New Zenith

The Monthly Newsletter of the Vectis Astronomical Society

Vol 27 Issue 11 — December 2019 & January 2020 *When Printed, this Newsletter costs VAS at least £1*

SOCIETY NEWS

Well that's about it for another year!

As most members know, NZ takes a bit of a break for a month, so the next issue will be February 2020.

I hope you all have a good Christmas break and, judging by the recent efforts of the Dark Skies Initiative, it could well be a great New Year for VAS, the AONB, CPRE, IW Council and the whole Island.

As part of the Christmas holiday, the observatory will be closed on Thursday December 27th this year.

Recent Mercury Transit

A few members and visitors went along to the observatory on Mon 11th Nov to try a get a view of Mercury passing in front of the sun. The sky was somewhat clear, although a little windy, however a persistent band of cloud stayed across the sun. Very difficult to observe visually as it's so hard to line up and incredibly small. However we did manage to get a few glimpses in the cloud breaks all were pleased they came along. Great opportunity to put the solar filters into action and Richard brought along his Coronado.

Transit photo on Page 9.

Brian Curd
Observatory Director and NZ Editor

VAS Website: wightastronomy.org

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

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.

Registered Charity No 1046091

Observatory Diary

Monday, 19.30hrs	Members Only and by arrangement Telescope and night sky training. Please contact Martyn Weaver 07855 116490
Thursday	Members (19.30hrs) and Public (20.00hrs). Informal meeting and observing

VAS Website: wightastronomy.org

Contents this Month

2019 Monthly Meetings

Date	Subject	Speaker
Check *http://www.wightastronomy.org/meetings/* for the latest information		
22 Nov	How (on Earth) did Life Start?	James Fradgley

2020 Monthly Meetings

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

Observatory Visits Booked

No bookings so far

Please phone me for the current situation (number on the front page)

It would be appreciated if members could avoid using the observatory at these times.

IMPORTANT

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

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

VAS Contacts 2018/19

President	Barry Bates president@wightastronomy.org
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NZ Distribution	Graham Osborne distribution@wightastronomy.org
Others	Dudley Johnson

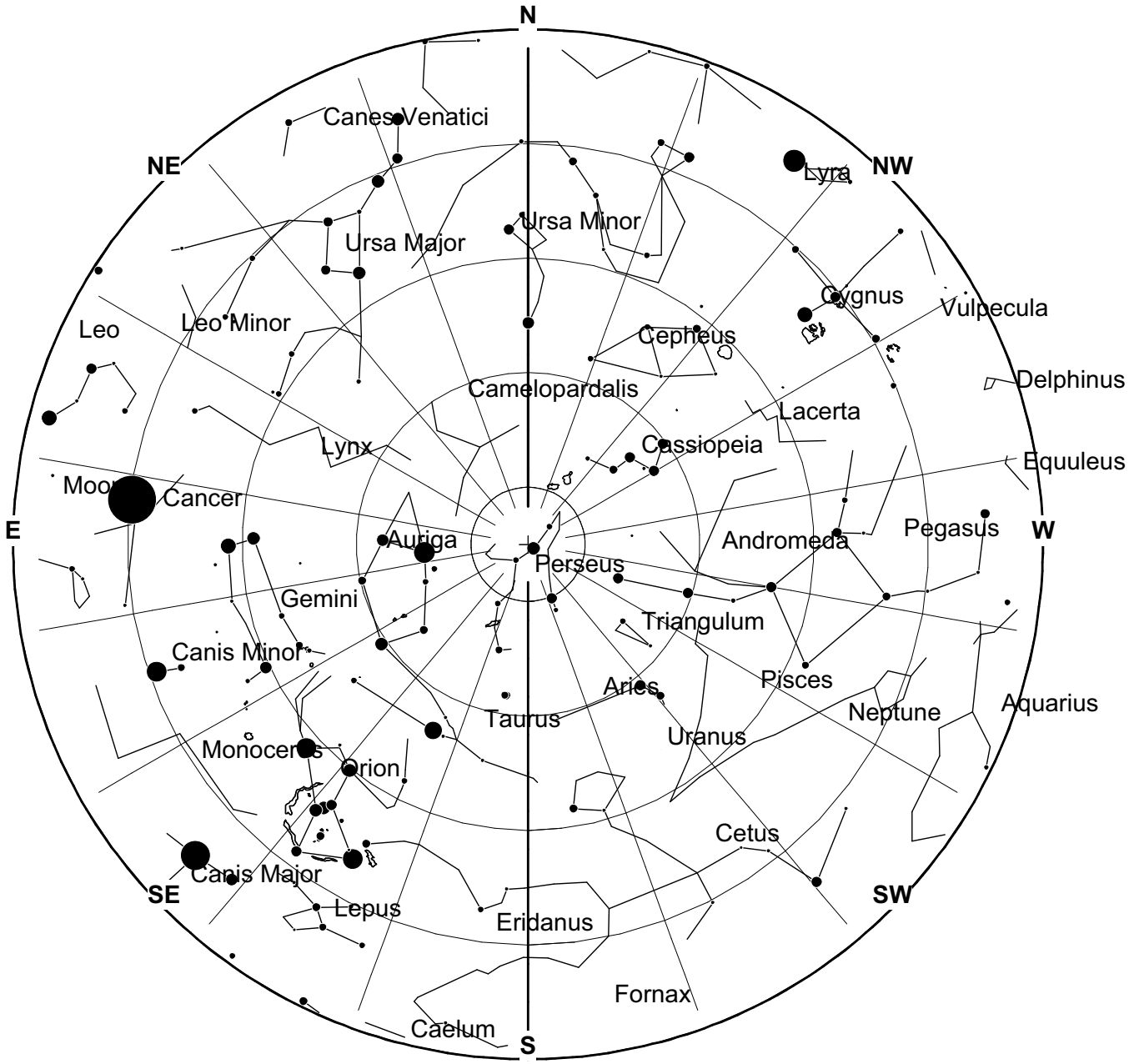
Important

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

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

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

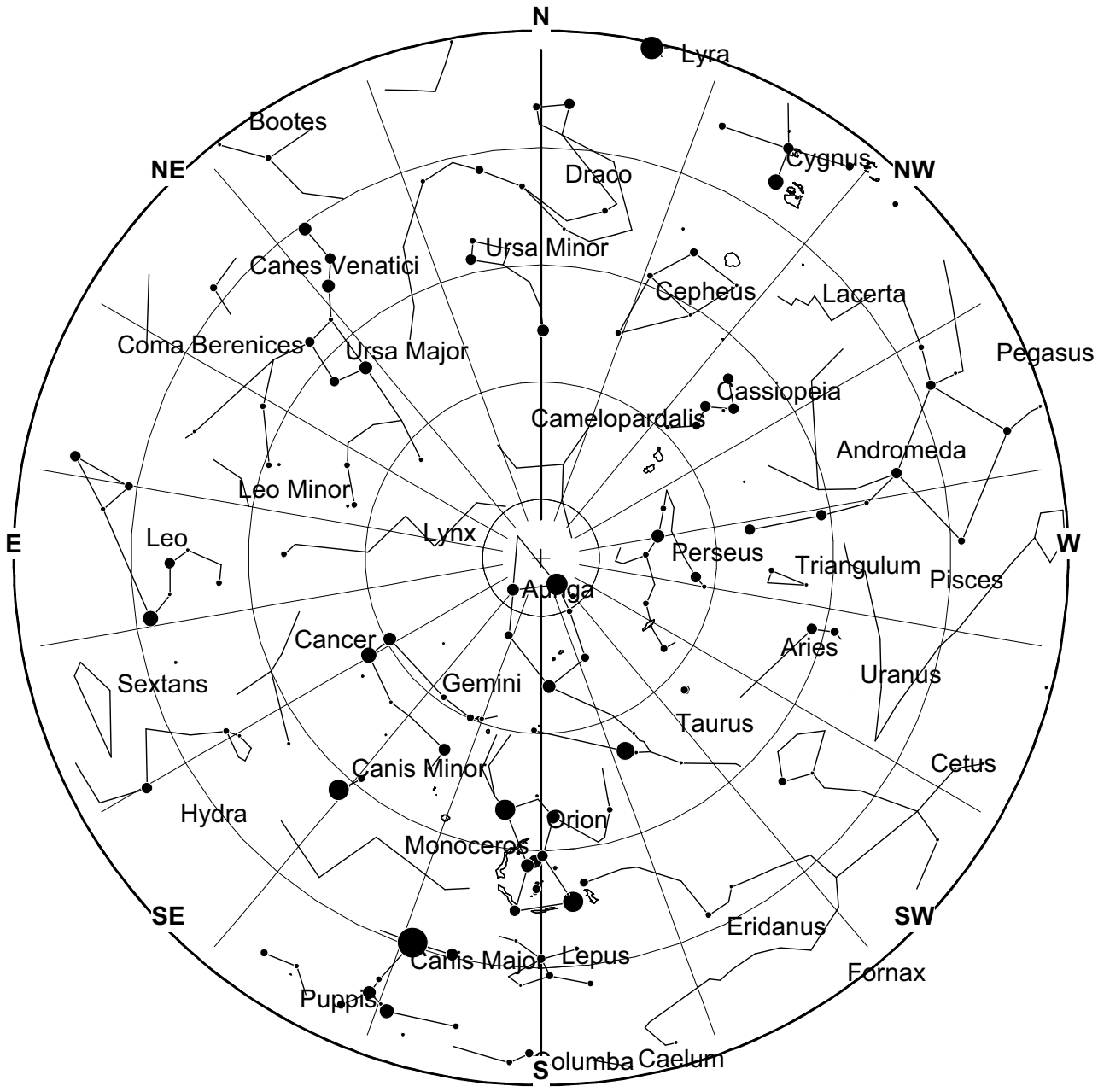
DECEMBER 2019 SKY MAP



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

NGC 457 (also known as the Owl Cluster, the ET Cluster, or Caldwell 13) is an open star cluster in the constellation Cassiopeia. It was discovered by William Herschel in 1787, and lies over 7,900 light years away from the Sun. It has an estimated age of 21 million years. The cluster is sometimes referred by amateur astronomers as the Owl Cluster, Kachina Doll Cluster, the ET Cluster (due to its resemblance to the movie character) or the "Skiing Cluster". Two bright stars, magnitude 5 Phi-1 Cassiopeiae and magnitude 7 Phi-2 Cassiopeiae can be imagined as eyes. The cluster features a rich field of about 150 stars of magnitudes 12-15.

JANUARY 2020 SKY MAP



View from Newchurch Isle of Wight UK - 2200hrs - 15 January 2020

The **Little Dumbbell Nebula**, also known as NGC 650/651, the Barbell Nebula, or the Cork Nebula, is a planetary nebula in the constellation Perseus. It was discovered by Pierre Méchain in 1780 and included in Charles Messier's catalog of comet-like objects as number 76. It was first recognised as a planetary nebula in 1918 by the astronomer Heber Doust Curtis. However, there is some contention to this claim, as Isaac Roberts in 1891 did suggest that M76 might be similar to the Ring Nebula (M57), being instead as seen from the side view. The structure is now classed as a bipolar planetary nebula. Distance to M76 is currently estimated as 2,500 light years.

DECEMBER/JANUARY NIGHT SKY

Winter Solstice

The winter solstice, the time when the Sun reaches its most southerly point in the sky occurs on December 22 at 04:19. From this point on the Sun starts its journey back to the north and the days here start to lengthen.

Moon Phases

New	First Qtr	Full	Last Qtr
Dec 26th Jan 24th	Dec 4th Jan 3rd	Dec 12th Jan 10th	Dec 19th Jan 17th

Planets

Mercury

During the first week of December Mercury can be seen low in the southeast before sunrise and during the last week of January can be seen low in the southwest just after sunset. Neither apparition is very good.

Venus

Venus can be seen as the Evening Star throughout December and January, getting higher in the sky throughout the period. It is a very bright and unmistakable object.

Mars

Mars can be seen low in the south-south-east before sunrise. During the last half of January it is quite close to the bright star Antares, the opposite of Mars. See how similar they are in colour.

Jupiter

During the first two weeks of December Jupiter disappears into the evening twighlight. It may just be glimpsed again low down in the southeast during the last few days of January as it re-appears again in the morning sky just before sunrise.

Saturn

Saturn closely follows Jupiter into the setting Sun. On the 12th of December it is in close conjunction with the much brighter Venus.

Uranus

Uranus lies roughly on a line between the fourth magnitude star Mesarthim in Aries and the slightly fainter Xi2 Ceti. It is about 8 degrees south of Mesarthim and 5 degrees north of Xi2.

Neptune

Over the coming two months Neptune moves from about midway between Phi Aquarii and 81 Aquarii back towards Phi. On the 27th of January it is in close conjunction with the very much brighter Venus. The conjunction occurs when the pair are quite low in the sky, this coupled with the brightness difference between the two planets will make this a challenging event to observe.

Deep Sky

NGC457 The Owl or ET Cluster
RA 1h 20m Dec 58° 20' mag 6.4

Best viewed in large binoculars or a low powered telescope, it is visible in 10x50s but the ET outline is just a little too small, it really needs more than 10 times magnification, but not too much. The star Phi Cass and a close companion make the two bright eyes and two more chains make the arms and body of the stick figure.

M76 The Little Dumbbell Nebula
RA1h 43m Dec 51° 37' mag 12

Just under 1° in the direction of Cassiopeia from Phi Persei lies one of the faintest of the Messier objects; a small bipolar planetary nebula that, as its name implies looks like a miniature version of the famous Dumbbell Nebula. At magnitude 12, it is beyond the reach of all but the largest binoculars, however in medium sized telescopes, with averted vision the two halves of the dumbbell can be seen. It was once considered to be two distinct objects and was given two NGC numbers NGC651 & 651

NGC1662 Open Cluster
RA 4h 49m Dec 10° 54' mag 6.4

About 2° towards the Hyades from the northern tip of Orion's shield can be found this large but rather sparse group of stars. About half way along the lower edge is a small diamond of tenth magnitude stars that along with an 11th magnitude outsider form a group that has a resemblance to a miniature, slightly squashed Delphinus.

NGC1647 Open Cluster
RA 4h 46m Dec 19° 7'

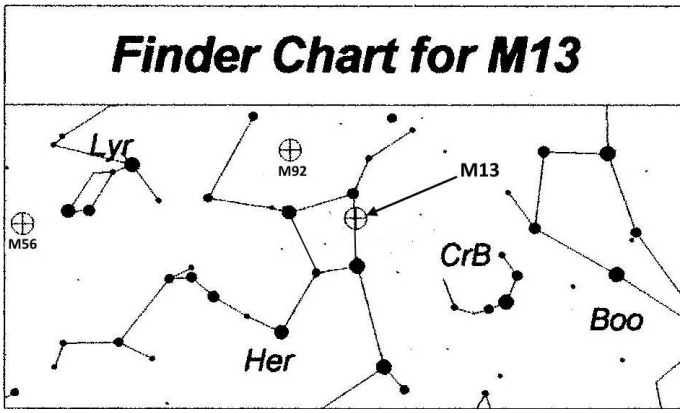
Scanning with a pair of 10x50 binoculars from Aldebaran towards Elnath, (the star often shown shared with Auriga) just as Aldebaran is leaving the field of view there in the centre should be a fuzzy triangular patch of stars about the same size as the full moon. This is NGC1647. Like many galactic clusters aperture is more important than magnification, an increased aperture will show more members of the cluster and allow them to be resolved whereas magnification will lessen the visual impact of the overall cluster.

Peter Burgess

MY 100 BEST NIGHT SKY SIGHTS

So we reach the final article of the series, which has run for 26 issues of the New Zenith. I set out to provide what I consider to be the 100 best sights visible from the Isle of Wight through modest telescopes or binoculars. As many have other fine objects associated with them directly or by virtue of being in the same field of view the 100 expanded to 111. Recent articles included the best in each object category, here to conclude are the last four.

Globular Cluster



***Coordinates**: **M13**, RA 16h 41m 42s, Dec +36° 28'*

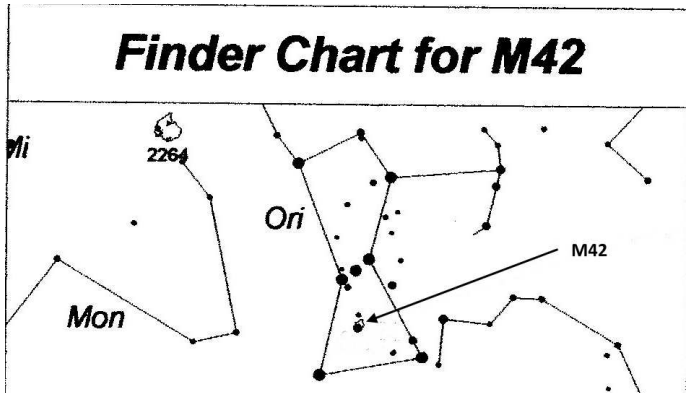
High in summer night skies Hercules goes about his 12 labours wielding a club (the original night-club?). He also carries with him the most celebrated globular cluster visible from here. ***M13*** is truly magnificent; 16.6' across it covers an area over half that of the moon and at mag 5.9 is also bright. Easily seen in binoculars as a fuzzy 'star', the smallest telescope shows it to be no single star. Containing over 300,000 stars (some estimate nearer one million), if we were at its centre Heinrich Olbers would not have asked 'Why is the sky dark at night' as it wouldn't be dark, but ablaze with thousands of stars as bright as Sirius.

Locate the four stars of the Keystone of Hercules and, using a low power find Eta, the top right-hand one. Pan one-third of the way south towards Zeta (bottom right-hand) and M13 will blaze into view. A 4" telescope shows a bright white core with tiny sparkling grainy stars around the periphery. A 10" spreads the grains right across the cluster incredibly seen gleaming against the white glow of the dense centre. M13 will take high magnification and, in 8-10" instruments at around 250x, completely fills the field with stars streaming in long, curving chains away from the centre – a magnificent spectacle.

No photographs show what you can see through a modest telescope, the centre burnt out through overexposure to record the outer stars – you must see it for yourself and treat your neighbours to yet another exclamation of delight.

While you're in the neighbourhood, take a look at M92, also identified on the chart. It's a little further away from us – 26000 light years as against M13's 23000, more compact, smaller and less bright but still a fine sight in a 6". See New Zenith September 2018.

Emission Nebula



***Coordinates**: **M42**, RA 05h 35m 24s, Dec -05° 27'*

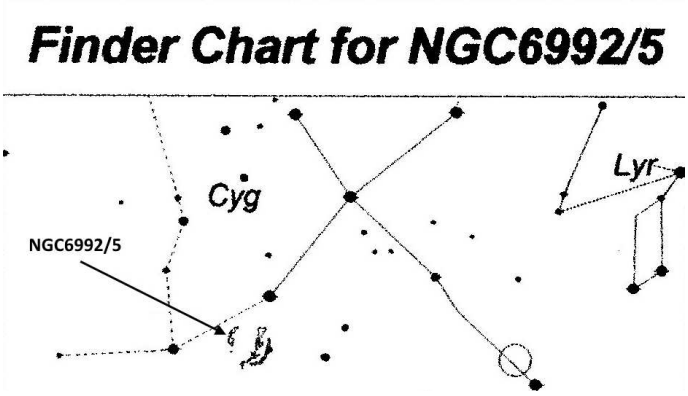
The Great Orion Nebula is arguably the greatest spectacle in the whole sky. Most emission nebulae if bright are also small or, if large, are also dim, but not this one. M42 is both bright and huge, four times the area of the moon, completely overflowing the field of all but the richest field telescopes and if this were not all, it's ***green***.

Inadequacy of photographs is never more revealed than with M42 – to show nebula detail the stars are blotted out, but viewed directly through telescopes all is visible. A glowing profusion of grey-green gases and four brilliant baby stars of the Trapezium, exciting this stellar nursery to luminescence, combine to produce a scene of unparalleled splendour.

Binoculars reveal the true nature of the central 'star' of Orion's sword, albeit a tiny image. ***Any*** telescope provides a stunning scene of swirling clouds surrounding their progeny. In a 10" the wealth of detail is incredible – John Herschel described it as 'the breaking up of a mackerel sky'. Whirling lanes of dark matter intermingle with glowing gasses seemingly flowing away either side of the Trapezium, reminiscent of a bird in flight with backswept wings. This is enhanced by the smaller and less bright nebula M43, in reality part of M42 but separated by obscuring dust and gas, and looking like the bird's head and beak.

Use every eyepiece you possess, and especially an Olll filter if you have one, to appreciate fully this magnificent nebula and set aside a large chunk of time to view it. Best of all invite friends and neighbours to share the spectacle – your own enjoyment will be immeasurably enhanced by their gasps of astonishment.

Supernova Remnant



***Coordinates: NGC6992/5**, RA 20h 56m 42s, Dec +31° 28'*

To me there's no more hauntingly beautiful sight in the heavens than ***NGC 6992/5*** in Cygnus, the eastern part of the Veil Nebula. In March I described the western portion, noting that it's not so difficult to find as some hold as it straddles the brightish star 52 Cyg. NGC 6992/5 has no such aid to location, which means a little more effort on your part. You're rewarded handsomely however as 52 Cyg interrupts the view somewhat whereas the eastern part is unsullied by stars save the glittering background of the Milky Way.

As with NGC 6960 you really need at least an 8" telescope and preferably 10" to view the Veil in all its glory. If you can beg or borrow an Olll filter do so, it makes an immense difference. Spreading well over 1º of sky this pale filamentary fragment of a one-time star glimmers gently. Some years ago I gave my impression of this exquisite sight and, for the first (and only) time, I repeat part of a previous article.

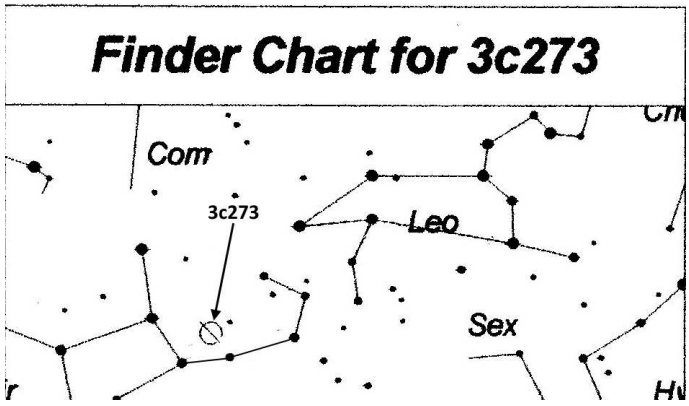
Imagine a length of the most diaphanous chiffon suspended ghostly grey-white against a black velvet backdrop. Imagine further the faintest zephyr gently nudging it into a graceful arc – a curving, twisting wisp of translucent material.

That's how the Veil Nebula appears to me, with the added sparkle of minute Milky Way stars peeping through the 'velvet', adding lustre to a scene never to be forgotten. Yet this description falls light years short of the sheer beauty of the spectacle seen directly through the telescope. Do try it in August or September.

Quasar

***Coordinates: 3c273**, RA 12h 29m 06s, Dec +02° 03'*

I conclude the series with the most innocuous, dim and unspectacular object you're ever likely to see. On my scale of 1 to 10 its appearance would rate nearly zero. Buried in the dark regions of Virgo is ***3c273*** (it doesn't even rate a name), a ***quas***i-stell***ar*** object, so called as even the greatest telescopes only show a point of light. So why include it here?



At the outset I said I'd note the best in each object ***category***. At mag 12.8, this is the ***only*** quasar visible to us amateur astronomers (no other exceeds mag 16). Theoretically seen with a 5"'scope, you really need at least a 6" ***and*** very clean skies. Best found from Leo whose two 'rear end' stars point to it, location will be confirmed if you glimpse a dim, bluish point of light.

Undoubtedly the furthest object you'll ever see through any telescope, 3c273 lies at the enormous distance of over 3,000,000,000 light years so, when you gaze at this unremarkable spot, consider that the light you see left the quasar before life began on earth.

Originally published March 2000

Bert Paice

Editor's Note

I really hope you have enjoyed these articles. Bert really did a great job when these were first included in NZ.

If you have followed the series and followed the information, I'd like to think there may be a few members who have taken photographs. If you are one of them, please send them in to the me (email address on page 1) and I'll put them in NZ.

It's almost 20 years since this information was last published in our newsletter and it is fascinating that, apart from a few cosmetic updates, nothing has changed.

Thanks Bert! A great set of articles that will hopefully last everyone another 20 years!

42 YEARS ON, VOYAGER 2 CHARTS INTERSTELLAR SPACE

A probe launched by NASA four days after Elvis died has delivered a treasure trove of data from beyond the "solar bubble" that envelops Earth and our neighbouring planets. But for every mystery Voyager 2 has solved about the solar winds, magnetic fields and cosmic rays that buffet the boundary between interstellar space and the Sun's sphere of influence, a new one has cropped up.

Shaped something like a windsock in a stiff breeze, the heliosphere is formed by the Sun's magnetic field and solar winds that can reach speeds of three million km/h.

It can be compared to a cosmic supertanker ploughing through space, said Edward Stone, a professor at the California Institute of Technology and lead author of one of five articles published in Nature Astronomy.

"As it moves through the interstellar medium" - there's a wave in front, just as with the bow of a ship," Stone told journalists by phone.

Scientists hoped to answer a number of questions by comparing data sent back by the two probes, which pierced the Sun's protective bubble at different angles and locations.

Particle 'leakage'

"We didn't have any good quantitative data of how big this bubble is that the Sun creates around itself with supersonic solar wind and ionised plasma speeding away in all directions," Stone said.

Voyager 2 confirmed, for example, the existence of a "magnetic barrier" at the outer edge of the heliosphere that had been predicted by theory and observed by Voyager 1.

"But contrary to expectations and predictions, the magnetic field direction did not change when Voyager 2 crossed the heliopause," Leonard Burlaga, of Goddard Space Flight Center and lead researcher, told AFP.

The so-called heliopause is the relatively thin contact boundary where solar wind of charged particles and interstellar wind collide.

Scientists were also surprised that it took 80 days for Voyager 2 to cross this magnetic barrier, while its sister probe did so in less than a day. And then there's the leakage enigma.

As Voyager 1 crossed the heliosphere threshold, it detected particles from outer space - notably cosmic rays, racing the other way.

"On Voyager 2, it was just the opposite," said Stone. "Once we left the heliosphere, we continued to see particles leaking from the inside out." It was a similarity between the missions that was perplexing.

"This is very strange," said Tom Krimigis, a scientist in the Applied Physics Laboratory at Johns Hopkins University and senior author of a study reporting on measurements of charged particles. "One crossing (of the heliopause) occurred at the solar minimum, and the other at the solar maximum," he told journalists. "If we take our models at face value, we expect that there would be a bigger difference."

The Sun's activity waxes and wanes in 11-year cycles.

The missions also measured incoming cosmic rays that grew stronger as the probes approached heliopause, with direct implications for the health of manned space missions into deep space.

"If an astronaut moves closer to the source of cosmic rays, it is going to be important to understand how much intensity there is," Stone said. "A factor of three is big when we're talking about the affect of radiation on life."

Built to last five years, Voyager 1 and Voyager 2 set out to explore the solar system's outer planets. After 42 years in action, they are still going strong, although both will run out of power and fall silent within five years.

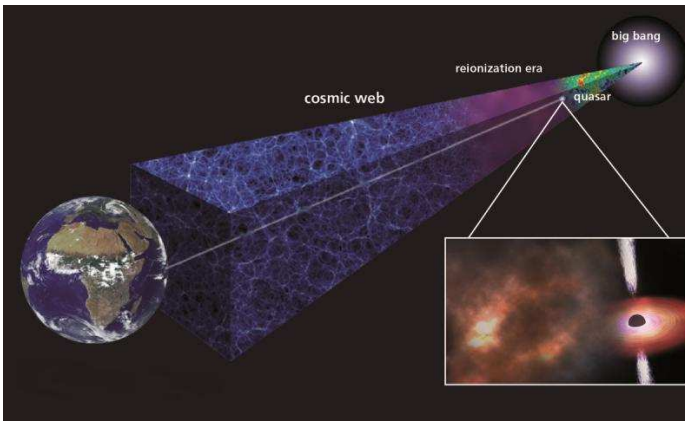
But that does not mean they will disappear, said Bill Kurth, a researcher at the University of Iowa and co-author of the study focusing on plasma waves.

"They will outlast Earth," he said. "They are in their own orbits around the galaxy for five billion years or longer, and the probability of them running into anything is almost zero."

If intelligent life in a far corner of the Milky Way finds either probe one day, a "golden record" including drawing of a naked man and woman, bird and whale songs, and "Johnny B. Goode" by Chuck Berry will be on board.

Read more at: https://phys.org/

Ancient Gas Cloud Reveals That the Universe's First Stars Formed Quickly



An ancient gas cloud discovered by a team led including recent Carnegie-Princeton fellow Eduardo Bañados and Carnegie's Michael Rauch and Tom Cooper formed just 850 million years after the Big Bang. Its chemical composition reveals that the first generation of stars formed quickly and rapidly and enriched the universe with the elements they synthesized. Illustration is courtesy of the Max Planck Society.

The discovery of a 13 billion-year-old cosmic cloud of gas enabled a team of Carnegie astronomers to perform the earliest-ever measurement of how the universe was enriched with a diversity of chemical elements. Their findings reveal that the first generation of stars formed more quickly than previously thought. The research, led by recent Carnegie-Princeton fellow Eduardo Bañados and including Carnegie's Michael Rauch and Tom Cooper, is published by The Astrophysical Journal.

The Big Bang started the universe as a hot, murky soup of extremely energetic particles that was rapidly expanding. As this material spread out, it cooled, and the particles coalesced into neutral hydrogen gas. The universe stayed dark, without any luminous sources, until gravity condensed matter into the first stars and galaxies.

All stars, including this first generation, act as chemical factories, synthesizing almost all of the elements that make up the world around us. When the original stars exploded as supernovae, they spewed out the elements that they created, seeding the surrounding gas. Subsequent generations of stars incorporated these elements and steadily increased the chemical abundances of their surroundings.

But the first stars formed in a still pristine, cold universe. Consequently these initial stars produced elements in different proportions than those synthesized by younger stars, which were formed in an environment that was already enriched by earlier generations.

"Looking back in time far enough, one may expect cosmic gas clouds to show the tell-tale signature of the peculiar element ratios made by the first stars," said Rauch. "Peering even further back, we may ultimately witness the disappearance of most elements and the emergence of pristine gas."

Astronomers have long used quasars to learn about the chemical composition of cosmic gas over time, showing how different generations of stars enrich their surroundings.

"We found this ancient gas cloud when following up on an inventory of very distant quasars using the Magellan telescopes at Carnegie's Las Campanas Observatory in Chile," explained Bañados, who is now a group leader at the Max-Planck Institute for Astronomy in Heidelberg.

Quasars are tremendously luminous objects comprised of enormous black holes accreting matter at the centers of massive galaxies. Because the gas cloud exists between the quasar and us on Earth, the quasar's incredibly bright light must pass through it to get to us and astronomers can take advantage of this to understand the cloud's chemistry. This discovery presented an unprecedented opportunity to characterize a gas cloud from the first billion years of cosmic history.

Read more: https://carnegiescience.edu/

Mercury's Transit

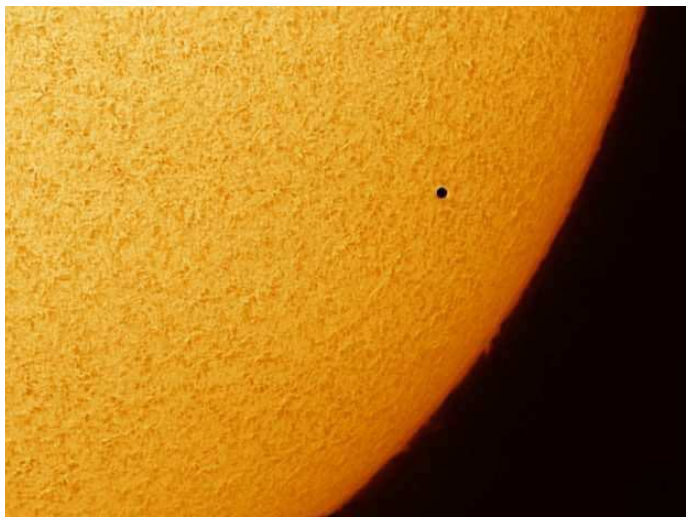
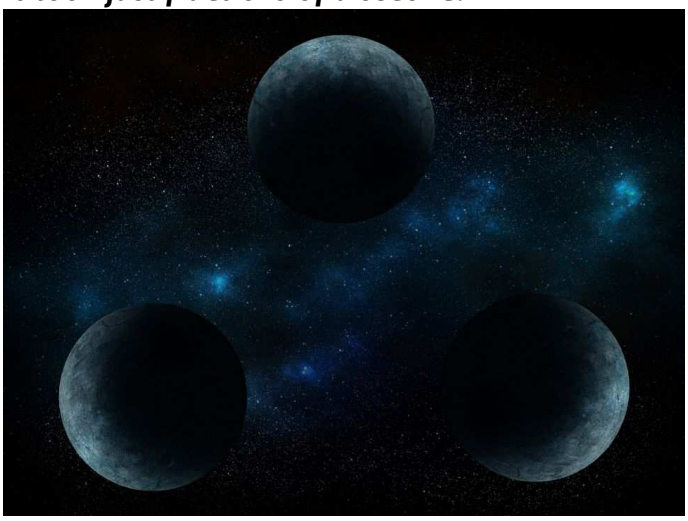


Photo by John Slinn

THE 'THREE-BODY PROBLEM' HAS PERPLEXED ASTRONOMERS SINCE NEWTON FORMULATED IT. A.I. JUST CRACKED IT IN UNDER A SECOND

It took just fractions of a second!



The mind-bending calculations required to predict how three heavenly bodies orbit each other have baffled physicists since the time of Sir Isaac Newton. Now artificial intelligence has shown that it can solve the problem in a fraction of the time of previous approaches.

Newton was the first to formulate the problem in the 17th century, but finding a simple way to solve it has proved incredibly difficult. The gravitational interactions between three celestial objects like planets, stars and moons result in a chaotic system — one that is complex and highly sensitive to the starting positions of each body.

Current approaches to solving these problems involve using software that can take weeks or even months to complete calculations. So researchers decided to see if a neural network — a type of pattern recognizing A.I. that loosely mimics how the brain works — could do better.

The algorithm they built provided accurate solutions up to 100 million times faster than the most advanced software program, known as Brutus. That could prove invaluable to astronomers trying to understand things like the behavior of star clusters and the broader evolution of the universe, said Chris Foley, a biostatistician at the University of Cambridge and co-author of a paper to the arXiv database, which has yet to be peer-reviewed.

"This neural net, if it does a good job, should be able to provide us with solutions in an unprecedented time frame," he told Live Science. "So we can start to think about making progress with much deeper questions, like how gravitational waves form."

Neural networks must be trained by being fed data before they can make predictions. So the researchers had to generate 9,900 simplified three-body scenarios using Brutus, the current leader when it comes to solving three-body problems.

They then tested how well the neural net could predict the evolution of 5,000 unseen scenarios, and found its results closely matched those of Brutus. However, the A.I.-based program solved the problems in an average of just a fraction of a second, compared with nearly 2 minutes.

The reason programs like Brutus are so slow is that they solve the problem by brute force, said Foley, carrying out calculations for each tiny step of the celestial bodies' trajectories. The neural net, on the other hand, simply looks at the movements those calculations produce and deduces a pattern that can help predict how future scenarios will play out.

That presents a problem for scaling the system up, though, Foley said. The current algorithm is a proof-of-concept and learned from simplified scenarios, but training on more complex ones or even increasing the number of bodies involved to four of five first requires you to generate the data on Brutus, which can be extremely time-consuming and expensive.

"There's an interplay between our ability to train a fantastically performing neural network and our ability to actually derive data with which to train it," he said. "So there's a bottleneck there."

One way around that problem would be for researchers to create a common repository of data produced using programs like Brutus. But first that would require the creation of standard protocols to ensure the data was all of a consistent standard and format, Foley said.

There are still a few issues to work through with the neural net as well, Foley said. It can run for only a set time, but it's not possible to know in advance how long a particular scenario will take to complete, so the algorithm can run out of steam before the problem is solved.

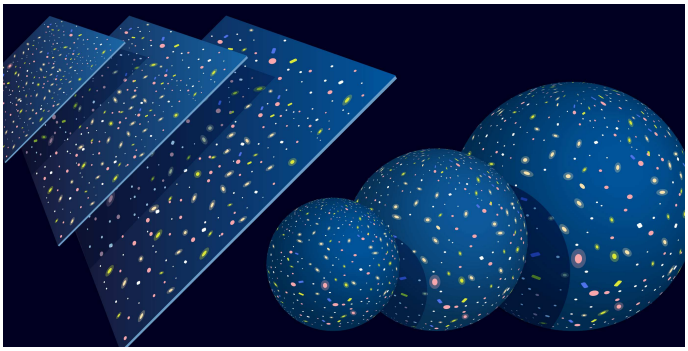
The researchers don't envisage the neural net working in isolation, though, Foley said. They think the best solution would be for a program like Brutus to do most of the legwork with the neural net, taking on only the parts of the simulation that involve more complex calculations that bog down the software.

"You create this hybrid," Foley said. "Every time Brutus gets stuck, you employ the neural network and jig it forward. And then you assess whether or not Brutus has become unstuck."

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

WHAT SHAPE IS THE UNIVERSE? A NEW STUDY SUGGESTS WE'VE GOT IT ALL WRONG

When researchers reanalyzed the gold-standard data set of the early universe, they concluded that the cosmos must be "closed," or curled up like a ball. Most others remain unconvinced.



In a flat universe, as seen on the left, a straight line will extend out to infinity. A closed universe, right, is curled up like the surface of a sphere. In it, a straight line will eventually return to its starting point.

A provocative paper published today in the journal Nature Astronomy argues that the universe may curve around and close in on itself like a sphere, rather than lying flat like a sheet of paper as the standard theory of cosmology predicts. The authors reanalyzed a major cosmological data set and concluded that the data favors a closed universe with 99% certainty — even as other evidence suggests the universe is flat.

The data in question — the Planck space telescope's observations of ancient light called the cosmic microwave background (CMB) — "clearly points towards a closed model," said Alessandro Melchiorri of Sapienza University of Rome. He co-authored the new paper with Eleonora di Valentino of the University of Manchester and Joseph Silk, principally of the University of Oxford. In their view, the discordance between the CMB data, which suggests the universe is closed, and other data pointing to flatness represents a "cosmological crisis" that calls for "drastic rethinking."

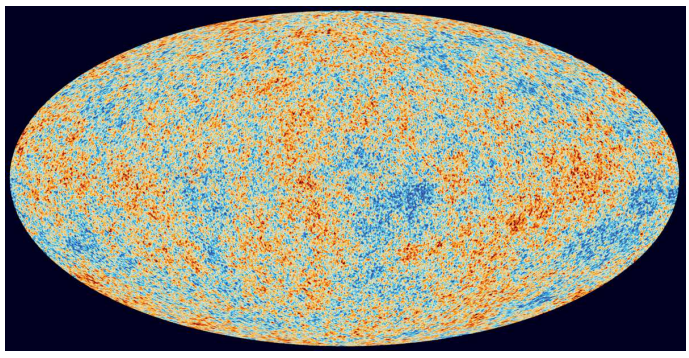
However, the team of scientists behind the Planck telescope reached different conclusions in their 2018 analysis. Antony Lewis, a cosmologist at the University of Sussex and a member of the Planck team who worked on that analysis, said the simplest explanation for the specific feature in the CMB data that di Valentino, Melchiorri and Silk interpreted as evidence for a closed universe "is that it is just a statistical fluke." Lewis and other experts say they've already closely scrutinized the issue, along with related puzzles in the data.

"There is no dispute that these symptoms exist at some level," said Graeme Addison, a cosmologist at Johns Hopkins University who was not involved in the Planck analysis or the new research. "There is only disagreement as to the interpretation."

Whether the universe is flat — that is, whether two light beams shooting side by side through space will stay parallel forever, rather than eventually crossing and swinging back around to where they started, as in a closed universe — critically depends on the universe's density. If all the matter and energy in the universe, including dark matter and dark energy, adds up to exactly the concentration at which the energy of the outward expansion balances the energy of the inward gravitational pull, space will extend flatly in all directions.

The leading theory of the universe's birth, known as cosmic inflation, yields pristine flatness. And various observations since the early 2000s have shown that our universe is very nearly flat and must therefore come within a hair of this critical density — which is calculated to be about 5.7 hydrogen atoms' worth of stuff per cubic meter of space, much of it invisible.

The Planck telescope measures the density of the universe by gauging how much the CMB light has been deflected or "gravitationally lensed" while passing through the universe over the past 13.8 billion years. The more matter these CMB photons encounter on their journey to Earth, the more lensed they get, so that their direction no longer crisply reflects their starting point in the early universe. This shows up in the data as a blurring effect, which smooths out certain peaks and dips in the spatial pattern of the light. According to the new analysis, the large amount of lensing of the CMB suggests that the universe may be about 5% denser than the critical density, averaging something like six hydrogen atoms per cubic meter instead of 5.7, so that gravity wins and the cosmos closes in on itself.



The Planck satellite's map of the cosmic microwave background - ESA/Planck Collaboration

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THE BACK PAGE

LINKS, COMMENTS AND OBSERVATIONS

A BLACK HOLE THREW A STAR OUT OF THE MILKY WAY GALAXY

So long, S5-HVS1, we hardly knew you

There are fastballs, and then there are cosmic fastballs. Now it seems that the strongest arm in our galaxy might belong to a supermassive black hole that lives smack in the middle of the Milky Way.

Astronomers recently discovered a star whizzing out of the center of our galaxy at the seriously blinding speed of four million miles an hour. The star, which goes by the typically inscrutable name S5-HVS1, is currently about 29,000 light-years from Earth, streaking through the Grus, or Crane, constellation in the southern sky. It is headed for the darkest, loneliest depths of intergalactic space.

The runaway star was spotted by an international team of astronomers led by Ting Li of the Carnegie Observatories. They were using a telescope in Australia for a study known as the Southern Stellar Stream Spectroscopic Survey — the S5. The star is about twice as massive as our own sun and ten times more luminous, according to Dr. Li.

Drawing on data from the European Space Agency's Gaia spacecraft, which has charted the positions and motions of some 1.3 billion stars in the Milky Way, the astronomers traced the streaking star back to the galactic center. That is the home of a black hole known as Sagittarius A*, a gravitational monster with the mass of four million suns.

The astronomers hypothesize that the runaway star was once part of a double-star system that came too close to the black hole. One of the pair fell in, and the other was sling-shotted away at hyper speed. The process, a three-body gravitational dance, was first predicted by Jack Hills, a theorist at Los Alamos National Laboratory, in 1988.

The dance with S5-HVS1 unfolded about 5 million years ago, according to Dr. Li and her team, which included Sergey Koposov of Carnegie Mellon University, lead author of a paper describing the results published Tuesday in the Monthly Notices of the Royal Astronomical Society.

The astronomers estimate that in about 100 million years the star will have exited the Milky Way entirely. It is yet another example of nature's ability to mix things up — tossing comets from faraway stars into our solar system, and flinging ice, rock and who knows what else between the planets on asteroids.

Out there, drifting among the other galaxies of the Local Group, far from the crowded circumstances of its birth, the star called S5-HVS1 will exhaust its thermonuclear fuel in about 2 billion years, blow up and die, alone. Like some people going off to college, say, some stars leave home and never come back.

From: https://www.nytimes.com/

At The Observatory

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

Articles Needed

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

"In the beginning there was nothing, which exploded"
Terry Pratchett

"Everything we call real is made of things that cannot be regarded as real"
Niels Bohr

"If all of mathematics disappeared, physics would be set back by exactly one week"
Richard Feynman

"Reality is merely an illusion, albeit a very persistent one"
Albert Einstein

"All of physics is either impossible or trivial. It is impossible until you understand it, and then it becomes trivial"
Sir Ernest Rutherford

"In physics, you don't have to go around making trouble for yourself - nature does it for you"
Frank Wilczek