

# WE ARE ETH – Episode 17

## With Joseph Paradiso, expert on sensor systems and professor at the MIT Media Lab

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[00:00:00] **Joe Paradiso:** But What fascinates me is, what fascinates everybody now, is AI. Holy cow. Holy cow.

[00:00:05] **Susan Kish:** And AI and music. AI and sensors.

[00:00:09] **Joe Paradiso:** Everything. 2022 is the year that we developed AI.

[00:00:13] **Susan Kish:** In this episode, I'm talking with Joe Paradiso, who's a professor at the MIT Media Lab, an expert on sensor systems, the internet of things and electronic music, who built one of the world's largest modular synthesizers, and who completed a postoc at ETH Zurich in the early eighties. This is the We are ETH podcast, and I'm Susan Kish, your host.

[00:00:36] Joe. Let's talk about what you're doing right now at the Media Lab, which is, if I understand correctly, you're teaching a class on the metaverse with a bunch of fascinating guest lecturers. How did you pick that topic and what are you gonna be focusing on in the course?

[00:00:54] **Joe Paradiso:** Sure. The Metaverse class is a special class that we formed this semester.

[00:00:59] Most of us probably have dabbled into aspects of what you would call metaverse over the last decades, really. And in some sense, there's nothing new about it. But of course, the new technology always lets you do different things and look at it in a different way.

[00:01:13] And in this class that's what we're doing. We're trying to explore it from all these different vantage points to really capture a snapshot of what this thing is becoming and what it could be. So it's called metaverse, really. What, when, how, and why? That's the subtext. And the way I'm doing it is a hybrid class where we have a seminar where you invite two well-known practitioners in something related to metaverse to give back-to-back talks. It's a two-hour session.

[00:01:44] And then we have project sessions with the students who are taking it for credits. So we drill down into some of the core technologies and teach them how to

develop in some of these environments and brainstorm projects that they can do to explore it.

[00:01:55] So everyone has a different opinion of what it is. I think if you look at the Media Lab how we look at it, it is really a cornucopia of ideas. So, it's not just putting on a 3D headset and being immersed.

[00:02:08] It's this world of information pushing and pulling on you in different ways through different conduits. That's what I'm fascinated with.

[00:02:15] **Susan Kish:** So, of the bazillion definitions of metaverse. What's the one that resonates with you most now, today in 2023?

[00:02:24] **Joe Paradiso:** I'd like to think of it as certainly a place to experience information in different ways. It's just connected information manifesting itself into your awareness in different ways, right? Then you look at the subtext. You have the game worlds where you go into an artificial environment.

[00:02:43] But then there's the real world connecting through this. And that's what I like about this world. If you go back in history and speculative fiction, you have books like Vernor Vinge's True Names, which is a great insight into that kind of a thing.

[00:02:55] **Susan Kish:** Who was the author again?

[00:02:57] **Joe Paradiso:** Vernor Vinge. He used to be a professor at San Diego State in computer science, but he's one of the world's foremost hard science fiction writers. And because he's a professor in computer science, of course, he knows all of this stuff pretty well. He used to come and visit us at the Media Lab.

[00:03:10] So yeah, you've got the real world. Can you make a richer connection to the real world through this intermediary of what would be metaverse or through the different devices you could wear.

[00:03:22] Yeah. I'm looking to the screen, it could be that, and we have manifested lots of things on the screen with surround audio and things like that. You could put on a headset if you want. Or I also have my watch, my watch is tied to my doorbell. And people come and it pulses at my wrist and, you know, I'm connected physically to a space through a haptic device in this case.

[00:03:42] So there's a whole scalable ecology of ways this information can manifest. I think it's fascinating to think of smooth ways to transit this, have your toe in the virtual water, but you're still in the real world, but didn't get pulled into immersion. And how was that gonna be addressed?

[00:03:57] **Susan Kish:** Do you think all of this accelerated during Covid?

[00:04:01] **Joe Paradiso:** I think people saw the reason for it. I think the whole presence, conversation, everybody gets now pretty much because we didn't want to be just at home even though we wanted to connect.

[00:04:14] **Susan Kish:** And we wanted to see a museum.

[00:04:16] **Joe Paradiso:** Exactly.

[00:04:16] **Susan Kish:** We wanted to hear a concert, we wanted to dance.

[00:04:19] **Joe Paradiso:** Yep. And can you go somewhere without going somewhere? This is...

[00:04:22] **Susan Kish:** That's a great way to say it. Yeah.

[00:04:24] **Joe Paradiso:** Yeah. So, I think there's a lot more we can do. What we have is, it's great what we have cuz it got us through, but it's not perfect.

[00:04:31] I remember the beginning of Zoom when we were quarantined. I'd have to give talks once in a while or run class or something like that. And people would always, after a while, put off their realtime video feed and put on a picture. And the problem is their pictures were always have them smiling.

[00:04:50] And the people in the real world, they wouldn't be looking displeased, but they wouldn't be smiling the same way. So these feedback cues are always used with an audience to see if they're following you. So you have to learn how to go on autopilot pretty quick.

[00:05:04] I used to call it zoom induced paranoia in a way.

[00:05:08] **Susan Kish:** They've all gone off to have a cup of coffee and nobody's actually there.

[00:05:13] **Joe Paradiso:** Yeah. That's the good news. Or you just look at the real people but they don't look happy anymore cuz you're comparing them to people that are all smiling. So it's very weird. We got used to it anyway.

[00:05:23] **Susan Kish:** In a talk you just did in Paris for this Da Vinci Center. You talked about Neri Oxman's Krebs Cycle of Creativity.

[00:05:31] **Joe Paradiso:** Yeah. You saw that talk. It was so much fun being there.

[00:05:34] **Susan Kish:** The joy of the internet and YouTube. Yeah, that's true. But can you talk about what that is because it does feel like there is a magic that sometimes happens at the MIT Media Lab that you manifest in the work that you've done.

[00:05:47] **Joe Paradiso:** What Neri was trying to address there was the tension between art and design, which, she works at that boundary, right? She's an artist, but she's a designer and she really works back and forth. Her group would publish in technical journals, really well regarded journals about materials and fabrication, so on and so forth, as well as put on great exhibits, which is what we love to see at the Media Lab.

[00:06:07] Cause she's doing both. So she basically expanded it cuz you also have art and science. So you have engineering, design, art, and science. And they have a similar relationship where... the beauty of this is that you could transpose it any way you want and it's still an argument to cross a boundary.

[00:06:24] So you look at design and art. Art is the high world. Design is applied, but it's not, it's exactly true for people working in design. They do incredible innovation. And it can be art. It always depends. Engineering and science: Some of my engineering colleagues are actually doing wonderful science too. And some of my science colleagues are actually doing engineering to some extent. It depends on the level of questions you're asking. They're different if they're extremes, but there's a flow between them. And then you can always jump between engineering and design and art and science may be a bit more of a leap.

[00:06:53] But people recognize that more. There's similar modalities of thought to some extent. In science, you're trying to figure out what's going on in the world. Art, you're trying to find a new way to express something in a different way. But it's always searching the new, breaking fresh ground.

[00:07:07] That's what's science is about. And engineering, you're always trying to do something innovative too. Sure. But science, you're trying to get a new discovery. Art, you're trying to come up with some piece no one's ever seen before, that's gonna blow your mind. So that's a similarity there too.

[00:07:20] And she talked about Media Lab.

[00:07:21] **Susan Kish:** You're both breaking boundaries.

[00:07:22] **Joe Paradiso:** Yeah, it's breaking boundaries. Yeah. And you look at the similarities between the fields, the Media Lab and why we drew that cycle is because it is all about breaking the boundaries between it, where we can go from one to the other and it's one of the few places I think, where we can do it as fluidly as we do.

[00:07:38] **Susan Kish:** And it feels like you do it. Right? You work in music, you work in science and high energy physics with words like "Muon" that I have no idea what they mean. You work with engineering cuz you build those crazy synthesizers with all those, anyway, lots of complicated things. So it sounds like your career actually embodies that or am I being overly simplistic?

[00:08:02] **Joe Paradiso:** No, I think that's why I came to the Media Lab because it's a place where I could do everything I like to do. And not have to do something strictly on the side. It could all be part of, you know, my occupation, which is great. I don't have to worry where this activity or question fits, as long as it's innovative and can make a statement, I can do it.

[00:08:23] Of course, some of my life is a trajectory. It's not all happening at once. So I did come from high energy physics. I did work on Muon, pure production and measurement. At the ISR at CERN, I lived in Switzerland for two years before I went to ETH, so I was also...

[00:08:37] **Susan Kish:** Before we go too far. What is a Muon?

[00:08:40] **Joe Paradiso:** It's a heavy electron

[00:08:42] **Susan Kish:** Okay.

[00:08:43] **Joe Paradiso:** It's like an electron. A muon has negative charge. So the muon is essentially a heavy electron.

[00:08:48] **Susan Kish:** And the muon doesn't have components to it, like the electron. It's a basic material?

[00:08:53] **Joe Paradiso:** Muon, electron, both are point particles as far as we know. It could be super strings if you want to probe it finely enough, right? But we won't get there with the kind of experiments we can make. But for all practical purposes, the Muon is a point particle.

[00:09:09] **Susan Kish:** How did you get from studying at Tufts to flying all the way to studying at CERN.

[00:09:14] **Joe Paradiso:** At Tufts, I was a physics and electrical engineering double major and I loved physics because of the questions it was asking and the mindset that it took. And I loved engineering cause I like to make things and I loved electronics and building electronics since I was a kid.

[00:09:28] I built my first synthesizer, actually, when I was at Tufts. Cause I loved electronic music at that time too. So I got into graduate school at MIT. They gave me a fellowship there and I got a chance to work with Ting's Group. He just won the Nobel Prize for the discovery of the charm quark.

[00:09:42] It was a group that was clearly on the move they were making things or building a detector for the e+e- collider at DESY in Hamburg. The Petra Collider. He had an experiment running at CERN, which is the one I wound up joining.

[00:09:57] **Susan Kish:** Got it. And then from MIT, you went to CERN and then you went to what I think you referred to as a small technical college called the ETH?

[00:10:05] **Joe Paradiso:** Yes, I did my thesis at CERN and that was just so wonderful because CERN is a city of physicists, really from all over the world. It's just exciting. The discussions in the canteen, the people you meet, the students that come every summer from all over Europe is another wonderful thing cuz I was a kid from the states, so I'd never been to Europe before and now suddenly here I am hanging out with, I hung out with the Germans one summer, it was wonderful time. Then the next summer I hung out with the Italian students. Cuz I'm an American, I'm intrinsically naive.

[00:10:35] See when I go to CERN now, and I love this, the young people identify as being European and not so much Italian, it's more the European and much more mixing between the different countries.

[00:10:48] But it was such a fabulous time just being with the other students, nevermind learning physics and being in such a great place, and I love Switzerland so much. I figured, okay I'll go back to ETH. That, that wasn't the exact plan.

[00:10:59] I was thinking going back to CERN, but Ting basically had put together a proposal for a lab while he was at CERN while I was finishing. And that activity started to really pick up as I was doing my thesis when I went back to MIT. And Hans Hofer at ETH was one of the fundamental members of that consortium Ting had built.

[00:11:17] So there was an MIT-ETH alliance that was formed really between Ting and Hofer. And, we took on the task of building the central detector at Lab that Heinrich Valenta, another dear friend at the time, one of the co-inventors of the drift chamber, Heinrich pretty much invented one of the main tools of high energy physics at that time when I was there.

[00:11:38] He had come up with this new kind of drift chamber called the time expansion chamber, where you slow the drift velocity down so you can get more resolution

[00:11:44] But anyway, this crazy chamber, ETH decided to build it. And they needed help. And the group said, why don't you go in and plug into this team and be the MIT guy at ETH. So go and work with the group. And I did.

[00:11:58] **Susan Kish:** And, but this was not at the main campus downtown. This was up in Höngg?,

[00:12:02] **Joe Paradiso:** There was no experimental physics that I knew of that was downtown. So that was all in Höngg. And Höngg was a very quiet place in those days. Now I go, Höngg is just lively, even have dorms up there. And so students are there, it's alive. You've got all kinds of other departments there.

[00:12:17] **Susan Kish:** There's a great picture of you with your feet up with a synthesizer that you had built.

[00:12:23] **Joe Paradiso:** That was the one in my apartment. What happened in Zurich is that okay, I went there supercharged MIT style and ETH of course was very conservative back then.

[00:12:33] I was warned before I went, it's very conservative at ETH and you aren't really a conservative type person, be careful, but you should go. You should go. But I'm warning you, several senior physicists basically told me this. And even ETH did, Hans Hofer himself told me this. He said, it's really different at ETH. It's very conservative.

[00:12:55] I got there, I said, I don't care. I'm gonna go anyway. I went and the first year I just ran on inertia essentially. I was just working constantly cuz in Höngg there was nothing else to do. It takes a while to really settle into Zurich to meet people, especially back then. In CERN it was easy cuz you have students from all over Europe, you have international people. It's...

[00:13:13] **Susan Kish:** You could plug right in.

[00:13:15] **Joe Paradiso:** I plugged right in, so I had lots of friends in Geneva. In Zurich, I didn't know how to plug in. So I was working all the time and that was okay for the first year and I got a lot done in developing the new electronics from the chamber and testing some ideas out.

[00:13:28] But I couldn't do that anymore. After a year I needed something else in my life. My old girlfriend in the states decided that, okay... Long distance relationships are different now cuz there's Zoom, right? But then no matter where,

[00:13:39] **Susan Kish:** You just had the telephone and those were long distance calls.

[00:13:43] **Joe Paradiso:** Oh it was expensive. I actually plotted my phone bill and cause I, it takes, I could get a phone within three months. It took a while to get a phone back then too. But in three months I got a landline and we did a once a month call, whatever it was.

[00:13:57] **Susan Kish:** And you wrote letters. Did you like to write letters?

[00:13:59] **Joe Paradiso:** We wrote a lot of letters. So letters, postcards, stuff like that. But at the end when things started to drift, which they, of course they would have to, because it's long distance, my phone bill went up astronomically and then it dove down.



[00:14:13] So I needed a life basically. And eventually I got to, I had Swiss friends, I got to know people. I did a radio show at Radio LoRa, I believe so. Probably still there in Zurich.

[00:14:23] **Susan Kish:** Oh, that's cool.

[00:14:23] **Joe Paradiso:** When I first started, I would go to concerts and got to know some of the music people.

[00:14:28] But I needed to do something else. So I decide, okay, I'm gonna build this... I have all these ideas about new synthesizer modules. I have a lab. So I started building synthesizer modules, figure out okay to do maybe four or five.

[00:14:39] I did 80 or 90, I forget how many you see it in the picture.

[00:14:42] **Susan Kish:** What is a synthesizer module? What does that mean?

[00:14:45] **Joe Paradiso:** What I built when I was an undergraduate was a modular synthesizer. And those are, it's like a rack of test equipment in a way, right? A module is a unit that has a certain set of functions and you can use it to generate sound, oscillators, sample players, things like that.

[00:15:02] And I had a speech synthesizer that I found talking in a gas system in Aachen, one of our collaborators, and I got a hold of the chip and built that into a module when I was in Zurich. So they can make sounds, they can modify sounds like filters and amplifiers and they can distort the sound in different ways.

[00:15:17] And they can produce control waveforms. So you have the envelope generators that generate the contour of the sound, things like that. But in a module of the synthesizer, you connect them with wires. When I do these pieces, I do different kinds of things on my synth, but what I love to do a lot is put in massive patches that just play autonomously. Cuz when I do that kind of a work I'm an engineer cuz I designed all these modules.

[00:15:40] I'm still designing some, now I'm modifying my pedals as well. I buy commercial pedals for guitar players, but they can do amazing things with sound. But I can actually go in and put my own signals in to twist the way they behave in different ways. So all of my pedals have extra jacks in there so I can plug into my synthesizer and really make it breathe.

[00:15:57] So I have ...

[00:15:57] **Susan Kish:** What's a patch? Before you get too far.

[00:15:59] **Joe Paradiso:** A patch is essentially, putting wires in between the inputs and outputs of different modules so that the synthesizer does something. If there's



no patch in there, if there's no wires in a module, the synthesizer, it doesn't do anything right. Lights will flash, but huh, it doesn't do anything.

[00:16:15] But if you start patching up a sound structure, you're connecting sound sources to outputs, you're putting a modulator of different sorts. You have different kinds of control, logic and control circuits that come on and they make the thing breathe and change and evolve. You build a music machine essentially through these chords. It's like programming and you just listen to what kind of unwinds from it.

[00:16:38] **Susan Kish:** Can you play us a patch?

[00:16:39] **Joe Paradiso:** Yeah, of course. I can.

[00:16:44] (MUSIC)

[00:16:44] **Susan Kish:** Now there's an anecdote about you doing music in one of the garages in Höngg.

[00:16:49] **Joe Paradiso:** Yeah. Yeah, that's indeed true. I love the sound characteristics of the parking garage there. The ambience of a place really is almost like a smell.

[00:16:57] It has a certain feel to it, right? And the Höngg parking garage, before they put the acoustic treatment in it, which happened I think about maybe 10, 20 years ago, if you made a noise, it would echo forever. If you closed your car door, it would be like a huge crash that would take many seconds to die down.

[00:17:14] So I thought, okay, I should do some recording here. And, to put a synthesizer unit there, set up modules there would be awfully hard. I instead bought a melodica at the store down the street from my apartment, and I went and played it, put microphones at a few places in the parking garage and just walked around playing my melodica.

[00:17:32] So you get that ambience.

[00:17:33] **Susan Kish:** Oh, that's so cool.

[00:17:35] **Joe Paradiso:** There was no one there at night usually. Once in a while, someone would come out and they'd look at me in a weird way. They understood, it was okay.

[00:17:42] **Susan Kish:** So after you did your studies, in Zurich, if I understand correctly, you took a right turn and decided you wanted to do spacecraft control systems?

[00:17:53] **Joe Paradiso:** Yeah, I was.

[00:17:54] **Susan Kish:** You got bored?

[00:17:55] **Joe Paradiso:** No. I was a little alarmed where physics was going with the huge experiments, the time delays, it takes decades before you put the experiment on. You have teams of thousands of people. So is this really what I want to do? And it wasn't just me.

[00:18:10] But I was coming back from a party in Geneva and I was reading the Herald Tribune and there was this little article, a tiny article saying NASA wants scientist astronauts. Oh, that's maybe what I should try to do.

[00:18:23] I figure, how do I do this? I dunno anything about spacecraft, I figure the best thing is to go someplace where I could learn. And after living in Europe for four years, darn I loved it and I still do, but I thought it was time to come back to the States and, pick up here and, I'll go back to Europe, spend time there, but let me transfer over.

[00:18:38] Draper Lab, where I worked as an undergraduate, it's a spinoff of MIT's astro department. One of their main claims to fame is that they did the guidance navigation control for Apollo. They did the Apollo flight computer and they kept on, after that they had a strong liaison with NASA and they were very active in shuttle.

[00:18:54] So I went and visited some old friends at Draper and they said, yeah, definitely come back. We want you. And they gave me an offer, a good offer actually, to work with the group that did the NASA work.

[00:19:03] **Susan Kish:** Oh, cool.

[00:19:03] **Joe Paradiso:** I felt, okay, this is a way to do it so I can learn all this stuff and I can be close to NASA and heck, I can apply to be an astronaut. And I did, of course. But since I had thyroid cancer, it was an automatic rejection, chances of getting that position... never anything to rely on. I have some very good friends that are astronauts. I have infinite respect for them. It's a special kind of a person. It may not have been for me, but... it definitely wasn't for me because of, what I went through when I started being a graduate student with thyroid cancer, fortunately I'm good. It was cured. It's all good, but they took off a box, so that was off the table.

[00:19:31] But when I make choices like this, I like to look at, certainly wanna take a wild road, right? I like that road that goes somewhere interesting, but also a road that's gonna lead to other roads in a way where probably there's gonna be a lot of other branches, a lot of possibilities. And I saw it going to this, learning spacecraft and learning this other stuff, this could lead to other things. Granted, applying for an astronaut, maybe give me my motivation to jump, but it doesn't matter if I don't land on that narrow pad. Probability is low anyway. Wherever I'm gonna go is probably gonna be pretty interesting.

[00:20:04] **Susan Kish:** Very cool.

[00:20:04] **Joe Paradiso:** I've gotten so close to so many NASA labs and there's such great work that's happening in and around them, especially now. Now it's incredible. But what happened after that is I started getting back to high energy physics cuz ETH called me back actually.

[00:20:16] **Susan Kish:** Huh

[00:20:17] **Joe Paradiso:** Sam Ting's Group started a LHC detector proposal. It's called, was called LPP, to take our L3 detector beef it up and make it work for the Large Hadron Collider. So we have a cheap detector. It still could work. And I went back for two summers to work with the team to look at different aspects of that.

[00:20:34] And then when I went back to Draper, I had my own contract with the Super Collider to do precision alignment with the detectors down there. So I was doing for another two years, again, high energy physics, both with ETH and with the US consortia. And then the Media Lab formed and that was a siren call for me and I went. When I left spacecraft control around that time, I thought I'd never do spacecraft again. Totally wrong. We actually have, we've got five or six projects in space now. I've just wrote an article with my students about moving ubiquitous pervasive computing applications into space, and it goes over all these trajectories of projects that started as something we did for Internet of Things basically.

[00:21:12] **Susan Kish:** What would be an example of that? What's your application?

[00:21:15] **Joe Paradiso:** There are a few, but a few good ones. But one good example probably now is a little micro robot that we built to crawl on clothing for dynamic wearables.

[00:21:24] We had this crazy idea of wearables that could change their positions. So wearable computing now is a watch. We would have a badge or you'd have a chest strap if you wanna measure heart rate and breathing or things like that. You have glasses. They're all the canonical things, but what about a wearable that can move to be where it wants to be, to do whatever function it wants?

[00:21:43] And yeah, this evolved with some of my students, I was, talking about the Intel Selfie Drone, which was a really conceptual example. It was a design competition where you'd have a drone that would be on your wrist as a watch and you could flip your watch up and it would go up, take a selfie, and then come back.

[00:21:57] I don't think it was ever built as such, but it's a great idea. And we started thinking then of robots that can crawl on the body for different purposes. And we went and made these microrobots that crawl on clothing. It won an award at UIST, one of the big ACM conferences for human computer interfaces.

[00:22:13] And then I pushed the student to think about robots that crawl on the skin for medical purposes. For telemedicine, this could be another approach where you can navigate the skin and make measurements, deliver therapy, whatever else. And we developed a version of that. But we had these microrobots and we started thinking about space.

[00:22:28] We thought, okay, maybe they have a role there. And my student Ariel, who's graduated now is running her own space institute slash company looking at large space structures. She had this idea of using them to look at the health of space structures so they could crawl instead having an EVA or an arm get to the place that has to get to and inspect.

[00:22:46] It may not always be possible. Just run these little microbots that can traverse the structure and look at it.

[00:22:51] **Susan Kish:** Right, cuz they don't need, they don't need air to breathe in a big space suit and the whole bit.

[00:22:56] **Joe Paradiso:** And you can pack a lot of technology into a small robot now, you can have a battery so that it can, get more or less where it needs to be and then recharge, or can even have maybe solar cells, the scavenge power that is in the sun.

[00:23:07] So we built a fleet of these. We did zero gravity experiments on flights, but then we had an opportunity to bring one to the moon because an MIT spinoff lunar outpost is actually launching a set of rovers to the moon, really within the next year. So there are two of them going up. One, one actually soon, maybe.

[00:23:24] You never know, right? It could get pushed, but it's within months. And the one we are on is gonna go around the end of the year. And we have...

[00:23:33] **Susan Kish:** Very cool!

[00:23:33] **Joe Paradiso:** ...so many grams of payload to put a tiny rover on the top of this little thing that will land, it's gonna crawl out on the back of the big rover and make thermo measurements to see how well the heat transfer service is working.

[00:23:46] It's a project concept more or less, but yeah, we're gonna have the world's smallest planetary rover going out on top of the big one and making some measurements.

[00:23:54] **Susan Kish:** That sounds extremely cool.

[00:23:56] **Joe Paradiso:** Oh, it's fun.

[00:23:58] **Susan Kish:** So just getting back to the ETH, how do you think those years at ETH influenced the work that you do?

[00:24:06] **Joe Paradiso:** Oh, it was a period of development in so many ways. Especially the two years I spent there because I was living in Europe. I was doing all this deep electronics. I was heavily integrated into the high energy physics community at a fundamental level.

[00:24:17] I grew a lot as a researcher. And I developed more and more appreciation for Europe. And it's like a second home in a sense that I spent my four years in Switzerland and I go back often now for lots of collaborations, lots of colleagues, and I just feel at home there because of that time I spent.

[00:24:34] During that whole period, there are moments when I was ... ETH was so frustrating cuz it was conservative. It's different now. I have so many friends that are doing all this wild stuff. I go there and it's exciting. The students that come from ETH to my group, they've always been good.

[00:24:47] Zurich is such an important part of my life. When I go back and look at the pictures and think about the times I spent, if I hadn't gone, it would've been very different.

[00:24:55] I don't think it would've been nearly as, as rich as it was.

[00:25:00] **Susan Kish:** When you go back to Zurich, what's your favorite place?

[00:25:04] **Joe Paradiso:** That's a great question. I used to go to the record store. My friend Veit Stauffer in Rec Rec Zurich, I've known him ever since I lived there. He just closed a shop down. I was one of his last customers, cuz he closed it down after I was in Zurich last time. And we had a great fondue dinner down the street.

[00:25:18] It was so much fun. But yeah, I would hunt out music always, right, and I'd hunt out performances. I used to go to the Rote Fabrik and places like that quite a bit. Zurich had a real Avantgarde. This is another important thing for me cuz Zurich was a center for all that, cuz bands are traveling in Europe, they'd always stop in Zurich. People I'd never seen in the States.

[00:25:34] But there is something I miss. It's the food, the Swiss food. It's not the healthiest food, but it's so good. And when I go, I always get too many Geschnetzeltes and the Rahmschnitzel, whatever else, right? It's that, that creamy Swiss food with Röschi and maybe an egg. It's so good. It's hard to find it here.

[00:25:56] And I remember there was a Swiss restaurant. We used to have a Swiss restaurant maybe you remember it, it was called the Swiss Alps, I believe, in the middle of Harvard Square. We went there, we sat down, I ordered some stuff and I ordered a beer, a Hürliemann, and

[00:26:08] **Susan Kish:** Oh my gosh, right.

[00:26:09] **Joe Paradiso:** Yeah. The real Swiss beer, I hadn't seen it at all since I've been... but I took a sip. It was like Proust's madeleine moment, right? Where all the memories come back, the sip of the Hürlimann and whoa, all these memories flooded back. It was just incredible.

[00:26:24] **Susan Kish:** That's wild. And what are you curious about now? What are you reading? What are the books on your book stand?

[00:26:30] **Joe Paradiso:** Yeah, too many books pile up as I have to spend too much time reading theses and reports, unfortunately.

[00:26:35] But when I have a chance, I always love just reading mainly fiction books, but other kinds of books as I can. I love science fiction and I've long been a huge fan of Steven Baxter, the British hard science fiction writer. He writes what I would call physics fiction where he incorporates what we see as some possible emerging physics principle or crazy idea into some sort of a amazing concept in a novel.

[00:27:00] And I'm reading something a little closer to fantasy that he did. He wrote this series of books with Terry Pratchett before he died. He basically mapped it out and it's basically the long cosmos. One day people are able to suddenly step between parallel worlds cuz they have this little device that somebody posted on the net, just has some simple components in it, and you just flip a switch and boom, take a step and you're somewhere else.

[00:27:21] So he has a whole series of them. They're just tremendous fun. And I'm reading the last one now, so I carry this with me. It's almost done.

[00:27:27] **Susan Kish:** And what is it called again?

[00:27:29] **Joe Paradiso:** This one's the Long Cosmos, but it's the Long Earth Series. It's the last book in the series. I read Permutation City a while back, that totally blew my mind about living in a simulation, more or less. And this one is about other ways for to basically expand through the cosmos, not just, physically to go there. You can send other things. I, I will see when I get through it.

[00:27:51] Adrian Cherkovski is one of the new darlings of sci-fi and I just picked up sharks of earth, cuz this sounds awesome. I haven't read anything he's written yet, but this is top of my list.

[00:28:01] But what fascinates me is, what fascinates everybody Now is AI. Holy cow. Holy cow.

[00:28:07] **Susan Kish:** And AI and music. AI and sensors.

[00:28:11] **Joe Paradiso:** Everything. 2022 is the year that we developed AI. We see it. Cuz before it was always fragile, abstract. Right now, of course, a lot of it that we see is text based, where we go in with prompts, we say things, we get responses. It's essentially training on language and sequences of language, of transformer models. But it's incredible the way that kind of builds a cognitive structure in computational device that can start to generalize, right?

[00:28:37] These are discussed at all levels of the media and research now. So it, we're figuring, we are just finding out what this is and we don't yet know where it's gonna stop. It's an incredible moment actually, really is, I've got a project now that I'm doing with one of my students about music and AI and I think that's, we've seen progress there.

[00:28:55] Certainly computational imagery and AI is huge. You have all the, yeah, platforms like Stable Diffusion, Mid Journey, so on and so forth. Dolly, where people I've done a lot of it too. If I need to make an image, even for an article that kind of a fanciful image that sums it up, or a cover for one of my talks, I'll go into Mid Journey, give it some examples from things we've done in the group. Give it some prompts and boom, I'll get this incredible image coming out.

[00:29:17] **Susan Kish:** Joe, thank you. That was a wonderful conversation.

[00:29:21] **Joe Paradiso:** Oh, my pleasure, I loved it. I enjoyed it very much too. Thank you.

[00:29:26] **Susan Kish:** I'm Susan Kish, host of the We are ETH series. Telling the story of the alumni and friends of ETH Zurich, the Swiss Federal Institute of Technology in Zurich. ETH regularly ranks amongst the top universities in the world with cutting edge research, science and people. The people who were there, the people who are there, and the people who will be there.

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