Stars Over Surrey October 2024

Stars Over Surrey, a monthly guide to astronomy and developments in space with Graham Laycock and Rachel Dutton of Guildford Astronomical Society. And welcome to Stars Over Surrey. And I'm Graham Laycock and with me is Rachel Dutton from the Guildford Astronomical Society and a fellow of the Royal Astronomical Society.

Hello, Rachel.

Hey, Graham.

How are you? All right, thank you. Been doing some good stargazing? I have. Been quite a month one way or another.

Comet C/2023 A3, Tsuchinshan ATLAS

It has, especially in terms of comets.

Indeed. So, well, should we start with some comets then?

Comet Widefield Shot. Guildford October 2024. Credit: Rachel Dutton FRAS

Yes. So, at the beginning of the month, we had Comet C/ 2023 A3, Tsuchinshan ATLAS. Um, going towards the sun and so it was visible in the morning and then towards the end of the month went around the sun and came back out and it was visible in the evening sky.

So I posted some pictures I took from the cathedral. So if you want to take a look at the first picture now, this is going to be on the replay notes and it's also on my Instagram page at astro underscore cellist but if you take a look at the first landscape picture I'm not sure you'll spot it Very easily, because it's so well hidden.

Yes, I'm not seeing much at the moment.

Now you have to really zoom in. So what I also did was do a second one where I've circled the area.

Comet Widefield Shot. Guildford October 2024. Credit: Rachel Dutton FRAS

Ah.

If you zoom in on that.

Right.

Okay. You should hopefully see something.

Indeed. Indeed. Yes.

It was really hard to see with the naked eye due to all the light pollution towards the north.

If you don't see that, you can scroll down a little bit more and you can see the image I took with my telescope.

Lovely image. I can see that very clearly.

Comet C/2023 A3 Tshichinshan ATLAS October 2024 over Guildford. Credit: Rachel Dutton FRAS

Yes, so you can see the tail of the comet, which is coming away from the sun, but also that line in the opposite direction, that's the anti-tail.

Oh, right.

So what's that? All comets have a tail and an anti-tail. It's just due to the way that things sort of get blasted off in different directions as it's off gassing. So they get lit up, and most of it gets blasted back, but you can see it there.

So, it's quite unusual to get it, the anti-tail that clear in such a short exposure.

So I was quite happy. Yes. So we've got that. And then if you scroll down a little bit more, I turned around behind me and took a nice picture of the cathedral, but hopefully you can just about make out on this. There's the full

Full Moon Over Guildford Cathedral October 2024. Credit: Rachel Dutton FRAS

moon above the cathedral. And around that moon is a halo. It's called a 22 degree halo.

Also called a moon dog. And this is when you have, it's usually ice crystals, but in this case it was water vapour, but it was quite cold that night. So you get something called a paraselenae, which is the circle around the moon. And then there's like a cross that goes through it as well.

Yes.

So I just about managed to get that with my phone.

Very good.

Full Moon October 2024 from Guildford. Credit: Rachel Dutton FRAS

And then. I zoomed in and did a picture of the full moon, so I then played with it on my phone and you can see the browner areas and the bluer areas on the moon.

And the browner areas are iron rich and the bluer areas are titanium rich. That's quite a spectacular picture. It is. That's just with editing with my iPhone.

My goodness.

And then, on my outreach endeavours, I was imaging a dead white dwarf. So white dwarfs are stars that are of a similar mass of the sun, and they don't go boom at the end of their lives. Instead, they gently shed their outer layers. And

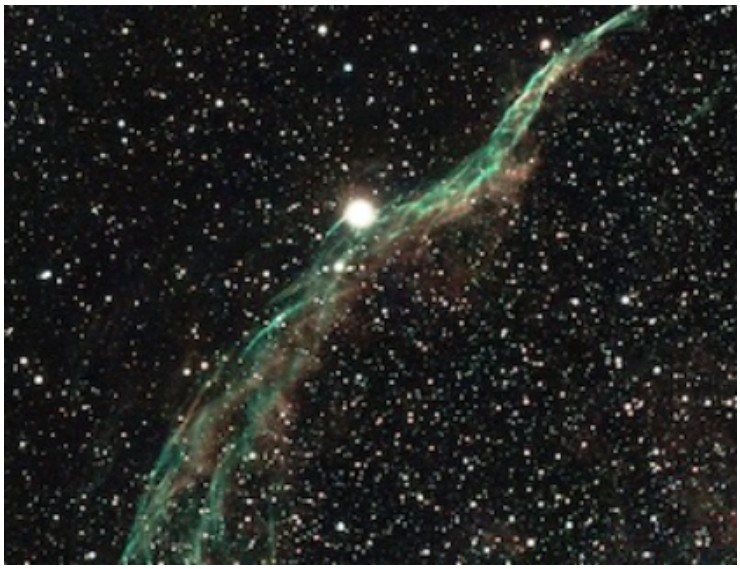
As this happens, it enriches the interstellar medium, and then you get this leftover white dwarf remnant behind.

So this is the star shedding its outer layers. Now it's quite small, but this one's called the Dumbbell Nebula, and you can just about make out a dumbbell shape in there. You can, yes. Yes, and the blue is

Dumbell Nebula from Guildford. Credit: Rachel Dutton FRS

oxygen and the green gases are hydrogen and the red bits on either side of the dumbbell, those are nitrogen and ionised hydrogen.

And then if you scroll to the right a little bit, you will see, that's going to be my Halloween picture that I'll put on now on Halloween. This is called the Witch's Broom Nebula, which is part of something called the Western Veil and that's the supernova remnant.



NGC 6960 known as the Western Veil or Witch's Broom Nebula, October 2024. Credit: Rachel Dutton FRAS

Right. Spectacular.

I think it kind of looks like Witch's Broom.

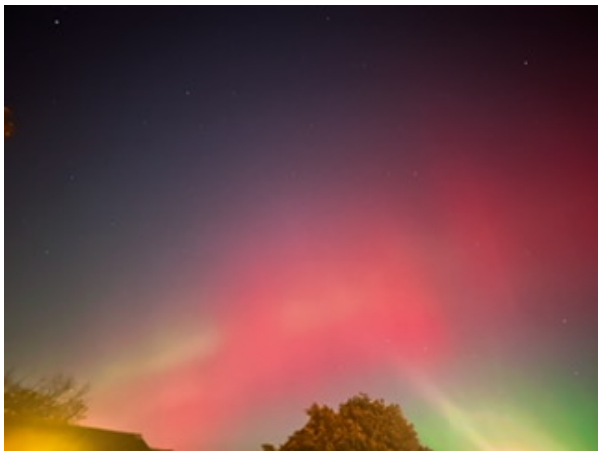
It does, rather, yes.

Right, so if you want to see the pictures, you can go to the replay page and there'll be a link to the file with, um, the transcript and all the pictures in there.

Right. Right. We've been having all these Aurora storms, haven't we?

Yes, so I've included some pictures of Aurora, but I think everyone's probably got Aurora pictures by now.

Did you see them, Graham?



Aurora in Guildford October 2024. Credit: Rachel Dutton FRAS

Aurora in Guildford October 2024. Credit: Rachel Dutton FRAS

I did see one or two of them. Yeah, amazing.

Yes. It's just so far south this time, isn't it? Yeah, so that particular night, the 10th of October, it was a continuous storm all night with four big bouts of Aurora. Now, I stayed up for number one and number two. And then I went to bed for numbers three and four, because I had a lot to do the next day.

So I've seen some spectacular images from throughout the night, and I've included some here with some sort of shapes in them. But my favourite one, if you go to the third one, it's probably the least spectacular looking one.

Yeah.

And, this is Pewley Downs over Guildford. But when I talk about people learning to stargaze and looking for places to go, I'm always talking about finding somewhere dark and without light pollution.

Aurora over Pewley Downs October 2024 Credit: Rachel Dutton FRAS

And what do you notice about the sky at this point in time?

Well, it's quite blue, isn't it?

Yeah, so this was at sunset. It should be impossible to see an aurora at sunset. This gives you an idea of the strength of the aurora that I could catch it at sunset. So even though it looks quite boring, it's actually pretty amazing.

Yeah, very unusual.

Yes, I've got quite a few pictures that are sort of astronomically, they appear to be boring to the naked eye images, but actually they're pretty awesome. So I've got what looks like a pretty plain sky over a desert background, you know, like, Why is anyone getting excited about that? But actually, it's the sky from Mars and the star you think you can see in the sky is the Earth.

Right! So, there's a lot of astronomy pictures that we get quite excited about and everyone's like, it's, it's just the sky. But it's actually from somewhere different. So yes, that's another one that can be deceptively boring, but actually it's really fascinating that you could see the aurora at that time of day. It's wild.

Absolutely.

Now, is the solar wind one of the reasons why we have water on Earth?

So this is something quite interesting. Now, you've probably heard many times by now that in our hunt for alien life, or even habitable worlds for alien life, we're particularly keen to find worlds in which water is liquid, and we call this the habitable zone of each solar system.

So if you go too far out, it's ice, and it's not easy for human like life to be able to access that water. If you go too far in, then all the water gets boiled off. So you want somewhere with liquid water, although astrobiology has sort of moved on and we look at different types of life, but generally water is a good start.

And we call the zone around each star where you can have liquid water, the Goldilocks zone. And each star has one. And in our last episode, we talked about potentially bigger stars having a Goldilocks zone. That's a lot bigger, but you again, don't want to go too far in because you would get, zapped by a load of x rays.

So the working hypothesis of where water comes from on Earth, The main one is thought that water comes into Earth from comets and then when we have volcanoes that would draw the water out from the middle of the mantle and other places up and then sort of distributed on the surface and we have oceans.

And that's why astrobiologists get excited about worlds with volcanoes. But another theory is that we could have had water when the solar system formed in the solar nebula, and I've mentioned before about these oceans of water in the Orion Nebula, which is a stellar nursery. So that's another possibility, but supporting the comet hypothesis is researchers looked at the isotope ratio on Earth and compared, that ratio of water isotopes to those on comets and it's most similar to those of primitive comets.

So we think that, comets brought water in with them and sort of bombarded the earth. So that's what we think. However, there is some new research that discovers, that suggests, sorry, the sun's relentless solar wind could have played a role in creating some water on earth. So solar wind is that phenomenon that gives us aurora.

Quick 101. The sun has magnetic fields. They go from the north to the south pole. In those loops, the sun is not a solid body. The equator moves much faster than the poles. So these magnetic field lines get tangled. They create be loops that, um, create sun spots and loops of plasma. And when those loops sort of erupt, they're called coronal, mass ejections that sends particles towards the earth.

And as it interacts with our atmosphere, we get aurora, but it's also responsible for blasting away the hydrogen from Venus' atmosphere, causing it to thicken and create a runaway greenhouse effect.

It's also stripping away the Martian atmosphere, so the Martian atmosphere is very thin, thanks to space weather and solar wind, but essentially it's a load of protons and electrons and a proton can be thought of as a positively charged hydrogen atom, which is extremely reacting and in theory could combine with oxygen and make water.

So scientists were looking at whether it could combine with oxygen in minerals to produce water and also If it does produce water, they wanted to test that mineral's adsorption capacity. And adsorption is different from absorption. Something absorbing water is soaking it in like a sponge, and adsorption is that water adhering to the surface.

So, I was wondering how on earth can you create a solar wind? And what they did was they exposed these minerals to a strong current of hydrogen and hydrogen positively charged and molecular hydrogen that mimicked the solar wind and then exposed them to intense visible and UV radiation which generated something similar to a solar wind.

Now this was successful But something to bear in mind is that the Earth's atmosphere and magnetosphere do shield it from the solar wind. So there's no way the wind could have created the water on the Earth's surface, but it could have created water on the surface of other bodies like asteroids and comets, which then, as they impacted the Earth, delivered that water to us.

And we also think that this is how water thin forms on the moon where those hydrogen ions react with oxygen on the moon and it creates water as like a temporary atmosphere which then gets blasted away by solar radiation.

Right, and extreme solar storms leaving records in trees?

Yes, so again, same thing, solar radiation sorry, not solar radiation, space weather.

So when we have auroras, we also can have really, really extreme storms and the most extreme ones are called Miyake events and these can leave traces on Earth. Now Miyake events bring with them an increase in the amount of radiocarbon in the atmosphere and it's this that can be traced in trees. So the first event happened in 774 AD and another one in 993 AD.

And they have been looking at evidence within tree rings. So do you remember at school you were talking about aging trees by looking at the rings, the darker wood and the lighter wood? So They were looking at these rings and correlating them to these Miyake events, and it appears that when you have this radiocarbon, the tree prefers that radiocarbon as opposed to regular carbon and has a bigger growth burst.

So they found seven more events that could be dated back, um, over 14, 000 years, and they were looking at trees all over North America and sort of like remnants of old

tree forests where just the stumps are left. So. It could be that we could find out more about the sun from looking at old trees on Earth.

How fascinating. Goodness. I never would have thought that would be the case. And I see the sun's officially at solar maximum.

Yes. So we've been talking about this solar maximum period, but according to the space weather program at NASA's headquarters in Washington, we are officially at the maximum point, which should last for another year.

So we should have opportunities for more auroras. If you haven't caught one yet, um, I was seeing someone sort of predicting there should be another sort of decent, maybe up to 10 more at our latitude over the next year. So hopefully everyone will have the opportunity to see an aurora. That would be good.

Now, the first black hole triple systems discovered.

Yes. In our solar system, we have one low mass star. In some other solar systems, we have binary stars. So, People who watch Star Wars have seen, um, the binary stars of Tatooine as they rise and set. Some systems have triple stars or even multiple stars in their centre and other ones orbiting them, um, like Alnitak, one of the stars in Orion's belt.

So, those stars, if they are of particularly high mass, when they explode at the end of their lives, they blast off their outer layers in a very violent explosion and then they collapse into a neutron star or even a black hole, which is an incredibly dense object. Now, most of the black holes that we've detected to date, appear to be part of a binary pair, with the second object being a star that's being consumed by the black hole.

And we often call these x ray binaries because you see x rays being sort of thrown off these. So astronomers were observing a black hole in constellation of Cygnus. It's called V404 Cygni, it's about 8, 000 light years away and is known as a micro quasar. Now, quasars are these super bright accretion disks around black holes that can launch jets over millions of light years.

And these micro-quasars have little baby jets that only reach a few light years. So, they're quite cute in comparison. So, V404 has a central black hole in the act of gobbling up a smaller star that's spiralling in very close to the black hole. It's so close that its orbital period is 6. 5 days. So, it's very close in.

But, now they've spotted a second star which appears to be orbiting much further out. So they estimate that the second star completes an orbit every 70, 000 years and it's roughly 350 astronomical units or AU away from the central black hole. Now an AU is the distance from the earth to the sun, Pluto is 35 au and 350 au is obviously 10 times further out than Jupiter from the sun, not Jupiter, sorry, Pluto from the sun.

So it's quite the distance away. However, theoretically it shouldn't be there because that violent explosion from the star going supernova releases a huge amount of light and energy, and it usually kicks away anything sort of loosely bound or vaguely nearby. So. This second star should have been kicked out of the system.

The only sort of other way it could still be there is if there was a gentle direct core collapse without any kind of explosion. Now this is something that was thought to happen, but this could potentially be the first one that we've actually found. that probably didn't go supernova. Wow. Now the first discovered brown dwarf may be a twin.

Yes. So the first thing to remind people of is maybe what is a brown dwarf. Now we have the old fashioned definitions of what's a star and what's a planet. And a star is something that is fusing hydrogen into helium in its main sequence and then heavier elements later on. And anything orbiting that star traditionally was a planet, then we had the tightening up definition of a planet.

You can have stars orbiting stars, but those stars are typically using something. However, you've got this kind of strange area where you have something that could be a star or it could be a planet. They were called planemos originally. They're now called brown dwarfs, and some brown dwarfs have a little bit of fusion, usually lithium.

Essentially, they're about 200 times the size of Jupiter, and they, they are not very bright at all. They are really, really dim, often barreling around on their own and we can't see them. So the first one that was detected was one orbiting the star Gliese 229, and it was detected in 1995 by Caltech researchers.

Now Gliese 229 is a red dwarf star, so it's smaller and dimmer than our own Sun. But it's only 19 light years away. And the brown dwarf orbiting it is called Gliese 229b, which is about 70 times the mass of Jupiter. But one of the mysteries of Gliese 229b is why is it so dim for its mass? Now, last month, I gave a mini lecture on the Hertzsprung Russell diagram, which is how we plot and chart our stars.

And we can equate the colour of a star to the temperature of the star and the temperature is largely determined by the mass of the star. So really massive stars look more bluish in colour and they whiz through their lifespans because they burn through their fuel super quickly and they're really, really hot.

And the more red a star is, the smaller the star is, the slower it's going through its evolution and a brown dwarf is further along that red spectrum. The star's colour and its mass didn't make sense, so scientists have gone back and re examined this star with more recent instruments and techniques, and they examined the spectra of the light coming off this brown dwarf, and its Doppler shift, to discover that in fact it's a pair of brown dwarfs.

Right. Is that unusual?

Well, it's the first pair that we've come across, but we don't know how common or uncommon that is. Right. Right. Right, now the James Webb Telescope then, currently on a mission for a British scientist, that's good. Yes, so there's a British astronomer based at the University of Columbia in New York called David Kipping and he runs a YouTube channel called Cool Worlds and one of his passions that has been sort of on and off throughout his career is the thought of exo moons.

We've been talking a lot about exoplanets the last 30 years. Exoplanets have gone from something theoretical to something that we, we finally found one, then we found more, now we're finding lots more. What about exomoons? And a lot of the astronomy community are not keen to spend resources on looking for exo moons because it'd be so hard to give you an idea of using something called transit method of finding an exoplanet.

You start by observing the amount of light coming from the star, And then you look for disturbances in that light. And if it's a periodic disturbance, the same amount, um, you start to think, well, something could be transiting like a planet going in front of it. And other things could be going in front of it too.

Um, like interstellar visitors or comets or asteroids, or even flares could be coming off it. But if it's that same periodicity and you're getting that same change in brightness, then you start thinking there is an exoplanet there. And it's so sensitive, it would be like looking at Manhattan from the moon and seeing one person move a blind down from a lit window from a room that's lit behind them by like a centimetre.

That's the sort of sensitivity you need to find an exoplanet. And, um, If you can imagine finding an exomoon, which is going to be likely a lot smaller than the planet, is going to be really, really challenging. So this is why so many people are reluctant to even go down that route. However, his team won observing time on the James Webb Space Telescope for exoplanet Kepler 167b, that David Kipping found 10 years ago, and it's the closest thing we found to another Jupiter.

It's a similar mass, size, etc. And it transits in front of its star every three years. So as we are talking at this moment in time, JWST is observing for that team. Now we won't hear anything for another at least year because they get a year proprietary period on the data, but it's quite exciting that a British.

astronomer is hopefully going to find an exomoon or, you know, furthering exomoon research as we speak.

Right, okay. Now, what can Martian meteorites tell us about the geological history of Mars?

Meteorites, rocks that land on Earth from space, come in many different forms. different shapes and sizes, and we get everything from the massive ones that wiped out the dinosaurs or even resurfaced the planet, to the teeny tiny micrometeorites that look like grains of dust.

Most of the small ones burn up in our atmosphere, but it's estimated that the Earth receives anywhere between 100 and 300 metric tons of meteorite material every year. The majority of meteorites we get are from the asteroid belt, or even comets. And when we have meteor showers, which is when the Earth passes through the debris of broken up comets, we can get comet remnant meteors.

We also get lunar meteorites and Martian meteorites. These are the results of large impactors hitting the Moon or Mars so hard that nothing can be done. Not only do chunks of rock fly off into space and escape the gravitational field of their body of origin, but they can end up elsewhere, like on Earth, and we can tell they come from Mars or the Moon by their chemical compositions.

I remember when I was at school and we had a planetary geologist bring in a meteorite from Mars that had olivine crystals. It was stunning, but it was also kept in a small glass box. Now the Earth has about 200 confirmed meteorites from Mars and if you're wondering you can buy a piece of Mars or the Moon, the answer is no.

So samples were returned to us from missions such as Apollo, um, and they can't be brought or sold. Although some pieces of the Moon have gone missing, so I suspect that they are on the black market somewhere. I have been lucky enough to see a piece of moon back in March at the European Astronauts Centre in Cologne, and again, that was kept very secure.

And various large Martian and lunar meteorites are in specialist research facilities or museums like the Natural History Museum. You can, however, purchase tiny little Martian meteorites and lunar meteorites, but you do have to be super careful and check that they are verified and not fakes. And yes, I do have a few little ones in my personal collection.

So, researchers were curious to see if they could trace the Martian meteors of significant size to the craters from which they were formed back on Mars. So they started making a note of the meteorite chemical compositions and working on the ages of the meteorites, and then looked for impact sites on Mars that we now know to have similar compositions and geological ages to see if they could match them to their crater of origin.

They were able to get a number of meteorites classified into five main groups and match them to five impact craters. So this is incredibly useful. Uh, incredibly useful to us because it gives Gives us more of an idea of later Martian geology and what may have happened once we can date these meteorites.

And it can help us answer big questions such as, did Mars have water and are there any signs that it could have hosted life?

From one type of Mars rock to another.

It kind of sounds like we're discussing different types of Martian rock bands. But anyway, the Perseverance rover has found a rock that looks kind of like a zebra, which has been named Freya Castle.

The strange looking black and white striped rock resembles metamorphic rock on Earth. We have three main types of rock. So you have metamorphic rock, which is shaped inside the earth by heat and pressure like marble, igneous rock such as cooled crystals from lava flows, and sedimentary rock, the kind of rock that you see in layers or stripes on the beaches when you look at the cliffs.

Now, This rock kind of looks like white halite to me, which is sedimentary rock. And these are the kind of questions being asked by Martian planetary geologists. If it is metamorphic rock, then how did something like that that should be formed inside the planet end up here? In the ro crater on Earth, a similar rock would be exposed by erosion.

But on Mars, perhaps an impactor blasted it out. It could also be that the pressure and the heat of the, um, impactor shaped the rock and made a metamorphic rock. But, if it's sedimentary, then it may have been altered by contact with water, and may have been deposited to the site by flowing water, which would make sense as the Jezero Crater was thought to have hosted water at least twice in the past.

The big issue is that the rock is a solitary sample against a background of rusty coloured dust and sediments. In the area, which are all from previous water flows, and Perseverance finds a lot of sedimentary rock and clay in the region, unsurprisingly. There are also some igneous rocks in this region, and we don't yet know how they got there, so hopefully the team will return the rover to do more investigations.

And again, this could give us some more clues as to the more recent geology and history of Mars.

Now, what is the astronomy tip of the month?

So A big thing that I'm noticing at the moment when people are out and about joining us for Observing is they are using the star charts on their phone. Um, which is fine.

We all need to start from somewhere. Just make sure that you have your screen at its dimmest setting. If you have night mode, turn on night mode so that you're not ruining your night vision. But one thing a lot of people are saying, and you've heard me say this before, your phone GPS knows where you are fairly accurately.

It may be out by five meters in all directions, but that's still fairly accurate compared to like the rest of the cosmos. What it doesn't do as well is know what direction you're looking in. Indeed, I remember that, yes. Yes, so I've heard so many people at all the outreach events I've done just this month alone saying, it says the moon's

there but it's behind me, or it says Saturn's there and I'm like, Saturn's over, over there at one point.

Now some of these Apps, you can calibrate, but you need to look up the instructions. So some of them you need to turn the phone around, some of them you need to do like a figure of eight in the air with the phone. So if you're using a star chart app, do an internet search to see whether you can calibrate it.

And some of them you can calibrate by lining up a target, you know, like the moon with a picture of the moon on the screen. Other ones you have to do these funny sort of dances on the spot. Right, okay, good tip.

And what's the target of the month then?

So Mars is coming back into view, um, and it's kind of at the top of my mind because I just saw the exhibit at Chichester Cathedral.

But Mars is a fun one because it looks like an orangish star and lots of people get excited thinking it's Betelgeuse, but actually it's Mars and it moves across the background of stars very quickly. So Mars is an exciting one to see back in the sky again. Absolutely. Right, well, we've gone through the astronomy section.

We'll be back with Space News shortly, right after this short break.

Stars Over Surrey, your monthly guide to astronomy and developments in space, on Brooklyn's Radio.

And welcome back to Stars Over Surrey with Graham Leacock and Rachel Dutton. And we're on to the Space News now, and something close to home, the ISS Ham Radio broadcast from Brooklyn's Museum.

Yes. My goodness.

I was disappointed we weren't invited, Graham.

I know. I know nothing about this. This passed me by.

So, I don't know if you know this, but on the International Space Station, they have something called ARISS Amateur Radio on the ISS, and it's this, educational project where they link up with like schools and other sort of youth groups or education based groups, um, and you get to talk to an astronaut.

So, on the 5th of October, they were, were, dialling in, as it were, from Brooklands, and it was the Girl Guiding Surrey West Division and the Innovation Academy. And they collaborated with the Radio Society of Great Britain and ARISS, which is the

amateur radio on board the ISS. And they were speaking to Sunny Williams on board the ISS.

Hopefully you recognize the name Sunny Williams by now.

I do. Yes, indeed. Yes.

She's still there.

Yes, she is. Yes. Yes.

And, on the ground keeping them company was ESA reserve astronaut Megan Christian and the Duchess of Edinburgh, Sophie.

So they had a good event. You can listen to the broadcast online if you go to ariss, A R I S S dot org and hear what they spoke about.

Right, I'll do that. Now, what's this about chopsticks? Catch a 20 story building?

Yes. This program gets stranger and stranger.

So, Flight 5 of SpaceX. And it was a huge, huge achievement. Now, the biggest thing that Elon Musk has been pushing with SpaceX is sustainable space travel, because at the moment we blast off and the boosters get thrown away.

And, It would be ridiculous if, say, you drove to Cornwall on holiday or caught the plane to France and threw the engine away afterwards. We would think that's bonkers, but yet we do it with space travel. So, sustainable space travel is important. And over the past decade, SpaceX have been doing all sorts of iterations of landing.

So, the original ones, um, I remember these legs coming out and sort of trying to land and it was a bit sort of wonky in places and you had to get it sort of exactly horizontal, but on top of that, legs add a lot of weight. So they were looking at alternatives. So, Flight 5, they also did have a starship, or ship, aboard, and we'll talk about that in a minute.

But the big thing here that got so many people excited was that the Super Heavy booster came down, lined itself up with the Mechazilla Tower, which is what it's called, Mechazilla, and sort of, made itself a bit wonky and moved towards it, also so that if it was likely to go wrong it could sort of blast back away and not wipe out the tower and the launch pad.

And these chopstick arms, they call them chopsticks, came in and sort of grabbed it in a big hug.

Ah, yes, yes, I saw that, yes.

Yes, and just, um, give it some kind of context. This is like catching a 20 story building.

Oh, I see. That's where it comes from. Right. Yes.

So if you think about that, that's just so incredible.

And it's now the start of a huge change in space exploration history that we can capture these super heavy boosters. So that was the bit that got so many people excited. It did me. I mean, it was a fantastic shot of that, wasn't it?

Yes. Astounding. Absolutely.

So that was incredible. And it may have changed the history of space flights, as I said.

But then the other thing as well was on that flight five, the second stage continued at orbital speeds. And then they sent a new starship out into sub orbit, I think it was, but they were working on the autonomous descent. So, do you remember when we were last talking about flight four, it kind of came down and one of the flaps was damaged in the heat and it kind of did this belly flop at the very end?

Yeah. So this time they were really working on the sort of thermal protection system to make sure that all the flaps were protected, they had cameras on all the flaps, and this time they got a really accurate targeted splashdown in the Indian Ocean, perfectly upright, and then it exploded once it had landed in Houston.

Right. So, but that, that was kind of by the by at that point. They were working on getting the, um, the thermal protection, getting those flaps right so that they could get that precision landing. So hopefully the next time all this will sort of be stacked up more and they can land the whole, whole thing safely.

Yeah, I guess we're still on a learning curve, aren't we? It's a tremendously short life we've had with this, isn't it, really, overall? It is, but it's just incredible, to sort of think that they landed a rocket and caught, as I said, it's a 20 story building with essentially chopsticks. Yeah, giving it a hug.

Yep. Amazing.

Now, Europa Clipper launch.

Yes. So this one is exciting. We reported in previous months that there were some issues with Europa Clipper, but they were hoping they could still fly it. So Europa Clipper mission is going to the moon of Jupiter Europa, which has covers um, across

the surface, this massive ocean and it's one of the potential places for life in the solar system.

So ESA have sent the JUICE mission, Jupiter Icy Moons mission, which is exploring three of the icy moons. Europa Clipper is specifically looking at Europa with different instruments. JUICE and Europa will hopefully meet up successfully around , Europa, which I think's quite exciting, like two probes from Earth meeting up around another system.

They will work together for a little while and then, JUICE will go off and look at some other moons. So it was successfully launched on the 14th of October and it's going to go through a series of gravitational assists to hopefully arrive in the Jupiter system around April 2030, and it'll start off by doing a series of flybys of Europa whilst in orbit around Jupiter.

So I'm very excited that that's launched, and hopefully with that, we're going to get so much more data. Interesting information about Jupiter and its large moons, because it's almost like a mini solar system in its own right. It's such a fascinating part of the solar system.

Right, gotta wait a few years though.

Yes. Yeah. Right, now China's offering commercial space missions.

Yes, so we are starting to get used to the idea of commercial space missions. So we have SpaceX and we have the Polaris storm mission we talked about last month with the first ever commercial spacewalk and the violin performance. We have also had Virgin Galactic, Blue Origin, and then there are all the private companies sending things to the moon that we've spoken about this year.

But we don't hear much about China. China have their own space station, so some people might not be aware of that. It's called Tiangong. Um, they've successfully landed robotic missions on the moon, so they've even done a lunar sample return. And they are looking at building the International Lunar Research Station on the moon and even plan to send crewed missions to Mars in the 2030s.

But China also has a lot of private space companies and startups and is really innovating this area. So some examples are Galactic Energy, Landspace, Linkspace, XPace, OneSpace, OrionSpace, and they are all discussing various different commercial space flight options. But there is one company, called Deep Blue Aerospace, who appear to be making good on these goals, and they've developed technology which seems to match that promise.

So they have developed a rocket that passed the hop test, and it did a vertical takeoff and landing, and this rocket's called the Nebula 1. Now it has had some accidents on the way, but its next test flight is in November. Which will be its first high

altitude vertical recovery flight. And in early next year, they are looking at the rocket's first orbital re entry and recovery test.

So, they are hoping that this means in 2026, they can offer, um, commercial seats on space flights in 2027. Not that far away, really.

No. No. Amazing. Just need the money. Yes, I was going to say, it's all about the money, isn't it, I'd imagine.

Now, spacesuits for Artemis missions.

Right, so, at the International Astronaut Conference that is just finishing up in Italy as we speak.

A collaboration between Axiom Space and Prada revealed the Artemis spacesuits for the astronauts returning to the Moon. And this was not just to make them look great. A lot of fashion houses do have a lot of innovation in terms of fibre arts and textiles and things, so it was a good collaboration to happen.

And the suits do look amazing, but the key things that I noticed, the hand had lots of articulation points. Articulation is really hard to deal with in spacesuits because you need to make sure that there's no sort of pressure or gas leak, um, around those joints, but you still need to be able to move. And these gloves had these sort of rubber bits over like each segment of the finger and over the major areas of the palm.

So you could bend your hands. They can do experiments and maneuve their hands around a lot more effectively. There's also a lot more redundancies built in and there's more cameras built in. There's biometric monitoring, which makes sense because lots of people have smartwatches now. There's also an internal CO2 scrubbing system, so there were just sort of lots and lots of pros, and it was really good to see all the technology we've seen and being sort of miniaturised and being made smaller and smaller to the point that you've now got this suit, um, with lots of high tech in it, but super maneuvreable.

It was stuff, isn't it? And now, news that Crew 8 returned, then.

Yes. So, Crew 8, the mission that lasted longer than it should have done, returned to Earth on the 25th of October, in the morning our time. So, Roscosmos cosmonaut Alexander Grebenkin and NASA astronauts Michael Barrett, Matthew Dominic and Jeanette Epps all returned on, um, their Dragon vehicle.

This was the longest U. S. mission duration, because it was 235 days due to the Starliner changing the scheduling a bit because it was docked there which meant that other things couldn't dock and undock at the same time. I think we're all pretty familiar with the whole Starliner by now.

Indeed.

Okay, so usually missions are five to seven months, so that they were delayed a fair bit.

And I will say that some of the astronauts have been posting the most amazing, images that they've taken from the Starliner. The limited windows on the ISS. So one of them took a one second exposure of the Milky Way and put it on Reddit and it was like the sort of things that landscape astrophotographers do, you know, 30 second exposures on a whole night's worth of things and sort of stacking them on top of each other and they got it with one second. It's amazing.

Wow.

He's in the group that returned. So they spent 36 hours on the return, and landed down safely. However, they did do an extra stop to be medically checked. So the standard procedure is you come out of the dragon capsule. You can't walk, you need help into. It's essentially a wheelchair, but it's more of a sort of medical trolley stroke wheelchair thing.

You get checked out by the crew immediately for like all the big emergency things just to make sure that you're okay, you don't need emergency medical treatment there and then. Once they're able to support their weight a bit more and they've got their land legs back, they helicopter them to the mainland and then from there they get a flight to their home base.

So for the NASA astronauts that's Houston, for the cosmonaut that's Russia, and then they go through their full battery of medical checks to check that everything's all right and they're reunited with all their friends and family. But there has been a stop for them in a hospital in Pensacola and, um, no one's sort of communicated what it is or which astronaut it is, so that their privacy is, maintained, but apparently it's nothing major.

It's just an abundance of caution, which doesn't surprise me. Because even like the slightest, maybe it's like glitch in heart rate, but here someone will go, okay, well that happens statistically this amount of time, if you're looking at someone on an ECG. Weird space flight. They just want to make sure they're super careful.

They're looking after their astronauts because their bodies have gone through a lot and being in capsule for 36 hours. So no one's in critical condition or anything like that. It's just everyone's stable. Um, it looks good. It's just an abundance of caution. So there is a bit of speculation going on there, but I'm sure they're all fine and they'll be happy to see their family soon.

Indeed, indeed. What about astronaut health on long duration missions?

Most people who are interested in human spaceflight are aware of things like astronauts having to do exercise to maintain muscle and bone mass, but there are many other considerations when we start thinking about long duration missions such as a trip to Mars, which will expose astronauts not only to radiation from our Sun, but also galactic cosmic rays, or GCRs, from the other stars in our galaxy.

Most people assume that the radiation from the Sun being so close is dangerous and therefore solar maximum would be the most dangerous time for astronauts. But, actually the Sun's magnetic field protects us from the GCRs. So, actually solar maximum is our safest time. Scientists looking at the effect of radiation on the brain used a 33 ion beam on mouse models and found that it impaired cognition in areas of the brain associated with motor control, vigilance, anxiety, and social novelty, and the effect was more pronounced in the female population.

However, the effects were mitigated somewhat, but by an antioxidant and anti inflammatory drug, so there may be ways to mitigate these effects in human astronauts too.

Now it's time for Astrocast for November.

Yes. So, lots of things going on in November. On the first we have the new moon. On the 5th, we have the moon near Venus.

On the 9th, we have the first quarter moon, which is the waxing half moon. On the 10th, we have the moon near Saturn. On the 15th, the full moon, which is a supermoon, meaning the moon is closer to the Earth in its orbit, so it looks a bit bigger. On the 16th we have Mercury at elongation. This means that it's the most far out to the left or the right of the Sun, so it's a bit easy for us to see it.

On the 17th we have Uranus at opposition and the Moon near Jupiter, as well as the Leonid's meteor shower. On the 19th, we have the Moon near Castor and Pollux. On the 20th, we have the Moon near Mars. On the 23rd, we have the last quarter Moon, or the waning half Moon. The telescope uses Callisto, lies near Jupiter's south pole on the 1st of November, and Titan's shadow transit Saturn on the 4th of November.

Mercury, Venus, Saturn and Neptune are all evening planets, and Mars, Jupiter and Uranus are presented, well, all month. And we've got some events coming up, I'm sure, in November. We have. On the 7th, Guildford Astronomical Society have Dr. Andrew Mummery from the University of Oxford presenting the spaghettification of stars by supermassive black holes, understanding one of nature's most extreme events.

On the 8th, Ewell Astronomical Society has Professor Andrew Coates looking for life on Mars and habitability on icy moons. And on the 12th, Farnham Astronomical Society have Andrew Eddington, English astronomer, physicist, and mathematician, and how Eddington played a major role in the verification and acceptance of

Einstein's work, presented by John Price from the Federation of Astronomical Societies.

And then on the 20th of November, the University of Surrey are holding an observing night for primary school age children, which we will be helping out with the observing portion of. And lasting through October to the end, I'm sorry, till the 9th of November is the Mars exhibit at Chichester Cathedral, which I visited.

And if you go and see it, do spend some time looking at it because you start seeing many more surface features of Mars. As you look at it, including the Smiley Face Crater. Oh right, well worth a visit then. Yes. Well that completes our look at stars over Surrey this month. We'll be back again on Tuesday at 8 o'clock on the 26th of November.

So all remains now for me to say goodbye. I'm Graham Laycock and with me has been Rachel Dutton from the Guildford Astronomical Society. Happy stargazing everyone. Happy stargazing. Clear skies. And clear skies.

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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