AirSpace Season 1, Episode 10

Happy (Planet) Hunting

Matt Shindell:

I actually don't think I've ever seen a good image through a telescope. I've always just seen blurry images. I think it's my eyes.

Nick Partridge:

Welcome to AirSpace from the Smithsonian's National Air and Space Museum with help from PRX. I'm Nick Partridge.

Emily Martin:

I'm Emily Martin.

Matt Shindell:

I'm Matt Shindell.

Nick Partridge:

On this episode, we're going to talk about exoplanets and the search for life.

Matt Shindell:

And Emily's feelings about this so-called Goldilocks Zone.

Emily Martin:

I have strong feelings about the Goldilocks Zone.

Nick Partridge:

Before we get into feelings, let's dive into TESS. TESS stands for the Transiting Exoplanet Survey Satellite launched in April of 2018 and should be returning first light any time now. Emily, what's first light in an astronomical sense?

Emily Martin:

Is it kind of like first night where you go out and party and ring in the New Year?

Nick Partridge:

I think it might also involve partying on behalf of the scientists of the mission.

Matt Shindell:

I thought first knight was Lancelot.

Emily Martin:

K-N-I-G-H-T. I was talking about first night.

Nick Partridge:

You just made a joke about a Richard Gere movie, man.

Emily Martin:

Whoa. No, first light really refers to that first moment that that instrument takes in photons or the little bits that light's made up out of, and creates some kind of data or image or some kind of product that scientists can say, "That was the first light."

Nick Partridge:

As part of science though, not as optical testing.

Matt Shindell:

Right. Not a test.

Nick Partridge:

TESS is going to build on the work of its sibling mission, its older sibling, Kepler. Matt, can you give us the skinny on the Kepler mission?

Matt Shindell:

Yeah. Kepler was an exoplanet-hunting, space telescope that launched in 2009, and exoplanets are planets that are orbiting stars outside of our Solar System.

Nick Partridge:

How many planets did Kepler find?

Matt Shindell:

Thousands.

Emily Martin:

4,496-

Nick Partridge:

That's a lot of planets.

Emily Martin:

... as of October 27, 2017.

Matt Shindell:

Mm-hmm (affirmative).

Nick Partridge:

How did Kepler detect exoplanets?

Matt Shindell:

Kepler used what's called a transit method. So, it did a type of detection called transit photometry. So, what that means is, it looks at a star and it looks at that star for a long time, enough time to observe a small change in light when a planet crosses between the telescope and that star. That's called a transit so that is the detection of a exoplanet transiting.

Emily Martin:

Well, and if you think about the eclipse that just happened, the big solar eclipse that just happened, that was the moon transiting across the sun. This is like that, but you need a space telescope to see it.

Matt Shindell:

Yeah.

Nick Partridge:

So you're talking about a minor eclipse of a star, not the total eclipse of the heart?

Emily Martin:

The heart.

Matt Shindell:

Right.

Emily Martin:

Yeah.

Matt Shindell:

So Kepler was built around the idea that you could buy an off-the-shelf CCD, charge-coupled device. You have one most likely inside your cell phone or inside of your digital camera and it's how you take digital images on a daily basis and post them to Instagram. These CCDs that you could buy off-the-shelf would actually work to detect these incredibly small changes in light.

Emily Martin:

Remember when you got your first flip phone with a one megapixel camera in it?

Matt Shindell:

Oh yeah.

Emily Martin:

Yeah. It was pretty exciting.

Matt Shindell:

I still have some of the photos I took with my flip phone. They're on Facebook, which-

Nick Partridge:

Everyone friend-

Matt Shindell:

Both of those things date me as a very old man, I guess, but-

Nick Partridge:

Everyone friend Matt on Facebook-

Matt Shindell:

Yes.

Nick Partridge:

... and check out his one-megapixel camera photos.

Matt Shindell:

I mean, Kepler was kind of designed to answer the question, what is the sort of prevalence or the... What's the word, Emily? What am I looking for here?

Emily Martin:

Well, it's sort of like it's... instead of trying to measure every planet around every star in the sky, which would not be feasible, they picked one spot in the sky and they said, "How many planets can we count in this one spot of the sky? When we do that, we'll then extrapolate that across the entire sky and say, 'This is about how many exoplanets we think is in our corner of the galaxy.'"

TESS is different, because rather than trying to make one probe into one part of the sky, it's actually going to survey the entire sky but look at stars that are much brighter than what Kepler was looking at.

Matt Shindell:

Yeah, the main question with Kepler was, how many exoplanets are likely to be out there? Before we start trying to pinpoint individual planets, what can we say about how likely it is for a star to have planets? What it really told us was, it's incredibly likely for a star to have planets. It may be the sort of common case. Even though it pretty remarkably discovered 4,000 planets in that-

Emily Martin:

4,496.

Matt Shindell:

Yes-

Nick Partridge:

Let's not minimize those 496 planets.

Emily Martin:

That's right.

Matt Shindell:

Right. We can't say that that's all the planets in that segment of sky because it couldn't detect a planet if it was orbiting in such a way that it wouldn't transit in between the telescope and the star. So if the orbit of that planet was off at an angle, it went undetected. So it's possible that there's two or three times as many planets as were detected by Kepler.

Nick Partridge:

Is TESS looking for a particular kind of planet?

Matt Shindell:

The focus of all of this, I think, is to find Earth-sized planets in what we would call the habitable zone. Emily has some issues with that.

Emily Martin:

I have some issues with the habitable zone. We'll talk about it.

Matt Shindell:

Yeah.

Nick Partridge:

Oh. Okay.

Matt Shindell:

The habitable zone is sort of defined as that place in the Solar System-

Emily Martin:

The Goldilocks Zone if you will.

Matt Shindell:

The Goldilocks Zone around where the earth, Mars and Venus are here in our Solar System, where you can have liquid water and-

Emily Martin:

At the surface.

Matt Shindell:

At the surface, yes, and you can pretty much have the same type of water cycle that we have on earth, where we get all three phases of water and a very active atmosphere. Water, as far as we know, is required for life.

Nick Partridge:

Emily, the enthusiastic way in which you said, Goldilocks-

Emily Martin:

Goldilocks.

Nick Partridge:

... Zone.

Emily Martin:

Well, it's just a fun... I think it's a fun way of labeling this area in our Solar System, where we think the conditions are just right for life.

Nick Partridge:

Not too hot, not too cold?

Emily Martin:

Not too hot, not too cold, just wet enough, I guess. But from my perspective, and it's maybe a unique perspective on our Solar System, or at least within my little scientific discipline, we have water everywhere, everywhere in our Solar System as far out as Pluto and probably further out than that. If you have water at some phase and frankly, you can go out as far as Jupiter and Saturn and there's moons out there with liquid water, oceans underneath these icy shells. So as far as I'm concerned, there are habitable environments.

I think one of the reasons the habitable zone is so narrowly defined in our Solar System, and why that's extrapolated out into other exoplanets in particular is, because they want to find or identify exoplanets as being habitable to certain kinds of life. So not just life that they think has to be carbon-based and requires water in order to exist, but they want to increase their chances of finding big bits of life. Rather than just little bugs and critters, they want to find something that's either intelligent or something that is sizeable, that can affect its environment in a way that maybe microbial life can't.

Matt Shindell:

But it's worth saying that this Goldilocks Zone was defined back at a time where we hadn't yet really discovered on earth that there were all kinds of life that lived in very extreme conditions, which has really-

Emily Martin:

Extremophiles if you will.

Matt Shindell:

Yes, extremophiles.

Emily Martin:

We actually have been able to identify critters that live in these completely closed, hidden lakes in Antarctica. There's actually very little light if no light, which means you can't use photosynthesis to create food. There's very little heat so there's not a lot of energy sources in order to survive. The fact that we know we have these microbes here on earth that have been able to evolve and sustain their little microbial communities, means that it's not out of the question to think that at the bottom of Europa's ocean, and Europa is one of the moons around Jupiter, one of the big four Galilean satellites

that goes around Jupiter, that there might be some kind of microbial community down there, which is why NASA is going back.

Matt Shindell:

Yeah. If you're wondering how the study of extremophiles might have affected your life at any point, Nick-

Nick Partridge:

And I am.

Matt Shindell:

... do you ever use Tide or any other heat-activated detergent?

Emily Martin:

Tide's heat-activated?

Nick Partridge:

How would I know if my detergent was heat-activated?

Emily Martin:

I do all my laundry in cold water.

Matt Shindell:

Well, if you have a detergent that works best in hot water and claims that it has an enzymatic component to it, that enzyme actually was isolated from a thermophilic bacteria, which means it loved living in hot water. It had an enzyme that it used to eat and that enzyme is being used to eat the crud off of your clothes in hot water.

Emily Martin:

Oh snacks. I just read a Dan Brown book. What's it called?

Matt Shindell:

Conspiracy.

Emily Martin:

No.

Nick Partridge:

Da Vinci Code.

Emily Martin:

No.

Nick Partridge:

Dante's Inferno.

Matt Shindell:
Some kind of conspiracy involving a large government agency.

Emily Martin:
It was this big conspiracy where they actually faked astrobiological life.

Matt Shindell:
Oh yeah, I read that.

Emily Martin:
Oh my gosh. What is it? Anyways. It was-

Matt Shindell:
Yeah, something Point [crosstalk 00:09:22]-

Emily Martin:
... incredibly convincing.

Matt Shindell:
... I think.

Emily Martin:
Deception Point.

Matt Shindell:
Deception Point.

Emily Martin:
It was incredibly convincing. It was incredibly convincing.

Matt Shindell:
Was it?

Emily Martin:
They brought... Well, in the story, they bring in all these world-class scientists who are really good at science, to try and figure out if it's real and it's real and-

Matt Shindell:
Except it's not. It's fake.

Emily Martin:

Except it's not. But the idea is that you have to-

Nick Partridge:

Spoiler alert.

Emily Martin:

Sorry, you had like 20 years to read it so we're good. One of the things I liked about the book was, how do you actually look at this evidence and make a convincing argument that being biologic in nature is the only answer, the only way you could have produced the data that you have. So, I think TESS is going to get us closer. Is it Carl Sagan who says extraordinary claims require extraordinary evidence?

Nick Partridge:

Yes.

Emily Martin:

Well, okay. So, poll. Will you see convincing evidence of extraterrestrial life in your lifetime?

Nick Partridge:

Yes.

Emily Martin:

I vote yes.

Matt Shindell:

I vote yes, and I think it will be found in our Solar System.

Emily Martin:

Y'all we're optimists here. I think it's in the cards. I think the way in which technology and science progresses is not linear. It's exponential. We get better, a lot better, a lot faster these days and so I'm feeling very confident.

Matt Shindell:

I'm optimistic. Yeah. Definitely.

Emily Martin:

Mic drop.

Nick Partridge:

AirSpace is produced by Katie Moyer, Jocelyn Frank and Lizzie Peabody, mixed by Tarek Fouda. Special thanks to Jason Orfanon and John Barth. You can subscribe to AirSpace wherever you get your podcasts and please tell a friend.

This episode was supported by PRX and the Alfred P. Sloan Foundation, enhancing public understanding of science, technology and economic performance. More information on Sloan at sloan.org.

I saw, I want to say it was a quasar through a telescope? I want to... No?

Emily Martin:
Definitely-

Nick Partridge:
What did I see?

Emily Martin:
... do not see a quasar through a telescope.

Nick Partridge:
It was something weird.

Matt Shindell:
Were you blinking?

Nick Partridge:
They were just smears of light.

Speaker 4:
From PRX.