



The Newsletter of the Astronomy Section of La Société Guernesiaise

Summer 2021

Forthcoming Events

We hope to run a public course in October/November, but we have not yet confirmed the details. Please follow our Eventbrite page and check out our website for updates.

Public Open Days

We will be running public open evenings during 2021, although the exact format and timing of these is still to be decided. We will also be running more daytime solar open days, which due to the nature of the event will be advertised only a few days before they take place. It is likely there will also be a Halloween themed event in October as there has been in previous years. Our events will be announced via the media, on the Astronomy Section website, www.astronomy.org.gg, and on the Section's Facebook pages.

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Section meetings

The Section meets at the Observatory every other Tuesday evening at 8.00 pm, sometimes with a discussion topic. The meeting dates for the rest of the year are given on page 8. Also the last Saturday evening of each month, if clear, except summer, for observing and photography.

Observatory

Rue du Lorier, St Peter's, Guernsey

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www.astronomy.org.gg

Material for, and enquiries about Sagittarius should be sent to the Editor: tharvey303@gmail.com

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Introduction from the Editor

Welcome to the summer 2021 edition of the Sagittarius newsletter. This issue contains some great articles written by our members, along with some very exciting news from our Secretary, Jean Dean. With Guernsey's borders opening again to fully vaccinated travellers we would like to ask that anyone who has travelled into the island in the past 7 days **does not** come up to the observatory. This is due to the small and enclosed nature of our meeting room and the fact that not all our members are fully vaccinated yet. This policy will be reviewed periodically, so please check our website for the latest guidance or contact one of the officers.

We would also like to ask that if you exhibit any of the covid symptoms (you can find them here: <https://covid19.gov.gg/guidance/symptoms>) please don't come to the observatory until you have received a covid test. This is again in order to protect our members and keep the observatory safe. I hope everyone has a relaxing summer and look forward to seeing many of you at the observatory soon.

As always I'd like to thank everyone who contributed to this newsletter and reiterate that I'm always looking for new articles, so if you'd like to submit something for the next edition please get in touch.

Thomas Harvey

Astronomy Section Report Summer 2021

Welcome to all our new members in 2021. As a club we meet every other Tuesday evening from 8.30pm onwards, so please come along and join in with activities which are listed on our website (www.astronomy.org.gg/events) and on our members only Facebook group (www.facebook.com/groups/557188241419877). Occasionally there are talks on a Tuesday night that cover a range of astronomical topics which are suitable for novice and more advanced astronomers, more details are given below.

I am very pleased to report that we have a new ten-year lease on our premises. Thank you to Jason for assisting with this critical task. We are also making progress with the new telescope building. We have produced a set of drawings thanks to Owain which are currently with a builder for pricing, and with the Planning Authorities for their approval. The new building will be of a similar roll-off roof timber structure, but without drop-down sides, and will be slightly wider to the east and west, and slightly longer towards the south. Improved illumination in the interior and a large flat screen monitor on one wall will allow us to use it for lectures and as overspill space as required.

The new telescope building is part of a two-stage project that will also see us change the 25-year old Meade LX200 mount for a new, modern mount with more functionality and ease of use. Shortly, we will be starting to fundraise for the project, but hopefully have already secured enough money for the replacement of the telescope building. Our aim is to get the new telescope building in place for October/November 2021.

We have a selection of modern, very good quality GOTO telescopes that are controlled via a computer handset. They are relatively easy to learn. Recently we have been busy with telescope training, and now have one new member fully trained on the Celestron Nexstar 8SE and Skywatcher HEQ5 and others well on the way to being fully trained. If you want to learn how to use some of the

telescopes, then come along on Tuesday club nights. We also have a few less expensive telescopes that with some basic instruction members can borrow and take home to use.

This is the time of year we carry out the majority of the maintenance on our site: we have been busy repairing, painting, upgrading the kitchen area and gardening. I would like to thank Stephanie, Nick, Jill, Richard, Owain and Allan who have helped with this essential task and particularly Roger Chandler for keeping the grass cut.

La Société Guernesiaise are looking for volunteers to help set up/dismantle and to man the stall at the West Show this year, 18/19th August. If anyone wishes to volunteer their time for a couple of hours, please let me know. If you man the stall during the show, it means you get free access to look around before/afterwards.

Jean Dean

Committee Members Reports

Owain Catton – IT/Website Officer

Apart from the normal updates and corrections we have continued try and expand the available content on the website to cover all our member from experienced and new members. There are more articles which have been published on a variety of topics from the extensive back catalogue of the old website as well as those published by David le Conte and we hope to continue this as an when we can. All the articles are obviously readable directly online or available to be downloaded into a printable PDF for reading later or offline.

We have updated the Events page to now not only show the upcoming events but a full calendar of the Astronomy Sections events to the end of the year. Events are published as and when we have firm dates so keep an eye out.

The Monthly Sky page has had a makeover at the beginning of the year, the update now shows sections for all the months for the year which contains the usual viewing highlights and sky charts. There are also separate sections for weather, sunrise/sunset times, planet rise/set times, moon phases, meteor showers and ISS sightings. Hopefully within the next month we will also add a new section which will predict when Jupiter's Great Red Spot is visible.

Unfortunately, we have had to turn off the live feed from the All Sky Camera while the planned renovations of the main observatory building take place, this will be reinstated once the work has been complete.

If you have an article you would like to be put onto the website or spot something that needs correcting please get in contact via the contact form on the website.

Jill Barnicoat – Group Visits Officer

Following the Summer Solstice in June, the Sun appears to begin its descent. And there will be a darkening of the evening sky, increasingly perfect for Night Sky observations. At the observatory, as

Education Outreach Co-ordinator, I will have sent letters to all the island's primary schools. In anticipation, making the links to those teachers and their curriculum, who align themselves with our interests in observing the skies, and in learning about such topics as the solar system, deep space, and the adventures of the movements of celestial bodies - focusing on a clear night what might be seen through our array of telescopes. Other groups such as scouts and guides finding their way to our door, resplendent with tasks and badges.

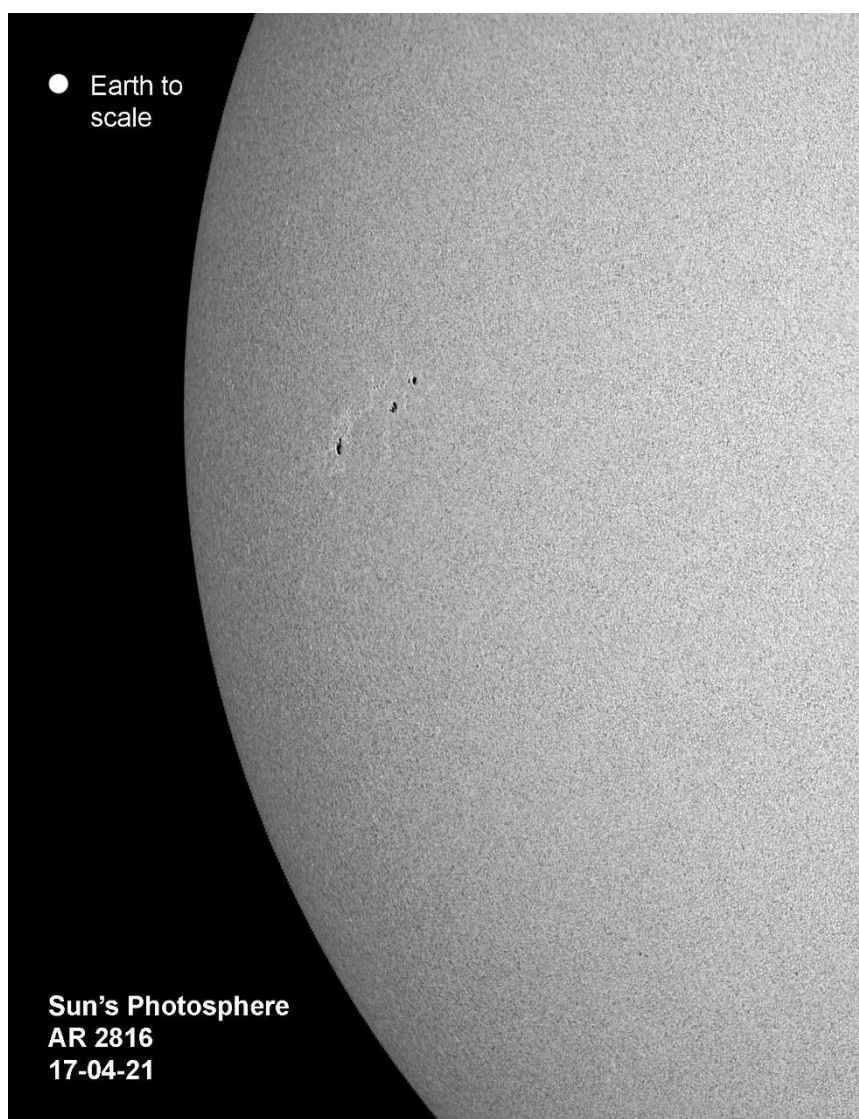
At the Astronomy Section our volunteers with skills, knowledge and enthusiasm engage with these young minds: in the Summer with safe solar viewing and in the Winter with telescopic sights of the dark sky. Giving presentations and interacting with questions and answers, those curious, ask about how a telescope works, what a star is made of, and why does a planet look red. Just by looking skyward of course, many objects can be seen with the naked eye, such as the unexpected 'shooting star', the arching Milky Way and the track of the ISS. Feeding the scientific mind and also the sense of wonder and enrichment.

With our young people as welcome guests, those with the responsibility of meeting and organising children to our site, we are engaging, and currently undergoing, formal training with the Youth Commission for Guernsey and Alderney and other bodies related to Child Protection, the ISCP (Islands Safeguarding Children Partnership) Levels 1 /2. We have a risk assessment procedure, first aid equipment, and members will have disclosed their background as related to the Section. We are committed to keeping our young people safe at all times.

April Solar Open Day

On Saturday the 17th of April the observatory hosted a solar open day to the public. Despite some concern due to a volatile weather forecast leading up to the event, the weather on the day was very good with clear skies most of the time and only the occasional cloud passing over the sun. On the day we set up the Celestron SCT, the Takahashi, a Ha (Hydrogen Alpha) solar scope and the Heliostat. Additionally some volunteers engaged with visitors using makeshift cereal box pinhole cameras, and the live feed to the solar dynamics observatory.

The sun itself had some activity with three sunspots which were clearly visible through the Celestron and the Takahashi, and some noticeable



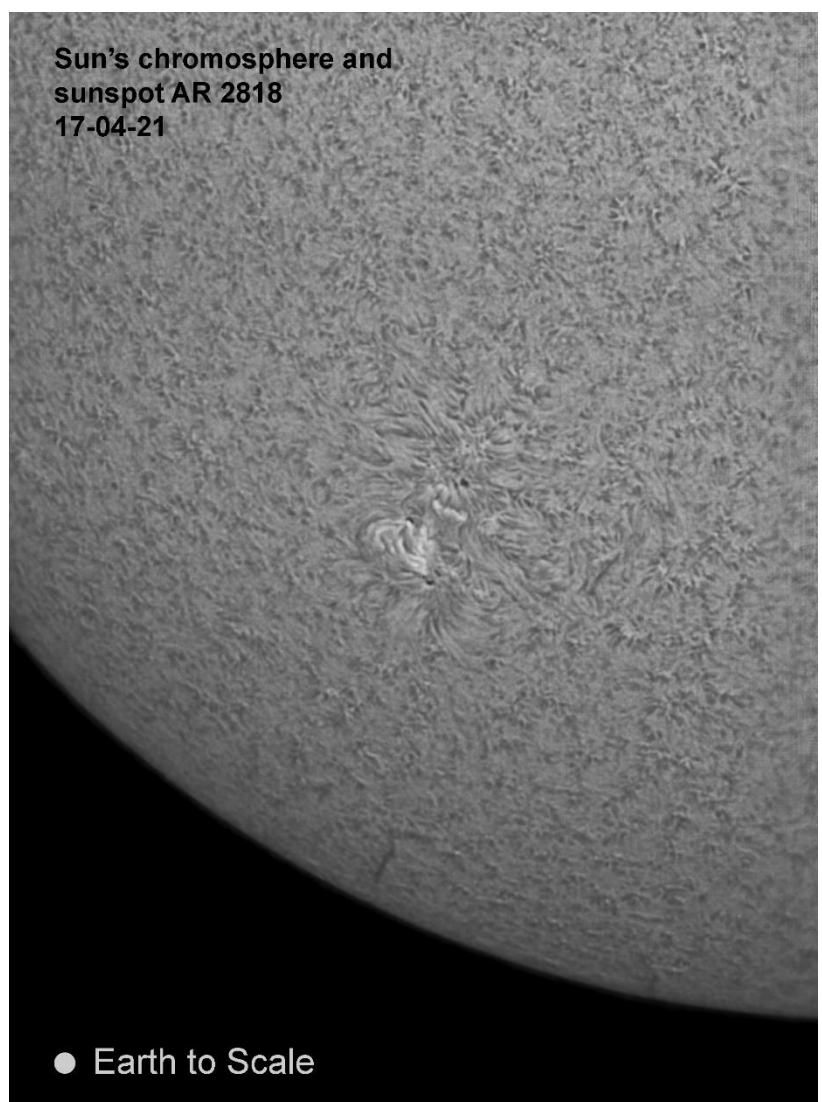


prominences visible through the Ha solar scope. Overall the event had a good turnout of all age ranges.

Thanks to Clive, Jean, Jen, Jill, Nick, Owain, Peter and Rich who helped out on the day. Additionally thanks to Elaine and Martin who offered to help out on other dates, and thanks to Allan who came up beforehand and helped mount the Takahashi to the HEQ5, and also anyone else I might have missed.

Anthony Nel

Pictures of the Sun taken by Jean Dean using a Lunt solarscope and ZWO planetary camera on the 17th April.



Upcoming Talks

These talks are generally recordings played on the club projector in the meeting room for members to watch and discuss. The talks are shown every other biweekly meeting.

Darkness Surrounds Us: The other 95% of the Universe .

13 Jul 2021 at 20:45

All the material we can see is just a small fraction of the universe. The rest, a full 95 percent, is invisible and mysterious. These are the enigmatic dark matter and dark energy. While dark matter keeps things like galaxies together, dark energy acts in an opposite way – it pushes groups of galaxies apart and expands the universe itself. This event will discuss how astronomers are working to map the universe's dark matter so they can see the effects of dark energy. The results could help us understand if the universe will expand at an accelerating rate forever.

Speaker(s): Alina Kiessling and Jason Rhodes — Astrophysicists, NASA-JPL

Mapping the Heavens to Understand Dark Matter and Black Holes

10 Aug 2021 at 20:45

From time immemorial humans have been charting the night sky to make sense of the cosmos - from the mapping of stars for navigation to today's digital surveys of galaxies to understand dark matter. In this presentation Dr Priya Natarajan, author of the book "Mapping the Heavens," recounts the evolution of celestial map-making and shows how maps literally track our ever evolving cosmic view. In particular, she discusses recent developments in our understanding of two invisible entities: dark matter and black holes.

Dr. Natarajan is a theoretical astrophysicist at Yale University, interested in cosmology, gravitational lensing and black hole physics. Her research focuses on making dark matter maps of clusters of galaxies, the largest known repositories of dark matter.

Speaker: Dr Priya Natarajan, a theoretical physicist at Yale University.

How Our Solar System Began

7 Sep 2021 at 20:45

Professor Sara Russell takes us on a geological voyage around our Solar System, describing how the Solar System came to be as it is today and looking at rocks and landscapes on other planets.

Speaker: Professor Sara Russell, Natural History Museum

Space Cameras: A Sharper Image

5 Oct 2021 at 20:45

Space-exploring cameras are bringing the universe into an even sharper focus. Imaging experts on the Mars rovers teams discuss how to get images from millions of miles away to screens here on Earth. This is not just for people interested in astrophotography – the talk is illustrated with many stunning images from Mars.

The Search for Life - Exploring Ocean Worlds

2 Nov 2021 at 20:45

The search for life is "civilization level science." What happens if or when we find it? Using the upcoming block of "Ocean Access" missions, astrobiologist Morgan Cable shows us why ocean worlds are important and what the discovery of life could mean to us as a civilization.

Speaker: Morgan Cable, Astrobiology and Ocean Worlds, JP

Talk Mercury

30 Nov 2021 at 20:45

Explore volcanoes on Mercury and the history of formation through our past missions to our Solar System's smallest planet with Professor Dave Rothery.

Talk Apollo 8 Go for TLI 1969

21 December at 20:45

On 21st December Apollo 8 launched, the mission lasted 5 days and carried astronauts James Lovell, William Anders and Frank Borman to the Moon and back. They were the first humans to leave low Earth orbit and head for another celestial body. Mike Collins, who was later to be the command module pilot on Apollo 11, was acting as Capcom (the point of contact on the ground) at Houston and the Apollo 8 crew.

At 002:27:22 (mission time) Collins said: "Apollo 8. You are Go for TLI. Over."

At 002:27:27 Borman replies: "Roger. We understand; we are Go for TLI."

Mike Collins later said of giving the go for Trans-lunar Injection, that the call to the spacecraft for the TLI burn was about as dramatic as asking for a second lump of sugar, that there ought to be more to this "umbilical snipping ceremony". The photographs of Apollo 8's TLI taken by David Le Conte with assistance from Joe Coldwell and Bill Perry are the only record of this event, which in total lasted 5 minutes and 29 seconds.

We will be showing original footage of the Apollo 8 mission along with mince pies and other Christmas nibbles.

Bi-Weekly Meeting Dates

Club nights start at 8pm, or 8:30 pm for new or prospective members, who are very welcome to come along to any club nights. The first half hour is reserved for discussions on committee matters, outreach and other logistical matters. A list of club nights through the end of the year is given below. Please see the note for recent travelers and anyone feeling ill in the introduction.

13th July 2021 – *Talk: Darkness Surrounds Us: The other 95% of the Universe*

27th Jul 2021 – *Club Night*

10th Aug 2021 – *Talk: Mapping the Heavens to Understand Dark Matter and Black Holes*

24th Aug 2021 – *Club Night*

7th Sept 2021 – *Talk: How Our Solar System Began*

21st Sep 2021 – *Club Night*

5th Oct 2021 – *Talk: Space Cameras*

19th Oct 2021 – *Club Night*

2nd Nov 2021 – *The Search for Life - Exploring Ocean Worlds*

16th Nov 2021 – *Club Night*

30th Nov 2021 – *Talk: Talk Mercury*

14th Dec 2021 – *Club Night*

21st Dec 2021 – *Talk: Apollo 8 Go For TLI 1969*

As always there is tea/coffee and a good supply of biscuits thanks to Jill. Please note there is a donation box to cover the cost of this and other minor kitchen consumables.

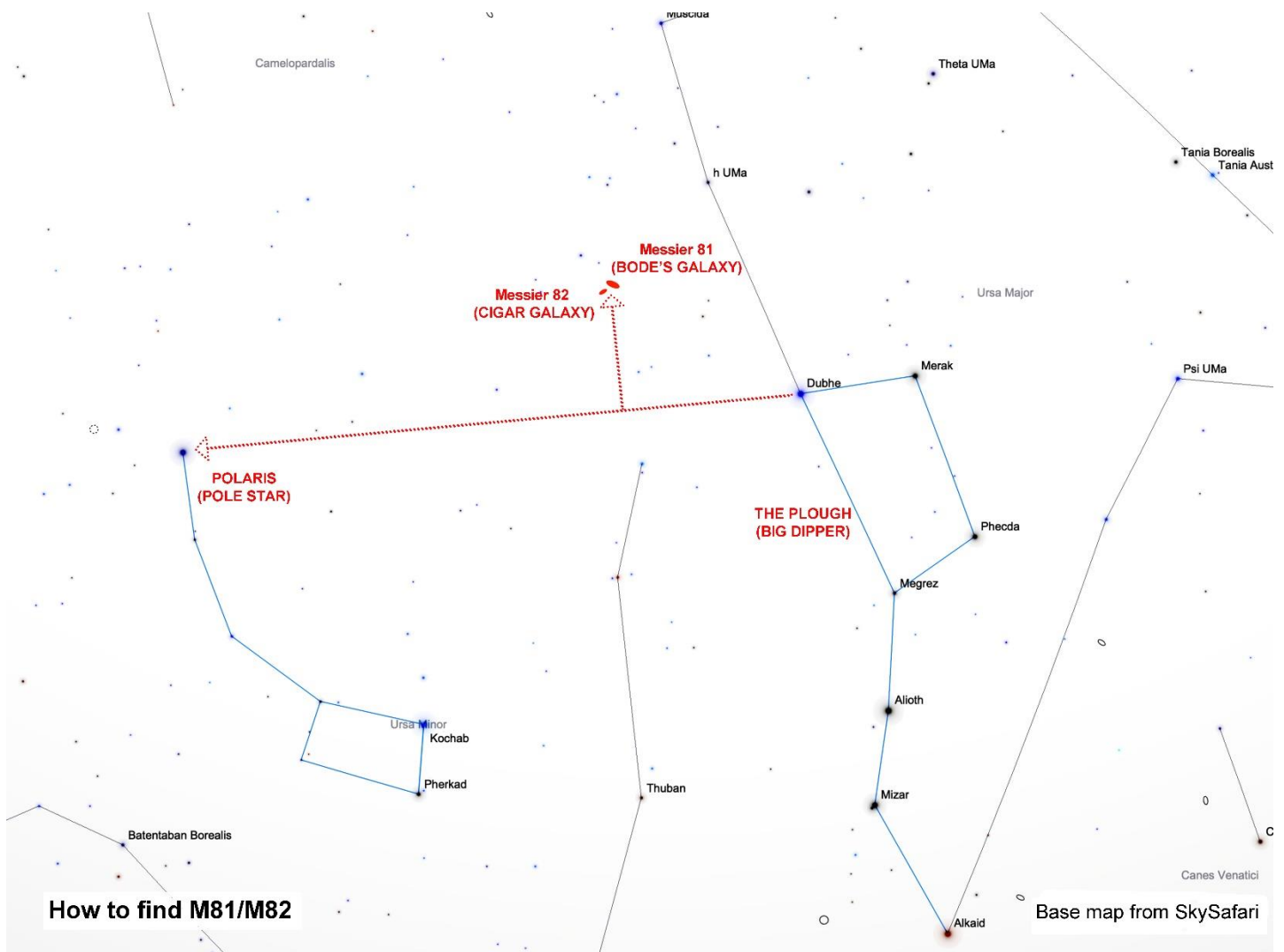
Astrophotography

Over the last few months members have been learning some astrophotography skills using the Skywatcher HEQ5 equatorial GOTO/tracking mount and Esprit refractor. This image showing galaxies Messier 81 and 82 was taken by Stephanie over a few nights and represents a total integrated imaging time of 3 hours with a Canon 600D and 60Da. The data was calibrated and noise reduced with dark, flat and bias frames.



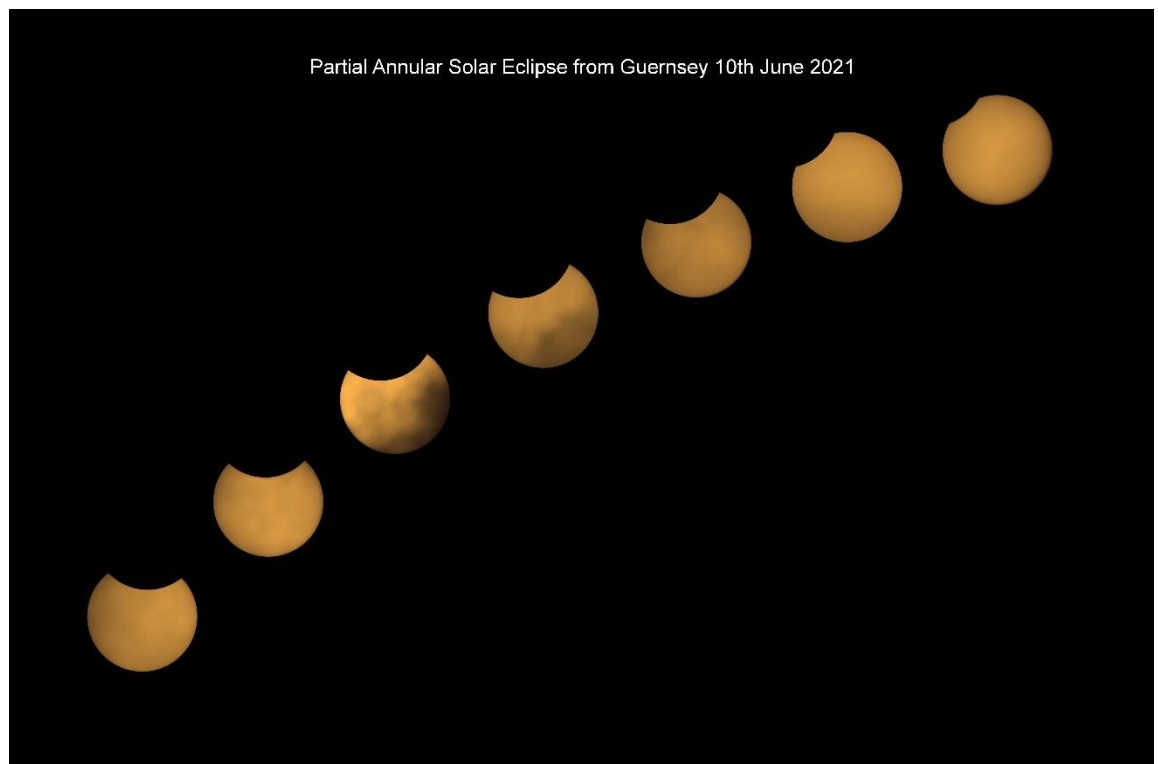
Grand design spiral galaxy M81 (Bode's Galaxy) and starburst galaxy M82 (Cigar Galaxy) are approximately 11.7 million light years from earth in the constellation of Ursa Major. M81 is similar in size to our Milky Way galaxy and being one of the brightest galaxies in the night sky it makes a splendid sight in a telescope and an excellent target to image.

Here is a sky chart showing how you find M81 and M82.



In the image of M81/M82 how many other galaxies can you see? The answer is on page 20.

Here is an image of the partial solar eclipse on the 10th June 2021 as seen from Guernsey. It was taken by member Jean Dean using a DSLR and 400mm focal length lens fitted with Baader solar film.



Extra-terrestrial Life: Closer than we think?

When we consider the potential for life other than that on Earth, we often think of worlds similar to our own orbiting around stars light years away. However there are locations much closer to home that are of interest, and could potentially provide conditions suitable for some form of life.

One such location that could potentially provide conditions amenable to life is Europa, one of the Galilean moons of Jupiter. At first look, the moon's distance from the sun combined with the high reflectivity of its surface resulting in average surface temperatures ranging from -160°C to -220°C between the equator and poles, in addition to the radiation levels on the surface capable of killing a human within a day, would make the moon seem rather inhospitable. However, scientists believe that beneath the thick sheet of ice on the moon's surface is a subsurface ocean heated by the tidal flexing of the moon caused by its proximity to the gas giant Jupiter. It is speculated that life could exist within the ocean around hydrothermal vents, similar to the life found around these vents on earth. The hospitality towards life as we know it would depend on the temperature of the subsurface ocean, and the salt content which is unknown. Additionally, it is estimated that the ice sheet on the moon's surface could be as thick as 30km, leaving the secret of what lies beneath Europa's icy surface a mystery. Hopefully future missions such as the Europa Clipper set to launch this decade and the JUICE(JUpiter ICy moons Explorer) set to launch in 2022 will provide us with further information on the moon and its composition.

Enceladus is a similar case to Europa. The moon of Saturn is covered by a thick sheet of ice, with what is believed to be a subsurface ocean beneath. However more is known of the composition of the subsurface ocean, due to the Cassini space probe sampling some of the plumes of water vapour being expelled from the moon. The sampling of said plumes revealed trace amounts of simple hydrocarbons, as well as molecular hydrogen which could be due to hydrothermal activity beneath the moon's ice sheet, increasing the likelihood that the moon has the potential to support some form of life.

Titan, Saturn's largest moon is very different to the previous two moons, and most other moons in the solar system. It is the only moon in the solar system that has a thick atmosphere, consisting of more than trace gases. Additionally, it is the only known location other than earth that has liquid lakes and rivers on its surface. However, with a surface temperature of -179°C , liquid water cannot exist on the surface. Instead the bodies of liquid on the surface consist of liquid methane and ethane. All known life on our planet requires liquid water, however should there be life on the surface of Titan it would be very different to life as we know it. Scientists have speculated on the possibility of life that could take in hydrogen to combine with some of the organic compounds present on Titan to produce energy. This combined with another possible subsurface ocean of liquid water on the moon, makes it a target of interest in the search for life in our solar system.

If microbial life does exist on another world within our own solar system with a distinct origin to the life on our own, this would hint towards life being very common in the universe.

Anthony Nel

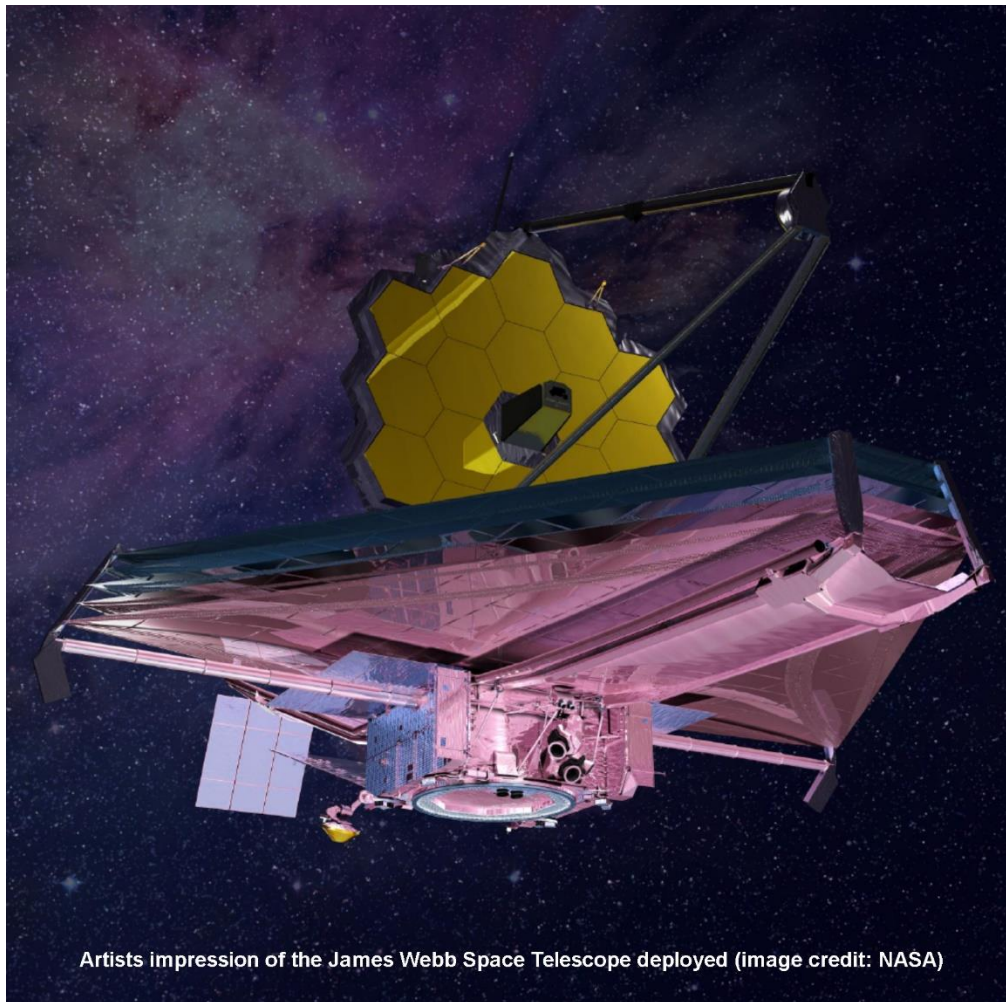
How to beat the pesky clouds!

This image is an interacting pair of galaxies ARP 273 in the constellation of Andromeda, about 300 million light years away. Taken with a reflecting telescope, 2.4m diameter and 57.6m focal length, this is just under 6 hours (the Hubble Space Telescope!).



The larger galaxy, UGC 1810 is about five times more massive than the smaller galaxy, UGC 1813. The gravitation pull of the smaller galaxy has distorted the larger galaxy and it is thought the smaller galaxy has actually passed through the larger galaxy. The smaller galaxy shows distinct signs of active star formation within its core, probably as a result of the strong tidal forces from interacting with the larger galaxy.

Data from the Hubble Legacy Archive. If you would like to try processing some HST data here is the link: <https://hla.stsci.edu>.



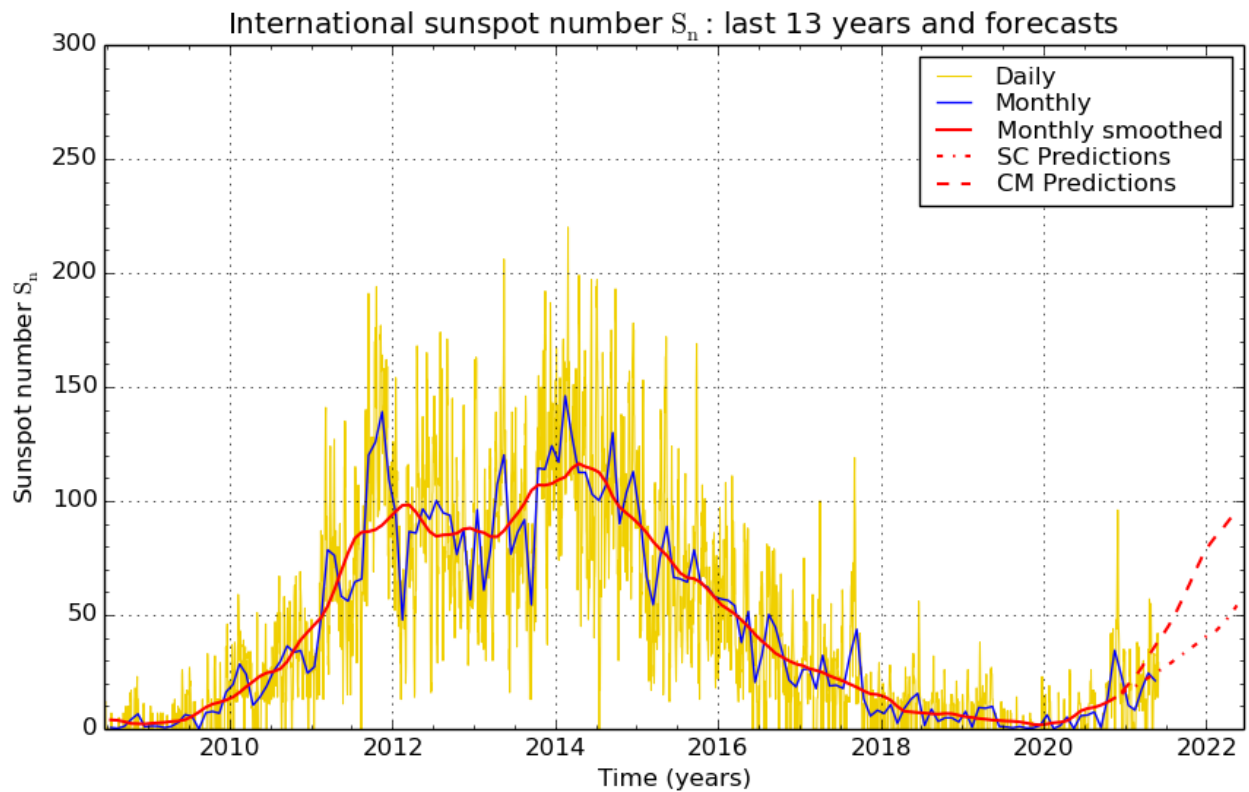
Artists impression of the James Webb Space Telescope deployed (image credit: NASA)

One final note, staying on the topic of space telescopes NASA's James Webb Space Telescope (JWST), which will be the premier space observatory of the next decade, remains on schedule for a launch readiness date no earlier than Oct. 31, 2021. If you want to follow the progress of JWST here is a link: www.jwst.nasa.gov

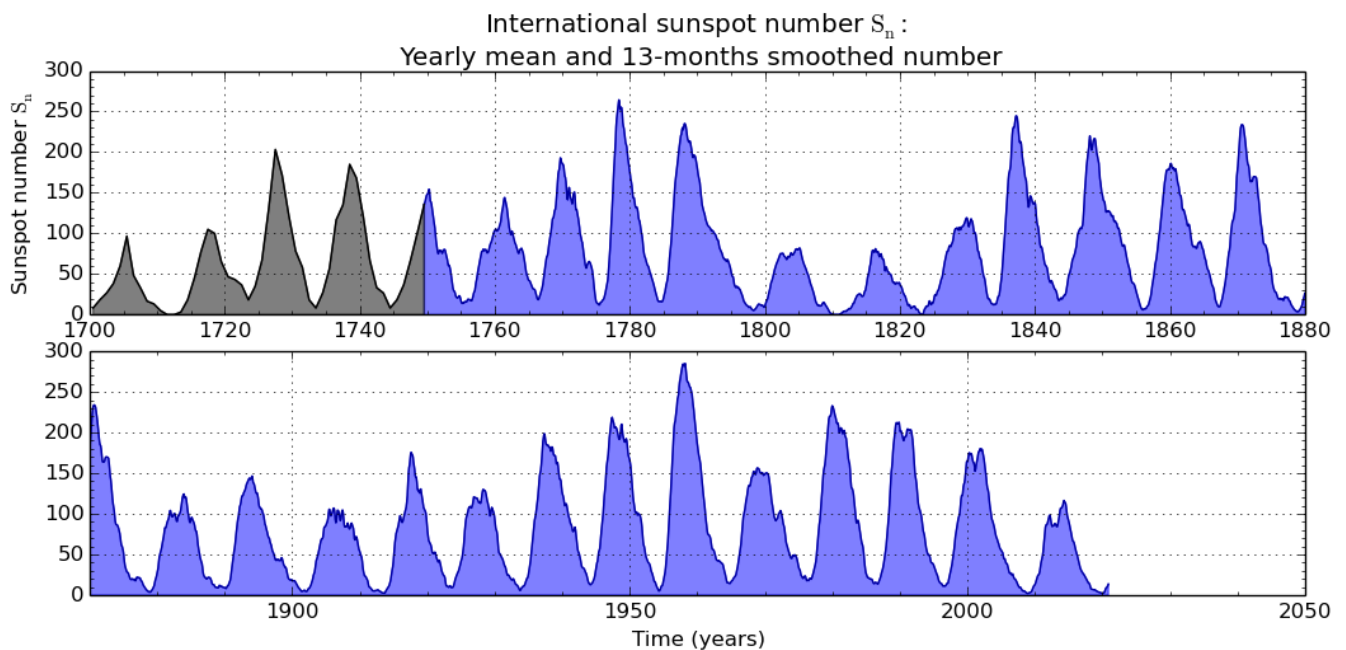
Jean Dean

Solar Activity

As solar cycle 25 progresses sunspots are becoming a permanent feature on the solar disc. The predictions for the next 12 months are still quite variable and it is too soon to determine if cycle 25 will be less or more active than cycle 24. If you wish to follow sunspot activity here is the link to the Sunspot Index and Long Term Solar Observations (SILSO): www.sidc.be/silso/ssngraphics.

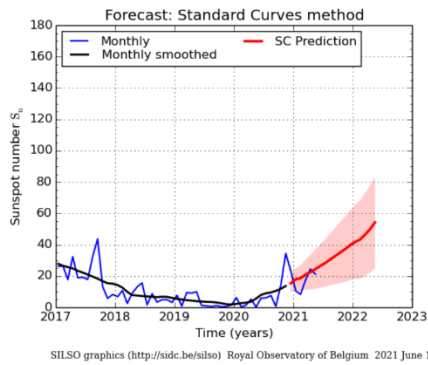


SILSO graphics (<http://sidc.be/silso>) Royal Observatory of Belgium 2021 June 1

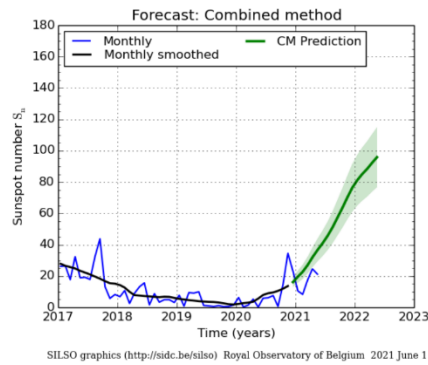


SILSO graphics (<http://sidc.be/silso>) Royal Observatory of Belgium 2021 June 1

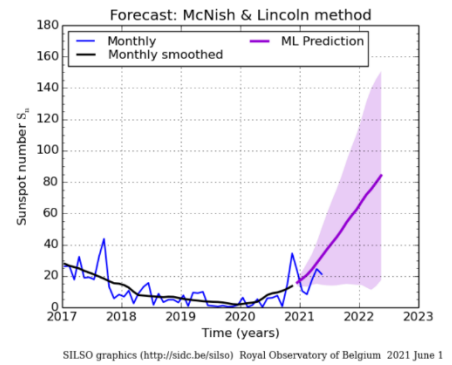
12-month ahead predictions of the monthly smoothed Sunspot Number



Standard Curves method (SC)

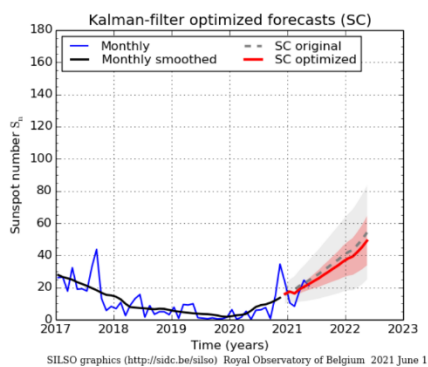


Combined method (CM)

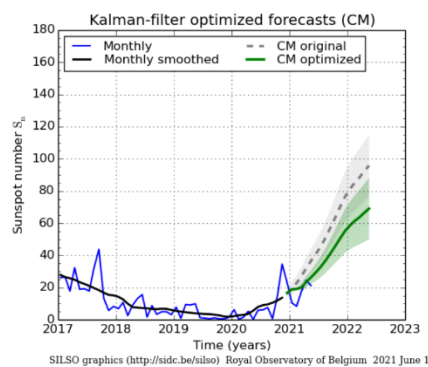


McNish&Lincoln method (ML)

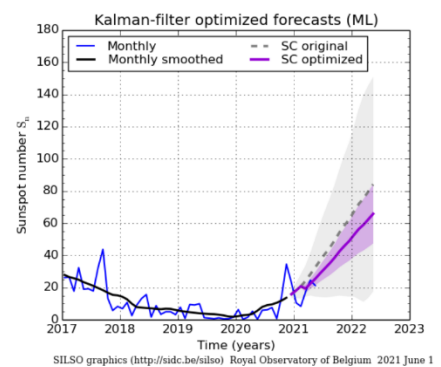
Kalman-filter optimization of the 12-month ahead predictions



Standard Curves method (SC)



Combined method (CM)



McNish&Lincoln method (ML)

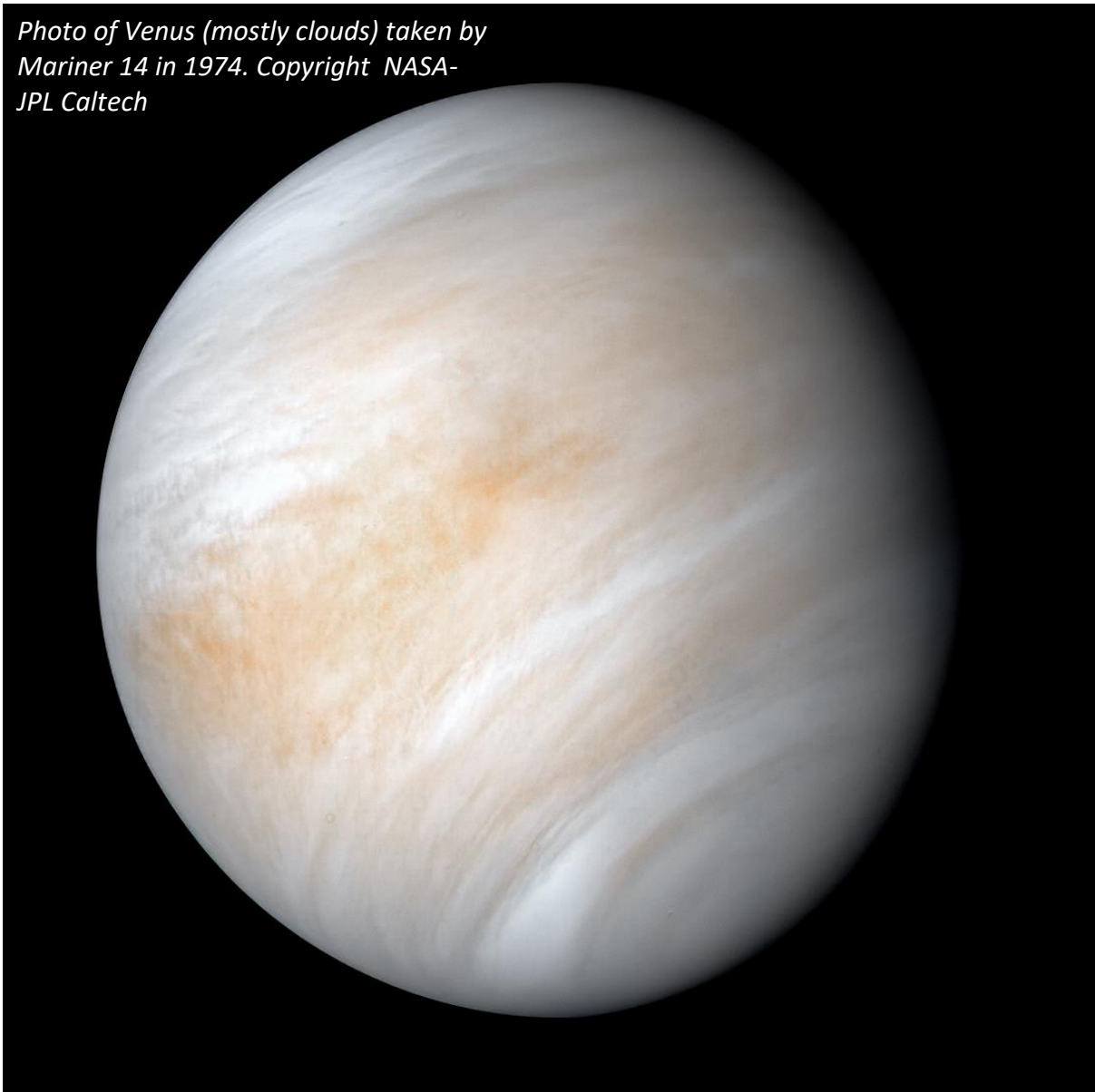
Sunspots are a measure of how active the sun is and astronomers have been measuring sunspot activity since the early 17th Century; although the first recorded observation of a sunspot originates in China and dates back to 364BC. Today we measure all aspects of our environment in great detail, however, historical records that provide context against which we might determine change and thus causes are typically lacking. Having a relatively detailed record of sunspot activity, which make a reasonable proxy for past solar activity, is extremely useful. We can see from the historical records that solar activity goes through very distinct cycles with periods of 11/22 years. Superimposed on this is a much longer semi-centennial/centennial cycle that shows periods of higher than average activity and periods of lower than average activity – a little like spring and neap tides and the extreme spring/autumn equinox tides.

Jean Dean

Venus: Past, Present and Future

Venus, which is considered one of the least hospitable planets in the solar system, received considerable media attention last year when scientists observed a chemical that may have been produced by cellular life. Phosphine, which is a poisonous chemical that is produced by anaerobic microbes (microbes that don't need oxygen), was detected in the upper atmosphere of Venus by observing the absence of the light absorbed by this molecule. This observation was completed by 2 telescopes, the James Clerk Maxwell Telescope in Hawaii and the Atacama Large Submillimetre Array (ALMA) in Chile. They are both submillimetre radio telescopes, so they can see the correct part of the electromagnetic spectrum to detect this absorption.

Photo of Venus (mostly clouds) taken by Mariner 14 in 1974. Copyright NASA-JPL Caltech



Phosphine is a delicate compound and would be quickly broken down by the harsh UV light. The fact that it is observable means there must be a process which replenishes it. Scientists calculate the pathways by which this chemical could be produced, and there are no known chemical or geological methods that could produce it in the observed quantities, suggesting it is a by-product of life. The signal comes from the upper atmosphere of Venus, where at around 50km the temperature and

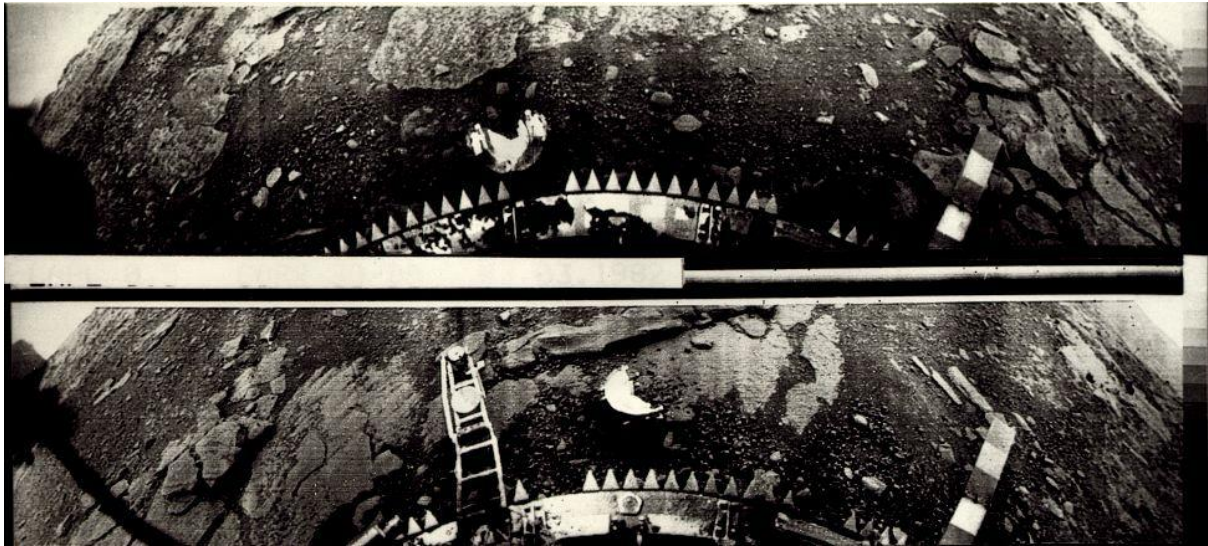
pressure are similar to earth and potentially more hospitable for life. The absorption was detected only near the equator, which would be consistent with large floating clouds of microorganisms. The discovery of phosphine was controversial, and there is currently an ongoing scientific debate as to the veracity of the observation as independent reanalysis has failed to reproduce the result and suggests the much more boring sulfur dioxide lead to the detection. Overall the jury is still out, but there is a reasonable chance that this discovery will join the long list of other disproven discoveries of alien life.

One of the ways questions like these are settled is by sending spacecraft to take a look.

Venus has long been shunned in comparison to Mars, at least by western space agencies such as ESA and NASA. NASA's last dedicated Venus mission was over 40 years ago in 1978 with a Pioneer probe. The USSR had a successful and long running Venus exploration program with the Venera probes. The first probe to arrive at Venus was NASA's Mariner 2 in 1962, which was also the first ever successful interplanetary mission. Venera 4 was the first Soviet probe to make it to Venus, and it measured the atmospheric composition (96% CO₂) and surface temperature (over 500 °C), as well as the extremely high pressure (92x Earth at ground level) . Many scientists were disillusioned by the inhospitality of Venus, which had long been hoped was a sister planet of Earth. Venus also has near-constant sulfuric acid rain, which eats away at the landers.

Venera 7 landed on Venus in 1970 and was the first spacecraft to land on another planet and transmit back. It's parachute partially melted as it descended through the atmosphere and eventually failed, causing it to crash into the surface at 40mph. Contact was thought to have been lost but when the radio logs were later reviewed 20 minutes of very weak signals from the surface were discovered, which confirmed the expecting high temperature and pressure. Venera 8 and 9 were also landers which returned the first black and white images in 1975, and Venera 13 and 14 returned colour pictures in 1982, as well as conducting soil samples. Venera 13 was the longest surviving Venus probe, lasting 127 minutes on the surface. The Venera landers have a lot more resemblance to a deep-sea submarine than the moon or mars landers you might have seen pictures of, with a thick spherical pressure chamber to stop the spacecraft from immediately being crushed. Since then there have only been a few Venus orbiters, such as the European Venus Express which arrived in 2005 and monitored the atmosphere for 9 years. At the moment there is only the JAXA (Japanese space agency) probe Akatsuki orbiting Venus, which is also studying the atmosphere and has been there since 2015. Not exactly the 13 mars orbiters/landers/rovers/helicopters currently operating on the Red Planet!

In June 2021, NASA announced 2 new missions to Venus, which are planned to launch by 2030. They are known as DAVINCI+ (Deep Atmosphere Venus Investigation of Noble Gases, Chemistry and Imaging) and VERITAS (Venus Emissivity, Radio Science, InSAR, Topography and Spectroscopy). DAVINCI will study Venus's atmosphere to understand how it formed, as well as taking high resolution photographs of surface features thought to be continents, which would suggest Venus has plate tectonics. DAVINCI+ will also carry a descent sphere that will fall into the Venusian atmosphere and take much more accurate readings of the trace gases, to try and understand why Venus underwent a runaway greenhouse effect and Earth didn't.



Photos taken by Venera 14 from the surface of Venus.

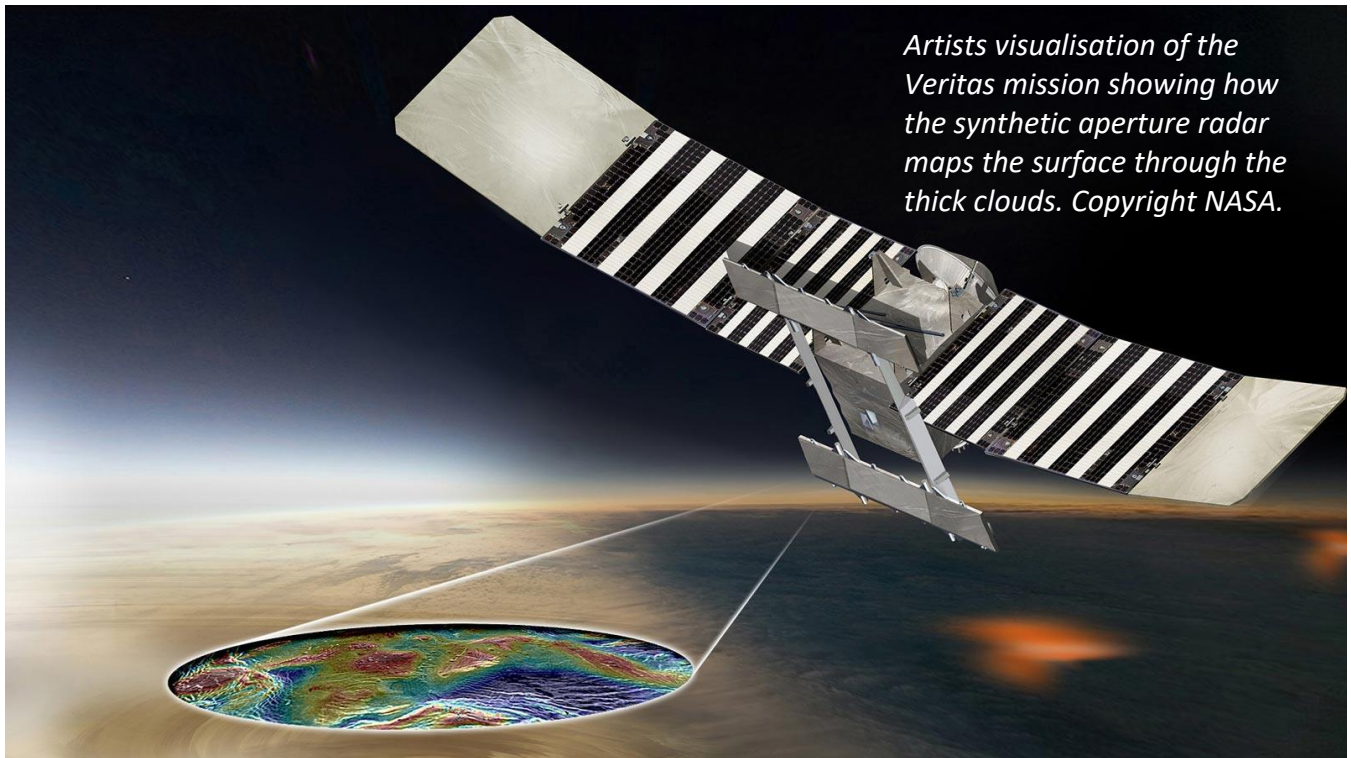


VERITAS uses a clever piece of technology called synthetic aperture radar, which bounces radar signals of the planet in such a way it detects the return signal further along in its orbit. This trick which takes advantage of the orbital motion of the spacecraft, increases the apparent size of the radar antenna allowing the system to take much higher resolution maps of the surface. This will allow 3D terrain reconstructions to further study whether there are active plate tectonics and volcanism. VERITAS will also use infrared emissions to determine the makeup of surface rocks and measure whether active volcanos are releasing water vapour.

There are also proposals from the ISRO (Indian Space Agency) for an orbiter and upper atmosphere balloons, which would be released at around 55km carrying a 10kg payload to study the upper atmosphere. If it is funded, it would be launched in 2024 or 2026. ROSCOSMOS have a similar proposal for an orbiter, several balloons and a lander known collectively as Venera D, which would be launched in 2029. The lander would aim to operate for up to 3 hours on the surface.

NASA ran a competition last year looking for innovative proposals for the challenge of designing an autonomous rover that would work on the surface, either by designing electronics that can withstand the temperature, pressure and corrosion, or by replacing the delicate semiconductors with an entirely mechanical system – a clockwork rover! There were some very clever submissions

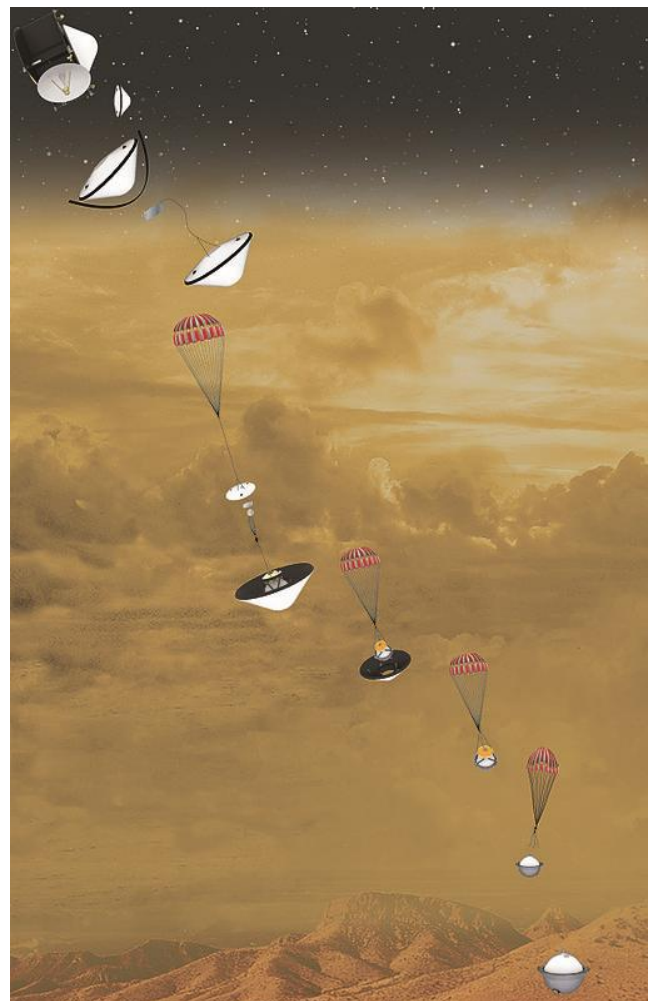
for mechanical solutions for autonomous driving and collision avoidance and even entirely mechanical data transmission! The Mars rovers have taught us so much that we couldn't have learnt any other way, and the idea of a Venus rover is an incredible technical challenge that is worth exploring for the future.



Artists visualisation of the Veritas mission showing how the synthetic aperture radar maps the surface through the thick clouds. Copyright NASA.

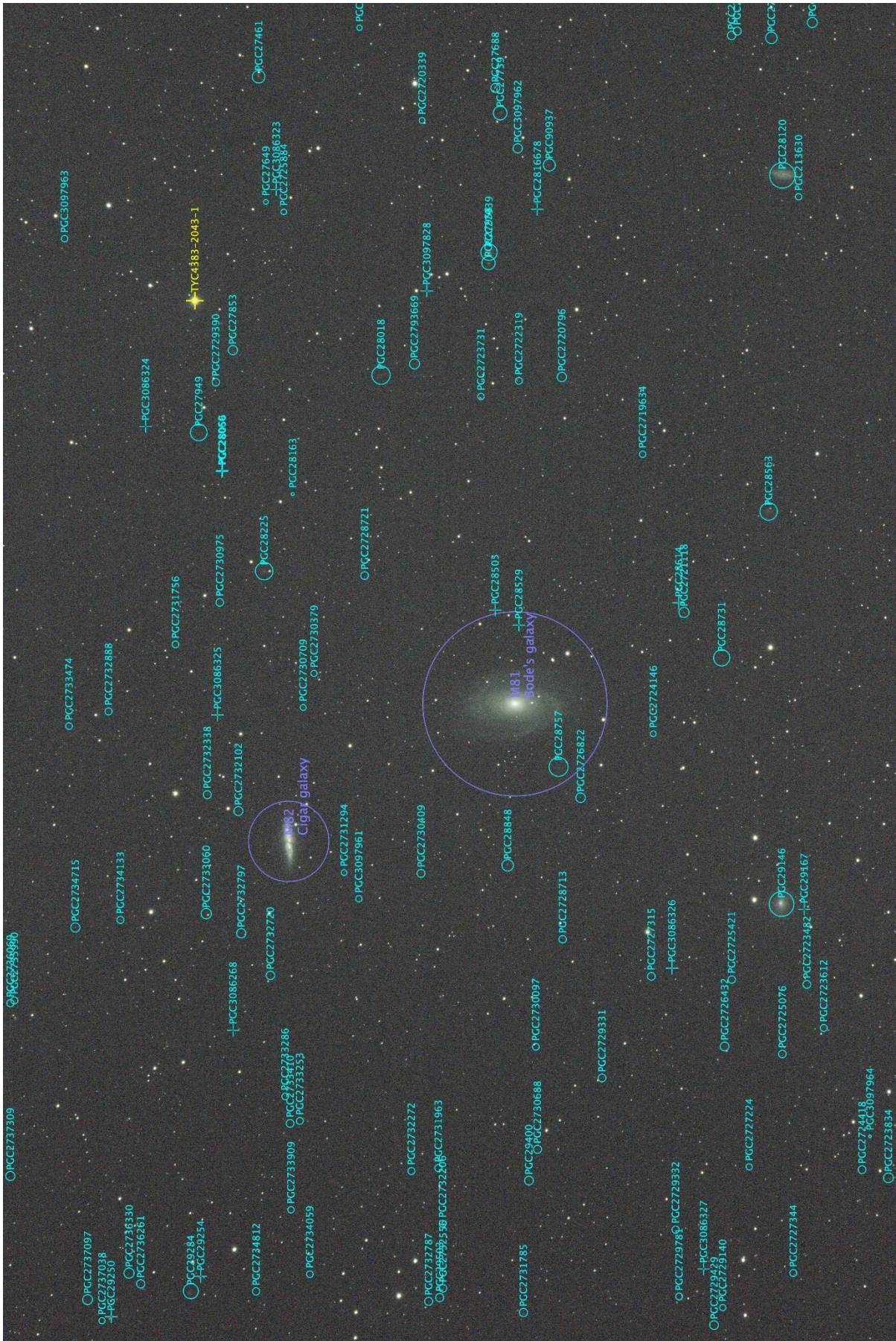
It is a very exciting time for Venus exploration, and I'm pleased that the next step in understanding Earth's sister planet is underway. This next generation of Venus missions might tell us what lead to Venus's runaway greenhouse effect and maybe give us some hints as to how we avoid the same thing happening here. We might even learn whether there is life in the clouds!

Thomas Harvey



Artists visualisation of the descent of the DAVINCI+ sphere through the Venusian atmosphere. Copyright NASA.

Answer to how many galaxies you can see



All the blue circles/crosses are galaxies so there are 113 galaxies in this image which represents a field of view of approximately $3^\circ \times 2^\circ$ (6 x 4 full moons).