

Chapter 19: Alien Science

As a professor of physics, I find this chapter fascinating. But I do realize that those not familiar with the bizarre physics of time and space distortions may be inclined to skim over it, which is fine. But for those who share my interests, I encourage further exploration by reading some of the recent scientific Earth publications that introduce and expand the ideas presented here.

Despite Jazz's efforts, the beach disappeared and the sound of a roaring waterfall became deafening. Then the sound started to diminish until she found herself in a classroom with Joe and a group of graduate students. She looked at him and started to talk but Joe raised his finger to his mouth, beckoning her to be quiet. He whispered to her. "We have to be quiet. Jazz is going to tell us how the universe works."

At the chalkboard, an older Jazz drew a space-time diagram on the board. She looked at the class and nodded. "Okay, let's start with what we don't know. What are some things science can't explain?"

Joe raised his hand. "I've never understood the vacuum energy of empty space? Particle accelerators like CERN show particles appearing out of nowhere. Some of them travel backward in time."

"Good," the older Jazz said, "Anything else?"

Another student raised her hand. "The expansion of the universe suggests there is a mysterious dark energy in the universe. We don't know if that is related to the energy in empty space that Joe was talking about."

Another student raised his hand. "The fundamental constants, why is the speed of light a fixed constant? Why is the electron's charge a constant? And why is there uncertainty in position and velocity when you get below Plank's constant?"

"Excellent," Jazz said. "Now I am going to add another mystery that many of you may not know about. We have special entangled crystals we call Star Doors. As you know entangled particles can transfer information instantaneously across vast distances."

Instantly several students raised their hands. Jazz pointed to one of them. "Nothing can travel faster than the speed of light. In order to decode the information sent, you need to send some decoding information from one entangled particle to the other and that has to travel at the speed of light. So what you are describing is impossible."

"Yes, that is true," Jazz answered. "But these crystals are made of billions of entangled particles that are configured in a unique way. I'll explain more shortly. Let's just assume they communicate instantaneously. Why can't we use them to build a time machine?"

The younger Jazz, sitting next to Joe, tentatively raised her hand. She wasn't sure if she was allowed to participate in the class, but no one else seem to have an answer and this, after all, was her dream. "You are talking about taking one of those entangled crystals and time-shifting it by accelerating it close to the speed of light, or perhaps bringing it close to a black hole and back. In any case that will push it into the future. I think nature destroys the link if you do that."

"Good point," the older Jazz smiled at the younger version of herself. "But why do you think that happens?"

The younger Jazz was not as confident answering this question. "Because the world wouldn't make sense if you could travel in time. That would destroy cause and effect and free will. If you knew what was going to happen in

the future, that would mean all the events that are needed to lead up to that event could not be changed. If I foresaw a future where I was going to win a million dollars by buying a lottery ticket, then I have to buy a lottery ticket for that to happen. I have no choice. I have no free will."

"That's a circular argument, but it's a good point," the older Jazz went to the board and drew a curved cone shape. "We need a working theory that explains all of these curious mysteries. Here is a black hole. What is wrong with this shape?"

Joe raised his hand. "I never understood the concept of singularities. That cone shape has a sharp point at the end of it." Joe's eyes opened like he had just thought of something important. "That's another mystery, isn't it?"

"Yes. Let's add that to our list." The older Jazz stepped back and looked at the cone shape. "On second thought, let's get rid of it. From our perspective it looks like a singularity. But from inside the singularity it must look like something else." She went back to the board and erased the sharp bottom of the cone. "What can we add to it that would make it stable?"

The younger Jazz looked around the room. No one had an answer, so she raised her hand. "Add an upside-down cone to it. This becomes an Einstein-Rosen bridge, a wormhole."

The older Jazz drew the shape on the board. "Okay, now I have to ask, does this kind of thing exist in our universe?"

Several students shook their heads. One raised her hand. "Wormholes are a solution to Einstein's field equations but there is no known observation of wormholes anywhere in our universe."

The older Jazz smiled. "What if I told you they were everywhere? Every black hole is a wormhole. Every particle with rest mass is a wormhole. The reason we can't observe them is because from our perspective we only see one end of them. I'll call that the entrance." She pointed at the top of the double cone structure. "A key question is where does the exit of this wormhole go? What is at the other end of this wormhole?"

Once again no one raised their hand, so the younger Jazz volunteered an answer. "It could go to another universe, an anti-universe."

The older version walked over to the younger Jazz, smiled and nodded her head slightly. "How do you know this stuff?" She looked around the room. "Somebody tell me another mystery in physics. The keyword here is 'anti'".

Joe looked from the younger Jazz to the older Jazz. Somehow it didn't bother him that there were two Jazz's in the classroom. "Anti-particles," he said out loud without raising his hand. "Our universe doesn't have much anti-matter. Why don't we have anti-galaxies? Theoretically, according to Einstein's field equations, there is no reason why they shouldn't exist. Why don't we have more anti-matter in our universe?"

The older Jazz went back to the board. "Let's hypothesize that all of reality actually does have an equal amount of matter and anti-matter. Furthermore let's hypothesize that the anti-universe," she pointed at the bottom of the double cones, "contains mostly anti-matter. If that is true, what is going on at the center of these two cones?"

Joe stared at the narrow point between the top and bottom cones. "Matter and anti-matter destroy each other. There is a high density of both at the center, so that wormhole is not stable. It will explode."

The younger Jazz looked at Joe and at her older self. "Unless there is some kind of exotic matter there keeping it stable. Exotic matter has repulsive gravity. Maybe it keeps the matter and antimatter apart in some kind of geometric shape."

The older Jazz looked at the narrowed tunnel between the two cones. "I can't say that is wrong. But I want more. I agree that particles and anti-particles with non-zero rest mass destroy each other. The only things that can survive

at that narrow point are photons. Photons define what we know as space-time. What does light do here in this curved space at the center?"

Joe's eyes opened wider. "What if it travels in circles?"

"And..." The older Jazz beckoned Joe.

"Light, that is photons, are bosons. They don't mind taking up the same space. You could have a circular laser beam there that could add up to incredible powers."

"What would that look like to us as we look down the entrance throat of that wormhole?"

Things were beginning to take shape in Jazz's mind. "It would appear to be a fixed object with mass, a particle. It would have the strange properties of matter though. That is it would obey the laws of quantum mechanics."

"I want more." The older Jazz said. "Tell me more."

"To us light travelling in circles would look like a particle of matter," Jazz explained. "There are many types of particles just as there are many types of orbital shapes photons can follow in that region of no-time. If you were looking at it from the anti-universe, you would see an anti-particle. But wait, if time travels backward in the anti-universe it would look like a regular particle to an anti-person there."

"More."

"That's why we don't see anti-particles in our universe. Anti-particles can come together to form anti-atoms, anti-stars and anti-galaxies with time flowing backward. When time flows forward those things all appear random to us in the form of vacuum energy."

"More."

"You can't travel through a wormhole to take advantage of time travelling backwards. Wormholes are like blenders, the intense circular laser beam breaks up any particle that comes into contact with it. The particle loses its energy and information to the circular beam of light. The wormhole destroys everything falling into it. That is it reduces and scrambles any particle with a non-zero rest mass like protons, neutrons and electrons down into pure light. Particles get destroyed and photon trajectories get bent beyond recognition. You have uncertainty. So you can't send meaningful information through that wormhole to the anti-universe."

"What can you do with it? Tell me about the fundamental constants."

Joe raised his hand. "I can't prove it mathematically, but that narrowed part where time stands still sees the entire universe from beginning to end, all of it happening at once. Its shape is dependent on the size of the universe and the anti-universe. And it's that shape that determines the constants. So the constants don't change from our point of view because time has come to a stop at the center of the wormhole. Furthermore photons travelling in tight circles are a stable configuration that defines the curved space-time in that wormhole. But only certain wavelengths and trajectories are possible which explains the quantum nature of particles."

"We'll get into the math later, but I like your hunches. Now tell me about star doors. How do they work if information can't be sent through a wormhole?"

Jazz answered tentatively, "Information can't be sent through a wormhole, but a force on one end of a wormhole affects the other end of the worm hole. You must need two wormholes." Jazz thought for a few seconds. "Star doors might be paired wormholes left over from the Big Bang. The entrance end of these special wormholes might be anywhere in our universe but the exit end of these two wormholes, the antimatter side, must be right next to each other in the anti-universe. When we communicate we send messages to the anti-universe by shaking one end of a wormhole. That shakes the other end which shakes the wormhole next to it on the anti-universe side. That

wormhole sends the message back to the opposite end of the other wormhole, which could be anywhere in our universe.”

“Furthermore,” Jazz continued, “if we try to time shift one wormhole on our side it must move its anti-universe side away in time from the other wormhole. You can’t time shift wormholes very much without scrambling their entanglement. Entropy will eventually destroy these links as the universe ages.”

“But the entanglement isn’t totally lost all at once.” The older Jazz added. “As the time shift increases, it gets quantized into more and more paths until finally there are so many paths that all possible correlation is gone.”

The younger Jazz tried to understand what the older Jazz was saying.

“That’s enough for now,” the older Jazz said. “I think you have everything you need. Do the math. You will find you have everything you need to save the world. And one more thing, what humanity needs now are real heroes, a group of people that can solve the world’s problems and are ready and able to change and adapt. Remember that, we need ‘real heroes now.’”

The dream faded. Jazz felt like someone had performed surgery on her brain. She was now different somehow, but different in a better way. She thought she understood the physics of star doors. Or was that just the dream giving her a false sense of confidence in her ideas. She needed proof.