



Galloway Forest Dark Sky Podcast transcript

Episode two

Length: 42:14

Speakers: Lucy and Steve

Lucy: Welcome to the Galloway Forest Dark Sky Park Podcast, a series looking to expand your knowledge about Scotland's dark skies. What to look out for and how you can get out and about and explore them this winter. I'm Lucy from Forestry and Land Scotland and I've come to Glasgow Science Centre to meet astronomer Steve Owens. In this episode, Steve's going to guide you through the sky above the Galloway Forest Dark Sky Park and what you can expect to see during the winter months of 2023 and 2024. Your guided tour of the Galaxy we call home.

Lucy: So, the lights have gone down and the planetarium has come on and we are currently now sitting under the dark sky of Galloway in Winter 2023, and what a fantastic sight this is, Steve. I mean, just looking at the Milky Way across the sky, that is amazing, but focusing in on the constellations that we'll see over the course of this winter season. Which ones will we be looking out for?

Steve: Well, there are lots and lots of constellations to look out for. What we're going to do is pick out a specific constellation, or two, every month that we can highlight as a good thing to go out and look for that month. But that doesn't mean that the other constellations aren't visible.

The best way to learn your way around the sky is getting a good star map. There are some really good, simple star maps available on your phone. You can get astronomy magazines, that have star maps every month that help you piece together this jigsaw puzzle of the night sky. But yes the view is beautiful and we're going to pick out a few constellations over the winter that are real highlights for me, some of my favourite patterns and shapes to see in the sky.

So, we're stargazing at the moment, as if it's October 2023. We're in the middle of October and we've set the time in the planetarium to 9pm We can set the time here to any time in the past,

anytime in the future, we've happened to home in on 9pm in the middle of October 2023, and this is really the start of the dark stargazing season.

It's a couple of weeks to wait until the clocks go back and it becomes darker even earlier, but this time of year there are some great constellations to look out for. The one we're going to focus on is in a part of the sky that we call the zenith. So at this time of year, and at this time of night, 9pm in the middle of October, if you look straight above you you're looking towards the zenith, the zenith is the astronomers name for the bit of the sky directly above your head.

And if you look up there right now, you can see a very obvious pattern of five bright stars, in kind of a W shape or a zigzag shape, depending on which way you're looking, sometimes it appears like an M rather than a W. That constellation is incredibly bright. It's also famous because it's always visible in the skies in Scotland.

Many constellations, in fact some of the ones we're going to talk about shortly, are seasonal constellations that come and go as the Earth orbits around the sun. But that particular constellation is called Cassiopeia, the zigzag of five stars. This W shape is always visible because it sits really close to the North Star, and as our planet orbits the sun and as it spins around once a day, Cassiopeia is always above the horizon. So, it doesn't matter what season you're in, or what time of night you're stargazing, you'll always be able to find it.

Lucy: So, that's the top one on the list to learn?

Steve: Yes. It's really great and it's really easy to spot if you want to work out how to find it easily. Remember, we spoke about finding the North Star by using the pointer stars of the plough. You take the seven stars of the plough, that kind of saucepan shape you use the two stars furthest from the handle of the saucepan, they point in a straight line to the North Star. If you keep that line going in a straight line the same distance again, you find Cassiopeia so you can star hop. That's one of the ways I've learned the sky, is by star hopping from one thing to another. And the other great thing about Cassiopeia is that it happens to sit directly in front of the Milky Way.

The stars and Cassiopeia are close to us. The stars in the Milky Way are much further away. It's just a line-of-sight effect appears to sit where it does in the night-time sky. But that means if you're looking for the Milky Way, and the Milky Way sometimes it's really tricky to spot if you've not got perfectly dark skies or if there's a lot of hazy cloud around it's a bit difficult to work out whether what you're seeing is actually the Milky Way, but you can test whether it is, you can find Cassiopeia then that's where that band of silvery grey light stretches behind that constellation.

Cassiopeia represents a queen lying on her throne, brushing her hair. I'm sure you can see that Lucy, most constellations don't look like the name suggests, but in the past, different cultures and civilizations named the stars. We've inherited the constellations from the ancient Greeks

and when they looked up at Cassiopeia, that's what they saw. Queen reclining on a throne. And it's a beautiful constellation, very bright, really easy to spot. You can star hop to it from the plough and the North Star and it helps you find the Milky Way.

Lucy: Brilliant, so that's a good one to learn. You can try and spot that any time of the year and that that's a good one to get in the bag early on.

Steve: And it's directly above our heads in the middle of October, if you're out stargazing in the evening.

Lucy: Which would be the next to look out for? once you've got that under your belt, and you know where you are in the night sky, which is the next one to look out for?

Steve: Well, we're going to keep star hopping and Cassiopeia still up in November, as I mentioned it's visible the whole year round. We're going to use Cassiopeia now as a signpost to find other things. Remember, we star hopped from the plough to the North Star and then to Cassiopeia. Let's continue star hopping.

So, Cassiopeia in the middle of November at 9 o'clock at night, you're still almost directly above your head, and if you find it, find that W-shaped sitting in front of the Milky Way, if you imagine it as a W and take the right hand V of that W and imagine that's an arrow, that arrow points down towards a fairly bright star. It's not quite directly overhead. It's not anywhere near the horizon. But you've got to go a short distance down from the right-hand V of Cassiopeia to get the bright star.

And that's the middle star in the constellation of Andromeda. Andromeda was a princess, in fact, the daughter of Cassiopeia. And that bright Star is in the middle of a very shallow curve of three stars. The right handle of that curve of three stars is in a big square. It's the left hand corner of top left hand corner of a big square known as the square of Pegasus.

Pegasus was the winged horse from ancient Greek myth and legend. So you can use Cassiopeia to star hop to Andromeda and use Andromeda to star hop down to Pegasus. Pegasus and Andromeda are great constellations in the late autumn, especially in November, because it's in the constellation of Andromeda that you find the furthest object visible to the naked eye, the furthest we can see without binoculars and telescopes.

In fact, the only thing we can see in the sky that is outside the Milky Way. And to find it is pretty tricky. So, let's see if we can do a bit of star hopping. Go back to the W shape of Cassiopeia, back to the right-hand V, that's an arrow pointing down to the middle of three stars in Andromeda.

Stay on that middle star there and go back up a little bit towards Cassiopeia. You'll find a little faint star in the same distance again. There's a little faint star, but off to the side a bit to the right

of that faint star is a tiny little smudge. Now I can see you squinting and looking like it's hard to see, and you're absolutely right, that little smudge is almost impossible to see if you stare straight at it, you've got to kind of catch out of the corner of your eye.

So, if you look over here, out of the corner of your eye, maybe see that little smudge look a little bit off to the side and that smudge will become brighter. And that's because our eyes have evolved for hunting in the daytime on the plains of Africa, not for stargazing. The only useful bit of our eye, the bit we didn't need for hunting is the outer part of our retina, and that's the bit where you can see faint things a bit more easily. So you've got to look out of the corner of your eye at faint things and it doesn't look like much, just a little faint smudge in the sky. But what you're seeing is another galaxy, a collection of a trillion stars that's 1,000,000 million stars, and the light from the stars in the Andromeda Galaxy has been traveling through space for so long, it's taken two and a half million years to get to us. So, if you look at Andromeda in the real sky and you find it by hopping from Cassiopeia down to Andromeda and then back up to little faint smudge, your eye will be absorbing particles of light that are two and a half million years old, far older than the human race.

Lucy: Wow, that is amazing. And you really do have to divert your gaze to be able to see that, it's fascinating.

Steve: It really is, and it's a real problem for stargazers like me, because we often want to see the faint things or count the very faint stars, and you've got to do that out of the corner of your eye, you can't even look straight at them. You've got to catch them out of the corner of your eye, the side of your vision. So it's an amazing thing to see as a broad rule, if you find anything in the sky that's fuzzy and faint, that's the interesting bit, that's the bit you should point your binoculars to or your telescope if you happen to own a telescope. Now through binoculars the Andromeda Galaxy just looks like a slightly bigger smudge, you can see it's kind of elongated its kind of a long smudge, through a telescope even a relatively modest telescope, you'll be able to see some detail in the Andromeda Galaxy.

So, we're going to have a look at the constellations that are visible in December to January. We are going to have a look at two constellations, Orion and Taurus. And this time of year is a great time of year to see these constellations. They are visible beyond December, January and in fact, the constellations we've already talked about, including Cassiopeia, Pegasus and Andromeda, they're still up in the sky in December and January, but we're our focusing in on each month on a specific constellation, go and find a good star map that will show you how to join up all these different things. And Orion The Hunter is one of the most spectacular constellations in the whole of the night sky. It's my favourite constellation of all of the 88 official constellations because there's no one else in the sky you find such a symmetrical and easily identifiable pattern of stars.

Orion is made up of four stars in a big rectangle. Two at the top, which are his shoulders and two at the bottom which are his feet. Right in the middle of the rectangle is probably the most

famous bit of Orion, Orion's belt, and Orion's Belt there are three stars, really close together and almost in a perfectly straight line. You don't find those stars anywhere else.

So, Orion's belt helps you hone in very, very specifically on the constellation of Orion the Hunter. And Orion is visible like Cassiopeia, like the plough, like Pegasus and Andromeda. Those constellations are all visible, even in light polluted skies, even in towns and cities. But in towns and cities you can only see the bright things, in fact, when I see Orion from my garden in Glasgow, I can only see seven stars in the constellation.

His two shoulders, two feet and the three stars of his belt, under a dark sky, like in Galloway Forest Dark Sky Park, and in the planetarium here, you can see, I don't know if you want to guess, 40, 60 stars in the constellation of Orion, there are a lot of stars there, in fact the sky somewhere dark like this, it's almost overwhelmingly full of stars, it becomes, in some cases a bit trickier to find things because the sky is just so busy. But if you can find the three stars of Orion's belt, you'll find the centre of the constellation of Orion the Hunter, and like we did earlier with the plough to the North Star and then on to Cassiopeia and then down to Andromeda, you can use Orion as another basis for star hopping, for finding other objects around it.

If you go back to Orion's belt, in the middle of the constellation of Orion, and go up and to the right from the belt, keep following that line up you get to a V-shape of stars. It's not that bright, but it's quite a distinct V-shape, and that is the head of Taurus the Bull and Taurus is one of the most famous constellations in the night sky because it's part of what we call the Zodiac. Astronomers call it a slightly different name, we call it the ecliptic. But the ecliptic, or the Zodiac, is the line through which all the planets and the sun and the moon appear to move over the course of a year.

So whenever you find a planet in the sky, wherever you find the sun and the moon, it's going to be in one of the 12 signs of the Zodiac and Taurus the Bull is one of those which makes it quite famous, at least by name, but it's not that straightforward to find Taurus on its own, so you've got to use the pointer stars of Orion's belt to point up to the V-shape of the head of Taurus, and out of the end of each of those tips, of each of those v's, there are two bright stars quite far away from the head of Taurus, which are two huge long horns, and that's got a tiny little body at the back, the front legs and back legs back here.

So, Taurus the Bull has huge horns at the front and a tiny little body at the back, but quite a distinct pattern of stars up into the right from Orion's Belt. But what makes Taurus most distinct is above the back of Taurus the Bull is a beautiful little cluster of stars, very compact, very tightly knit together, and we call those the seven Sisters or the Pleiades. One of the most obvious odd things you see in the sky. People are used to seeing stars, but they aren't used to seeing little clusters of stars like that. So the Pleiades is a great example of a star cluster.

The stars in that cluster are all born out of the same cloud of dust and gas, we think perhaps a few million years ago. And although we can see seven of them, with our unaided eyes and in fact, if you can't see seven in the Pleiades, time to get your eyes tested, it's a pretty good test of your eyesight, but through binoculars, you'll see the fact that there are many more than seven stars there, we reckon there's probably about a thousand stars all together in that cluster and that sits up above the back of Taurus the Bull

Lucy: Looks like a mini plough.

Steve: It does, actually. Yeah. It's got the same shape as the plough doesn't it? It's got three little stars off to the right and a little kind of rectangle shape and a slightly squashed rectangle on the opposite sides. So yeah, it does look like a little mini plough. Good eyesight, if you can see it that clearly in the night sky you'll be doing really, really well. You should be able to see seven bright stars.

Lucy: It is really bright. I mean, it does just stand out really well, doesn't it?

Steve: It really does. And it's one of the things in the night sky that looks better through binoculars than through a telescope. Broadly speaking, the bigger the thing you're looking through, the bigger your device, the better you'll see. But in some cases telescopes magnify too much, if you point the telescope at the Seven Sisters, the Pleiades there, it just zooms in too much, you don't get to see very much of it in one view. But through binoculars, you can zoom in on the whole thing in one field of view and you get a beautiful view of that spectacular little star cluster.

Orion and Taurus are really prominent constellations in the southern sky in December, January. They're visible through the whole of the winter season, if you were up really late in late October, you'll see Orion, but the later the season goes on and we get into February and March, Orion rises early tonight so it becomes more convenient, you can see right just after dinner, and if you're stargazing in late January, February or March. But as the seasons go on, Orion will disappear from the sky because as the earth orbits the sun, the sun appears to move around the sky and at some point in the summer the sun will be in the constellation of Taurus.

So, Orion and Taurus will be up in the daytime and you won't see them. So Orion is a very specifically seasonal constellation.

Lucy: So, that's some great constellations to look out for in December and January. What about February, Steve? What should we look out for then?

Steve: So we're going to stick in the same part of the sky. We're going to stick around the constellation of Orion the Hunter, but we're going to continue using Orion as a signpost to find

other things. I'm going to look another quite famous constellation, that certainly many of your listeners will have heard the name off.

If we go to Orion's Belt, the three stars in the middle of Orion the Hunter and go up and to the left, up, up through Orion's left shoulder. That star incidentally is called Beetlejuice, a red giant dying star. If you keep going, you get two stars that are side by side and very, very similar in brightness, twins you might call them, and those are the two brightest stars in the Constellation of Gemini, the twins. Gemini, like Taurus, which we saw when we were stargazing in December or January is one of the signs of the Zodiac, one of the constellations through which the sun, the moon and the planets pass as they move through the solar system and move, appear to move rather, around our sky over the course of a year, and Gemini is not an especially bright constellation, apart from the two stars that form the head of Gemini.

So again, you can't just stumble across Gemini if you don't know what you're looking for. But using Orion like a signpost, you can point up from Orion's belt through beetlejuice's left shoulder and keep going to the two bright stars, in the head of Gemini the twins.

Lucy: And Orion's, moved in the sky.

Steve: Yes. So, we're still star gazing, as we have every month so far, at 9pm each night. So originally, we were looking at Orion at 9pm in December, now at 9pm in February, he is way over to the right hand side. He's moved quite dramatically in the sky, and again, that's because the earth in the meantime has orbited around the sun. The angles of all changed, the position of the sun in the sky is changed. The position of the constellations have changed. So we see Orion in a different bit of the sky, but he's still really prominent. February is again another great month to look at Orion the Hunter, and you can still find Taurus by going up and right from his belt, find Gemini back up and left from his belt.

And while we're here for a little extra bonus star, which is if you go down the left from Orion's belt to the directly opposite direction from Taurus, you get to this really bright star here, the brightest star in the whole night sky, a star called Sirius, the dog star in the constellation of the big dog. Orion is helped in his hunt, he is hunting Taurus the Bull, he's helped in that hunt by a big dog represented by the dog star Sirius, and then up to the left of Sirius a little bit is a slightly fainter star called Procyon in the constellation of the little dog. So Orion has two hunting dogs helping him pursue the bull and following across the sky are two twins, Gemini.

Lucy: Excellent. So we're coming to the end of the winter stargazing season now Steve, so looking at March, what can we expect to see in March?

Steve: Yeah, it's a sad time of year for astronomers as the night start to get brighter. Not for most people. Most people like the winter going away and the spring coming. But for stargazers, like me who really like dark nights, the spring is the last, really last chance to see some of the beautiful sights in the sky. In March, just before spring begins, we're going to have a look at two different constellations that are equally prominent and visible in the skies during March.

The first thing we are going to have a look at is another constellation, famous because of the fact that it's in the Zodiac. That constellation is Leo the lion and Leo the lion is visible in March at 9 o'clock at night and throughout the month of March by looking directly towards the south and remember, you can work out what direction south is by finding the North Star and putting it to your back and what you're looking for with Leo is a bright star, the star Regulus, which is if you like, the dot in a backwards question mark. There's kind of a big hook shape here, backwards question mark shape of stars, that is the main head of Leo the Lion, and to the left of the head of Leo the Lion is the lion's back and a little tail at the back here so you can visualize it as looking a bit like the Sphinx, It's kind of sitting or lying in the ground, looking out to the right. It's looking towards Gemini and Orion, which are much lower down on the sky in the West. But Leo is quite pronounced and quite a recognisable spring constellation because of that distinct backwards question mark.

Lucy: You can really clearly see that.

Steve: You really can. And it's one of the regions of sky where with telescopes you can find lots and lots of other galaxies. There's clusters of galaxies in the constellation of Leo the Lion that are only visible with a telescope, but show you just the abundance of galaxies in the cosmos, the bigger the telescope you use, and when you get on to using expensive research telescopes, space telescopes, we've calculated that there are trillions of galaxies in the universe, and you can begin to find the closest ones by using your own telescope if you have one, and the constellation of Leo is a great place to start.

Lucy: So you said two constellations.

Steve: Yes, I did. So we're going to have a look at a constellation that is not nearly as famous, probably the least famous of all the ones we've spoken about tonight. But it's a constellation that has a star in it that heralds the beginning of spring that shows that spring is coming at the end of the winter season.

Lucy: And some warmer weather.

Steve: And some warmer weather hopefully and some brighter skies. And to bring us full circle, we're going to go back to the plough again. We've been doing a lot of star hopping from the

plough to the North Star to Cassiopeia and then down to Andromeda and Pegasus. Then we use Orion as a signpost to star hop. Let's go back to our original signpost, The Plough, which in March is high up above our heads the point to start at the in the plough is still point to the North Star. But now we're going to have a look at the tail, the handle of the plough with the tail of the big bear in which the plough sits. And it's quite a distinct shape. It's an arcing shape, that kind of arc of the handle. If you continue that arc down through the sky, you arc down to a bright star that is called Arcturus.

Lucy: Okay.

Steve: Good way of remembering it, so you arc down the handle of the sauce pan to Arcturus and Arcturus is the brightest star in the constellation of Bootes the Herdsman, which is quite indistinct. It's kind of if you want to join up the dots, you might see it looking a bit like an ice cream cone shape. But Bootes is a Herdsman that was herding animals across the sky and the brightest star in Bootes is that star Arcturus.

And Arcturus is when you begin to see Arcturus in the evening sky, that tells you that the winter constellations are leaving the sky behind and the spring constellations are coming and although we've been focusing on the winter constellations, you can stargaze the whole year round. But I would really encourage people to visit during the winter months to get out in the dark sky park, because that's when you see things like the Milky Way, the Andromeda Galaxy, when you get the opportunity of seeing things that you cannot see, when the sky is that little bit brighter.

Lucy: So that was a great guided tour of the constellations, Steve, that we will see through the winter stargazing season. Thank you. What about planets? What should we look out for planet wise over the winter?

Steve: Yes. So there are a few planets to look out for over the winter. And before we talk about where and when to find them, it's important to understand what planets are. Planets are much closer to us than the stars. The stars we see at night, the ones we have been joining up the dots of to make the constellations. Those are big burning balls of gas, a long, long way off in space.

Planets are either lumps of rock or gas in our solar system, that orbit of our star, the sun. And because they're local to us and because they move relative to us around the sun, the planets don't stay still in the sky. The planets move. In fact, they're called planets because in ancient Greece, when they recognised that these things were moving, they called them wanderers.

And in ancient Greek, the word wanderer was planeta. So we get them our planet from the fact that these things wander around the sky. And I've already touched upon it. They wander around a line in the sky we call the ecliptic, or more famously, the Zodiac and the Zodiac passes through the famous constellations, like Taurus and Gemini and Leo and others that make up the signs of the Zodiac.

So wherever you find a planet in the sky, you'll be in one of these constellations. But that also means that the planets aren't always in the same part of the sky. Every January or every October, you've got to really identify for that specific month that you're in, what planets are up, and what planets are visible. So over this winter season, from October through to March, there are three planets really that are the most prominent and visible in the sky.

Those are Venus, Jupiter and Saturn, all of them very bright. In fact, when Venus and Jupiter are in the sky, they are brighter than any star up there. Saturn looks like a very bright star, but Venus and Jupiter look like incredibly bright stars brighter than even a dog star, Sirius. Now at Venus is visible in the early part of the winter season. So you'll see Venus, but not in the evening. You've got to get up before sunrise to see Venus and in October and November, and early December you'll see Venus rising just before the sun. It's a morning object, and that means you've got to set your clocks for a couple of hours before sunrise. Head outside and watch for Venus rising.

It is a beautiful sight if you happen to have a good pair of binoculars and a steady hand, you might be able to make out that Venus has phases like the moon, Venus has crescent shapes, or sometimes you have a half Venus or a full Venus, depending on where it is in its orbit around the sun.

If you are stargazing with a telescope or binoculars looking at Venus though, make sure that you know exactly when the sun's about to come up. You don't want to accidentally catch the sun in your telescope or binoculars, because it can cause severe damage to your eyes.

But Venus will be a really pronounced, visible, morning planet throughout the early part of the winter season. For more convenient stargazing though, you'll want to look at evening things, and Jupiter and Saturn are the planets that are going to dominate the night skies over the whole of the winter season, Jupiter especially so.

Jupiter is going to be visible in the sky the whole winter season through from October all the way through to March. Although towards the end of the season, if you're out in the evening observing Jupiter, you'll notice it will be setting earlier and earlier each night. But Jupiter is again a really brilliant, bright thing, not quite as bright as Venus will appear, but certainly brighter than any other star in the sky and Jupiter is probably my favourite planet to observe if you happen to have a telescope. But binoculars will do sometimes, you can make out around the planet Jupiter four tiny little specks of light and those specks of light, if you watch them over the course of a few hours or from night to night, you'll notice they change position and those are moons orbiting around the planet Jupiter, you can see moons beyond our earth/moon system orbiting around this giant planet, Jupiter.

And that was an observation that was first made in 1610 by Galileo, who was one of the first people ever to look at the night sky with a telescope, and that one observation proved that the

earth wasn't the centre of the universe, up until that point there was no direct observation that anyone could make that suggested that the earth wasn't at the centre of things.

People had realized that a few decades before Galileo, that it was probably true that the Earth wasn't the centre. It made more sense to think of the sun as the centre. We now know that's not true either, the sun isn't the centre of anything. It just happens to be the star around which our planet's orbit. But here is was an observation that anyone who had a telescope could make from 1610 onwards that showed at least four little things that didn't think the earth was the centre of the universe It orbited around the planet Jupiter. And they aren't spectacular. They aren't big and bright, four tiny little faint specks. But that observation is a really important historical one, and one that anyone with a small telescope or a decent pair of binoculars can repeat.

Lucy: That's amazing. If you haven't got a telescope, could you use a scope that you might have for birdwatching?

Steve: Yes, you could. So at even a modest pair of binoculars would do the really the important thing for smaller devices like that is a really steady tripod, or something steady to balance them on. It's not so much the lack of magnifying power, that would limit how easy it is to see the image of Jupiter. In fact, technically, you should be able to see where the naked eye its just Jupiter itself is too bright, and it kind of dazzles the moon, they're separated enough in the sky that should be able to resolve not just with your eyes, but Jupiter dazzles you. With even a small scope, like a birdwatching scope or binoculars, you will magnify the view, you will separate out the image from Jupiter, making it easier to spot. But one of the hardest things to do when you're observing with a handheld device is to stop that wobble just from your hands and from your breathing. So a good solid tripod is the best way of seeing.

As well as Jupiter, which is visible, as I mentioned, the whole way through the winter season. You can see Saturn, which is another gas giant planet like Jupiter. Saturn is really only best visible at the start of the winter season, October/November November into early December, Saturn is probably the most recognizable and beautiful and spectacular of all the planets because of the rings, that orbit around Saturn. It's very famous for those, and most people have seen images of Saturn and its beautiful rings.

To the unaided eye it will just look like a twinkling star. It will be a fairly bright object, not quite as bright as Venus or Jupiter, but if you have a decent telescope, your telescope will be able to resolve the rings of Saturn and you'll be able to see little bits poking out from the side of the planet. The planet itself with a tiny little circular disk and out of the edge of the planet you'll see what Galileo described as looking like ears sticking out from the side of the planet. The bigger the telescope you use, the more detail you can see in the rings. And they are a beautiful, spectacular sight. It's one of the things that I enjoy showing people most through a telescope because people don't believe they're seeing the real Saturn.

I've had people go to the front of my telescope and look whether I'd stuck a little photograph of Saturn on the front to fool them. But you can actually observe with a fairly modest telescope the rings of Saturn. And they don't look as spectacular as some images you see online. But the reality of actually seeing them in real time through a telescope is pretty amazing.

Lucy: Amazing. That's really amazing about Saturn and its rings. I'm definitely going to look out for that this winter Steve. So that's three planets that you've highlighted, but obviously there are more planets. Why can't we see those?

Steve: It's a really good question. You might ask that about Mars, very famous planet and that planet that we've sent was a spacecraft too, where's Mars gone? Has it disappeared from our solar system? It's not, it's still there of course. It's just that as the planet's orbit around the sun, sometimes a planet, and it's the case for Mars during this winter season, sometimes a planet happens to sit in our sky as seen from the earth in the direction of the sun, which means it's up in the daytime, which means it's not visible evening or morning object in the in the night sky.

So Mars just happens to be not visible very easily in this winter season because it happens to lie in the direction of the sun, just because of the way its orbit lights up with ours.

Lucy: So it's still there.

Steve: It's still there. And we'll see it next winter season. We'll see it and in future months you'll see it throughout and throughout the year. But not all planets are visible at all times because as the earth orbits the sun, the orientation of Earth, the sun and whatever planet you're looking at will change, and sometimes the sun gets in the way of our view.

Lucy: Okay, so that's constellations and planets. What about meteor showers, which are fantastic to see. And some of them you can see shooting stars, you know, maybe 70, 80, an hour. But which ones which ones are we to look out for? And when roughly in the winter observing season, are they likely to happen?

Steve: Well, one of my favourite experiences ever is going down to the Galloway Forest Dark Sky Park and sitting out at night looking at a spectacular meteor shower, there are meteor showers that happen throughout the year. Some are more spectacular than others, the ones that are really worth highlighting this year. In fact, there's one very specific one worth highlighting, and that is a meteor shower that happens in the middle of December each year.

And as I mentioned, these meteor showers occur because as the earth orbits the sun, it passes through clouds, dense clouds of space, space dirt and hoovers up lots and lots of bits of grit and they form spectacular meteor showers. The best meteor showers of the year happens in December. It's called the Geminids meteor shower. It's called the Geminids because if you're out observing it and if you trace back the lines, the streaks of light from all of the shooting stars you

saw, they would all trace back to a point in the sky, in the constellation of Gemini, which we've identified earlier, which is the one the constellation you find using Orion's belt up through Orion's left shoulder and keep going.

Now, you don't have to be looking in the direction of Gemini because these shooting stars can happen anywhere in the sky. That's one of the most important things about stargazing, and meteor watching, is that you don't need to be looking any specific. You want to turn your back on any nearby lights, if there's a road nearby or if there's any torchlight nearby, you want to put that to your back.

But broadly speaking, you've got to fill your eye with as much sky as possible and just be really patient. Wait for the beautiful show to happen and the night this year to observe the Geminids at its best is overnight from the 14th into the 15th of December. It occurs almost exactly when the new moon in December, which means the moon is not going to get in the way of the view and it won't spoil our view of the fainter shooting stars.

It's a sad fact that in almost every meteor shower, the best time to go stargazing to see the meteor shower is well after midnight. In fact, towards dawn. So it's not a very convenient time. But really for most people, any time that's clear, any opportunity you get at that night, overnight from the 14th and 15th of December, if you head out somewhere really dark.

Like Galloway Forest Dark Sky Park, if you happen to have clear skies and you give your eyes, plenty of time to dark adapt, and if the peak of the meteor shower happens, as it should, which we expect it to this year, as you say, you can see perhaps sometimes 70 or 80 shooting stars every hour, sometimes more. These things are a little bit unpredictable. Sometimes the showers are a little bit less good than we expect sometimes a little bit more good. Sometimes actually they are spectacularly better. Now, we're not expecting that this year of the Geminids meteor shower, but nonetheless it is one of the best meteor showers to observe and it happens to coincide this year with a new moon, which is the perfect stargazing conditions for it.

Lucy: And why does it only happen at a certain point in the calendar? Why doesn't it happen all the time?

Steve: So broadly speaking, the peak of the showers are the days that you want to be a meteor watching. The Geminids meteor shower actually is quite prolonged. It happens over the course of weeks and weeks and you can go at meteor watching in the weeks running up to the Geminids peak on the 14th of December or you can go out in the weeks after that, you will see some Geminids but there's a dramatic spike in activity as you get exactly overnight into that one, one night's peak of activity.

And that's because we're passing through the densest bit of that cloud of dust in space and these clouds of dust aren't everywhere. Space is a lot of dust in it, but broadly speaking, they're quite

widely spread out these bits of dust. But as comets go around the sun, comets tails leave huge trails of dust behind them. And that's what we're passing through when we see a meteor shower, we're passing through the leftovers of a comets tail that has a very dense clump of dust. And in the middle of that clump, densest bit, that's where we see the peak occurring.

Lucy: One of the best meteor showers I've seen similar to you, Steve, was in the Galloway Forest Dark Sky Park, and it was a number of years ago now and it was with a group and it was the reaction from seeing the shooting stars was like being at a fireworks display. They were so frequent and so exciting. It was it was really a fantastic experience.

Steve: I love stargazing and meteor watching in groups, especially during a meteor shower, because what you tend to find is if people are standing up meteor watching to find someone happens to be looking in just the right direction, a big shooting star goes past and they go WOW when everyone else doesn't see it and they turn around to watch and there's nothing there but someone else sees something and they call out, and in fact, that highlights one of the best bits of kit you can bring for meteor watching, which is a reclining deckchair or a blanket to lie on the ground if it's warm enough. In December, I appreciate it might not be, but you want to get as much sky in your eye as possible. Standing up is fine, but you're kind of excluding the stuff behind you. If you can recline back or lie back and just look at the whole sky at once that maximizes your chances of seeing and seeing the shooting stars.

Lucy: Helps your neck as well.

Steve: It really does. Yes. It's not that comfortable keeping your neck craned, looking up into the sky for hours on end and you don't want to turn away because there's exciting stuff, like you say, it's like a fireworks display, exciting stuff happening all the time, and you worry if you turn away to stretch your neck and look at the ground, you miss something spectacular.

Lucy: So that's the Geminids...

Steve: Yes. The Geminids is the best one of the year and certainly the best one of the winter. There's another great meteor shower called the Perseids, which occurs in August, but that's out with our dark sky season and the skies that are often really bright. And you've got to be at just the right time of night to see the Perseids.

But in the winter season, the Geminids is quickly followed by another meteor shower called the Quadrantids. Not quite as spectacular, but getting up there and not nearly as well known as the Geminids or the Perseids meteor shower. The Quadrantids happens in early January, in fact, in January 2024 It's happening overnight from the 3rd in to the 4th of January. Maybe that's why it's not quite as famous because by that time of the year, people are exhausted from Christmas and New Year and they're not really inclined to head out stargazing. But if you happen to miss

the Geminids, because of weather or because you can't travel somewhere dark, then Quadrantids is your next chance to see a peak meteor shower again.

You'd expect a similar rate to the Geminids, maybe not quite as high, but the same rules apply get somewhere as dark as possible, fill your eyes with sky and taken in the view and be patient and one of the things that increases your chances of seeing these shooting stars dramatically is getting somewhere as dark as you can. Not everyone will be able to make it down to Galloway Forest Park, although we hope people will really make the journey and the effort to see these spectacular meteor showers this winter. But if you can't make it into the park, just getting away from towns and cities a little bit will help, the difference between stargazing and meteor watching in cities compared to meteor watching in Dark Sky Parks like Galloway Forest, is about a factor of ten.

If I was out in my garden in Glasgow, meteor watching at the peak of the Geminids and you were down in Galloway for forest meteor watching, we might be watching exactly the same meteor shower, but I would see only 10% of what you saw because the rest of it is just washed away by light pollution.

Lucy: So I've heard of Leonids. Is that something that we could possibly see during the winter?

Steve: Yes. So the Leonids meteor shower is in November. The Leonids meteor shower is often much less spectacular than the Geminids and the Quadrantids meteor shower. There are far fewer meteors every hour for the Leonids. It's worthwhile looking at, certainly the rate will increase. But rather than seeing maybe 60, 70 or 80 shooting stars in the hour, if you got perfect conditions for the Leonid, you might see ten an hour, still good, still better than normal, but not nearly up there with the Geminids.

The good thing about the Leonids, though, is that the comet that leaves behind the dust from the Leonids, that comet goes around the sun every 33 years, and every 33 years that means the dust gets refreshed. And in the years just after that refreshing of the dust, you get a much increased rate of Leonid meteors. And in fact, the last pass of that comet happened in the late 90's. 99, 2000, 2001, 2002 the rate of Leonids dramatically increased. In fact, I saw my best ever meteor shower from Galloway Forest Dark Sky Park was the Leonids in 2001, I believe. And on that night, the rate increase didn't classify it as a meteor shower anymore, they classified as a meteor storm. And the skies weren't perfectly clear, there was a bit of cloud around, so we didn't have anywhere near a full view of the sky. It was pretty dark being Galloway Forest. But despite the broken cloud, in the course of the hour that we were there until the clouds came in, we must have counted about 300/350 shooting stars. It was amazing. And that's not going to happen for a while. The next pass of this comet is not until 2033, in ten years time, but set your calendars because a good opportunity to see that meteor storm again and that's happened throughout history.

In fact, every 33 years you see this record of Leonid meteor storms, the best of which was recorded in 1833 in North America. And the rates were so high that's there engravings of it, there's images of it that people have drawn, they estimate the rate of shooting stars in that meteor storm was something like 100,000 every hour, it looked like the sky was falling again.

And we don't get to see that very often. I'm not promising you'll see that in 2033. You almost certainly won't. But going outside at the peaks of these meteor showers and during meteor storms just increases your chance of seeing something spectacular.

Lucy: That's fantastic. Steve, thanks ever so much. I'm really excited about getting out into the night sky in Galloway this winter and how fantastic to get a little bit of a glimpse just now under this wonderful simulated night sky in the Glasgow Science Centre's Planetarium. Thanks ever so much for taking time to guide us through the winter sky in Galloway 2023/2024, and happy stargazing!

Steve: Thanks, Lucy. And yes, it's always brilliant to come to the planetarium here, but there's nothing like being outside under a proper dark sky in Galloway Forest Dark Sky Park.

Lucy: Thanks, Steve.

Steve: Thank you.

Lucy: A big thanks to Steve and the team at Glasgow Science Centre for creating this series with us. To learn more or to plan your visit, visit our website first. Forestry and Land. Dot Scot. Dot gov.