

ALIEN atmospheres

Learning about life on exoplanets

- A planet's atmosphere can tell you a lot about it and the life it might host.
- Dr Hannah Wakeford, University of Bristol, UK, is an expert in alien atmospheres.
- Her research into the clouds surrounding exoplanets reveals much about their temperature, air and more.
- But, why is this research so exciting, and how are these findings being translated for the general public?



Dr Hannah Wakeford, University of Bristol, UK

What is an exoplanet? Where would you find one? And what are the clouds on other planets made of? Dr Hannah Wakeford is an astrophysicist from the University of Bristol whose research focuses on the atmospheres of planets only visible through space telescopes. At [Cheltenham Science Festival 2024](#), Hannah was involved with an intriguing event; after telling a mathematician and composer, [Dr Marcus du Sautoy](#), all about the planets she studies, he had gone away and composed a score reflecting what those planets are like. *Research Features* caught up with Hannah, just before she heard the music for the first time.

Where does astrophysics and music overlap?

First, they overlap in the emotions that it can evoke, the different things that we're studying, and how can we translate that into something understandable. We're looking out at the universe and asking questions, and it doesn't necessarily feel like there is a translation to what is happening here on Earth. Using music to evoke the feelings of what it's like in these environments, or why we're doing it, or how that changes the way that you might look at something, is a really interesting way of bringing people to that really remote science. It's about the emotions that are connected with it and the sounds are a translation of some of those. We're playing around with strange ways of building chords or cadence in the music.

The thing that makes up the chip in your computer is a cloud in another planet's atmosphere.

Could you tell us more about your research into clouds?

A lot of my work is trying to understand the nature of a planet's atmosphere; what is it made of, where are the things in the atmosphere and how does it change under different conditions? I want to understand how, if you put a cloud on one side of the planet but not on the other, how that changes what that planet might be like if you were there? Clouds are really my favourite thing, I'm British. Clouds are wonderful. The sky is actually quite beautiful today; we've got some really nice fluffy clouds and we've got some very structured clouds. Planetary wise, two-thirds of the Earth is covered in clouds every day on average, so this is a cloudy planet. That has really important implications for what it's like here in terms of our temperature, circulation of air and the movement of different things in our atmosphere. The Saharan desert would also be considered a cloud. It is picked up off the surface of the Earth and it's

transported across the planet. We see that in the orange sunsets that we get here in Europe. The exciting thing about my research is that I'm looking at completely alien planets. These are giant gas balls that are thousands of degrees. They have winds of over 5,000 miles per hour. By comparison, the fastest winds

called WASP-17b, and we have now measured for the first time what its clouds are made of. They're made of nanocrystals of quartz. So silica, the thing that makes up the chip in your computer, is a cloud in another planet's atmosphere. It's mind-blowing and ridiculous at the same time.

There are thousands of planets out there that we call our own little test tubes.

on Earth are 250 miles per hour. The clouds actually can't be made of water because it's too hot. Water can only exist as a gas. The clouds have to be made of something completely different. At those really high temperatures, the things that form droplets or are suspended in the atmosphere are actually the rocks we're standing on; imagine the sand on the beaches forming clouds in the atmosphere and that's what we're seeing. One of the planets that we're looking at is

How do you communicate your research to the public, and is this challenging? It's challenging to make it succinct. There's a lot of nuance associated with what we do, a lot of gaps in knowledge you need to fill in along the way. I started by talking about Earth's clouds and something that you're familiar with, so that we can then translate that into something that you're less familiar with. Putting things into context is a key part of that and it is a tough thing to do. When I'm



An expert science communicator, Dr Wakeford fuses comedy and science to discuss all things exoplanets in her 'Exocast' podcast.

talking about my work I also try to convey the excitement we have about what we're learning. Science isn't always about the answer, sometimes it's about what question we are asking.

How does your collaborative research offer new ways of looking at the world?

I would generally be considered an observer. I make measurements of these planets and try and understand what those measurements are telling me. A fundamental part of my job is to ask, What is the question we're trying to ask? How can I test that? What is the test that I would do to prove that this or this is the case? And with exoplanets, it's really exciting because I can take a question and I can go, oh, I have a planet for that. There's a planet that should fit in this category and there's a planet that should fit in this category. If we measure both of them, are they the same or are they different? If they're the same, why? If they're different, are they different enough to match our hypothesis? And there are thousands of planets out there that we call our own little test tubes that we can apply to

these different questions and mix and match them in different ways so that we can answer many questions. But it always starts with, what is the question you're trying to answer?

You're engaged in lots of outreach activities. Could you tell us more about your podcast?

I run a podcast called 'Exocast'. We talk about exoplanets. I run it with two of my colleagues, Hugh Osborne and Andrew Rushby. Hugh detects planets, so his job is to find exoplanets beyond our solar system. My job is to understand them. So, What is that planet like? What would it be like on that planet? What is it made of? And Andrew's job is to ask the questions, Could that planet host life, What would that life look like? The three of us bring our expertise across this really diverse field to focus on planets and discuss what we can learn. We also talk about the latest results in the literature; what people are finding, what the newest things that are going on are. This year we're really focusing on interviewing other scientists in the field; we're trying to show the huge diversity of things that people are studying

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in exoplanets. There are many different avenues you can come at it from, and we want to showcase these different paths.

I think a little bit of comedy and a little bit of lightness is really important for getting people engaged. What do you feel when you think about the discovery of a brand new planet beyond our solar system? It's not the details that are capturing you, it's not the fact that it's the size of Jupiter. It's how that makes you feel and comedy is a really easy way to get to people's feelings, so if we can be funny that's great (but we're scientists so that's not something that we're naturally great at!).

Could you tell us more about your experience of Cheltenham Science Festival?

I think it's absolutely fantastic. I'd heard of it for many years but I only managed to get involved last year and I was really excited to come back this year and talk with a different audience through a different medium. This year we're using music to convey science and that's a really exciting way of doing it. There are very limited spaces like this that really embrace that huge diversity in science. This week there is everything from pop sci books to neurodiversity, we've got AI all over the place, there's the science of the moon, there's technology... It just allows this real breadth of curiosity and I don't think there's anything more fun than learning lots and lots of different things.

Interview conducted by Todd Beanlands
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Cheltenham
Science Festival 4-9 June 2024

w: exocast.org
w: stellarplanet.org
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