Mark Royce (00:00):

Hi, Dan. How's it going?

Dan Peluso (00:02):

Hey, Mark. Good, how are you?

Mark Royce (00:03):

I'm doing well. Well, we're here today to talk about modeling and astronomy, teaching astronomy, using modeling methodologies in the classroom. So, I would love for you to tell me a little bit about the history of astronomy modeling as we get going here. How did it get started? What do you know? And what's your journey been in it?

Dan Peluso (00:32):

Yeah, so this goes back all the way to 1992, when I was just a little kid and had no idea what modeling was. Maybe didn't really even understand what astronomy was. But the kind of beginning started with this program called Hands on Universe, or HOU, and this was a program that was developed by Carl Pennypacker. Carl is a semi-retired astrophysicist with Lawrence Berkeley National Labs. And he and others were interested in trying to find way to bring real astronomy to the classroom to maybe improve upon science education. So they got some teachers to come down to Lawrence Berkeley Labs, and one of them was pretty excited about trying to use some of the stuff that the astronomers were showing the teachers. And this was very kind of beginnings of using technology in the classroom.

Dan Peluso (01:39):

So there's like command line image processing and could barely display an image, but it was still very powerful to bring any kind of real astronomy into the classroom. So they worked on this more, and they turned it into a full-fledged National Science Foundation NSF grant proposal, which was funded. And they turned that into a workshop for teachers. And it improved where they got teachers using telescopes remote telescopes, and working on using image software. They even developed a image processing software so that teachers and students could take real astronomical images and process them in the classroom. Someone who was really fundamental early on with Carl was a person by the name of Alan Gould, and he was an astronomy educator with Lawrence Hall of Science. I think he still does work with them, but he's a world-leading astronomy curriculum developer and big contributor to this Hands on Universe project.

Dan Peluso (02:47):

He helped give a lot of valuable feedback to Carl and the team and how they could improve this work of bringing it into the high school and middle school classrooms. And they initially trained, I guess, about a thousand teachers across the country. And it was really successful. And then, it grew to become the Global Hands On Universe project, or GHOU and Europe started initiating some of this trainings too. And, to date, they have over 80,000 teachers around the world that have been trained with GHOU. And this is about bringing astronomy to the classroom, using real telescopes and real scientific images from telescopes and, using planetarium software in the classroom. The image processing software, as I mentioned, there's one called Salsa J, which is how we do photometry. When you get an image from a Telescope, a lot of people have this misconception that... There's actually a really a fun example to think about how telescopes work. Do you think, I'll ask you, Mark, a question. Are you familiar with the Hubble Space Telescope?

Mark Royce (04:05):

Sure.

Dan Peluso (04:06):

Yeah. So the Hubble Space Telescope, as I'm sure everyone listening is familiar with, has brought us all these amazing images of the cosmos. Do you think astronomers are going up to the Hubble Space Telescope and putting their eye through an eye piece to look at these images?

Mark Royce (04:26):

I would guess that they're being digitally captured and shared among astronomers, would be my guess. But, you know, cuz having access, you know, being able to travel to the physical, Oh, no, the telescope's in space, isn't it? It's up there. It's not on earth. Right.

Dan Peluso (04:47):

It's not on Earth. No it's orbiting around the planet.

Mark Royce (04:49):

Right. <laugh>.

Dan Peluso (04:51):

So it wouldn't be too feasible to be flying up to space every day. Exactly. Yeah. Um, but well, besides the impracticality of actually doing that, you know, with professional astronomy, we are getting images by processing light that comes through. And a lot of times in astronomy, we are getting what's called a FITS file. And I believe that's Flexible Image Transport System is what it stands for. But there's just a fancy word for an image file that has all the data and metadata that we need from a celestial observing event, so that we can process it and we can combine the images together to make them beautiful with colors and understand the brightness and the changes in brightness over time and all these different things that we can study from an image in order to learn about our universe.

Dan Peluso (05:53):

So the GHOU project created this software that allowed teachers and students to actually do this in the classroom, which is really powerful because nothing has really ever been done like that. And, you know, this is usually reserved for, professional astronomers. So this is something that was working through the nineties. And then a few of the GHOU participants were modelers. And this is kind of how we transition into how, well, how did, how did astronomy modeling begin? How did we get from GHOU or HOU to GHOU to astronomy modeling? Well, some of these teachers were modelers, and one in particular by the name of Steve Carpenter, who's a pretty well-known modeler in modeling instruction. He loved GHOU.

Dan Peluso (06:57):

And there was other HOU modelers that were also really excited about having some sort of modeling-specific activities. You know, using the modeling instruction pedagogy with GHOU activities, the astronomy activities I was talking about. Mm-hmm. <affirmative> and the modelers were very innovative. There was actually a professor of astronomy from Western Kentucky University by the name of Richard Gilderman. And he knew Carl and the GHOU program, and he really encouraged Carl and the

other people working on GHOU to create a modeling instruction astronomy course. They've been talking about it for years and bouncing ideas back and forth and, you know, trying to invent this modeling astronomy activities. And in fact, it was originally funded, I think, through this Norwegian Science Foundation to fund the initial work on it.

Dan Peluso (08:01):

And we're talking, I'm not sure exact years in here. Cause I wasn't participating in this at the time, but we're talking like 2010s, maybe 2000, somewhere between 2010 and 2015 maybe these discussions were happening. I know one of the seminal events happened around 2017 or 2018, where the Norwegian Science Foundation, which helped fund this, brought all of these modelers to Berkeley to work with Carl and other people from GHOU. And they had this goal to create a modeling astronomy workshop. Okay. And Colleen, which I'm sure, I know you're familiar with Colleen, and I'm sure a lot of people listening to this podcast know Colleen. So, Colleen Megowa-Romanowicz, she's got her PhD, you know, with David Hestenes, one of the fathers, the father of modeling instruction. Right. Yeah. Right. And she's been very involved with AMTA, through, its inception. I think she was actually the first member of AMTA, maybe, or one of the first.

Mark Royce (09:11):

Yeah. She was a founding member, at least, if not the first Yeah, you're right. Just a side note, if people who are listening are interested in hearing Colleen's focus and, uh, I did an interview with her, it's been a couple years, but you can go to science modeling talks.com and find in our archive the recordings of the podcast from with Colleen and many other people. But Colleen especially is very good.

Dan Peluso (09:39):

Yeah, that's great. I think I even, I remember listening to it, it was a really good interview that you did. There's a few with Colleen. She she was involved in that first key meeting about developing the astronomy modeling workshop. And she did a lot of the work around identifying the key models.

Mark Royce (10:00):

Yeah.

Dan Peluso (10:01):

So, as we know with modeling instruction, we have to figure out what our important models are for a particular subject that we're teaching

Mark Royce (10:11):

In the storyline

Dan Peluso (10:12):

And physics, you know? Yeah. In the storyline. Exactly. So, Colleen and the other people that were in this initial meeting, it included a high school astronomy teacher who was very involved with GHOU, Richard Lowman, Colleen, as I mentioned, Carl Pennypacker, who I said, Steve Carpenter, who I mentione, Alan Gould, who I mentioned, and a lot of other very valuable collaborators. And these activities were developed there, kind of combining some of the stuff that GHOU had and ideas that the modelers had. And they went out to be tested with existing modelers and the modeling community to get feedback. So

this happened over some time. And then, Colleen actually helped to compile everything together, and then eventually it turned into a workshop. And in 2019 at the University of Louisville, in Kentucky, was the first astronomy modeling workshop. And the workshop leaders for that were Stephen Colbert and Doreen Grener. So that's, that's kind of the background history of how it came about.

Mark Royce (11:26):

Yeah. Is that where you jumped in?

Dan Peluso (11:28):

Yeah. So this is where the crossroads meet and with my path and astronomy modeling. So at the time, so I'm a former high school physics teacher. So from like 2017 through 2020, so for three years straight, I was teaching high school physics in the Bay Area. And in my last two years teaching, before I started my PhD, I started working at a new school. And that new school was Mare Island Technology Academy in Vallejo, California, where I also currently live. And the former physics teacher, she had this astronomy club after school. And I was really excited about this astronomy club because I always loved astronomy. In fact, I had always had these aspirations of getting a PhD in astronomy and astrophysics. But at the time, didn't think it was gonna be something that was gonna be in my future for various reasons.

Dan Peluso (12:30):

And I met Carl that first year teaching at MIT Academy because Carl was working with this teacher. And he would go to this astronomy club and bring these GHOU activities to the astronomy club. So that's how I met Carl and him and I kind of hit it off. I told him how, Yeah, I'd love to get a PhD, but, you know, I don't really wanna move around to the entire country. My wife and I are kind of happy here in the Bay Area, and, not sure if there's any opportunities for some of the schools here for the kind of research that I'm interested in. And then he kept talking about modeling, and I was like, Oh, what's modeling? I don't know what that is. And then, then I kind of learned a little bit, you know, osmosis through him, what it was.

Dan Peluso (13:20):

And then he told me about this PhD program in Australia at the University of Southern Queensland, where I could pursue a PhD in astrophysics, make my own research project, which would include, a astrophysics portion, but also an astronomy education portion. Cause that's what I wanted to do. I wanted to be able to do actual science and learn the skills and the knowledge and experience of being a real scientist. But I also wanted to do research and work around education so that I can improve upon education. And this opportunity at University of Southern Queensland would allow me to do that. Carl was involved with it because Carl is a researcher with Uni SQ that's the kind of abbreviation for it. And he does work on preventing wildfires by using--This is actually pretty interesting.

Dan Peluso (14:23):

He's a cosmologist Carl, and they use these satellites and other imaging devices in order to look for wildfires before they start.

Mark Royce (14:36):

Wow.

Dan Peluso (14:37):

With the same kind of techniques that he used to look for supernovas out in the cosmos, which was kinda cool. Wow. Yeah. But that's how he was involved with Uni SQ and the people that he worked with there, one of them, my supervisor, Brad Carter at Uni SQ, they were very interested, as well with another collaborator, Duncan Wright, to, create some unique research project for one of their PhD students in the future around incorporating this modeling instruction and a more inquiry-based way of learning astronomy. And I was there at this, you know, at the Crossroads. And I picked up my guitar, if anyone's a music music fan at the Crossroads-- Well do you know, sorry, I had this tangent, but I just kept making me think about Crossroads and, the guitar player who went to the crossroads, to sell his soul. A great guitar player.

Mark Royce (15:38):

I do know the story. I can't remember his name. Darn.

Dan Peluso (15:43):

Robert Johnson. Robert Johnson.

Mark Royce (15:44):

Robert Johnson, Yes.

Dan Peluso (15:45):

Yes. Yeah. It was Robert Johnson. Yeah. So, um, but for me, this was, this was me, you know, looking to, you know, improve upon my career and do the next steps and, some of these aspirations that I had. And it was very serendipitous that I had met Carl while I was teaching, and he had these connections with Uni SQ in Australia, and at the same time he was developing with Colleen and the other modelers, this astronomy modeling workshop. And I went to the 2019 astronomy modeling workshop. And that was actually when I began my PhD. So I got into the PhD program, and I'm still doing it now. And I was a participant. It was my first experience with modeling, and I went through the workshop and then taught for another year, and then I was doing my PhD part-time that first year, and then I went full-time into the PhD and there's a lot of other things that kind of happened and transpired after that. That was kind of how I got involved.

Mark Royce (16:52):

When you and I talked two years ago, you had just finished your first year of teaching astronomy, I think at that point, I'm trying to remember. There was a milestone of one year when we talked last. Anyway, I was just curious how has modeling influenced you in the classroom, as you've gone on to employ modeling techniques?

Dan Peluso (17:18):

My first year of teaching, and even much of my second year and a little bit of my third year, so I was in the classroom full-time for three years. The first two years was heavily direct instruction. And then I went to the modeling instruction workshop, the summer of 2019. And then I completed another year of teaching. However, that was also the year we all transitioned to this online learning environment because the pandemic, so half that year was, I was with, with everybody else that was teaching that experienced that for, you know, that, second semester. But I started trying to incorporate more of this inquiry-based type of learning in my classroom, especially after the modeling workshop. Now I was teaching physics, so I wasn't teaching astronomy, and I was so new to this astronomy modeling.

Dan Peluso (18:16):

And even just being a new teacher, I had a hard time, I think, bringing some of those activities into the classroom. But, I did do several activities, that were modeling specific. And I noticed a huge difference in the student engagement and their excitement and even their understanding of concepts. And, one of my greatest memories of the first time I tried to do a modeling activity was just this, like, kind of maybe say like, kind of a little bit of a controlled chaos, but like a good chaos. Like this is like chaos of learning and excitement of, of people being engaged and, not so that then I would compare that to the chaos of students not being engaged Yeah. <laugh>, because that's another kind of chaos that's maybe not good. That, you know, we, we as teachers, uh, have all experienced, but this was a more productive type of chaos that, you know, had this like kind of synergy between the students actually developing their knowledge and asking each other questions and being excited about actually learning by, by doing something.

Dan Peluso (19:35):

So that was kind of my first impression of it. And then Covid happened, and, you know, we all know what happened after Covid in teaching. And, I went into my PhD full-time. Shortly after that. I started a research job at the SETI Institute. And, also to mention that Colleen became one of my supervisors with my PhD. So I have a couple different PhD supervisors. I have actually five of them. I have a team of these awesome experts, from all kinds of different backgrounds to kind of help with my unique PhD project. And Colleen is bringing all of her expertise in the science education and modeling instruction world to help me. I'll learn, you know, from her. So, you know, through the course of my PhD, I have been, you know, I meet with her very regularly, and as you and all the modelers know, Colleen is one of the best people to be learning modeling from.

Dan Peluso (20:44):

Which I'm very, very honored and, and privileged to have her as a personal teacher on learning about modeling. But I've also been to other modeling workshops. I was at the computational modeling workshop this past summer in Cleveland. I co-developed and co-taught the astronomy modeling with exoplanets course with Colleen. And I've included modeling in a lot of my day-to-day with just talking about science and science education and my research, but also in a lot of the work that I'm doing, through the SETI institute. So I don't have this like, traditional experience that I think a lot of your listeners and other modelers have where they're in, you know, a high school classroom, you know, doing modeling. I was for a little bit, and I do work with a lot of high school science teachers and also a lot of community college teachers and other educators. But I am bringing it in, in a kind of different way.

Mark Royce (21:53):

Tell me about your work with SETI and, and remind me what it, I, I know it's extra terresterial something, but <laugh>, the S E T I, <laugh>, what does that stand for?

Dan Peluso (22:08):

So SETI is the search for extraterrestrial intelligence. And this is a non-profit, scientific, and, scientific education organization based out of Mountain View, California. And it started in, I believe it was in the, the eighties that a famous astronomer co-founded it by the name of Jill Tarter. Have you ever seen the movie contact with Jody Foster?

Mark Royce (22:37):

Yeah. Yes.

Dan Peluso (22:39):

Yeah. Yeah. It's based off a book by Carl Sagan, the same name

Mark Royce (22:42):

I saw the movie.

Dan Peluso (22:43):

Yeah, I saw the movie too. It's a really good movie. And that character played by Jody Foster was, was modeled, I should say, after Jill Tarter, who's a famous SETI astronomer. And the organization is dedicated towards the search for extraterrestrial intelligence in the universe. And this organization comprises of many different types of scientists from many different fields. So there is, and SETI this way of organizing our search through a quote unquote equation called the Drake Equation. Have you ever heard of the Drake equation?

Mark Royce (23:26):

No, I haven't.

Dan Peluso (23:27):

So, it's not after the famous singer Drake, but after the late Frank Drake, who also co-founded the SETI Institute. Um, sadly, he, he did pass away recently, but at a nice old age, and he had a wonderful career. And this equation was developed, I believe it was in, at a meeting in I believe, the 1970s. And Carl Sagan, I believe, was at this. And Frank Drake, he wrote this equation on the board to organize their thoughts and their best ideas of how we can conduct this search. How do we even do a search for extra terresterial intelligence?

Dan Peluso (24:11):

What the equation compromise --what's inside the equation are these different factors that are kind of a probability that allow us to get our best guess of how much life there could be. So you don't put in data into this equation and spit out a perfect answer. This is more of a really highly educated guess. And the different components of the equation include how many stars there are. So how many stars are there, like in our galaxy? Okay, How many of those stars in our galaxy have planets around them? How many of those stars in our galaxy that have planets around them are capable of supporting life as we know it? Then how many of those, et cetera, et cetera, planets that can support life as we know it, have life. And then how many of them have life that's intelligent? And then how many of them that have life that's intelligent are communicating that actually have these technology that allows 'em to communicate and are actually interested in communicating? And then the last part of the equation is one of the most interesting, and my perspective is the capital letter L.

Dan Peluso (25:25):

Can you take a guess what L might stand for?

Mark Royce (25:28):

I don't know.

Dan Peluso (25:30):

Life. So it's lifetime of though, lifetime of the civilization. So lifetime of the technological civilization. So if we have a intelligent technological and communicating civilization, how long do they last? And that's a really important one because, if we have all this life throughout the universe, and we have all this intelligent life throughout the universe, once they become technological, how long do they last after that? If you were to take a guess, how long do you think humanity has been technological,

Mark Royce (26:07):

Not very long,

Dan Peluso (26:08):

And communicating i

Mark Royce (26:08):

In the grand scheme of things.

Dan Peluso (26:10):

With communications,

Mark Royce (26:12):

What? Hundred and something years?

Dan Peluso (26:14):

Yeah. Yeah. A hundred, 150 years approximately. Right. And so we could talk a lot about the Drake equation's, really interesting. But the point is that this equation, all those different factors, there's different fields of science that can determine our best estimate for each one of those factors. Right? You know, the formation of stars in our galaxy. You know, you're gonna need astrophysicists that specialize in that. If you're talking about planets and exoplanets, you know, then you're gonna need astronomers that specialize in that. If you're talking about life, well, you're gonna need a biologist. You need chemists, You need geologists, Right? If you're talking about the lifetime of a civilization, you've gotta bring in some philosophers to talk about this, right? So you have all this, the synergy amongst all these different scientific fields, this multidisciplinary approach about trying to conduct this search.

Dan Peluso (27:09):

So we have scientists at the SETI institute, throughout the world from all these different backgrounds, but they're also very heavily involved in education. And I got involved with the SETI Institute through another serendipitous moment. I tend to, I'm very fortunate to have a lot of this serendipity in my life, and it's very exciting. But Carl and I were talking, when we first started planning my induction, if you will say, into my PhD program, and saying, Well, you need to build this team of supervisors, cuz we're gonna create this unique project for you of astrophysics and astronomy and education. And he said, oh, find a local astronomer that does some things with exoplanets. And I got an email within a day or so from the San Francisco Amateur Astronomers Association with an event that was coming up like in a couple days where this planetary astronomer from the SETI Institute was gonna be speaking. And the name of his talk was the next Pell Blue dot. And are you familiar with the Pale Blue dot from Carl Sagan?

Mark Royce (28:22):

It sounds familiar to me. Is it Earth?

Dan Peluso (28:25):

Yeah, It's Earth taken from the Voyager spacecraft from outside the orbit of Saturn. And from that vantage point, Earth appears as this blue pixel on a screen. And Carl Sagan very eloquently and poetically described Earth as, you know, small speck, you know, in the deep abyss of space where everyone who's ever lived or ever died, all of our wars, you know, all of our hate over love, everything has ever happened on, happened on this pixel. And it, and it's a very inspiring speech that he gave, which then turned into a book. So I highly encourage you and your listeners to look it up. And if you go on YouTube and search Pale Blue dot, you'll find some pretty cool videos that have nice visuals with it, and it'll definitely make the hair on the back of your neck stand up and give you some goosebumps.

Dan Peluso (29:19):

And it's, it's really nice. But, but that was one of the things that inspired me to go into astronomy and go back to school for science, and that's another story. But, but anyways, I was very, very interested about this email I got. I was like, Oh, this is cool. And he works for the SETI Institute, and I always thought the SETI Institute was really cool, you know, search for aliens, and that'd be a cool place to work one day, but never thought I'd actually work there. Right. And I told Carl about it just jokingly. I was like, Well, how about this guy? And he's like, Go to his talk and ask him. And I was like, No, I'm not gonna do that. And he's like, Just do it. And I was like, Okay. So then I did, and I listened to his talk and he was really interesting. Gentleman's named Franck Marchis.

Dan Peluso (30:00):

And he also had this telescope with him. This telescope is this brand new type of telescope that I'd never heard of or seen before. It's called the Unistellar Enhanced Vision Telescope, or Unistellar eVscope. And he talked about it and did a little demo of it afterwards. It's this telescope that's, it's a smart telescope that fits in a backpack, and it's completely controlled on your smartphone with an app. And you can look at deep space objects such as galaxies, nebulae, star clusters, and it collects scientific data, scientific data that you can use in the classroom. And so I told him about how I was starting this PhD and I was gonna have a heavy education lean to it. And he was interested and he wanted to talk more. So then he became a part of my PhD supervisor group along with Carl and Colleen and Brad and Duncan at Uni SQ. And then that did turn into me having a research job, with the SETI Institute, working with him and this Unistellar network. So, that's how it kind of came about.

Mark Royce (31:07):

So I was gonna ask you to go on and talk a little bit about the work with, that you help with at the SETI, UCAN.

Dan Peluso (31:16):

Yeah. So UCAN is the acronym for a project that I work on with the SETI Institute with a collaborator, Thomas Baito and Franck Marchis and other people on our Unistellar science team with the SETI Institute. So to understand, UCAN which stands for the Unistellar College Astronomy Network. Give you a real quick background on what Unistellar is. I already told you about the telescope, but it's, it's grown so much since that meeting with Franck back in 2019. It was kind of really at the beginning stages of its development. The SETI institute, they completed a I guess it's what mou, with, Unistellar. And Unistellar

is a telescope company in France. And Franck is one of the co-founders, co-developers of it. And their goal is to democratize astronomy. So if you think about our science classrooms and biology, what kind of instruments do you use to collect data?

Mark Royce (32:24):

Well, microscopes and, you know,

Dan Peluso (32:28):

So Yeah, yeah. Microscopes. What about, what about chemistry?

Mark Royce (32:30):

Well, they got gas spectrometers and <laugh>, you know, lots of different devices.

Dan Peluso (32:38):

Yeah. Or more simply even, you know, just beakers and chemicals. Right. Beakers and chemicals. Right. And physics, we have projectiles, right? Or, you know, earth science, we're gonna have rocks and soil and, you know, the just, I mean, you go outside and you got your lab, right? With astronomy, the universe is our lab and it is really hard, until now to collect that data to be used. So Carl and his GHOU team, were doing this by connecting teachers and students with remote telescopes. But for a teacher to actually have a telescope that collects data, they'd have to go and connect a bunch of special cameras to it and all this equipment and wires. And, you know, there are some very dedicated citizen astronomers that are very capable and create these elaborate setups. But 90, you know, maybe 99% of teachers aren't gonna do that, or not gonna be interested or not gonna have the time to do that.

Dan Peluso (33:37):

So the point is, is having that instrument, you know, getting a beaker and chemicals is pretty easy for most. Science teachers getting a microscope, Well, I don't wanna say it's pretty easy. Sometimes it's pretty hard, but it's a lot easier than getting a telescope that's able to collect the scientific data. Right. And it's much more common. You don't really see too many middle schools and high schools with telescopes that are able to actually collect astronomical data. Because it's been, the technology has been out of reach and been too expensive. Right? So this, this telescope, the Unistellar eVscope is a consumer telescope that's really easy to use, fits in a backpack, and it can collect the data. So we can, we can collect from asteroids and alting asteroids, planetary defense.

Dan Peluso (34:27):

We can even observe exoplanets, which are planets around other stars. And that data can come to be research level that is actually publishable and it has been publishable. And this network has grown to over 10,000 telescopes around the world. And we have many publications out now. And what we're doing is putting these telescopes into the classroom. And with the UCAN network, we, funded by a grant from the Gordon and Betty Moore Foundation to place them into community colleges. And we have over 30 community colleges in the United States where I work directly with the professors and helping them learn how to use a telescope and also implement it into their curriculum, into their teaching. And I try as best as I can to introduce them to modeling and I even tell them about modeling and invite them to modeling workshops and, you know, encourage them to do more inquiry-based, practices which this telescope can allow them to do.

Mark Royce (35:26):

Wow.

Dan Peluso (35:27):

Yeah. So that's what UCAN is.

Mark Royce (35:28):

Gotcha. So the reason I contacted you about doing this podcast is cuz I saw an announcement from the AMTA that you and Colleen were doing a modeling workshop coming up here online. A virtual workshop. And, so I thought it'd be good to share with our listeners about that and maybe have you talk a little bit about where you guys are going in that workshop.

Dan Peluso (35:57):

Yeah, I'd love to. So, so we first offered this, this course in the northern hemisphere spring. So, from January to May of 2022. And it's called astronomy Modeling with exoplanets. And we're offering it again this January, 2023. And it's a 45 hour distance-learning course. And it's very similar to a lot of the AMTA distance-learning modeling workshops. And it utilizes some of those initial activities and models that were developed in the 2019 workshop that I attended as a participant. But what happened is, Colleen and the other people on our teams that we work with, we worked on improving it because as we know with modeling workshops, if you consider our workshop as a model, right. And in modeling instruction, our model's never perfect. Right. We always wanna,

Mark Royce (36:58):

It's always improving.

Dan Peluso (37:00):

Yeah. We always wanna improve the model and that includes our workshops. So, you know, we took the feedback from the first workshop and I had feedback too cuz I was a participant and we tried to improve upon it and, you know, refine it and make it better. But since I specialized in exoplanets and exoplanet citizen science and that education, those education pieces involved with that, we themed the course around exoplanets. So, it has a lot of the same material, but it's also a little bit different. And, you know, we start with how do we map and measure space from Earth's perspective? Then we go into how do objects interact in space? And then how do we know about objects and events in space that includes light. So measuring light and that's how we can find exoplanets by measuring lights in a certain way. And then it ends with the evolution, fate of the universe, and the search for extraterrestrial intelligence. Cause that's exciting. And I think all teachers and students, and most humans that I know are interested in that question too: are we alone?

Mark Royce (38:07):

Yeah. Very cool.

Dan Peluso (38:09):

Yeah. It starts in January and enrollment's open now. We'd love to have you and you don't have to teach astronomy in order to do this. So it was a misconception that I had. So, great thing about science and modeling is we blow misconceptions out of the water, right? So astronomy, has a lot of, can be taught

through a lot of concepts of physics, but even in chemistry and biology or you, maybe you're not even a high school teacher. Maybe you teach community college or even you're a professor at a four-year university, or maybe you just wanna learn astronomy cuz you've always been interested, Right? Anybody can take it. Right. So, no matter what your background and interest in astronomy and for your reasons for taking, you're gonna get something out of it. And we are also gonna be connecting the teachers with the Unistellar network.

Dan Peluso (39:02):

So the network is very organic and is very excited about doing observations for education. So we did this the last iteration of the course, and we're gonna do it again, where teachers and their students, if they want to as well, will actually say, Oh, we want to get an observation of this exoplanet. We wanna plan an exoplanet observation. So I'll then, put that notice up on our communication boards with the Unistellar network around the world and say, Oh, I have a teacher in Maine, or a teacher in, in New Jersey or in California, and their students and the teacher, they wanna get an exoplanet. So then the network will observe it for them and we'll get the data for them and we'll teach the teachers how to do this in their classroom. So not only we're doing modeling, but we're also combining it with like this really focused project-based learning, uh, experience where they're literally doing science and learning from it. And sometimes this can even result in publishing or being involved in a published journal article. Which has happened already

Mark Royce (40:03):

Through the network. Now I want to just clarify, you said you have how many of these telescopes deployed around the world now?

Dan Peluso (40:12):

Over 10,000.

Mark Royce (40:14):

Oh my gosh. Okay. So you said that those telescopes will gather data

Dan Peluso (40:21):

Mm-hmm.

Mark Royce (40:21):

from what they observe. And is it all being funneled into some kind of master archive? Or is that what, how this is all working? So you have 10,000 telescopes around the world that are gathering data and combining all their known information that it collects. Is that correct?

Dan Peluso (40:40):

Yeah, more or less. Now, I will point out that not all 10,000 plus of those Unistellular eVscope users are involved in citizen science. So, when a citizen science observation happens from the network, we actually have a human being controlling the telescope. And a lot of users are just using this for fun or for outreach or just as a backyard telescope. But then there is a good portion of them that are using it for citizen science. And as an example, our network, we, we communicate them, communicate with them

through Slack. And on our Slack channel we have, I think close to like 1500, more, VITEL users that are dedicated towards citizen science.

Dan Peluso (41:34):

Yeah. And then, you know, a smaller portion of them dedicated towards exoplanets. But what happens is when users do observe an event such as an exoplanet or an asteroid or a comet, they will upload their data to the cloud. And the data goes into our cloud system, and then we have a science team that then processes that data and then gives it back to the citizen scientists. And in some cases, that data contributes to publishable work. And we do have publications that are out in press. So, for example, there's a really cool one recently that a colleague of mine, Ryan Lambert, led with, with Franck and some other people on our team and a bunch of citizen scientists where they observed the James Webb Space Telescope or JWST when it deployed. So they actually observed spacecraft, this is another citizen science project where they observed a spacecraft leaving Earth and observed it with the Telescope Network, and were able to create light curves and learn about its deployment, which also helps improve the space industry. So you can also learn about, space science and the space industry and collect data that can help improve what we know and do in our space industry and initiatives with NASA and SpaceX and stuff like that.

Mark Royce (42:57):

Yeah. That's really cool. Well, the course you guys are gonna start in January. Sounds very interesting. And so people who are listening, if they want to get involved with that course, join that course, they would go to the AMTA website, is that correct?

Dan Peluso (43:12):

Yeah, they can go to the AMTA website. There's also a Bitly, that goes to the registration page. It's, bit.ly slash 2023 astronomy. And I can share that link with you too, if you wanna put it in the show notes.

Mark Royce (43:31):

Yes, absolutely. That's very cool, I want to ask you, this is a complete side thing, but I know you're a songwriter and you do music as well as all this other cool science stuff that you do, uh, science musician.

Dan Peluso (43:51):

Yeah.

Mark Royce (43:51):

That's really cool. And I saw your name, your stage name is Conner Echo, Eko Echo.

Dan Peluso (43:59):

Eko. Conner Eko, Yeah. Yeah,

Mark Royce (44:00):

That's correct. But it's E K O, right?

Dan Peluso (44:03):

Yeah, Eko is is how it's spelled. And it's con c o n n e r. A lot of people spell it the O, but it's c o n n e r. It's for my middle name and middle name's O'Connor. My middle name is O'Connor. And then, uh, Eko comes from one of my favorite television shows, Mr. Eko from Lost

Mark Royce (44:22):

<laugh>.

Dan Peluso (44:23):

He's one of my favorite characters.

Mark Royce (44:24):

Wow. So do you have like a website or something where if people wanted to check out your music?

Dan Peluso (44:31):

Yeah, yeah. I, uh, write my own original music. I would say it's indie pop, indie singer songwriter. Some of my songs produced or produced with synthesizers and kind of have it like an eighties kind of sound to them. And some of them are more acoustic singer songwriter. And I do release music on Spotify and Apple Music and all the different places where people can stream music. And if you just look up Coner Eko at Conner Eko on all the social media or Conner eko.com or you Google it, you'll be able to find it.

Mark Royce (45:02):

Okay, cool. Well, that's awesome. Yeah,

Dan Peluso (45:04):

I have a new single that just released, It's called I didn't see you at all, and it's an acoustic track that I did live in the studio. So there's a version of me performing in the studio there, and one of my goals down the road is to do more, you know, science influenced kind of songwriting. And include some of the set stuff in there too. In fact, I do have a song that I've written that's kind of about the Drake equation and the lifetime of civilizations and about how all the ways that humanity's killing themselves from climate change to nuclear war, to mass extinctions and et cetera, et cetera, and how our cosmic perspective can help, hopefully inspire and inform us to be a better people to hopefully prolong our existence on this planet for us and for other life too. So I try to bring that philosophy into my music.

Mark Royce (45:49):

That was actually my next question, and you answered it without me having to ask it that do you tie the music and the science together and like, that's really cool.

Dan Peluso (45:58):

Yeah, and I'm working on a show, I'm working on a show that includes me doing a science talk as well as performing original music. So trying to maybe target science centers, to, you know, talk a little bit about SETI and our search for life and what that means to us, but then also perform some of my music as well.

Mark Royce (46:17):

Yeah. That's awesome. Very cool. Well, it has been very interesting talking with you today, Daniel. And, I really appreciate you taking the time to do this. It's it's been great.

Dan Peluso (46:31):

Thanks. I appreciate you taking the time to talk with me.

Mark Royce (46:33):

It's been great. And so we'll, uh, go check you out online and hopefully your new modeling course is going to have some cool impact in people's lives, and some teachers can, and others can grow from it. I'm really looking forward to seeing how that all turns out. It'll be fun to see how Thanks. You know, that goes Okay. Well, yeah. And.