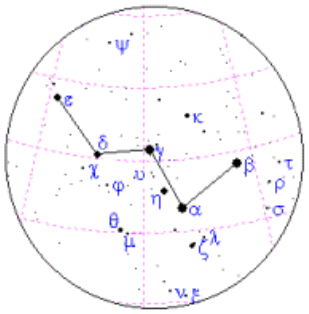


Wadhurst Astronomical Society Newsletter June 2017

MEETINGS

MAY MEETING

Our May meeting was opened by Phil Berry. After outlining the evening's programme, he told members that our visit to the Royal Astronomical Society library is postponed because of a chance to visit the Space Geodesy facility at Herstmonceux as detailed in last month's WAS newsletter. The date is now confirmed as Tuesday the 8th of August beginning at 8.0 pm. We can take up to about thirty and we will be shown round in groups of ten. We would have to find our own way to the facility. A list had been provided for members to sign with contact details. Already quite a few names are on the list but the list will also be at the June meeting.

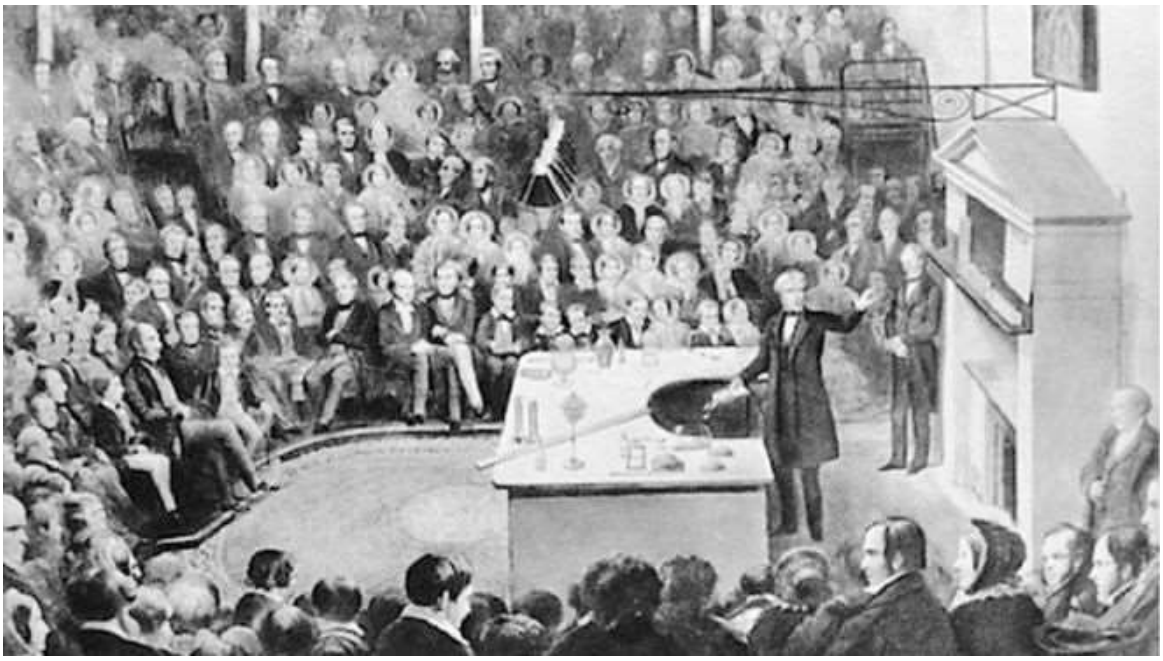
Tonight's speaker is Colin Stuart who is talking about his recent book that he has brought along for members to buy the reduced price of £12; the full price is £12.99, which he is willing to sign during the break.

Phil told us that Colin is a space expert who has talked to well over quarter of a million people. He is a prolific writer and has produced a number of books and periodical articles on space and astronomy and has broadcast on a number of occasions.

13 Journeys Through Space and Time – Christmas Lectures from The Royal Institution
Colin Stuart FRAS

The famous Royal Institution Christmas Lectures are held every year in the Faraday Lecture Theatre at the Royal Institution, Albemarle Street, off Piccadilly in London and have been since 1825 except for the early war years. Colin told us that he had been approached by the Institution to write a book about the lectures relating to space and time.

The Christmas lectures were the brainchild of Michael Faraday who gave the first one. His idea was that the talks should be aimed at children and should include as many practical demonstrations as possible.



Michael Faraday began the Royal Institute Christmas Lectures in 1825

The first lecture about space and time was given by Sir Robert Ball in 1881 and Colin said that he had encountered a great deal of difficulty finding out what happened in those early talks. Records were not very detailed in those early days and he spent much of his research time looking through incomplete records in the Royal Institute library and reading old newspapers of the time.

One source Colin found both interesting and useful were James Dewar's notebooks from 1885 in which he found sketches drawn of ideas for demonstrating what meteors were by using a lathe. But the most impressive feature about the notebooks was they were radioactive. Dewar was a chemist and had been working with chemicals that were radioactive but which wasn't known at the time. Colin had to sign a waiver and sat with a Geiger-counter next to the books.

The scripts for James Jean's Christmas lectures about space and time were found in the Royal Society archive. They contained sketches and ideas to explain the subjects to his young audience. One drawing included the constellation of the Plough with the names of the stars written in to remind him.

Carl Sagan drew a lot of interest in his Christmas lecture of 1977 and Colin found amongst other things in the archives, a telegram from Sagan outlining his requirements, such as his 18-night stay at Brown's five star hotel, opposite the Institute with a double room and bathroom. The fee for the lecture was £800 and by today's rate the total amount came to £5,200.

At that time, Sagan began to employ a junior assistant named Arun Aggarwal and Colin managed to find him and asked for an interview. Not only did Dr Aggarwal agree, he also came to Colin's book launch.

Colin now looked at some of the thirteen lectures on Space and Time beginning with Robert Ball in 1881. During his lecture, he told the children that no one would ever go to the moon because it is too difficult and risky. At the time, Mars was thought to have canals, built by intelligent life to move water around the planet and Jupiter was thought to only have four moons.

Robert Ball gave the first lecture about Space and Time in 1881

One thing Ball did talk about was how to inform astronomers around the world when a new comet was discovered, but in those early days, the information took too long to get to them and also were often full of errors, so a method was devised by making sure everyone had the same copy of Worcester's Dictionary. The comets position was communicated by sending just one word from the dictionary so that the page number was the number of degrees round the sky and the line down the page on which the word appeared was the arc-minutes.

In 1913, there are notes and photographs that showed Herbert Hall involving children to help him explain his subject. But he also talked about sunspots being comets moving round across the surface of the sun.

Sir James Jeans in 1933 talked about the game of cricket being played on the moon where the ball would go 6 times further than on Earth and therefore the pitch would be 6 times bigger and it would take 6 times as long to get the ball back.

The first video record of a lecture was of that given by Sir Harold Spencer in 1944. The Astronomer Royal talked about astronomy in everyday life.

In 1970, Sir George Porter used a model time machine. It was so large that a window in the Institute had to be removed to allow the model to be brought in and then the window replaced.

Carl Sagan gave a lecture about the planets in 1977. He had been involved with Mariner probes to Mars, with the Viking landers and with the Voyager missions so he was ideal to give his talks. He was on the naming committee for many of the features on Mars and he talked about a large boulder close to the Viking lander which they called Big Bertha but once this became public, the Women's Liberation Group objected, so it was renamed Big Joe.

Carl Sagan giving his Christmas Lectures on the planets in 1977

We were shown a video clip from Sagan's lectures in which he said that technology is almost at the point where robots on the planets would have wheels and be able to explore away from the landing site.

Colin said this has now happened and showed a video clip from Spirit, one of two robots successfully deployed on the surface of Mars and showing it drilling into rocks to find evidence of water. The clip also showed dust devils dancing round the surface and of dust in the atmosphere after the Sun had set.

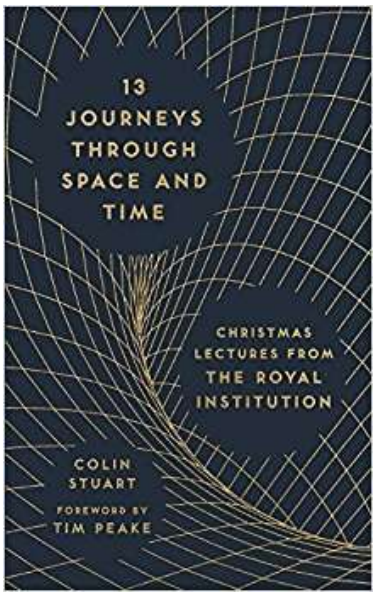
In 2015, Tim Peake talked live during Kevin Fong's talk on surviving in space

In 2015, Kevin Fong gave a series of lectures called "How to Survive in Space" and included a live link from the International Space Station with Tim Peake demonstrating life in space and showed how fluids around his body had redistributed because of the lack of gravity, giving him a much fatter face and what he called 'chicken legs'.

Colin finished his talk by saying that the question very often asked is why spend so much money on space research. He said that human nature is to be curious and always will be, but also the gains from research included learning how to treat osteoporosis from understanding how to survive in a gravity free environment. Also, using the same software developed to look at extremely distant galaxies was now used to analyse tumour cells, and many more examples.

He said that the most important work is to encourage and develop following generations with the enthusiasm to continue research in space and time.

Colin's book goes into a lot of detail and contains many interesting and humorous stories about the lectures.



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Snippets from the World of Science
John Wayte

When looking at the Universe and trying to unravel the wonders behind it, we must use all the resources we can.

We are familiar with the conventional types of optical telescopes and space based viewing apparatus to radio and infrared types.

I was reading through a magazine and came across this one which I thought gave a different twist to the normal. The telescope I am going to talk about is a Water Telescope that is hunting for new pulsars.

Just to remind you – a Pulsar is a highly magnetized, rotating neutron star that emits a narrow beam of energetic electromagnetic radiation.

This water telescope is called "HAWC". It is the "High Altitude Water Cherenkov Observatory" in Puebla, Mexico near the Sierra Negra Volcano, at an altitude of 4,100 metres (13,500 feet).

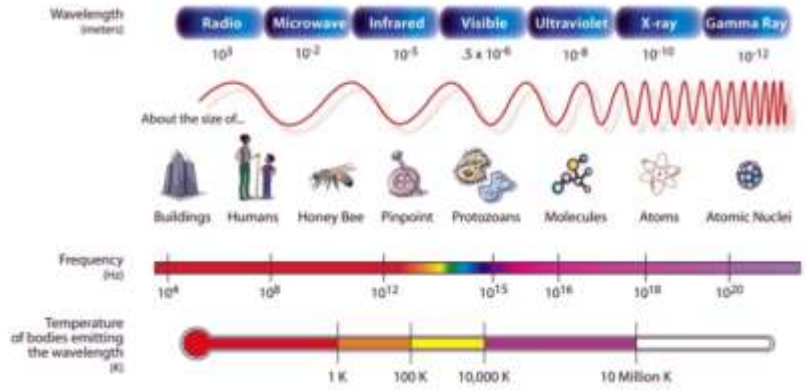
HAWC Observatory – close to Sierra Negra Volcano, Mexico

Aerial photograph of HAWC

So, what have these storage vessels go to do with a telescope? HAWC is a facility designed to observe gamma rays and cosmic rays between 100 GeV and 100 TeV.

TeV gamma rays are the highest energy photons ever observed – TeV is a Trillion electron Volts (eV), which is about 1 trillion times more energetic than visible light!

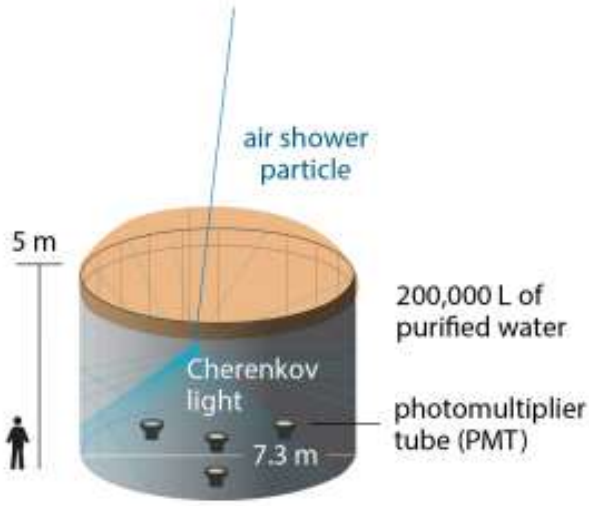
These photons are born in the most extreme environments of the known universe: supernovae explosions, active galactic nuclei and gamma-rays bursts.



Electromagnetic radiation spectrum

HAWC doesn't work like your conventional telescopes though. Instead, it uses the Cherenkov Radiation effect. HAWC is made up of 300 water tanks each filled with 200,000 litres of pure water and every tank has detectors. Scientists then use Cherenkov light to reconstruct images from the distant universe.

Cherenkov Radiation visible in the water



Principle of detecting gamma rays

When high energy photons interact with the atmosphere, they generate a shower of secondary particles. Those particles are the ones that reach the observatory. These particles are moving at almost the speed of light in a vacuum, but they are moving faster than the speed of light in water. So, when they enter the water they emit blue light (Cherenkov Radiation), like a supersonic jet generates a sonic boom.

Detectors in each tank are linked in a computer to determine the location of the source of gamma radiation.

The observatory works 24 hours a day and can pick up the changes in brightness in many gamma-ray sources both in our galaxy and beyond. Thanks to this feature, the team was able to observe a flare from a galaxy called Markarian 501, more than 450 million light-years away.

In the first year of data collection, HAWC picked up 40 distinct sources of gamma rays, ten of which had not been seen in gamma rays before. The team is now working to figure out if they were associated with any other known objects that have been seen in other wavelengths like visible or infrared light.

One, for instance, was associated with a known supernova remnant from an energetic pulsar. When massive stars die as supernovae, they slough off material in a cloud called a 'supernova remnant'. The shock wave from the explosion then sweeps through the cloud and accelerates particles in it to extremely high energies, where they radiate gamma rays.

It is hoped that over the next five years, this observatory will provide more insight into the gamma-ray sky and supermassive black hole flares, maybe even observing flares from the centre of the Milky Way itself.

This was followed by the June Sky Notes that follow later in the newsletter.

BOOK OF THE MONTH FROM THE WAS LIBRARY

This month, Phil Berry has chosen “Stardust” by John Gribbin.

One of the most fabulous revelations afforded by modern cosmology is the fact that we are all stars, literally. The elements that comprise our bodies (like iron or oxygen) were all forged in the burning cores of distant suns, before being flung across the endless wastes of space by the enormous force of stellar explosions. Great stuff!

Now well-known writer and respected astrophysicist John Gribbin has taken this fairy-tale bit of Big Science and used it as the central premise for a book: which describes how the cosmos made us, and what we can therefore make of the cosmos. It's essentially a biography of man from the molecular point of view, with diversions into evolution, astronomy, geology, extra terrestrial life, and so on. One of the more poetic notions covered is that of "panspermia", the idea that the seeds of life are continually being carried across the universe--like so many sycamore keys in an autumn wood. The author definitely sides with those who believe the answer to life is "out there".

As always with John Gribbin, the writing is fresh and accessible, the thinking clear if occasionally complex. The real joy of Stardust is its perspective: in contrast to so many pop cosmology writers, Gribbin has managed to tell a fairly well-known tale in an original and very satisfying way. --*Sean Thomas*

About the Author

John Gribbin is one of today's greatest writers of popular science and the author of bestselling books, including *In Search of Schrödinger's Cat*, *Science: A History* and *Deep Simplicity*. He is famous to his many fans for making complex ideas simple, and says that his aim in his writing - much of it done with his wife, Mary Gribbin - is to share with his readers his sense of wonder at the strangeness of the universe. John Gribbin trained as an astrophysicist at Cambridge University and is currently Visiting Fellow in Astronomy at the University of Sussex. --This text refers to an out of print or unavailable edition of this title.

JUNE MEETING

21st June – Popular speaker, Melanie Davies returns to tell us about “Mission to Mars: Fiction vs. Reality”

Meetings will take place at Uplands College, Lower High Street, Wadhurst and are held in classrooms IL5 and IL6 which are in the blue walled classroom block at the far end of the drive from the main gate and up by the tennis courts. Signs will direct you. There is car parking near the block. The postcode is TN5 6AZ.

Meetings begin at 1930 prompt although members are invited to arrive anytime after 1900 as this is a good time to exchange ideas and discuss problems and also help set things up before the meeting starts.

Anyone is welcome but non-members are asked if they wouldn’t mind contributing £3 towards costs.

FUTURE MEETINGS

19th July 2017 – Two talks this month. Phil Berry describes “My Smartphone Controlled Telescope”, and Brian Mills continues his series about women in astronomy with “NASA’s Unseen Female Astronauts”.

There is no meeting in August.

20th September - Barry sodden recalls “NASA Disasters (and Some Causes)”.

18th October - David Pulley asks the question “So, How Do We Know They Are Planets?”

15th November – Jan Drozd regales us with stories about “Astronomical Blunders in Science Fiction”

13th December – (This is the second Wednesday in the month) Brian Mills FRAS tells the story of “The Great Telescope at Birr Castle”

SKY NOTES FOR JUNE 2017

Planets

Mercury is a morning object at the start of the month, but is so close to the Sun it will essentially be unobservable. It then reaches superior conjunction (on the far side of the Sun) on June 21st and so will not be visible again until late in July when it will be an evening object once more.

Venus is also a morning object reaching greatest western elongation on June 3rd when its angular separation from the Sun will be 46°. At the beginning of June it rises 1½ hours ahead of the Sun although by the end of the month this has increased to 2¼ hours.

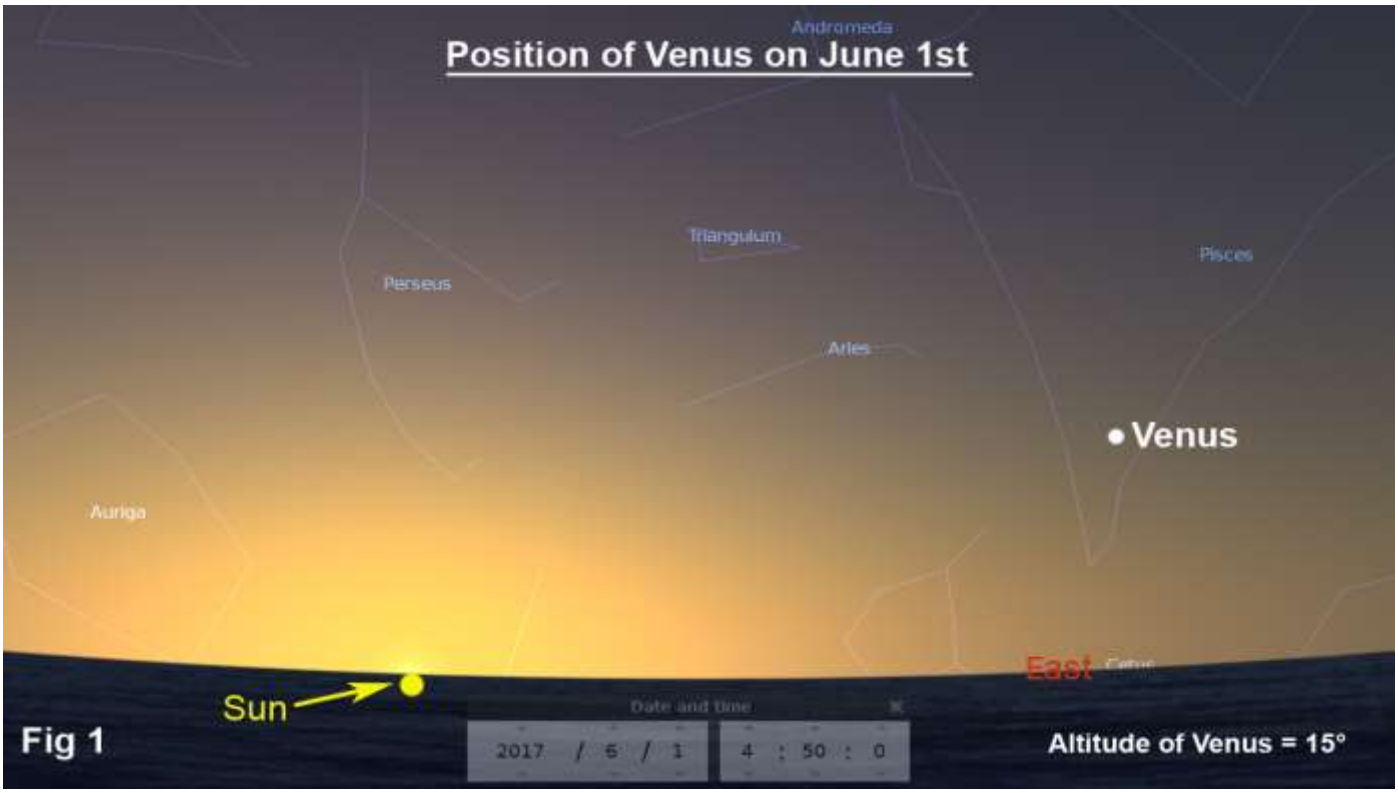


Fig 1

It may seem counter intuitive that as the planet moves closer to the Sun it also becomes more observable but it isn't as surprising as you might think at first if you consider the position of the ecliptic with relation to the celestial equator.

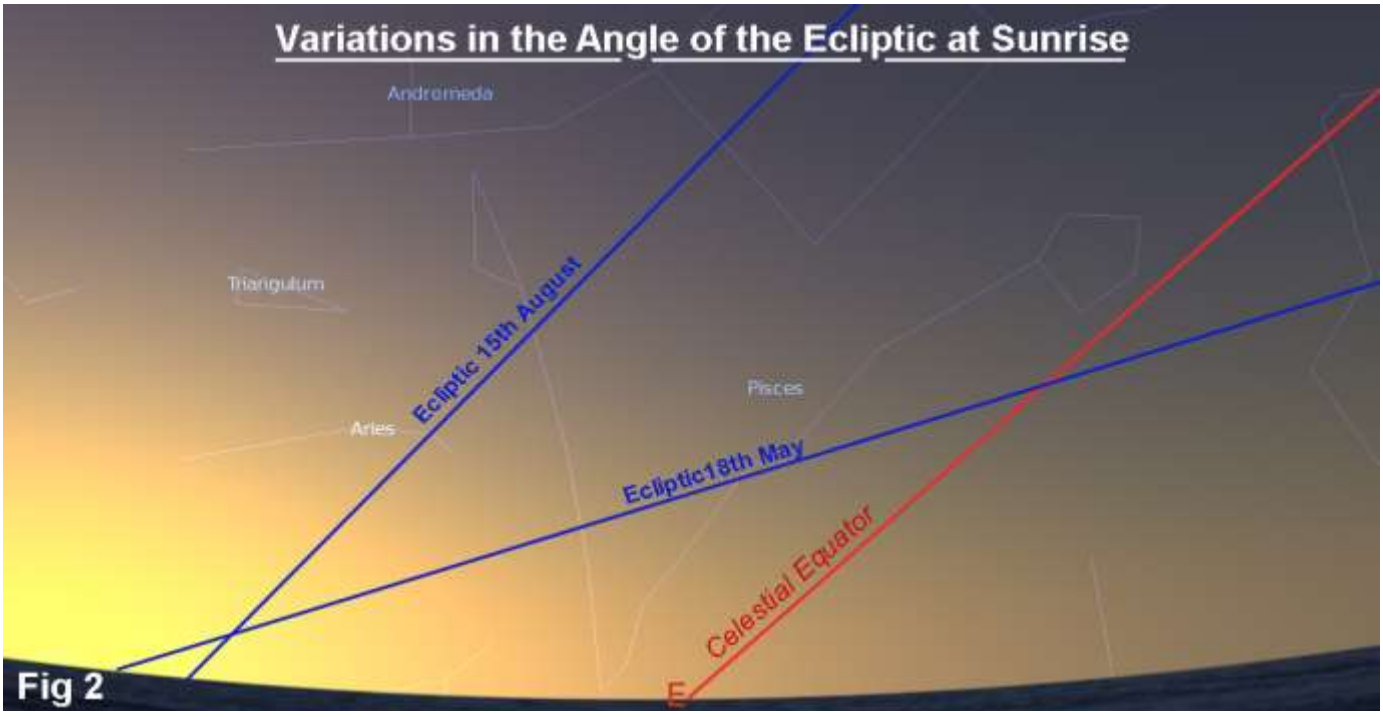


Fig 2

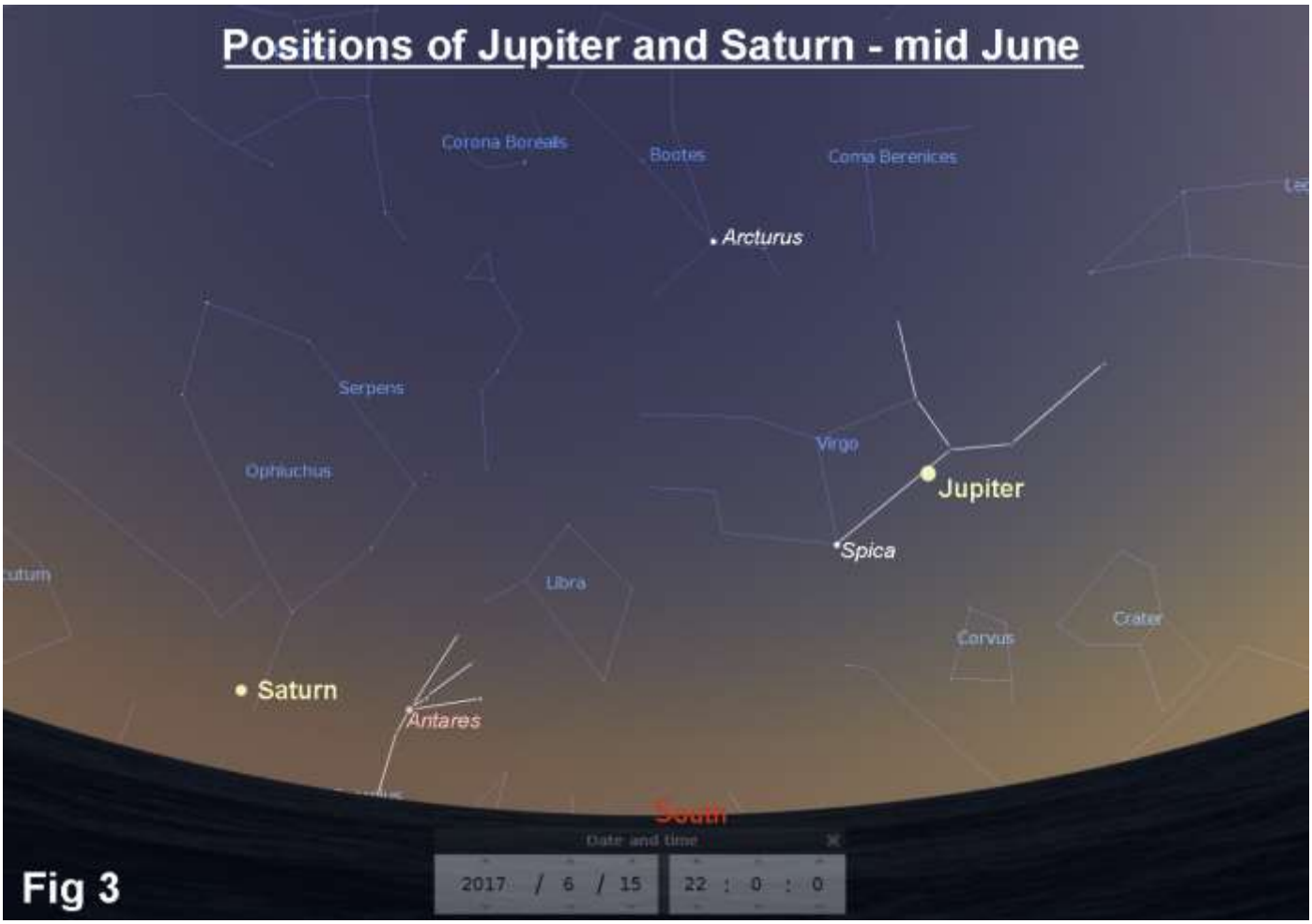
In fig 2 you can see how the ecliptic varies at different times of the year with respect to the celestial equator and the horizon and that during the early mornings in May it is much lower than it is at the same time in August. This means that the time between a planet

and the Sun rising is considerably shorter in May compared to later in the year. Of course all the planets can be found within a few degrees of the ecliptic but where they lie along that line will affect how easy they are to see. In some cases they will be above, and in some cases below, the celestial equator so will correspondingly have either positive or negative declination. In general terms the more positive the declination of an object is, the better the viewing prospects for it will be.

Earth reaches the summer solstice at 05.25 BST on June 21st. At that moment in time the Sun will be as far north of the celestial equator as it is possible for it to get so we receive sunlight for the maximum amount of time. From that moment on though, the Sun will be travelling southwards towards the celestial equator and the amount of daylight will be gradually declining as we move towards the autumnal equinox.

Mars is just 16° east of the Sun at the start of June and given its magnitude of +1.7 it will be effectively unobservable. The red planet passes through solar conjunction on July 27th after which it moves west of the Sun to become a morning object in early to mid October.

Jupiter begins the month moving retrograde in Virgo, but reaches its second stationary point on June 10th after which it resumes direct motion (west to east). Fig 3 shows its position for mid June although the planet moves quite slowly so the map is valid for the whole of the month.



A
s you can see, at 22.00 in the middle of the month, Jupiter has passed the meridian and is closer to the south west. It will be easy to find because there is nothing in that area of the sky that comes anywhere near it in terms of brightness. Its magnitude is currently -2.1 and its apparent diameter is 39" (39 arc seconds). Make the most of Jupiter while it is still visible because its period of visibility is shortening and by the end of June it will set at 01.00 BST. In subsequent years, oppositions of the planet will see it culminating lower and lower in the sky.

Saturn rises at 22.00 BST at the beginning of June and by the end it is above the horizon in daylight. It reaches opposition, which is when it's closest to Earth, on the 15th of this month so it will be at maximum brightness and apparent size around that date. Unfortunately, it will only be 17° high when it culminates (crosses the meridian due south) on the night of opposition. Its position is shown in fig 3, a little to the west of the obviously ruddy hued star, Antares, in Scorpio. If you get the chance to look at Saturn with a telescope, the rings are currently very well presented.

Lunar Occultations

In the table below I've listed events for stars down to magnitude 7.0 that mostly occur before midnight although there are many others that are either of fainter stars or occur at more unsociable hours. DD = **d**isappearance at the **d**ark limb. RD = **r**eappearance at the

dark limb. The column headed “mm” (millimetres) shows the minimum aperture telescope required for each event. **Times are in BST.**

June	Time	Star	Mag	Ph	Alt °	% illum.	mm
2nd	23.53	ZC 1732	6.8	DD	23	64	70
3rd	19.46	ZC 1821	2.8	DD	35 (Sun +10°)	73	50
3rd	21.11	ZC 1825	5.9	DD	37	73	70
⚹ 22nd	16.19	Aldebaran	0.9	DB	24	4	70
⚹ 22nd	17.12	Aldebaran	0.9	RD	16	4	50

⚹ This is a daylight occultation of Aldebaran by the Moon.
At the time, the Moon is 22° from the Sun, which lies to its east, so **a degree of care should be exercised to ensure the Sun does not enter the telescope’s field of view accidentally.** The Moon’s proximity to the Sun indicates that it will be an exceptionally thin crescent as it approaches “new” on the 24th. Both phases of the event occur with the Sun above the horizon and will require the observer to locate Aldebaran rather than be able to use the Moon as a guide to the star’s position. The star will first be seen to disappear at the bright limb of the Moon at 16.19 BST, and then reappear at the dark limb just under an hour later.
Figs 4 and 5 show the relative position of the Moon to Aldebaran for both phases of the event. If you have a go-to mount, then locating the star should be straightforward. However it will be much more difficult if you are sweeping for it. **Please remember the warning above!**

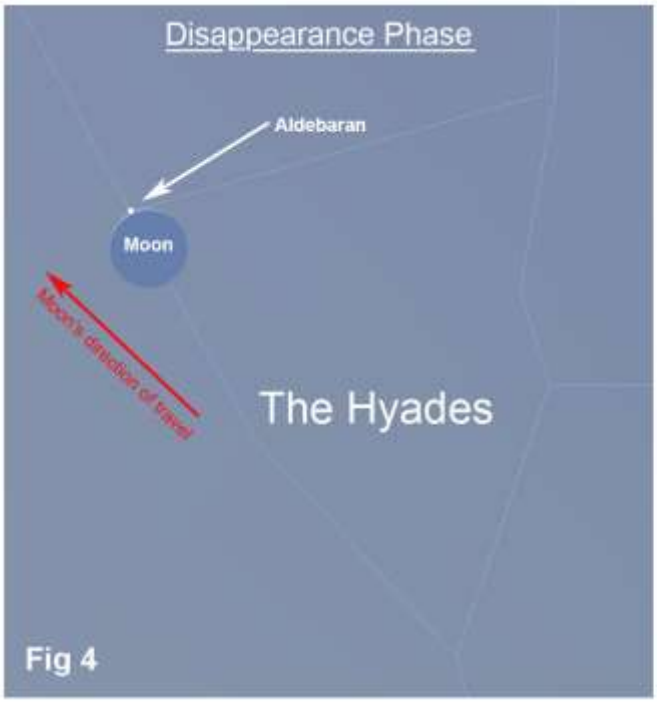


Fig 4

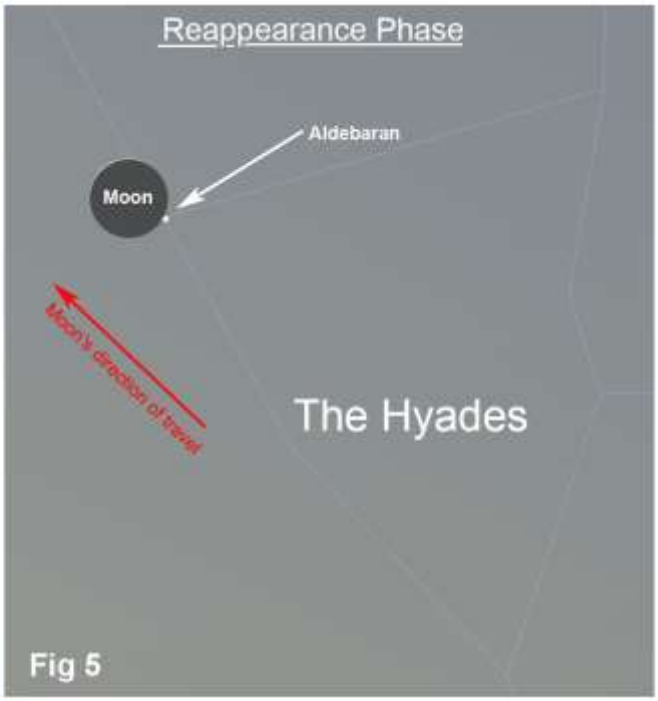


Fig 5

Phases of the Moon for June

First ¼	Full	Last ¼	New
1st	9th	17th	24th

The full Moon that occurs on June 9th is what’s known as a “micro-moon” because it occurs when the Moon is at apogee or at the point in its elliptical orbit when it is furthest from Earth. This means, of course, that it appears smaller than usual. A new Moon can also be a micro-moon, but if this coincides with a solar eclipse the result will be an “annular” eclipse where a ring, or annulus, of the Sun is still visible around the dark body of the Moon.

ISS
Below are details for passes of the International Space Station (ISS) when it is magnitude -2.0 or brighter. The details of all passes, including those visible between midnight and dawn, can be found at www.heavens-above.com. Please remember that the times and directions shown below are for when the ISS is at it’s ***maximum*** elevation, so you should go out and look at least five minutes beforehand. **Times are in BST.**

June	Time	Mag.	Alt°	Az.		June	Time	Mag.	Alt°	Az.
1st	22:00:18	-3.7	78°	N		4th	22:36:40	-3.5	52°	SSW
1st	23:36:46	-3.8	59°	SSW		5th	23:20:37	-2.2	21°	SW
2nd	22:44:38	-3.9	78°	SSW		6th	22:28:34	-2.7	31°	SSW

3rd	21:52:27	-3.8	87°	NNE		7th	23:12:18	-1.4	11°	SW
3rd	23:28:46	-3.1	36°	SSW		8th	22:20:19	-1.8	18°	SW

Iridium Flares

The flares that I've listed are magnitude -2.0 or brighter although there are a lot more that are fainter or occur after midnight. If you wish to see a complete list, or obtain timings for somewhere other than Wadhurst, go to www.heavens-above.com . When one of these events is due, it is sometimes possible to see the satellite before and after the "flare" although, of course, it will be much fainter then. **Times are in BST.**

June	Time	Mag	Alt°	Az.°		June	Time	Mag.	Alt°	Az.°
1st	21.31	-3.8	59°	50° (NE)		25th	22.45	-3.2	28°	276° (W)
6th	23.53	-7.9	46°	236° (SW)		27th	22.42	-6.4	25°	280° (W)
11th	23.32	-7.3	42°	247° (WSW)		27th	23.59	-2.3	48°	234° (SW)
15th	23.17	-7.5	39°	256° (WSW)		29th	22.39	-6.1	22°	285° (WNW)
19th	23.02	-3.3	35°	263° (W)		30th	22.42	-2.8	19°	288° (WNW)
22nd	22.54	-5.4	32°	270° (W)		30th	23.50	-3.1	44°	242° (WSW)
24th	22.51	-2.6	28°	274° (W)						

The Night Sky in June (Written for 22.00hrs BST mid month)

The sky towards the north is still bright with the Sun just 6° below the north western horizon. The plough has just passed its best and is beginning its descent towards the horizon, so it follows that Cassiopeia is as low in the sky as it is possible to get, being a little to the east of the meridian. The galaxies M81 and M82, that lie within the boundaries of Ursa Major, are well positioned at the moment being a little to the north west of Polaris. M81 is a spiral of magnitude 6.9, so is an easy object in small telescopes. M82 is a starburst galaxy where star formation, that is thought to have been triggered by the gravitational influence of its neighbour M81, is occurring ten times more quickly than in regular galaxies like the Milky Way. The pair of galaxies are a favourite for astro-imagers as they can be imaged together in the same frame.

Draco, the celestial dragon, is now well positioned so that its twists and turns around the two bears can be identified.

In the east all three members of the Summer Triangle are visible although the second brightest of them (Altair) is only 15° in altitude whilst Vega is due east with an elevation of 50°. Above and slightly west of Vega lies the constellation Hercules, which contains two bright globular clusters, M13 and M92. Of these M13 is the most striking and certainly the best of the globulars visible from the UK at magnitude 5.9, so it is technically visible to the naked eye from a really dark site. Fig 6 shows you how to find the two clusters in Hercules using the plough, Arcturus in Bootes and Corona Borealis.

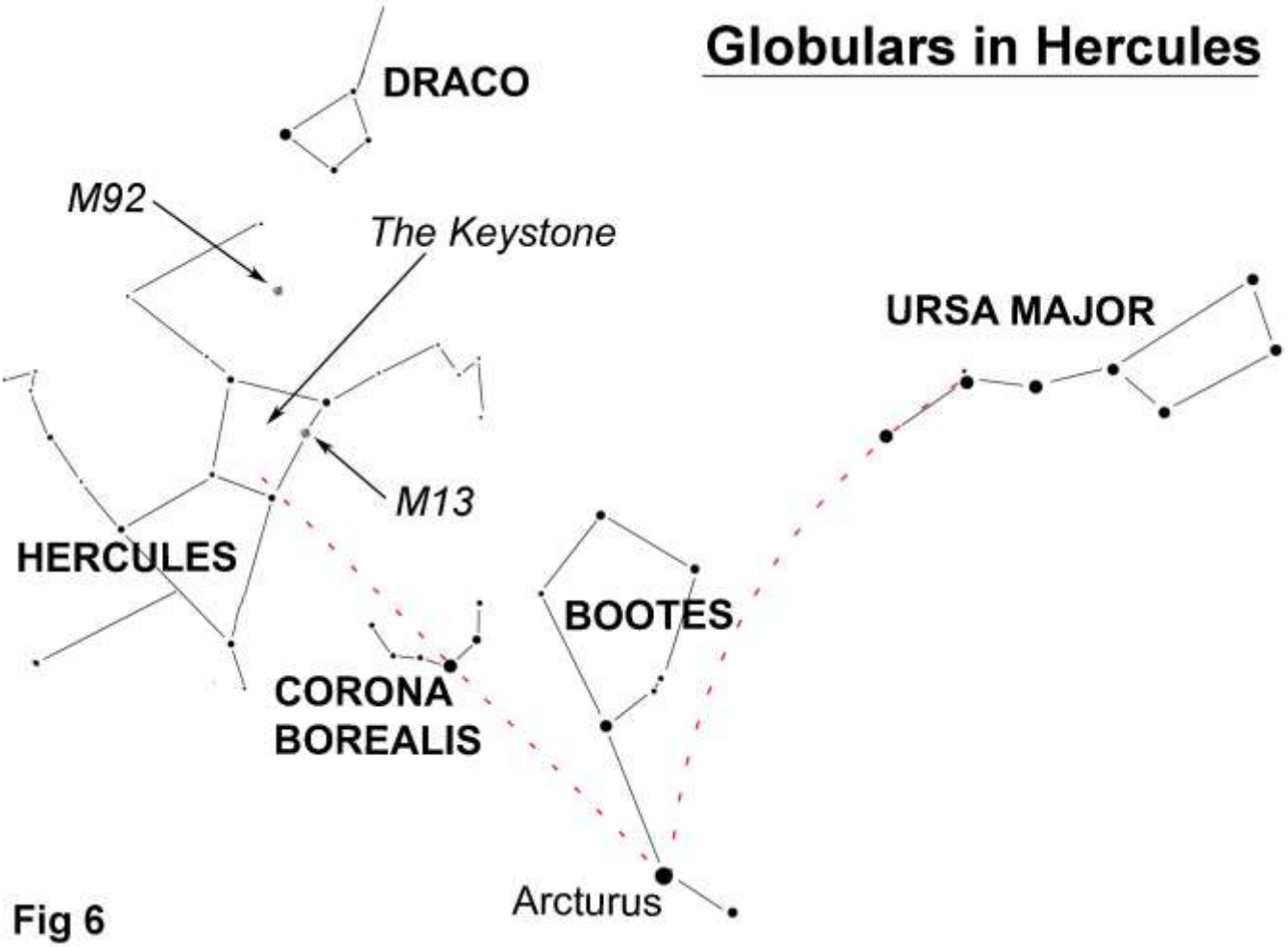


Fig 6

In the south Arcturus is high up and just past the meridian. The faint and rather formless groups of Ophiuchus, Serpens and Libra are moving towards the south. Antares, the brightest star in Scorpio and whose name in Greek tells us that it is the rival of Mars, is 10° high and a little to the east of south. Sadly we never see the celestial scorpion at is best because the "sting" remains stubbornly below the horizon as seen from southern England.

Towards the west, the twins may just be glimpsed in the twilight but otherwise the winter groups have all but gone. Leo and Virgo, the latter of which is still home to Jupiter, are both still well seen but the former will soon become a victim of the approaching Sun.

Advance Notice
On the morning of July 25th the Moon will occult Mercury at 08.33. The planet will re-appear at 08.53. This will be an extremely difficult event because the Moon and Mercury are just 25° west of the Sun and only 6° above the eastern horizon.

Brian Mills

SPACEPLACE - NASA

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The Fizzy Seas of Titan
By Marcus Woo

With clouds, rain, seas, lakes and a nitrogen-filled atmosphere, Saturn's moon Titan appears to be one of the worlds most similar to Earth in the solar system. But it's still alien; its seas and lakes are full not of water but liquid methane and ethane.

At the temperatures and pressures found on Titan's surface, methane can evaporate and fall back down as rain, just like water on Earth. The methane rain flows into rivers and channels, filling lakes and seas.

Nitrogen makes up a larger portion of the atmosphere on Titan than on Earth. The gas also dissolves in methane, just like carbon dioxide in soda. And similar to when you shake an open soda bottle, disturbing a Titan lake can make the nitrogen bubble out.

But now it turns out the seas and lakes might be fizzier than previously thought. Researchers at NASA's Jet Propulsion Laboratory recently experimented with dissolved nitrogen in mixtures of liquid methane and ethane under a variety of temperatures and pressures that would exist on Titan. They measured how different conditions would trigger nitrogen bubbles. A fizzy lake, they found, would be a common sight.

On Titan, the liquid methane always contains dissolved nitrogen. So when it rains, a methane-nitrogen solution pours into the seas and lakes, either directly from rain or via stream runoff. But if the lake also contains some ethane—which doesn't dissolve nitrogen as well as methane does—mixing the liquids will force some of the nitrogen out of solution, and the lake will effervesce.

"It will be a big frothy mess," says Michael Malaska of JPL. "It's neat because it makes Earth look really boring by comparison."

Bubbles could also arise from a lake that contains more ethane than methane. The two will normally mix, but a less-dense layer of methane with dissolved nitrogen—from a gentle rain, for example--could settle on top of an ethane layer.

In this case, any disturbance—even a breeze—could mix the methane with dissolved nitrogen and the ethane below. The nitrogen would become less soluble and bubbles of gas would fizz out.

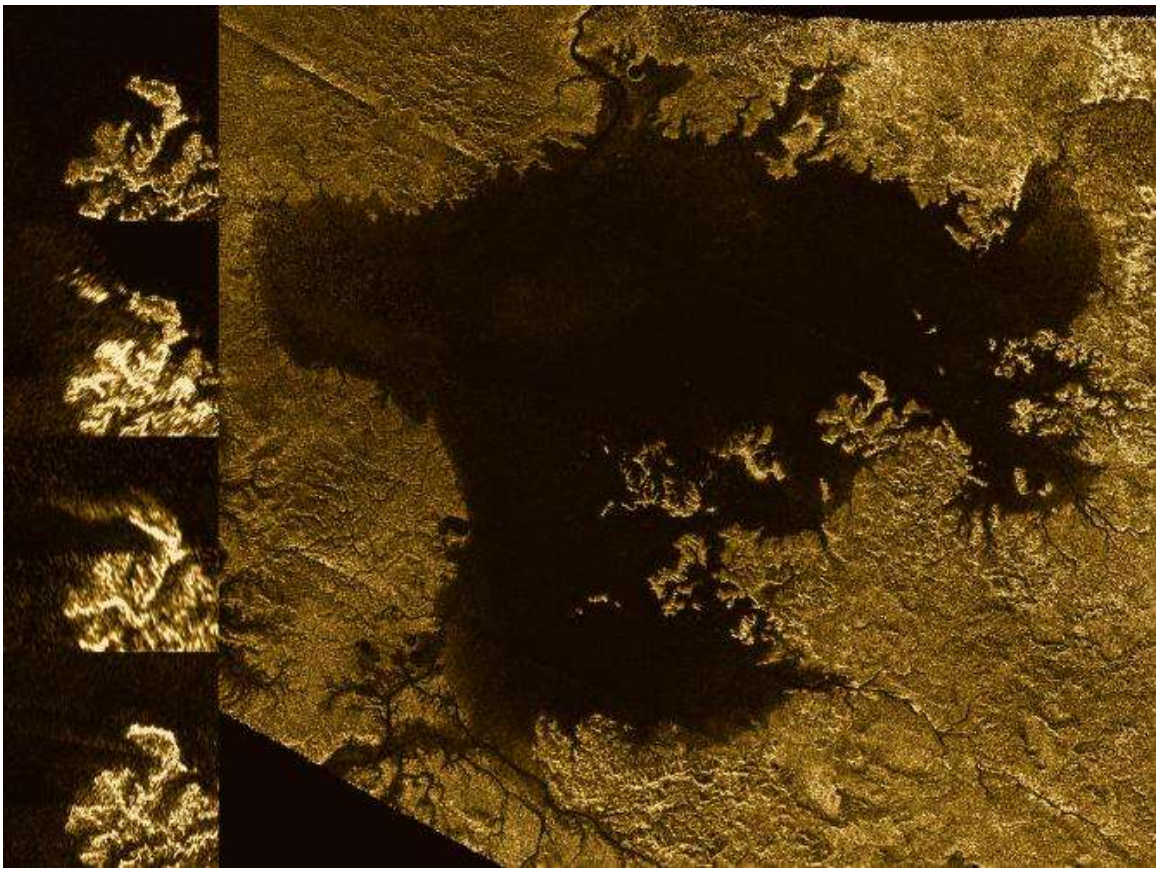
Heat, the researchers found, can also cause nitrogen to bubble out of solution while cold will coax more nitrogen to dissolve. As the seasons and climate change on Titan, the seas and lakes will inhale and exhale nitrogen.

But such warmth-induced bubbles could pose a challenge for future sea-faring spacecraft, which will have an energy source, and thus heat. "You may have this spacecraft sitting there, and it's just going to be fizzing the whole time," Malaska says. "That may actually be a problem for stability control or sampling."

Bubbles might also explain the so-called magic islands discovered by NASA's Cassini spacecraft in the last few years. Radar images revealed island-like features that appear and disappear over time. Scientists still aren't sure what the islands are, but nitrogen bubbles seem increasingly likely.

To know for sure, though, there will have to be a new mission. Cassini is entering its final phase, having finished its last flyby of Titan on April 21. Scientists are already sketching out potential spacecraft—maybe a buoy or even a submarine—to explore Titan's seas, bubbles and all.

To teach kids about the extreme conditions on Titan and other planets and moons, visit the NASA Space Place: https://spaceplace.nasa.gov/planet-weather/



Caption: Radar images from Cassini showed a strange island-like feature in one of Titan's hydrocarbon seas that appeared to change over time. One possible explanation for this "magic island" is bubbles. Image credits: NASA/JPL-Caltech/ASI/Cornell

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