Mark Royce (01:26):

Well, hi Paul. How are you doing?

Paul Sasso (01:28):

Hey, Mark. I'm doing well. Thanks for having me.

Mark Royce (01:31):

Yeah, I'm glad you're able to take the time to spend with us. It's really cool. And I'm looking forward to hearing more about your adventures in modeling, and I know our listeners are looking forward to it as well. So let's just dig in here. First of all, let me ask you, in your bio, I saw that you came from engineering into teaching. What caused that change to happen?

Paul Sasso (01:59):

Originally I had gone and then studied physics in college. And I was sort of a late bloomer, so I didn't go to college until my late twenties. Went to school, studied physics, and a little bit of engineering. And then when I got out of school, was planning to teach high school. That was what I wanted to do. And it was in the tech boom and there were lots of opportunities. So I ended up taking an engineering job, well, actually, it was a production job with Motorola at first. And one thing led to another. Ended up staying with that for a while and just sort of staying in the engineering track. Obviously the money that time was better than teaching, and so it was a little hard to jump ship. And then I just reached a point where the kids were grown, or grown enough and cut ties and went and got my teaching certification and got into high school teaching. Yeah.

Mark Royce (03:00):

That's cool. So you kinda came back to your original intent. That's really neat.

Paul Sasso (03:06):

Yes, I did. I don't regret it one bit.

Mark Royce (03:09):

And then you somehow discovered modeling. What led you down that path?

Paul Sasso (03:14):

My first teaching job, believe it or not, I was a substitute. I started subbing at a local high school, and there was an opening that became available for a physics teacher. And I had only substitute taught a couple of days in a biology class and in a freshman science class. And so within about two weeks, I found myself taking over for a teacher that taught honors physics, conceptual physics, and an environmental class. And I literally had just started taking my certification courses. So my start, the only thing I knew how to do was sort of fall back on what I remember from college, so I began to kind of administer my classes that way. Very, very traditional.

Paul Sasso (04:05):

Where's the book? What's the book? Follow the book. It wasn't until a couple of years later that I ended up with a permanent position. And then my department head was a modeler, or knew about it. I'm not sure how many workshops he took, but he suggested that I might want to take this-- the modeling workshops that were done here in Maine, down in Kennebunk. So that was sort of my first, of course I quickly did the research and kind of tried to discover what modeling, what it was all about. I had no idea

what it was about. And immediately became very interested in it. And went, took the workshop that summer with another teacher from the school. He was in the biology workshop and I was in the physics mechanics workshop. And just remember just really loving it and it just sort of clicked. There was a click.

Mark Royce (05:06):

That's cool. Who was your workshop leader?

Paul Sasso (05:11):

The workshops in Maine were run by Jamie Vesenka, and he's a physics professor at University of New England. But my workshop leader was Shannon McLaughlin. And I still to this day have my notebook from the workshop in my classroom. And I'm still opening it up every now and then going, how did we, you know, how did he start that lab? Or how did he start that activity? And I still refer to it, so.

Mark Royce (05:41):

Modeling workshops started out most primarily focused on the physics discipline. And other disciplines have been added along. And I know that one of the more recent ones is astronomy modeling. And I know you've been recently started teaching it. When did you start teaching astronomy, and then how did you get connected with that? What caused you to go into the astronomy thing?

Paul Sasso (06:14):

I was, after my modeling in physics, I was mostly teaching physics. I was teaching actually all three levels at our school. And then somewhere around 2020, well, that 2021-22 school year, one of the teachers at our school was looking to offload an elective that he was teaching. We had an astronomy elective, and he'd been teaching that for some years. And he was ready to pass it on and let somebody else take it. And so I raised my hand, which, I wasn't quite sure at the time that I should have done that. 'cause I had never taught astronomy, and I knew a little bit of backyard astronomy. And that was it.

Paul Sasso (07:00):

But I took that on and that was '20, maybe the fall of '21 and the first astronomy with exoplanets modeling workshop taught by Colleen and Dan Peluso, that was in the spring of 2022. So I managed to get through that first semester, based on the old curriculum that I inherited, which was very standardized. It was very starry night driven, online simulator and worksheets. And so I saw that the astronomy modeling workshop was available, signed up for it. That was my introduction to Colleen, whom you know, and whom everyone knows I'm sure in the modeling world, and Dan Peluso, who's been on the modeling talks as well.

Paul Sasso (08:01):

So I was there as a student and it instantly transformed my class that I was currently teaching. Because here I had in front of me the resources that they produced, and that you acquired during the course. It's just incredible. So I immediately started incorporating. I would get something on Thursday night, in our three-hour workshop, and then I would be doing it on Friday, trying some of it with my kids on Friday. So for me, not really having the resources and kind of stumbling along at first, the gates were opened up and I was just like, oh my gosh, thank you. I have all this. And it was really great hands-on stuff. And it was so modeling oriented that it was a good fit. I kind of had that in my teaching psyche already. And it was great. It was definitely life-changing for my astronomy stress levels and and teaching levels. And again, I was learning it at the same time because I really did not know much about astronomy. So I really was learning it and then rolling it out the next day or the next week with students. So it was pretty exciting. It was a little exhausting, but it was pretty exciting.

Mark Royce (09:30):

That's really neat. So I assume that you would recommend that if there are people who are looking at teaching astronomy or who are teaching astronomy, that they would get connected with the modeling workshop for astronomy?

Paul Sasso (09:46):

Yes, definitely. I developed a bit of a relationship with Dan. In his modeling talk, he talks about his citizen science network and the work that he's done with Unistellar in creating their...use of their Digital telescopes. Yeah. And so during that first, during that first class, and Dan was working on his PhD at the time, and we used my students to take some of his survey data. So I administered pre- and post- surveys with my kids. He helped me get a telescope actually for that, a loaner telescope, a digital telescope to use with my students. And we went all the way down the road observed an exoplanet transit and did some real citizen science. So Dan was great. And he helped me along the way. I would leverage him from time to time. We would have some one-on-one Zooms, and he would help me build curriculum and help me build activities for the students.

Mark Royce (11:07):

I remember Dan talking about, if I remember correctly, it was like crowdsourcing, discovery from all of the different schools that were employing these digital telescopes and aggregating together the information that was being discovered and actually getting it published And participating too, Have you been involved with some of that?

Paul Sasso (11:32):

The data that we collected ended up not being the best set of data. But everyone would observe the same exoplanet transit, different places, multiple telescopes. The data would all converge, into Unistellar's servers. And they would aggregate all the data, put it all together, and try to build a light curve from the transit. And then Dan did use that data in a paper that he published. And in that paper were many, many, many high school students. So you can imagine, these high school kids having their names mentioned as contributors in a scientific paper.

Mark Royce (12:19):

That's exciting.

Paul Sasso (12:19):

Yeah. Very exciting. So we did that on a smaller scale, but I believe he did use, my kids did surveys for him. There were a couple of them on their knowledge of astronomy, sort of a pretest, what do you know? And then at the end of the semester, we did an exit survey of the same, and there was also another survey that asked them about just their interests in space science and their career interests and student attitudes. And so I think he used that data that went into his paper, into his PhD as well, on surveying high school students. So it was a fun ride. And then after the first year, I raised my hand.

Paul Sasso (13:07):

They were looking for folks that might wanna help out the next year. So the 2023 class, I became a very old intern, and there were a couple of us, and was able to essentially take the class, but help out a little bit. At first, there was a covert activity, so nobody knew that I was an intern. So I came into the class and joined lots of the groups and a lot of the breakout sessions as a student and helped out a little bit. And then I took the course again as an intern. And then that summer, which was the summer of 2023.

Paul Sasso (14:00):

I was invited to ASU to participate in the workshop leader workshop that they have. And so that was a week in Tempe with a bunch of other modelers, which was awesome. And we were all trained to lead workshops. And it was great fun. The week was with Colleen and Larry Dukerich. And they were our leaders for that workshop. And at the time, there were other workshops going on in the same science building. I don't remember the name of it. But there were computational modeling workshops going on, electricity & magnetism, mechanics. And so as workshop trainees, we were able to sort of go in and observe actual workshops that were happening, even if they were out of disciplines that we normally did.

Paul Sasso (15:06):

And we got to meet... Jane Jackson was there. We got to meet Jane, we got to meet, and I always pronounce his name, David. Hestenes, the founding father. We went to a little mixer at a local brewery. And there were other founding modelers there. Swackhammer, all the people that I had been reading over the years, reading their original papers and their publications. So it was really pretty crazy to get to meet some of them and sort of thank them and have a beer with them. That was a lot of fun.

Mark Royce (15:59):

You're gearing up then to actually lead some workshops in the future?

Paul Sasso (16:03):

So, currently, right now. So the 2024 version of astronomy modeling with exoplanets started in January. And so I am co-teaching that now with Dan, with Dan Peluso. So Colleen gets a semester off. As I told you, she's been drawing me in slowly. And so she's gracefully stepped aside and had me trained up so that, Dan and I are now co-teaching that class. So we're about halfway through it. It goes until the first week of May. It's Thursday nights, three hours, seven to 10 Eastern time. We've got about 14 folks. 14 students. And the crazy thing is that some of these teachers that are in the workshop now have way more astronomy knowledge than I do. There are people that have been teaching astronomy for a long time, but I believe the course has so much to offer, and just the different approach to it and the use of real data and the use of very current, real relevant, data science activities for the students. So there's a lot to be had. a lot to be taken away from it, no matter what your level, I think.

Mark Royce (17:28):

So are you only teaching astronomy now, or are you still also teaching physics courses?

Paul Sasso (17:34):

No, so currently at my school, I teach three levels of physics. And I teach a semester. So I've taken this astronomy modeling with exoplanets, and Dan and I both at our schools, he's teaching at high school as well in California. We call it modern astronomy. Currently in my school, I teach a foundations levels physics course, which is for kids that're not the most jazzed on science. And, and their math skills are maybe a little bit lower. So it's very super conceptual course. I teach an academic level course, which is sort of that college bound, not necessarily destined for a STEM career, but certainly still want to take a full four years of science in high school, but are college bound generally. Or community college bound. And then I teach an advanced class, which is a concurrent enrollment class with our local community college. And so that's pretty rigorous. It's not calculus-based, it's still algebra-based, but for the kids that definitely know where they want to go for a science or engineering, after high school. And then the astronomy class.

Mark Royce (18:58):

Yeah.

Paul Sasso (18:58):

So it's a dream job.

Mark Royce (19:00):

That's great, man. So let me ask you, employing modeling techniques in an astronomy classroom versus in a physics classroom, what are the differences? I mean, do you employ basically the same kind of approach, or are there differences between the way you approach the classroom with modeling?

Paul Sasso (19:25):

Yeah. I think at the very high level, they're the same. One of the things that piqued my interest with the astronomy, that there's a certain nuanced approach to modeling with the astronomy. You still start with a sort of an introductory or what they call a paradigm activity, with demonstration and asking questions. And the astronomy, the next steps in building the model with the astronomy course, they just, I don't wanna say they're more engaging, but they employ a little bit more of the real world, because all of a sudden we might be using a bit of software and doing photometry with real images of celestial objects, so there's a, I'm trying to think of the right, you know, the right word.

Paul Sasso (20:23):

And I don't wanna indicate that like physics modeling is in any way less exciting, but you're still running carts down tracks and doing experiments with friction and looking at other phenomena where it might not be the most exciting stuff for kids to see in a classroom, but it's good solid physics. And with the astronomy, you get a little more awe out of the kids because you're talking about big things, you're talking about light years, and you're talking about images that are just so huge and so far away, and just kind of a little bit more mind blowing. So, um,

Mark Royce (21:18):

More wonder,

Paul Sasso (21:19):

Yeah, kind of. It kind of sticks a little more, I think, with the students. But I would say it is a little bit more difficult in other ways, and you do, in the astronomy piece, I think all of us as modelers, we try to stay in that modeling trajectory all the way through a particular lesson or unit or topic. But there are times when we come out of it and we maybe are a little bit more prescriptive, or we are a little less Socratic, because sometimes you just need to get a message across, sometimes you just need to get into the lecture mode a little bit. I know we all probably go back and forth.

Paul Sasso (22:07):

And I would say in the astronomy, there are some parts of it that you lapse into more of a prescriptive mode. And sometimes it's nice just to build an activity for the kids. And Dan Peluso has done a lot with this. He's built some really great activities, but they tend to come out of the modeling "model" a little bit, a little bit more than you'd like to at times, but it seems kind of necessary because there just needs to be a little bit of practice, a little bit of, this is how you do this, because some of the tools we're using are tools that the students really haven't used before. And are actually tools that real astronomers use in terms of analyzing images and robotic telescopes and requesting images and things like that. So yeah, some differences for sure.

Mark Royce (23:03):

So for schools that are teaching astronomy, and especially if they are using the modeling approach, is there like an investment of equipment and stuff that becomes involved, with having to procure some funding or...

Paul Sasso (23:18):

Not to start. You certainly don't need it to start. I was able to use everything in my physics classroom, plus a few things here and there, to get started with it. Nothing is super high dollar in order to get started. You can certainly-- there are different pieces of equipment and you can build class sets of different setups for celestial spheres and other demonstration devices. You can certainly do that. And there's lots of information in the curriculum resources. The other thing that Dan and Colleen did initially was they developed so much. And, you know, piggybacking, I think off of the original astronomy workshop that was done in 2019, they built this just massive collection of resources, both digital, and then in those digital resources, the ability to acquire different types of pieces of equipment, construct different types of pieces of equipment for yourself and for your classroom.

Paul Sasso (24:35):

The ultimate sort of expense or the largest expense that you could be driven to, is our telescopes. And as I said earlier, Dan facilitated my borrowing a Unistellar EVSCOPE for my classroom. The first semester. And the last couple of years I've been working with someone in my district and just recently was able to order two brand new Unistellar odyssey scopes, digital telescopes. For my classroom. Which is huge. So this will get us using the telescopes, gonna put together a program where kids can check out the telescopes. They might be able to take a telescope once they pass a little training class that I'll put together. They'll be able to take a telescope home for the weekend and do some of their own observing. And we have a couple of other students that are interested in doing some independent study. So we're hoping to get those kids going on one of the citizen science projects with Unistellar. So that's a big expense. They're not inexpensive. Unistellar, the company, has been great. Dan facilitated getting us a little bit of an educational discount, which was great.

Mark Royce (26:03):

I think he mentioned that when we were talking on his, the broadcast I did with him.

Paul Sasso (26:11):

Yep. 'cause he mentioned that in class too. He mentioned that to other teachers, you know, see me if you think. So that was nice. I haven't received them yet. They're actually, hoping to get them a few days before the eclipse, so I can set them up for for solar eclipse viewing. In terms of teaching astronomy, we're in Maine, we're in the path of the eclipse. Totality through the state is a couple hours north of us,

Mark Royce (26:41):

Which is happening when?

Paul Sasso (26:43):

This is happening April 8th. A total solar eclipse starts down in Mexico, in terms of continental US and comes across the country through Texas, through the Midwest, and then exits through Maine, and Quebec. And the line of a hundred percent totality is north of us, a couple of hours. Where our school is located, it's still gonna be 97.4%, um, total. So we're hoping to set up some viewing and have some activities. Hopefully it's not cloudy.

Mark Royce (27:21):

Yeah.

Paul Sasso (27:24):

But for me, the astronomy piece ...and physics is my thing, but sometimes I get a little guilty, I feel a little bad for physics, because I'm having so much fun with the astronomy.

Mark Royce (27:38):

You're cheating.

Paul Sasso (27:41):

Yes. That's exactly it.

Mark Royce (27:45):

So is there some fun exercises? Have you done something that's really fun with your kids in your astronomy classes? I don't know, an exercise that was particularly

Paul Sasso (28:00):

Yes. There are many. I mean, one of them, just recent. So my semesters at school, I have one semester that's mostly freshmen, ninth graders, and then my next semester is mostly 11th and 12th graders. So I, and again I'm still working this out, changing things every day, but, so, you know, teaching that the same material to ninth graders, is a little different than teaching it to juniors and seniors. So there's a different math level and a different maturity level and so whenever I'm able to do something with my ninth graders that I've done with my 11th or 12th graders, I get really kind of jazzed about that. I have hope, I have hope for humanity <laugh>, um, to get to ninth graders sometimes who are still, a lot of them are still in middle school.

Paul Sasso (28:56):

But recently I did an activity with them where we requested images from a robotic telescope, from micro observatory robotic telescope. They went in and created an account, requested images, they were able to pick different-- there was a catalog-- Andromeda and M 51, or the crab nebula, the moon. They picked different objects and they had the images sent to them. And then we used those images to do some real live photometry where, just like regular astronomers, they received three different colored images. So they were images with a red filter, a green filter, and a blue filter. And they were able to take those images. And these are fits files, which are not viewable in any normal JPEG or PNG viewer.

Paul Sasso (29:51):

These are fits files that come from the telescope. And we walk the kids, they walk through downloading the images, getting them into the special viewer called JS nine. Working with them individually, the images, individually preparing them, and then putting them together and coming up with a colored image. The images that we see, that they see all the time in the news and in the media, from James Webb most recently, but also Huble and other telescopes, those are composite images, those are layered images. Those are images that are made to be very pretty and colorized, in our visible spectrum, or enhanced at least. So they were able to actually go through that process and came up and colored their own images and put them together and did some sort of real junior astronomer work.

Paul Sasso (30:47):

So that was fun. I could tell they kind of got into that. There are other things, and I know Dan has done this more with his students, that was more of a computer driven activity. One of the things we do early in the course, the first part of the course is based on ancient astronomy. And so there's a little walkthrough astronomy in different cultures, different civilizations going back many, many years. And one of the first discussions is-- it's Carl Sagan, who I'm sure you're familiar with. Carl Sagan had the original series Cosmos back in the late seventies, early eighties. Which was sort of my-- he was my Neil deGrasse Tyson, I suppose, with the Cosmos series.

Paul Sasso (31:43):

I was just getting outta high school then, to date myself. But the kids know about Neil deGrasse Tyson and Space Time Odyssey and his Cosmos series. And so in the first episode of Cosmos, Carl Sagan, after his little introduction, he starts to talk about ancient astronomy, and he talks about Aristostenes, the scientist philosopher who came up with the measuring the circumference of the earth, or essentially coming up with the premise that the earth is round, that the surface of the earth is curved. And he references in the show about Aristostenes, and I don't remember the names, and I'll probably mess this up a little, but in a well, at a particular time, the sun is shining straight down into the well in one location, but then in another location, so many kilometers away, there's a shadow created on another tall object.

Paul Sasso (32:45):

So using that information, and the phrase is, using only his brain, sticks, and feet, that as he pays someone to pace out the distance from, from...why am I not, why am I blanking on the name of the, well, the city that the well was in, that he, brains, sticks, and feet, he determines the circumfrence of the earth to a fairly well known percentage of maybe, I don't know what it is, maybe three or four or 5% of the known value today. So there's a great activity with the kids where you can do that. And they actually are outside with meter sticks, measuring shadows, and then they take their data and they use a sister city somewhere else and look at their data at noon, and then they do, they learn all the, all the trigonometry and geometry and a little bit of math that they need to actually calculate their circumference of the earth. And when kids are able to do that, and some of them have not had any trigonometry yet, or maybe are just in geometry, when kids are able to do that, they're pretty happy with themselves, you know? They're pretty proud of themselves.

Mark Royce (34:03):

That's cool.

Paul Sasso (34:04):

So that's a fun one too. And that's a great outside activity.

Mark Royce (34:08):

That's great.

Paul Sasso (34:12):

I could go on.

Mark Royce (34:13):

Oh, I know it seems like there would be a wide open door for like, some very cool activities for the kids. I assume that your workshop in May --was it May that you said, or April?

Paul Sasso (34:30):

January, yep. January to May. So the astronomy modeling with Exoplanets, it started with, the modeling with Exoplanets workshop started in 2022. So it was all online. So it was still during the days of doing everything online. So Dan and Colleen developed it, and it was a 45 hour workshop. So it's not a traditional modeling workshop where you're there for three weeks. Or two weeks. It's 15 weeks, three hours a week. And it's retained that online version, that online concept, it has not been offered in person yet, but that's something that we've been talking about, to have it in a summer lineup perhaps, and do an online, and then it might be a two week workshop or a three week workshop like that. But currently it's only in the online version.

Mark Royce (35:22):

Okay. And is there like, resources for astronomy teachers at AMTA's website to, get stuff for their classroom? Like some of the stuff, Dan posted stuff and you and whoever Colleen?

Paul Sasso (35:38):

Well, in the curriculum, right. In the materials section on the website there's astronomy curriculum that came out of the first 2019 astronomy modeling workshop. The astronomy modeling with exoplanets material that it, that moved forward to incorporate some of the new things that I do not believe is loaded onto the, onto the AMTA website. Yet. And that is something that needs to be done. I know that Colleen and Dan are working on that. When you do take the workshop, you do get access to a Google drive from Heaven with all of that great stuff on it. After you've taken the workshop, so, yeah.

Mark Royce (36:23):

Wow. Well, I have a feeling we could talk for another half hour or so pretty easily about all the stuff in the information that you have and, I think we'll need to do another podcast that focuses on astronomy.

Paul Sasso (36:41):

Yeah. That would be great. Yeah.

Mark Royce (36:43):

It's been really awesome talking with you, and you've shared some great stuff and your personal journey has been wonderful. Let me just say thank you, Paul, for taking time to do this. This is really great, and it's been great meeting you. I've enjoyed it very much. Everybody, go to AMTA check out, you can go to science modeling talks.com and that'd be a great place for you to find, listen to Dan Peluso's podcast, where he talks more about astronomy stuff, some very cool and interesting information from him at sciencemodelingtalks.com and support AMTA. It's a wealth of resources. Thanks. Thanks, Paul.

Paul Sasso (37:35):

Thanks, Mark.