Hypot-enthuse_ Lia Li on optical tweezers and entrepreneursh...

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SPEAKERS

Lia Li, Maymana Arefin, Malcolm Chalmers

M Malcolm Chalmers 00:11
Hello and welcome to Hypot-enthuse the podcast of the faculty of mathematical and Physical Sciences here at UCL, or as we like to call it MAPS. I'm your host Malcolm and I'm here with my co host, Maymana.

M Maymana Arefin 00:22
Hello.

M Malcolm Chalmers 00:24
And today we are speaking with Dr. Lia Li. Lia got her enzyme physics from Imperial in 2010. her PhD in physics from UCL in 2016. She was a research scientist at ba systems, the quantum technology Enterprise Center executive fellow at the University of Bristol, and is currently the CEO of zero point motion. Lia, thank you very much for joining us. Thanks for having me. So there's quite a few people we've spoken to on the podcast recently, we've talked about their research, we've talked about their work in academia. You are in that wonderful midpoint where you're still in UCL, you're still very much part of the structure here. But you're also working as an entrepreneur for a completely separate company. How do you find that kind of division of division of labor, the right way of phrasing it that

kind of division of ideas?

L **Lia Li** 01:12

Yeah. So I think this all kind of stems back to me being a teenager, and I was around when the internet kind of first happened. And there was this sudden, like excitement of like, Oh, I can find out anything I want to I don't have to go to a library, I don't have to find an expert, I can talk to people and find out something new that I would never know. And from that I kind of became a bit of kind of jack of all trades. So I used to do music when I was younger, and I really loved instruments, I would just kind of learn more and more instruments I learnt violin and then piano and then singing. And I think I'm a collector of information and and sit down. I wouldn't quite say skills. Because sometimes I don't think I have enough time to put into something to be truly skilled in it. But I certainly am very curious. And so when I was a teenager, I used to get up to all sorts of stuff. I once I organized a two day rock festival when I was 14, 15. And that was that was purely because no one else would be in a band with me. So I was like, Well, fine, I'll just control who gets. And I would do all these weird things. I did gig promotion for a long time in Bristol. And I also felt like I had quite a lot of kind of personalities, if that makes sense. I mean, some of that comes from the fact that I'm a first generation Chinese woman. When I went to school, I was pretty much one of the only kind of Chinese girls around. And I think I just kind of decided that I wasn't going to be held to a particular stereotype or just going to try everything and anything I wanted. And actually, when I was kind of, at uni doing physics, I had this real like, anxiety about the fact that had I spent all my teenage years being jack of all trades, master of none, I really had a significant amount of imposter syndrome. Like, I can't even tell you how much it really bothered me. I actually failed three exams my first year, because it was so debilitating. And I was kind of trying to like reconcile, who who am I if I just do physics and nothing else. And what I realized was that that's not me at all I like to have my mind kind of placed into different subjects and different things. And so to be honest, it was just time, like just kind of going through that degree. Working in industry really helped build up my confidence and kind of really started to show me that the things that you get judged for at school is like nothing, like related to the actual work he would do in a company, and all the soft skills and all the random stuff that I had done as a teenager organizing stuff, finances, that kind of thing, they suddenly became really useful. And so I just rolled over it. I just decided Actually, yeah, I'm just gonna amplify this kind of jack of all trades thing. It's all anchored to a certain scientific journey, that my research is going down. It's not just kind of sporadically everything. But it does cross into lots of different disciplines. And I've transitioned from, you know, being a physicist, I guess, who's funded by a physics research council, to an engineer, you know, I'm funded by the Royal Academy of Engineering right now. And I couldn't have done that without that initial. I don't know whether it's brave or whether it was just kind of, you know, me thinking it was

fun to just read about lots of different things. But I think that's kind of what's really helped in that. I don't see my tie. As a singular thing, I see my time as, where am I going to get energy from and learning something or making something,

M Maymana Arefin 05:09

I really, really liked the way you've explained that I'm sure a lot of people will be able to kind of relate to that journey as well, especially in school of just being interested in a lot of things. And kind of it's a shame that we get kind of really pigeon holed down certain parts. So it's really reassuring, I think, to hear that you have managed to kind of integrate a lot of those interests into what you do now. And I wonder if you could speak a bit more about that about kind of how, because your bio sounds like so much like very physics, physics II. But at the same time, it sounds like you've got lots of different areas, which you're kind of able to weave together into something that's feels feels more comfortable for you.

L Lia Li 05:50

Yeah, I think, for me, what's really helped is kind of saying yes to opportunities, but making sure that decision is informed. So not closing yourself off. And also kind of getting getting past some of the confidence issues of kind of being like, Oh, my God, lots of responsibility if I take on this project, but making sure that that decision is informed in terms of how you want to be treated, or how you want to treat others, or how you want to see the work being disseminated or who you're working with. So not quite kind of is this going to be the next big thing in nature, because I don't think that necessarily, if you follow that route, I'm I personally wouldn't be satisfied, I wouldn't be as happy. Because every single decision that I've made, especially in the last, I would say four years, I can see the train of thought. And sometimes the train of thought wasn't entirely clear. But the feeling of direction was there, or the feeling of gravitating towards a new collaborator, where it felt like there could be something bigger than just a paper, there was something more there. And so I think for me, a lot of my background is physics. at Imperial, I specialized in building diode pumps, solid state lasers from scratch. And that kind of really excited me because lasers, you kind of feel like it's this box and magic comes out of it. And to be able to make one from scratch and to be like now it's lazing the power is mine. Is that the correct verb to lay? lazy? Yeah. And that lab at Imperial was absolutely fantastic. That was really great PhD students there who I still talk to now this is like over 10 years ago, and I still have those relationships. And that introduction into laser physics really helped in terms of knowing that there was nice people working in that field, knowing that even you know, an undergraduate could get to a point where with an empty table, you can make a laser that was pretty empowering for me. And so from there, it was like, What do I do next? Now,

obviously, I worked in industry for two years, and I did a lot of photonics stuff, I started working with optical fibers to kind of related but in a different way.And then when I was working there, I spent six months working in a cleanroom. And a cleanroom is where they make chips. So how are you, you take like a slab of silicone and you use whatever, like chemicals, or heat or liquid acid or whatever you want to use, and you add structures into them. And that's how they make computer chips and sensors. And you know, all the little tiny stuff that makes things work these days. And that was really interesting for me, because as a kid, you know, you obviously I love the internet, I love computers, I love games, I love gaming, but I've never ever thought that I would even be close to the fabrication of the components that make those things work as it was, wasn't even something that I thought a physics degree could bring me to because it's so grounded in engineering, that kind of work. And so that was kind of inspiring in terms of Oh, the the problem solving skills I learned in my undergraduate degree are actually useful. And, and I can apply them to something that I would never dream of being able to access and being able to do, you know, that was like, once again, that was something like eight years ago or something. But it gave me the confidence to then do my PhD, which was in basically quantum mechanics. And so my progression from classical to quantum starts then. And that was a really good experience in terms of it was like, you know, really intense. You know, I pretty much worked alone for a lot of it. And experiment was really, really difficult. I mean You know, people still trying to get that type of work to actually work. So it's not something that can easily be achieved within like one PhD students kind of time. And at the end of that, I knew that quantum physics was awesome, I and I had kind of gone over my fear of it a little bit. But it's really expensive. It's like, so expensive to do a quantum experiment or to be attached to one, right? It's kind of, you know, you know how funding works at universities, you can't really get a permanent position working on a quantum experiment, you're always going to need to have top up funding and people and stuff. And so I kind of, in the back of my mind revisited the experience I had in the cleanroom, like eight years ago, and I thought, oh, maybe I can kind of combine what I'm doing my PhD, but not at this quantum regime at the classical regime, but just kind of mature it on a chip platform. So instead of, you know, making things out of kind of bulk optics, you know, you have like a laser beam on an optical bench, and you have fibers that you're kind of shaping into structures, and it's all kind of big kind of, you know, you're holding things and bolting things down, designing all those structures, but at the kind of micron to nano scale. And then what's nice is that someone else then makes it kind of cuts out a lot of the hassle. And all the fiber alignment I used to have to do. And although cleanroom work is obviously very expensive, too. I mean, you have to do the you need to have a room, which is clean, hence the name. But what they mean is that there's like, you know, one molecule per cubic feet or something ridiculous. I probably quoted Mitt Romney, just right, not one air molecule, one dust molecule. Sorry. That'd be ridiculous. It would be interesting. Yeah, everything we'd be about vacuums too much. No, I mean, one, one dust particle per

whatever cubic feet, it just means it's like, super clean. And so what's really nice about chip fabrication, which is not quite there for quantum technologies, is that because chips are a commercial product. There's foundries all across the world. And they will make like hundreds of millions of chips per year. And they have standard processes. And they offer their services to academics and startups, where you don't have to pay to have the whole wafer, which would be like, you know, 50k 100k 200k, depending how many layers you need, but instead, you're just renting a little portion of it. So you can get out maybe 10 devices, but at a much lower cost. And that kind of doesn't exist in the quantum ecosystem, you can't just, you know, share a Cold Atom experiment or that that'd be cool, right? If you could just share some time on,

M Malcolm Chalmers 13:03

you've got the look on your face that says some ideas just cropped into your head now.

L Lia Li 13:07

Yeah, but I don't think I want to be the one to copyright that. It's pretty neat. So so that that really helped. And so that's how I kind of got into all of this chip stuff. And that's what the company is really based on. And so, yeah, I couldn't tell you, you know, like five years ago, even 10 years ago, that this is what I'd be doing right now. But looking back it what was really nice was I didn't regret any of the kind of research that I was involved with the things that I learned and and that all built up to this ease in pivoting myself. And following what feels right for the technology.

M Malcolm Chalmers 13:52

I wanted to ask you then specifically about the work that zero point motion does. Now I was looking online to try and find what I thought would be an accurate description of the kind of work that the company does. And I found two different descriptions, one on the company website and one on the Twitter. I'm gonna repeat these two descriptions. And I want you to tell me how, which you feel is a more accurate representation. So the website says that zero point motion harnesses the quantum properties of light and combines it with the mass volume production capabilities of micro electromechanical systems. We are developing devices that sense motion with 10,000 times greater precision than smartphone sensors. And then on the Twitter, it describes the company as quote, making tiny optical sensors so y'all can navigate indoors and not get lost. Some good science communication. Soon as I read that description, I thought, okay, yeah, I get that that's all you know, none of these multisyllabic words that get confusing people no hyphens just we make sensors, so you don't fall over.

L Lia Li 15:01

Yeah, straight up. Okay, so yeah, so this is something which I, I'm still figuring out. So I would say that zero point motion is in stealth mode, where we're deliberately not trying to say too much, because we're still really early, I mean, super, super, super early, you know, not to scare off any investors or anything. But it is a very, it's a different entity. And it's a different technology than the than what I was working on before. In terms of, you know, architecture in terms of aims, I would say that quantum description that is on the website is a bit more forward thinking. And it's not necessarily going to be their first product. But there's, there's this kind of weird, really weird period when you're writing your business plan. So before you get any, you know, seed investment, and you have to define your market, you have to define where you fit in. And I obviously, I started doing some of that work at UCL, but for quantum sensing for for quantum sensors. And it was really difficult to actually come up with a roadmap, that is gonna sound weird that I felt comfortable about. And, and so and I don't mean that, in that I don't have any faith in the technology, I always have faith in technology, I've spent, like all my life chasing technology, so that that's not the issue. But the issue is risk appetite. And that changes for every person. And for me, I mean, from just my background, you know, it's just me, my parents in the UK, I don't have that kind of sense of belonging, necessarily, I still have this thing about this feeling of if I do something wrong, I'm gonna get kicked out. And I don't know how to describe it, but it's just feeling that there's extra scrutiny, because I didn't I wasn't born here, you know, that kind of thing? That definitely, yeah, so you know, a lot of what the first kind of year or so of a company, as you're kind of getting ready for your seed investment is figuring out where your risk appetite is. And, and the key is, and I say this to everyone, don't force yourself into something. You know, there's lots of legal things attached to being a director of a company. I don't know whether it's just me, but when I was going for the documents and the liabilities and getting like insurance for the company, it scared the living daylights out of me, because I've never had to do that ever. In my life, I've never had money to be able to set up something where there's risk to be had. So it was an and it was something which I didn't take for granted, I didn't just say, Oh, I'm sure it'll be fine. I, you know, really wanted to be accountable. And that can cause stress. But the key is, I think is to is to pivot the company. If you feel like the path that you're presenting, if you can't get on board of it, you need to pivot the company. And so what we've done is we've started to try and use more easier to understand phrases, we just, we're moving away from that academic description of things, and just kind of, you know, saying so many complicated words that someone has to think it's, you know, pretty fancy, right? And we're starting to kind of really change the, the branding, I guess, the feel. So it's, it's gonna look a lot less like a normal spin out company, like from a university or something like that, it's going to feel a bit more grassroots. And it's going to feel a bit more, in a weird way, a bit more ambitious, actually asked letting go of the quantum stuff has made us more ambitious. So yeah,

M Maymana Arefin 18:51

I really like that I feel like you've explained really well. So the kind of idea that you're you're trying to get rid of a lot of the sort of jargon that often excludes people. And I wonder where that comes from? Do you feel like that's a very personal thing for you that you thought that was important to make sure that the business that you set up was more accessible? Because I can really hear what you're saying about that frustration? Sometimes if like, what what does this actually do? And just being maybe a bit more transparent and accountable about that?

L Lia Li 19:19

Yeah, no, I totally agree with that. So I mean, just to give some context, I think I started that web page last year, and it hasn't been updated. Once it's the landing page, which is just like we exist, it's not like a fake. And, and in that time, so much has changed in terms of my thought process. I would say that this The thing about terminology, which is really difficult is for a long time, I myself played to the kind of academic preference in writing style and gendered writing. I'm not going to lie and say that I've tried, you know, for the whole of my 10 years at UCL to make sure that everything I wrote every application was like You know, thoroughly, you know, checked and for, you know, gendered words and stuff like that. I have checked my writing before. And I think I'm at this kind of 60% male gendered words type thing. I'm not surprised at that, because I've learned how to write applications and papers from men. I've not I've never been supervised by a female scientist ever. So that's hard for me. Because there's, there's a part of your psychology where you think maybe this is the only way that I get success. If I try something else. And I don't have someone there to guide me as to how to try writing a different way that I'm suddenly going to get 000 rejection, rejection rejection. And I would say it's only in the last two years that I've really started to take notice of how I'm writing things, how it comes across, and the feeling that it puts into people because a lot of the time I even when I'm reading physics journals, I feel inadequate. So, you know, and I'm not trying to impress physicists. I'm trying to impress normal people and businesses. So so it's an extra layer that I certainly have to be careful about. And the way that I've kind of learned that is through working with other researchers or other academics who aren't physicists. So, last year, I worked with Dr. Rima otsu. And Dr. Hope Russia and Dr. Rachel Oliver. So there they all have science backgrounds, Rachel and hope are physicists, but a remmeber is special. Reema, she does curation for film festivals. They're involved with kind of climate change, things are evolved with racial equality in who gets to say, things about climate change, who gets to decide policy who's involved in funding. And we worked on a paper for science and parliament, which is, I don't know the magazine, I guess that MPs read. I didn't know about it until we, we vote for it. And we wrote about racial inequality in science funding, using statistics from UK arrived, but also our experiences. And what I

found fascinating was a rember, she was just so knowledgeable, and her expertise in words, how words have impact, when you're talking about science is relatively easy. In terms of words, when you're talking about social science, we're talking about inequality, you're talking about fairness, the importance of choosing every word. And I've honestly, that was just a really eye opening moment for me. And so throughout last year, we just had all these conversations. And it's really led me to kind of think about how we have the branding of the company should be

M Malcolm Chalmers 22:58

I there's there's a lot of things that you've raised there with regards to issues around racial equality and gender equality and things which I definitely want to cover more. But while we're on the subject of the actual the science behind what you do, there was one term that I saw cropping up in some of your work, which I found fascinating. Just, you know, when you you see words out of their usual context, and you know what those words mean, but not specifically, I think I know which one you're going for. Yeah. Let's, let's see, there was a lot of talk of your work being based on whispering gallery mode resonances. Yeah. Now I think I know what a whispering gallery is. I don't know what are whispering gallery mode resonances. Is it something you think you could try and explain to a very lay person audience?

L Lia Li 23:46

Of course, because yeah, so whispering gallery modes, you may have heard of the whispering gallery part because of St. Paul's Cathedral has this nice dome top. And if you whisper if you stand on one side of the dome and someone's downs all the way across on the other side, and you whisper the sound waves, they bounce within the curved boundary, it's like total internal reflection. And they bounce with not too much loss. So it means that the other person all the way on the other end can still hear your whisper quite clearly. There's actually other domes, by the way, all around the world. So it's not just simple as edraw.

M Malcolm Chalmers 24:27

But it's to do with the parabola curve of the particular wall, I think is

L Lia Li 24:32

Yeah, it's just it just needs to have a curve up any curved boundary will do it. And obviously, you know, the, you can have discs, rings, domes, whatever. And all that has to

happen is that the sound wave has to bounce an integer number of times and come back on itself and kind of not cut itself basically. And so the same thing happens with light so you can trap light inside. spherical objects like spheres, rings, desks, even like kind of, like bottles, you know, like a wine bottle is spherical, you can, you can do that too, what you just need to do is get the light into the spherical kind of object somehow. And so what we do in our work is we take an optical fiber, and usually light is just confined in a fiber, you don't get like kind of leaking out the size or anything. But if you melt the fiber and stretch it, pull it, it's called what's called tapering, you basically you make the diameter of the fiber, smaller, smaller, smaller, and then when it's less than a micron, so like much smaller than the width of your hair, the optical field as it's propagating through the fiber, it starts to leak out of the sides. Because Because the the the wavelength of the light is much larger than the physical size. And that's that's called an evanescent field, which always makes me think of the band every now. And so and what we do is we just place that fiber, which is almost like an in out kind of delivery system for light, if you just place it close to the edge of a sphere, then what happens is light in, you know, can tunnel across the gap from this evanescent field, it kind of leaks out, and then it goes into the sphere, and then it gets trapped in the sphere. And the Lightwave literally just bounces an integer number of times into the sphere. And so and that creates a resonance condition. So if the sphere somehow gets bigger, then you're not going to be on resonance anymore. And if it gets smaller, and that kind of thing. But in the same way, if the sphere moves away from the coupling, kind of waveguide, that also changes the condition for you know, what is the color of light, that's going to cause that resonance. So you can play on that sensitivity that kind of like, you know, if you know distances is related to whether it's on resonance, or off resonance, and you can play on that to make displacement sensors, or motion sensors, or inertial sensors, and then we get what I'm doing. So that's kind of the basics of it.

M Maymana Arefin 27:21

That sounds a really good description. Yeah, that's kind of blown my mind. So many possible avenues we could go with that. So with the resonance condition, why do you need that? Like, what can that lead to? I guess that kind of leads on to probably what your work is. So what would be a good place to start?

L Lia Li 27:38

Yeah, so with what any optical resonance is, is very useful. Because resonances are like filters in a way, they're kind of they give you a condition, right? You're either exciting it or not exciting, or you're slightly detuned from it, or whatever. But it gives you a kind of reference, right of, you know, are you on the resonance of the residents, that kind of stuff. And so people use optical resonances everywhere for sensing, they'll use it for

temperature sensing, refractive index sensing, you know, you can use it to characterize materials and stuff like that, you know, if a material has a resonance somewhere, you can basically characterize as refractive index or its size, you know, a size sorting is an application for this kind of stuff. And the really nice thing that kind of happened in the last, I would say, 10 to 20 years, is that there's this field of research, which, which is where I come from, which is called cavity optomechanics. And what that looked at was, okay, what if you have an optical resonance, and it's coupled to motion. So you can use a Fabry perot cavity, so the easiest one to imagine, is basically two mirrors facing each other. And so if you send laser light into this cavity, it's going to bounce the laser back and forth. And they only do the bouncing if the length of the cavity is an integer number of wavelengths. So if you can fit one of those six wavelengths in the cavity, then you're going to have a resonance. If you fit six and a half, you're not going to get resonance, that's kind of the condition got a and so with these kind of linear cavities, you know, the really simple thing to do is to say, Well, what if one of the mirrors can now move, so if this mirror is now moving back and forth, it's changing the length the cavity, so you're either able to fit in more wavelengths or less wavelengths, but in turn, that means that you've got this kind of condition where it's like off residence on residence off on residence, so the mirror motion will then change the intensity of the light inside the cavity. And then that's your readout of of displacement. And that's really how the Laser Interferometer gravitational wave Observatory, that's how that works. And it detects gravitational waves, because the gravitational waves they come from tube coals merging, it produces these really violent forces that literally they actually ripple spacetime, it makes it makes space like compressed and stuff. And so when the waves pass through us, it distorts the physical space between the mirrors, which is the equivalent of a mirror moving, and that's how they detect them. So that's really only come out in the last, I would say, 10 to 20 years. And so you know, loads of my colleagues loads of people in the world, they're just playing around with the systems where you just have to create an optical resonance and have some motion coupled to it. And there's like, so many is a whole playground of different devices, not just whispering gallery modes, but lots of other types of resonances, to

M Malcolm Chalmers 30:47

facts about gravitational waves, it always makes me think that physics to me is the subject. I always sum it up with, you know, you think you understand how things work wrong. Because physics will come along and tell you Oh, you think that you know, space is a fixed constant. And that's not gonna change, physics will tell you that you are wrong.

L Lia Li 31:09

until five years ago, I didn't know that space wasn't a fixed constant. So don't worry, you

can always learn those things later on in life.

M Malcolm Chalmers 31:18
Speaking speaking of things from several years ago, I'm going to go back 15 years now, Leo, okay, to the start to the start of your science communication career. So embarrassing. His first talk, which she did at Ignite in Bristol, with the fantastic stop asking for a lightsaber. So in the last 15 years, has the lightsaber become more feasible or still? I think I just heard million Star Wars fans crying out and then being silenced.

L Lia Li 32:03
See, what's gonna happen is you're gonna get a comment from someone going, excuse me, I think you're fine with the new plasma base, probably. You can't. And there's like, Oh, I'm sorry. But like, I define a laser as a laser has to be photons. If you'd like to debate that subject later. Gosh, yes, that was so long ago. I had I have no more half and half black cat or was it half black?

M Malcolm Chalmers 32:36
Oh, all I can see is a still frame on a YouTube video on your website. And you seem to have slightly longer than shoulder length black hair.

L Lia Li 32:44
It was before my hair became interesting. I hope that was because I was still working at the system. That's why confessional.

M Malcolm Chalmers 32:52
Obviously, this is an audio platform and not visual. But what how would you describe your hair at the moment peach colored perhaps?

L Lia Li 32:59
In need of a hand? Yeah, so I've been locked down and we haven't I haven't had access to a hairdresser. So I would say it's been either rose gold, which is the nice version of slightly a bit brassy, pink, with substantial roots.

M Malcolm Chalmers 33:18

There was also something I found out, which I found fascinating. But unfortunately, you are only the second person on this podcast that this fact applies to, which is that you were one of two people who were Miss January in the science girl calendar was put out a few years ago. This was we had an interview with Suze couldn't do a couple of weeks ago, where she mentioned this as soon as I noticed that I thought we have to mention this. This is now two of the science girl calendar girls we've had on this podcast.

L Lia Li 33:51

Take them all off. Oh god. Yeah. So science communication. Yeah. So when I was just before my PhD, actually, so when, and this actually not contributed, but it was like a bit of a boost in terms of Oh, yes, I made the right decision. So one thing about working in defense was that you can't talk about any of the work you're doing. And also, I mean, there's all sorts of other uncomfortable aspects of working in defense. But I'm someone who, you know, I'm sure it's come across now. I'm very curious, and I'm very open. And that does not work. Well, I don't think in a defense kind of industry. And one thing that I wanted to do was to improve my presentation skills. So, you know, back then this is like over over 10 years ago, I used to be really shy. I still am shy. I would consider myself quite introverted sometimes. And I hadn't had an opportunity in my undergraduate to really talk about science or talk about science and the way that I wanted to, I used to do Imperial College radio. But that was that was that was doing a kind of radio show of my friend where we talk music. And that was something I was very comfortable talking about, you know, it was, I was super comfortable talking like that. But just never found that level where I felt that I spoke with, I don't know, whether it's grace, or power or with kind of conviction, it was just something that I wasn't very confident in. So I decided to do that ignite talk, which is kind of like a mini TED talk, I guess. And that really helped define who I was, in terms of how I wanted the public to see me, which is very different to necessarily how you want academics to see you. And that really helped and I'm glad that it's still on the internet, I'm surprised it's on the internet. And it kind of an obviously, you know, especially then moving from Bristol to London to start my PhD and not knowing very many people, you know, two years have gotten since my undergrad. So nearly everyone I knew wasn't in London anymore. And, and it was nice to kind of feel like, Oh, I really enjoyed doing that ignite talk. And the science communication community is really friendly. So if things get really hard in the lab, and I don't have many friends, you know, in the first kind of year or so of your PhD, then then actually I can hang around these people see what they're doing and contribute learn was a lot of learning that I did that year, just listening to other people. And, and I really, really appreciated that time, because I think it's made me a better person, but also a better kind of scientist as well. I don't do it as much now because it takes a lot of work. I truly think that you know, science communication

might might feel easy on the outside, because it's supposed to feel easy, because you're the audience. But people that do science communication, they put so much effort in it's a lot of prep time, there's a lot of practice, there's a lot of not acting, but there's you have to hold a presence on stage. And that takes effort and time, you can't just do it one day, I think you build it up. And obviously, you know, the direction for my research has kind of gone up more into a commercialization path. So I don't do certification as much as I used to. But I still use all those tools when I'm doing talks and stuff like that.

M Maymana Arefin 37:24

One thing that I think kind of speaks to some of the interdisciplinary stuff that you were talking about right at the beginning of kind of always being interested in lots of different areas like music. And one thing that I found, which I really resonated with was that you also kind of really like the interactions between science and art. And they wondered if you could tell us a bit more about that there was something really cool that I saw about using lasers as like textures and art. And I don't really know what that means. But it's so cool. So I want you to talk more about it.

L Lia Li 37:57

I can't really be found all these things. That's incredible. Okay. So this was, I think, still in my PhD. And I can't even remember how I met. Laszlo. So I'm a photographer, who also did some photography. I mean, just like a very creative person who was, I think, working part time at the there's like this national TV and broadcast university or college. It's just outside of London, I remember the name, but he was a tutor there or something I just met him at, I think it was a science communication event or just an event. And we got talking, and we had some really like common kind of likes in terms of, you know, cinematography and sci fi. And he, his mom used to do physics in Poland. So he was talking about how as a child, he would hear her talk about stuff. And I just happened to say, Oh, yeah, I build little laser spider graphs in my bedroom. Because I still do that, by the way, it's just it's more of a personal thing. I just like doing it. So you can build the latest paragraph, if you have a laser beam. If you shine it on to a rotating mirror, because the mirror is rotating, you can make a circle. So that's how you can make a circle with a laser beam on a wall. So if now you're bouncing the mirror of multiple mirrors, and they're all slightly misaligned from each other, that's how you can then make stars. Because you're doing that you're kind of you know, you're kind of doing ellipses, that kind of move and that's how you do paragraphs basically. So I was making that in my bedroom. Just cool. There's like I think there's, I think there's like a mini documentary where they, they they came to film in my bedroom is this when I lived in like a basement flat and it was gross. And you could just see laser light coming out of the window. It was great. And so he wanted to come in and

obviously film it and also to photograph it so he can I'm over. And we basically did a lot of I was really interested in lasers and laser light showing texture. Because I because the way that I think about lasers is I always think about them as photons like these individual like pseudo kind of virtual particles, when actually the way that other people might think of lasers is like a beam of light or a ray of light. And and how cool would it be to just completely like, blow that up and just make lasers seem like they're organic, or that they look like flash or they look like smoke or something like that. So we just played around, and we did a bunch of photographs, where we're shining light into different forms of like, not clouds, but like smoke, like smoke rings, that kind of stuff. But then we also did some work where we shine lasers into liquid. And we put different fluorescent dyes and stuff in that liquid, so that you would get this extra dimension of intensity in the light. And then we made these like cool, they look like I forgot our Clint paintings, you know those paintings where it's like something's, like, almost not melty, but like a little bit like that. It's kind of like that, or I guess a bit of like Darley stuff where it's like, it's like the laser is melting in droplets or something. And that was super fun. And, you know, I wish I had more time to do stuff like that. But, you know, once again, it's like, there are people out there I think laser light shows have come a long way since and that was like eight years ago, probably. And there's so there's far more amazing stuff going on now, where people are using lasers to create really beautiful art you know, with music and stuff.

M Malcolm Chalmers 41:45

So cool. Looking through your your CV in your career to find things to talk about. You were given a making space award by the stem squad, he were a famed lab, UK 2012 finalist, you were head of the women in physics group at UCL for three years, you're now a member of the race quality steering group, you've worked a lot with Tiger in STEM, like, how have you found the extra 12 hours a day that you must need to get all of this stuff done? While the rest of us are stuck with the standard? 24? How have you managed to get 36 hours?

L Lia Li 42:16

So it was really funny, as I say that to people as well is there's a hierarchy By the way, because if you've ever met Dr. Jess Wade, you don't know what a Schedule C adjusted schedule I'm think I'm pretty sure she's she's flown for one day to do a talk and then come back. I can't remember exactly. But she is exceptionally busy. So, okay, maybe surround yourself with people that you're like, I'm inadequate. What I'm doing right now, to be quite honest with you. It's not good advice. Okay, so I mean, not to talk myself down, but so I don't really have, like, a huge amount of hobbies, like my time is quite kind of boring. I don't, I don't eat well exercise, that's probably another thing. I'm just gonna be on eskers. You know, I don't want people to think I'm also going to like a five kilometer run every

morning. That is not, I am not a morning person. I am not very good at kind of being responsible in terms of looking after myself. That probably gives me an extra amount of time, I think in that I'm just not thinking about normal stuff. Like when we're going to clean the dishes and stuff. I think the other part of it is I don't know how to explain it. But it's this all the stuff that I order stuff you listed. What's really funny is that I at the time that I decided to do those things, or that I want all I decided to do something extra. It never felt like I was adding another string to my bow. It actually felt more at times actually felt like I was taking time away from my research, if I'm going to be really honest. And some of that was other people commenting on how much I was doing other things, right. And that's, by the way, that's not a dig at any specific person. It's just a general feeling that anyone would feel in academia. If If you know, I listed those things out, because none of those things are really positions of power, if I'm going to be honest that positions of of enabling better practices to happen. And so and I think that's why I do them, because there's a higher reason there's a bigger calling as to why that needs to happen. versus just filling all of that with like, I don't know, I don't know what else I would do to be fair, because I think the other part of it is, I'm really careful who I work with. So I wouldn't want to get roped into some science based organizations or committees or being an editor in a journal or that kind of stuff. But Cuz I cannot guarantee you that I'm going to surround myself with the people that are going to lift me up. Whereas all of the things that you mentioned that kind of around communities where I would feel uplifted, or I would learn something, or you know, that I would be a better manager or business owner, better mentor better something, rather than just being like, Oh, I got to control that, or something like that.

M Maymana Arefin 45:30

I think that's really admirable, just to have the kind of discipline that you have. And also, I can hear that maybe it's been like a journey to get to the point now where you know, what sort of things you do want to take on? And the sorts of things maybe you can you can move to someone else?

L Lia Li 45:46

Yeah, I think that comes like, you know, I hadn't had to describe it. But it's like, I've taken on things which I know, are viewed as detrimental to my scientific career, if that makes sense. And that, and I think, what the only thing I can ever hope is that people see beyond kind of the metrics, because the other thing that I forgot to say is that I don't publish competitively. I know that about myself, compared to my peers, I have substantially lower publications, and I'm just gonna be the first one to say it so that no one else can say it to my face. I know, I don't have enough applications. That's fine. That was never my mission statement when I did my PhD, or my postdocs or anything else. So that's the other side of

it is I lose out in time to Publish to publish, but that's not what's important. So I don't mind it. Yeah.

M Malcolm Chalmers 46:42

See, I think that's fair. I think that ties in a little bit, something you were saying earlier about? looking out for gendered language in the publications you were doing and not writing in the way that some people might have thought you should for a scientific career. I think that the traditional idea of what your science career would be, you write in this very traditional gendered way, you publish papers competitively, you don't spend your time with things like tiger and stem or race equality, because they're distracting you from the serious work. I wonder whether it's, I mean, I would hope that society is changing in such a way that we're moving into a world where those things actually end up being beneficial for a career. Because the focus has changed that way, I suppose Only time will tell us whether that actually turns out to be the case,

L Lia Li 47:28

I really hope so I really, really do. Because there's people who do things that I do, and much more, you know, people who don't just kind of dip their toe in and kind of balance it with a scientific career, but people who end up dedicating their whole being into it. And and those people rightfully deserve equal, if not more compensation than a professor, that's my honest opinion. And yeah, I hope one day that that recognition is there. Because there's there's people right now who need that recognition, like really right now. Yeah. Not Not me, by the way, because I've, I've got enough things that I can fall back on. But some people who are experts in this, you've really like put a lot of academic kind of effort into stuff. Yeah, they really, they really need that recognition. I know what it feels like to be treated well and to be respected. And it hasn't happened my entire career, it's more of a rare occurrence. And that is an expected one. But because of that, that tiny taste of it. That's why I'm so adamant about things. Because if I hadn't have had that, I wouldn't be in academia, I wouldn't have been in academia for the last four years, five years for robotics, I wouldn't have had the confidence to, to bid for fellowships. And, you know, so so I think it's kind of me trying to, you know, just try to give back a little bit, because, because so much was given to me in terms of building me up. Yeah.

M Maymana Arefin 49:00

Yeah. On that note, I think it would be really nice to, I mean, this might be a really difficult question. But do you have any sort of advice for maybe your younger self as to like, what, what you would do differently? Or maybe how, how to get to the place that you find you

are? And now?

L **Lia Li** 49:16

Yeah, I think the the one thing I keep trying to tell myself, even to this day, is to trust your gut instincts. We are all born with an innate kind of feeling inside of us as to when things don't feel right. Or things might go into a worse situation. And I would say that 90% of the time, I haven't listened to my gut instinct. And that's not to blame myself, because there should never be any blame on that no one can predict the future and stuff like that. But in terms of I do have control as to believing myself more than next time it happens and I feel like I don't know whether it's related to being in lockdown, but because I've had so much time to kind of be in my own thoughts. I feel like I've started to really pay attention to that feeling. And I think we all feel it a little bit in terms of how we're all coping with, you know, do we go outside? Do I meet my friend kind of thing? We're all having that intense pressure of thinking to ourselves, does this feel right or wrong? And yeah, I think if more people felt confident, or were guided to listen to that, that really helped. So the thing that's helped me is, as part of my company, I have someone who is the Executive Chairman. Sorry, I really don't remember all these names, because they're meaningless right now. And it's a team of two people. I mean, we do everything. And his name is Dr. Gordon Aspen. And Gordon's been fantastic. He's been working me for a whole year. We've never met physically. He's just supported me throughout the whole year. And he's an actual business person, like he's had companies. He's floated them onto stock market, he's done the whole shebang. And what's been really good is being able to talk to him openly and say, Well, my gut instinct says this, and just having that confirmation or having that guidance has really helped. So definitely find your people is the first one and trust your instincts and and just keep you keep having people around you with different opinions, different backgrounds, to just you know, keep you uplifted, and make making sure that you've got a really good outlook on on the world, I guess. Yeah.

M **Malcolm Chalmers** 51:43

So that has been a fascinating chance to talk to you. I've really, really enjoyed this. I hope everyone listening has done as well. So thank you again very much to Dr. Lia Li for her time. And Maymana and I will be back next month with another episode of Hypot-enthuse. Thanks very much