



Stars Over Surrey

And welcome along again to Stars Over Surrey, the last of 2024. And with me as usual is Rachel Dutton, a member of the Guildford Astronomical Society and a fellow of the Royal Astronomical Society. Hello Rachel. Hi Graham, how are you? All right, better than you are at the moment. Suffering a little bit from the voice.

See how we go not a good way to end the year I suppose But it's a time of the year to sort of reflect back on the year really I guess isn't it?

So we're going to look at astronomy first of all and what happened in 2024 and the JWST second birthday already time flies.

JWST 2nd Birthday

Yes, it does. So it launched on the Christmas Day 2021, and we're on our second year of science, which has led to quite a few interesting things.

So we've had more records broken for the earliest and the faintest galaxies and stars, and that will continue to happen as we get to know the instrument a lot more and as people get to know it, better in processing techniques and knowing what the telescope is capable of. So there's going to be many more records there.

For the second birthday they released an image called the Penguin and the Egg Galaxies. This is known as ARP 142 and I highly recommend you google it at this point and we'll put pictures in the show notes. Right, it's just quite staggering the images aren't they? Yeah, so there are two galaxies in the image.

There is the egg galaxy, which is an elliptical galaxy, and this is an old galaxy, so it looks like slightly, yellow rather than white in colour. And this is because these are all stars that have formed, there's no gas left for star formation, so it's what's often referred to as a dead galaxy, or a ghost galaxy, because they kind of look a bit like ghosts.

And at this point they've kind of condensed a bit more, as the heavier stars have gone towards the middle due to gravity. And as I said, there is no sort of, of this blue gas, there's no dust to turn into anything. So it's quite condensed and as such, it's kept this egg shape, but it's interacting with a large spiral galaxy, like the Milky Way, but the spiral galaxy is more of a penguin shape now, because Even though this egg galaxy looks a lot smaller, its gravity is a lot stronger and concentrated.

So it's essentially distorted the shape of this spiral galaxy to where it's unrecognizable. And if you look at the Hubble image, you can see the blue gas that you see in spiral

galaxies, and you can see the dust lane that you normally see in spiral arms around, but it's sort of going across the middle, so it looks like the penguin has sunglasses.

And there's an updated JWST view where you can see all the regions that are now forming new stars. It's called a starburst picture because you can see, thanks to all this gas being pulled around and moving, it's causing things to interact. So you get a whole wave of new star formation, which actually pushes the galaxy through.

It's life a lot faster because the more stars you form, less gas for new stars. So it's going to go through its life cycle a lot quicker. Right. And I guess we're seeing further and older objects. Yep. So we'll see more and more of those. And then finally, this year, it completed its first set of all the giants.

Planet images. So we have these beautiful images of Uranus with its moons and it pretty much looks like its face with the rings going around it. We've got Neptune, we've got Jupiter and we've got Saturn. So we've got the full suite of giant planets now within our solar system.

And I see it's the 25th anniversary of Chandra.

Right. So Chandra is our one and only x ray observatory at the moment. Unfortunately, it will be decommissioned soon. So x rays do not come through our atmosphere. So the only way we can do x ray observations is with space telescopes. And that's why it's such a huge loss that we're going to be losing Chandra.

But it is its 25th anniversary. and it has these beautiful images of various different x ray systems. Now if you're wondering what x ray systems we have, we have things called x ray binaries and these are binary stars where one of them is a black hole and as a result of the interactions between the pair you get x rays and Chandra is not just there for the images in the x ray and the data from the x ray.

It's been really useful for calibrating x ray technology. So not just airport scanners, but also x ray machines and also for people who are being screened for breast cancer. Um, thermography machines have been better calibrated using the Chandra data so that women are not exposed to as much radiation as when they originally came out.

So it's more accurate. And we're exposing people to less radiation. This is great, isn't it? Really getting the benefit of space exploration back on Earth for us as well. It's not just the exploration, but learning all these technologies and improving upon them. Absolutely. There's so much that we've gained from the space sector and the astronomy sector that filters through to so many different parts of our lives.

And Chandra has been really significant for so many people and they'll never know. No, well, it's been amazing how long it's been going then 25 years. Yeah, but being decommissioned as you say Yeah, and not due to falling apart. It's due to lack of funding from NASA. Oh Really? I was gonna say what would replace it?

Nothing, unless you can find a consortia of rich people that are willing to fund it Right, my goodness me.

Now about the auroras we've had this year.

Yes. Did you get to see any of them, Graham? I did manage to see one. Yes. Yeah, absolutely. But your stunning photographs were brilliant over Guildford. Right.

Yeah. Um, so we were very fortunate. There's been so many aurora storms that have come this far south this year. We are now officially at solar maximum. So. Hopefully most people listening have at least seen one of the Aurora by now. We've actually had them all over December, but thanks to the gloomy weather.

Yes. We haven't been able to actually see them. So Aurora is what occurs as a result of the sun's rotation and poles flipping and the effects on the sun's magnetic fields. So at the beginning of a solar cycle, the sun has magnetic field lines from the North Pole to the South Pole that go out and around the sun.

We see diagrams of the Earth in physics lessons at school, where you have those magnetic fields. The sun has the same ones, much stronger, and that protects us from galactic cosmic rays from the other suns in the solar system. But because the Sun is rotating, and it's not a solid body, you get this dragging effect on those magnetic field lines. So they get dragged and sort of pulled and stretched and twisted. So if you were to image those magnetic fields, After a while, it kind of looks like a ball of wool that a cat's been playing with, with lots of loops coming around. And where those loops go through the different layers of the Sun, you get different sunspots at those places of interaction.

Now eventually those loops of plasma will explode. And we call that space weather. And as it interacts with the Earth's magnetic field, that funnels some of those particles into our own atmosphere, and they excite the atoms in our own atmosphere. So they jump up an energy level, and then as they drop back down an energy level, you get this colour of the aurora.

And you get lots of different shapes, depending on how active the aurora is. So we had the big storm in May, and that went down as far south as 24 degrees. Images were taken in Namibia, which was amazing. There was another storm in August, and in October, we had a non stop storm with, I think, four major bouts of aurora throughout the night, and Lots of people I know saw that one, and several people I know said they could actually see the colours with the naked eye, which is very rare.

So people with blue eyes have better adaption to see the colour of the aurora, whereas to someone like me with brown eyes, I can just see the lighter patches of sky and light coloured shafts sort of appearing and disappearing, whereas some people were able to see actual pinks and reds, which was pretty amazing.

Hmm, that's interesting. I didn't realise the colour of your eyes would make that difference. Yes, it's part of the adaption. And why, why did we see them so far south this time? It's because it's the strongest storm, so moves further and further away from the poles. As that's likely to happen again. Yeah.

So we're at maximum now. So we've probably got, if you sort of mirror it from May and was, we've probably got like another seven or eight months of Aurora, so it's definitely worth people keeping an eye out. I always post on the Guildford Astronomical Society Facebook page. When I think there's a chance that I might see them, or if I definitely see them, I post there, even if it's two o'clock in the morning.

So people do have a chance to go out and look if they follow on there. Several people ask about how to see them as well. So the easiest thing to do if you've got a phone with a camera is to turn your camera on to night mode. So you've got at least three second exposure, ideally going up to 10, but you might need a tripod for that.

And literally just point the camera, start pointing North take the three to ten second exposure, and you may or may not get a colour. Now, if you've got no stars, then it's likely to be some kind of light reflecting off clouds. There's lots of people who believe they have aurora pictures, but it's actually pink greenhouse lights reflecting off clouds.

So you want to see stars behind that colour. Right, indeed. What about effects on things like communications, electronic systems and so on? It has a major impact. So, you may know some ham radio operators. Um, that's actually the first sign that we're due a big storm because lots of ham radio operators say it's too hot.

Interfering with that tech, but also things like the Hubble satellite, the extra effects of having more particles in the atmosphere is that it slows down anything in orbit. So it orbits very slightly. So actually, Hubble's useful life is getting shorter because it's being slightly knocked out of orbit but also communication satellites for things such as disasters and natural disasters across the world.

There have been some flooded areas where the emergency satellites that are either taking images of the areas or acting as communications in those areas, such as the North Carolina devastation after the hurricane, that was affected by Aurora impacting satellites. Really? Mm hmm. So it does have some negative impacts as well, so I am very aware of that when I'm enjoying my pretty display.

All right, well, look out for more Auroras. Yes.

And now in our review of 2024, how about comets?



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

Right, so, we had two comets in particular, that people were focused on but the one that I think most of us saw was 2023 A3 Tsuchinshan Atlas, and that one was the one that was visible September and October.

I got to image it from Guildford Cathedral. A number of people who were there came over and had a look at my telescope screen to take a look at it as well. So that one was a periodic comet that comes back every 80, 000 years. There was another one that we were due to see at the tail end of the year but it broke up.

As it got closer to the sun, so we didn't get to see that one. That's right. So how many comets do we typically see in a year? Anywhere between sort of one and four. So there were several that were in the sort of astronomical guidebooks for the next year ahead. That either broke up, or we did see, but not very easily from the UK, but A3 was one that many people did manage to see and image, so that was one of my favourites of the year.

And now we move on to Mars.

Yes, there's been quite a lot of stuff that's come from Mars. We have a number of interesting rocks. So I think we've discussed the zebra rock, the popcorn rock and there's also been sulphur crystals. So many people will be wondering why is everyone so excited about these rocks.

Now the reason why is because all these rocks are showing Either signs of the chemistry that we need life to have been present on Mars or they show that they've interacted with water that you would have needed for life to have been present on Mars. And we're obviously assuming life in the form that we know it.

As we don't know of any other life, we've got a sample of one. So it's really exciting when you see evidence that these elements have been present or these molecules have been present because it means that there may have been life there at some point. We've also had some studies done on various different water cycles.

So we've got evidence that water has been cycling through the atmosphere and forming dew at the top of volcanoes. And then There was that hidden volcano that they found hiding in plain sight, where it had been worn down so much that it just kind of looked almost like a mountain range. And whilst we're there, actually I was going to mention this in the space news section, but the perseverance, rover has now made it right up to the edge of the crater rim that it was in.

So it landed in Jezero crater, which is a crater that was believed to be filled with water and had several different um, rivers running in and out of it. It's now eventually made its climb up to the top, which we'll talk about in more detail a bit later. So there's been a lot of interesting discoveries on Mars that indicate that it had the potential to host life.

And ExoMars 2029, the Rosalind Franklin mission, maybe we'll find out more. One day we'll actually find out that there has been life there, hopefully. That's the hope, isn't it? Yes.

Right, let's move on now to review some of the eclipses of the year.



Lunar Eclipse 18th September 2024
from Guildford Credit: Rachel Dutton
FRAS

Yes. So, There was the Great American Eclipse on the 8th of April, which was a full solar eclipse.

I know many members of the Guilford Astronomical Society managed to go out there and image it, and I am super jealous. Then there was an annular solar eclipse in October, again across the Americas, and this one is where the Moon is slightly further away from the Earth, so instead of being a complete eclipse, Elite eclipse, you get this ring of fire effect where you get the full ring of the sun around the moon.

And people who imaged that got a view to people that imaged the full solar eclipse. So the

full solar eclipse, you can see the coronas from the sun, which is the outer layers. And people even got the pink helium as well. With an annular solar eclipse, you don't get any of that because you're not blocking out the light.

But what you do get to see is the ruggedness of the moon and some of the craters around the rim which is pretty exciting. So both sets of images that people have produced are gorgeous and well worth a look at. Absolutely. And then we had our partial lunar eclipse in September which I imaged and one of my images got shared quite widely because I got photobombed by a delta flight.

Very good. Yeah. So you can go to my Instagram at astro underscore cellist, and you will see that on there. We also have the fake lunar eclipse as well. So this one was in August, where it looked like the moon was red, which is what you see during a full lunar eclipse. However, it wasn't due to an eclipse.



Lunar Eclipse with Plane: 18th September 2024 from Guildford Credit: Rachel Dutton FRAS

It was actually due to the wildfires in the US and Canada, and the particles. Going into the atmosphere and changing the colour of the light that's coming through.

Right, that was a recent impact on those, those, those terrible and amazing fires. Yeah, yeah, so lots of people took a picture of the moon looking red, saying, oh, I didn't know there was an eclipse, it was a full moon, and you need a full moon for a lunar eclipse, but actually it was the effect of the wildfires affecting the atmosphere.

Have you got any advice about taking pictures of the eclipse then, seeing as you've done so well? Um, with the lunar eclipse, you can pretty much do it with any camera, but I've got my little smart scope. And actually I've now got a little array of smart scopes, which pretty much does it all for you. If you're using a DSLR camera, you probably would like to use something like a 200 - 300mm lens to get a decent size of the moon.

Mobile phones don't do it as well because they don't have the dynamic range, but you can sometimes find with some of the better high end ones. If you put your phone on video mode and then change the exposure a bit as well, so take the exposure right down, you might get something that resembles a moon rather than a bright blob.

My lovely little smart scope is cheap for a telescope. It's around 500 pounds and they've got a newer model which has a wider field of view, so the moon would look a bit smaller. But that one's around the 350 pound mark, so those are the Seestar telescopes. There's the Dwarf telescope as well, which has a similar price point.

So if you really want to get into lunar observing, you can do that. And also, just a good pair of binoculars. Um, I've got a pair of Celestron 15 by 70s binoculars. They're called

Skymasters and I think they now cost anywhere between 80 and 100 pounds at places like Argos and Amazon. So that's very affordable and if you learn how to use them and how to focus them you can still see a lot on the moon that you can't see with the naked eye.

So there's lots of different ways of viewing those lunar eclipses. Right, some good tips there. Thank you, Rachel.

Well, in the news over Christmas is the **Parker Solar Probe** passing the Sun very close to it.

Yeah. And some do we know getting hot feet. Very much so. So, the Parker Solar Probe is actually investigating space weather and all the world.

All that stuff going on with the Sun. The Sun's our nearest star. It's the only place we can go to really get the measurements and the data for this. But it's

really hard to get close to the Sun. You need as much energy to get close to the Sun as you need to escape it. So if you think how hard it is to get close to the Sun, Launch a rocket from the Earth.

If you were to try and approach the Earth, you need, you know, a similar amount of energy available to you. So it's really, really hard to do. And a lot of people forget the Sun is not solid. It's got many, many, many layers, but it's like a cloud. It looks solid, but there's no solid surface. So this Parker Solar Probe is getting closer and closer as it sweeps through each pass, and on board is a chip with lots of different names.

Names on it, and that includes John Axtell's, the previous Stars Over Surrey host, so he has his name on there and he successfully survived his Christmas Day pass through the Sun. Indeed.



Rachel Dutton

images

2024

Now, we've been through the year, but what still hasn't happened that we hoped would have happened?

So, there was due to be a nova going off in a constellation called **Corona Borealis, the Northern Crown.**

So, we were expecting this to happen between May and September. and supernova. Instead, what you have is you have a white dwarf star and it's siphoning material from a companion and this material starts swirling around the star in an accretion disk similar to what you have around a black hole. And as this material is swirling and getting closer and closer, it's getting hotter.

And eventually there will be enough to ignite fusion and you get this runaway explosion effect. So you would just get this brightening of the star. So at the moment it's not visible to the naked eye, but you would see this star being visible all of a sudden. And it's supposed to happen once every, I think it's 80 years for T. Corona Borealis.

There's only five recurring nova that we know of and no one has imaged this one yet. So lots of astrophotographers are on tenterhooks waiting for it to happen, hoping that it didn't happen, but it was super dim. But it's due to happen any time now, but obviously in astronomical timescales, we can't be that accurate.

So any time now could be any time within months or years.

Now let's go to the astronomy tip of the month.

So last Christmas unboxing day, we did the episode where we talked through basics of astronomy and I did a guide. [You can get that PDF guide updated a little bit on the Star's Oversight website.](#)

I recommend actually just going there, taking a look at it whilst the weather's bad. and you can um, get an idea of how to get started in astronomy, understand the language that we use and there are some links to guides and things there. So you can get started and start researching until the weather gets a bit better.

Advert Break

And after the break, we'll be coming back with a recap on space in 2024. And welcome back to Stars Over Laycock and Rachel Dutton.

And now, Rachel, we're going to be looking at the big themes of 2024 in space, starting with those **moon landings and attempts.**

Yeah, so we started off the year, unfortunately, with a fail with the Peregrine launch that did include some instruments from the UK, from the open universities.

That was a bit gutting. Yeah. What happened there was there was some damage to the craft that caused a propellant leak. So they tried to get some data from the environment that the instruments were in, and then they had to safely crash land it back towards the Earth.

Then we have the private moon landing, which is the first U.S. based moon landing since the Apollo era. Graham, I believe you watch that. Yes, indeed. Yeah, it's quite quite amazing moments. Yep. So that had some art displays inside as well as some instruments. Um, it landed on its site. Then some of the art displays can get deployed onto the moon. But it was quite interesting watching them trying to get the signal.

That's right. I can remember that. Yes, yes. It's a wait for it to come round again from the dark side, wasn't it? And I can't remember. I think it was because it landed funny. The signal wasn't going in a straight line. So they had multiple radio telescopes including Jodrell Bank trying to pick up a signal for them, but I did feel sorry for them because you had their cameras in the control room panned on their faces of them looking at their screens and I was just reminded of when you call IT and they log into your machine and you had this problem for days, you show them the problem and then the problem fixes itself.

And as soon as IT log off. Yeah, the problem reappears again, just reminded me of that sort of pressure, but the whole world looking at your screen. So we have the intuitive machines landing, which was successful, although it didn't do everything they wanted it to JAXA, the Japanese space agency that landed on the moon, becoming the fifth nation to land successfully on the moon.

And they deployed two little toy robots, one that hops, and one that rolls, made by Tomy, the toy company, and Sony, the electronics company. So, JAXA has joined the list of countries that have successfully landed on the moon.

Finally, China did a landing on the far side of the moon, then to warn up the Americans, they put a flag on that was made of some kind of material that is made from basalt.

So it should last a lot longer than the American flag that was put on the moon, which should just be. Shreds of material by now and they've also done a sample return as well. So they've brought back some lunar samples after drilling on the far side. But the results of any analysis of those samples have yet to be shared.

Starship

Right. I think one of the memorable images of the year was, was, was with Starship and those chopsticks coming down to catch the rocket. Yeah, that was pretty amazing. So we had Starship flights three through to five, I think this year with the next flight being due in January. So Starship is a huge program that is required if we want to go to Mars and also as another way of getting to the moon.

It's this massive ship that requires completely different processes for launching, because it's super, super, super heavy, not just super heavy, it can carry more people, about 30 people, as opposed to like one to three astronauts. Um, or even just massive payloads, so we can get infrastructure to different places.

I've mentioned it's a super, super heavy payloads. Just launching it is going to be really difficult, but the really important thing is the reusability. At the moment, we just drop our boosters back into the ocean, and if you were to say to someone, you've done your flight from the UK, say to the US, great we've landed in New York now, let's just drop the engine into the Atlantic and stick another engine on the plane, you'd think that's bonkers.

And spaceflight, at this point, has been like that. So, they had some smaller ships where they had legs, and they've landed them successfully on those legs. But then, those legs are going to be extra weight, so. The next thing they tried was this Mechazilla Tower with what they call the chopsticks, but they are these two massive arms that are reaching out and catching what is essentially like a 20 story building, just the booster, and then the whole thing would be like an 80 story building, which is pretty cool.

Doing a precision landing to aim itself back into those chopstick arms before they close on it. So the whole thing is just incredible and wild to think about on the scale it's being done. So Starship, the earlier tests in the year, they had heat problems, which is a big theme for the Artemis program as well, getting the heat shield sorted.

So they've been working on the heat shield and Elon's doing the whole sort of try fast, fail hard, and get lots of iterations out there as fast as possible, which is sort of new way of doing business. So, I was like, okay, the success of this mission is not, did we launch a ship and did we get it back in one piece?

It's, did we launch a ship? And. We want to test these new heat shield tiles and we want to test this kind of flap to see if it survives and we want to test the cameras to see if they work and we want to test whether we can open the payload doors, whether we can move fuel around. Um, there was even a banana floating around in the last one that was tied on a piece of string.

So there's various different tests going on there. So their criteria for success is testing all these elements each time and making sure there is like an iterative progress. Every single time. So the very last flight this year, they didn't get to do the chopstick catch again. They think because the antenna actually got bent on the launch so they didn't have the signal to be able to aim it back.

But I would expect to see the future tests are included. or chopstick catchers, but that is a moment in space history that has literally changed the future of space travel. So that is one that if you get the chance to even just look at the YouTube video again, I recommend that you do. Yeah, it's amazing, isn't it?

Absolutely amazing seeing it happen. It was incredible.

Well, Boeing's had a bit of a difficult year one way or another, both with its aircraft and with its space mission.

Yeah, and I'm gutted for all the engineers that work on this, because it's not their fault with the way a company is run. So The Starliner, which is the bit we're interested in, it's launched in the summer.

The mission was going to be anywhere between 8 and 45 days, then it was extended to 90 days. As they discovered problems with the thrusters and eventually they had to return it back to Earth without including all the tests that they wanted to do to try and fix it. So we ended up with Suni Williams and Butch Wilmore taking the place of two astronauts who were then kept down on the Earth so that they were doing essentially the next expedition crew.

So they're staying up for six months Now, for Suni and Butch, any astronaut is always going to want more time in space. Um, so it wasn't a big deal for them. Sonny is a very well known space veteran. She built the International Space Station and then did one of the first spacewalks going out to fix things after it was built.

So, Both of them know what they're doing, both of them knew what they were signing up for, both of them knew the risks and were willing to stay in space longer. Um, so they were originally due to return on the Dragon Capsule in February, but actually there is a new Dragon being built that has had some delays.

So that's going to be sent out tomorrow. to return them, but the earliest that's going to happen is March. So they've been extended again now, and that's recent news. And Suni seems to be doing very well as well.

So she was also on the ISS ham radio broadcast with the West Surrey Brownies guides. and I think Venture Scouts that were at Brooklyn's Museum recently, so they did a ham radio broadcast together where the Sophie Duchess of Wessex was there and she sort of introduced everyone and then All the girls got to ask questions in turn to Suni before they lost the signal. So, there has been some silver linings there with other things going on.

Obviously, there are two astronauts who were gutted that they did all their training and didn't get to be part of the crew. Um, it's just one of those things that unfortunately happens. Um, NASA did say that they are really keen to get more options available to fly people up and down to the space station, so they're still working with Boeing to see if they can get Starliner into a place where it's operational.

But obviously the space station only has a few years left in it, so we'll see if that happens. Indeed, and of course newspapers being newspapers, we had those headlines about astronauts being stranded in space. Yeah, they're not stranded. There's always at least a four month supply on there. They're safe.

It was actually, they believed the Starliner would have been safe to use as a lifeboat and maybe even be safe to return people in, but they just didn't want the risk profile itself was fine, but the uncertainty and the risk was something they, they were uncomfortable with. Yeah. Which is, which is fair enough, and they're perfectly safe where they are, so you're not going to unnecessarily push risk profiles or returning people if you've got other options available.

Indeed, and **astronaut graduations during the year.**

Yep, so NASA finished the basic training and graduated a class of astronauts in March, and then ESA did the same in April as well. And that included Rosemary Coogan, who is a UK astronaut and astrophysicist. So we saw two astronaut graduations.

NASA have put out a call for more astronaut applications. So anyone in the US who is eligible you can still apply. Um, And then two of the astronauts from ESA had already been assigned their missions within a month of that. And then a number of other ESA reserve astronauts are due to start their training, including Megan Christian in January next year.

And also a number of the astronauts have been given their missions now. And some of them are partnering with private companies as well. So they'll be doing shorter flights to

and from the ISS. So there's been quite a lot of movement for the UK based astronauts as well. So I'm very excited for them to get on with their training and their mission.

And in our review of 2024 in space news of **Voyager 1 being saved**.

Yes. So obviously before my time, but Voyagers 1 and 2 were launched. last century now, or even last millennium, and they went out through the solar system at a pretty decent time because most of the planets were sort of in an alignment so they could visit each of them and fly by, and that's where we got some of our first decent images of things like Neptune and Uranus as they went past.

So they're both out in the Heliopause, but Voyager 1's communications started breaking down and it was sending back nonsense. Um, and there's like a 22 hour delay between the communication being sent and it be arriving at Earth. So they tried to get it to restart, they tried several different sort of command prompts, nothing.

It was just sending back nonsensical noughts and ones. So eventually they managed to get it to send a data dump of its code and work out the problem. And what they ended up doing was splitting out the operating code into different areas of its hard drive essentially. And when they did that, it eventually came back online again.

Back to operating, which is insane amounts of maths and engineering, and really it's a testament to these super clever, clever and creative people who sat in a control room to try and rescue a probe out of the outer reaches of the solar system, because that's the furthest that any probe has gone. Or with the two Voyagers and they're sending back data literally from outside of the influence of the sun.

So it's really, really unique, important data that we, we really could do with. Excellent, still going strong. Yes.

And now we move on to Polaris Dawn.

Yes, so Polaris Dawn was the first commercial spaceflight with a spacewalk included. So they had their own suits which were different to the sort of standard ESA and NASA suits.

They weren't the kind that I'm used to seeing. So I'm used to seeing ones with like extra articulations around their arms so that people can do spacewalks along the ISS using their arms for movement. These were pretty much sort of like all in one suits. And I think I mentioned I was quite nervous about this mission because they would be doing the spacewalk, but they had no safe haven. It's just one capsule.

The whole capsule was being pressurised. So there was no room for error if their spacesuits failed or didn't work. That would have been very, very serious. There was no safe haven. But they were successful.

We saw the first commercial spacewalk done by the sort of mission leader and funder, Jared Isaacman. So it kind of looked like he was doing the Macarena to a lot of people. At first he just pokes his head out, then he sort of climbs up this ladder and you see him lifting his arm and holding it at a funny angle.

And actually that's part of being in space that your arms will sort of float up. But what he was doing with the strange movements was he was very, very gently seeing the movement and the ranges within that space suit. And you do so very gently because you don't want to shock a space suit because that could cause it to depressurise.

So that's what was with the sort of strange movements. Um, so it was the first commercial space walk. They spent a couple of days up there in orbit doing various experiments. My absolute favourite was Sarah Gillis playing the violin, and I've been reading since on the preparation for that. So not only did they pre-record the Star Wars theme with various different orchestras around the world for her to play along to, they also had to test the violin in various different vacuum chambers.

So I'm a cellist. I'm aware that, you know, the cello is made out of wood, but what a lot of people don't realise is, as well as that, you have to put rosin on your bow to get the sound out. And rosin is crystallised tree sap. And as you put it onto the bow, it creates a load of dust as well. So you don't want dust in space stations because people can breathe that in and it can get into components and things and cause catastrophic failures.

But also they're worried about the wood off-gassing as well and getting like tiny bits of wood sort of floating around that could cause problems in there as well. So they did a lot of testing on this violin in advance to make sure it was safe to go up. Um, so just in case, like any billionaires funding space missions are listening, I'm more than happy to play the cello in space on one of your missions, just put that out there.

So yeah, that was the first spacewalk and then I don't know if you've been watching the news since Trump being re-elected, but he has nominated Jared Isaacman as being the new head of NASA. So I believe there's stages like that nomination has to be accepted by various different committees, etc.

I'm actually not annoyed about that nomination, despite what a lot of people have been saying. Um, because Jared Isaacman is really passionate about space travel, space flights. He's spent billions, or at least billions, like 200 million of his own money into private space flights. That's something that he's really excited about.

The commercial background might be something that's needed at NASA. NASA has had massive problems with funding and also costs spiralling out of control. So, it might be that going from a public sector to a commercial mindset might be helpful for their finances. Something I don't know that could be something of concern for astronomers in particular is that if he is mostly focused on spaceflight, does that mean less probes, less rovers, less telescopes get funded?

I don't know where his priorities are, so that's something I'm going to be keeping an eye on. But it could be a very interesting appointment and it might be what they need to sort of turn things around at NASA because there have been a few projects that have been defunded.

I mentioned Chandra X-ray observatory. We've mentioned as well, one of the Moon missions may not go, which is a shame because it's all ready to go. But, it's just a rule saying that because it wasn't completed within a certain period of time, despite the fact the whole thing's assembled and ready to go, may not be able to go.

So maybe he can help reduce that kind of thing happening. I don't know. It'll be interesting to see. Yep, time will tell, we'll keep an eye on that throughout next year. Yeah.

And a major milestone during 2024, **the 100th woman in space.**

Yeah, so this was a private Blue Origin flight, and a well known, known as an influence for quite a lot, but Emily Calandrelli, she's actually a former NASA engineer, who was the first woman science show host, where she hosted the complete science show by herself in the US.

And she's super, super passionate about spreading science and STEM amongst young women, girls, and children. She's written many books, including New York Times bestseller *On science experiments that you do with kids at home*, I highly recommend those books is a great way of getting kids interested in science.

So she became the 100th woman in space on a suborbital flight. So it was a flight that lasted less than 20 minutes, but she's still got to go weightless and see the Earth. Um, and if there is anyone worthy of being the 100th woman in space, it is absolutely her. Congratulations to her.

And 2024 saw the **first extraterrestrial air crash investigation.**

Yeah, so I mentioned Perseverance, the rover that landed in the Jezero crater and has now moved up to the crater rim, having done a lot of exploration. And Perseverance was equipped with a little helicopter called Ingenuity. And everyone was joking about the Weasleys from Harry Potter being on masks, they were called Percy and Ginny for short.

So Ingenuity was supposed to have maybe a maximum of five flights and it had a camera on board and it ended up doing over 70 flights, which was pretty incredible until it crashed this year. And they were working so well as a team, so it was gutting to a lot of people and we got images back showing the shadow of the rotator blades.

One had been sheared off completely, so it was no longer able to fly, but the camera on board still worked. And whilst Perseverance was within range, it was sending back images and data. So we've had our first extra terrestrial air crash investigation trying to work out what happened. And they believe that the problem is that the area that Ingenuity was in didn't have much in terms of pattern on the landscape.

It was pretty much just like a solid desert, kind of brownish. Orange colour but with no features and ingenuity was designed to use various features in order to work out where it was. So it can no longer work out its relation to the grounds. And that's probably what caused the crash. Right, so something a bit different there.

Yeah. Could be more, I guess, as we go on.

January Astrocast

3rd	Quadrantids, Moon near Venus
4th	Earth at Perihelion
	Moon occults Saturn

6th	First quarter moon
10th	Moon occults the Pleiades
	Venus at Eastern Elongation
	Moon near Jupiter
12th	Mars closest to Earth
13th	Full moon near Mars
14th	Moon near Mars
16th	Moon near Regulus
18th	Venus near Saturn
21st	Moon near Spica
	Last Quarter Moon
25th	Moon near Antares
29th	New Moon

And we have some **events coming up in January.**

Yes, on the 9th of January, Guildford Astronomical Society have a talk from Professor Lucy Green. Some of you may remember her from BBC Sky at Night. She is a local heliophysicist or solar physicist, based at Midland Space Science Laboratory, which is part of UCL.

So she'll be coming and talking to us about the Sun. On the 10th, Ewell Astronomical Society have a talk from Tim Parsons about the upper reaches of the Hertzsprung Russell diagram. So those are the more massive stars. So that'll be quite an interesting one for people who are really into astrophysics.

Um, on the 14th, Farnham Astronomical Society will have a talk on lunar gazing by Carolyn Kennett, who is an archeo-astronomer in Cornwall, and she will be providing information on the connection to the moon from prehistory up to the 20th century in science and popular culture, which also sounds very interesting.

Yeah, some good talks there to start the year off. Well, Rachel, thank you so much for being with us again this month for Stars Over Surrey, and we do hope the voice gets better soon. So do I. Wishing everyone hopefully clear skies soon. Yeah, let's hope so. Get your telescope going. Anyway, thank you, Rachel.

That's Rachel Dutton from the Guildford Astronomical Society and Fellow of the Royal Astronomical Society. And the next edition of Stars Over Surrey will be on Brooklyn's Radio on Tuesday the 28th of January at 8pm. For now, goodbye.

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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