Night Sky Network Telecon:
Chilean Astronomy for Amateur and Professional Astronomers

Moderator: David Prosper
October 21, 2015

Operator: Welcome and thank you for standing by. At this time, all participants are on a listen-only mode until the question and answer session of today's conference. At that time to ask a question, please press *1 on your touchtone phone and record your name at the prompt.

This call is being recorded. If you have any objections, you may disconnect at this time.

I would now like to turn your call over to Mr. David Prosper. Sir, you may begin.

David Prosper: Hi there everyone. And welcome to our new teleconference. Our apologies to those of you who had some issues signing in earlier. We had a mix up in our reservation system. So for the first time in ten years, we have a new name and passcode for calling in. But we'll make sure that it's all sorted out in the future.

So I'm excited to present this teleconference with not one, not two, but three wonderful guest speakers. Our topic this evening is on astronomy and Chile for both amateur and professional astronomers. And our guests are veterans of the Astronomy and Chile Educators Ambassadors Program.

We are joined tonight by Dr. Brian Koberlein, Senior Lecturer of Physics and Astronomy at the Rochester Institute of Technology. Peter Detterline, Astronomy Educator and Director of the Boyertown Planetarium and Professor of Astronomy at Montgomery County Community College. And our very own, jet-setting Vivian White, Educator at the Astronomical Society of the Pacific and Night Sky Network Admin. And she is freshly back from her stint on the White House lawn showing kids of all age the wonders of the night skies as part of yesterday's White House Astronomy Day.

So before we get started, I want to make sure that you can all view our presentation slides. If you don't have the slides up in front of you, you can download them from the Night Sky Network at our short URL http://bit.ly/nsnchile . That's bit.ly/nsn C-H-I-L-E. And if you have any problems along the way, feel free to email us at nightskyinfo@society.org. And we have already got a few of you for our updated info. So thanks for writing in. So we have some folks to talk to.

So if this is your first teleconference with us, welcome. Just stick around and follow along with the slides and there will be time for a brief Q&A at the end of the talk with our guest speakers. And also stick around for a minute after the presentation and Q&A, as we'll be giving away a signed copy of The Total Skywatcher's Handbook -- 275 plus tips and tricks for watching

the night sky, donated by the Astrological Society of the Pacific. And I have to confess, I am one of the writers of this book along with one of our speakers, Vivian as well as our boss, the Director of the Astronomical Society of the Pacific, Linda Shore.

And now we have just a brief minute for the latest Night Sky Network news for our members. Just remember, add your events to the Night Sky Network calendar so the public as well as your members can find your club and participate in astronomy events.

Every club that adds and logs at least two public events per quarter is eligible to receive new toolkits as well as quarterly prizes and annual pins. And yes, I said quarterly because now we are back on a quarterly shipping schedule.

And speaking of the annual award pins, I had a message from Andee Sherwood from the LA Astronomical Society and I'm just now remembering it because I got it when I was on a very long and very jetlagged trip. She had a question about our yearly award pins. The design for the pins isn't final yet but when that happens, which should be in a couple of weeks, we will start the process of getting these pins to all of our qualified clubs.

And, by the way, if your club logs events taking place between July 1st through September 30th, you're eligible to win a scale model of the James Webb Space Telescope. The more events you log, the more chances your club has to win this lovely transforming model.

And one last bit of news -- we are also participating in NASA's Exoplanet Week. So go on Twitter and Facebook to find all sorts of cool news and information on the hunt for planets and other worlds on this 20th anniversary of the discovery of the first known planets orbiting a sun-like star that is not ours. You can find it with the hashtag Exoplanet Week. That's all one word, Exoplanet Week. The home page on the Night Sky Network also features, activities, articles, and more information on Exoplanets in honor of this historic anniversary as well.

And with that, it is my great pleasure to introduce our speakers, the Astronomy and Chile Educator Ambassadors, as they talk about the wonder of astronomy in Chile. And I think Vivian, would you like to start the intros?

Vivian White: Thanks. Dave, can you hear me all right?

David Prosper: I can hear you just fine.

Vivian White: Great. Thanks everybody for coming. I'm sorry to put you around last minute. It's exciting (unintelligible) there are a few of you out there.

I am really happy to talk tonight about the Astronomy in Chile Educator Ambassadors Program. I guess go onto slide two.

And that gives you our logo, the patch that we all got when we went to Chile this past July. This is part of an NSF program that is getting educators from the US down to Chile to learn about the telescopes that are already in place there and that are coming online in the near future.

So there were nine of us that went. And we are amateur astronomers and teachers and planetariums. You see a picture of all of us there on the left. And this was a program organized by Tim Spuck of Associated Universities, Incorporated out of Washington DC. That's him of the right looking very prophetic. He did a great job organizing this. This was the first year that the program was active and there will be another next year, so keep your eye out. I will post on Night Sky Network in the newsletter when the new application is -- sometime this winter, probably.

All right. So go onto slide three and I'll just introduce our first speaker, Brian Koberlein. He is a professor at Rochester Institute of Technology. And you should definitely check out his blog. It is fantastic. He is also now contributing to Forbes Magazine. Very excited for him. That's a new endeavor he's on. And he's a talented musician and singer. He sings not only bawdy sea shanties -- as we learned on our many long trips on the bus and on planes -- but he also composes real music and it's really beautiful.

And so it's my pleasure to introduce Dr. Brian Koberlein. Brian, you want to take it from here?

Brian Koberlein: Sure. I'll take it as I take it. Thank you for having me. I guess I am going to talk a little bit about ground-based astronomy, which is where - what we have in Chile is ground-based astronomy.

And if you look I guess on slide four, you can see there is basically a graph of the various wavelengths of light that reach the Earth. And while we love having an atmosphere that helps us breathe and all of that, an atmosphere is not particularly good for astronomy because many of the wavelengths that occur in outer space get absorbed by our atmosphere. So things like x-rays and ultraviolet and gamma rays generally get absorbed, but also parts of infrared light and things that we would like to see in that.

And if you look at the graph, you can see there's, you know, the visible spectrum, there's - most of it gets through the atmosphere. A good chunk of it gets through the atmosphere. And radio waves, a good chunk of radio waves get through the atmosphere. And that's generally what we have in terms of ground-based astronomy. You'll see some infrared, some kind of short wavelength radio waves -- which would be millimeter wavelengths -- and those are done in areas like Chile because there is extraordinarily clear skies. The nice thing about Chile is there's lots of high elevation. It's dry and you have very stable skies because air off of the Pacific comes in in a nice, stable way.

And if you go to slide five, you can see this is an image of Gemini South. There's a corresponding one in Hawaii called Gemini North. But one of the things you'll notice is what looks to be an orange laser coming out of this. And that's exactly what it is. It's a sodium laser that's beamed out from Gemini. It's actually a collection of them. But that actually serves a very specific purpose because if you ever look out in the night sky, you'll notice that stars will twinkle. And the reason they twinkle is because of disruptions in the upper atmosphere that are causing light to be deflected and bent and warped in all these (willy) ways.

That makes for a pretty star, but it doesn't make for good astronomical images. And even if you're at a high elevation, you're still going to have some of that distortion. And so one of the ways in which this is dealt with is what's known as adaptive optics. And that's actually where the laser comes in, as you can see on the image.

And if you go to slide six, you can see what this adaptive optics does. For those of you that can see the animation, there's kind of a blurred image without adaptive optics. And then very clearly a planet shape -- that's Jupiter in the infrared. And you can see that it's a radically different image. It's a radically sharper image. And that's because what it's doing is it's adapting for all the little perturbations.

So the other part of the image you can see is a turbulent layer, and you can see the light coming in through this turbulent layer of atmosphere actually kind of bends and warps the light, and that's the problem we have to deal with.

So if you go to slide seven, you can see the basic setup of how adaptive optics works. So in order to get rid of this disruption, what you have to do is you have to change the shape of your mirror. Basically what you're going to do is disrupt the shape of your mirror so that it matches the disruption caused by the atmosphere. But of course, that means that you need to know what that disruption actually is.

And that's where the laser comes in, because we use sodium lasers and there are sodium atoms in the upper atmosphere. So about 90 kilometers up or so, there's this layer that when you strike it with a laser beam, a sodium laser beam, it excites these atoms and then these atoms actually give off light.

And so what we do is by shining the laser beam, you normally wouldn't see it but you can actually see these sodium atoms glow. And because we have shined it in a very specific spot and it's in a very small point -- 90 kilometers away -- it looks like an artificial star. And so since the turbulent layer is underneath that, any of the turbulence that causes the light to be distorted will distort this point of light, this glowing little patch of sodium.

And so what we can do is by looking at how that's distorted, refocus the mirror in order to make that artificial star, that glowing patch of sodium, be in focus. And so as the turbulence atmosphere causes the stars to twinkle and all of that, we refocus in real time. And so you're constantly adapting to that. And you can kind of see the basic idea in the image with the mirror that's really, really exaggerated. You're only doing small, small changes.

But if you look at the picture on the right, these are actually the little (memes) they're called that distort the mirror and so they will flex. They're like little electromagnetics that flex back and forth and they actually distort the mirror slightly. So you have this very thin mirror and then you can distort it adaptively. And that's how you adjust for the turbulence of the atmosphere.

And the nice thing about Chile is that there's a minimal amount that you have to deal with, so you know, this type of bizarre engineering actually works really well when you're at high altitudes on the ground.

So the other one I wanted to look at, if you look at slide eight, is radio astronomy. So radio astronomy is the other area where we do a lot of ground-based as opposed to space-based. And if you look at the image here, you can see all these dishes and it says radio telescopes. And a lot of people think that each one of these dishes is a radio telescope. And that's actually not the case. Each one of these is an antenna, and those antennae - antennas. I'm sorry. Antennae are bugs. Antennas are actually part of a much larger telescope because they work together in order to make a single image.

So if you look on page nine, slide nine, you can see kind of how this works. It's known as interferometry and basically what it's doing is it's gathering light from different signals. So you've got radio signals coming in, and different antennas will each gather radio signals from a particular direction.

But the thing is, is that each of them are slightly different in distance from the object. And so what happens is light comes from an object out in deep space. It will reach one antenna before it reaches another antenna. And the time, since everything's moving at the speed of light, the time depends upon how far away they are and what angle they're looking at.

And so what we have then is we have this information about the same kind of light coming in but reaching two different antennas at two different times. Now what we can do with those is we can actually line them up. So it's called correlation. And what you do is you take the two signals that should be pretty much the same and shift them so that they line up. And when they line up, you get all of the signals will amplify. They'll line up and you get a strong signal. So you use a computer to realign these so that they line up.

And the reason why that's useful is not really to amplify the signal but because by knowing the time that you have to shift them, you know then very, very precisely where this signal is coming from. You can use trigonometry to determine very precisely where that source is. And that means you can make high resolution images. And that's what we want. That's what's hard to do with radio waves.

So if you go to slide ten, you can see another trick that we use, which is called aperture synthesis. Since each antenna that you use, any pair of antennas can be used to precisely triangulate where a signal is. And so if you have, in the case of something like ALMA, you have about 60 antennas and each pair, each one that you would pair up, will give you a separate source signal.

Well, even if you do that, what would happen is you'd get kind of like a pointillist image. You would get very specific signals but only for each pair, so you'd get a whole bunch of dots rather than a continuous image. But the nice thing is that the Earth rotates, and so as the Earth rotates, the relative distance of the antennas -- relative to some signal in space -- shifts over time.

And so if you keep taking data, what happens is those signals will smear out and you can get a continuous image.

And so if you look on slide ten, you can see kind of an animation of how those dots would smear out to create a single image.

And if you look on slide 11, you can see the type of images you can get. These are two different examples. If you look on the right, you can see what kind of looks like a grayish image. That's a Hubble image of a galaxy, and the name eludes me, but it gives you an idea of the resolution of the Hubble telescope. So that's an idea of how high resolution that is.

And if you look at the inset on the right, you can see overlaid the color parts of it are actually of an image from ALMA in radio wave microwave wavelengths. And you can see that the resolution is still very high. And the nice thing about a large telescope array like ALMA is that it gives you a resolution on the order of a Hubble telescope, if not better than the Hubble telescope. So it's almost like having a space telescope but for radio wave because of this.

And if you look on the left image, this is why we really do this, particularly at ALMA. ALMA is at a very high elevation and if you remember back to the slide, most of the infrared is absorbed by the atmosphere. Well ALMA's at 16,500 feet and it's so high that it can actually pick up some of these radio waves on very short radio waves, so what they call millimeter and submillimeter wavelengths.

And that's really important because the type of things that are whole gas and dust out in the universe, that's the wavelength in which they emit. And it's really hard to see without something like ALMA. So that now ALMA is online, we can get these types of images. We can see images like the one on the left. That one is actually cold gas around a very young star. And you can see that there are gaps within this, you know, kind of gray area. And those gaps are where material has cleared out by young planets.

So the image on the left is actually an image of a young solar system where planets are already forming and we couldn't get images like that without a site like ALMA.

So that's kind of a basic overview of why we do this stuff and why it's in Chile and the type of thing that's going on.

So I guess I will then pass it onto Peter Detterline, who is the Director of the Boyertown Planetarium, Professor of Astronomy at Montgomery County Community College, and he's also an absolutely amazing astro-photographer. And so his images are incredible and it was great seeing him work in Chile and then to see the images that he gathered was really awesome.

So I will hand pass you onto Peter now.

Peter Detterline: Thank you, Brian. And what a pleasure to be able to talk to everyone tonight. I'm going to take you on a little journey of the southern sky.

So we're going to start on slide 13 looking at sunset over the Pacific Ocean with the Andes in the foreground, we are at Cerro Tololo 7,000 some feet up above with lots of telescopes and ready to do some night sky observing. So let's take a look.

You know, when we go down to the southern hemisphere, I guess the first thing that we're excited about is we're going to see a whole new sky. We're used to seeing Big Dippers and all sorts of things in the north every single night. But now we get to see new constellations and new patterns. And of course Southern Cross is the one that we'll recognize easily and the one that's the most famous, as we can see in this picture. Alpha Centauri is also gorgeous to see, and we can think of a bunch of other constellations, but the sky is just different. And that's what makes it kind of fun and unique.

On slide 15, you're looking at the Victor Blanco Telescope. This is a four-meter at Cerro Tololo. And this is their large one. That's the workhorse up there. This picture was taken over about two and a half hours and just letting the camera sit there and take pictures of the sky every 30 seconds and just combining them together.

What you notice next is that you have no pole star. There is no Polaris sitting in the middle of that thing as things turn around. And that also makes the southern hemisphere kind of fun and unique when we compare it into the north.

But the most amazing thing, slide 16, the Milky Way. We see Sagittarius and Scorpio, the center of our galaxy sinking low in the sky just kind of skirting across the south as it goes over our meridian. But here, it reaches the zenith. And what a perspective, having the center of the galaxy directly above you, watching the arms sprawl out on either side. It's just absolutely amazing.

The photograph there in 16 is a 40-second exposure. That's all -- 40 seconds with the almost fish eye lens, semi fish eye lens. Look along that. Constellations. We connect the dots and make things like Dippers and Southern Crosses, but to the Incas, they look at those dark lanes along the Milky Way.

Slide 17 shows some of the Inca constellations. See if you can match those up with picture of the Milky Way that I took just below it. The Llama is the big one, the Drinking Llama. Here the eyes are actually Alpha Centurion Hadar. And if you can make that out in the dark lanes of the Milky Way, the story is the Llama's going to drink up some water of the Pacific, and as he rises across the sky, he's going to spit it out as rain in some of the driest deserts of the world. It seems he misses quite a few of the Atacama regions, since they haven't much rainfall in the last 400 years.

Slide 19 -- the Large and Small Magellanic Clouds. We often think of seeing that when we go south, too. That's one of the big things we really want to see. And here it is all put together. We've got the Milky Way. We've got the Large and Small Magellanic Clouds, and you've got some dormitories. These are some of the houses that they use at Cerro Tololo. I know it looks like a lot of light pollution, but it's 40 second exposure again.

And notice that you can see stars right on top of the building. So there's no light pollution that's really going up. It's just phenomenal skies, beautiful viewing.

Let's get a close-up look at the clouds for a moment. On 20, you can see the Large Magellanic Cloud right there, and on 21, the Small Magellanic Cloud. That bright, star-light object next to the Small Magellanic Cloud is actually a star cluster, 47 Tucanae. Very bright, very beautiful to see.

Another favorite in the south, slide 22, Eta Carinae. Eta Carinae is absolutely gorgeous. What you're looking at is something. It's 7,500 light years away. A star for lack of a better term that simply burst back in the 1840s and in that shell of gas, we're looking at a star that could possibly have exploded into a beautiful supernova. Some say it might be the next supernova. But it is pretty far away. So it seems to be a toss-up between that and Betelgeuse. We'll see which one goes first. Absolutely stunning to see in the sky.

And again, all these are taken with a camera -- nothing through a telescope. That's a 55-millimeter lens in that one.

And just when you don't think it can get any better, it's almost time to go in. The sun's getting ready to come up. You turn around and there on slide 23 there's a zodiacal light. And that's gorgeous. Because zodiacal light, you're looking at dust and ice particles left over from the beginning of the solar system and the sunlight is starting to reflect off of them and it's absolutely amazing, very bright. This went up way past the zenith. It's a shame it didn't intersect with the Milky Way, which was setting down onto the other side in the west. It was absolutely beautiful.

And if you look just down below at the very bottom, Pleiades star cluster just beginning to rise. And that little fuzzy thing right over to the left, that's the Andromeda Galaxy.

Now, I took a lot of pictures of this. One of my goals was to capture the zodiacal light. And I don't usually do this, but I thought I really wanted to take a selfie. So I put it on a timer and the result is image 24. And I put my arms out and I said, "Yes," and then I realized I can't move my arms for the next two minutes. One alligator, two alligators, three alligators, four alligators. But it worked out. And it was just beautiful, just a beautiful night of observing. That's the southern sky and that's what it's like.

Finally, looking at 25m light pollution. Not much. We've got 900,000 acres surrounding Cerro Tololo with the Milky Way high overhead. But that's always a problem no matter where you're at. But the sky here is tremendous. And it's an absolute beautiful place for you to do astronomy.

I'm going to pass the torch over to Vivian White. Viv of course is the Astronomy Educator with the Astronomical Society of the Pacific. Of course, you know her through her tireless efforts with the Night Sky Notebook. I had the beautiful opportunity to spend time with her and Brian off on Easter Island after our journey, and that was just simply a joy to be able to relax in that place and take a look at big stone heads and I have a really good picture of them trying to match the expression on one of the moai, one of those giant stone heads. It's fantastic.

She was at the White House Start Party last night and I saw some of her posts on Facebook. They're absolutely beautiful. So in short, if there's something cool happening in the sky, you're going to find Vivian sharing that experience with others. Vivian?

Vivian White: Thank you, Pete. Well I just wanted to take a minute because I don't think I properly explained at the beginning exactly what we did in this program. And they've clearly shown that we learned a lot about the telescopes and we saw a lot of beautiful skies. What we did is we started off in San Diego. We flew into San Diego, all of us, and learned about the observatory headquarters that are posted there.

And then we flew out to La Serena to see the Cerro Tololo Observatory Complex. And that has dozens of telescopes on a couple of mountaintops, including Gemini South and the Blanco Telescopes that Pete showed in the beginning.

And then from there we went out to San Pedro de Atacama near the ALMA Telescope, the Atacama Large Millimeter Array, and that was the radio telescope that we talked about in the beginning. So that's what we got to do while we were there. We learned a ton. And the one thing I wanted to say about the trip starts on slide 27. And that talks about the tourist observatories. I wanted to talk for just a minute about that because this is what you can do just for fun if you ever get a chance and I highly recommend it.

So astronomy is a big part of the culture in Chile. There is actually a country-wide lighting ordinance. It's enforced to varying degrees. But just that they care that much about the night sky. It's actually been really integrated with their culture.

And the first slide on slide 27 is outside of La Serena where we went to the Cerro Tololo Observatory. It's about an hour, hour and a half flight north of Santiago. And Cerro Mayu was the observatory that we are visiting here and it was started by a Catholic priest. But they integrate so much of the culture into their observatory there. So there are the sculptures that you can see here. It's got beautiful gardens around that observatory. And they teach you about the local history of the place as well as the sky history while you're looking through your telescope. It was beautiful.

The next slide, 28, is the Observatorio Astronomico Andino. And that is right outside of Santiago. This was one of the most amazing experiences I've ever had in an observatory. They're called tourist observatories, and this was unlike any other I've seen. It's a half an hour drive, maybe a little bit longer, half an hour, 45-minute drive outside of Santiago. And they drive, which is great because it's up some windy roads on a steep hillside. I'm glad they were driving and we were not.

But once you get there, you can see from the pictures it is just beautiful. The setting is beautiful. It is on the other side of the mountains from Santiago, which is not just light polluted like any big city will be, but Santiago also has issue with air pollution because they're in a valley, and so it gets stuck there. So it's not great skies in Santiago proper. But even just the 45 minutes outside is gorgeous. So we went up there. They gave us a lecture and a local astronomy

student gave us a lecture on astronomy topics and had some demos and some local artifacts that she showed us. They told us sky stories out of the (porch) of the - stories that the local Chilean people told back before I guess like Peter was showing you the story of the Llama and other stories along those lines, the traditional stories of the southern skies. She told us those.

She also - well they give you, you know, when it gets cold you get heavy wool ponchos made from local llamas. You get delicious food and wine is served. It is a fully integrated experience. And you get to see great telescopes. So it was cloudy the night we were there sadly, but we did get to see their telescopes and they even have CCD imaging . They have a very nice observatory, this one. I highly recommend it.

I put the URLs on the notes of these slides so if anybody wants to find these observatories, you can check that out.

The on slide 29 we went up towards the ALMA site, the radio telescope. This was right near San Pedro de Atacama. So this was the town itself. It's an old town made of red dirt bricks and you really feel like you stepped in kind of an old western, maybe. But it's also a tourist spot for hikers and sand surfers and bikers and anybody who wants to adventure travel. It's very remote, very high altitude, which makes it a great observing spot.

So like in the picture here, you'll see tours go out on clear nights and they'll bring hot cocoa or wine and give sky tours. And I talked to some of the tour providers and you're welcome to bring your own telescope, or you could just take your own telescope out not very far out of town and you have some of the darkest skies I've ever seen. The terrain around there, there was valley of the moon we went to visit and it was unlike anywhere I've ever see. It really, when I read the book The Martian, that's exactly what I thought of. I thought well, that's what it's got to look like. It really feels like you're on a different world.

So the last slide, this is very similar to the one that Peter showed when we started with his sunset over the Andes mountains. I think it was a favorite moment for most of us, watching it from Cerro Tololo.

And I just want to say that this is an amazing program. And like I said, applications are going to open up this winter and I'll post on the Night Sky Network Newsletter and put it on the Web site when those are available. So keep an eye out. I encourage you to apply. It is such an amazing adventure. And even if you don't become a Chilean Educator Ambassador in Astronomy, you should take a trip down to Chile. It is just an amazing experience and a great one for sky watchers.

So with that, I guess we'll open it up for questions.

Operator: Thank you. As we begin our question and answer session, to ask a question please press *1 on your touchtone phone, unmute your phone, and record your name clearly when prompted. Your name will be required to introduce your question. To withdraw your question, please press *2.

One moment please for any incoming questions.

Vivian White: Dave, are you still on?

David Prosper: I am still on.

Vivian White: Ok. Are you going to apply this year?

David Prosper: Yes.

Vivian White: You would love it.

David Prosper: Yes. This is fantastic. Especially just to see the southern skies in general. But all the other observatories look incredible, too. I've actually been fascinated by the Atacama Desert since I was a little kid and saw a special on it.

Vivian White: Brian, I forget. Have you seen the southern skies before?

Brian Koberlein: No, this is my first time.

Vivian White: Yes, me too.

Brian Koberlein: And definitely well worth the trip.

Vivian White: Yes. It's the Eastern Time zone so it's not like you have to go all the way around to Australia to see it. That makes a big difference for flying down and back.

Brian Koberlein: Yes

David Prosper: It's actually in the Eastern Time zone?

Vivian White: I think so.

Peter Detterline: It's one hour ahead.

Vivian White: One ahead of you.

Peter Detterline: Yes, it's one hour ahead.

David Prosper: No kidding.

Vivian White: Yes, it surprised me too.

Peter Detterline: Yes. You have to go east to see the Pacific.

Operator: Currently I'm showing there are no questions. Again, if you'd like to ask a question please press *1.

David Prosper: I have a couple questions. Like was traveling -- for Pete, especially -- traveling with your equipment, what do you kind of travel with? Like with your astro photography stuff and everything, like how do you keep it small as possible, I guess?

Peter Detterline: Yes. That's a biggie. I'm not bringing a telescope. So I have a Canon 60D and I'm definitely bringing a tripod. So those are the two. But if I just do that, I can only take up to about 40-second exposures if I'm using the widest field lens I have without star trails.

David Prosper: Yes.

Peter Detterline: And that's not really the best. So I got an iOptron Star Tracker. And it's like a really small little portable equatorial mount really. Yes. Hook it up to a tripod. You put your camera on it and you set the latitude. It has a little finder for Polaris and for the South Pole and you just kind of set that and you're ready to go. And I've been able to take up to ten, twelve-minute exposures with minimal tracking -- basically none -- out in the deserts of Utah with very little setup with that. It worked out very, very well.

David Prosper: That's awesome.

Peter Detterline: Yes. Now, the problem is it - and it doesn't weigh very much and it's very compact. It actually fits in my camera case.

David Prosper: Yes.

Peter Detterline: And it runs off eight AA batteries. The problem was when I set it up the first night, it didn't work. It just didn't turn on. And I said you got to be kidding me. I took the batteries out and everything when I packed it. And I had been using it constantly at home. And here it looked like one of the contacts was corroded. I had nothing to scrape it with to try to clean it off.

And eventually, Brian and I found an old can opener in our dormitory. And I'm scraping it with it and it doesn't even have an edge on it. It's just like this round edge. And I'm trying to scrape this thing off.

But I was able to scrape enough off that I got the thing to turn on and work again. I was like, great. So I did get a change to use it but not for the Milky Way (Unintelligible) shot, which is what I really wanted. I'd love a five-minute exposure of that. I only got 40 seconds.

And the next night I couldn't redo the picture because of the moon.

David Prosper: Of course.

Peter Dettterline: Yes. But it was a lot of fun. It was just beautiful skies.

David Prosper: That's amazing. I have a question actually for Brian about ALMA. So is ALMA completed now? Are they going to add more antenna to this structure? Or how does that work?

Brian Koberlein: They may add I think like four more antennas.

David Prosper: Ok.

Brian Koberlein: But it is up and operational, so it's considered now fully operational.

David Prosper: Cool. Is it going to be linked up with any other observatories around the world, like one of those very large baseline-type setups?

Brian Koberlein: It might be. The thing is that it operates at a very different wavelength than most radio telescopes.

David Prosper: Of course.

Brian Koberlein: Because of its altitude. Most of them work at, you know, centimeter or longer. And so this is millimeter and submillimeter. And so it's specifically because you're so high up, you can actually get, you know, for me radio telescopes for me is like centimeters or more and then to say millimeter or submillimeter, that's like far infrared. So it's really, really short wavelengths. I guess we could use it in a large baseline, but I don't know that you would.

David Prosper: Yes. Makes sense. It'd be hard to match up.

Brian Koberlein: Right.

David Prosper: Ok. And Vivian, do you think the monks that you've talked to in Tibet would like to come on this little trip?

Vivian White: Absolutely, for much better skies. But, skies in the Himalayas were not all that great. Of course, it was the beginning of monsoon season, so that didn't help.

David Prosper: Ok. Cool. So do we have any questions from anyone else this evening? Or maybe we just have a few people on.

Operator: I do apologize. At this time, there are no questions. Wait -- one's coming in. Just one minute.

David Prosper: Awesome.

Operator: Ok and the person that did signal to ask a question, your line is now open. Unfortunately, you didn't record your name so I can't introduce you. Go ahead.

Vivian White: Hello?

David Prosper: Hi there.

Operator: Go ahead, ma'am.

Man: Can you hear me? Hello?

David Prosper: Yes, we can hear you.

Men: Hello.

Man: Hello. Can you hear me?

David Prosper: Yes, you're loud and clear.

Man: Ok very good. This question is for Dr. Koberlein. Dr. Koberlein, with respect to the adaptive optics, how quickly are the different elements of the mirror able to adjust when reacting to the excitation caused by the sodium laser beacon?

Brian Koberlein: I think it's on the order of like a quarter second. It doesn't have to be particularly fast because you're taking long exposures. So, you kind of take the data in that sense. It's not happening -- as far as I know -- it's not happening at, you know, very tiny fractions of a second.

Man: I see. All right. Thank you very much.

Brian Koberlein: Yes.

Operator: And currently there are no further questions.

David Prosper: Ok. Well, I'm getting near 7:00 so I think we'll wrap this up for tonight. And - but before we sign off, we do want to have a drawing for our prize, which is a signed copy of The Total Skywatcher's Manual by the Astronomical Society of the Pacific, written by Linda Shore, myself, and Vivian White.

And so we'll take the lucky third caller. I believe it'd be the same as if you were to call in with a question, correct, Operator -- *1?

Operator: That is correct, yes.

David Prosper: Cool. So press *1 if you'd like a copy of the book. You may be lucky. And while we wait for that, I just wanted to thank the Night Sky Network members who were able to come in tonight. I apologize for the confusion. That will not happen next time.

And I wanted to very much thank our guest speakers for this evening -- Dr. Koberlein, Pete Detterline, and Vivian White. You were all excellent and I'm extremely jealous of your amazing trip to Chile. And hopefully I will be there next year. We'll see.

And we'll definitely post the Astronomy Ambassador's Program when it becomes available again in the Night Sky Network and in our newsletters, too.

Operator: Ok and we have nine people that queued up, so do you want me to take the third person, you said?

David Prosper: Yes, the third person.

Operator: Ok one moment.

David Prosper: Cool, And Vivian, do you have any more info for our folks while we wait to find out who our winner is?

Vivian White: No I think that's all for me.

Operator: Miss Thompson?

Faith Thompson: Hello?

David Prosper: Hi there. You're our lucky winner.

Faith Thompson: I'm surprised.

Peter Detterline: Congratulations.

Faith Thompson: I had trouble getting the phone number. I was late getting in because the phone number was wrong and kept having to check the Web site and trying to see did I have the right number. And eventually an email popped up and that gave the number. So I did get in.

David Prosper: Don't feel bad. We were all late, including us. Same reason. My apologies. What group are you with?

Faith Thompson: I'm with the Mohawk Valley Astronomical Society in Clinton, New York.

David Prosper: Awesome. I was just in Northern New York State the past weekend visiting my family.

Faith Thompson: Where is it at?

David Prosper: Basically, people know it as the place where those two prisoners escaped with the help of their guard. At the very top of the state. There's not much there.

Faith Thompson: Clinton.

David Prosper: Exactly. What's your full name again? I'm sorry.

Faith Thompson: Faith Thompson.

David Prosper: Ace Thompson.
Faith Thompson: Faith, F-A-I-T-H.

David Prosper: F-A-I ok.

Faith Thompson: T-H (unintelligible).

David Prosper: Awesome. Cool. Well we'll get you - I'll send you an email shortly with some info on how you can - where we can ship your book to. So thank you so much.

Faith Thompson: Thank you very much. I enjoyed the program.

David Prosper: Great. Thank you.

Faith Thompson: Bye bye.

David Prosper: Bye bye. And so, that's all for tonight. So you can find this telecon along with many others that we've had in the Night Sky Network under our Astronomy Activities section. If you just search for "telecon" you'll bring up a whole bunch of awesome talks. And tonight's presentation with full audio and written transcript will be posted by the end of the week, and hopefully sooner.

So goodnight everyone. And keep looking up.

Man: Goodnight.

Vivian White: Thanks, guys.

Operator: Thank you for participating in today's conference. That does conclude this call. Please disconnect your lines.

END