted, may leave ET rather underwhelmed about the prospect of intelligent life elsewhere in the Universe. In 2008, Doritos beamed a 30-second advert towards a solar system in the Ursa Major constellation, just 42 light years away from Earth. Three years earlier, the online classified adverts site Craigslist sent over 100,000 posts into outer space, on the off chance that someone in a far off galaxy was in need of an IKEA Billy bookcase in perfect condition (collection only).

Amongst this hodgepodge of messages, there has never been a sustained, scientific attempt to send a message to aliens. While the search for extraterrestrial intelligence (SETI) has coalesced around a handful of well-funded and significant projects, such as Breakthrough Listen at the Berkeley SETI Research Centre and the China's FAST telescope, the scientists and amateur astronomers committed to messaging ET have mostly been left to go it alone. But why has the task of composing a message on behalf of the entire human race fallen to the handful researchers who are determined enough to push ahead with the project under their own steam? The problem, it turns out, is that no one can quite agree on the best way to message ET, or even if we should be doing it at all.

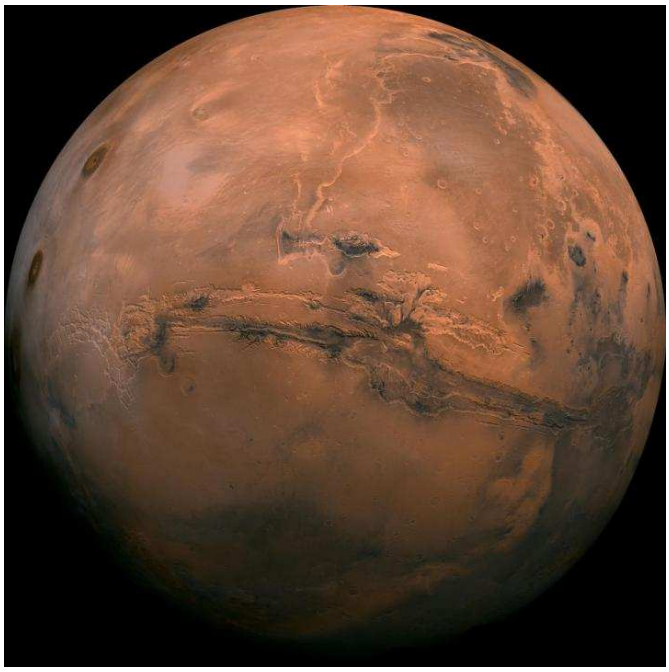
In the summer of 1997, just after finishing his dinner, Seth Shostak got the call that SETI researchers spend their lives waiting for. The SETI Institute, a not-for-profit organisation based in California that explores the origin of life in the Universe, had detected a signal from outer space directed exactly at the Earth. On the other side of the country, in West Virginia's Allegheny Mountains, an antenna was picking up a narrow-band signal – the kind that only transmitters can emit – that appeared to be coming from a fixed spot in space.

As Shostak, who is a senior astronomer at the SETI Institute, waited for his colleagues to check the signal against the frequency of known Earth satellite, conversation at the Institute turned to "the protocols". These are a set of principles that set out what should happen if researchers detect a sign of ET from outer space. The protocols, agreed by the International Academy of Astronautics in 1989, are brief – a little over 1,000 words that tell us what to do if we discover that we are no longer alone in the Universe.

There are nine parts to the "Declaration of Principles Concerning Activities Following the Detection of Extraterrestrial Intelligence". The first three deal with confirming that the signal is indeed a sign of extraterrestrial life and include sharing data about the finding with the UN and a long list of arcane-sounding bodies including the International Astronautical Federation, the International Institute of Space Law, Commission 51 of the International Astronomical Union and Commission J of the International Radio Science Union.

Read Much More at: https://www.wired.co.uk/

New Research Suggests Ancient Mars had Right Conditions for Underground Life



A new study shows evidence that ancient Mars probably had an ample supply of chemical energy for microbes to thrive underground.

"We showed, based on basic physics and chemistry calculations, that the ancient Martian subsurface likely had enough dissolved hydrogen to power a global subsurface biosphere," said Jesse Tarnas, a graduate student at Brown University and lead author of a study published in Earth and Planetary Science Letters. "Conditions in this habitable zone would have been similar to places on Earth where underground life exists."

Earth is home to what are known as subsurface lithotrophic microbial ecosystems - SliMEs for short. Lacking energy from sunlight, these subterranean microbes often get their energy by peeling electrons off of molecules in their surrounding environments. Dissolved molecular hydrogen is a great electron donor and is known to fuel SLiMEs on Earth.

This new study shows that radiolysis, a process through which radiation breaks water molecules into their constituent hydrogen and oxygen parts, would have created plenty of hydrogen in the ancient Martian subsurface. The researchers estimate that hydrogen concentrations in the crust around 4 billion years ago would have been in the range of concentrations that sustain plentiful microbes on Earth today.

The findings don't mean that life definitely existed on ancient Mars, but they do suggest that if life did indeed get started, the Martian subsurface had the key ingredients to support it for hundreds of millions of years. The work also has implications for future Mars exploration, suggesting that areas where the ancient subsurface is exposed might be good places to look for evidence of past life.

Going Underground

Since the discovery decades ago of ancient river channels and lake beds on Mars, scientists have been tantalized by the possibility that the Red Planet may once have hosted life. But while evidence of past water activity is unmistakable, it's not clear for how much of Martian history water actually flowed. State-of-the-art climate models for early Mars produce temperatures that rarely peak above freezing, which suggests that the planet's early wet periods may have been fleeting events. That's not the best scenario for sustaining life at the surface over the long term, and it has some scientists thinking that the subsurface might be a better bet for past Martian life.

"The question then becomes: What was the nature of that subsurface life, if it existed, and where did it get its energy?" said Jack Mustard, a professor in Brown's Department of Earth, Environmental and Planetary Sciences and a study coauthor. "We know that radiolysis helps to provide energy for underground microbes on Earth, so what Jesse did here was to pursue the radiolysis story on Mars."

The researchers looked at data from the gamma ray spectrometer that flies aboard NASA's Mars Odyssey spacecraft. They mapped out abundances of the radioactive elements thorium and potassium in the Martian crust. Based on those abundances, they could infer the abundance of a third radioactive element, uranium. The decay of those three elements provides the radiation that drives the radiolytic breakdown of water. And because the elements decay at constant rates, the researchers could use the modern abundances to calculate the abundances 4 billion years ago. That gave the team an idea of the radiation flux that would have been active to drive radiolysis.

The next step was to estimate how much water would have been available for that radiation to zap. Geological evidence suggests there would have been plenty of groundwater bubbling about in the porous rocks of the ancient Martian crust. The researchers used measurements of the density of the Martian crust to estimate roughly how much pore space would have been available for water to fill.

Finally, the team used geothermal and climate models to determine where the sweet spot for potential life would have been. It can't be so cold that all water is frozen, but it also can't be overcooked by heat from the planet's molten core.

Combining those analyses, the researchers conclude that Mars likely had a global subsurface habitable zone several kilometers in thickness. In that zone, hydrogen production via radiolysis would have generated more than enough chemical energy to support microbial life, based on what's known about such communities on Earth. And that zone would have persisted for hundreds of millions of years, the researchers conclude.

The findings held up even when the researchers modelled a variety of different climate scenarios - some on the warmer side, others on the colder side. Interestingly, Tarnas says, the amount of subsurface hydrogen available for energy actually goes up under the extremely cold climate scenarios. That's because a thicker layer of ice above the habitable zone serves as a lid that helps to keep hydrogen from escaping the subsurface.

"People have a conception that a cold early Mars climate is bad for life, but what we show is that there's actually more chemical energy for life underground in a cold climate," Tarnas said. "That's something we think could change people's perception of the relationship between climate and past life on Mars."

Exploration Implications

Tarnas and Mustard say the findings could be useful in thinking about where to send spacecraft looking for signs of past Martian life.

"One of the most interesting options for exploration is looking at megabreccia blocks - chunks of rock that were excavated from underground via meteorite impacts," Tarnas said. "Many of them would have come from the depth of this habitable zone, and now they're just sitting, often relatively unaltered, on the surface"

Mustard, who has been active in the process of selecting a landing site for NASA's Mars 2020 rover, says that these kinds of breccia blocks are present in at least two of the sites NASA is considering: Northeast Syrtis Major and Midway.

"The mission of the 2020 rover is to look for the signs of past life," Mustard said. "Areas where you may have remnants of this underground habitable zone - which may have been the largest habitable zone on the planet - seem like a good place to target."

More at: https://news.brown.edu/

A Few Pioneers of Astronomy

Nicolaus Copernicus (1473-1543), was a physician and lawyer by trade. His fascination with numbers and the study of the motions of celestial objects made him the so-called "father of the current heliocentric model" of the solar system.

Tycho Brahe (1546-1601) was a nobleman who designed and built instruments to study the sky. These were not telescopes, but calculator-type machines that allowed him to chart the positions of planets and other celestial objects with great precision. He hired **Johannes Kepler (1571-1630)**, who started as his student. Kepler continued Brahe's work, and also made discoveries of his own. He is credited with developing the three laws of planetary motion.

Galileo Galilei (1564-1642) was the first to use a telescope to study the sky. He is sometimes credited (incorrectly) as the creator of the telescope. Galileo made detailed studies of heavenly bodies. He concluded that the Moon was likely similar in composition to planet Earth and that the Sun's surface changed (i.e. the motion of sunspots on the Sun's surface). He was also the first to see four of Jupiter's moons, and the phases of Venus. His observations of the Milky Way, and the detection of countless stars shook the scientific community.

Isaac Newton (1642-1727) is considered one of the greatest scientific minds of all time. He deduced the law of gravity and realized the need for a new type of mathematics (calculus) to describe it. His discoveries and theories dictated the direction of science for more than 200 years and truly ushered in the era of modern astronomy.

Albert Einstein (1879-1955), famous for his development of general relativity, a correction to Newton's law of gravity. His famous discovery that $E=mc^2$ is important to astronomy, as it is the basis for our understanding of how the Sun, and other stars, fuse hydrogen into helium.

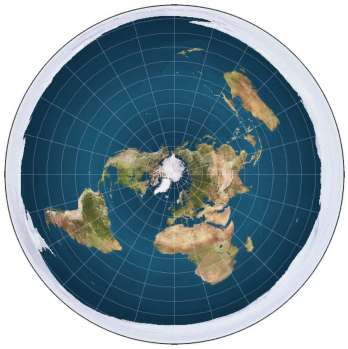
Edwin Hubble (1889-1953) is the man who discovered the expanding universe. Hubble answered two of the biggest questions plaguing astronomers at the time. He determined that so-called spiral nebulae were, in fact, other galaxies, proving that the Universe extends well beyond our own galaxy. Hubble then followed up that discovery by showing that these other galaxies were receding at speeds proportional to their distances away from us.

Stephen Hawking (1942-2018), one of the great modern scientists. Few others have contributed more to the advancement of their fields than Stephen Hawking. His work increased our knowledge of black holes and other exotic celestial objects. He also made significant strides in advancing our understanding of the universe and its creation.

THE BACK PAGE

LINKS, COMMENTS AND OBSERVATIONS

How Do Flat-Earthers Explain the Equinox?



The autumn equinox has just been reached. On Saturday (Sept. 22), the sun shone directly on the Earth's equator, autumn officially began in the northern hemisphere, and the length of day and night was nearly equal across the globe... or, "across the disc," if you're a flat-Earther.

For flat-Earthers — the vocal online community of folks who believe the world is actually flat and science is a conspiracy — the equinox can be tricky to explain. Without axial tilt, the phenomenon in which the rotating, spherical Earth angles its poles toward or away from the sun, how can the changing seasons be reliably explained? How can sunrises and sunsets occur if the sun is constantly shining on the entire, flat surface of the planet? If the North Pole sits at the exact center of the world, can compass directions even exist? [*7 Ways to Prove the Earth Is Round*]

Flat-Earth thinkers have come up with many answers to these niggling questions over the last century or so, and we've scoured the literature to share the explanations with you. Be warned: Understanding them requires discarding a few thousand years of what you might consider accepted scientific knowledge. For starters, forget the heliocentric model of the solar system. You won't need it here.

The Sun is Really, Really Small

In the most popular flat-Earth maps, the North Pole sits roughly at the center of the planetary disc, while Antarctica forms a giant ice wall along the planet's circumference. The equator forms a ring hallway between the two.

Many flat-Earthers agree that the sun perfectly circles the ring of the equator on the equinox; however, to account for the equal hours of daytime and nighttime, the models make a few tweaks to how the sun itself looks and behaves.

While you might envision the sun as an enormous ball of exploding gas located 93 million miles (150 million kilometers) away, a flat-Earther would see it as a teeny, tiny spotlight hovering just over the Earth. How teeny and how close is it? According to the early flat-Earth thinker Samuel Birley Rowbotham, who published the influential treatise "Zetetic Astronomy: Earth Not a Globe" in 1881, the sun is only about 32 miles (52 km) in diameter and hovers anywhere from 400 to 700 miles (640 to 1,130 km) above the Earth, depending on the month.

Many modern flat-Earthers now believe that the sun sits about 3,000 miles (5,000 km) over the Earth, but Rowbotham's general idea remains popular in the community. Here's how members of the Flat Earth Society (one of the foremost flat-Earth activist groups in the world) describe the idea on their official wiki page:

"The sun moves in circles around the North Pole. When it is over your head, it's day. When it's not, it's night. The light of the sun is confined to a limited area, and its light acts like a spotlight upon the Earth."

Enjoy the animations and more at:

https://www.space.com/41915-flat-earth-explanation-for-the-equinox.html

Observatory

For your own safety, please bring a torch. Also, please 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.
Contact details on page 1.

"If we wish to make a new world we have the material ready. The first one, too, was made out of chaos"
Robert Quillen

"Science is the great antidote to the poison of enthusiasm and superstition"
Adam Smith

"Research is the process of going up alleys to see if they are blind"
Marston Bates

"Should we force science down the throats of those that have no taste for it? Is it our duty to drag them kicking and screaming into the twenty-first century? I am afraid that it is"
George Porter