TRANSCRIPT

Here Be Monsters

An independent podcast about fear, beauty, and the unknown. Since 2012.
https://www.HBMpodcast.com

Title	HBM142: The Vastness of the Universe
Producer	Jeff Emtman
Season	9
Episode	2
Released (YYY-MM-DD)	2021-03-03

Please Note: Transcript generated by artificial intelligence and may contain inaccuracies.

Jeff Emtman 0:08
From beyond the furthest edge of the Oort cloud, this is Here Be Monsters

2021, February 24. 115 in the morning, having trouble sleeping again. So I've got this bad habit of avoiding my big questions all throughout the day, and just kind of letting them wash over me while I'm trying to fall asleep. And anytime that I think about something big, instead of having like actual thoughts, my entire body just gets really itchy. And, yeah, it's super itchy. Anyways, I was thinking about this thing that makes me really sad about the universe at the speed of light just isn't really that fast. I don't know the numbers off the top of my head. But yeah, I think the the sun, right? Even the sun, that thing that we can see so easily. It's like, if the sun just vanished, it'd be a good handful of minutes before we ever noticed. And yeah, like, it's just not that fast when it when it comes to the scale of the universe, you know. And something has changed my life is kind of when I was growing up, I think astronomers kind of thought it was fairly rare for there to be solar systems like ours. You know, we just couldn't observe them. And it was thought that maybe this was someplace special, right? My understanding now is that there's a lot of solar systems out there, there's tons of them, it might actually be more than norm to have a handful of planets around a star. But there's this real central irony there, because there's all these planets, but they're hundreds and 1000s and millions of light years away, if not more. So it's possible that we're going to be, you know, poking around in the heavens someday.

And get that real signal from ET that says, Hello, here we are. We're intelligent. How about you? You know? And I don't know what you think about like, the prospects of humanity, right? Like, do you think that our species is going to make it another 1000 years, over another 100,000? A million years, are there going to be humans in a million years? Our species has a lot of destructive power, and we use it against each other all the time. We also have a changing planet is becoming less hospitable to our species. And presumably, other intelligent species have the same problem. So you get that message that took a million years to get to your planet, you're likely talking to a ghost, you know, you send that message back. By the time it gets back there, million years to 2 million years round trip. What's the likelihood that there's gonna be anyone there to pick it up? You know what I mean?

I think it's profoundly sad. You know, this, like near certainty, that there are other things out there who are curious about us and vice versa. And yet, you're either never going to find each other or in the off chance that you do find them, that society might be completely dead, and that there's nothing more that can be done, right.

I think that looking for the signals from those other societies is a hard job, just from the scientific standpoint, but just kind of that mental weight of knowing the odds, you know what I mean? We think that life moves past Based on the scale of the universe is really not very quick. Makes you feel small. But I'm just an itchy person trying to fall asleep

Bethany Denton 5:38
Here Be Monsters Podcast about

Dr. Seth Shostak 5:41
The totality of all these perturbations.

Bethany Denton 5:45
the podcast about the unknown.

Jeff Emtman 5:54
The sponsors for this episode are all the patrons of here be monsters on patreon.com. Now each month, these patrons send just a little bit of money to me, and I use that money mostly to help pay my rent, honestly. But I also use it to pay people for sounds music taxes. You know, there's a lot of things in this world that cost money and the HBM patrons really help out. So that's who's sponsoring this episode. And there's a couple people that I want to thank by name. Courtney Monroe, john Hill, Shannon Wong, Julian Pratley, Greer, Nicole Carter, Timothy prettiman Paloma Pierce, Todd Walton, Ricardo BORT Allen Bradley trust. Epphram McCormick, Florida seal McKean to be Ted Favre, Lisa schlaepfer, Andrew Conklin, Emmett, and Rashard. I asked Rashard why he signed up for the Patreon and he said that it was because he appreciated how here be monsters approaches topics in a kind and open minded way. And so he said he was happy to send just a little bit of money each month to keep this project going. And if you'd like to help support the show financially, you can do that at patreon.com slash HBM podcast. And if you sign up, there's actually a couple modest rewards

in it for you, too. You can read about those@patreon.com slash HBM podcast. There's also a link in the show notes. So thank you, again, here be monsters patrons. It really helps. So thank you.

You know, Seth, can you just tell me what happened in 1997?

Dr. Seth Shostak 7:40
Oh, yeah. People will occasionally ask if we've had any close calls when it comes to SETI. And of course, there's no such thing as a close call. But there were some interesting episodes, and the most, to me, at least, happened in the late summer of 1997. I was here at home having dinner when the phone rang, and it was the CEO of the SETI Institute, Tom Pearson. And he said, Seth, I think you ought to get down here. So he met to the office, of course, and I thought he was going to fire me, but I just thought it was a little unusual for him to fire me at night. So I put on some clothes, went down to the office, and I found most of the other people involved in our programs sitting there looking at computers. We had picked up a signal using an antenna in West Virginia, that looked like the real deal. We sat there all night, watching the signal on their computers. And I was very nervous, I couldn't sit down. And I kept waiting for the phones to ring, you know, because there's no policy of secrecy in SETI. So we figured that a lot of people knew that we had found this signal. And then the phone eventually rang and it was the New York Times and they wanted to know what we had found. As it turned out, it wasn't et lamentably. But it did show that people who think that we would keep it all secret or wrong, because the New York Times knew about it within hours.

Jeff Emtman 9:03
Was it a letdown? Like, what did you feel?

Dr. Seth Shostak 9:06
I was very nervous. And I thought it was the real deal when I thought it was actually a signal because it meant I was going to have to rearrange not only the coming week, but rearrange maybe the coming months or maybe the coming years. And so it was a little disruptive. put it that way. You know, it's one of those things you keep hoping to hoping to score and then if you actually score it, you realize you don't know how to deal with that.

Jeff Emtman 9:31
You've spent a fair portion of your life looking at the sky, right?

Dr. Seth Shostak 9:35
Yes.

Jeff Emtman 9:35
What kind of waves are you looking at?

Dr. Seth Shostak 9:38

Well, I was a radio astronomer, right. A radio astronomer doesn't use telescopes that most people think of the kinds of that, you know, employee lenses, or mirrors. You know, those are the kinds that are most familiar to people, but they're also what are called radio telescopes. And they just look like a giant antennas. And in fact, what they are is giant antennas.

Jeff Emtman 9:59
You know, I've never seen a radio telescope in my life, I just picture you sitting there in front of like a big machine and has a knob on it. That's just like the tuner in a car radio. And you focus in on a single frequency at a time, is that how this works?

Dr. Seth Shostak 10:11
Well, sort of, except that there's no big knob, because you don't want to just listen to one frequency at a time, that might be great when you're in your car, trying to tune in your favorite country in western station, you know, you keep spinning the knob until you pick up something that you like. But if you're doing that, when you're trying to do what I do now SETI research and you're trying to pick up et, you know, if you, if you did it, by turning the knob, you'll spend all your time turning the knob, because most of the time, you'll be at the wrong frequency. So what you want to do is build a radio receiver that can listen to as many frequencies at once, as many channels at once as it can. And that way, you can be much more efficient in doing this kind of an experiment.

Jeff Emtman 10:56
One thing that I have a lot of trouble understanding is like how the electromagnetic spectrum actually works, right? Like, I know that our vision is part of it. And there's like x rays, and there's like radio waves, right? But I don't think I actually understand fully how it exists and like what medium it exists, and where exactly is the electromagnetic spectrum?

Dr. Seth Shostak 11:17
Well, electromagnetic spectrum is, is just in fact, a fancy way of saying, light. But you know, radio waves are also light, just light of a different color, if you will. And what you can't see your eyes can see only a small range of colors again, if you will, you don't see for example, ultraviolet light, but it's there, it's in the room next to you, bees can see it their eyeballs, insofar as they have eyeballs, or can see ultraviolet, or at least a little bit of the ultraviolet, you don't see the radio waves, you don't see the television signals, you don't see the radar, you don't see all this sorts of stuff that are being, you know, produced and running around the universe at the speed of light. So, yeah, it's just the totality of all these perturbations, that are like waves that bring us information.

Jeff Emtman 12:11
And so when we're talking about radio waves, right, we're talking about something on that spectrum, right? where it's like, our vision is part of that. And then somewhere down below there some lower frequency stuff. That's what we hear when we talk about, like listening to the radio, but that's also like flying through space all the time. Is that how that works?

Dr. Seth Shostak 12:28
Right? There's no real difference between light waves and radio waves. I mean, you know, it's sort of like saying, all cats are the same too, right? I mean, you can take a small cat, and there is a little Tabby over there. And then you got this big cat over here, that a couple of guys in Las Vegas are going to, you know, crack whips in front of and see if they jump onto stools and stuff like that. But they're all just cats. Well, it's the same with the electromagnetic radiation. You have radio waves, and you have light waves, but they're basically the same. They're, you know, just different wavelength.

Jeff Emtman 13:01
So, you know, the kind of impetus for me writing you was that I found out about this frequency 1.42 gigahertz, right? And that's a really special frequency. Do you know when people started taking interest in the specific frequency 1.42 gigahertz?

Dr. Seth Shostak 13:16
Yeah, it happened just before the war. It was in the 1930s. It was the late 1930s when a young student Hendrik Vander host. And it was suggested to him by a very eminent astronomer, young oort Dutch astronomer, he was aware of the fact that radio astronomy was becoming a thing, that there were people who were using big antennas to try and study what radio waves are coming from space. So he put that problem in front of Hendrik van der host, and founder host worked out in a theoretical way that hydrogen, you know, just hydrogen, which is, after all, three quarters of the universe is hydrogen by weight, right? There's a lot of hydrogen in the universe, that hydrogen would spontaneously produce radio waves at 1420 megahertz, to more decimal places, but that's where it is. And that turned out to be in an enormous prediction that was verified by actual observations with a year both in the United States and in Holland. So what did he actually you know, this frequency, again, 1.42 gigahertz or 1420 megahertz, right?

Jeff Emtman 14:29
Yeah. What was it about this lining up with hydrogen that was important?

Dr. Seth Shostak 14:33
It was produced by hydrogen, right? If you take a bottle of hydrogen, and you let it sit there, it will spontaneously produce this radio emission. Now, you know, you'd probably wait a long time for a bottle of hydrogen to produce very much of this. But when you point an antenna toward you know, outer space, you know, there's a lot of hydrogen there space is big, really big as Douglas Adams said, the fact that you're looking at light years worth Hydrogen means that you're always going to pick up the signal. And as I say that signal was first detected, you know, very shortly after Vonda Hill's prediction. So that was really great science, he makes a prediction. And sure enough, it happened.

Jeff Emtman 15:13
So this frequency, right? 1.42 gigahertz, 1420 megahertz, I believe that's known as the hydrogen line. Is that correct? That's right. That's right. So it's kind of a shorthand for this frequency. What is it about the hydrogen line that is interested extraterrestrial researchers,

Dr. Seth Shostak 15:30
we spend a lot of efforts studying the hydrogen line as radio astronomers, because it can tell you a lot about the universe. If you want to know the speed at which the universe is expanding, the hydrogen mind can tell you that. So it's very useful for radio astronomy. But the other point is that it's known by all radio astronomers, right? They all know about this. And the assumption that was made, even with the first SETI experiments was that look, if we know this, you know, the aliens will know this frequency, too. So the idea was that if the aliens are sending any signals into space, they might be choosing to do so near the hydrogen line frequency, because everybody will know it. It's sort of like hailing channels on Star Trek. Apparently, everybody in the Galactic Federation knows what frequency that is.

Jeff Emtman 16:18
Hmm. So you said that the interest in this first took place in the 30s, right, that's when people first started picking up the ears and saying, like, hey, this frequency, the hydrogen line is something important and special that we need to think about. So what happened with the wow signal that was like 40 years later, right? That was in the 70s.

Dr. Seth Shostak 16:37
It was the Wow, signal was found by people at The Ohio State University. in Columbus. They had a radio telescope that they had built in the 50s that they had used for a long time for astronomical studies. But by you know, the 70s, that instrument was kind of, you know, old school, it wasn't sort of state of the art anymore. So what Ohio State decided to do was just to let it sit there all day, every day, scanning the skies, and then, you know, see if they found any signals that weren't due to nature, but were due to, you know, cling ons or something like that. So it was just a sort of continuous running backburner project. You know, one morning, Jerry Ayman, who was one of the astronomers working there, came in and he looked at the printout from the night before his observations, and he found a strong signal, but it was very close to the hydrogen line in frequency, you know, it looked like a source of radio waves that was in the sky. And, you know, moving at the speed at which the Earth rotates, if you will, it looks like the kind of signal you'd expect from deep space. And it was so strong. And so just like what they were hoping to find that he wrote, wow, next to it, so became known as the wow signal.

Jeff Emtman 17:54
Yeah. And you know, I'm looking at the printout right now. And it's this kind of sheet of paper with like ones and twos and threes and fours peppered all across it. And then there's just this long line where it says six, EQ uj, five. And then you know, the greatest piece of marginalia I've ever seen, which is just his red pen handwriting that says, Wow, exclamation mark.

Dr. Seth Shostak 18:14
Yeah, yeah. Though those letters, by the way, where the signal is, seem to endlessly intrigue the members of the public who will send me emails in which they say they have decoded what those letters mean. And of course, those letters were just used to represent the voltage coming out of the receiver. They're, they're not a message for me at.

Jeff Emtman 18:34
You know, this is anomalous, as far as I understand the jury's still out on what exactly happened here. And people have theories and this and that, this and that. But what it really did is capture the public imagination, which then went kind of haywire on like, hey, there's aliens here. There's aliens here. Right?

Dr. Seth Shostak 18:51
Well, to some extent, I think many people will indeed recognize the wow signal as an unexplained signal. But it has to be said that that telescope there in, you know, outside of Columbus, Ohio, automatically re observed in the same direction 70 seconds after the first observation. So this signal was found in the first observation, but it wasn't found in the second. And so that sounds a little bit suspicious. If you can't find something more than once, you, you're always going to end up with saying I don't know what it was. And by the way, the last signal was certainly not the only signal being found in those days. There were signals, many signals that were found that looked very suspicious. But Jerry Ayman would be good in marketing, because he wrote Wow, next to it.

Jeff Emtman 19:36
So these anomalous signals that we get from space, is there any consensus on what what they are?

Dr. Seth Shostak 19:41
I think most people would bet that there's simply interference caused by our own society, not by an alien society, right? We have 1000s of satellites whirling around the Earth now, you know, when the wild signal came on that that wasn't quite so true, but it's mostly Earth satellites that cost Problems are steady, because they are at the frequencies. That said he likes to use, including 1.42 gigahertz.

Jeff Emtman 20:08
So 1.42 gigahertz the hydrogen line in 1977 was at a restricted frequency or not, I don't

Dr. Seth Shostak 20:16
think it was in 1977. It has since become a protected frequency, or there's actually a range of frequencies from 1400 to 1427 megahertz. So that includes the hydrogen line, of course. But maybe more importantly, it also includes the redshifted hydrogen line, right? If you're studying a galaxies I used to do that are moving away from you than the frequency the hydrogen will be shifted out. So they try and protect that end of the spectrum to me, it was, you know, set up to protect research, just basic research. It's not always honored. But that was the idea. And yeah,

Jeff Emtman 20:53
you said it. You said it's not always honored. You said people today still sometimes broadcast at that frequency?

Dr. Seth Shostak 20:58
Yeah, yeah. When we observe for SETI experiments, we find plenty of interference caused by humans. In this protected band, it's protected. In principle, it's sort of like maybe the speed limit on highway 101. Here, in principle, you're not supposed to go faster than 65. But in practice, you'll find that it's not always honored.

Jeff Emtman 21:22
I mean, it's interesting, you mentioned that, right? Because when I first came across this recommendation that this worldwide Federation, put together was at the ICU. What's that stand for?

Dr. Seth Shostak 21:33
International Telecommunications Union,

Jeff Emtman 21:36
Which I'm fascinated by. I went through and I read a lot of, well, not a lot of it's 1000 pages long, but I read a lot of their 1979 report, it's just to me absolutely fascinating that you can get people from every country in the world, essentially every country in the world to come together and say, Hey, we're gonna talk about how we split up the radio frequency spectrum. Because it turns out that a lot of frequencies can be used for a lot of things. And I assume it was causing confusion, right, the different countries were treating the spectrum in a different way.

Dr. Seth Shostak 22:08
In the case of the electromagnetic spectrum, yeah, it there's a finite resource, if you build a powerful transmitter, at essentially, any frequency, you can name now, you're going to interfere with somebody else. And if that somebody else is, you know, emergency services, you know, fire trucks, or ambulances or something, you want to prevent that. So sure, it's a finite resource, we got to share it. And so you have these agreements.

Jeff Emtman 22:32
You know, you know, I'm gonna ask you a question that I had a hard time googling, right? So it's really easy to understand that we're listening to a lot of the electromagnetic spectrum, right? We're listening there to see what anomalous things are coming through and what, you know, kind of the shape of the universe and all this and all that, right. I couldn't figure out are we blasting out some powerful signals in every direction on the hydrogen line to let extraterrestrial cultures know that we are here? Or more likely, we're here?

Dr. Seth Shostak 23:03
Well, Jeff, I don't know what people are doing in your hometown. But around here, they're not to begin with, it's a protected band. So you know, you're gonna get in trouble with people, some people gonna complain at you if you do that. Maybe the FCC, but no, Earth is not broadcasting deliberately to the universe. We do broadcasts inadvertently, with our radar, mostly, and FM radio and television, all that goes out into space. And I'm sure that there are aliens who are just really delighted by our reality television.

Jeff Emtman 23:37
You don't see it as a problem that we're not broadcasting on the hydrogen line, because I had this like, weird thing in my head where I was like, What if there's two societies that both decided this is too important to broadcast on? And we're just both sitting there in silence?

Dr. Seth Shostak 23:51
Yeah, no, I suspect that all societies make that decision, right? The real problem with broadcasting a powerful signal on the hydrogen line would be, you would instantly incite the ire of radio astronomers, right? Because no matter where you did it, if it's a strong enough signal, it's going to get into their antennas and mess them up. Right? It's sort of like, you know, turning on a bright light in a movie theater. You don't ingratiate yourself to the other patrons there who've spent $10 to sit in the dark and you ruin the dark. So broadcasting right at the hydrogen line or near to it is not going to be encouraged by anybody. But if they broadcast not at the hydrogen line, but you know, I don't know, 10 megahertz higher up or something, you know, then you don't mess up any radio astronomy. And so it's still it's a good goalpost. It's like saying, I'm gonna put, you know, a palm tree wherever there's an oasis in the desert, so people can find it because there's a source of water, but they don't put the palm tree right where the water is. They put it you know, 10 feet away, it's still okay.

Jeff Emtman 24:57
I want to ask you about something you said in 2012. And just see What you think of it now? In 2012? I heard you say that you were very sure that we would find signals from extraterrestrials within two decades, which we aren't to yet. But we're getting closer. Like, what's your what's your reflection on on that statement now?

Dr. Seth Shostak 25:22
I hope I'm tired. I still stand by Look, I bet everybody a cup of coffee. So I'm really you know, and I figured, I'm not going to have 7 billion people lined up outside my door here saying, Yeah, why my coffee? Because by that point, some of the better SETI experiments will have looked at, you know, a million star systems. And just as a gut feeling, I figure millions probably enough, so we'll find out and if I'm wrong, I mean, you should buy Starbucks stock now. You know, sell your GameStop stock, and buy Starbucks.

Jeff Emtman 26:00
Seth, I'm so grateful for this, this is wonderful. I learned a ton. So thank you so much.

Dr. Seth Shostak 26:04
All right, Jeff. Get in touch anytime, man. Okay, I

Jeff Emtman 26:07
will do. Okay. Bye bye.

Please Note: Transcript generated by artificial intelligence and may contain inaccuracies.

Dr. Seth shostack is the senior astronomer at the SETI Institute, which searches for extraterrestrial intelligence in our galaxy and beyond. He's also the co host of big picture science. You can find big picture science on any podcast app or radio.seti.org. The music on this episode came from the black spot.

My name is Jeff Emtman and I produce this episode. Here Be monsters is an independent podcast about fear, Beauty and the unknown. And it's supported by individual sponsors and donors. You can support here be monsters by visiting patreon.com slash HBM podcast. Thanks for listening more episodes soon.