Transcript: An Interview with Dr. Tyler Nordgren
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Speaker key

BV: Brian Ventrudo/AstronomyConnect.com
TN: Tyler Nordgren

BV: This is AstronomyConnect.com. My name is Brian Ventrudo and my guest today is Professor Tyler Nordgren of University of Redlands. Our subject is solar eclipses, a topic which Dr Nordgren covers beautifully in his book titled Sun Moon Earth: The History of Solar Eclipses from Omens of Doom to Einstein and Exoplanets. We'll talk about his book today and about how solar eclipses have influenced the path of civilisation from ancient times until today. We'll talk about a few of his experiences observing total solar eclipses, and we'll get some advice about how to see the upcoming solar eclipse across the United States in August 2017.

Dr Nordgren is an astronomer, professor, photographer, author and an artist. He is a full professor of physics and astronomy at the University of Redlands in Southern California. Among other things, he helped develop the extraordinary Mars Dials carried to Mars aboard the Spirit Opportunity and Curiosity rovers. Most recently, Dr Nordgren is working to develop a meter class telescope system based in Great Basin National Park in Nevada to look for planets transiting across the disk of stars which will be an important installation to confirm exoplanet detection from space-based telescopes such as Kepler and its successor, the upcoming TESS satellite, which will monitor more than 200,000 stars for exoplanet transits.

Professor Nordgren holds a BA from Reed College and an MS and PhD in astronomy from Cornel University. I hope you enjoy the interview. Hi Tyler, thanks for joining me today at AstronomyConnect.

TN: It's a real pleasure, thank you.

BV: Now I want to talk here about your excellent book, Sun Moon and Earth. It combines a survey of the history of eclipses back into prehistory almost with an overview of the science of these events, and also with your own personal reflections, seeing total solar eclipses for yourself. Now it's not like you're not busy already, so what motivated you to write this book?

TN: I was nine years old, up in Portland, Oregon, when the last total solar eclipse that touched the continental United States passed over, but at that age of nine years old I could have just gone outside and seen this total eclipse. But I was so terrified by all the news that if you looked at the sun you'd burn your eyes out that I actually hid in the house with the curtains drawn. So it's been something... I've been looking forward to this eclipse pretty much ever since 1979 and one of my goals is to make sure that there aren't any other children out there that have the same fear and thus miss out on this amazing experience that I did.

BV: Yes, I remember that eclipse, I had a similar experience. We were also locked in the house for that one, and for some eclipses earlier, in the '70s also. Now and you're talking about now... You're looking forward to the 2017 eclipse, of course.

TN: Correct. It's something that... It's been 38 years since the last time a total solar eclipse has touched the continental US and it's a pretty large drought and finally it's about to end.

BV: Yes, it's going to be quite a show. We'll get into that in a second, but talking about your book, the early part of your book talks about how solar and lunar eclipses were viewed in the ancient world. Of course, many ancients were terrified of eclipses, especially totally solar eclipses when everything went dark for a few minutes. But other ancients took a different view of these events. What are some ways the observations of eclipses affected the thinking of ancient civilisations?

TN: The wonderful thing about astronomy is that the sky is regular, the stars come back each day, the sun rises each morning. And so in this random world of chance events, weather, storms, plague, the sky was something that was regular and ultimately predictable. And when you think of the origins of what would become science, science only works if you can make predictions. And those predictions happen. A chaotic world, a fully chaotic world, and no science every comes about.

So things like eclipses, solar eclipses and lunar eclipses, if you could predict these otherwise terrifying events, that tells you that you know something about the universe. And it allows you to begin to draw information out about maybe a calendar and a calendar that allows you to, say, celebrate events, passage of time, the... Your dear leader or religious experience. This is something that's important for developing civilisation.

BV: So over time, as they discovered the regularity of these events or, to some degree, their predictability, what are some discoveries or insights that were made by ancient astronomers? For example, by the Chaldeans, or the so-called Beaker people at Stonehenge, or the ancient Greeks, or even medieval Arab astronomers. Were there any significant discoveries other than the predictability of these things with a regularity?

TN: Well because of that regularity, I mean, that's the first thing. If you're the type of civilisation that goes out and day after day, morning after morning, looks at where the sun rises, looks at the moon, where the moon rises, you will eventually hit upon these [inaudible]. The numbers of days that pass between eclipses. And at that point you can start to figure out what the year is. The cycles of the moon. And you then begin to figure out, okay, the moon has these different cycles that only over I'd say an 18 year period allow these patterns of eclipses to reproduce. And it's called the Saros cycle.

And once you do that, then you begin to be able to predict these otherwise terrifying events. And if you think about these... The awesome spectacle of the moon turning blood red, or the sun turning black at day, to be able to predict these, in part some sense of order, at least power... Say you're the court astrologer, if you're the court

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astrologer to the king, that king is going to need to be able to say that, well, the moon has turned red because the folks opposing me are bad and they're going to be defeated. If you aren't able to say that, then maybe your opponents are able to say, well, the moon has turned blood red because the king is evil and needs to be deposed. Literally it becomes the difference between does your kingdom continue or are you overthrown? And that's power right there. And that's a very important thing.

BV: Interesting. So knowledge of the heaves is power in this case.

TN: Exactly.

BV: Now by the late 1700s, so this is thousands of years later, thanks to Isaac Newton, and others, of course, astronomers had the predictability and the timing of eclipses down pretty well. But it was less clear what solar eclipses revealed about the sun and the moon themselves. This changed, at least in part, with the work of the English Astronomer Francis Baily in the early 1800s. He was an interesting character. I didn't really know much about him and your book was quite interesting. Tell me a little bit about Baily.

TN: So he was this fellow who was very good at science and wanted to go out and learn about the world. And after graduating, essentially, from school and his apprenticeship, he set off for America and had this amazing series of adventures that looked like they could have been something out of a Jack London experience or Treasure Island. He was literally in a shipwreck in the Caribbean, he makes his way to the mainland, he travels overland to New Orleans from the East Coast, and then decides to hike back through at that time Indian infested country. So all of these things and writing back to his friends and family in England, he's having the adventure of a lifetime.

And by the time he finally returns to England, he wants to continue this. He wants to go off the East India Company or set off to Africa or perhaps discover the geography of that continent. But none of it works out. And eventually he has to take a job in banking, and yet, through his mathematical mind he's able to impose mathematical equations on banking and finance. And really is the first person to do this.

BV: He was a stock broker, right?

TN: Yes.

BV: A mathematical stock broker if you will.

TN: Absolutely. And so he makes his fortune, but because of his scientific interest which has never really left him, he turns his eyes slowly back to astronomy and to eclipses. And so begins to do things like say, calculate what some of the earliest known eclipses might have been, when they happened, where they would have been seen. And eventually, when he'll be able to see the next one. And this is one of the things that makes him special because he realises there's a couple of eclipses, solar eclipses coming up. One is an annular eclipse where the moon is a little too far to totally cover the sun and so a ring of fire is left. And that's going to happen up in Scotland. And then a few years after that there's going to be a total eclipse in Europe.

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And so he, with his telescope, sets out to observe these, and to observe these from a scientifically rigorous standpoint of making observations and recording what he sees in real time. As opposed to just say what had happened before where people would go out, an eclipse would happen, and after the fact they'd write down whatever they remembered. So he's actually making scientific observations in real time with his telescope.

BV: So... And it's more than just a matter of timing, and the eclipse happened or not. He was actually watching it very closely to see what he could find out about what was happening.

TN: Exactly. Previous folks who would time these could use the timing of eclipses, when did totality begin, when did totality end, they could use those timings to say refine the orbit of the moon, or to identify the precise longitude of where they were on earth. But his observations were meant to learn about the moon and sun themselves, and that's really different.

BV: Right. And of course he is... We still use his name today, he was the discovered of what we now call Baily's Beads.

TN: Right. So what happened, this is what he first noticed up in Scotland, was that at the last moment as the moon fully moves in front of the sun and you get this full ring of fire around it, in that last instant as the ring forms, he saw the light of the sun break up into a whole bunch of little beads for a second, and he wasn't totally sure what the cause was. And he wasn't quite sure if this was something that always happens. So he made plans for the next eclipse, the total eclipse that was going to happen in Southern Europe, to go and watch it.

And he observes it from Italy, and he sees the same thing, these beads caused by sunlight, shining down the mountainous valleys along the edge of the moon. But more importantly, as it becomes total, as the moon fully blocks out of the light of the sun, he sees the corona, that sun's outer atmosphere, and he's blown away by that.

BV: Not long afterwards, Baily's work was augmented by the invention of photography which made for a powerful tool in all astronomy, of course, but also in studying solar eclipses. So the first expedition of photographing an eclipse was by Warren De la Rue in 1860. I guess a few decades after Baily. What was he hoping to discover about the sun and moon with photography?

TN: One of the things that Baily's observations had revealed and emphasised was that during totality you see the corona, you see this ghostly aura around the combined sun and moon. You also saw these red flames, they were called flames, it's what we now know they're prominences, eruptions of hydrogen gas off the sun. Both those phenomena, Baily wrote about, and... But it was unknown if those were phenomena that were associated with the sun or the moon. You only ever saw them when the sun and moon aligned. So it could have belonged to either one of those bodies.

With photography, for the first time, you A, didn't have to depend upon the artistic ability of the astronomer, and B, you could record something that could be studied in-

depth by anyone later. So De la Rue watched as the moon passed in front of the sun, he photographed the corona and these prominences both at the start of the eclipse and at the end of the eclipse. And during those two photographs, between those two photographs, you could actually see that it was the moon moving across the corona and prominences and that revealed that they were associated with the sun and not part of the moon. And therefore, because we knew that the sun was much, much farther away than the moon, these prominences and the corona had to be huge. They had to be enormous. That they utterly must dwarf the earth in size.

BV: Right. It's amazing to think of, I mean, that was only 150 years ago and before that we had no idea what this light was coming from.

TN: Exactly. And so in the mid-1800s at the time that chemistry is really coming about and the idea of spectral lines, that you could determine the chemical composition of something by looking at the light that it gives off, this got wrapped up in astronomy. And for the first time, astronomers could look at the light coming from these prominences, or look at the light coming from distant stars, and begin to measure the composition of these distant bodies. And that's where astronomers first learned that the sun was made of hydrogen. And there was this new element, helium, that had never been seen on the earth before, and so it was named after the sun god, Helios. And we discovered helium on the sun 25 years before we ever discovered helium on the earth.

BV: Right. This was the same time, roughly, as the advent of spectroscopy in the mid-19th century too.

TN: Exactly.

BV: Now you have a full chapter in your book about the eclipse that changed the world. This was the eclipse of May 29th, 1919 when the great British Astronomer, Arthur Eddington, was sent to test the controversial new theory of the German physicist, Albert Einstein. Now this was right after the bitterness of the First World War when British scientists were inclined to reject Einstein's theory. But the theory did explain a strange feature of the orbit of the planet Mercury. What was Eddington's mission?

TN: Eddington, during World War I, was one of the only European, or at least British astronomers, who believed that Einstein's theory of general relativity was correct. He was eager to popularise this, to spread the word of this new physics. But in order to do this there needed to be a conclusive test of Einstein's prediction that mass should warp the fabric of space, which would cause light to bend as it passed by a mass of object. For instance, the sun. There'd been some attempts by Einstein and other German astronomers, in fact other astronomers from both the United States and South America to test this phenomenon by looking at the position of starlight around the sun during a total solar eclipse when the sun becomes so dark that you can actually faintly make out the stars that are behind it.

Unfortunately, with the outbreak of World War I, all of these attempts failed. In some instances the German astronomers who had travelled to Crimea to observe this total solar eclipse at the outbreak of World War I suddenly found themselves as enemy

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aliens in Russian territory, and so they were arrested and all their equipment confiscated. In other instances, the weather was bad, and it rained in South America. In other instance there was a total solar eclipse in the United States in 1918 but at that point the American astronomers had actually had their equipment confiscated by the Russians during the outbreak of World War II.

So it was the absolute worst time, literally, on earth, to try to do this international experiment to test a German's hypothesis.

BV: Right. And so he didn't evade the First World War, but he was a pacifist. He was a Quaker, was he not? Eddington?

TN: He was. And as a result, this was a very bad thing to be in England at the time. Imagine how devastating World War I was for everyone involved. The British and French soldiers, the entire generation was being destroyed on the battlefields of Europe. So to claim to be a pacifist was the worst possible thing you could say because it meant you weren't going to go off and defend your fellow countrymen. Well, the colleagues of Eddington managed to come up with the explanation that he had this special knowledge that if, at the next eclipse, he would alone have the knowledge necessary to go off and test this special hypothesis.

And so as a result, they needed to make sure that when the 1919 eclipse came along, Eddington and the Royal Observatory and Greenwich Observatory could actually mount this expedition to test Einstein's prediction. And by the end of World War I which had ended just a few months earlier, it turned out that they alone, of astronomers worldwide, they alone happened to be still prepared and equipped and able to go off and test this hypothesis.

BV: Yes. I mean, he was one of the few who understood general relativity, Eddington that is. It would have been a shame if he was sent off to be an infantry officer.

TN: Exactly. And so when this happened, Eddington and the Astronomer Royale, they put out notices to the popular press, to the scientific literature, that this needed to be investigated. And in order to help spread the news of this they prepared both the public and their fellow scientists with what the general theories predictions were about light so that when the experiment was done people already knew what this complicated theory was trying to explain. And so they essentially prepped the public and their colleagues to understand the results they were preparing.

BV: Yes, I found that extraordinary. Of course when the discovery was made, when his results were analysed, this made front page... The front page of newspapers all over the world, but I had no idea that they actually did background work to prepare the press. I mean, it was a very unlikely idea that the sun could bend light, or any body could bend the path of light, of course.

TN: It made very little sense, and you can read the writings of even some of the folks involved with Eddington who said that they had to admit that they didn't even completely understand the mathematics of this new theory by Einstein. So as a result, there was a concerted public relations effort put out ahead of time so that when these

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results came in everyone could understand what they meant. And also, at the same time, the newspapers would pick this up.

And so by the time they were ready to announce their results, the Times of London and even the New York Times in America were ready to run with this incredible news.

BV: Right. And the New York Times had the extraordinary headline that the lights are all askew in the heavens or something along those lines.

TN: Exactly. And it made Einstein into the legend that he is today. Prior to that he was recognised as brilliant and that his general theory was a tremendous advancement in human understanding. But if it hadn't have been for the public press, he would not have entered the mind of laypeople everywhere. And so today when we think of a brilliant scientist, we all have this crazy-haired moustachioed physicist, we have this caricature of Einstein in mind. None of that would have happened if it hadn't have been for the New York Times and the Times of London carrying this news.

BV: That's fascinating. Now your book talks about many of your own personal experiences, chasing solar eclipses. Now other than your near miss in 1979, what was the first total solar eclipse you observed successful and how did it affect you?

TN: I was a PhD astronomer by the time 1999 rolled around and I was at a conference in Budapest in Hungary that just happened to be scheduled at the same time as the 1999 total solar eclipse over Europe.

BV: How fortuitous.

TN: It was amazing, and I fully admit it was one of the reasons I wanted to go. But it just so happened it was a conference on pulsating stars which actually happened to be in my research area at the time. So I thought, well hey, this is a literal alignment of the heavens, so I'll go. And on the day of the eclipse the conference organisers put us in a bus and had us drive south into the path of totality. Which was fortunate, because it was cloudy, almost everywhere across Europe. But there was a break in the clouds in Southern Hungary and we in the buses were able to drive right into that clear sky. And I got to finally see a total solar eclipse 20 years after I had missed it when I was nine.

And it was more beautiful and astounding and awesome in the awe sense of the word than I could ever have imagined. The hairs stood up on the back of my neck. It was the moment of a lifetime.

BV: And you were hooked.

TN: Absolutely. And it is something that in talking to others who've seen a total solar eclipse, we all share the same spot that when totality finally ends your first question as you look around at your fellows standing there around you is, wow. When can I see another one? And I, for myself, I knew that there was this one in 2017 that I had to see.

BV: Right. Yes, you mentioned that in the very excellent chapter of your book titled Saros Siblings, you say that once you've seen totality, travelling half way around the globe isn't too far to see it again.

TN: Exactly. And so fortunately I've had a chance to at least travel to two other total eclipses since then, and so waiting until 2017 wasn't even good enough at that point. I was able to see another one in 2013, from the middle of the Atlantic Ocean from on board a sailing ship which there is perhaps no more dramatic way to see the eclipse than that, so if you should happen to get a chance I do highly recommend it.

BV: Right. This was on a luxury sailing ship travelling from Spain to Barbados, is that right?

TN: We spent three weeks sailing across the Atlantic Ocean, and so in the middle of that trip, a week out from any land, we encountered the sun for a total of 40 seconds of totality. It was the most fleeting encounter between our sailing ship and that swift shadow of the moon across the Atlantic, but for 40 seconds, once again, we had a break in the clouds and were able to see the sun go dark at midday.

BV: Well that is seeing an eclipse in style, that's for sure.

TN: Standing there on the deck of the ship, hanging from the rigging, while cresting a wave and seeing the sun overhead. It was amazing. But I had the exact... I guess I paid for it in 2015 when I travelled to the Faroe Islands in the North Atlantic. There we once again had cloudy skies and I missed totality by just a fraction of a second. So I have literally had every thigh from the pinnacle of joy to the depths of sorrows that I missed totality on that occasion.

BV: So this was just a small bank of clouds that came by at the wrong time?

TN: It so happened that where I was standing, we had mountains all around us, and there had been a storm that had swept through beforehand. And so the humidity was so high that when the moon shadow passed over us and the temperature dropped, that humid air suddenly condensed into clouds. And so clouds formed 30 seconds before totality and they cleared up 30 seconds after totality ended.

BV: So you're two for three. You're two for three, then.

TN: Two for three.

BV: Fantastic. Well it must have been something just to visit the Faroe Islands, I mean, they must have been just inundated with tourists.

TN: They were, and the people there were absolutely amazed at what was going to happen. And how... And they were stunned by the number of people that wanted to come and experience this. But fortunately through the work of psychologist Kate Russo and others who were helping spread the message of what totality, a total solar eclipse were, these folks were very prepared. They knew exactly what time this was going to happen, they made sure to do things like not schedule surgeries in the local hospital at that time so that the doctors and nurses and patients could go outside to

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look up. So it was really something that the entire islands all joined together in to experience as one. And folks continued to talk about it for months afterwards.

BV: Well that's wonderful. Now... So the next one, the next big one, is the great American eclipse which is upon us this August, August 21st, 2017. Now it's amazing how solar eclipses have moved from an omen of doom to an important scientific event to a gigantic tourist attraction. In this case maybe the biggest tourist attraction of all time. How many people do you expect will come out and see the eclipse of 2017?

TN: We know that 12 million people live within the path of totality. So all those people have to do is go outside and look up. It's midday on a Monday, so perhaps an earlier or late lunch, and this is something that folks could do with minimal effort. There's another 20 million people that live within about an hour's drive of totality. Then you have people from all over the world, tens of thousands are going to travel, as they do travel to other eclipses.

So with minimal effort, this is something that perhaps 50 million people could see totality. On top of that, the partial eclipse is something that every single person in North America is going to be able to see. So this will be the largest audience for any total solar eclipse in the modern era. And when you add in the prevalence of digital cameras and social media, this will become the most photographed, the most shared, the most tweeted event in human history.

BV: Now not to sound defeatist but do you expect it to be too crowded for... Along the path, for serious eclipse watchers to enjoy, do you think? Or is it worth making an effort?

TN: Grand Teton's National Park is one of the most spectacular places that's right on the path of totality in North Western Wyoming. I know that people are going to be flocking there. All their hotels are full, their camp grounds are full in the park. But, if you can be there and the weather is clear and standing amidst 50,000 people, you're able to see the sun go black at midday, that's going to be the most intense shared experience. The sound of tens of thousands of people screaming in joy and awe at once. I can't imagine what that's going to be like. So if you're the type of person that...

BV: I'm sold.

TN: Yes. So if you want, go there. If you want to be the sort of person that sees this by yourself and have just a moment of your own, there are certainly going to be fields out in Nebraska and lonely mountaintops in Idaho where you can see this on your own, or maybe in the middle of a lake somewhere out in Oregon. So however you want to spend this, there is a place for you.

BV: Now you don't have to give away any secrets here, but what's your game plan for seeing the 2017 eclipse? Are you going to tote a lot of gear or just do visual observing or what do you have in mind for yourself?

TN: I don't think I'm even going to take a camera. When you go back and you take a look at Warren De la Rue's notebook from his very first expedition to photograph

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an eclipse, he writes in there that it was such an incredible experience that he hopes he will have the opportunity to see one again, but without any equipment, so he can simply enjoy the beauty and this natural sense of awe. And if that's the viewpoint of the very first person to ever photograph an eclipse, then I can tell everyone, don't waste your time trying to photograph this. You're only going to have 120 seconds, maybe better to spend that time just looking at it.

And I know that after literally my entire lifetime of waiting for this, I don't want my memory of it to be seen through the viewfinder of a camera. I want to be able to just sit back, look up, and soak it in.

BV: Yes. Or to spend your time looking at your camera screen, or worse, a computer screen during the brief two minutes of the eclipse.

TN: Nobody should spend totality fumbling around with the menu on their camera, trying to adjust the focus or exposure time. You will have cheated yourself of a lifetime experience if that is how you see the eclipse this year.

BV: That's an excellent tip. Do you have any other tips or wisdom or tricks of the trade for us first timers to see this eclipse? Anything we should or shouldn't do other than your advice on photography?

TN: I'd recommend, if you can, find a way to get into that path of totality early, if you can get there the night before, or early in the morning. For most people in the US this eclipse is going to happen near midday or afternoon, so if you're going to be out in the sun bring lots of water, bring a hat, have some shade, bring some sandwiches so you've got some food and some water. Get yourself a lovely seat and just sit back and enjoy the spectacle.

BV: That's good advice. We talked about science earlier. Is there any science left to be done during a solar eclipse? Do astronomers have any serious science plan for this eclipse this August?

TN: They do. We do have the ability now to create a false eclipse, a synthetic eclipse. There are telescopes and satellites that can put what's called a mask, a circular block in front of the disk of the sun, and so see the outer corona at almost any time. But unfortunately these masks, they block out where the corona actually touches the sun's surface. And so knowledge about how energy gets from inside the sun to the surface, and from the surface into this corona, is still largely unknown and can only be viewed during an actual total solar eclipse. So there are NASA scientists that are going to be travelling to the path of totality, as they do to all total solar eclipses, wherever they occur.

And it's an opportunity to learn more about the energy source which is the sun and how it affects life here on earth.

BV: Okay. So this will be a spectroscopic investigation or...?

TN: It's imagery as well. And, in fact, one of the interesting citizen science experiments that's being done this year is there's a group from the National Solar

Observatory that has created... It's called the Citizen CATE Experiment, C A T E, that is creating a telescope camera system that groups along the path of totality, if they have agreed to sign up for this project, they can get this telescope camera setup so that they can photograph the corona from their location. And at any given location you'll have about two minutes of totality.

That's where you'll be able to make images over the course of two minutes, which you could stitch together into a little two-minute video of the corona for your totality, your area. But by getting groups all across America along the path of totality, they want to be able to stitch all of these little two, two and a half minute long videos together, to make a single 90 minute video of how the sun and the corona change and evolve as the moon moves from... As the shadow of the moon moves from West Coast to East. So it will be the longest continuous movie of the solar corona ever made.

BV: Well that's very interesting. Are they still looking for people? Is there a way that people can get involved with this if they're so inclined?

TN: Check out their website. At this stage if you can agree to get this and test it, it's possible they are still looking. I have to admit, I haven't checked it recently.

BV: Okay. I'll see if I can include that website in the notes to this, it sounds quite interesting. Now it's always amazed me, but it's an amazing coincidence that we see these eclipses at all, that we can see the sun's corona. I mean, the moon is 400 times smaller than the sun, but also 400 times closer. So they almost exactly overlap and give us this beautiful view of the corona. But this isn't just a coincidence in space, it's also a coincidence in time. What does this mean for solar eclipses of the distant future?

TN: The moon is slowly spiralling away from the earth, and that happens because of tides between the earth and the moon. So there is going to come a day at which the moon is too far away to fully block the disk of the sun. Fortunately this is many millions of years into the future, so we don't need to worry about this, at least for ourselves. But it does point out that we do occupy a really privileged point in both space and time that the earth alone has a moon that's sufficiently large and at a sufficient distance to fully block out that sun.

And so our understanding of the universe, our understanding of the sun, is something that's a pleasant and unusual appearance in nature. And so whenever any total solar eclipse happens I like to think, well enjoy it now, because someday, some infinitely far off point in the future, people will no longer be able to do this. Whatever people are still here.

BV: All the more reason to see one then.

TN: Exactly.

BV: Now along with your teaching and research you're also a photographer, and a former astronomer for the National Parks Service. But you also create, and this is the first time I came across your work, you also create some very beautiful, retro-style,

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astronomy travel posters. And I say travel in quotation marks because these are trips no one can take yet. But they're based on the old-style WPA Travel posters of the 1930s. What inspired you to create these quite incredible posters?

TN: Back in 2007 I was on sabbatical working with the National Parks Service and so I travelled through the National Parks for a full 14 months, working with park rangers and visitors, all the ways that people could experience the night sky and astronomy in a national park. And I wrote a book called Stars Above, Earth Below, and one of the things I wanted to show in this book is this connection between astronomy and the parks. And when people think of the national parks, one of the things that people think about are these old WPA posters that encouraged people to go out and see America.

And so I created a series of posters called See the Milky Way where half the park is after dark and encourage people to go out to these national parks and see a star-filled sky. And they just... They were meant to be an illustration for the book. But as park rangers and then visitors came across this, they asked, well, can you make one for Grand Canyon? Or could you make one for Yosemite or Yellow Stone? And pretty soon it turned into a national poster campaign that's been seen now in 50 national parks all across the country.

And so, taking that idea one step further for this eclipse, we wanted to make sure that people knew about the eclipse and knew where they had to go in order to see totality. And in ways, that's the original purpose of the WPA, the Works Progress Administration poster campaign was back in the 1930s. It was to help educate people and let them know about what was going on. In this case we're letting folks know about the eclipse and where they have to go to see totality and how to be safe when they're there.

BV: Well that's wonderful. That's a good story. I didn't know that's how they were hatched, over that time since 2000. I'll provide a link to these posters in the notes, for sure, and where else can we learn more about your work and your excellent book Sun Moon Earth?

TN: You can find more about me, what I'm doing, where I'm travelling, the posters I've created, the books I've written, on my website. There's two versions of it. There's TylerNordgren.com and there's SpaceArtTravelBureau.com which is really trying to popularise this idea of traveling for the sense of astronomy.

BV: That's wonderful. I'll post those links for sure. Tyler, thanks very much for speaking with me today, this has been wonderful.

TN: It's absolutely been my pleasure, thank you for having me.

BV: Thank you. This has been a presentation of Agena AstroProducts and AstronomyConnect.com.