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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. Hello, Rachel. Hi Graham, how are you? Alright, thank you. Hope you've had plenty of clear skies. it's getting clearer and we do have an astronomy image to take a look at.

So, well, let's get going because we're going to be looking at astronomy and later on what's been happening in space, aren't we?

Supernova NCG7331

Credit: Rachel Dutton FRAS

So let's go for that image, first of all, then. Okay, so back on the 16th of July, a supernova went off in the galaxy NGC 7331, and on the 25th of July I went out to have a go at imaging it.

So I've got the sort of raw stacked image here. It needs a bit of prettying up, but Graham, if you want to take a look, hopefully you can see there is a galaxy there. I can see the galaxy. Yes, indeed. Yes. Shining brightly. Yes, and if you zoom into it, you'll see there is a blob that is not the centre of the galaxy. Indeed.

And that that is the supernova going off. Oh, really? Right? Mm-hmm. Well, that was lucky you caught that. Yeah, so sometimes it can be a few hours or a few days. So that, luckily that was one of the, the longer ones. So this one, the Host Galaxy is a spiral Galaxy located about 40 million lightweight years away.

It's in the constellation of Pegasus, and it was discovered by William Herschel back in 1784, and it's often referred to as a twin of the Milky Way. Due to its similar size and structure and orientation and its disc is inclined about 75 degrees from our line of sight. So it offers quite this dramatic view of the dust lanes and spiral alarms.

When you've got a telescope that can really zoom in a lot more, and obviously my image is a lot more zoomed out, it's got a prominent central bulge and it hosts a super mass of black hole and its apparent magnitude is 10 point. Four. So lots of people use it as a astrophotography target. but if you look at the whole sort of frame of view, there is a smaller group of galaxies nearby called the Deer Lick Group, and they are actually nowhere near this.

They are 300 million light years away. But because we are looking at the sky in this 2D. Way. because obviously it all looks sort of flat to us. they kind of look like they're in the same field of

view and that they're nearby, so Ah, right. They can all appear in that same frame, but they're, they're not related to each other and nowhere near each other.

But I was really happy. That's my first image of a supernova that I've caught. Oh, really? Well done. Mm-hmm. Okay. Yes.

Let's go on to, **Vera Rubin Observatory. Observatory**.

Yes. So this is the new Vera Rubin Observatory that has. Just sort of gone online and we've got our first images published from it, which is super exciting.

So this is the newly operational telescope in the Atacama Desert in Chile. It has a primary mirror of a whopping 8.4 meters in diameter. Can you imagine transporting? Goodness me. How do they get that into place? I don't even want to consider the logistics of it. It breaks my head thinking about it or how they made it, made it even at that size.

It's amazing. Yes, they did. Yes. It's one, it has to be one, one big mirror so you don't get a massive line down the middle. Mm-hmm. I know that they. Make them. I think it's, it was probably made in Arizona. So the University of Arizona, their football stadium is on top of their telescope, mirror manufacturing facility, which is underground underneath it.

And they have become experts at making these telescope mirrors. So it's probably come from their, um. It makes me laugh because you see like these games at University of Arizona and underneath I'm like super excited that there's a mirror being made somewhere. it also has the world's largest digital camera with 3.2 giga pixels.

Goodness me. Yeah. So it is, it is pretty incredible. I'm really excited to see what it has coming for it. So, it's named Dr. Vera Rubin. She is the scientist that gave us the most convincing evidence for the existence of dark matter because she was looking at galaxies and obviously when we look at galaxies, we.

If we're looking at, say, a spiral galaxy like Milky Way, you see the blue spiral arms and you see the dark dust lanes, and you get a rough idea of the amount of matter that you can see in that. And the amount of matter that you see in those galaxies should have a calculate, if that's the word, you should be able to calculate from that, the effect of gravity on that galaxy.

She actually worked out that there was more gravity for each galaxy that she was looking at than the amount of matter that you could see would make you think of possible. So something really odd was happening. And also the way that spiral arms move, they are rotating around. In what looks to be like, a solid wheel right sort of rotation pattern so they don't change their pattern, but theoretically with the amount of matter you can see, they, these fire alarms should be like, stretched out as they rotate more and more and more.

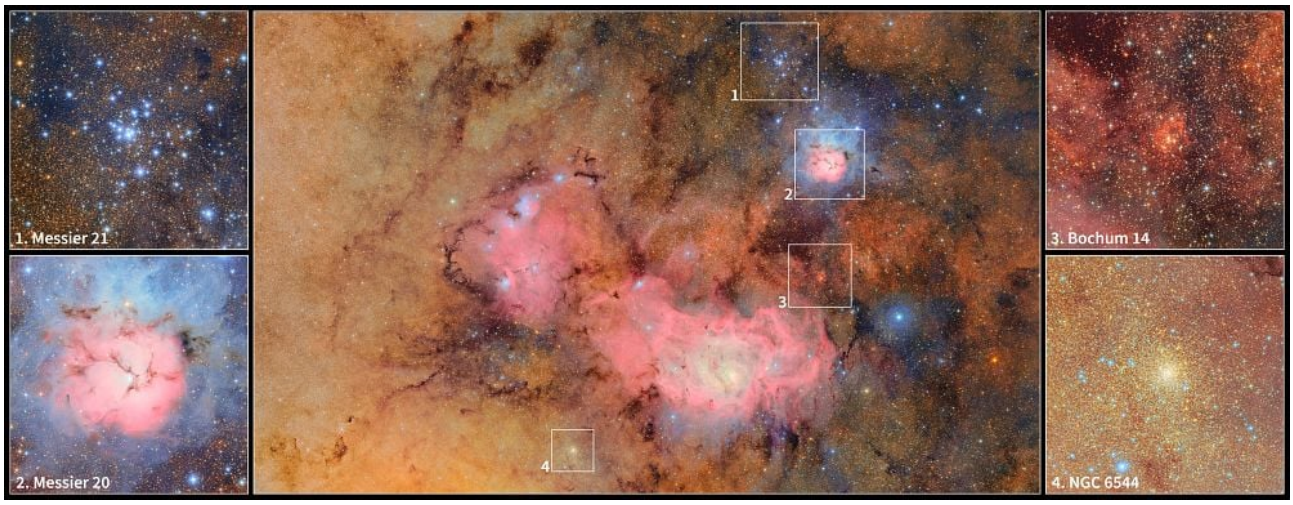
So she provided this as like evidence that there is something there that has an effect on gravity. So it's probably matter, but we can't see it. We can't feel it. We can't measure it in any way, shape, or form or interact with it in a way that we know of. So we call it dark for that reason. So she was the person that sort of worked out that is.

Probably the reason to explain these odd things that happen and this telescope was named after her, which is awesome. So this telescope is going to conduct the legacy survey of time and space or LSST by photographing the entire visible southern sky every few nights for 10 years. And this survey will.

Be a massive catalog, cataloging billions of galaxies and stars tracking moving objects throughout the solar system, and it will help scientists study dark matter, dark energy in the changing universe with more remarkable precision. So with these kind of survey telescopes that you don't tell them, I want to look at this this night and this this night, these give us so much data, not just for calibrating and aligning things and calculating things in the future, but like we've had many stories about the Gaia telescope before she ended her mission, and people go back and they find black holes or the brightest quasar we've ever found.

It's providing so much data that people can go through aand find new insights from. So we've got another image, which has come from the original commissioning images that we're going to take a look at.

I'll put this and the other image on the show notes that is on the Stars Over Surrey page in the Brooklands Radio website. So do take a look, but you can Google this for the first, Vera Rubin image release. So Graham, can you see that central image? I can? Yes, indeed. Quite spectacular, isn't it? Mm, it's a large, it's field of view.



NSF-DOE Vera C. Rubin Observatory

Yeah, sort of a a, a pink in the middle, isn't it? And then getting Yes, yes. Dark around the edges. But, and there are also four closeups you've got there as well. Yeah. So let's talk about what we can see. So that big pink blob, that is the other star forming region that is visible from, with the naked eye from the Northern Hemisphere.

So we talk about the Orion Nebula a lot that looks like it's the middle star of the sword on constellation of Orion, but it's actually a stellar nursery. This is another cell nursery and it's got three lobes. So it's called the Trifid Nebula for that reason. And you can tell it's a stellar nursery because it's pink, and that's because these new stars are lighting up the gas around them.

So it's ionising it and it creates that sort of pink glow, right? And you can see it with the naked eye. It looks like a star in the sky. But it's a stunning nebula in its own right. And then we can zoom in, on the other one. So. Number one that they've zoomed into known as Messier 21 or Webs Cross.

This is an open star cluster and an open star cluster is lots of young stars, so they kind of look more bluish as you hopefully can see. They look kind of blueish. Yes, I can see yeah. Of And it's of open. Yes. And it's open because there's no pattern. They kind. Take up that whole sort of field of view. And this is because stars that have more mass will burn through that mass much more faster so they burn blue.

Because if you think of a flame, a hotter flame is blue and a cooler flame is red. And because they are so young, they're going to go through their main sequence much faster and they don't have as much time for gravity to interact and pull them together. So they're kind of spread out across the frame.

So that's an open star cluster. we have another open star cluster, Boham 14, but you'll see you've got that red gas in the background. So you've got the open star cluster of young stars and you've got the red cluster because it's in a star nursery. So you can see, you can start telling what's going on.

Once you start knowing a few things about the colours of things you're looking at, whether it's a star or a piece of gas. And then the final zoom in they've got is a globular star cluster NGC 6544. As you can hopefully see it kind of looks a bit globby. Yeah. As I call it. So globular star clusters are older star clusters.

Normally when you think of a collection of stars, you think of a galaxy star. Clusters are collections of stars where they have no dark matter halo holding it together as a galaxy. So instead. After a long period of time with these smaller mass stars, they get pulled in together and you get this sort of globe shape or a globular cluster.

They kind of look slightly more red compared to that blue light from those other stars. And when I say red, it's a warm, more sort of warmer yellowy tinge. Yes. And these are older stars that will take a really long time to go through their main sequence. So they're on the redder end of the spectrum.

And they've had time for gravity to pull them together. And some of these star clusters, it, the globular clusters, some of them, are similar to the age of the universe and slightly embarrassingly the techniques that we use to try and age globular clusters. Some of them come out as older than the age of the universe.

So, they are very old objects and obviously we know that there's lots of problems with the trying to get the exact age of the universe. So that was the first image. You can look it up online again, I'll put it in the show notes. also within that first dataset, there were 2,104 new asteroids in the solar system, including seven new near Earth objects, 11 Jupiter Trojan.

So that's captured asteroids that end up round, Jupiter nine transient. Neptune objects, so those ones are caught into the, gravitational well of Neptune. And within this field, Ruben also detected approximately 180,000 additional previously known objects for a total of. Just under 4,000 detections.

Now, if you'd like to be one of the first humans to see these comets, you can go to the Vera Rubin comment watch on the Zooniverse website, and help researchers classify and detect those comets and images so you can actually start working with data from this brand new telescope Pretty much straight away.

That's marvelous, isn't it? This modern technology now that you know, everybody can get in there and, help the analysis Yes. And discover things. Yeah. And you may even get your name listed on the paper with the researchers if you've, been a significant contribution. Well, we'll be looking for your name in due course, Rachel.

Right? **Should we go on to Comet 3i/ATLAS**

Yes. So this is our third known Interstellar visitor. So do you remember, am our first Interstellar visitor and then we had come Borisov. Yep. So this is another one that must have come from outside the solar system. So the NASA funded Atlas Survey telescope in Rio Hurtado, Chile.

First reported observations to the minor planet centre of Comet 3i/ATLAS on the 1st of July, and then astronomers then. Dug back in recent data going back to the 14th of June since that first report, and found other observations gathered from the archives of three other Atlas telescopes around the world, including Caltech Wiki transient facility at the Paloma Observatory in San Diego County, California.

So they've then got all this extra data, and from that they can put together its trajectory and its path and work out that it's not from our solar system. So how can we tell it's from our solar system or not? Well, hopefully you've seen images of the solar system. You've got the Sun and you've got planets going around.

And planets, they have an elliptical orbit. But for the most part, it pretty much looks round with you. Yeah. You see the Moon going around the Earth. Yeah. Also, it's elliptical, but to naked eye

pretty much sticks round. Yep. When we've got comets and asteroids coming in, obviously they are taking more elliptical path, so like a more oval orbit, but we can still see from that path that it is going around the Sun and these objects.

They're doing a hyperbolic shape of its orbital path. It's a curve that is so huge. It practically looks like a straight line going through our solar system a bit like, we are too small to see the curvature of the Earth. It kind of looks like it's flat to us. It kind of looks flat to us as it's going through our solar system.

We can just about detect this paint curve. So that's how we know it's come from somewhere else. But even more exciting, is that it's probably older than our solar system itself, really? Mm. Wow. So we, we still are doing lots of different investigations. so the size and physical properties are being investigated by people taking spectra.

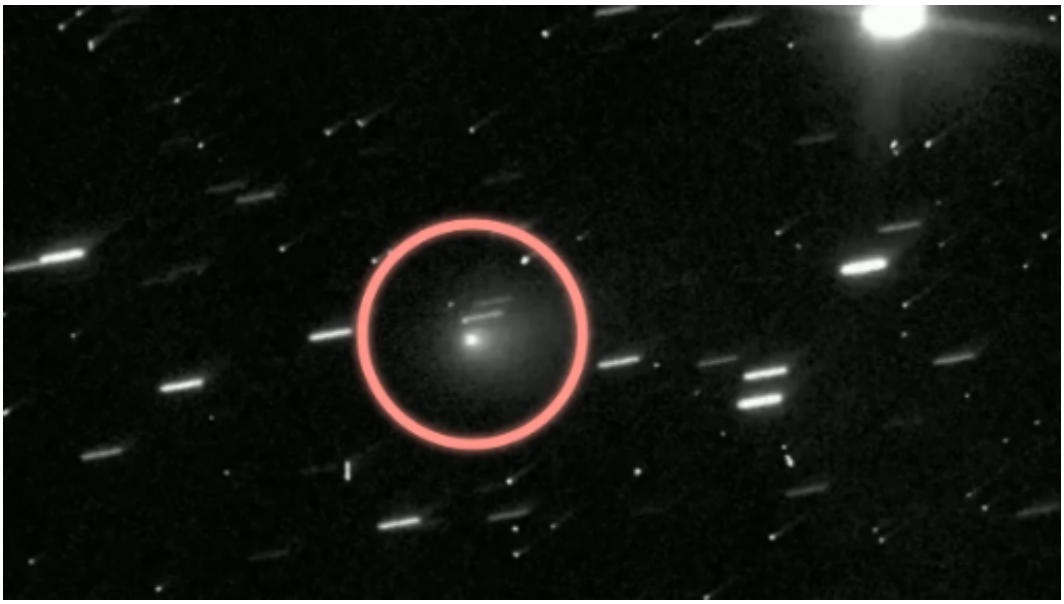
It looks, like it's active, so that means that it's got an icy nucleus and a coma, which is that bright gas and dust surrounding the comet. And as it approaches the Sun. That gets heated up by the Sun and it sublimate, so it goes straight from a solid to a gas like dry ice does. So you get like that head and that.

So that's pretty exciting. And there's a team that are looking at that composition and they think it likely formed around a thick disc star. So on the, the outer disc of the Milky Way. and they think it's rich and water. Ice. So if that's true, that could be significant and point to conditions that existed long before us.

So the system was born where water was around, so people worried about will it hit the Earth? Absolutely not. It will get at the closest approach to us, 1.8 astronomical units, or 170 million miles or 270 million km. That will be its closest approach. and that will be in October, 2025. So lots of people are taking as many or, um.

Images and spectra as they can with whatever telescopes we can point at it. And I've included on here as well the Hubble image. Oh yes, I got that. Yes. Yeah, you can see it there. And the bin Space telescope also gave us an image, but it's quite. Pixelated at the moment, so need someone to go in and sort of clean it up a bit.

So that's quite exciting. We have an interstellar visitor and we actually have enough time to get a bit more information and readings and data about it. So I'm really excited to see between now and October what data we can get. And then hopefully over the next few years we'll get some really interesting insights as to potentially where it's come from, what it's made of, and conditions that could potentially host life elsewhere within the galaxy.



NASA/ ESA/Hubble

Absolutely. Well, let's now go to Beetle Juice's Companion.

Yes. So Graham, your favourite star? Yeah, absolutely. So only because, only because of the name really. I know, but, and you never, you have a favourite star Until we started doing this. Yeah. So I didn't realise it had a companion. Right. So you remember we talked about the great dimming events that happened in 2019 and 2020.

Yeah. And we are pretty sure it's going to go supernova at any time soon. And the other weird thing about Betelgeuse is that it has two regular dimming patterns. One of 400 days and one of six years, and there are changes in its velocity. So. Aside from the fact that it's a variable star at the end of its life, so that means you've got a star when it's at the end of its life.

Once the stars come off its main sequence, it stopped fusing hydrogen into helium. It's then fusing other things, and then when it runs out of things to fuse, gravity pulls it in, it gets dimmer because. there is nothing being fused that forces all the matter together, and then it starts the next layer of fusion and then it expands out and ignites again until it runs out of that material.

And this keeps going on, on and on. So they're called variable stars and you can guess from these pulses of variability where they're in their lifecycle, look at the amount of maths and work out how heavy they can go. The maximum is iron and. Then you get a supernova. So we think Betelgeuse will go supernova any day soon in astronomical terms, which could be, you know, tomorrow, the next a hundred years, the extra thousand years.

But you know, any day soon in astronomical terms. But it had the second dimming pattern. And that plus the changes in its philosophy has meant that for about a hundred years, we've thought that it's had a companion. Betelgeuse is huge. So if you were to take the Sun off of our solar system slot, Betelgeuse in, then it would go out as far as the, the orbit of Jupiter.

Wow, okay. So that gives you an idea of It's big. Yeah, it's, it's literally got this huge radius because it's outer layers sort of expand and swell away from it as you get with giant stars. So. It's huge. But that means that if it does have a companion, that companion is going to be really hard to spot because it needs to be as far out to one side or the other outside of the outer layers.

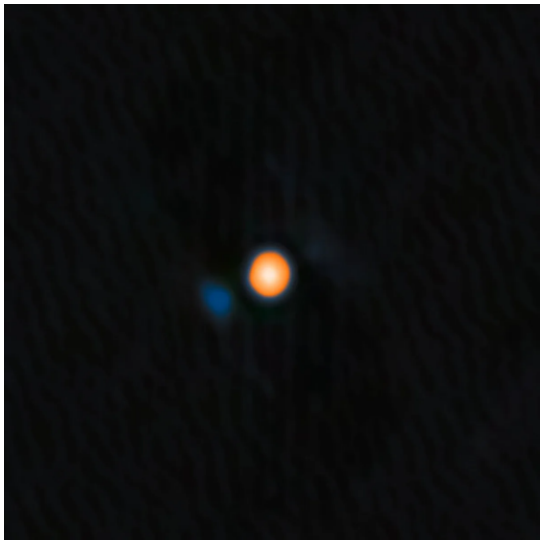
And we think if it did exist, it was within the. Let the outer layers of Betelgeuse. So it'll be really, really hard to spot and you've got this very, very time period, small time period in which you can try and find it. It's a bit like trying to get images of mercury. That's quite challenging because mercury is so small compared to the Sun, and you've got to wait for the greatest elongation.

So it's got to be at the most East or West of its orbit from our point of view to, to have a chance of finding it without. Damaging our eyes. So this is a sort of an analogous situation. So as I said, the timeframe for doing this is very narrow, but Steve Howell, a senior research scientist at AMES, recognised the ground-based Gemini North Telescope in Hawaii, one of the largest in the world, paired with a special high resolution camera built by nasa, had the potential to directly observe the close companion if it existed.

And that's despite it being on the Earth, because obviously with the Earth you get blurring due to Earth's atmosphere. So this instrument is called the Alopeke speckle Instrument and they managed to take many thousands of short exposures to measure the atmospheric interference in their data and remove it, which gives you a more detailed image.

And this provided an image of Betelgeuse and it's companion star. So Graham, hopefully you can see the image. I can, yes. My goodness me. Yeah. It's that little blue smudge. Yes, smudge. Just to the side of it. Yes. Yes. And can you notice that there is like almost a slight teardrop shape to Betelgeuse pointing at it?

Oh yes. Is it, is it some sort of gravitational pull then or? Probably. So we've always noticed that it's had this. Irregular shape in recent years, and part of it was thought, well, you know, it's going to go supernova and it's got these huge convection cells so it no longer has this regular shape anymore.



Credit: International Gemini Observatory/ NOIRLab/NSF/AURA. Image Processing: M. Zamani (NSF NOIRLab)

because it could be one of those convection cells. But if you notice it's pointing at this blue star, then maybe it is some of that gravitational interaction. Now, this is a really young protostar. It's not even hit its main sequence yet, and it's six magnitudes fainter than Betelgeuse. So it's the magnitude scale is logarithmic.

So is literally many decimal places fainter than Betelgeuse, and it's only about 1.5 times the mass our Sun, so it's probably an A or B type. Pre main sequence scar star. So it's going to be scorching hot, it's a blue white colour, it's not even yet properly begun. Burning hydrogen. At its core, it's still sort of this cloud that's trying to sort of get together into a star formation, but because it's, so close to Betelgeuse, so it's about four times the distance between the Sun and the Earth from Betelgeuse, it's probably going to sort of.

Get consumed by Betelgeuse, by being pulled in, ripped apart probably at some point in the next 10,000 years. but the interesting thing is they were probably born at the same time, and if Betelgeuse was more massive, then it probably. A lot of material towards it. So the star never really had much of a chance of survival to start with.

But, as I said, the tidal forces will probably cause it to spiral into Betelgeuse in the next 10,000 years. But it's super exciting that we can finally see this because Betelgeuse has been such a fascinating star to study, not just because it's a variable star that might go supernova. We had that great dimming.

It's had the weird shapes. We've looked at the convection cells and now we can see that it's got this binary companion. Hmm indeed.

Earth's shortest day in July. Yes. Is the Earth speeding up?

Mm-hmm. That is the question that everyone's been asking me. So we had news reports in 2024 that the 5th of July was the shortest day on record.

And then we had reports again on the 9th of July this year, the 22nd of July this year. And something similar is going to happen on the 5th of August also this year where we're probably going to lose just over a millisecond of time in each day and people are. Seeing all these clickbaity titles saying, yeah, it's speeding up, and some people are asking if we're going to go flying up into space, is it affecting global warming, et cetera, et cetera, et cetera.

Yeah. It went through my mind actually whether the heating up is causing a problem, possibly in a very indirect way, but the Earth's spin is actually not constant. It changes, it speeds up and it slows down all the time. Right. I thought Yeah. Detected that from what you were saying. Yeah. Yeah. So, you probably remember we've had times where we've added in leap seconds.

I think we added one in at the end of 2016. Yes. To account for this. So it speeds up and slows down all the time. The biggest cause of this is due to the Sun and the Moon and sometimes Jupiter. So we know the Sun is spinning on it's axis but as I said before when we were talking about orbits, we are going on a circular orbit around the Sun.

We've got the Moon going in. Circular orbit around the Earth. Now, they're not technically circular orbits. They're slightly elliptical, which means that there is a point where we are slightly closer to the Sun than we are at other times in our orbit. And the same with the Moon and the Earth. And if

you just think about the interactions of the Sun and the Moon to create tides, so you have spring tides and neat tides.

Bigger tides are where the Sun and the Moon and the Earth are completely lined up. So a new Moon or a full Moon, that's when you get your bigger tides because they're all in a line. So it pulls, the softer stuff that the Earth is made up of and therefore more malleable. So water and the atmosphere, into these bigger tides.

But then when the Moon is at either side of the Earth compared to the Sun, we get those weaker tides because the gradually interaction sort of. Weaken each other a little bit. So those are our flatter tide times. But we've also got, Jupiter has a slight effect on us. And in fact, even though Jupiter is only like 1% of the mass of the solar system, it has a big enough tug on the Sun that sometimes the solar system centre of mass is not within the Sun itself.

So Jupiter is still pretty significant and that has a smaller effect on the Earth as well. So that's number one. That has an impact on our speed as the Moon gets closer and further away. But also if we think about an ice skater spinning when they've got their arms and legs out with pretty poses, they're going slower.

And then when they pull it all in, they speed up, right? So when we have more west towards the equator, we are going to slow down. We have more mass towards the poles, we're going to speed up. So if you've got bigger polar ice caps. You're going to slow down the Earth's rotation a bit. But equally, if you think about how the Earth changes over time, you've got shifting tectonic plates, you've got volcanoes going off.

You've got all these different things happening within the Earth that's shifting land mass around, and therefore shifting the gravitational spread of. That mass and the impact it has, that's going to change the speed of the Earth's spin. If you have, if you look at the liquid molten core of the Earth, we have a dynamo effect thanks to this.

So that's going to impact. The rate of the spin of the Earth. So we've got all these things happening and it could be that a little bit of warming does create various different things to move around and has a teeny tiny impact, but more likely if it's sort of layered in with the other things. So if you have global ice caps all forming going into an ice age or all melting, as well as you are suddenly going into a near or a further away part of your orbit around the Sun or the, the Moon is doing the same around the Earth. That could have an even bigger impact on the Earth's rotational speed. So that is what is likely to be happening and. As I said, we account for this, your computer accounts for this, your phone accounts for this.

And it's really important that we know about this and this is the reason why it's communicated. because we have the international Earth rotation and reference system service that measures the Earth Day and works out the speed, and also the US Naval Observatory as well. And there are two ways that you can do this from Earth quite easily.

We have two types of days. We have a solar day and sidereal day. So a solar day is when the Sun appears back in the exact same patch of sky that it was in the last time you saw it, and that's 24 hours. And then the sidereal days are the same with stars. Those stars appear in the exact same place. Technically you're looking for the first point of Aries, but you know, in theory, any star would do.

And that's slightly shorter because. The Earth just has to spin on its rotation a full 360 degrees so the stars be back in the same place. But when you're looking at a solar date, we are moving a little bit along in our orbit and our face against the Sun is obviously going to change within that same time period.

So it takes a little bit longer to sort of catch up. And we are measuring that because all the satellites we've got in space, et cetera, they have to be recalibrated regularly thanks to, you know, general relativity. They would be off by hundreds of meters. If we didn't calibrate for this, and that would just sort of incrementally get worse every hour.

So we have to keep an eye on this because we use satellite communications and satellites for so much of our technology on Earth. The ancients wouldn't have even noticed that we were spinning up and slowing down, and it certainly doesn't affect us or how we live or interact with the Earth. Our computers and our devices do that for us.

But no apocalypse thanks to the Earth speeding up or anything like that. It is part of being on a spinning ball. Right. That's reassuring, isn't it? Mm-hmm. And it's only milliseconds, which you say vital. We do keep an eye on that. Yes. Well, time to take a quick break, but when we're back we'll have the target of the month.

An astronomy tip, and also go on to the space News

Star Stars over Surrey on Brooklands Radio. Join us on the last Tuesday, the month at 8:00 PM for the monthly guide to astronomy and developments in space.

Your monthly guide to astronomy and developments in space. On Brooklands Radio

And welcome back to Stars Over Surrey.

Let's go now to the target of the month.

So I know I do this every year, but we have to say. We're doing Perseid meteor showers for August, and we've also got the Delta Aquariids and a number of other smaller showers going on as well. So the Perseid meteor shower is the remains of the Comet Swift Tuttle.

Now, unfortunately, at its peak on the 12th of August, we're, we've also got a, a decent Moon out as well, so, so it's going to brighten up the sky, making it harder to see them, but it's the one meter display of the air that you've got a good chance of seeing and give you meteors. Last year I saw quite a few fireballs, which was quite exciting.

So, so many people have told me that they've never seen a shooting star, which is a meteor and it's a real shame, and this is a really good time to see them. So what you want to do is go out kind of between midnight and maybe three o'clock in the morning. it's actually a really nice way of socializing with friends.

It might sound a bit odd, but if you get out some camping chairs or something, especially if they recline or you have, I call them star lounges, but Sun lounges, you can lie down and look at I like that. Star lounges. Yes. Yes. I, I've defaulted to calling them that for years. Much people's, amusement.

So you can do that. Get some wine out. Look up at the sky, talk about life, the universe and everything way, and, enjoy the, the meteors as they come along. And what a meteor looks like is you will see a streak appear in the sky, most of them. You'll just see a line that appears and disappear so quickly that by the time you even squeaked out in excitement, not even formed a word, it's disappeared.

Last year I saw quite a few that lasted, you know, a full second or even two or three seconds, and had a clear like fireball on the end of them as well. So you're not going to get quite that amount of drama this year. So if you want to find them, and this is our astronomy tip of the month, the best way to do it is to find the radian point, so it's called the Perseid meteor shower.

So it's coming from Perseus. You can use your phone to find Perseus in the sky, turn around, away from it because they're coming away from it. And just keep looking up at the sky. Now you're more likely to see them on the edge of your vision, so the cells in the middle of your eye are really good at detecting colour.

The ones on the edge of your eye are better at detecting, bright versus darkened things on your periphery. So you are more likely to see them outta the periphery of your vision. But if you're just looking up, especially if you've got a nice camping chair out, and you're relaxed, you're going to see a few.

Because there's going to be a few every minute. So that's how to observe the meteors if you want to do it visually. Now some people say to me, but Rachel, it's really cloudy. If you're feeling really adventurous and good with tech. There is an alternative way, Graham. Oh, right. So you know the old FM radio receivers?

Yes. And the old television receivers. Yes. You can use those, really tune them into the atmosphere and you'll hear a ping every time one, reflects off the atmosphere. You get this ionisation ping noise, right? So you can actually listen to, your meteors as they come along. There is actually live meteor listenings.

Where you can actually listen live. So if, if you're feeling a bit sad because it's a bit cloudy and you're hoping for things, you can play that and you hear. More of like a Morse code extended beep, which means that a meteor has interfered with your signal. And if you're really getting excited about radio meteors on the Zoo Universe website, there is Radio Meteor Zoo, and you can look at the visual representation of the sound and actually, draw boxes around where the meteors are interfering with it.

Right. I've learned something there. We'll have to have a look at that. Yes. Right. Well, let's go onto the space news now, and first up is **Axiom4 Mission**.

Yes. This one I was particularly excited about because we have an Issa astronaut from Poland on it. So this was a commercial mission that was going to be ISS, for two weeks.

And after two months of delays, us astronaut Peggy Whitson, who is the commander. Pilot Shubhanshu Shukla from India, Sławosz Uznański-Wiśniewski, from ESA. He's Polish astronaut and Kapu from Hungary. Spent two weeks docked onto the ISS carrying out over 60 scientific studies and activities representing at the. 31 countries in lower orbit, including contact with the ISS Ham Radio, who previously did a session with the Girl Guides in Surrey at Brooklands.

They were due to launch on the 29th of May, but due to the Dragon capsule C 213 not being ready, it kept getting pushed back. So finally, on the 25th of June, they launched and when they arrived we saw them ring the bell and get a really warm welcome from the current ISS residents.

We saw some incredible photo opportunities where they were doing team photos, and I'm just going to use the words floor and ceiling for reference of what you saw on the screen, but obviously there's no up or down on the ISS.

So you had like a line of them on the floor and a line of them on the ceiling with their heads interlocked in the middle, and then they switched around. And did it the other way around and did various, like circular formations and took pictures. So that was really good fun to see a lot of them ate the, the food from their home countries and shared that with the other ISS residents.

So they got to try out different cuisines in space. Space food is really boring when you first arrive. They have something, that you like that is. Can be taken to space just to welcome you, but pretty much after that you're on space food, which are these dry packets of foods. because you can't have like drops of fat or, powders go disappearing off and getting into the switches and things, or being sucked into the filters that keep the atmosphere clean.

So they're very limited in what they can eat. Your sense of taste goes in space. So, it's very rare that the ISS residents get to try any other food, so that was exciting for them. And I'm getting a lot of questions about the future of the Space Station as people trying to understand the commercial impact of what's going on.

So. A lot of people are like, why do we need a space station? Why do we have commercial companies going to and from? What's going on with all this? So space stations are not just for fun, although I'm sure people have fun sort of spinning around in space and doing all sorts of tricks on them. They are floating laboratories.

There has been a huge diversity of experiments going on since it first, launched. So the researchers help all sorts of researchers down on Earth from Alzheimer's and Parkinson's to cancer, to imune problems, to, spinal cord research. There are many, many different conditions on Earth that are treated thanks to the different experiments that happen on the Space Station, and then obviously they're doing other experiments as well to see how humans fare in microgravity so that we can do research on whether it's viable to send people safely to Mars or even further out.

There are experiments trying to grow plants and so far we've only managed to get leafy plants, like lettuces type plants, but no fruiting plants to grow. So that needs a lot more research on it if we want to have more exciting cuisine away from the Earth. We're also looking at how astronauts, fa, due to the radiation in that environment and also things like when you see them exercising, that's because we're looking at the impact on body mass, muscle mass, bone mass, looking at fluid distribution throughout the model.

One big problem is the shape of eyes. So if you are shortsighted, your eyeballs are squished one way, and if you are alongside, your eyeballs are squished another way. And obviously your eyeballs get. Change shape in space due to the lack of gravity, so that can have an impact on people's site. And how do we treat that?

So in total, I counted 62 experiments carried out over two weeks, and then finally they splashed down in the Pacific Ocean. This is SpaceX's first splash down on the West Coast on the 15th of July after a 20 day mission to the Space Station. So they all landed in the water at)2:31 Pacific Time in the morning and within a day, WA Wash was back at European Astronaut Centre in Cologne where I visited last year.

So they all safely landed. It was an action packed two weeks. They got a lot done. That is impressive. 62 experiments in two weeks. Mm-hmm. Never realised just how much was going on up there. Yeah. I thought that rather than me trying to constantly explain to people how much goes on, if you think about how much happens in two weeks, and then expand that out, and that's just three people.

Yeah. Yeah. Absolutely. **Now satellite constellations are too bright.**

Yes. So anyone who does any star gazing or does any astronomy or astrophotography will not be surprised by the latest study repeating that satellite constellations are too bright. So I mentioned how to spot meteors earlier. Spotting satellites is even easier because you see a dot that initially looks like a star, and then you see it's moving and it's moving a lot slower.

It doesn't create a line or a streak after it, except for on photos, and it's really annoying. I saw loads of them last night when I was trying to get my supernova image. So most people have heard of SpaceX's Starlink, but they aren't the only ones so that we can blame For this, we have Bluebird One Web, Qianfan, and Blue Origin will be launching Project Kuiper.

The growth is not technically exponential, but it certainly feels that way when you are on the ground looking up and more and more companies are vying to get the ability to provide global internet coverage around the globe. Despite the recent decrease in popularity with Starlink, when people realised that SpaceX and Musk could be accessing their private data, if you remember all the stuff that was happening in the US at the beginning of the year.

So that's one of the reasons why defence contractors don't use these constellations, but more and more people are using them. There is certainly use for them in disaster zones, where if you have a receiver, you can plop down near you. You've got the internet and obviously that's what's been used a lot in Ukraine.

So the magnitude of something is the brightness of something, and it's a back to front scale. So the higher the magnitude, the fainter it is, the Sun is -27, the Moon is -13. Venus at its brightest is around minus 4.7, and Uranus at its brightest is around five or six, and the human eye can detect between five and six.

If you've got good eyesight, you're in a dark site, you have no light pollution, et cetera. Um. These satellites are coming in sometimes brighter than magnitude seven, which is what you, you would need for professional astronomy, home star gazing, magnitude six, you can see with the naked eye. So a lot of ground-based telescopes and astro graphers are having to discard a lot of data because you're just getting streaks through the images.

And for some people, if they're looking at something huge like a nearby galaxy. They might be able to sort of recover enough of that data to be able to do some science with it. But there are plenty of people who are looking at these tiny points of sources. Maybe they're looking at a planet or something.

And that's enough to sort of ruin the observation. Now, I know Musk said, well, we just need more space telescopes. He may also be responsible for the suggestion to defund most of our space telescopes. so space telescopes really expensive. They cost billions, JWST was a $30 billion project. That's not something you can easily fund and place all our ground based telescopes with this is a problem.

So the IAU, that's the International Astronomical Union Centre for protection of the dark and quiet sky from satellite constellations. Interference has been working with operators to try and come up with solutions on how they can make their satellites less problematic. The problem is there's no real way of controlling who launches what into space.

Because you might ban launches in one country, but in another country is perfectly fine as long as they're being paid. And we have to trust that people want the best for everyone on Earth. And even then you know, people's perceptions of what that might be would be very different. So an astronomer might say, well, astronomy has provided many, many spinoff technologies and things, and therefore astronomy and space research is really important and we need an unpolluted night sky.

But other people are going to say, well, actually no, internet and satellite access for communications across Earth is what is more important for everyone on Earth. You've got that conflict going on as well. So it is going to be an interesting one. but our next story, don't mind me sort of jumping on, is actually trying to fix this problem.

And it's a local story as well. I see **Surrey Nano Systems and the University of Surrey partner to combat satellite reflectivity.**

Yes. So they have been trying to work out how we can mitigate this and. obviously this is nice and local. It's all happening in Guildford and I know some of the people that are working on this, which is super exciting.

So they are experimenting with mitigation strategies, including dark coatings and changes to satellite position so that we can reduce that negative impact on ground-based measurements. And Surrey Nanosystems has a heritage of ultra black technologies and they have. Developed an innovative new solution. So, I dunno if you've heard of Vanta Black.

No. So Vanta Black is a black material or. Paint or pigment, that is supposed to be the most black we can get. And black obviously absorbs light, whereas white reflects light. So this would be the most absorbent and people have been experimenting with it for years to try and create invisible cars and look at it for cloaking and things like that.

So they're looking at creating this banter Black 310, which is a Handleable customer applied coating resistance. To the challenging low Earth orbit environment, and they're going to trial the technology on jovial one, the first satellite mission from Jupiter. The joint University's program for in orbit training Education Reserve Mission scheduled to launch in 2026, which will carry payloads from the University of Surrey, Portsmouth and Southampton.

Um. And they are looking at one side of this shoebox size cube SAT will be coated in this van to black 3 1 0 marking the first UK LED initiative to explore reducing satellite brightness. so they're

looking at this as a whole darkening solution, and then they're going to evaluate. The impact of the experiment from Earth, and I really, really hope it works.

So Vanta Black would absorb a lot of radiation and light from space, but some people also say, well, painting it black may not work because it would just absorb more and more radiation eventually heat up and glow in the infrared. So it may then impact infrared observations. And infrared is one of the wavelengths, that we can detect.

On Earth. So it'd be really interesting to see the results of that. And I'm super excited that, Surrey is leading the way in that as well. Yeah, absolutely. Only thing is you wouldn't be able to see, see them anymore, would you? Where they were? Well, no, but they've got trackers on them so we know where they are.

Of course, of course. Course. So we don't want to see them, but we want to know where they are. Right. Good, good, good. That is the solution we're trying to come to. Great. Let's hope it succeeds.

Now, **Moonlight team recruits in the UK**.

Yes. So ESA is a key partner in NASA's Artemis program, which obviously aims to return people back to the Moon by the end of the decade.

Obviously with the stuff going on in the US we don't if that's going to stay or get scrapped, but so far no one has canceled plans. So to achieve a permanent and sustainable presence on the Moon, we need reliable autonomous lunar communications and navigation services. But if you go to the far side of the Moon, it's radio opaque.

You can't send anything back from the far side. You need another satellite. And that's how, the far side Moon landings have worked. They've put a satellite around that can relay information, and that's how China got their return samples back. So. ESA is working with its industrial partners on this initiative called Moonlight Initiative to become the first off planet commercial telecoms and satellite navigation provider.

Following their launch, three or four satellites will be carried into lunar orbit by a space tag and then deployed one by one to form a constellation of lunar satellites. And the number and specification of these satellites are currently being defined, so the constellations orbits will be optimised.

Give coverage on the Lunar South Pole. Where we are hoping has water, ice and things that can be helpful for some kind of space station or habitat and Moonlight will provide data capability sufficient to serve these planned and future missions with a navigation service that enables accurate real-time positioning of lunar emissions.

So like we have sat nav on Earth, you could have sat nav on the Moon, because the Moon. We have less easy to read features like on Earth. You can go along and say, well, we've got a road, and that road goes in that direction. We don't have roads on the Moon. We just have sort of this black, white, and gray landscape with sharp lunar craters.

So you, you're going to need sat nav to figure out your way around the Moon and also avoid sort of falling into craters that are darker than you expected or getting caught out with Luna shadows where the, there are huge temperature differentials. So. On the 17th of July, ViaSat announced that it's working with SSTL and MDL space in the UK to develop designs and proposals for lunar orbiting communications and satellite systems around the Moon.

So anyone who doesn't know, MDA Space that's based in Harwell and Oxfordshire, along with, part of the European Space Agency in ESA. But excitingly, SSTL is Surrey Satellite Technologies Limited. They're a fully owned Airbus subsidiary based in Guildford. So Guildford is getting in on this Luna communication and navigation system.

And Andrew Cawthorne, managing director of SSTL said “We're proud to be part of the ViaSat LED UK team that's helping turn E'S Moonlight vision into reality. Building on our core role in lunar, pathfinder, and decades of experience in pioneering small satellite missions. SST L's excited to contribute its expertise to delivering reliable high performance lunar communication services.

“Moonlight is a powerful example of strength, ambition, and international relevance of the UK space sector.”

All very exciting stuff and as you say, yes, all all happening in Guildford. Yes. Super exciting for me. Indeed. Well, that's our look at space, this month and now we go to Astro Cast.

Astrocast

1	First quarter moon
9	Full Moon
11	Moon to the right of Saturn
12	conjunction of Venus and Jupiter
12	Moon to the left of Saturn
12/13	Perseid meteor shower
16	Last quarter moon
17	Moon near Pleides and Aldebaran
19	Mercury at greatest western elongation
20	Moon between Venus and Jupiter
21	Moon near Mercury, Venus and Jupiter
23	New Moon

Events

GAS	No August Meeting
Ewell	No information available
Farnham	General Relativity – Made Simple, John Price (FAS)
	John takes up the challenge of explaining Einstein’s theory in an easy-to-follow manner, with as little maths as possible.

Excellent. Well, thank you so much for taking us through everything this month, Rachel, and we look forward to talking again next month. And clear skies and happy star gazing everyone. Indeed. Our next edition is on Tuesday, the 26th of August at 8:00 PM and we've been with the Graham Laycock and Rachel Dutton, a fellow of the Royal Astronomical Society, and a member of the Guildford Astronomical Society.

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

We look forward to a brighter show next month. Yes. So wishing your clear skies and happy star gazing everyone. Thank you, Rachel. That's Rachel Dutton, a fellow of the Royal Astronomical Society, and a member of the Guildford Astronomical Society. And the next edition of Stars Over Surrey will be on Tuesday, the 29th of July at 8:00 PM.

Until then, good star gazing.

Stars over Surrey on Brooklyn's radio. Join us on the last Tuesday, the month at 8:00 PM for the monthly guide to astronomy and developments in space.

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.

https://mailchi.mp/f7101b2028fc/spaceastronomy-media-updates

Stars Over Surrey Previous Episodes