



## Season 4, Episode 2

# Casey Berger: Choose Your Own Multidimensional Career

### SPEAKERS

Sarah Webb, Casey Berger

#### **Sarah Webb 00:00**

I'm your host, Sarah Webb. And this is Science in Parallel, a podcast about people and projects in computational science. In this episode in our series on creativity in computing, I'm talking with Casey Berger, a computational scientist who has worn many professional hats. Many know her by one job: as an assistant professor of physics in data science at Smith College in Northampton, Massachusetts. She completed a physics Ph.D. at the University of North Carolina at Chapel Hill in 2020. And that work was supported by a Department of Energy Computational Science Graduate Fellowship, often called CSGF for short.

#### **Sarah Webb 00:43**

In addition to her interdisciplinary research, Casey has published four novels, including a new book in the Choose Your Own Adventure series, *Sister from the Multiverse*. And that's not the only plot twist that she and I discuss. Before pursuing computational physics, Casey worked in Hollywood and planned to be a studio executive. Join us for a wide-ranging conversation about how the discovery of the Higgs boson led her toward physics, how focusing in more than one area can bring innovation, and the questions that she constantly asks herself to build a sustainable, joyful life and career.

#### **Sarah Webb 01:22**

Casey, it's great to have you on the podcast.

#### **Casey Berger 01:24**

Thanks so much. It's great to be here.

#### **Sarah Webb 01:26**

So first of all, give me the brief version of who you are and what you do.

#### **Casey Berger 01:32**

So I just started my job as an assistant professor at Smith College. So for anyone who doesn't know, Smith College is a small liberal arts college in western Massachusetts. It's a gender-diverse women's college. So it is a very unique and wonderful position to be in, and especially as a woman in STEM. And I'm jointly appointed, which is I'm in two departments. So I work on questions of many body quantum mechanics, but I answer those questions using data science methods. And it's quite an interesting challenge living on interdisciplinary boundary like that, I love it. It's wonderful and exciting. But of course, it is also challenging in a lot of ways. So it's been a fun direction to be going with my career.

**Sarah Webb 02:10**

You did not have the most direct path into this career. And so I wanted to learn about your journey into physics and computing and all of that.

**Casey Berger 02:22**

Yeah, it's funny when you asked me to say who I was and what I did – my brain immediately went, that's actually a very long story.

**Sarah Webb 02:28**

I want to go back and actually get the long story.

**Casey Berger 02:31**

When I was a kid. I loved science. I loved math. But I loved a lot of things. I was an avid reader, I would always tell stories, I think my mom enrolled me in Shakespeare camp at the age of like, three. So I've always been interested in a huge variety of activities, a huge number of ways to be curious about the world, but didn't have to specialize, right. As a kid, you get to kind of do whatever you're interested in. And as I approached college and was starting to get asked the question, you know, where are you going to go to college? What are you going to major in?

**Casey Berger 02:58**

At that point, I had started to have a lot of confidence issues in my science abilities. I had been at an all-girls school, and I switched to a coed school. And right around that time, I found that I didn't think I could stack up to the guys in my class. I just didn't feel like I was as good as they were at science. And there's a lot of reasons I'm sure why I developed that sense. But at that point, I decided, well, I love science, but, you know, I also love other things. So I went to college, I went to Boston University, and I majored in film production and philosophy. I did not take a single math or science class in my entire time at BU.

**Casey Berger 03:34**

And when I graduated, I moved out to Los Angeles. As I mentioned, I'd been in theater camp as a kid, I was still very involved in theater and the arts. So I actually worked in Hollywood for a couple of years. I was working in talent management, which is very much about building the careers of writers and directors. And my goal was to become a studio executive, make movies. But about two years in the had been working there, steady job, I was doing all the right things to move forward in that career, I realized that I really missed talking about science. And I really missed asking rigorous questions. The Higgs boson was discovered, right around, I'd been there maybe a year and a half. And I came into work really excited. And I was like, Wow, you guys, this amazing news. Like they found this particle. And everyone in the office was just like, why do we care about that? And I remember feeling like, well, you know, sure, it doesn't have any bearing on your career. But it's interesting, right?

**Casey Berger 04:31**

And I missed having people I could talk to you about things like that. So it wasn't like a light switch, like, but over time, I sort of realized I wasn't happy, and I wanted to leave. So I took what at the time felt like the biggest stupidest risk I could take. And I quit my job. And I moved home to Ohio and went back to school and studied physics, because I had some perspective. I was like, Maybe I wasn't so bad at math and science after all. The fact that I tested out of every math and science class in college. I didn't have to take any, maybe would have been a good hint. But I just decided to this is the thing that I regret not doing. And so if it all blows up in my face, then I already quit my job. So I'm already at rock bottom, what's gonna happen? I just had to try something new. And it turned out that – surprise – I actually am pretty good at physics, and I love it. And that is actually half the battle. So I went back to school, and

immediately after getting my, I guess, technically, third bachelor's degree, I went to grad school for physics, and the rest, very compressed, led me to where I am now.

**Sarah Webb 05:31**

That's terrific. Talk about where computing came into that. Was that an offshoot of the physical problems you wanted to study? And once you got into physics, how did you get into the problems that interest you? And where did computing come in?

**Casey Berger 05:45**

Computing was a very unintentional direction. Similar to my feelings about math and science, I thought I was bad at computers. I just had this narrative about myself that every time I touch a computer, something goes wrong, right? So it must be me. And we had to take a C++ class for my physics degree at Ohio State. So I remember saying, Okay, it's one semester, how bad can it be, you just have to survive. And then you never have to look at a computer again, for the rest of your life. I think it was two weeks into the class, I was like, Wow, this is really cool. You can do so many amazing things. Just like with physics, right?

**Casey Berger 06:23**

A lot of being good or bad at something has to do with comfort level and has to do with experience. If I had just tried learning more about computers, I may have decided much earlier, actually, I like them. They're very interesting; you can do some really cool things. So I took, you know, the one C++ class. And then I decided I'm going to try computational physics research. So as an undergrad, I did a little bit of research. I did a computational physics REU and by then I was completely sold. And then when I applied to grad schools, I also applied for fellowships, and I got the DOE CSGF. And it just felt like the perfect fit. As time goes on, I shift more and more towards computers, in the way that I work on my research. It's all computational at this point.

**Sarah Webb 07:02**

So talk to me a bit about the science questions that you're interested in, the research that you're working on.

**Casey Berger 07:07**

Very broadly, I'm looking at quantum materials. And I am a theorist. I don't do any work with actual materials. But what I want to understand is how do the physical laws that we know about, how do they work in this, what we would call many body scale? We have more than two or three particles, right. So it's you know, the two-body problem, we can solve. The three-body problem is complicated-- we can still solve it, the more particles you add, the harder and harder it is to understand what the fundamental physics is doing because you have all of these interactions between the objects. But once you get to a huge number of objects, then you can ignore the quantum effects, right, you're looking at macroscopic behavior, you know, we're made up of so many atoms, that we don't think about what each individual carbon atom in this is doing. But in that weird in-between range, we want to understand the quantum behavior of you know, 100, 200, 300 particles, it's actually extremely challenging. So we need innovative methods to understand the way all of these interactions sort of play off of each other. And what the end behavior is, I'm leaning more and more heavily towards data-science methods, using machine learning to try to recognize patterns in quantum materials. And the hope is that these insights will help us develop better materials that are maybe more energy-efficient, that are maybe going to allow us to do more precision experiments.

**Sarah Webb 08:32**

I want to learn a little bit more about your academic career, and the fact that you ended up working at Smith, at a liberal arts college. There are many things that you could have done with your Ph.D. And how did that end up being the path that you wanted to take?

**Casey Berger 08:47**

The advice that I always give to students is just as you said, there are so many things you can do with a degree. But what matters is, do you enjoy the day-to-day of what you're doing? And does the life that you're living align with your values, right? It doesn't matter what your advisor says you should do; it doesn't matter what your family thinks you should do. Obviously, those things influence us. But when it comes down to it, you're the person who has to live with your life every day. And if you're not happy doing something, you won't be able to maintain it: you'll burn out, you'll get tired, you will be unhappy. So for me, as happens, I think, to many people in grad school, I got to a point where I realized I wasn't happy. And I had been there before, right. I had done that already in my film career. And that prompted an entire change of career. So I did sort of sit down and go, Whoa, all right, I see these warning signs again. Am I about to quit my Ph.D. and go be a whatever, you know, pick a new career? Or is there something about this that's making me unhappy and something else that's keeping me here? And you know, what's the balance of the things that I enjoy and the things that I don't? And when it came down to it, I loved helping people. I loved working with other students. I loved teaching to the degree that I was able to as a graduate student. And I loved outreach and communication. I enjoy research, I really do. But it wasn't the thing that drove me, right. The thing that drove me was coming in and working in a community, supporting other people, mentoring people. And when I was looking at jobs, I looked at all of these postdocs, I looked at R01 faculty jobs, what would I be doing if I was in that career? And I realized the emphasis would be in the wrong place. So a very long way of saying: I knew I loved teaching; I knew I loved mentoring. Those were the things that would keep me going every day. And I did some informational interviews at liberal arts colleges. And I realized everyone there felt the same. And so it was immediately like, this is where I want to go, these are the people I want to work with. It's just the right fit. So that was what I looked for. After I graduated. I just looked at liberal arts college jobs. I didn't even consider R01 faculty jobs.

**Sarah Webb 10:49**

How much teaching had you done? There's a lot of mentoring that happens in a graduate school setting, other people in your research group, that kind of thing. But how much teaching had you done before you went to Smith?

**Casey Berger 11:01**

I'd done a couple of classes. But I'd also been tutoring. So when I went back to school at Ohio State, I was doing a second degree, there weren't a lot of financial resources available to me. So I tutored to pay the rent. And I really loved it. I loved the challenge of seeing these problems from totally new angles, students come in today raise questions, and you go, Wow, I've never really thought of it that way. And I've got to figure out how to explain this. So I really enjoyed that. And I kept tutoring all through grad school just to help out people who were really struggling, I did teach a class. So in addition to this CSGF, I had a fellowship at UNC, which allowed me to actually work with two other graduate students to develop and teach what they call a First-Year Seminar. So this is a course that's meant for freshmen. And we put together a science and policy course. And it was really incredible experience to just develop like you take this idea of how do we teach incoming students to become good, informed citizens of science. And it was amazing to take that idea and turn it into an entire class and then see these students grow and ask these amazing questions. So I think that was really when I was sold on the idea of a lot being a professor actually sounds great. And specifically, the teaching part.

**Sarah Webb 12:15**

Got it. And what a wonderful opportunity to get your feet wet and get that experience to say, Hey, this is right for me.

**Casey Berger 12:24**

Yeah, absolutely. It was one of the pieces that that turned me toward liberal arts colleges. And so then at this point, when I knew that's what I wanted to do the last year of my Ph.D., I specifically asked my advisor, you know, I'd really like to teach again, can I be co-instructor of record on this? We did a mathematics class for first-year grad students. And he said yes. So I helped develop that course, as well. And yeah, at that point, I was like: This is it; this is what I want to do.

**Sarah Webb 12:49**

That's awesome. One of the things that I'm going to refer people to in our show notes is your website, because your website does show that you have this full, multidimensional professional life and the professional priorities that you put out there, I want to learn a little bit more about those priorities for you.

**Casey Berger 13:07**

As a person who has had now two careers, I think that everything that I did before I officially became a physicist still matters, it's still important; it's still part of who I am; it's part of what drives me. But it's also part of how I see the world, right. And I think that it's really easy because we are told from a very young age to specialize to become the best at something. And a lot of our heroes in society are people who were driven to just do one thing, and who were so exceptional that one thing we talk a lot about the 10,000 hours rule, and some of that is just about hard work. But a lot of that is about this person was so obsessed. You know, Mozart was so obsessed with just this one thing, just music, that he became this incredible figure.

**Casey Berger 13:07**

Well, I think you can contribute huge amounts without being obsessed with just one thing, without having that drive look one particular way. I feel like I'm a very driven person. But I may not look like that on the outside to some people because I have so many interests. I think that one of the words I've heard a lot is scattered, right? This idea that if you focus on too many things, you'll be bad and all of them are not good enough at all that much, I think, is a huge part of it. And I think that was a piece of my own struggle when I was choosing what to do. The first time I went to college I felt like I didn't have one clear path. And that felt like a failing. And I want other people who don't have one clear path to understand that that doesn't mean they aren't contributing something amazing. And, in fact, they're bringing innovation, that someone who only focuses on one thing won't bring right that person is going to do a great job. They're going to do wonderful and important invaluable things. But because they've specialized, they will no, by necessity, see the connections to other areas that are outside of their narrow focus. So these are two different strengths, right? These are two different things. And I think that we have as a society really emphasized one and devalued the other. And I do think that's changing. But I certainly want to make sure that people know that we're out here. We're out here, and we're doing interesting things.

**Sarah Webb 15:20**

I want to ask you a little bit about your writing, because it's a little more separate from your scientific work than some of these other things that we talked about. But it sounds like it's a passion for you.

**Casey Berger 15:29**

I said as a kid, I was really interested in stories and storytelling. And when I left Hollywood, I did not leave that interest behind, right. I was trained as a screenwriter in college. My degree was in film and

television production. And but my specialization was screenwriting, and I kept writing after I left because I liked it. It made me happy; it gave me a totally different way of thinking about the world. So I kept writing, just as a hobby. I wrote my first novel when I was an undergraduate at Ohio State. And when I went to grad school, I decided, you know, okay, writing is time intensive. And I've been told in graduate school is very hard, and you have to focus very hard. I'm going to put aside all of these hobbies that don't help you. Help – in big air quotes. I'm gonna put this book away and that's that. So I started grad school. I didn't write for two or three years. And it hurt. It hurt because I had denied myself this really important outlet.

**Casey Berger 16:28**

So when I got to the point I mentioned earlier, where in my Ph.D., I was stuck, when – I think this is a pretty normal experience in a PhD, get to a point where you know, you're doing the same thing for so long, and you're kind of wondering why. And I decided, I miss writing. I'm just going to pull this book out, and I'm going to mess around with a little, and it'll just be for fun. So I pulled out this book that I'd written, and I revised it, And I revised it again. And I started getting really involved with this community of writers. And every draft of my book got better. And I was finally like, maybe I could publish this. I'm just gonna try. So I sent my book out. And I started querying for agents asking people to represent me, but I actually participated in a Twitter pitch fest, where you basically pitch your book in a tweet. And some publishers were interested, and one eventually gave me an offer to write a book and two sequels.

**Sarah Webb 17:17**

Wow.

**Casey Berger 17:18**

This was maybe my last year of my PhD. I signed this offer and wrote two more books, and they all came out, fall of 2021. So a full trilogy, and I continue to write to this day. I've written more books since then. I actually have a Choose Your Own Adventure book coming out in October, which, as a child of the 90s, it just blows my mind. There's going to be a Choose Your Own Adventure book with my name on it, which is just amazing. So I have found that writing gives me a space to let go of some of the things that I can get stuck on in research. And I think it's really easy to kind of start beating your head against the wall, when you hit a problem. And having something that can pull you completely out of that world that you're inhabiting-- It gives you so much perspective.

**Casey Berger 18:05**

Maybe in a more practical way, learning what makes a good story and what's going to draw on a reader is a really important skill in science. Because, as a teacher, I want my students to care about what I'm telling them, right? So I need to have good narrative structure in my classroom. But also, if I'm writing grants, I need to convince someone to fund me and humans love stories. You know, we are we are a social- and narrative-driven people. If you can tell a good story, whether it's about science or about science fiction, people pay attention. So I think it's been a really interesting sort of dual career path for me that I think actually has helped both of my lives as a writer and as a physicist and a data scientist.

**Sarah Webb 18:47**

I think a barrier to many people thinking about pursuing their passions – I mean, writing is demanding.

**Casey Berger 18:54**

Oh, yeah.

**Sarah Webb 18:55**

That's a demanding hobby, and physics, academia, it's a demanding career. How do you think about the practical aspects of feeding this multidimensional person.

**Casey Berger 19:07**

I have learned how to manage my time and my energy. I think it's a big, big piece of it. The advice that I give when people ask me this because it's amazing how many people I encounter at physics conferences and at data science events. When they find out I have a book they tell me, "Oh, I'm, I'm a writer, too." What I tell people is there is no one size fits all advice for how to manage bringing all of your interests and all of your aspects of your life into one. You have to know who you are, what you need. And that takes a lot of self-reflection. So I'm very restless. I really struggle to sit still, mentally more than physically, right. I was never a disruptive, running-around kind of kid. But my brain was always going. I was that kid who'd be up all night asking questions that I'm sure her parents didn't want kids to be asking because they had to answer in there. Big questions about the universe. And I have found that for me, having a really intense hobby actually helps me to not put all of my energy into work. I'm also a distance runner. So there's another example of a extremely time-consuming and intense hobby. So I have learned for myself, that I need something that will jolt me out of whatever mental rumination is happening.

**Casey Berger 20:26**

And sometimes my writing is really the thing that I'm stressing over and ruminating on. And if that's happening, I need to focus on physics for a little while because it will reset my brain. It'll give me a chance to get some distance. So that's something I know about myself. But I also know that I need to sleep enough. So I've had to develop ways to stop myself from just working late, you know, I've had to find ways to set boundaries. And I think that that's a really personal thing that my advice won't work for everyone. But so what I'd say is know who you are, know what you need, try things and see if they work. I followed so much productivity advice from the internet. And was like, Why is this not working? I'm doing exactly what all of the four-hour workweek person says to do. And if doesn't work for me, I think this is something that we can learn from science, right? If you try something and it fails, you learn something, right? That's still good information. And it's the same with the how you manage your life. If you decide, I'm going to be fine with six hours of sleep a night, and after a few weeks, you're like, why am I so foggy all the time? Well, maybe you need more than six hours of sleep a night. Right? Most everyone does. So I think that being patient with yourself, learning what you need, and giving yourself permission to do what makes you healthy, mentally, physically, whatever. I think that's the hardest lesson, especially for those of us who go through grad school.

**Sarah Webb 21:51**

Well, I think there's a push to always do more, because there's always the one more thing that is out there that you could do, right?

**Casey Berger 21:59**

Yeah, absolutely. This is something I've had to tell myself before, you know, I have had to stop and look at the things that are on my list of goals and go: This is unreasonable. Nobody can do this. Why are you asking yourself to? And that has been one of the hardest lessons is to say: Okay, you know, what of this is actually feasible? and what of this is actually going to bring value of whatever kind to my life to my work? It's really hard to say no to things, but you have to.

**Sarah Webb 22:28**

We've been talking about so many different kinds of creativity in this conversation. I mean, everything from scientific creativity to writing creativity to storytelling overall. And most recently, the creativity in managing your own life and taking control of your life. And I guess from all of that, what does creativity mean to you?

**Casey Berger 22:52**

I think creativity is a kind of openness. It's a willingness to let go of the lines that have been drawn that you're supposed to color inside of, right? It's funny, because there was a time in my life when I would not have called myself creative. And that was because I had worked so hard to fit the boxes that I thought I was supposed to fit into. And I've done such a good job of fitting in those boxes that I had closed myself off to creativity. And so I think letting go of some of those expectations and some of the rigidity and just not being afraid to take a risk. I think that's a big part of creativity. Because by necessity, if you're doing something new, you don't have a blueprint. And you have to be the person who's willing to take a step into the unknown and accept that it may not work out. But you will still learn something right. And you will still be able to use those same skills to find your way back. So I think creativity is a combination of letting go of those external expectations, which can be very hard to do, and being brave enough to try something untested. No matter how big or how small, and trust yourself enough to know that you will come out the other side. And that's maybe not the definition of creativity you would get from a lot of people. But I think that's how functionally it works in my life.

**Sarah Webb 24:26**

That's the sort of answer that anyone could apply to almost any situation, right? Whether that's inside science, outside science.

**Casey Berger 24:35**

Creativity doesn't have to be the visual arts, or it doesn't have to be the arts in general. I think that we have a lot of stories in society. I think stories are valuable and interesting, but I also think they can be dangerous. A lot of our stories say that scientists are a certain kind of person and the kind of person doesn't have creativity, and I think that's absolutely wrong. I think that creativity can be applied to anything.

**Sarah Webb 24:59**

Are other nuggets of advice that you like to pass along?

**Casey Berger 25:04**

You know, as a professor, I get students asking me for advice a lot. And the things that I think are the most important that I always make sure I tell them are. First of all, understand who you are. What do you need? What do you want? And what do you value? And then take that information and follow it right. So the direction that you take in your life, that is your it's your life, right? Other people will tell you what they think you should do with it. But in the end, you live with your day to day; you live with the choices that you make and with the world that you build around yourself. So don't ever stop asking yourself: Is what I'm doing right for me? Does it align with the things that I value? Does it bring me the joy that I need?

**Casey Berger 25:50**

I think that we tend to seek happiness, like it's a thing that happens or doesn't happen, right? There's like a line that you cross and like on this side, I'm happy on the side, I'm not happy. It's more complicated than that. Are you fulfilled? Are you getting joy? Are you doing something that's sustainable? And I think those are a lot harder questions to answer. And I tell my students to never stop asking those questions. When you get stuck in that place where you're feeling unhappy, stop and ask yourself: What is working? And what isn't? This question needs to be asked all the time, never gonna stop. You're never going to get to a point where you found the exact pattern that works for you forever. So understand who you are, understand what's important to you, be willing to make changes, and always listen to your interests. I think those are the sort of central pieces of advice. And I think a lot of times my students are looking for: go to this graduate school, get this job, you know, work with this kind of person. And unfortunately, there's no one size fits all.



**Sarah Webb 26:47**

Is there anything that we haven't talked about that you think is important to mention?

**Casey Berger 26:51**

I think something that we haven't talked about a lot, but has been in the conversation, is this question of, of DEI work and equity and inclusion. Maybe unsurprisingly, given everything I've said about the way I operate, I don't think that that work, can be separated from everything else. So you asked earlier about my website, and kind of how I present myself and my work to the world. And I think that it's really important, just like I haven't said, I am sometimes an author, sometimes a scientist, right, I'm both all the time. I'm also always trying to do better, to be better, to make the world that I inhabit better. And I'm trying to do that through my teaching, my research, my writing, my interactions with people on a day-to-day basis. So I think that one of the things that is really hard, when people are talking about this kind of work is acknowledging as a faculty member, you can't have this be committee work that you do when you're in the committee meetings and when you leave, you're done with that. You can't ever be done.

**Casey Berger 27:56**

And that's both a huge challenge to acknowledge, but also, I think, a huge relief sometimes because acknowledging that making the world a better place is incremental. And it's constant. It frees us up to not have to treat it like we treat a lot of other things where I had this particular goal, and I'm going to achieve this goal. It is a constant state of flux. I think this is a conversation that's happening a lot in higher education very broadly. And I think that one of the challenges that I hope we're able to overcome, is acknowledging that this is not work that you can put in a box, just like you can't put any people in a box. This is work that has to be integrated fully into everything that we do. So I think that that's something that it's really important to remember and that I try to express through my words, through my actions through my website, through whatever means I have to get these thoughts out into the world.

**Sarah Webb 28:49**

Casey, this has been such a rich conversation and I really want to thank you for coming and sharing the many dimensions of your life and career with us today.

**Casey Berger 29:00**

Thank you for having me. It's really a fun conversation to have.

**Sarah Webb 29:05**

To learn more about the many pieces of Casey Berger's professional life: teaching, research, writing, and her diversity and inclusion work. Please check out our show notes at [scienceinparallel.org](https://scienceinparallel.org).

**Sarah Webb 29:17**

Science in Parallel is produced by the Krell Institute and is a media project of the Department of Energy Computational Science Graduate Fellowship program. Any opinions expressed are those of the speaker and not those of their employers, the Krell Institute or the US Department of Energy. Our music is by Steve O'Reilly. This episode was written, produced and edited by me, Sarah Webb.