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Stars over Surrey. A monthly guide to astronomy and developments in space with Graham Laycock and Rachel Dutton of Guildford Astronomical Society.

And welcome along to Stars Over Surrey with Graham Laycock and Rachel Dutton, a fellow of the Royal Astronomical Society, and a member of the Guildford Astronomical Society. We're looking again at astronomy and space. Hello, Rachel. Hi Graham. How are you? Very well, and you? I'm good. Thank you. It's been a good month.

Image Credit: Rachel Dutton FRAS

I managed to get some astrophotography in, so that's a good start. All right, well, what was the astrophotography? Okay, so I am showing Graham an image of the Eastern Veil Nebula. So if you want to see this image, you can go to the show notes. It'll be there. And this is a remnant leftover from Supernova in the Cygnus constellation.

It's part of what we call the Cygnus loop. And if you look at it, you can see sort of red some greens in there. And if I edited a bit more, we'll see some blue as well. Yes, I can see that. Yeah. It's sort of like a crescent shape in there. Yes. Because this is a star that exploded and this is the material spreading out in that shockwave away from the star.

So, you've got green, which is sulphur, red, which is hydrogen, and blue is oxygen. And this is obviously going to spread out and seed the interstellar medium. Now I think. But this, whilst it's often just called the Eastern Veil, I think it kind of looks like the profile of Alien from the Alien movies.

Yes. Just look a bit like it, doesn't it? Yes. So I have my own little thing where I quite like to rename it the Xenomorph nebula, but I don’t how popular that's going to be. Oh, right, yeah. There you are. Have a go then. How'd you go about getting that done? I have no idea, but it, it is more the colloquial name rather than anything else.

Yeah, indeed.

Now, apparently we've got a new planet in the solar system.

Back in 2006, Pluto was relegated to a new class of planets called dwarf planets that are small planet like objects in the far reaches of the solar system, known as the Kuiper Belt. Those planetsare also what we call trans Neptunian objects.

So they are large objects outside the orbit of Neptune, and there are five of them recognised by the IAU at this time. Although most people would say there are eight, and this is the new candidate. So this would be the sixth official one, or the ninth unofficial one. And I will say after the five officially recognised dwarf planet, one is Ceres, which is in the main asteroid belt between Mars and Jupiter.

But we're going to ignore Ceres for now. So what happened here, researchers found another rare type of trans Neptunian object called an Extreme Trans Neptunian Object. And they are even more distant from the Sun, which is why we're calling them extreme. And their perihelias in their nearest point from the Sun is roughly 70 astronomical units, and this object's working name at the moment is 2017 OF201. That rolls off the tongue. It does. If it is eventually classified as ADO Planet, I'm sure it'll be given some kind of mythological God name. Okay, so in 2017 OF201, it's currently located at a distance of 90.5 astronomical units and one astronomical unit, or AU for short, is the distance from the Sun to the Earth. So it's 90 times further out than the Earth and it's orbit is extremely wide and extends right out through the Kuiper Belt to the inner Oort Cloud. With a perihelion of 44.9 AU, and this was precisely determined from 19 observations over seven years.

And this planet candidate 2017 OF201 is notable for two reasons. One, it's got a large size and two, the extremely wide orbit. And its size is roughly 700 km in diameter. Now, to give some comparisons, we've got Pluto, which is 2,377 km in diameter, and the moon is 3,475 km.

So you're thinking, okay, it's nowhere quite the size of those, but if you think about Bennu, where we had the sample return that was only 525 meters in diameter and Dimorphus, that asteroid that got nudged in the Dart mission, it's 170 meters, so it is clearly a dwarf planet and not an asteroid.

It's of significant size and it's got this really extremely wide orbit. So it must have been hit by a giant planet at some time, earlier on in time or history. But this has complicated things in the search for Planet X or Planet Nine Now. This is a whole other sort of ball game in terms of astronomy.

So we had the Naked Eye Visible planets, mercury, Venus, Mars, Jupiter, Saturn. Then William Herschel, he and his sister Caroline Herschel, used to look for comets in the sky and they found a comet and they realised its motion wasn't quite right and worked out it was a planet. And at the time, he named it after his patron and sponsor King George.

So it was originally called George's Star or George, and we named it after the Greek God, Uranus. And then. People started examining Uranus and realised that something was not quite right with its orbit, so something must be tugging on it to change its orbit. And that's when they worked out. There must be another planet, and Neptune was found.

And then people started looking at the perturbations within the orbits of Uranus and Neptune and said, well, there must be something else out there. And they found Pluto. Pluto doesn't kind of explain all those perturbations. So we've still got this idea of a Planet nine sometimes also called Planet X, and there are lots of different theories about this, but it essentially stems from these unusual clusterings of orbits of extreme trans Neptune in objects beyond the Neptune.

Um. They were looking at some of these objects and they're sharing a plane, a direction, a perihelion, which suggests a gravitational influence from something massive and unseen. And the best explanation for most people is this extra planet. But other people are saying, well, maybe it could be like a pet black hole, like a baby black hole in the Solar System.

So some people are thinking that this candidate. Planet could be more evidence that you can have planets further out. But when they were looking at the mathematical simulations of these groupings of ETNOs 2017 OF201 does not match those. So it looks like it's not supporting that, and other people are saying, well, it is supporting that.

So it is causing a bit of a, a flurry and a fluster in that community as well. Now, it doesn't match those orbits, but even more confusingly, it's only observable to us for 1% of its orbit time. So that means there could be many, many more of these objects out there that are only going to be observable for a tiny portion of their orbit.

So we are completely unaware of them, if that's the case. Mm-hmm. Yes, I can see that indeed. Just don't know what exists on that basis. There we go. Yeah, but we don't know what we don't know. That's very true, isn't it? Yes.

I see we've got time team Solar System edition now all about Jupiter.

Yes. So this is a bit of planetary archeology.

Right, okay. As I'm calling it, as, that's not a proper field. I'm calling it that. No, just digging then. But we have, galactic archeologists who work out what happened to the Milky Way in the past. So I thought, you know, Planetary. Archeologists, we could have something similar. Yeah, why not? So Jupiter is the most massive thing in our solar system that isn't the sun.

It's famous for having so much mass. It's so significant that it can trap asteroids making it responsible for the asteroid belt. And it doesn't just save us from these asteroids, it can fling them at as well. So it's a bit 50 50, whether it's our saviour or, going to cause us problems.

And eventually it'll probably eject all of the planets from the Solar System way in the future. I'm not gonna worry about that right now. And it's so significant that sometimes the centre of mass, the whole Solar System is not inside the sun. It's slightly outside of it. So just in case you're not quite getting it, the overall message is Jupiter is massive and to put numbers to it, it's 318 times the mass of the earth.

Wow. And it, it has a ridiculously strong magnetic field. Its magnetic field is 20 times stronger than that of the earth as well. Right. So yeah, we'd lose against it, I'm sure. Yes, any day. And some people also say that Jupiter was a failed star and it should have been a brown dwarf, but it would need to be 200 times more massive again if that was the case.

But anyway, research that Caltech are trying to understand more about how the solar system came into being, and they've posted a paper suggesting that Jupiter was once two to two and a half times bigger than it is now. A little while ago, and it would've had a magnetic field 50 times stronger. Wow.

Understanding the formation history of Jupiter is therefore vital to understanding how the early solar system evolved as it was essentially an architect in the process or like creating asteroid belt and helping move things around, and it likely heavily influenced the orbits of the planets that we know and recognise today.

As well as potentially flinging other protoplanets out and about causing collisions between protoplanets, such as possibly the Thea collision with the Earth that created the Moon, and even swallowing up small planets. We have evidence that Jupiter has small planets essentially in its belly. So when we look at the moons of Jupiter, we know it has at least 95 moons.

And Jupiter is also famous for having these large Galilean moons, which are very large compared to the others. And you can even see these with binoculars, or if you take a picture with a DSLR camera, they're very easy to spot. Now, the most inner, most of these is called Io. There are some much smaller moons, much closer into Jupiter, and these are called Amalthea and Thebe.

So not Phoebe from friends, but Phoebe with a T at the beginning. And these have slightly different tilts and orbits than they should have. So when you are looking at these moons you are thinking they should have this tilt and this orbit, but they don't.

So then working backwards as to what could have created that tilt and orbit research has worked out that Jupiter must have been much bigger around 2000 times. The volume of Earth, it's currently 1,321 times the volume of Earth, and about twice the mass, two and a half times the mass. So Jupiter must have been much bigger.

This might sound like just an interesting passing curiosity, but this is actually a really significant step in understanding Solar System formation because at the moment our models are based on things like the ability of gas to absorb or scatter electromagnetic radiation, the rates for creation and the mass of Jupiter's core.

So it's kind of working things out. Based on models and things, whereas these are actual measurable things that we can see that tell us that something was different. So it's kind of like

Solar System archeology where you know, they sort of have ideas what was at a site, and then they dig up one piece of China and then that gives them a whole load of clues as to what happened there.

Oh, fascinating stuff. Mm. Do they know then how it shrunk? No, that would be the next question. Yeah, indeed. Anyway. Maybe for a future edition we might know. Let's move on now.

Venus may have some tectonic activity after all.

Yes. We're not the only one with tectonic plates then. Well, this is the curious thing.

So plate tectonics and a liquid core are thought to be essentials for life on any terrestrial planet. When I say terrestrial, I mean rocky planet. So the Earth, we have a substantial liquid core that gives us a dynamo and a magnetic field that hold on the atmosphere that protects us from space weather, from the Sun.

Now Venus had a dynamo and it slowed down, and we believe that contributed to the weakening of magnetic fields and then. The solar wind would strip away the hydrogen in the atmosphere because there was no magnetic field funnelling it away. And hydrogen is a very light molecule. So that's the first thing to go.

And then it left behind this heavier atmosphere with lots of thick carbon monoxide. And the atmosphere is something like 90 times that of the pressure of Earth's atmosphere at sea level. And then on top of that, tectonics and volcanism also create heat, which can be needed for liquid surface water to exist.

And also volcanic eruptions can release water from inside a planet, which necessary for life, but also add gases to thicken an atmosphere. So if you're starting with. Thin atmosphere somewhere, say Mars, and you can get some volcanoes going. You might be able to release some gases into the atmosphere to help thicken it, making it more habitable because there's less radiation coming from the sun killing things off.

Whether it's a gas you can breathe or not is a whole other thing, but you might be able to thicken it to get the temperature that works and to block off radiation that could kill you. So for this reason, we're super interested in any signs of tectonics or volcanism, because that could mean that it either held life or it could host life in the future.

So scientists were analysing the data from a 30-year-old mission, the Magellan mission. And whilst they haven't found tectonic plates like we have on earth, it appears that Venus does have its own tectonic system. And there are structures on the Venetian surface called Corona, meaning crown. And these are very large circular structures ranging from tens to hundreds of miles across each.

And these structures occur where there's hot material from the planet's mantle, and it pushes upwards into the lithosphere or the stone's sphere, or the outermost shell of Rocky Planet, creating these distinctive oval formations surrounded by concentric fractures. And the team used advanced 3D modelling.

To reveal that the most studied of these Corona have hot, buoyant mantle material beneath them that's actively driving these tectonic processes. And these processes include the sort of Venetian version of subduction. So where a surface material spreads outwards from rising plumes and pushes surrounding material downwards.

We also have lithospheric dripping. It's a fun one to say, where cool materials sinks into the hot mantle and volcanic activity where molten rock pushes through thick crust. So despite not having active volcanoes or an active dynamo. These hundreds of Corona suggest that Venus' surface is still being actively reshaped, and it could be that early earth also had something similar.

And it also shows us that Venus' surface is not just constantly changing from the weathering due to like the acid rain from the atmosphere. It's also changing due to these subsurface flows as well.

So there's going to be a lot less data available about. Venus has past but because it's currently being resurfaced like the Earth is compared to something like the Moon, which is a near perfect fossil.

After the late period of bombardment, we've only got craters from things that have sort of smashed into it, but we can pretty much see the similar Moon that our ancestors saw.

Now, Titan has weather similar to the Earth.

So Titan is the only moon in the solar system that we know of with an atmosphere.

And its atmosphere is probably the most similar to Earth's. It's nitrogen rich, just like the earth, but unlike the earth, Titan's years are around 30 Earth years long. So it's summer is roughly 15 years, and obviously you've got sort of spring and autumn on either side of that. And scientists have been using data from the Keck Observatory, which is an Earth-based telescope in Hawaii and the JWST to observe the atmosphere on Titan a bit more during the Northern Hemisphere summer.

And they observed that Titan has a precipitation cycle very much like the Earth. Except where we have water, they have methane and both on Earth and Titan convection is driving the cycle, so the sun heats the surface and that causes water or methane depending which while you're on to evaporation, rise into the atmosphere and then the temperature drops at higher elevations in the atmosphere, and then the vapour condenses and falls as rain.

So. Titan has methane seas that are connected, sorry, concentrated in the northern hemisphere, and whilst clouds have been detected on Titan before, this is the strongest evidence of convection that we've seen so far. So when methane breaks up in Titan’s atmosphere, some of it joins with other molecules and falls back to the surface.

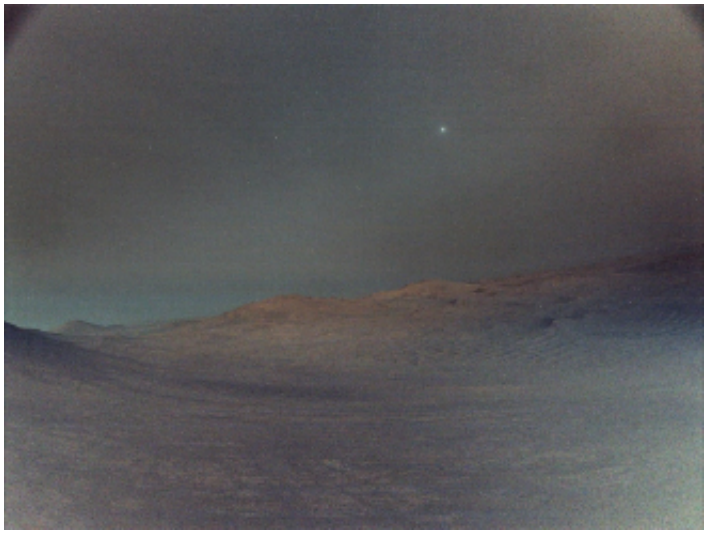
However, some of the hydrogen is escaping into space. So that means that without constant methane replenishment from some source Titan’s atmosphere will deplete in methane over time. And this is what we think sort of happened to Mars, which is now a cold and barren dry wells. So if there's no repletion of that methane, it could be that that would be the eventual fate of Titan as well.

Fascinating. Mm-hmm.

Now I see we've got some photos from Mars.

We have, I'm just looking at them. I love having photos from other planets. It's brilliant. It's indeed, yes. Is this from Perseverance? The rover? Yes, yes. You have recognised that. I'm impressed. There you are, Graham. You are making you into an astronomer.

I'm pleased to see that. You know, just look out. It's come, it's photographed on the surface, you know? Yes. You can see the hills and so on and the valleys and, yeah. Yes. And you can see one of Mars’ Moons Deimos.



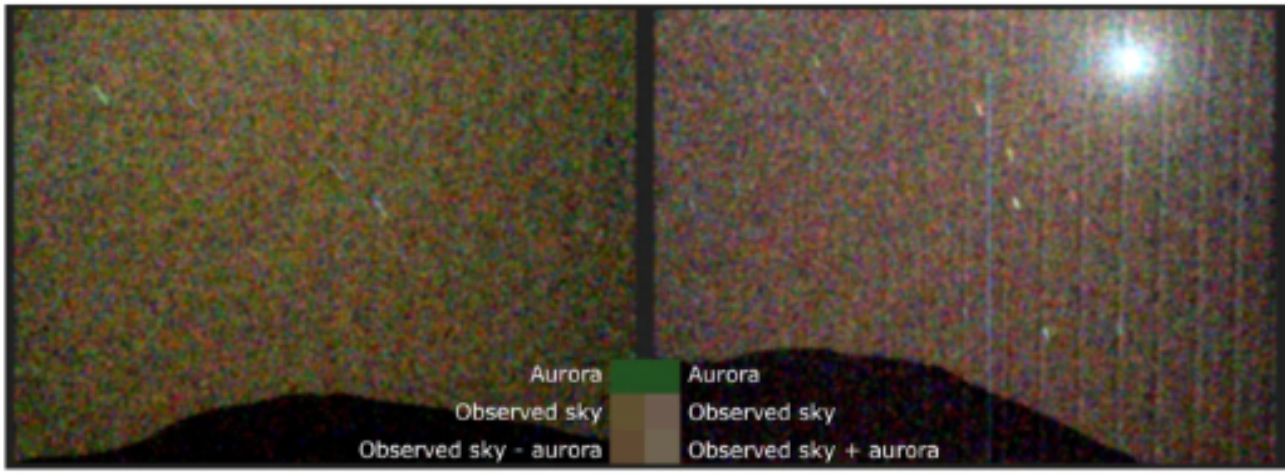
Credit : NASA/JPL-Caltech

Oh yes. It’s the early mooning sky. So here you can see Deimos captured in the Martian sky, and that pairs rather nicely with, if you remember back in March, the Hera mission blew by Mars and took a picture of de moss from sort of the outside.

This is a picture from the inside, so I thought that was quite a nice symmetry to that. Yeah,

absolutely. And the other pictures lower down then.

So on the 15th of March, the Sun released a powerful solar flare, which heightened, solar activity, and we got pictures of **Aurora from the surface of Mars**.



Credit : NASA/JPL-Caltech

Now, this obviously doesn't look as exciting as Aurora pictures from Earth, but you can clearly see a difference there between the two. Absolutely, absolutely.

And we've got water, ice found in another stellar system.

Yes. So we know how important liquid water is for life on Earth, and the first thing when astrobiology became a subject that we looked at was talking about the Goldilocks zone within a solar system.

So you want to find the point at which earth is liquid. It's liquid water is liquid on a planet and its not going to vapourize. So for example, water on the surface of Mercury is just going to vapourize into nothing. But then when it gets too cold and it's frozen, we can't use that very well either. So we do have water, we think on Europa and Ganymede, but they're probably frozen to some degree.

And Pluto has ice volcanoes. Which is pretty interesting. Now, the Spitzer space telescope, which was retired back in 2008, had tentative findings of water ice in a star system around Star HD 181327. And this is a very young star, that is only 23 million years old, but it is quite similar to the Sun, just younger.

Our sun is 4.6 billion years old and it has an active debris disc. Which means that things are moving around. So you've got these planetesimals and proto planets and asteroids, and they're all colliding with each other and breaking things up and fusing together to create new things. And the team believed that they can see something that re resembles our Kuiper Belt, but how it would've looked billions of years ago.

And now with data from JWST, they can see that there is a dust free gap between the star and the debris disc, and the collisions that are happening between icy bodies are continuously releasing these tiny particles of dusty water, ice, which is just perfectly sized for JWST to detect so the highest concentration of this water is in the outer region of the debris disc, which is cooler, and that makes more sense.

And then there's much less water in the middle of the system and almost no water, ice found at all near the star, which makes sense, because as I said, if you imagine like with Mercury, it would've just vapourized so. Either, it's vapourized or maybe the ice is being trapped inside unseen, planetesimals, and again, this is a really interesting research piece for how our own solar system has formed.

Yeah. Fascinating stuff. We're learning all the time, aren't we? And the JWST keeps on giving. It does.

We'll have a break now, but, we'll return very shortly with target of the month and, astronomy tip of the month. And of course, we're gonna have a look at what's been happening in Space Stars Over Surrey, your monthly guide to Astronomy and developments in space.

Join us on the last Tuesday, the month at 8:00 PM for the monthly guide to astronomy and developments in space.

Target of The Month

And welcome back to Stars Over Surrey, and let's find out about the target of the month. Rachel. Okay, so we're going to talk about the major Luna standstill. What, so we did reference this a little bit last year because we, we knew we were heading into this period and I think, we talked about English heritage.

We're doing a documentary around Stonehenge. Oh, right. Taking measurements as we approached it, and it's this month we actually hit the Major Luna Dance Cell. Right. So there is a documentary somewhere on the English Heritage website, um, that you can watch and on YouTube. So. There's a lot about the moon in June.

It's linked to romance. It's often called the Rose Moon, the strawberry moon, the mead moon, the honeymoon. And this becomes, because in some cultures it was traditional to get married in June and the Moon was named after the sweet things like honey to signify it, start with sweet marriage, but also it looks kind of a bit rosy and golden due to its point being so low on the horizon, giving it this gold more rosy hue.

What's going on? Why is that always the case in June? Well, the moon has a tilted orbit, so it passes either above or below the sun and sometimes directly in front of it, which is how we get eclipses and during the full Moon in June. 'cause it's opposite the Sun and the furthest south of the ecliptic. The ecliptic itself being the most southerly point.

We get the moon at the lowest point in the sky, and this is called the major standstill, and that happens every 19 years, technically 18.6 years, but we'll round it up to 19. Now, some of you may be wondering what on earth is the ecliptic? So I'll do a little bit of astronomy 101. Now the earth's equator.

Is that line around the middle of the Earth. And if you project that out into space, that's the celestial equator and the Sun has an equator. And if you were to project that out, if we had no collisions in the early Solar System, all the planets would be. On that projected out plane from the equator of the Sun, all the axes would be perfectly sort of upright and the plants would be rotating around that.

And as collisions and things happened, they all got sort of knocked around a bit. So the axis are tilted and the Earth has 23.5 degree axial tilt, which causes our seasons and the orbits are not quite on that perfect plane. They're all sort of knocked around a tiny bit now, where our earth orbit.

Intersects with that plane. We call that the plane, the ecliptic, and that's the reason why the sun and the moon and all the planets appear to rise and set in the sky rather than just sort of going around, um, in circles around each of the different parallels. So it's a bit of a weird one to try and explain to people.

I think I'm there. Yeah. But if you think about how things should have just been, if we had a simple Solar System and then things get knocked around, then we get that happening. And then if you think about the tilts of the orbits, so the tilt of the Earth's orbit around the sun, it's not perfect. And then the moon has a non-straight orbit around the earth that's tilted as well.

We are at the southerly point of the southerly point, and that creates this appearance of the Moon being very low on the horizon. And if you go up as far as the Shetland Islands, it's only one degree above the horizon around Surrey. It's going to be around 10 degrees above the horizon, which is still pretty close to the horizon.

So that's going to be pretty interesting. And then we're going to be looking at it through the most amount of atmosphere. So when you Think of the Sun. Most people say the Sun looks yellow, and that's if it's pretty high up because of the scattering of light from the Sun. Sun's actually pretty white, but you know, the scattering of the light makes it slightly more red, so it's yellow, but when you have it going through more and more of the atmosphere, so as it goes towards the horizon, you've got it coming through, the most atmosphere, there's more scattering, so it looks more red.

So that's why sunrises and sunsets, the sort of reddish orange. When we are looking at light from a full moon when it's on the horizon that has that slightly orange or gold or rosy glow, which is why we get the honeymoon, the mead moon, the rosy moon name, and the other thing as well, a lot of people say the moon looks huge when it's a full moon.

So just rising on the horizon. I don't if you've noticed that sometimes, Graham. Yes, indeed. Yeah. It does look big, doesn't it? Yes. And this is called the Moon illusion. It's not actually that big. If you photographed it, you'll be really disappointed because it's no one here as dramatic. And this is something to do with our primitive brain saying there is something big on the horizon, so I'm going to highlight it and make it appear bigger to you with your perspective really, so that you pay attention to it.

Because it might be dangerous. Right. And Patrick Moore used to say. The way you could counter this was to stand on your head or bend over and look between your legs. So quite often when we're doing outreach with kids and things, it's really important for 'em to learn to stand on their head and potentially get rid of some of their en energy.

So it's really good for. Astrophotography. If you want to do some landscape astrophotography, you can get a nice image of that.

So, leading onto the **astronomy tip of the month**, if you want to have a go at capturing the Luna standstill. In the days leading up to it, have a go at playing around with the exposure and focus on your camera, whether it's your phone camera, which I don't recommend if you can get hold for DSLR or any other kind of better camera.

Because your phone will make it look a lot less spectacular than it actually is. But whatever camera you do have access to, look up how to do, lunar photography or moon photography or lunar astrophotography. Take a look at the settings. The Moon is really, really bright, so it will automatically sort of blow out the exposure.

You'll just have this bright thing in the middle of your screen. What you want to do is reduce the exposure time and, increase the shutter speed so it's super far so you're not drowning out everything with too much light from the Moon. Some people find it easier to do a composite, so they'll take one where the, the landscape is perfectly in focus and then they'll switch it over.

So the Moon is in focus. So have a play around the light nights leading up to it where you've still got a pretty bright moon with lots of light coming off it. And then hopefully if you want to get a nice image of the Luna standstill, you've had a bit of practice getting it in focus. Right.

Let's move on to space now and we did a special recently, didn't we, on **Kosmos 482 on its way back to Earth.**

Yes. So this one, a lot of people didn't focus on why it was so, important to know about it. So this was an old probe launched 53 years ago from what was then the USSR. It was part of the Venera Missions, which were going to Venus and this one, the thrusters failed due to some kind of electrical error whilst in low earth orbits.

We think it broke up pretty early on, and most of that returned to Earth pretty early on, but the actual prob that was supposed to go to Venus ended up in this long elongated orbit going around the Earth for 53 years until it started. Hitting the point where deal biting and the atmosphere was slowing it enough to significantly have enough drag to deal with it further and further and further.

So at that point we could see it was going to have this uncontrolled crash landing into the earth. And normally with things that sort of size bearing in mind, it was roughly about a meter cubed and half tonne, we'd just assume it would burn up in the atmosphere. But this was a probe designed to go to Venus, and as I said, Venus 90 times the atmospheric pressure of Earth.

It's also pretty much solid acid rain all the way down. And then there's. The surface temperature of Venus is roughly 450 degrees C so it can melt lead, and all the probes that have have successfully landed there have lasted maximum sort of two hours, but usually, you know, 50 minutes is the average. So this was pretty much an armoured tank coming through the atmosphere designed to withstand horrible atmospheres, and we've got a really nice dental atmosphere in comparison.

So the likelihood was that if it hit, it wouldn't be a pleasant impact. So if it hit a person, obviously that would not be good. If it hit your house, your house would be rubble. Potentially either side might be as well. There'd be an impact crate, maybe three to 10 meters in diameter. It wouldn't be pleasant, but again, it would be a very localised impact.

It wouldn't wipe out a whole city. And the other problem is. We had no idea where it was going to land other than between 52 degrees south of the equator and 52 degrees north of the equator, so Antarctica would've been fine. From the tip of South America upwards, including all of South America, Africa, Australia, uh, New Zealand, et cetera, all the way up to the 52nd parallel north, which for us goes through sort of Ipswich, Milton Keynes and South Wales.

So unfortunately, Surrey, was in the red zone there. All the way around the earth. It could have landed at any point there. And most of us weren't too worried because we've got a lot of ocean and the chances are that it would've landed in the ocean. And even if it did land on land, most of the earth is not populated.

So we were all like, fingers crossed, it's not gonna hit anywhere. So there were multiple different websites showing the tracking of this. There wasn't a tracker on board the probe. Instead, we were relying on ground stations to sort of. Catch it as it flew over the top, and I was watching it slowly saying your period was 89 minutes, 80 minutes, 20 minutes.

And then when it should have been picked up over Germany, it wasn't picked up anymore. So we knew by, the the latest 07:30 BST, it must have crash landed somewhere. And now, ROSCOSMOS have come back and said that it landed harmlessly into the Indian Ocean West of Jakarta at 02:24 EDT, which is 06:24 GMT, and the Russian Space Agency.

ROSCOSMOS announced this on Telegram. They said there was no damage or injuries, that had been reported. And it's not clear whether the lander reached the ocean in one piece, but it's now only about 5,000 miles from where it was first launched in Kazakhstan's Baikonur Cosmodrome. So. It's finally launch landed, back on earth and it doesn't appear to have caused any problem, any injury or any damage.

Well, that's good news considering after 53 years orbiting. Yeah, but it's just the probe did get there. So Venera Eight got there, landed, launched in 1972, I think did land on Venus and it beamed data back, for about 50 minutes before being fried. Right. Okay.

Now let's move on to Australia's first orbital rocket launch.

Delayed because the rocket's nose fell off. Yes. It's not very good. I know. And there, there are so many jokes that one could make. Yes. This like upside down rockets because they're in Australia. Australia's didn't use enough gaffer tape, I suppose. I know so many potential memes and jokes coming outta this one.

How sad for them. I know it is. It is bit getting, but let's talk about it anyway. So, um, Australia's first orbital flight by Gilmore Space, which is a private company. It's going to be the Eris orbital launch vehicle, and it's designed to deliver payloads up to 305 kilograms into low earth orbit. And it was supposed to be first launch of this.

So the rocket was stacked and it was standing 25 meters tall on the launch pad, ready to be fuelled when the nose cone fell off hours before the first test launch. And it turns out that this nose cone was this clamshell like payload fairing that encloses. Satellites mounted to the top of the launch vehicle, and that then protects them from weather on the launch pad from airflow as the rocket accelerates to supersonic speeds.

And then what's in space. The rocket releases the payload shroud usually in two halves, and then, satellites obviously launched. Now. There were no satellites aboard this as it was preparing for its test flight, and as I said, there was no fuel. But during the final launch of the final launch preparations on the 15th of May.

An electrical fault triggered the system that opens the rocket's nose, and this is what caused it to sort of fall off. Now, payload faring problems have caused a number of issues in the past. Usually they don't jettison during launch, but usually it's something like they partially deploy and then that leaves too much extra weight in the launch vehicle for it to reach orbit.

So. There have been problems before, although this one is a new one, so the team are investigating this one fully before replacing it with another fairing from their Gold Coast base, and hopefully they will get something launched soon. And it's been a bit of a painful time for them because this was the first major rocket launch on Australian soil.

So the had to build the infrastructure and all the policies and regulations in place similar to what we had to do a few years ago in the uk. So if you, for example, you've never had of Rocket launch in that country before. Who's going to regulate that? So like in the US it's the Federal Aviation Authority that regulate all flights.

They're like, yeah, let's look after aerospace. We'll do that. But different countries might choose to do different things or they might set a completely separate regulatory body. So they have actually achieved a lot just to get to that phase. So I hope that they don't get two disheartened and that we get to see our Australian rocket launch soon.

I'm sure they won't get disheartened. Right.

Let's find out about Starship Flight 9

Okay, so light nine after a bit of a disastrous flight, seven and eight, which both had rapid unscheduled disassemblies over the Caribbean, which saw debris right down over the Caribbean and one significant piece over Poland.

Flight nine may be happening soon and people are kind of having to sleuth together to figure out when it is. So in mid-May, we got an announcement saying that Flight nine can only go ahead once the investigations show that what caused the RUD or rapid, unscheduled disassembly were all complete.

And then later on, on the 22nd of May, they issued the following statement, the FAA conducted a comprehensive safety review of the SpaceX Starship Flight eight mishap, and determined that the company has satisfactorily addressed the causes of the mishap and therefore the Starship vehicle can return to flight with the Starship vehicle.

Return to flight determination. Starship flight line is now authorised for launch. That was the official statement. They also said was that there was no, authorised landing space in the us. So that means that they're not going to go for the meccazilla chopsticks catch. It's thought that there is going to be the plan just to dump it in the ocean again.

And they've said, look at. SpaceX's website for confirmation as to the planned landing site, but that's where people are guessing at the moment 'cause we are literally having to guess. There are also a load of NOTAMs, which is notice to all airmen, clearing the airspace for 27th of May. And also there is a notification to close all the roads to the Boca launch site on the 27th of May.

So we are guessing that Tuesday the 27th of May is going to be the date. An American time date of the next launch. Oh, I'm very disappointed. The chopsticks aren't involved. I think they're trying to figure out what, yeah. How to just get the, to not explode. Yeah. They're just being very careful. Aren't sure.

Right. Let's move on to **NASA's 3D Rocket test explodes on social media**.

Yes. So this went viral. I dunno if you saw the video, Graham. No I didn't. Rocket test fail went viral. So it shows, the first bit sort of exploding and then the combustion chamber shearing off and then this uncontrolled fire. Oh dear.

A lot of people saying, oh, this is what happens when you 3D print rocket parts. So this was part of the 3D printed rocket, part of part of NASA's testing. Of, additive manufactured assembly program. I'm not entirely sure what it's called. That's a bit of word salad. So basically in most engineering places when you visualise people machining things, you get a piece of metal or carbon fibre or plastic, whatever it is, you cut out the bits you want and then assemble 'em together, and it's like screws and joints and things with additive.

Machining, you are creating something by adding to it. So if you imagine a glue gun, yeah. And if you wanted to build a statue, you would do like one layer of the base or wait for it to dry, then the next layer and keep going till you end up with the statue. And that's what 3D printing essentially is for anyone that was unfamiliar.

So. A lot of people think 3D printing, that's going to be quite poorly made material. But actually if you get it right, you don't have any seams or joints. So you have less weaknesses and weak points for things like gas under a lot of pressure to explode through. And this particular 3D printing technique, these chambers were made by putting down a layer of metal dust, them firing the lasers on to melt that dust into the exact shape.

So you get this very thin metal layer. Then they add another layer and then another layer. And this means that you get these really solid combustion chambers and they're quite substantial in size, but they don't have any joints or seams or anything like that for pressure to build up in these engines to blow things apart.

So this was the ninth firing of a test of this 3D printed combustion chamber designed to produce three tons of thrust. And when you see the video, you see the nozzle disintegrates, the combustion chamber breaks apart, and then if you're going everywhere, the nozzle, they expected that to disintegrate because it had weaknesses and defects in it.

So that was part of the test anyway. They were just curious as to how long that would last. But if you watch the video, you'll see this clean line appear in the chamber and then it blows apart. And it turns out this line was visible in the finished chamber, and this was as a result of the process being interrupted and the chamber had to go and clear out something or reset something in the 3D printing process, which created this almost like a fault line within the chamber.

And they've gone through and investigated and found things like unmelted powders. Which means that not enough energy was getting through to melt the powder.There are also some contaminants in there, so maybe opening and checking the overflow cause the contaminants get in there. And they also notice that the more and more they layer things up.

There was, an increase in porosity as well, which could have led to defects. So in summary, even though it was a really, really sort of spectacular video, it was quite interesting for them to start, um, replicating things. And what they did was they 3D printed things out and deliberately put these faults into the 3D print and then tried.

Break them in the same way and wrote a paper on it so that they can see and share those insights with people when you are 3D. Printing things, how to do so in a way that won't cause things to break apart. Yeah. Interesting stuff. It's a learning process, I guess, isn't it? Yeah. And it is really interesting that you will then get this component.

Mm. That is a solid piece rather than Yeah. Lots of things. Screw ball together with points. Yeah. Yeah. As long as you do it properly then and don't create this, and crack whatever it was. Yes. Right. Let's move on now.

How about that Blue Origin flight, all female crew?

Yes. This was a bit controversial, but there was an experiment on board, wasn't there?

Have you got some information on that? Yes. So Amanda Nguyen, who was the astronaut who I said everyone should know about, she's the Nobel Peace Prize nominee who took time outta her career to help other people. I don't why this wasn't a headline, but she took three experiments with her into space and the first one, they started looking at the data from it.

So cancer cells can grow the equivalent of 10 years on earth in just 10 days in space. And. She took up some equipment that is being used to see if they can detect, um, these cells a lot earlier using this ultrasound. So this one was for breast cancer research, and it was an ultrasound device that would essentially fit over the top like a bra and could be worn over the breast.

And she was taking it into space to see if it would be hard enough and study enough to cope in microgravity. It was testing its durability for the whole launch and whether it still worked in space and things like that. So they're looking at the data to see how well that fed. And this is really important one because.

Because you can grow cancer vast in space. You can do that and then do tests on the cancer that you can't do back on earth. Right? Or you can return those tumours back to earth and then do tests and you've, you've got a quickly grown sample. But secondly, with people spending time on the ISS. That means that their tumours could grow very fast in space.

So having these devices that can be worn and regularly do ultrasounds on you, you can check out for these sort of lumps and bumps much faster than having to wait for your return to earth. In which case it might have developed too fast to be treatable. My goodness. So it's an incredibly important experiment.

Yes, indeed. And another risk to space flight, I guess, for people. Yes. But also one. Like incredibly important thing in that mission that just wasn't highlighted again. But it's a bit frightening, you know, 10 years equivalent on Earth in 10 days in space for growth. Goodness me. Right.

Shall we go on now to the Axiom four mission being delayed?

Yes. So this one, I'm excited about because there is one European astronaut. Due to go on this mission. So the a x four mission will realise the return to human space flight for India, Poland, and Hungary with each nation's first government sponsored flight in more than 40 years. So this mission is made up of US astronaut Peggy Whitson.

She'll be the commander. We have pilot Shubhanshu Shukla from India, Sławosz Uznański-Wiśniewski a project astronaut from Poland and Tibor Kapu from Hungary, and they will spend 14 days dock to the ISS carrying out 60 scientific studies with activities representing 31 countries in low earth orbit. And that includes the ISS Ham radio that previously did a session with the Surrey Girl Guides at Brooklands.

Ah, so, they were due to launch on the 29th of May, but that's been pushed back to the 8th of June due to issues with the Dragon capsule, C 213 not being ready. So this module was originally slated to take crew Tent to the ISS last autumn. Um. So if you remember, we had Sunni and Butch who was supposed to do a very short duration mission, which turned into a long, normal length duration mission.

They launched two less astronauts in that crew temp flight so that Sunni and Butch could fly home. If you remember that whole saga, you can go back and listen to previous episodes on the replay page if you want the play by play of that. Now SpaceX encountered problems with the C 213's propulsion and environmental control systems, and then a battery needed to replacement.

And that accessing that battery required a whole sort of disassembly of a large part of the Dragon spacecraft. So the whole thing's just ended up being delays and delays. And if you think I've heard Peggy Whitson's name before, she was the woman with most hours clocked up on space walking before, um, Sonny Williams overtook her on that last mission.

So this will be her fifth time to the ISS her second as a private astronaut. And as I said, Sławosz is an ESA astronaut representing ESA, so he's flying the flag for us there as well. Let's look ahead to June then with

Astro Cast

1st	Venus at greatest separation from Sun in
	Crescent Moon lies between Regulus and
3rd	First Quarter Moon
6th	Moon near Spica
9th	Moon near Antares
10th	Major Lunar Standstill near Antares
11th	8.44 AM Major Lunar Standstill and Full
17th	Moon very near Regulus
18th	Last quarter Moon
19th	Moon near Saturn
21st	Summer Solstice
22nd	Moon near Venus
23rd	New Moon
25th	Moon occults some of the stars in the
27th	Moon near Mercury
29th	Moon between Mars and Regulus

Events

5th June	Dr Matt Bothwell, Public Astronomer Institute of Astronomy at Cambridge
10th June	Keving Pretorius - The Crisis in Cosmology
13th June	Sian Prosser - Pioneering Women

Thank you Rachel. Well, it's another packed program this month and uh, we look forward to next month's program as well, which will be on Tuesday, the 24th of June at eight o'clock on Brookland's radio. Well, thank you for being with me today and we look forward to next month.

Happy star gazing everyone.

Clear skies. And that's Rachel Dutton, fellow of the Royal Astronomical Society, and a member of the Guildford Astronomical Society.

Stars Over Surrey. Your Monthly Guide to Astronomy and Developments in Space. On Brooklands radio.

About

Rachel Dutton FRAS is an astronomer and cellist and she looks after outreach at the Guildford Astronomical Society. She presents Stars Over Surrey bringing a monthly review of space news, astronomical matters including a review of the past month's discoveries, events and space missions, Astrocast what to look for in the night sky over the coming month, forthcoming talks and events.

If you want a reminder of when the show is on, and links to the images discussed, you can sign up here for notifications from Rachel.

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