Making Art at 14,000 Feet

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[0:00] My new direction. I'm in the final throes of finishing off a manuscript for a book, Making Art at 14,000 Feet. And in this talk, I hope to answer the question I most frequently get asked is, why would anybody want to do an art residency at a telescope? Because it's weird, and yes, I'm the first. So why would you know? So several years ago, my husband Martin, who is a mathematician at UBC, got to be a Wall Scholar. And if you're a Peter Wall Institute Scholar, you don't have to teach, and you get a whole year of just having fun with your research.

One of the other Wall Scholars was a guy called Harvey Richer, an astronomer, who used to run Canada-France-Hawaii Telescope over on the Big Island of Hawaii. And about November, Harvey said, hey, do you all want to go to Hawaii just before Christmas? And it was an easy sell. You know, he says, I'll give you a great telescope tour. And we were all thinking, hmm, warmth, light, you know.

So all the spousal units and the profs, we all set off. And we had this absolutely astonishing tour of this facility. And I couldn't get it out of my head. We sort of, there's a bunch of us academics, and we're bumping along in a jeep, heading, why isn't it working?

You point towards the computer, not the screen. Oh, thank you. Sorry. Okay, thanks. Okay. So at Ground Point Zero, I knew less than anything about astronomy. I used to think, okay, astronomer, a guy in white lab clipboard looking through some lens in a telescope observatory, and I thought that was it. And it's so different. So there's a bunch of us, and we're all going up on this dirt road in a jeep. And there are these incredible glacial moraines. And, you know, first of all, we go to this place called Halepohaku, which is the stone house where you have to acclimate at 7,000 feet. And then you go up 14,000 feet, it's about 40% less oxygen than you're used to using.

So you have to spend about an hour at the halfway house before you go up. So just below the observatory, Dr. Christian V.A. hiked us into this glacial lake. And we were walking quite slowly for maybe half a mile. And we were completely puffed. It's like you'd run six miles. You're just that depleted. It's very interesting. And the other thing is, altitude affects different people different ways. And for me, it was sort of like a three martini lunch. I was kind of drunk. Yeah, it was an interesting altered consciousness thing. But I just was amazed at how beautiful it was. Whoops. It's just absolutely, spectacularly gorgeous. So we go up. After Halepohaku, we go up to the very top. And there's the dome for the Canada-France-Hawaii telescope.

[3:02] And it's higher than just about everything else on the summit. There's other telescopes too, but we're pretty high up. And you have this incredible view down of weather that's happening down there for other people. It's quite extraordinary. I was amazed at the stark physical beauty of the place. I didn't know it was going to be that gorgeous. And I didn't know that the actual impressive machinery inside was going to be so awe-inspiring either.

You kind of feel like you're in a James Bond movie. And you're in the lair of the evil mastermind. Only it's all real. The director would push a button and we'd silently slide around this inner catwalk and stuff. It was just wild. It was very, very, very amazing.

So we had this whole tour. And I basically couldn't believe how beautiful it was. And I kept nattering and nattering and nattering. And finally, Martin said, well, why don't you make them a proposal?

Why don't you go there and make some art? So it's his fault. And I even had a dream that I made a painting of. It's a dream of telescope. So I did approach Dr. Christian Vier. And I think the interesting thing about that is he's French from France. And I've lived in France. I've lived in Paris for two years. And the French have a respect for the arts that really, as North Americans, we can't understand. You know, every Wednesday afternoon, they're all marched off about this high to see their patrimoine, their heritage, that as French people, the great art of the world is from their country and from other countries that came there to paint. And, you know, it's a big deal. So the fact that Christian was French, I think, was key in his accepting my proposal. I think a lot of North Americans would have said, an artist wants to come here? Nah. Yeah, she'll just get in the way. But he was like, an artist wants to come here? Great. You know, so he said yes. So I was very lucky that way. So basically, I arrive in Waimea. And the first thing they say is, oh, there's a team of engineers going up tomorrow. And they're going to be going from day observations to night observations. And you should, you know, get on the next train up. We can do your safety talk tomorrow. We'll just, you know. And the safety officer was like, furious that this happened. But the guys basically gave me the talk on the Jeep up. You know, you have a walkie-talkie.

Every half hour, you have to check in with your buddy in case altitude sickness might be threatening, whatever. And while we're at Halepahaku, we came across these plants right at the vegetation line. Now, did they not look like Dr. Seuss designed them, right? For Whoville.

[5:45] I was just absolutely amazed by them. But I had plans for them. So while we were acclimating, I had the engineers hopping around them collecting dead leaves. That will come up later in the talk.

But basically, it's a silver sword. And it's just an amazing thing. So there we are hopping around getting dead leaves. And then we continue our ascent up to the telescope. And they basically say, okay, take it easy. It's bright sunny. It's 10 below. It's freezing. You know, I've got all my kit.

And the guys have told me, you need to do process at altitude. Okay, so you need steps going through your day. You can't go up there and be inspired or something. You've got to have steps that you're going to move through. And so they say, have some sweet hot tea right off the get-go, because your brain starts to die at altitude. And you have to feed it with sugar. That's what the brain runs on. So I know, every half hour, you know, you're eating a candy or you're having some donuts or Doritos, anything salty to slow down your kidneys too, because they go into overdrive up there. So you're eating all this junk food. It's hilarious. And then you go back to sea level, and you've lost two pounds. I mean, don't tell other overweight people, because it would be a run on telescopes. But it's very interesting. So basically, I have my hot sweet tea, and the guys are all off in the actual scope. And I'm in the lounge, and I'm having my tea. And so I get my camera out, and I get it all set up and everything. And I look through it, and it's black. It takes me 10 minutes to figure out, lens cover's still on. So I open up my parka with my cheat sheet, and I go, take off lens cover for next time, you know. And I thought, well, I have nowhere to go but more stupid. This is the most oxygenated my brain's going to be for the day. So I thought, okay, do the most difficult thing first, which was a land work that I conceived of. I had an image of what they call first light, the first image the telescope made from outer space when it was turned on, right? So I have this image, and it's a distant galaxy. Anyway, so I've got this pattern, and I go down outside the telescope where there's dry rocks, and I transport snow to basically mimic this enormous, wonderful thing. And then I go up on the catwalk, and I photograph it with different filters. So that's one of the land works. And so any physical exertion takes, as I mentioned before, a lot out of you. So after doing my land work, I was a bit dizzy, and I took a short break, and

I had some of my, I had a nice light lunch of junk food with the engineers. And so it's a bit surreal. There's a telescope office that actually mimics the control room at altitude, only it's down in Waimea at the head offices. They can do remote observing. In other words, they can move everything, drive the telescope, do everything from sea level, which is wonderful. But in the early days, in the 1970s, when this telescope first got turned on, observations had to be done overnight at the scope. So in the first couple of years, people would go up there, and they're all from different nations, like 50 nations. It's like United Nations at an international telescope, because they have different universities from around the world buy different chunks of time to do observations. So these guys are all flying in, and they'd be up there, and they'd be bored in the middle of the night in between observations. So they'd start working on a paper. Let's get some work done up here. I'm all alone, you know, got to stay up all night. And they think this is going really well, you know, and they'd get it down to Waimea again, and it was moose drool, absolute drivel. And so there's this really big sort of poster over the fridge in the lounge, never work at the big problems at altitude, you know. So I kind of, I took that story to heart and thought, must be very, very careful about adhering to process. If I have a list of things to do, don't be thinking I can go off-piste and go off-trail and do something the way I might if I was in my studio down at sea level.

So people are curious about what type of art I would make in a scientific community. And the joy of that was, because I was self-defining the project, it was anything I wanted to do.

[10:11] So the Mountains of Knowledge project, it's a painting. It's two large companion paintings, actually. They're five feet tall and about a yard wide. Both of the images are, this is the day one, there's a day and a nighttime one. And what I did was I asked the telescope workers, the astrophysicists, the astronomers, software guys, engineers, I asked everybody for what their contribution to the telescope had been in the terms of, you know, what have you done while you've been here? And I got the most amazing quotes in mathematics, in Greek, in French, in Portuguese, in Hebrew, that's from Genesis, let there be light, you know. Just wonderful, you know, that's an optics engineer who's Jewish from Israel. Anyway, I got all these wonderful quotes, and basically the telescope is resting on a mountain of knowledge of these people. So that's, it's sort of a metaphor. Anywho, because that's such a specific work, and it was all about this community, I gifted them to the telescope at the end. So they've got, they've got them in their lobby now, which is kind of nice. When you walk in, they're my two paintings.

So then, the Silver Sword Fern project, which I mentioned briefly before, that was born of an earlier time. I was in Oxford, England, working with somebody at the famous Ruskin School of Art, and she was very interested in medieval ink recipes, the chemistry behind them, because some of these inks, we've got recipes going back four, six hundred years, and you look at stuff, and you think, wow, that looks really fresh and good, you know, that's a good ink recipe, it's lasty, you know.

So she shared one with me, and I got all the bits and pieces together, and took them over, and then ground up the leaves of the Silver Sword Fern, and then rendered the plant in its own ink. So that was why I had guys leaping around, looking for dead leaves. So I wanted to use a sumi-ei technique I'd learned in Japan, which is an ink brush method of painting, and so that's that.

Wow, nice. Thank you. Excellent. Yeah, and then I did a black wax etching of the same thing, getting its silveriness. The Stars Brought Us Here was the title of the final exhibition. It featured work from the employee workshops that I did, as well as my own art in progress converging on the Big Island Hawaii.

It includes printmaking that celebrates the first Hawaiians, the people who came from Tahiti. Now, back in the day, it took a Tahitian brave about three years to learn the system of navigation that they used in the Pacific. It's absolutely fascinating to me, because this is still, the system of navigation about currents and weather and stars and everything is still taught to the cadets at the Royal Navy in the UK. So this is one of the pictographs of the early Hawaiians. I did some printmaking about it. That would be lashed to the outrigger of the canoe. That was their map, right? You had to lie down in the canoe at night. You had to feel certain wave patterns. You had to see certain stars. Everything had to be lined up, and then you knew you were on the right way. And they went between Tahiti and Hawaii for ages. This is one of the analyses that somebody's done on that star chart. So I've done some printmaking to do with those star charts as well. And the next couple of slides are all, I made painted, sketch, and photograph portraits of people working. That's the head of engineering having a thing.

[14:09] And I just caught him when he wasn't looking. I did a lot of that sort of sneaking around. Drawing people, laying cable. That's an abstract. I went into the computer room and did some camera swings on slow exposure to get some light variances. Did some abstract work there.

That's me sneaking into the computer room. That's some guys laying cable from an unusual angle. I was up on the catwalk. They didn't see me. That's Karen. He's an Indian astronomer putting up with me. He's just had his lunch, and I said, hi, can I come in and take a few shots and a few sketches? And he said, oh, all right. I said, just keep working. Act like I'm not here. So he's a little self-conscious, but there he is. And there's a guy taking a morning coffee break out on the outside of the catwalk.

There's engineers and astrophysicists having a chat in the hall. There's a guy who's suspending down into the optics of the telescope to change something off. And I loved, there was all this sort of machinery around him. And then he's very human. And there's this little hand, you know. It was quite beautiful.

Beautiful sort of scene. That's one of the top software guys in the world. And he's just thinking something up. The guy who's coming down in a cage to help out the other optics guy. Anyway, so, right. Now, so the reaction to my being there amongst them ran from interested in quizzical to actually anti-Pauline and quite belligerent about it, and even anger. As the month went on, they tended to soften for the most part. And when people showed up at my studio to look at what I was working on or make their own work with me, that softened things. There was this one enormous Hawaiian engineer who shall remain nameless, otherwise he'd hunt me down and kill me.

He actually got tears in his eyes at the final show at the exhibition. And he came over to me and he said, you really see us? And I said, yeah, you're heroes. And he said, I didn't know. I didn't know that someone could see our truth and put it up in the walls like this. I'm so glad you were here.

[16:38] And I'm really sorry I was snarky. He was really lovely. But he basically had shown up about four weeks before and said, and he's a big scary guy. He looks like a linebacker for American football.

We're scientists and engineers and stuff. We all have jobs here. Why do you need to be here? Why don't you go paint something pretty? And I went, yeah, but there's stuff going on here that really moves me.

And so anyway, so I mentioned I offered creative break workshops to the employees of the telescope. And at a short presentation, the first Monday I was there, I told everybody the story of my first tour of the telescope when I kind of fell in love with it visually. And how I decided to approach the telescope with this proposition of an artist residency, and how excited I was about making art at the telescope. But I also pointed out to them, I wanted my time there to be a dialogue, not just eat shoots and leaves, but you know, connecting with people. And I said, well, I don't always know all the science as a layperson, but I'd be really interested in hearing about it. I heard about some amazing science that I'm making projects about. But also, would you come into my lair and make some art with me? Now, this is very interesting. It's a bit of a gamble, because these people live in the analysis side of their brain. And if you're making art, you invite the judge to go out of the room. You can't start doing art if like you're making a line, go, oh, that's wrong. Oh, that's wrong. You know, we don't do that. We have to be free and happy and the judge is out of the room. You can bring the judge in later to assess whether or not it's any good, but not for the initial phases.

It's got to be intuitive. It's a different part of your mind. So I thought, okay, I've got to design projects for them that have very specific parameters. So the exercises had to be quick, easy, not rely on traditional artistic skills. And they had to have an outcome that pretty much was always gorgeous. You know, like if people had the payoff of, oh, that's beautiful and I made it, that would be a good thing. So first of all, cyanotype or sun printing, this is a sun print, is an easy and dramatic printmaking methodology. So paper is saturated in photosensitive chemicals.

It's laid flat. Various objects are placed quickly on top of the paper. It's exposed to sunlight for a certain amount of time, a few minutes. And then the paper is stop bathed in water. You rinse off all the cyanide, make people wash their hands afterwards. And any area that's blocked by an object comes out as white and anything that's not, it comes out as very deep blue. Now, I told them to arrange their objects on the paper and to go out in the courtyard and expose it, but don't jiggle. Well, they all jiggled.

[19:34] So they all got beautiful multiple images. And that was their first lesson, that mistakes are our friends in art. Not so much in engineering, but in art they are, you know. Things can just happen and you can go with that. So anyway, so I also learned that if people show up and they want to do a sun print but they don't know what to put on and they're in the engineering or software division, you just get them to empty their pockets. Engineers have great stuff in their pockets for this sort of thing.

I just use even keys. I mean, that's a very simple one, but they have all kinds of great stuff. And I would make them, I say, arrange them. And they'd go, well, I don't know the right way to arrange it. And I'd say, it doesn't matter. Just arrange it in a way that pleases you. Oh, that's a new concept. So it actually went quite well, the sun printing. I've also studied the Inchinary Sumi-e in Japan, which is ink brush painting in Kyoto. I was keen to share some of the techniques with the staff at Canon France Hawaii Telescope. Now, oriental calligraphy can be very precise and very, you know, you study for thousands of years and everything. The methodology I was showing them is something that was very popular in medieval times where you are inspired by a character, a classical character in Kenji, but then you kind of do your own thing with it.

You're very expressive. If there are a few droplets, if there's some mess, if there's some smudging, that makes it more idiosyncratic to the moment you made it. That's a very Zen concept. And you can't do it wrong. So that's kind of very beautiful Sumi-e type thing. It was done by a guy who drives a telescope. So getting them to sort of, and it's processor into two, so that was good. I mean, you have to make your own ink and you have to hold the brush in a certain way and you've got to get your body into position and then take a deep breath, focus on your character and then make a visual poem.

That's galaxy. It's quite lovely. So if they liked that, I got them to do something called, and they were athletic and they were into their bodies. I got them to do Sumi-e writ large, which is Shodo. And Shodo is this kind of poetry, poetry, competition, martial arts thing that monks decided on in medieval Kyoto. And these guys, basically, they compete making poetry with their brush as a broom dipped into a bucket of ink.

They have a very uncomfortable crouch. You have to use your dominant hand on the bottom with your thumb down the broomstick, non-dominant hand on the top. This forces you to use your entire spinal column and pelvis to make every stroke. And you're in a crouch, you're moving backwards, and you're focusing ahead on your character, which is written on the wall in front of you.

[22:21] So it's a, it's a, people that work on their golf strokes love this one. You know, um, here I've got some of the, there's Martin in the back looking on, but there's something, well, I can't believe she's getting, getting them to do that. But anyway, so that was, um, that was fun.

And then my final offering for an art exercise was a 360 degree continuous shared landscape drawing. This is an exercise been used by the Art Students League of New York City for over 100 years.

So it, the activity requires five people, okay? And you basically find a hill or something, and you divide it with yardsticks into a pie with five sections. And everybody's got their section, positions themselves in said section. They've got an accordion book that I've given them. They've got a little pot of ink, and they've got a stick from the property. They've got five minutes to render whatever they want in that moment, in that, that landscape. Then they reach back for sand, and they sprinkle it over the wet ink, and they shut their little double-sided bit of the book.

They pass the book to the right, and their body to the left. And then they open up the book that's there, and they do the same thing. And you've got five people with those five minutes, and you basically get five accordion books with five different viewpoints by five different artists. And it's absolutely amazing the drawings that come out of this. There's the astronomer who had no horizons.

There's the accountant that did every blade of grass. There's the engineer that did a park bench with, like, you could have built it like it was an Ikea drawing, you know? Here's this screw, there's that screw, you know? It was just, it was very, uh, it was very, very wonderful. And they loved doing it together. And then at the end of the exercise, I had hard covers that I would glue on, continuous landscape, Canada, France, Hawaii telescope, and we'd all sign our names. And then I had silk ribbons, and you could just bind your book up. So you can either display it that way, or have it in your bookcase and bring it out as a, as a sort of a ancient scroll. But it was, um, that was a lot. And the twigs, you'd use the twigs because it loosens people up. You can't be exact with a twig, right? Nobody can. And that sort of loosens up and makes the work more interesting.

[24:38] So I did these exercises with just about everybody at the telescope, amazingly, by the end of four weeks. They all signed up for one or more. And, um, there was this really curious repeating theme, which I didn't see coming. Um, I call it art scars. Now, some of you in this room might know about math scars. I grew up having math scars. It's kind of a tribute that I married Martin, a mathematician, in spite of my math scars, because I was sort of taught by a lot of really vicious people in high school. They liked to humiliate me up at the board and shy chalk at me when I didn't get the right answer and stuff. And I got one really good art or math teacher in high school that restored my faith in, you know, that I could actually learn math. But generally speaking, um, it was painful. And to the point where, you know, probably in my twenties, if you said the word math to me, I just involuntarily twitch, you know, like, oh, yeah, ow. You know, well, interestingly, I didn't know this. There are people with art scars, people who were humiliated in school about their art production. I never knew that.

I mean, I was always so happy in art. I wasn't even looking sideways to see what anybody else was doing. So I, I found a lot of them become scientists, as it turns out. So people would show up at my, at my studio and say, hi, my supervisor says, I have to take a creative art break with you.

Like in the same tone, you'd say, I'm here for my root canal, you know? Um, and, and I, I couldn't believe this. I just thought it was weird. And then what was interesting was they'd make something really lovely and they'd go, oh, and you know, especially in the, in the cyanotype prints take about eight hours to totally finalize in their development. It was quite an organic process. So they'd be running down from the engineering wing to my, my studio and checking on how their cyanotype print was doing, or it was just quite gratifying. And then at final show, several of them would hang out near their piece where it was exhibited and people were going, oh, I did that with Colton. Yeah.

Yeah. It turned out pretty well, didn't it? You know, and you actually went from art scars to people having a tiny bit of ego in their creative abilities. And it was really kind of amazing. Um, I wasn't expecting that, but it was, it was quite wonderful. Uh, I didn't, I'm no art therapist, that's for sure. But, uh, God was kind of healing people through doing some of these things. And I thought that was quite beautiful. Who knew? The other thing that was interesting was, uh, uh, productivity bump. Now this is something that the director actually noticed. When people were having a difficulty solving an engineering or software problem or something astronomical, and their team came and did some creative breaks, and then they went back to their problem solving, they just fix it. And people were noticing this within about two, three weeks of me being there, to the point where the last week I was there was like solid bookings for creative breaks. Because people were making the connection between getting out of your analysis brain, doing something intuitive down at Colleen's little studio, and then going back to the problem, and bing, you know, we get it. So, um, anyway, uh, this was noted by different department heads who reported it to me and reported to

Christian. And then Christian, um, had a meeting in Paris with all the other international telescope directors. And, uh, and he reported on this. And so the next thing I knew, I was being invited to a lot of other telescopes. And it was like, we don't really know what you do, but we want you to come do it at our telescope. So just make us a proposal. So I was getting invitations to make proposals, which is kind of fun. So, um, that's the final show at CFT. And, uh, this is, there's, there's just a whole bunch of, of different studies I did, abstractions. I mean, you know, wherever my nose led me really, it was just quite wonderful. Um, it was very, very, very rich, um, in terms of inspiration for me. So my next telescope was in the Andes Mountains in Chile, some Gemini South. So it's a two-part telescope. Part of it is down in Chile, and the other part is on Mauna Kea in Hawaii.

[28:54] Um, and, uh, but I was down in the southern Cordillera of the Andes, and I prepped for the trip by studying some Spanish and the history of the telescope and interviewing astronomers, doing science there. And what was really cool was the European Space Agency was about to land, um, a probe. They'd been working for decades on this space probe onto a moving comet. So, um, this was the spaceship Rosetta who landed Philae. And you may remember the project. It, it, uh, it was very exciting to be there because we were the Southern, um, observatory and space agency staff were there briefing the astronomers every day as we followed it. And so it was very, very thrilling.

Uh, British astronomer Colin Snodgrass began his first talk to us, to the Gemini staff. We not only had the first landing on a comet yesterday, we had the second and third landings too, because it bounced.

You may have remembered it bounced kind of like out of where its solar panels could get recharged. So they had to sort of speed up the science, but it did get a lot of, uh, of really good findings. And, uh, uh, that's, uh, yeah, that's it in its dark little, little area. But, um, it was very exciting being there and finding out about the nature of what was coming back and what can be done with that data about the origins of the universe and how things might have happened. Um, so, so, so basically, um, um, that was my, my first sort of, uh, big thing happening down in Chile. But, um, during that same first week, um, they were giving a national, uh, award to a guy called Father Pichetti, who's this, um, amazing Jesuit, um, who, he's got this passion for astronomy, La Sirena, where the chief offices of Gemini South are. Um, he's, he's just been raising up astronomers at this, uh, at this seminary school and everything. And he's, he's invented a whole bunch of tools, like teaching aids, to show people about astronomy from when they're little right up through teenagehood. And, uh, he's rigged up small telescopes to focus on a star chart so that someone can get the feeling two rooms away of being a telescope observer, you know, on the computer. Um, he's just done absolutely wonderful things. He uses antique paraphernalia. Um, he's just a lovely guy.

And I sort of caught, he builds telescopes and stuff. He's, he's, he's in his late nineties, believe it or not. And he's still chugging. And, uh, we sort of broke, we spoke in broken Spanish to a certain extent, but I also had another guy there who spoke very good English and Spanish and did some translation between us for some of the technical stuff. But, um, it was, it was a, a really interesting, um, insight into, um, you know, astronomy education, um, in Chile. So, um, so that was a kind of a little side trip, but, um, it was quite, quite wonderful, really lovely guy. That's one of his tools, just different gears to show how, how different things move in the world. Um, so after one intense morning painting, I gave a cyanotype workshop and got great results with, um, uh, Blair, who's an astronomer and his wife, Jazia. Um, she's from Algeria. He's from Australia. They're married.

They're both astronomers and they're both working at Gemini. And, um, Blair is doing really interesting stuff with galaxies. When one galaxy crashes into another galaxy, they don't go bang. Stuff happens with different gravitational pulls. And he's working with probability scientists to develop math on this. It's very, very interesting because sometimes it turns into something else and sometimes it just passes through, but it's changed. This is absolutely riveting. Anyways, he's doing wonderful stuff and she's doing mapping of far galaxies. And they're finding out an awful lot more about the composition of things at distance, um, through spectrographic data and the new interferometers.

[33:00] These are things that interfere with light that would otherwise mess you up looking at something so they can, um, figure out what types of light they need for what picture of the object.

And she, she does a lot of things on that. Um, so I was keen to see all the, um, the astronomer observers and the actual landscape up there in Seropachon, Pachon Mountain.

It's about three hours from the coast, which is where the, uh, offices are. The courtier of the Andes, very beautiful. Um, because I'd been at CF, CFHT before this in Hawaii, I knew about remote observing and I'd been through the night with remote observers, but I'd never been up at altitude with people observing through the night. And there was this young team of astronomers that was from like about four different countries. And they'd been working on something for about 10 years. And this was the culmination. They had to get their observations in over the next week sometime. So there are different universities that all paid for this time. Um, and, uh, so there we were. Um, and it's a sort of a, a coordination of, uh, who's driving the telescope? Who's the chief astronomer? Who's the head of the scientific team? What are we trying to look at tonight? And everybody's got to work together to achieve what they can with the given weather because you can have technical malfunctions. You can have weather coming in, but, um, they got everything they wanted that night and it was really thrilling.

The, um, different masks have to be designed to cut out all the light that might be confusing to the results. As I just mentioned, um, the project leader applies to this telescope corporation for a time slot in an optimum viewing. And it's, it's a, it's, uh, it's quite the, quite the dance.

And, uh, there's Gemini 2 with everything open, getting ready for the night, sunset. That's spectrographic data coming in from a galaxy far, far away.

[35:02] And it looks like, to us, it looks like crinklings of aluminum paper. You know, it's, it's not very thrilling, but if you know how to read this stuff and you're an astronomer who's been working on the project, you're going, ah, there's carbon, ah, there's nitrogen, ah, there's, you know, they know how to read that stuff. And they, and they, they're like little over caffeinated squirrels.

They're just like, oh, this is so exciting. So it was very thrilling being there. And about 3am that night, they got everything they needed, which is quite wonderful. Um, so, so basically we've got, these are just, because we had extra time, we had the telescope operator take us all into the bowels of the place and look at everything. And I did some of these sort of drunken, fuzzy photos.

And that's the final show where we put up everybody's work. And, um, I had this sort of moment with a couple of other people who said, wow, you see us as heroes. And I go, yeah, you're making engineering decisions at, you know, 12,000 feet with a lot less oxygen than most people have to do it.

And you are heroic. And so anyway, that was, that was a kind of a positive thing. So that's specter crinkles. And that's a sketch of the telescope operator trying to get, get his mind through the fact that clouds have just come in, they came in, but then they went out again. But right there, he's kind of like, hmm, what's plan B here? Um, they do have to react to what's going on there. Again, I did another, um, two mountains of knowledge and got, you know, quotes from, from different, uh, employees and they're not framed up there, but they're, and they're a bit wrinkly. It's not a great shot, but you get the idea. And onwards. So this is the large binocular telescope. My next telescope was in Arizona. And, um, so my, my base was, um, in Tucson at the University of Arizona, but the telescope is about three hours away up on Mount Graham. What's unusual about this telescope is it's about 11,000 feet. It's not that high, but, um, it is in a bunch of conifers because it's on what they call a sky island. So the geology of the area is really fascinating. You're driving through the desert and there's just all these cap die and stuff. And then you mount up into a coniferous forest. So it's usually the other way around. You leave, you know, a forest and you go up and there's just, it's like the dark side of the moon. It's just all, you know, gravel moraine. But this is actually what they call a sky island. These things pumped up during some previous geological era. And so it's a coniferous forest at the top. And this is, this has problems. They just had a horrendous fire this last summer on the mountain that threatened the telescope and has shut down observations for several months while they deal with, with stuff. Um, and I, I'd seen photos and

I knew the LBT was the largest ground-based astronomy observatory on the planet, but that didn't really, it's such a honker. Boy, is it big compared to the other telescopes I'd seen. It's binocular. So there are two collecting pools, which look like two ginormous lakes up there in Gregoria and stuff, of Vitaly. It's just beautiful. Um, so basically, um, we stopped for a needful early morning coffee on the three hour drive up there. And the next stop was rather unusual. We had to stop, um, in a small forestry office at the base of the mountain under a ceramic red squirrel cookie jar. There's a two-page form describing a small rodent. It's a red squirrel with small ears. And in entering the park, you must promise not to hound, worry, bother, kill, or otherwise interfere in said squirrel's squirrely existence. No way. Don't mess with the squirrel. And it's like paragraphs of ways that you could mess with a squirrel that you must not do. So you have to read through all this stuff. And then at the end, you've got to sign off on it. And this little bureaucratic deviation has to be signed by anybody going up the mountain because the squirrel is an endangered species. Now this dates back to the days of the protests, the First Nations people, um, and the Apache nation protested the establishment of the telescope on Mount Graham, which was their sacred mountain. And they were looking for ways to block the telescope. Finding an endangered species was a plank in their argument. But, um, at any rate, uh, the telescope did eventually go through. Um, it was an act of Congress actually that pushed it through finally. Um, but the forestry service mediates the mountain for the relationship between First Nation, the environmentalists, the telescope people, the Apache continue to come in and prey on their sacred mountains. So anyway, it's, it's kind of sorted out at this point.

[39:53] So snow was predicted, but it was a clear sunny day and it was cool at altitude. I felt a little lightheaded walking uphill, seemed more taxing. Got a great tour of the internal workings of the telescope and engineering, uh, twin 28 foot wide telescopes, um, mounted side by side on a common mount. It's really amazing. Um, the mirrors look like silver pools beneath all the adaptive Gregorian secondary mirrors and adaptive optics. And again, you get that feeling like you're in a Star Wars movie, only it's not a movie. You're actually there, you know? So in certain parts of the universe, astronomers don't have a guide star to calibrate in the area. So we haven't been able to look at these areas because generally a telescope driver needs a guide star to be able to calibrate light and then figure out what else is in the neighborhood. So if it's a very dark area, you don't have a guide star, you can't do it. So the world's first commissioning of a cosmic laser was happening at the LBT when I was there. And so scientists from 30 countries have all flown in and everything. Um, there's no room at the inn for the resident artist. So the director wants me up there, but he doesn't have a bed for me. Um, so they asked, uh, the neighbors if they could put me up and the neighbors were the Vatican advanced technology telescope. So yes, I was sleeping with the Jesuits.

So, um, it was, uh, it was very, very interesting. Um, the commissioning of the laser was amazing because they had to get military planes to make sure that there was nobody flying through.

This is a powerful laser. Um, they had, they had spotters all over the mountain with, with, you know, linked into communication systems. It was quite a big deal. Um, that's the view from the lunchroom.

Again, that's a coniferous forest above the desert. It's amazing. That's the laser. Yeah. Um, that's the laser up close. Yeah. Um, so it was, um, it was absolutely astonishing to be there. Um, so after a long day of drawing and doing some exercises with staff and dinner at the LBT and then on to evening observations, I headed over to bed down at the Vatican that night. Um, and when I walk in, I hear soft Baroque music and I think to myself, I don't want to go to my bedroom. I'm going to go out in the control room and meet a Jesuit. So I climbed up the staircase to the control room level and I met Father Christopher Cabali. He's an astronomer and a Jesuit and he was in between active observing modes that night. So he gave me a whole tour of the telescope, allowed me to take pictures, have a chat with him about his science. Um, I thanked him for letting me stay because, you know, otherwise I wouldn't have had a bed up there. Um, he's really, really interesting, nice guy. There's optic cable programs that run between the two telescopes. So they share light on certain things and stuff. And, um, anyway, very, very nice man, completely different look to the, that's the, the VAT telescope itself, just down from the large binocular telescope, more traditional looking telescope. And that's Father Christopher Cabali in his control unit with his box of Triscuits. I really liked that. So the next day at breakfast at about three in the afternoon, because that's when you get up for breakfast, because everybody was up the other night doing, doing observations. I'm having a chat with, um, Syria, who's an Italian astronomer in a very good mood because observations have been fantastic. I learned all spectrometers are not built equally. So if you're a bus driver and, you know, you get on with one bus company and then, you know, you decide to take a job with another bus company, it's a bus, you know how to drive it, right? But spectrometers, which are add-ons to the telescope, which, which help you get your data, um, every time they make a new one, uh, it's a completely unique design. And your university, who's sponsoring you as an astronomer to go and do these observations, you've got to know about that technology in order to tell the operator what you want to be focusing on and how.

So you kind of have to learn all this engineering and it's not your field, but it would be similar to buying a new car and finding out that the, the steering wheel's in the trunk, you know, it's just every time it's different. And, uh, Syria was whining about this bit, but, um, he says, if you don't learn your technology and it can take up to a month to learn a new interferometer or spectrometer, he says, if you don't know it, you're wasting everybody's time because you're faffing about, you know, so you've really got to know your stuff. I thought that was very interesting. Um, I told Syrio about my conversation with father Christopher Corballi the night before, um, Christopher Corballi is famous for unmasking Lambda Buddhist stars. Now Lambda Buddhist about 40 years ago, they're really mysterious stars. They were thrown into a grab bag of, we don't know what those are. Somebody look at that someday. And so Christopher Corballi and his colleagues hauled these things out, had a look at them. They used to be called twin stars. He's definitively proved that they are not twins, that they are what is known as enigmas. They don't fit into any of our current star classifications. What's interesting about them is the closest thing they resemble is our own sun. And there's a whole bunch of them. And they could unlock a lot of mysteries about how the universe is going and went. So anyway, that was, uh, that was fascinating. And I, I asked, um, um, Sirio, Italian astronomer about the Jesuits. And they went, um, oh, those guys, they're amazing. They create wonderful science. They don't have to go back for a, um, a renewal of their grant in every three years. They can do long range astronomy. They don't have families.

[45:53] They don't have job security whereabouts. They just get up every morning and do science for God. And they're really dedicated. They do wonderful, wonderful work. So that was, that was very interesting. Um, I also, he also said that the hot new area of astronomy is exactly what Chris Corbelli is up to, which is going back over old assumptions with new data and applying new data to old assumptions and coming up with more truthful science or a furthering of the truth in science. So after him, I talked with a Brazilian astronomer, Idr Martioli, who said, the data we can now obtain is so immense.

We need to pull in other people to help us with it. And I said, what do you mean? He said, well, like your husband's a probability mathematician, we use probability math to figure out the best data optimization. He said, now I could go back to school and become maybe half as great as your husband in probability, but it's better to get him on the team and get him working on probability math for this data set.

So he said, back in the day, you know, the great scholars of medieval times knew all the knowledge in their one brains, right? Then the disciplines happened. So you'd have, you know, engineering going off in this direction, chemistry going off in that direction, and all this breakup of the disciplines. He says, now, in order to deal with some of these mega projects we're working on in astronomy, we have to invite all these other disciplines in to work as a team. I've got a biologist on my team, I've got a mathematician on my team, so we've got all these people coming back together to work on their chunk of what they can solve about these enormous amounts of data. So I thought that was kind of interesting too.

And about the most impressive adaptics optics thing I've ever seen is the enormous link nirvana. At the height of the project, there were more people working on link nirvana than there were working at the large binocular telescope itself. It's like 15 tons of metal wiring, carbon fiber.

They got this thing onto the telescope, and then they had to take it off to make adjustments. So even just getting it off, and it's got a cryogenic cooler that weighs tons. It was just fascinating, all this stuff, and getting into the guts of it, because it was off the telescope and opened up so I could get in and do studies on that. So anyway, they were taking a break, link nirvana engineers, and I got the call from the head of them saying, we want them to do creative break exercises at altitude.

[48:21] Now, I've been at altitude for three days now. I'm not the sharpest crayon in the box anyway, but I hoped I'd have enough spit to teach these guys the various different techniques. So there they are laying down some objects for a cyanotype printing session. And one guy's from India, other guy's from Sweden. It is like United Nations. The lingua franca is English and kind of some Spanish sometimes, but generally it's English. One of those beautiful cyanotype. And this is, I said, put down what gets you through the night. And this one guy said, oh, well, listening to my music and tracking all my physiological responses and making sure that I've had enough coffee.

That's his bunch of stuff. That's Jürgen. Yeah. But they always sort of turn out dreamy and lyrical and beautiful. That's key for getting rid of art scars.

That's spectrographic data. These are just a bunch of quick sketches of stuff I did at altitude.

And some cabling stuff. There's just so much. Oh, these are wonderful little magnets. There's an eggshell thin piece of glass on the Gregorian part of the mirrors. And atmospheric changes can be dealt with thousands of magnets, which can adjust where the glass is in the world. It's just absolutely stunning stuff. It's an abstract looking down a hall. That's a boogie buggy. The whole telescope, two parts of it rest on these boogie buggies that are on iron trails. That's Safford.

If you look down from the top of the mountain, you see this little town. So I did a little point of losing thing about the town of Safford at the base of Mount Graham. There's the guys freaking out. Weather's coming in. They're always really interesting to draw because they don't notice me then. That's the control. That's Tom Herbst. He's a Canadian from Montreal who's the head of Link Nirvana, which is the largest and most important interferometer in the world. And he's laying down the lot of the team. Yes, you will go for a creative break exercise with Colleen this afternoon. That's the inner guts of the LBT. And it's been turned on its side so they can work on it.

[50:49] So the reflecting mirrors are at the top. You can just see the curve of that. You can't, it's really hard to get it all into one shot, really. But because the guys are just going up the ladders, you can see the scale of the thing. That's the final show with some of the Sumi-e, the Shodo, and their wonderful sun prints. So I got to visit the place that has the moon rocks. The biggest meteor collection in the world happens to be at University of Arizona at their astrolabs, the lunar and planetary labs, which has basically been all interplanetary stuff has come out of this lab. So they've got all the meteors. They've got the moon rocks. And Bashar Rizik was the specialist that was assigned to tell me about their latest project, which is OSIRIS-REx. So this is basically, we're sending out a spaceship to ride alongside an asteroid and then gently touch it to obtain the surface samples and then retreat to Earth. So it's a bit like the Phil-AE, only in motion.

So it was launched at Cape Kennedy Space Center last September, and a multinational sort of thing, the U.S., Canada, France, Germany, Great Britain, Italy. Terribly, terribly interesting. And so that's ongoing, another asteroid project, which I'm going to make some art about. So a lot of this is stuff where I'm getting ideas for projects that are coming along. So that was a bit of a diversion going to where the moon rocks are. But everything that we know that goes into those projects is from ground-based astronomy. So, you know, that mission wouldn't have been developed if it wasn't for ground-based astronomy. So it's going to reveal a lot about the history of the asteroid, the probabilities in terms of danger to our planet from asteroids and the possibility of life out in space. So that's OSIRIS-REx.

So, um, next we've got, yeah, that's the Pope's summer palace in Castel Gandalfo, south of Rome.

And that's walking across the way there is, um, brother Guy Consul Magno of the Society of Jesus. He's a Jesuit, and he's in charge of, um, astronomy at the Vatican. And he's in his mid-sixties. He was born in Detroit, Michigan. Um, he became a famous scientist first, and then he joined as a lay brother with the Jesuits. So he's probably one of the top meteor scientists in the world. He's really an impressive guy. So he's not a priest. They have lay brothers as well as priests and Jesuits.

Um, he's a scientist for God, okay? We had a fantastic tour. Um, I'm still processing it into art at this point. Heard many insights into Vatican science. Most people think of Galileo Galilei.

[53:58] And the Vatican, ah, those people, they don't believe in science, you know? They think that faith is on one side and science is the other, and you're evil if you believe in science, you know? That's completely wrong. The Vatican is not firmly against science. The best astronomical science in the world, both historically and currently, has and is being done by the Vatican.

So, one thing, the Pope, right after the Pope, who imprisoned Galileo Galilei, but let him keep working under house arrest, um, that next Pope blessed all new scientific endeavors to uncover God's truth in the universe. So, these people are on a mission. The Vatican was a scientific powerhouse from that very onwards. So, um, basically when you talk with astronomers from other universities in the secular world about the Vatican, it's, I was telling you, they don't have families, they're totally devoted to the cause. They do long-range stuff that we can't do because we have to keep applying for research grants every three years. Um, so Brother Guy points out his people don't need to reapply every three years for a grant. And they can do really long-range astronomy nobody else can do. So, and it was also great to talk to somebody who's a really committed Christian, as well as a committed astronomer, that the quest, his quest in his own eyes, is to uncover more of God's truth about the universe. Um, we were driving through the very beautiful gardens, um, of the

Papal Palace, uh, which is headquarters of Vatican astronomy, and, and we're passing these absolutely exquisite-looking cows, and he said, ah, this, these are the papal gardens, those are the papal cows.

If you want papal milk, you have to run a papal bull through here every so often. And I thought, wow, major Jesuit making really awful pun joke. Um, there's some of the observatories that we were toured through, that I did photographs and sketching up. There's Brother Guy.

You can see that thing is completely lined with wood, that dome. There he is, fixing something up for us to look through.

[56:11] And that is Mars with all the canals drawn on it from a long time ago. They've got a wonderful historical collection of things that he toured us through that I've, I've done quite a bit on, but, um, I, I didn't want to take up too much time this morning, and I had way too many slides. I'm sorry, but that's, uh, pretty much it for now. So thank you very much.

Questions? Yeah. You know, with this, by listening to you, it sounds like you've got quite a lot of insight. It sounds like you think in pictures. Now, if a person thinks in pictures, is that just the side of an artist, or is that just the way the person is, do you think?

I don't know. Good question, yeah. I think in pictures, obviously, and you've got, because the way the Hawaiians complimented you and your sensitivity, you seem to be able to see into things, and like, you're able to sense things.

Well, I like to think I've got some perception, yeah, but, um, but that's, that's a very interesting way of putting it. I've not thought about it that way. Maybe you're like a real people person, you can sense atmospheres, and you've got good street smarts.

Maybe. And you speak Portuguese or just Spanish? Uh, Spanish badly, English badly, French badly, some Icelandic, a bit of Japanese. Wow. That's pretty, that's pretty good.

[57:28] Yeah, yeah, I can, I can murder verbs in a number of languages. Wow, that's pretty neat. Yeah, anyway. So that, that was an observatory, is it at Castell? Yeah, it used to be, it used to be in the main show, but the competing light from Rome was kind of getting to them.

So they moved her out to Castell Gandalfo, because, uh, you know, this is, um, it's a tiny little, uh, village on this beautiful lake, and their palace already existed. So they just took over a chunk of the palace, and, uh, but it's, it's a very impressive place, because it's the repository, they've got all the antique stuff from, like, the last 400 years of astronomy out there, which is just incredible, yeah, yeah.

How do you stop, are you going to keep doing this again, or? Uh, well, I've, I'm, I'm hoping to get the manuscript for the book done this fall, and the rest of the work completed this fall, too, that, that series, but, uh, I would certainly be open to visiting another telescope.

I mean, they are kind of, you know, yummy, and each one is so unique, and has different things going on, and different science going on, and, uh, so yeah, I'm, I'm, I'm kind of nuts about it. So I, I wouldn't, I wouldn't say no, never, but hopefully we'll get the book done, and, you know, yeah.

So, yeah. Do you know why there are so many guesswork for astronomers and scientists? No, good question. Um, but I never met a dumb one. Um, on the first morning that I woke up after meeting Dr., uh, Father Christopher Corbelli, um, I kind of felt my way into the kitchen, because I smelled coffee, and he was there up bright as a penny at, like, three in the afternoon, and, you know, we'd all been up all night, and, and he said, do you know what day it is?

[59:09] And I said, no. He said, want some coffee? Yes, please. Thank you. Mm-hmm. And then he says, well, it's, it's Sunday. Oh, yeah, Sunday. And, uh, do you know what Sunday it is? And I said, no.

He says, Pentecost. And I went, oh, good. And, uh, and then he said, uh, so we're having a special mass up here. And I said, oh, great. And I'm looking around, and I'm saying, so, uh, so who all's here?

And he said, oh, just you and me. And I went, right. And while I'm kind of just, like, coming into, you know, my brain, sucking on the coffee, he's got the stola out, kissed it, boom.

You know, he's got the sibelium out, he's got his chalice, and he just goes for it. And so I, I celebrated, uh, mass at 11,000 feet at the Vatican telescope with Father Christopher Carelli, because that's what you do.

And it was, it was quite lovely. He had a very beautiful homily about miracles in the world and the universe, and, and I, I was it, though. It was quite funny. Got my wafer, and, you know.

[60:09] Anyway. Never met a dumb Jesuit. That's what I'm telling you. I mean, you, yeah. So on the day when tongues of flame are supposed to come up, people said that laser's going into the sky?

Could be. Could be. I don't know. It really, it did feel quite cosmic that night. It was quite amazing. And there were all these scientists running around and going, this is a, this is an area of space we've never seen before, and this is so exciting.

This is our new guide star, this laser, and we're observing stuff that we've never observed before, and it worked perfectly, and so everybody was pretty thrilled. Yeah. Last question.

I guess people are coming. I'm just curious. Do you, do you think that, I mean, in what you were observing and what people were observing, you know, as a, from a Christian perspective, you see the miracles of the universe, the miracles.

Mm-hmm. Do you think that there's that capacity that you see in the scientists to start wondering outside of themselves, just because of it? The Jesuits were already there, so they were discovering other Christians.

[61:08] Yeah, but I met other, other very devout Christians amongst the people I was working with, who also don't have any division between what they were doing and what they were finding out about the universe and God.

You know, that just God is so immense and so complex and so beautiful and so wonderful, to find out more about the truth of his world is, is, is just a blessing in its blessed work and that, you know, that was, and, and talking, I think, also to Guy Consul Magno, that became quite evident that he, he sees this as, this is what God wants me to be doing.

You know, this is, this is the mission. This is my remit, my part of the kingdom. It's what I'm supposed to be doing. So, um, that was, um, that was very moving. Quick follow-up to that.

Was there any, like, one wrestling though? Anyone who was an about atheist, for example, or an agnostic and they were looking through these teleco, telescopes and just saying, wow, uh, I feel moved by this to believe in God.

That's, that's, that's something that, uh, kind of... I, I don't know. Okay, you never met anyone. I, I met people that, um, said things at the moment, even the, we were getting the first pictures from Philae when I was down at Gemini, south in Chile, who were saying, how can anybody doubt that there's a God?

[62:39] Look, look at that, you know. So, but that would be, obviously, a Christian person, sort of going, wow, glory to God, you know, sort of in that moment. Yeah. But I didn't have any conversations with people about, like, trying to convert them or something, uh, or...

No, but they were themselves wrestling. Yeah. I look in these telescopes and I just... I don't, I didn't have conversations like that. I was mostly just trying to get them through that, the art that they came to make with me.

Yeah. So, different focus. Yeah. Would be interesting, though. I'm going to have to cut it, I guess. I, uh, I just want to take the opportunity to thank you so much, Colleen, for bringing in that.

Thank you. It's amazing what people are doing. We get these little insights, a little piece of it, and I really appreciate that.

Thank you. Thank you.