We're members of the Astronomy in Chile Educator Ambassador Program (ACEAP). This summer we visited several large telescopes in Chile including Gemini, SOAR, CTIO, and ALMA. We'd like to talk about ongoing astronomy in Chile.

ACEAP2015 [1] and r/Science AMAs[1]

[1]Affiliation not available

April 17, 2023

Abstract

We're members of ACEAP, which is a collaboration between The National Radio Astronomy Observatory, the National Optical Astronomy Observatory, and the National Science Foundation. It brings together amateur astronomers, planetarium personnel, and astronomy educators. As part of the program we traveled to Chile to get a behind the scenes look at large optical and radio telescopes in Chile. We survived injuries, spent a day without power on Cerro Tololo, and journeyed to an elevation of 16,500 feet to see the highest radio telescope in the world. Ask us about astronomy in Chile, viewing the dark southern skies, and how to make pisco sours! ACEAP Team: Shannon Schmoll - Director of Abrams Planetarium Brian Koberlein - Astrophysicist, Rochester Institute of Technology Tim Spuck - AUI STEM Education Development Officer at NRAO Sarah Komperud - Planetarium Educator, Bell Museum of Natural History Peter Detterline - Planetarium Director at Boyertown Planetarium Renae Kerrigan - Planetarium Curator at Peoria Riverfront Museum Michael Prokosch - Huntsville Amateur Astronomy Society, SHSU Planetarium Edit: Thanks for all the great questions! It's been fun. If you'd like to continue following the project, you can find us at: https://www.facebook.com/AstronomyAmbassadorsProgram

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ACEAP2015 R/SCIENCE

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It brings together amateur astronomers, planetarium personnel, and astronomy educators.

What kind of educators are involved? Are they classroom teachers? Also, could you please describe some ways in which this ambassador program helps educators teach about and get students excited about astronomy?

elfofdoriath9
(Tim) All educators ... formal (K through college) and informal educators and amateur astronomers who engage in public outreach. I think it gives educators a deeper understanding of the major facilities that do science, and they can talk about these facilities and the science they do from a personal perspective because they've been there.

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elfofdoriath9
Hello! Shannon here.

For the kinds of educators, it's a mix of informal educators and formal. Several work in planetariums and/or museum settings. Others are formal classroom educators working in K-12 schools or college level. Some work through informal content development be it through materials for educators or the general public through social media. For pretty much all of us, it's really some combination.

I think the answer to the last question about how it helps educators is likely more unique to each of us. For me, as a planetarium educator, I think having first hand experience allows my excitement for this seep through just a bit more because I have a richer way of describing the environment. For instance, I have talked about ALMA before I went to Chile and I talked about how dry it is there in terms of how much rain they get each year. Now, I can talk about how thirsty and desperate I was for lip balm in the couple hours I was without some.

For the planetarium, as well, we were able to takephotospheres which we can put on our dome and surround people with the images of the locations. This creates a more immersive and contextualized visualization of Chile, that I can now share with our visitors. So, that is something I am very excited about.

Another way for me, is that we now have a community between us as well as those we met in Chile to share ideas and resources. I will leave it to others to share what it means for them as well.

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elfofdoriath9
Brian here,

One of the goals was to have a diverse group both in terms of geography and background. Personally, I'm both a professor and a science blogger, so I'm in the classroom as writing to the general public.

One of the big shifts I've seen among the group is that these various telescopes (and Chile in general) now has a personal connection rather than just an abstract one. All of us engage with the general public, and now when we talk about astronomy in Chile we can talk about the experience of actually being there. That stronger connection can be conveyed in the presentations we give, which I think does excite students about astronomy.

Another aspect is that since we have experienced Chile together, we now have connections where we can work together on outreach activities to make them resonate more with the public.

For those who don't know much about astronomy, can you explain why you've focused your efforts in Chile and why it is so important?

firedrops
Chile is one of the largest centers for big astronomy. By 2020 about 70% of the world's astronomical infrastructure will be in Chile. Because of its climate, mountain ranges and clear skies Chile will be a center for leading edge astronomy for quite some time.

For those who don't know much about astronomy, can you explain why you've focused your efforts in Chile and why it is so important?

firedrops
(Shannon) There's a lot of reason why efforts for astronomy in the Southern Hemisphere have focused on Chile. First, your latitude limits how much of the sky you will ever be able to see. So, we need telescopes in the Northern and Southern Hemisphere to cover everything.

Chile also has ideal observing conditions in the Northern part of the country in the Andes. In astronomy, atmosphere is really our limiting factor in how well we can observe. Light bounces around the atmosphere, which is what causes stars to appear to twinkle and will distort images. Also, there are molecules in the atmosphere that may absorb or scatter some of the light you are trying to see. So, overall the less atmosphere the better. The high locations on the mountains are really great for dealing with this.

Also, those mountains are really dry, making for better weather conditions and fewer water molecules to distort your data. This is particularly important for the wavelengths of light that ALMA observes.

Beyond that, Chile is politically stable and welcoming of astronomers. The Chilean government offered space and locations for astronomers to come and build their telescopes back in the 1960s. Chile is also very protective of its dark skies, which we witnessed just a short ride outside the city and we saw some of the darkest skies we've ever seen. In fact, one of the observatory locations was just named the first Dark Sky Sanctuary by the International Dark Sky Association.

Which one was your favourite?

BATMANSCOOP
(Shannon) Everyone will answer this one differently. First, they were all amazing and I think I have favorite aspects of all them. We saw the Blanco telescope which is where the observations were taken that eventually showed the universe was accelerating in its expansion. We talked to Dr. Chris Smith who was on one of the teams that made that discovery and got to listen to his accounts of those days of observing. So the historical significance of the Blanco made it very special. SOAR was special for me since Michgan State University, where I work, is a major partner in that telescope, so I got to see where MSU reserach was done. Getting to experience 16,500 feet at ALMA is not something you get to do everyday, so that experience was phenomenal.

However, for me though, my top was Gemini. It was the first telescope we saw and it was a shock to the system. Gemini is an 8-meter diameter telescope and seeing how big that really is just made me giddy.

edit: Decided to add more about the other telescopes.

Which one was your favourite?

BATMANSCOOP
(Renae) The entire experience was incredible, so it is hard to pick a favorite. All of the scopes are impressive reflections of millions of hours of human engineering, imagination, and hard work. Just based on my personal experience at the sites however, the Cerro Tololo Inter-American Observatory (CTIO) was my favorite. It is a campus of 16 or so telescopes, the most well known being the Blanco Telescope that Shannon mentioned. We got to spend two nights on the CTIO mountain, and it was thrilling to observe the gorgeous night sky and walk among the scopes while they were operating. The mountain was beautiful and Andean foxes would come right up to us. In terms of science, the Dark Energy Survey being done on the Blanco telescope is cutting edge. Scientists use the Dark Energy

Camera to survey a large swath of the sky each night and look for supernova, Near Earth Objects, and other signs of Dark Energy. We got to be in that telescope while it was observing, and talk to Dr. Chris Smith all about it, which made it very real and exciting. CTIO will always be my favorite. Read more here: http://starsoverpeoria.blogspot.com/2015/06/telescopes-stars-and-joy-of-exploration.html

Which one was your favourite?

BATMANSCOOP
(Sarah) My favorite site was CTIO, but my single favorite telescope experience was the Blanco telescope on CTIO. The first night we were at CTIO we were allowed to go inside the Blanco dome while the telescope was taking observations! Not even the researchers get to do that anymore. They are stuck down in the control room if they are even in Chile at all to begin with (many, if not most, large research telescopes have remote capabilities that do not require the researchers to be at the sites themselves during their observation runs). So that night we were in the telescope dome, the only light is from the Moon as it streams in through the dome slit, and the scope is slewing to a new object in the sky. It was unbelievable, and dare I say magical.

Later that night, after being in the dome we spent almost 2 hours in the control room talking with Dr. Chris Smith; who in addition to being in charge of all the observatories in Chile, is still a researcher himself. One of the things we talked about was the use of Blanco by both teams who won the 2011 Noble Prize in Physics for the accelerating expansion of the Universe. It's a great story of how both teams intended to show that the expansion was decelerating, but found the exact opposite. Definitely look it up if you have the chance.

Which one was your favourite?

BATMANSCOOP
(Mike) Well, without a doubt, the single best day was the ALMA excursion. But for overall experience, CTIO wins hands down. There was the personal time to experience it on your own as well as the formal organized portions.

Which one was your favourite?

BATMANSCOOP
(Peter) Everyday was a new and wonderful experience. If I had to choose it would have to be the two nights we spent on Cerro Tololo. I first heard about this site when I was in college and had it on my bucket list ever since. When my college professor was there it had 6 observatories, people moved around in golf carts and they had a lot of foxes. Today it has 35 observatories, the golf carts are gone, and the foxes remain. We had the amazing opportunity to see the amazing observatories and even become part of an observing run with Dr. Chris Smith. We also had two nights on the mountain under those beautiful southern skies where the Milky Way was spectacular, as were the Magellanic Clouds. However, the bonus came in the early morning with the bright zodiacal light. Of course it was the people who made everything so special and created such an amazing experience for us.

How well funded are you? What kind of discovery are they working on right now?

trollivier
(Tim)The ACEAP project is funded for one more year by NSF. We hope to apply for additional funding for additional years. The educator needs to find the necessary funding for their flights to and from Chile and flights in Chile, but the expenses are covered by the grant.

It brings together amateur astronomers, planetarium personnel, and astronomy educators.

Do you mean people in the US only or does it work with amateur astronomers and educators in Chile or othe countries? I don't understand what work they perform.

Valle del Elqui is really beautiful, what else did you do in the area?

ffuentes
(Shannon) The ACEAP program specifically is forastronomy educators from the US. Through the National Science Foundation, the U.S has put a lot of money into astronomy in Chile. However, those of us who communicate to the public here in the US have never been there personally to experience these facilities or why Chile is such an important part of astronomy today. The advantages of this is that we now get to offer a much more authentic and richer description of astronomy in Chile through the regular modes of education we already do. It also has meant we have built a community between each other and with the Chilean educators we met while there to support and collaborate on new ways of communicating astronomy.

In Valle de Elqui, we mostly stayed up at CTIO and the observatories there. In general, we also went to Santiago and visited the main offices for the governing bodies of these observatories. When we went to ALMA, we stayed in San Pedro de Atacama and also visited the Valle de la Luna and the Flamingo reserve. It was all very beautiful.

Welcome,

Could you give a layman's overview of the difference between a radio telescope and an optical telescope and what each is best used for?

adenovato
(Brian) At the broadest level it's really just a matter of what wavelength you're interested in. Optical telescopes tend to focus on visible and infrared wavelengths. Radio telescopes focus on radio and microwave.

For example, the ALMA array we visited focuses on wavelengths around the millimeter range, which is the type of wavelengths emitted by cold molecular gases. This makes ALMA particularly good at observing things such as early solar system formation and nebulae.

On the other hand, Gemini observing in the optical and infrared is good at observing things like Jupiter-sized planets, and has recently directly observed a Jovian planet around a star known as 51 Eridani.

Welcome,

Could you give a layman's overview of the difference between a radio telescope and an optical telescope and what each is best used for?

adenovato
(Sarah) Here is an explanation of the different parts of the light spectrum and what each are used for in astronomy. https://public.nrao.edu/radioastronomy/hidden-universe

You can try our own hand at how radio telescopes take invisible light and turn them into pictures in the Piece Together a Radio Picture activity. https://public.nrao.edu/look-deeper/hands-on-activities

How much help do you get from the government(funding, policy etc)?

How does the community view all this? Is it involved or unware or what's up with them?

timonsmith
(Shannon) ACEAP specifically has funding through the National Science Foundation for 2 years. Our cohort was the first year and there will be at least one more group going next year. However, there are hopes and plans for this to go beyond that.

The astronomy education community, especially down in Chile, has been very positive and supportive. They helped arrange our many tours, gave us a variety of talks and presentations on what goes on in Chile, and were generally very welcoming.

How is a regular work day like for an astronomer? Are you all focused on separate research, and if so.. What is it about?

I am Chilean myself and can't help but feel really happy that my country is able to do this. I'm really interested in learning more about astronomy

ninja_space_pirate
(Shannon) Brian might be best to answer the regular work day as he is the only astrophysicist amongst us. As a former astronomy grad student my regular day was a lot of running computer models to understand what squiggly lines were telling us and talking about those results. They were very interesting squiggly lines! They were very interesting squiggly lines. We are all primarily educators though, so our every day life is teaching students and/or the public about astronomy.

Also, your country is wonderful and full of wonderful people. I have never felt so at home or welcomed in another country, let alone in one where I didn't speak the language. Your sentiment was echoed by a lot of folks we met down there. It's clear Chileans love astronomy and are passionate about it! So, thank you for being such lovely hosts!

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ninja_space_pirate
(Brian) The daily work of astronomers can vary widely. Some spend lots of time at telescopes gathering data, others gather data remotely. My own area is computational, so I mostly analyze data already gathered by other projects.

My daily work is a mix of teaching and research. About 3 days of the week I'll spend focused on teaching classes, and the other two focused on research.

As astronomers, seeing all that you do, what are the majority of your spiritual believes? do they vary like anywhere else or do you guys share a common believe?

Pugehenis25
(Tim) That's a great question. Many astronomers consider themselves to by very spiritual, some are religious and some are atheists ... its across the spectrum. Astronomers study the very origins of space and time and the connections we humans have to the rest of the universe. In many ways our quest parallels those who might consider themselves "religious" or "spiritual".

I spent two months travelling around Chile last summer absolutely loved it. I was really overwhelmed about how much a countries landscape can vary so wildly, Patagonia compared to the Atacama for instance. My question is what is it that makes Chile's landscape so ideal for

astronomy. Also have you watched the film nostalgia for the light?

theantwillrule

Chile is one of the prime locations on the planet for astronomy research. The combination of climate, high mountains, dry air, clear skies and stable government make it a mecca for ground-breaking research and new observing sites.

Located along the western coast of South America, Chile is unique in shape. More than 2,600 miles north to south, but only 215 miles at its widest east-west, it spans a wide variety of climates, landscapes and ecosystems. The regions that attract astronomical interest range from the area around La Serena in central Chile to the vast and arid Atacama Desert in the north.

Chile experiences more than 300 clear nights a year on average thanks to its geography. It's free from atmospheric moisture surrounding it on both sides. The towering Andes Mountains to the east block moist Amazon air, and persistent high pressure over the Pacific Ocean and cold ocean currents prevent clouds and rain coming in from the west. The Andes are the world's longest continental mountain range averaging about 13,000 feet in height, providing the ideal lofty setting for observatories.

The region from La Serena north leads into the harsh Atacama Desert, considered the driest non-polar desert in the world. Average rainfall across the Atacama is about 15 mm (0.6 in) per year, and some weather stations have never recorded rain. Records show that the Atacama may not have had any significant rainfall for 400 years prior to 1971. Dry air is ideal for astronomy research since water vapor in the atmosphere absorbs critical wavelengths of incoming light. Currently, Chile is home to more than 40% of the world's astronomy infrastructure, and by 2022 this number is expected to swell to 70%.