
Journey
To
Goldilocks
Finding Xeron
Xe

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Xe

Xerellian Press

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Xerellian Press

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Table of Contents

FORWARD

A journey is not always about knowing where you are going. It's about getting to where you want to be.

--Xe

The world is a very exceptional place. An extraordinarily complex place. If you don't feel that way right now, you will later on. Simplicity is something that tends to gradually slip away over time for most of us. Some of us yearn for a return to a time that was much simpler. That's only because we have something to compare it to. Now and then. Yesteryear and today. If you only have one of these, then you are either at the very beginning of something or hopelessly stuck in the middle.

Scientists have a word that describes all of this. It's actually an essential part of the second law of thermodynamics, one of the most fundamental laws of nature. That word is entropy. Entropy is a measure of the level of disorder in a system. A system that has low entropy tends to have more order. A system that is high in entropy has a high degree of disorder. All systems tend to move in a direction starting from low entropy to a higher degree of disorder, randomness, and complexity.

Scientists are interested in discovering how the world around us operates. How is this complexity constructed? How does it work? It's called physics. It does not attempt to answer the more existential questions that question why something occurs. That is the realm of philosophers and theologians. Scientists deal with the observable world. The things that can be observed, tested, and verified.

As such, it requires us to take journeys. A journey through the vastness of the Universe that surrounds us. A journey through the infinitesimal smallness of the confines of an atom. At some point they beautifully touch one another. At some point one leads to the other. Starting all over again.

That's what we all want when you really think about it. It's not about living forever. It's about being able to start all over again. But to start all over again you need to know where. That's what Xe needs to know. That's what Xe needs to find out. That's what this story is all about. It's about getting to where she wants to be.

The Open Door

Chapter One

Xe is suddenly startled by the opening of the door behind her to her lab. No one is supposed to know of this place. No one is supposed to know of the experiments being performed here. Nervously, she attempts to cover up what she was doing. Shuffling her pile of notes, trying to make things look as innocent as possible.

As she slowly turns around she sees that the door is open, but there is nobody there. Funny, there are no windows open down here to create a breeze. She cautiously walks over to the door and gently closes it. As if to say, “Not yet. It’s not time.”

The lab Xe is working in is something of her own doing. Assembled from discarded tools and parts confiscated from other labs that had either closed down or had been upgraded to the latest and greatest technologies. Not ideal, but perfectly acceptable for what she needs to do. Located deep in the basement of her house it is out of view and hopefully unnoticed.

It wasn’t supposed to be this way. She was supposed to have retired in this small sleepy town in California. All the while waiting for the effects of her previous research to produce the tangible results she was hoping for. All she had to do was just be patient. The door would eventually open.

Xe had spent a good number of her earlier years working at the Large Hadron Collider (LHC) in Geneva, Switzerland. The LHC is one of the most complex experimental machines ever built. Xe’s job as the lead theoretical physicist, was to examine the tiniest particles in the Universe and understand the part they play in the fabric of nature. How they hold things in our Universe together. How they exchange the information necessary to create matter and even universes themselves.

The only way all this could be studied at the time was to create this massive experimental machine that was capable of forcing a collision of these tiniest particles in order for the byproducts of this collision to be examined. Byproducts that contained even more particles that could help understand how the Universe formed. How we all formed. The particles that hold everything together.

The problem that presented itself was not only how to create just the right collision, but how to catch its effects. The resulting particles were only around for a very short period of time. So short a period of time that unless you

knew better, they appeared to have never existed at all. Thus, the complexity of the machine that forced the collisions in the first place. The LHC was responsible for accelerating particles close to the speed of light. In opposite directions. Forcing the collision. It was by accelerating particles to almost the speed of light that collisions of enough force could be produced.

Collisions with this much force produce multitudes of collateral particles. The LHC was responsible for capturing the effects of these collisions so that they could be studied and observed. It was like trying to re-create the moment of the Big Bang when all the matter of our current Universe was created. Capturing that interval between a particle's pop into and out of existence in order to understand the nature of the interrelationship. What Xe hoped would lead to a greater understanding of the exchange process itself. In the hopes of harnessing its power.

Xe's focus was on the actual exchange between the particles that created this virtual pop into and out of existence. This now you see it, now you don't phenomenon. Xe had prior knowledge of what could be done during this brief moment of embrace. A moment punctuated by creation, followed almost immediately by its own destruction. And although the moment seemed brief from an outsider's perspective, the universe it opened up for Xe was expansive. Life within that moment and the life external

to it, were both simply relative to one another. Separate universes, if you will.

Xe had proven that retracing the steps of another life form in another universe was not only plausible, but could be confirmed and verified. Xe had done this numerous times. On Xeron. Executing the calculations that were posited under the right conditions allowed Xe to telepathically travel to a time and place predetermined. As if surgically implanted into the brain of another life form. Not just an observer, but a participant. Xe's most favorite destination was Earth at the most critical steps of human development. But, of course, that was long, long ago.

Just as importantly, Xe showed that the process could be reversed with the same degree of precision. Xe could be returned to the starting point safely with only a small bit of confusion. All of this dependent on the length of stay. What signaled the return? What resulted in Xe's popping out of existence on Earth and back to Xeron? Unfortunately, to be returned to the point of origin required ending the existence at the point of destination. Death of the connection resulted in the particle's pop out of existence. Which in turn resulted in Xe's pop back to Xeron.

Xe already knew of all this. She didn't carry the burden of this knowledge lightly. The problem was that all of Xe's previous experience with this knowledge came from being

the inhabitant of another planet. A planet called Xeron. A planet located thousands of light years away from Earth. A planet that no one else here on Earth knew of or could ever accept. Let alone, find. It was in another universe, yet the planet of her origin. The planet she was trying to get back to.

In Xe's case her life on Xeron had expired. As is true with all Xerellians, you inflate until you can inflate no more. It is a very important principle of what Xerellians call The Laws of Everything. Here on Earth it is referred to as the process of aging. You are born, live life the best you can, and then you die. It's a very similar principle on Xeron. Only it's called inflation. When inflation is over, you expire.

The conservation of energy described in The Laws of Everything only allow for energy to be altered from one form to another. It cannot be created or destroyed. So when one's inflation ends, it simply begins somewhere else. In effect, it required that Xe be returned somewhere else when inflation ended.

What Xe had figured out how to do was to predetermine where that return was to be. So that the energy does not have to be created haphazardly, but instead can be exchanged for some energy elsewhere. This is what Xe referred to as transforming. A directed exchange of one life form ending and returning to that of another. Xe's

precise calculations and their purposeful and virtual insertion between two charged particles, allowed Xe to transform away from Xeron to places and universes far, far away. And ultimately, return to Xeron when the connection was closed.

Only this time it was different. Xe was inflating out. This was not just another round trip journey. If Xe was to orchestrate the transformation, it was going to be a one way trip. Xe's transformations had always been temporary. This one was to be permanent. That meant no easy way to return to Xeron by simply ending the connection. If Xe was to ever get back to Xeron she would have to recreate the connection from her end. Recreate the method of injection into the particle exchange process that she had perfected on Xeron. In other words, make Xeron the destination she would pop into.

Things were going so well. Her work at the LHC was highly successful. She left the LHC confident that they were heading in the right direction. It would only be a matter of time before they would discover the potential of the exchange of particles. Then would come knowledge of insertion. Then transformation. Xe had led them to the well. It was up to them to drink.

It would only be a matter of time until the technology of humans would catch up to what Xe already knew. She

would be heading home. Just give it time. But then everything changed. What began as a well laid out plan, began to become dismantled.

World Politics

Chapter Two

The world around Xe was a very volatile place in 2017. It seemed that every day a new conflict broke out. A conflict that was either economic or political in nature. The only thing that seemed predictable was the scientific work that continued to occur around the world. That's what Xe was counting on. That's what Xe was depending on. Unfortunately, what you would like to happen doesn't always happen. What you expect to happen is more often than not what does not happen.

Xe's life here on Earth had been very interconnected. She had a few of the closest of friends. Mainly colleagues that she worked with at the college. But she was most connected with her fellow scientists at the LHC. Working at the LHC had required the coordination of thousands of other scientists and engineers from around the world. People working together on a global scale. Nations coming together over a common goal. A shared scientific responsibility in trying to understand the events that shape our Universe. But as is so often the case, other factors intervene. In this case, political factors that tore apart the bonds created by the scientific endeavor.

Xe was very experienced dealing with the ideological differences bantered about between science and religion. On many occasions she was forced to debate the merits of one over the other. One had to be right. One had to be wrong. The thought that our world could be explained as a series of random events starting with the Big Bang conflicted heavily with those who believed it was all part of an intelligently designed master plan. But even with all the debate purporting to provide evidence supporting one side or the other, there was always an accepted tolerance between the two. Neither side had the ability to provide the knock-out punch. Neither side really wanted to. There was simply an unwritten understanding, agreement if you will, to coexist.

Not long after Xe left the LHC and retired to California the first few punches came. Unexpectedly. Not from the two ideological adversaries that one would have predicted. This had nothing to do with science finally being able to prove that God did not exist. This had nothing to do with religion proving that God did exist. This had all to do with political power and control of the world's economic purse strings. Although providing no proof supporting one side or the other, Xe's carefully prepared plans were placed on permanent hold.

It all started simply enough with scientific studies on the effects of climate change. Referred to as global warming, it was reported that over recent history the Earth's

average temperature was rising. And that if something wasn't done about it the world would continue to see longer and hotter heat waves, more frequent droughts, heavier rainfall, and more powerful hurricanes. Earth's ocean temperatures would rise, leading to rising sea levels that would cause heavy coastal flooding. In summary, there would be catastrophic environmental, economic, and health consequences. Alarming to say the least.

As dire as all the warnings were, it was one specific issue that seemed to garner all of the attention. That had to do with assigning responsibility for the dramatic increase or acceleration seen in global warming. A responsibility that was placed squarely on human activity. Study after scientific study conclusively showed that the tremendous amounts of carbon dioxide and other pollutants that humans regularly dumped into the atmosphere were leading causes of the increase in global warming.

Slowing the progress of global warming would require a truly global effort. An effort requiring all countries of the world to curb their amount of carbon dioxide and other pollutants added to the atmosphere. An effort that did indeed garner full global support. Until one nation decided that it wasn't necessary. That global warming was not the result of human activity. That it would be too cost prohibitive from an economic perspective to fund such an unproven effort. Unproven, because the science behind the causes was not sound.

And that was the key. A powerful nation with lots of money decided they were not going to participate. And the rationale? That there was no proof that human activity was the cause of the effects of global warming seen around the world. That, in fact, it was all just a hoax. It didn't seem to matter that there was clear evidence of weather changing for the worse. Or that glaciers were melting at an alarming rate. Or that ocean levels were rising. The emphasis changed from that it was happening to who was actually at fault.

There are always some people who will disagree. There are always some people who view everything as a conspiracy. But in this case it was a world power that questioned the legitimacy of its own scientists. It was a world power that created doubt in the minds of its own citizens as to whether the science was credible. It was a world power that single-handedly affected the distribution of monies for scientific research all around the globe.

The one thing that both science and religion have in common is belief. Xe's belief in the efficacy of her scientific research was just as strong as the belief of her opponents in their God. The only difference being the arguments used to support that belief. But without belief in the validity of your argument, you lose. It doesn't matter what the evidence is. The arguments used to support the idea that

humans were responsible for a catastrophe that lay ahead began to fade away. Fed by an active campaign to undermine the legitimacy of science itself.

It wasn't that all of a sudden there was some proof of an almighty God that could be verified by science. Or incontrovertible evidence that the laws of science and physics had been proven wrong. It didn't even matter that a majority of the people still supported scientific research. The damage was done. The element of doubt had been introduced at a more powerful level. Politics overruled religion. Politics overruled science. The net result was that a lot of the financial support for scientific endeavor started to dry up. The balance had been tipped.

Xe was eating her breakfast one morning in the waning months of 2017 when she got a call from a colleague at the LHC. It was late in the afternoon in Geneva. Her colleague had just received word that the particle accelerator was to be shut down. Everyone was devastated. The experiments were all to be wrapped up. Scientists from all around the world were told to pack up and prepare to go back home. Xe was told that the explanation given was simple. Not enough of the hundreds of nations financially supporting the research had renewed their funding. There was just not enough money left to continue. It seemed that studying the origins of the Universe was no longer a worthwhile venture. The money could be better spent elsewhere. To make more money.

Xe was stunned. Professionally, it was an affront to everything she stood for. Everything she believed in. But more so personally, it meant that her plans for returning to Xeron had been stymied. The door to her universe had been slammed shut.

The next few weeks were very hard on Xe. All of her dreams of humans developing the technology to interact with the virtual exchange of particles were dashed. Telepathically connecting to another universe, dashed. She had always hoped that humans could come up with this ability on their own. The groundwork had all been laid with her work at the LHC. They just needed time. She knew she couldn't just step in and develop the technology herself. Scientists were not quite ready for that zero-to-sixty in one second discovery. Humans were not ready for that kind of in the blink of an eye realization. Not ready that there was someone among them from another universe. Someone who just wanted to go home.

Finally, Xe came to an awareness that said she had no choice. If she was to ever hope of getting back to Xeron she was going to have to do it herself. And that meant going incognito. Going it alone. Xe certainly had the smarts to be able to pull it off. The thing that she lacked though were the tools to get there. After all, the LHC had been 30 years in the making and cost over $6.4 billion. And that was

just the cost to build it, let alone run it year after year. For one year alone the estimated cost was $1 billion. And the project that was just finished cost a total of over $13 billion.

Maybe that was the real problem. No wonder countries could no longer afford to support the organization. All this money was spent on just detecting the existence of minute particles smaller than an atom? Even if these particles could be found to exist, what could we do with this knowledge? Xe realized that she needed to figure out a different approach. Somehow act on what the LHC had discovered so far. Come up with an approach that was not too cost prohibitive. One that could be done on a much smaller level. Could be done by herself.

To do so required Xe to reflect further back in her memory of her days on Xeron. To the times when she successfully made the transformation from Xe the Xerellian to Xe the proto-human. When Xe helped to create fire. When Xe participated in the domestication of plants and animals. What had she done then to facilitate these transformations?

Xerellians had developed the technology to smash particles together without the likes of the huge LHC. Xe didn’t need something that massive. She just needed something that would allow her to capture the moment two charged particles repelled off of each other. The technology

to insert oneself directly into the middle of the disturbance created between the two charged particles. The virtual space if you will. The disturbance that resulted in a new particle's pop into existence and, almost immediately, pop right back out. As if it was never there. The exact process that Xe had hoped the scientists at the LHC could have discovered for themselves. She finally had hope. She knew she could do this.

Personal Particle Accelerator

Chapter Three

Xe wasn't quite sure where to start. She knew she needed to accomplish three things. One, find a secure location to build her laboratory. A place where she could conduct her experiments and perform her transformations. Two, physically construct a device that could capture the disturbance (oscillation) between two charged particles. Three, develop the calculations and formulas necessary to send (insert) her on her way to another time and/or universe. Seemed simple enough.

Where to build the laboratory? Obviously, somewhere as close as possible to Xe so that she could come and go frequently. Also obvious, it had to be a location far from the prying eyes of those who did not need to know what was going on. What Xe was attempting to accomplish had not ever been thought of or posited before. It was really beyond the realm of current day technology or serious human consideration. So it had to be kept a secret. It had to be kept under wraps. The ideal place seemed to be under the house. In the basement.

The interesting part about virtual particles is accepting that you don't really create virtual particles. They don't technically exist. They are for all intents and purposes, not around long enough to have an existence. What you do is create the conditions that allow for their existence. But only for a short enough period of time to be captured before they are turned back into real particles. You generate this period of time by supplying the particle exchange process with a little bit of energy. The particle exchanges this energy, in the form of a virtual particle, and then converts itself back in the form of another real particle.

After searching everywhere, Xe found a computer software application that is normally used to generate 3D applications for film, television, and gaming development. Spending some time modifying the code, Xe successfully adapted it for her own unique purposes. Now she could use this software to emulate the interaction of particles and control their movement. Specifically, how to make particles collide. By carefully setting the various properties of the software, she created a particle emitter, a method to force the collision of these particles, and a process to control what happens after the collision takes place. Such as how much energy a particle retains after the collision. And how long it will maintain its existence before disappearing. The whole idea behind popping into and out of existence. Perfect. Except for one thing. The software only generates a rendering of the process. A computer emulation. Xe needed it to generate the real thing.

Manipulating the software further provided Xe with a way to work directly with another apparatus she planned to assemble in her laboratory. So that instead of a particle simulation, she could control the real thing. So how does one go about creating a device that can create and accelerate particles? First of all you need a very good understanding of one of the four fundamental forces of nature, electromagnetism. The interaction of electric currents and magnetic fields. Xe had that. That's what her education in physics had taught her.

Next, Xe needed to assemble the device. Here's the short version. The device is composed of two round electromagnets. Sandwiched in between are two D-shaped cavities that when placed together also form a circle or round disk. So the whole thing kind of looks like a large hamburger with a bun on the top and a bun underneath. When a radioactive source is placed in the center and the electromagnets are turned on, the radioactive source emits a charged particle.

The D-shaped cavities are hooked up to a radio wave generator which then acts to switch the charges of the cavities back and forth, so that acceleration of the particle can occur. Radio waves are just one example of an electromagnetic force. Others would be x rays, gamma rays, and microwaves. And there you have it. Xe had all that she needed to create a device that would emit charged

particles, force their collision, and keep the virtual particles around long enough to do something with them.

The last part of the equation was going to be the hardest thing to accomplish. Creating the calculations and formulas. But before she did so there was one last step to be figured out related to the device itself. Xe was going to need to insert herself between the computer software and the personal particle accelerator (PPA). This would be the only way to connect the virtual particles occurring in her own brain with the virtual particles being created by the device. The more she thought about this the more her memories from Xeron started to flood back in. She had done a similar thing there. She needed to re-think the whole process of insertion before she could come up with the calculations necessary to place her in the right universe. The right time. Into the brain that was intended.

Although not as sophisticated as the method established on Xeron, Xe was able to figure out a wired connection between her brain and the PPA. Using electroencephalography (EEG), Xe was able to monitor the electrical activity of her brain through the placement of multiple electrodes placed on her scalp. The creation of a charged particle by the PPA was then locked to her own brain waves through the computer software's recognition of an associated event. In other words, when the electrically charged virtual particle had been temporarily paused by the PPA, Xe's brain waves were synchronized with the virtual

particle. All that was left was for Xe to properly calculate in her brain the appropriate destination and time period.

The question became where did she want to go? She knew she wanted to get back to Xeron. But Xeron didn’t exist yet in this place and time on Earth. It wasn’t part of their vocabulary. It wasn’t part of their science. How could she calculate the destination to pop into when no one here on Earth knew where Xeron was?

The Dream

Chapter Four

That which is the past can only be known by that which is the future.

--Xe

Xe found that most of her time was consumed in her work in the laboratory. She had so much to do and what seemed like so little time in which to do it. Xe used to have a social life prior to the breakdown of funding for the LHC. She and her friends would go out to dinner, socialize, and talk about life. At least, life here on Earth. Her friends still called quite a lot asking her over or out for a bite to eat. But Xe fell silent. Her friends began to worry about her and her sudden behavior change. Behavior that seemed increasingly isolationist.

Xe would sit out late at night under the stars and wonder. It was just she and the stars. She felt completely comfortable here. What was it like out there? Just where was it that she came from? Were they just rhetorical questions? One night she stayed out a little too late. Her tiredness caught up with her and she fell asleep. Not

necessarily a bad thing, considering what she had on her plate.

While deep in sleep she dreamed of a place far, far away. Most of the dreams she had on Earth were confined by the boundaries of life experienced on Earth. But this one seemed to be different. She was in a place unlike any place here on Earth. Unlike anything she knew of in this Universe.

Xe was lying on a grassy meadow overlooking a long and wide canyon that reminded her of Arizona's Grand Canyon. But with a few important exceptions. On one side of the canyon was a beautifully green and lush forest that worked its way all the way down to the banks of a small river. A river that ran the full length of the carved out canyon. On the other side of the river was another forest, climbing its way to the very tops of the canyon. What was unusual was that each side of the canyon seemed to represent a completely different season. On one side you were approaching winter. On the other side you were approaching that of summer.

There was something very alluring about this place that made it very familiar to Xe. Something arose out of her past that opened up some very deep seated memories and emotions. When she was very young Xe remembers being brought to a place like this. It was an annual event. Once a year Xe and her family would travel to this canyon to

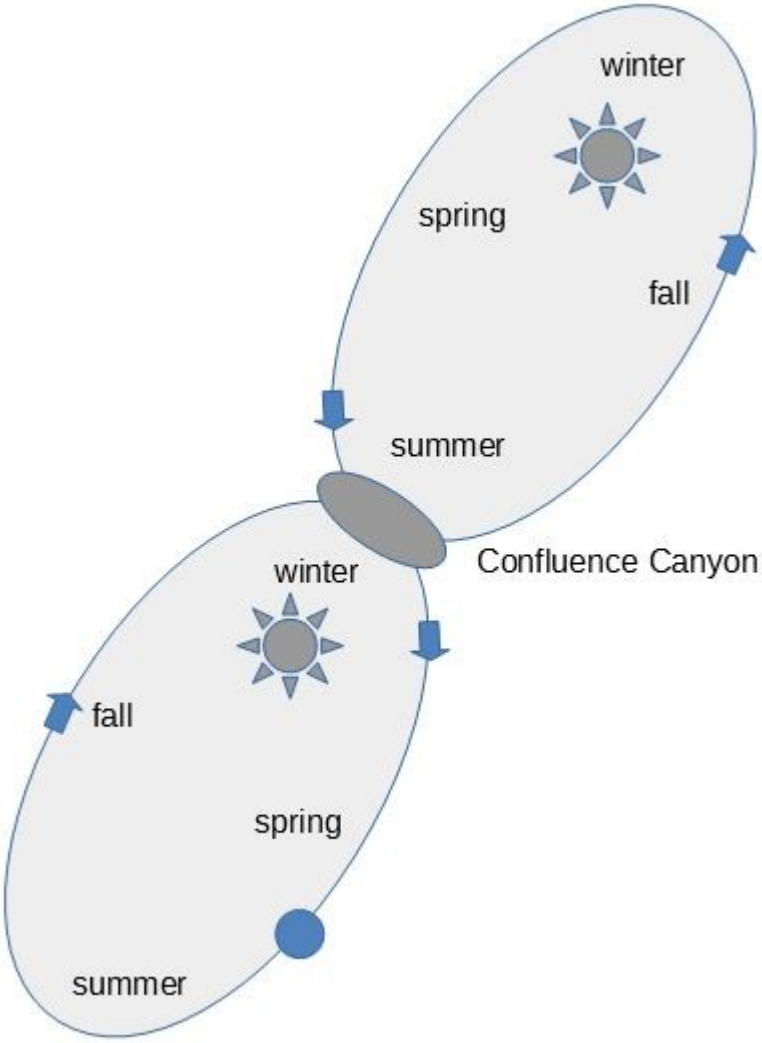
experience what could only be experienced once a year. Xe was starting to remember all of this from when she was on Xeron. It was playing itself out in her dream.

There was only one place like this on Xeron and it all had to do with the planetary motion of Xeron in relationship to its two stars. This site was more of a convergence of seasons caused by Xeron's figure-eight orbit around the two stars. Just as on Earth where the tilt of the planet and the distance from the Sun combine to create what are known as seasons, similar conditions caused seasons to occur on Xeron. But in Xeron's case there were two stars affecting the distance calculation. This was the scientist in Xe talking.

Xeron made an orbital path around each of the stars. Xerellians note the passing of time very similar to how those on Earth measure elapsed time. Consequently, the trip around each star took one year. Each year was comprised of the same four seasons. One complete round trip around both stars took two years. A year to orbit the first star beginning with winter, followed by spring, summer, and fall. Then a second year where Xeron would transition to the second star's orbital path beginning with summer, followed by fall, winter, and spring. All would then culminate with Xeron returning to the first star's orbital path, beginning with winter of the next year.

It made for a bit of seasonal confusion at times. Just when you thought spring had replaced winter, winter would come back again only to be replaced by another spring. The same was true for fall replacing summer, followed by another summer, followed again by fall. Confusing for someone from Earth. Not so much, if you were from Xeron. If you were from Xeron, this was made comprehensible when you understood that all of this was the result of experiencing the two star transition known to exist only within Confluence Canyon.

Xeron's Path Around Stars



Because of the overlapping figure-eight path around the stars, there was one unique occurrence that was never to be experienced on Earth. When Xeron was at its closest to the first star, it was actually at its furthest distance from the second star. Crossing orbital paths from the influence of the first star to the influence of the second star, created the experience of winter and summer at one and the same time. On different sides of the long and wide canyon. The single place on Xeron where a convergence of seasons could occur.

Confluence Canyon

Chapter Five

Confluence Canyon gave everyone on Xeron the opportunity to experience a change in season within a change of season. During this special occurrence of planetary and star alignment came the effects of two different seasons at the same time. Those playing in the cold and snow of winter could temporarily enjoy the warmth of summer. Simply by crossing over to the other side of the canyon.

On one side of the canyon was a lush green forest. It appeared to be in the full throws of summer. The trees were in full bloom and the animals and birds were all working hard to enjoy another season of growth and abundance. The temperature was warm and there was that feeling of needing to be outside enjoying everything around you.

Things were different on the other side of the canyon. Everything here looked and felt cooler, rather cold. The trees and bushes growing closer to the bottom of the canyon had no color and had no leaves. The animals seemed to be frantically gathering food for the months to come. It was if everything was changing to a winter coat.

Which was really no coat at all for the trees, since their leaves were all but gone. But for the animals it was time to grow that extra layer. The layer that would provide that extra bit of warmth and comfort. The further up the sides of the canyon you went the more it started to look like winter. There was even a dusting of snow way up at the very tops of the highest ridges.

As described earlier, Xerellians came to Confluence Canyon primarily as a means to temporarily escape the weather. When you were too hot, you would simply cross over to where it was cooler. When you were too cold, you would cross over to where it was warmer. Crossing the river that divided the two sides of the canyon was easily accomplished. The canyon had many bridges connecting the two sides. Confluence Canyon was quite the tourist attraction at just the right time of the year.

Occasionally, there would be a few of the more adventurous soles that would wonder what would happen if you stayed on the opposite side of the canyon too long. Xe remembers being one of those soles who thought if you stayed on the opposite side of the canyon too long, you would never be able to get back. You would be caught in this sort of limbo between the orbital paths of the two stars. Xe was highly disappointed to find out that nothing so sensational occurred. Staying too long simply made a lot of your friends and family very nervous as to your

whereabouts. It was an interesting idea, but not of much real value.

That was not all that Confluence Canyon had to offer. It was not just a place for resolving adverse weather conditions. It was a place for those such as Xe to come and hone the skills they had only been taught in an academic environment. It was live practice. Xe and the others would come to travel back and forward in time. The canyon was the only place they could do this. The canyon engaged in confluence was the only time that traveling in space-time could occur. When it was either winter or summer.

The journey would begin dependent on which side of the canyon you were on, winter or summer. From there you could challenge yourself to make a leap from being physically there to not being there. To take advantage of the opportunity to visit the times of your past or the awakenings of your future. This was what Xe remembered being trained to do. This is how it all played out.

The confluence was a place of singularity that one could tap into. A one-dimensional point so small that space-time itself curved infinitely and any laws of physics simply did not exist. The Laws of Everything didn't know much about this singularity either, but it did know that its existence signaled the end of something and the beginning of something else. The only thing that Xe could compare

this to was the Big Bang. A single point in space-time where everything suddenly appears.

That does not mean that there is some violent explosion into the depths of space. Space does not exist yet. It is this one-dimensional point that creates space. It just suddenly appears. The same thing happens at the confluence. Suddenly, under the right circumstances, a vessel occurs opening up a pathway that can be traveled. Not so much a physical journey but a virtual journey. Either back in time or sometime into the future. A transformation.

The normal training process consisted of taking one of two options. Advancing forward in time or reversing backward in time. It all depended on where you started. If you were standing in winter and transformed over to summer, you would experience your future self. If you were standing in summer and transformed over to winter, you would experience both your past and future self. In either case, these were only temporary processes. For the express purpose of practicing mental navigation of that field surrounding the mind that is sometimes referred to as consciousness.

Instead of two completely opposite sides of a physical canyon, Xerellians were able to unify the two space-times the confluence opened up and provide safe passage between them. A movement of the self from one space-time

to another. This was where young Xerellians learned to travel between the space-times. What in the future would be jumping between alternate universes. To experience themselves doing different things at the same time in parallel universes.

Each side of the canyon served a specific purpose. But it was within this one-dimensional point that they could experience multiple dimensions first hand. Dimensions way beyond the usual three dimensional world most of them lived in. The learning exercise, the game if you will, was to learn to traverse between and among the different dimensions.

It was well known to Xerellians that there was more to their existence than just physical matter. There was a higher dimension that was more similar to what could be called consciousness. It involved the merging of the science of that which occurs at the smallest of levels with that of the neurology of the brain. That led to the understanding that there was this mental field that existed in another dimension. A consciousness that existed in a field surrounding the brain. Another dimension that, like a singularity, allowed for that dimension to just appear. This was the learning exercise. Learning how to control one’s mental field to establish ladders between the dimensional levels.

Ladders made perfect sense. A ladder was constructed that would take Xe from the space-time where it was summer to Xe's other self in the parallel space-time of winter. Xe was learning how to listen to all the other instances of Xe. This was the easiest to do because these were the things that were going on in Xe's past. Just in different space-times. They were known occurrences. They could be identified as distinct destinations.

The ladder that would take Xe from the space-time where it was winter to Xe's other self that was parallel of summer was a bit trickier. This was projecting into the future. Where you would be a year from now. What your life had been and what it was to be were two totally separate things. But to find out what you knew in the future might reveal information that you simply did not know of now. Information not known now might become knowable.

The goal of the exercise was not simply to travel ahead in time to see what the future would bring. Future ladders could be just as easily built as those built to the past. The real goal was to learn how to build ladders from one future to the next. To instantaneously leap to a different level of existence, one step at a time. Knowing how to build ladders to a future's future would allow Xe to be able to find the answer to all questions of importance. Because sometimes, what we do not know now can be learned by traveling to a different future. A different dimension. A different universe that may have already come up with the

answer. It just involves a set of stepping stones to eventually get there. Knowing how to build ladders was another essential part to growing up Xerellian and understanding the Laws of Everything.

Xe was quite intrigued by the ability to travel forward or backward in time. What intrigued Xe even more was whether there was the ability to travel in space-time to all points at the same time. Time was an arrow that usually only pointed forward. Xe's question was, what would pointing everywhere do? Or better still, pointing in all directions at the same time?

The Laws of Everything had a concept that described how two objects can become entangled. What happens to one effects what happens to the other. Two identical objects, like mirror images. What is most important is that it doesn't matter how far away from each other the two objects are, the effect still occurs. The effect somehow travels from one thing to the other at greater than the speed of light. Thus, traveling while seemingly not traveling at all.

Xe decided to test this out within the confines of Confluence Canyon one day while on a field trip with the rest of the class. This was not just a test of transformation, but a test of entanglement between two space-times. Xe was not quite sure how it was all going to turn out, but was prepared to return as soon as possible if things didn't look

good. Preparing for the journey was a lot easier than actually creating the entanglement. The whole consciousness thing was still a bit new, let alone entanglement.

After struggling for a bit, Xe was standing near a river flowing through a gorge. Flowing through a canyon. A canyon that looked almost identical to Confluence Canyon. It had the same kind of vegetation. The same kinds of trees. The same feeling of being in some kind of season. The exception being that this canyon seemed to be devoid of anyone except Xe. A strange feeling suddenly came over Xe. Xe had always found someone else with which to share the experience. Classmates and tourists included. This time, the two sides of Confluence Canyon that Xe was so familiar with had become quite unfamiliar.

Xe decided to set off in one direction through a patch of berry bushes. Just to see if anything could be found that would ease the discomfort. To avoid becoming lost from the point of insertion, Xe carefully carved small arrows in the rocks found along side the trail. Arrows pointing the way back, if necessary. The farther Xe went, the more disoriented Xe became. Xe's anxiety continued to rise with every footstep taken. Xe didn't make it very far before it became quite clear that this was not the Confluence Canyon of Xeron. There were no others around to be found. There was no sign that anyone had ever been around. Xe was quite alone and frightened.

Xe did not know where this space-time was. Things seemed very odd and soon Xe decided enough was enough. Following the arrows back in the opposite direction, one careful step after another through the berry bushes, brought Xe back to the point where the space-time transformation took place. Pulling the curtain back, so to speak, Xe was was able to reverse the transformation. Brought back to familiar surroundings again. Looking around, Xe spotted the classmates that signaled the return. Breathing a heavy sigh of relief, Xe was back. Realizing that maybe some things are just better left alone. Then again, maybe what it meant was that some things just need to be explored a little more. Xe wanted to keep that channel open.

Ladders

Chapter Six

Just as dreamily as Xe had fallen asleep, she was gently awakened. She was still sitting comfortably under a night sky full of billions of twinkling stars and galaxies. One of which had just provided a clue to Xe's most perplexing question. How to find the coordinates to Xeron. Build some ladders.

Astronomers on Earth had figured out that in order to accurately measure the distance to a celestial object you had to be fairly close to that object. The standard methods of measurement worked great for those objects close enough to Earth, but they started to fail the further away those objects were. Thus, there had to be a method developed that could measure these far away objects that was both accurate and reliable.

What astronomers came up with became known as a distance ladder. The distance ladder was a succession of methods that combined the use of direct measurements good for measuring the distance to closer objects and various other techniques that could be relied upon to measure the distance to much further away objects. A true

succession of measurements that could be likened to the rungs of a ladder. Each rung providing the information helpful in determining the information possible at the next higher rung.

The initial step is to find the distance to the first closest object. Choose the moon, for example. The ancient Greeks estimated the distance to the moon by figuring out the circumference of the Earth. The rest is simple geometry. Working with things such as triangles and angles one can easily determine the distance from Earth to the moon. Once that is done, use that information to get you to the next object. For example, to a distant star. There are stars in our sky that are known as standard candles. Their brightness is known and predictable. In other words, their luminosity can reliably be used to determine their distance. Along the way, adjust the method to fit the distance to that next object according to the astronomical distance ladder being used. Until you reach the furthest away object. By building each step upon each step, you eventually reach your goal.

After spending the night out under the stars and experiencing what appeared to be a virtual visit to her planet of origin, the whole idea of a cosmic ladder made greater sense. If Xe did not currently know the coordinates of Xeron then maybe she could find that information by stepping herself into the future. In order to get there, Xe needed to build a succession of ladders. Each successful step to the next rung, hopefully, leading to an additional

successful step closer to Xeron. Each one providing her the information needed to get to the next level. A future level that may have information about Xeron.

Xe's previous experiments on Xeron had utilized the concept of being able to travel backward in time. Xe had remembered her doing just that in her dream. Transformations from the present to the past were part of Xe's training. But here there was no Confluence Canyon. What Xe needed to grasp was that it was the concept she was looking for, not necessarily the method.

She also remembered her travels to alternate universes so long, long ago. When she had traveled to a time on Earth that was 4.5 million years ago. And 2 million years ago. And 10,000 years ago. All done from the perspective of Xe's building ladders to the significant steps of human evolution. She had already done this. She had designed the tools needed for her to do it again once she found out where the destination was.

The Laws of Everything made it very clear that ladders could also be built to take you to various times and universes in the future. A time in the future when the people of Earth had acquired new knowledge. Hopefully, a knowledge of Xeron. Whether they were conversant or not did not matter. All Xe was looking for was where it was. Once she found that out, then she would be able to

calibrate her tools. Refine her calculations. Know where she was going.

In all of Xe's other transformations the direction of travel was to a far distant place located specifically in the past. But there was a future transformation as well. The return trip, when the link was broken, was always from the past back to Xeron. Back to a future universe. This was the trip that closed the connection and returned Xe to Xeron's present. What Xe was planning now was totally different. Xe had never started out with the destination being at some point and time in the future. This was all new territory. Technically, it should not make any difference. Still, it was of major concern.

The challenge for Xe was figuring out just how far into the future to travel. This was certainly going to involve more than just one trip. This was going to be more like a number of trial and error trips. Ladder rungs to climb. Hopefully not too much error and just a succession of journeys that would result in Xe learning the whereabouts of Xeron.

Getting There

Chapter Seven

Xe figured that in order to determine how far out into the future to travel she would need to assess the current state of human knowledge about the known Universe of 2018. Create a baseline that she could start from. That would mean mapping out more of what current cosmology, astronomy, and particle physics had theorized about the origins and evolution of the Universe. Then she would have to take that information and try to find common denominators between that knowledge and what Xe intimately knew about Xeron.

Xe started by thinking about the most obvious pieces of information that she had about Xeron. Number one, Xeron is a planet. A planet that orbits around two stars. Unusual, but certainly no help in determining its location. There were probably hundreds of thousands of planets that might fit that description in our observable Universe. Next, Xeron was situated in a galaxy that, although known to Xerellians, was definitely not known to anyone here on Earth. The same held true for the universe that Xeron was located in. But, herein Xe found a clue.

Back when she was on Xeron and time traveling to the different periods of human evolution on Earth, she was traveling to another universe. She remembered that quite clearly. It was definitely another universe, if not a parallel universe. That was key. Xeron was located in a different universe from the Universe of Earth.

Finding a common denominator in Earth's understanding of the Universe meant that scientists on Earth must at least have some concept of multiple universes built into their cosmology. Whether they be parallel or otherwise. If the current state of cosmology had no understanding of the multiverse then there would certainly be no way they could have any information about Xeron. So just what did the current understanding of astronomy and physics have to say about a multiverse? That's what Xe needed to better understand.

Being a theoretical physicist, Xe already thought she knew the answer. But Xe couldn't rely on what she thought she knew. She needed to thoroughly understand the current thinking and to do that she knew just where to look. Start with physics and work her way through the theoretical frameworks until she got to a place where multiverses were discussed.

Physics is one of the oldest academic disciplines or sciences. In its most general form it concerns itself with all

things that are nature. Nature can be looked at from both the macroscopic and microscopic level. The study of physics encompasses the behavior of objects in nature at these levels and under given forces. Those forces being gravitational, electromagnetic, and nuclear force fields. Like so many other disciplines there are many sub-disciplines underneath physics that deal specifically with the underlying principles of nature. The goal of physics is to come up with a few comprehensive principles that can explain the observable world. A unified set of laws. The fundamental laws of nature.

Xe knows that there are roughly two different types of physics. These are classical and quantum physics (also known as classical mechanics and quantum mechanics). Classical physics deals with the mechanics of nature at a macroscopic level. Whereas quantum physics deals with these things at a microscopic level. Think of it in terms of the atom. Anything larger than the atom would be classical. Anything smaller than the atom, the sub-atomic level, would be quantum. This is the level that Xe has worked at as a theoretical and particle physicist. Particles being the objects that reside within the atom and the smallest things making up the Universe.

This is important to understand because it is within quantum physics that we start to see the development of theories that are exactly what Xe is looking for. Specifically, in a theoretical framework called string theory. String theory

in its most basic form says that particles really aren't the smallest things in the Universe. That title goes to something called strings, which are the level below particles. Strings are propagated throughout space-time due to their vibration and are of importance to Xe in that they can be used to describe an enormous array of possible universes. In fact, they are dependent on multiple universes. Especially when looked at from what is referred to as M-theory. It is M-theory which unifies all the different flavors of string theory into one elegant paradigm. Eureka! The clue Xe was looking for.

Unfortunately for Xe, the current acceptance of string theory is iffy at best. There are a lot of criticisms of string theory and its inability to create a satisfactory explanation that can unify physics and create what is known as the theory of everything. They cannot be scientifically tested and they can barely be understood. So the only thing that Xe can surmise is that humans are only at the very beginning of their understanding of the multiverse. So much so, that even though it is talked about, it is a laughable matter for most scientific discussions. But at least they are being mentioned at a time when Xe can baseline the discussion in order to make an educated guess as to when they might become real in the future.

The question remains. How far should Xe travel into the future in order to confirm the theories of string theory? How far into the future before string theory can conclusively say that other universes exist? Once other universes are

known to exist, then inevitably there will be ways found to get there. Xeron itself may help in its own discovery.

It seems that if there is anything that is consistent, it is that when you ask a question it simply leads to other questions that need to be answered first. Now, Xe not only needs to find a future state that knows about Xeron, but she needs to find a future state where physicists and cosmologists accept that other universes exist. An acceptance based on verifiable evidence. Finding that out comes first. That may then lead to identifying the location of Xeron later.

Not that very long ago in Earth's history, around 1924, it was discovered that the Milky Way galaxy was not the only galaxy out there. Xe noted that prior to this time humans thought they were alone in the Universe and that this one galaxy was the Universe. Less than 100 years later it became widely known that there are more than 2 trillion galaxies in the observable Universe. It seemed to Xe that 100 years was a fair amount of time for humans to discover that theirs was not the only galaxy. It gave Xe a number with which to work.

Now that Xe had a number to work with regarding the observable Universe, it was time to look at the science behind what humans observed about their Universe. The two most important theories in physics underlying this

observation were classical mechanics and quantum mechanics. The understanding of physics from a macro and micro perspective, respectively. Xe wanted to find out just how much time had elapsed between the two. Because it is within quantum physics and string theory that there appears this very first flirtation with other universes.

Researching the current literature, Xe discovered that classical mechanics actually began around 1900 and quantum mechanics came along around 1942. But when did string theory and M-theory come about? These are the two theories born out of quantum physics that zeroed in on the multiverse even further. Again, researching the various topics, Xe concluded that string theory started around 1970 and M-theory began about 1995.

So again, it seemed that huge leaps in human thought and observation about their Universe took place within about a 100 year period. If about every 100 years there was a significant advance in understanding the Universe, Xe thought that a measurement of 100 years into the future might be ample time for humans to significantly advance their knowledge about multiverses as well. In other words, given another 100 years and based upon the glimmer of the multiverse that existed today, humans at this point in the future might have refined their theories enough to actually predict the existence of other parallel universes.

But first things first. Xe needed to test her devices. Her calculations. She had no idea whether or not what she had constructed would even work. It all looked good on paper. The scientist in her told her to experiment first. Confirm that what she was attempting to do would produce the intended results. Be able to predict the outcome with 100 per cent reliability.

She thought it better to try a test run. But a test run to where? And for how long? She knew the length was not something she could easily set. When one returned was based on the connection closing, which meant the termination of whomever or whatever it was she transformed into. She tried to think of possible short-term situations that could accommodate her.

The more Xe thought about this, the more she thought about her close friend Eve. Eve was a young musician and vocalist in her early thirties. Xe had met her a few years earlier when she played in a small jazz club nearby. Xe was totally mesmerized by her voice and went back stage after the concert to begin a friendship that became more than just a friendship. It became the most important thing in Xe’s life besides her quest to return to Xeron. Xe never told Eve about Xeron. She had intended to do so but the contemplation of doing such a thing changed when it was learned that Eve was dying. Then, that didn’t really matter anymore.

A few years earlier in Eve's life she had a malignant mole removed from her back. She didn't think too much about it, especially since it was removed. She continued with her career until now, when she noticed a persistent pain in her hips. Xe had accompanied her to the hospital for x-rays which revealed the melanoma had spread to her lungs and bones. She was given a terminal diagnosis of only a few months.

Now, as Xe thought about the journey she was trying to embark on, she thought there was nothing else she would rather do than be as close to Eve as possible during her remaining days. Setting her calculations ahead just a month or two would allow Xe to transform into Eve during the last moments of her life. That would also allow for Xe to project herself into the future. Even for only a short period of time. To be returned upon Eve's life ending.

Xe headed down into the basement to begin her journey. Through the door to her laboratory. A door she carefully closed behind her as she just as carefully prepared to open the door to the future. With a few precise calculations programmed into the equipment, she crossed her fingers and set herself up for transformation.

Eve

Chapter Eight

Xe awoke to a flurry of activity going on around her in preparation for a private concert that was to be given later that night. The concert had been hurriedly planned just a week earlier. Even though the doctors had begun to aggressively treat Xe, the cancer was winning. For all intents and purposes the informal concert was meant to sing the praises of Xe and honor her legacy. But everyone knew deep inside that the real purpose was to allow the voice of Xe to express itself one last time.

As she lay in her bed inside the small trailer that served as her temporary home, she reflected on her life up to now. Ever since she was a young child she learned to see and hear things the way her mother and father did. They had a unique ability to listen to these kinds of things. Her mother had a deep appreciation of nature and horticulture. Her father was a dedicated teacher, talented musician, and accomplished artist. Together, they instilled in Xe a natural ability to find life in all of nature. They gave her a voice that spoke of that life through her art and music.

She began to learn guitar at a very early age. Over the years she accompanied the guitar with her voice. A voice that her friends, family, and neighbors recognized as truly one of a kind. She was able to make it sound as if it was the only thing that mattered. She was a masterful interpreter of the instrument that was her voice.

Xe was a very shy person. Playing in front of an audience was uncomfortable at first. The more she played the more accepting of her abilities she became. It was alright to make small mistakes while fingering the chords on her guitar. A slight change in the rhythm opened up a whole new range of interpretation. The modulation of her voice unexpectedly changed the meaning sometimes. But a lot of times what she thought was a defect wasn't heard as a defect at all. A room full of strangers fast became a room full of friends and lifelong supporters.

Tonight's performance was to be her grand finale. In more ways than one. A benefit concert in honor of Xe was to be held in front of a small, special group of people. Seated in the audience were her family, friends, and very special fans. On stage for the initial sets were those musicians fortunate enough to have played along side Xe. It would be a misnomer to say that they were the warm-up bands. The last set of the night was for Xe. A set that consisted of only a single song. One of her signature songs.

As Xe pulled herself up and out of the small bed inside of her equally small trailer, she felt the deep pain in her bones threatening to call her back. As she stood up she held onto the counter to get her balance. To give her some strength to make it to the door. As she opened the door, her newly found companion “the scientist” as she called her, was there waiting for her. After a long embrace and a few tears shed, they both slowly made their way to the stage. Directly in front of them were a few short steps. Steps that seemed more like an endless flight of stairs. Arm in arm, they slowly made their ascent to the stage. Turning to the stagehand to her right, she was handed her guitar for the very last time.

Taking a deep breath and managing one final look back at her friend, Xe headed out to the front of the stage. Struggling to make it to the chair that fit her body and guitar like a glove. That shyness that she had struggled with early in her career returned. But only for a moment. And then the moment was gone. Instead, her song “Over the Rainbow” became the moment.

She gently moved the microphone a little closer. The fingers of her left hand formed a familiar chord on the neck of the guitar. The fingers of her right hand began to pluck the accustomed strings. She began to play. She began to sing. The audience melted away to a place somewhere way up high. Where the clouds were far, far behind them.

That’s where they found her. Beyond the rainbow.

Where To Next?

Chapter Nine

Huddled next to her desk in the basement, Xe is acutely aware that something has changed. There is that same eerie feeling of the door to her lab being opened that she experienced months earlier. Once again she cautiously looks over her shoulder to see that, in fact, the door is open but there is no one around. The only person in the room is herself. The only things in her lab are the equipment she just used to project herself into the future a couple of months. To witness the last inflation of her good friend and companion, Eve.

The more that Xe reflects on this strange occurrence, the more she realizes that it was she who opened the door. For whatever reason, Xe's awareness of her having returned to the laboratory had been prefaced by opening the closed door. In effect, opening the door back into her Universe.

Opening the connection to the Universe of Eve had resulted in the closing of the door to her current Universe. What Xe thought was a closing of the door to protect her experiments from the prying eyes of others, turned out to be

a requisite step in the process. Now that the portal to the future had been ended, the door back to Xe's laboratory needed to be re-opened.

Of course no one was there. The emptiness was only an indication that Xe had been there. Just scant moments earlier. Out of the emptiness stepped Xe. Out of nothing came something. Back to the present.

The deep depression that Xe felt for having witnessed the loss of her dearest friend, soon was replaced by the realization that everything had worked as planned. Her technical apparatus had performed flawlessly. Her calculations were spot on. Xe had successfully transformed herself into a future time and place. To another being. And, equally as important, she was able to return safely. Interestingly enough, with the knowledge that Eve was still alive.

So, where to next? It seemed that 100 years into the future was the next step. But maybe that was biting off a little too much. Xe felt she needed to do more research. A lot more research. Over a period of a couple of years she decided it better to take smaller steps. Baby steps if you will. Get a gauge on just how much science was progressing. Specifically, how much string theory was progressing in the pursuit of the multiverse. Understanding

what a multiverse was and how you could get to such an alternate universe.

The hard part was not knowing what lay ahead. Looking back was so much easier because from the present, you already knew what had happened. You could easily discern the significant stages in the slow process of human evolution. Looking forward was anyone's guess. Trying to predict the next significant stages of human evolution would not be easy. But once you got to the future you could then look back and, hopefully, extract the straw from the chaff. It would allow Xe to make judgments about how things had evolved.

Xe's earlier transformations had been prefaced with specific time periods and significant steps in the evolution of humans. There was no single Eve to transform into at some point in the distant future. The only things that Xe had going for her were the factors of time and the space within which to move. Moving forward in time within this Universe. The thing that was missing was knowing which event to transform into. Space and time were known quantities. Events and the event's host, were not.

So Xe thought she would head off into the future 50 years. Split the difference of 100 years. See where she landed. She would look for anything that stood out as a significant step in human evolution. For surely, something

like confirming the existence of another universe would be considered a significant step. With that in mind she executed her plan.

Life As We Know It

Chapter Ten

In the years prior to 2100 there was quite a push to create robotic machines that could replace humans in dangerous environments, manufacturing processes, and other tasks felt more easily done by a machine. Or, those that humans simply did not want to do. Most of these robots were constructed simply as machines that could carry out a series of complex instructions and automate the process. Others took on more of a human form. Forms that humans could more easily identify with. They resembled humans in appearance, behavior, and cognition. More importantly, these humanoid robots seemed to convey a sense of intelligence. To hold thoughts of their own. To be sentient.

Mark is a neuroscientist and artificial intelligence (AI) engineer working on developing the likes of virtual humans. Animats or avatars that are basically artificial animals. They can be physical robots as in androids, computer simulations, or a combination of the two. But the key factor is that they are alive. They are animate. They have been given life.

In his early years Mark created simulations of the human brain. This involved creating as best he could, the complex and difficult circuitry of the brain so that real cognitive abilities and human behavior could result. One example was that of a little boy. For all intents and purposes this was a live video of a little boy. Complete with all the body and facial expressions characteristic of a young and innocent child. Although just a simulation of a little boy, the boy could learn through experience, feel complex emotions, and express himself through real face-to-face interaction.

The technology at the time was in its infancy. The realism was at its finest. In reality, as sophisticated as it was, it was just a computer simulation. It was great for computer games. It made wonderful cinematography. But in the larger sense, no one really thought of it as alive.

Fast forward to about 2070 and Mark is part of a worldwide effort to redefine life as we know it. Up to this point, everything that was ever taught about our Universe depended on carbon. Everywhere we looked in our Universe for other forms of life, we looked for traces of carbon. Carbon-based is how humans define life itself. Everything that Mark was doing was to change that definition of life.

Mark starts his morning routine as he has done for the last 20 years by first getting out of bed, taking a shower, shaving, and eating a light breakfast. It has become somewhat of a monotonous routine that he performs habitually every day knowing that when it is done he can begin what he really loves doing. Working with androids.

In reality what people like Mark were experimenting with was the development of a new type of life form. One that was not carbon-based, the key component of all known life on Earth. Mark's creations sparked the beginning of an evolutionary path as significant as that taken by our earliest bipedal ancestors over 4.5 million years ago. One could say a significant step in human evolution.

Mark participated in a program that involved a group of young budding scientists interested in what this new form of life was all about. Today, he had brought them all together to discuss its particulars. Actually, it was a fairly young group of people that had come to see someone other than Mark. But that was of no matter.

Mark began his lecture careful to lay the groundwork of that which is new by describing that which is old. Life is extremely complex. At its most basic level, it has to be. Just think about everything that goes into the survival of an organism. The survival of a human being. That organism must be able to regulate its internal state. It must be able to

move, create energy, and release waste. It must be able to replicate itself through the creation of offspring. Finally, it needs to be able to do all this in the most flexible way possible.

What is that flexible way? The answer lies in creating a form that has some central building block or foundation that is strong enough to support itself. But, not so strong that it is incapable of adapting to changing conditions and replicating itself. Carbon, an abundant element on planet Earth, fits that bill.

But it's not just on Earth that we see the significance of carbon. The process began in the early stages of our Universe. Approximately 300 million years after the Big Bang. This is around when the first stars and galaxies were found. Stars comprised mainly of hydrogen, helium, and a little bit of lithium. These are considered to be the lighter elements. Through the process of nuclear fusion that takes place within stars, the heavier elements are created. Such as nitrogen, oxygen, iron, and carbon. It's these heavier elements that peal off of a dying star and seed the Universe with life. Including humans and all life on Earth.

Mark starts to feel the nervous energy level rising in the room. They are not surprised to hear what has been described thus far. They may be young but they are very well versed in the sciences. Even so, he continues to

describe the virtues of carbon and why it is that life on Earth is carbon-based.

Carbon is a key component of the important biological molecules such as lipids, proteins, carbohydrates, and nucleic acids. Of all the elements found on Earth, carbon is the best at chemical bonding. Bonding with other elements. Bonding with itself. And, in doing so, creating long carbon chains and rings. No other element is capable of doing this as well and efficiently as carbon. Carbon molecules are very stable, do not fall apart, and easily make new molecules. All of the things that life needs. As such, carbon-based molecules are the best suited to creating and maintaining life on Earth.

As Mark looks around at his audience he sees the expected nods of agreement. The acceptance of his description of why things are the way they are. But he also notices that some in the audience are distracted. Distracted by the large closet like box immediately to Mark's left. Back in the corner. The one with a curtain that seems to offer something curious hidden behind. The curiosity seems to be growing in the room. There is a curiosity growing in the box as well.

Inside the box there is a flicker of consciousness. A downward tilted head moves slightly upward. There is a slight movement of the eyes, blinking, opening to welcome

the opportunity to join the conversation. All eyes in the room are now transfixed on the box as the curtain is pulled back from the inside and out steps Xe.

Hello World

Chapter Eleven

All the young people in the room are mesmerized by the sight taking hold before them. That's what they are really here for. Waiting for the opportunity to meet their counterpart. Their eyes are carefully giving Xe the once-over, looking for that flaw or blemish that would let them know that Xe was not real. Unbeknownst to them, Xe too is carefully surveying the room. Analyzing the scene, listening to the sounds, picking up on the vibrations. The mood is somewhat electric but the sound is one of silence. Except for the slight whirring of small electric motors as Xe moved.

Xe is the first to speak as the long moment of silence has become unbearable. Xe reassures the young people that she is not a real human being. Although she may look like one. Think like one. She, like a human, is curious about what it means to be alive. She is, in fact, an android. Created to be human like. To be life like. To have the distinctively human traits of empathy, compassion, and creativity. But Xe is not carbon-based. She is not a life form that is native to this world or the Universe of which it is a part. She is a creation of humans and not a natural byproduct of biological evolution and natural selection.

Xe goes on to explain that it is her job to describe the life form she represents, just as it was Mark's job to describe the carbon-based life form that he represents. But in Xe's case, she is silicon-based. The atmosphere becomes a bit charged as she says this. After all, a different type of life form is a little unsettling. In an attempt to calm the anxiety of the moment, Xe casually walks over to Mark. They exchange an emotional hug. An exchange that proclaims the strongest bonds of trust, admiration, and respect that exists between the two.

Xe reiterates to the group that Mark was correct in his assessment that carbon just makes sense. It is abundant in the Universe. It is both strong and flexible. It forms a four bond structure that allows for a wide variety of complex chemical chains and branches. But she confidently assures everyone that carbon is only one of a few elements that can do so.

There are others. Others that can perform most of the same functions and values of carbon. Directly below carbon on the periodic table of elements is silicon. Like carbon, it is found in abundance on Earth. And just like carbon, silicon forms four bonds. An alternative chemical basis for life, silicon can be commonly found in computers, sand, and lubricants. Not what you would typically call life, but similar.

Xe points out that it was common in the past for science fiction writers to include silicon-based life forms in their stories. These life forms tended to be represented by such things as rocks and lava dwelling creatures that excreted sand or silica bricks. But that was just the fodder of science fiction at the time. These days, silicon-based life forms are represented by androids that rely on computer chips for their existence. Certainly not rocks or sand, these life forms look and act like humans. Something not so easily dismissed.

Sensing that the people in attendance are having difficulty reconciling the concepts, Xe points out that when you try to compare carbon's ability to support life and that of silicon, it's not a fair comparison. It's like trying to compare the skin of humans with the surface of a rock. One is soft, tactile, and warm to the touch. The other is hard, intangible, and cold. But what they share is that they are both containers. Made to contain that which is inside. It's what is inside that is important. She reminds them to think of the two in terms of what they do and not in terms of what they look or feel like.

What are the downsides to silicon? Silicon can form chains and branches, just like carbon, but they are not very stable. Silicon cannot easily form and break chemical bonds with other elements such as oxygen. And when expelled, the waste product of silicon is a silica. A solid not so easily

broken down. Not so with carbon, where the waste product, carbon dioxide, is a gas that is simply oxidized away.

Xe goes on to explain why it is she believes the comparison is not fair. Because of the context in which it is made. If all life on Earth is carbon based, then that becomes your bias. Things that initially look and act differently, naturally skew one's viewpoint. Until it seems, the differences can be shown to be non-threatening. That is what Xe is attempting to do.

There are a number of theories as to how life on Earth developed. Some say that life existed elsewhere and deposited itself here on Earth via comets or asteroids. Others support the theory that life developed uniquely right here on Earth in the form of ribonucleic acid (RNA). But whether you consider RNA or an asteroid, it was all a matter of chance. And then over billions of years life followed a pattern influenced by evolution and natural selection. What if chance had selected for silicon instead?

So in the context of androids, or any other life form for that matter, do these differences really matter? Life is a process not a substance. And that process must include certain things such as survival, regulation of an internal state, movement, creation of energy, release of waste, and finally, replication. Androids may not execute the process

the same way that carbon-based life does. But it does execute the process.

Xe goes on. Is there something about silicon-based life that really differentiates itself from carbon? In other words, where does silicon outshine carbon? One important thing is that a silicon-based life form is even more stable than carbon at high temperatures. High temperatures that may be found in the environments of other planets in our Universe. Not to mention in some other universe. If humans are ever going to be able to travel to distant planets, most of which may be very inhospitable, then the advantage of a silicon-based life form becomes significant. Then the importance of androids becomes more apparent.

At this point Xe turns around and rejoins Mark at the center of the stage. Together they begin a discussion extolling the cooperation that is already occurring between humans and androids in pursuit of the colonization of other Earth-like planets. They both stress the synergistic and mutually dependent relationship that exists between humans and androids.

Once again, they bring up space travel as an example of this cooperation. Traveling extremely long distances to planets unknown would not be wise for humans the first time out the gate. Humans are very fragile and the environment of space does not react well with the human

body. Humans require huge amounts of food, water, and oxygen. Not to mention the exorbitant costs involved in such missions.

Androids on the other hand do not have to worry about food, water, and oxygen. They don't have to worry about growing old on the journey. They do not have to be put into hibernation for extremely long periods of time in order to avoid the inevitable ill effects experienced by humans. They are immune from human diseases and can travel to extremely toxic environments.

Which brings out another important, moralistic difference. Androids are expendable. Like it or not, they are not human and, at least at this point in time, can be sacrificed in the name of science. Human life is considered to be too sacred in this sense. Whether because of religion or just basic moral decency, humans are not dispensable. They are not replaceable. Thus, should not be sacrificed. The life of an android, not so much. Androids are easy to make, easy to replace, and are considered to be simply expendable. Again, at this point in time.

So Xe and Mark turn to each other, turn to their audience, and explain what all of this means. It is not a choice of human or android. It is an acceptance of human and android. It is imperative that both be employed in the pursuit of outer space. It will only be with the assistance of

androids that humans explore the outer reaches of space. The future of our species is dependent on the cooperation that this union brings.

As Mark surveys the audience of young scientists, he boldly announces that some of them, those who succeed with their studies, will be assigned their own personal android that will accompany them throughout their life. Theirs will be the first generation to live side by side with a companion android. As partners. But it’s the next generation that will actually benefit from the bonds created by this partnership.

As the students continue to follow his every move, Mark reflects on the fact that quantum physicists and cosmologists are pretty much in general agreement now that other universes do exist. That has been the extrapolation from the work done by string theorists. Quantum mechanics has become the holy grail of physics and, as such, is the mechanism behind the currently accepted theory of everything. Starting at the smallest of scales, quantum mechanics is capable of predicting our world to the largest of scales possible.

Xe is quick to point out that, of course, quantum mechanics is highly probabilistic. Things that happen at the very smallest of scales, things such as sub-atomic particles, are very strange indeed. At very large scales things can be

described as being in very specific locations. At the level of quantum mechanics, you can only guess in probabilities that same idea of location. An object may be both here and there at the same time.

At this point the students are confused. Wondering how something based so much on probability could be used to say that other universes really exist? The answer, according to Xe, is that it can be reliably predicted by mathematics. Mathematics is the language of physics. It is what is used to describe how the world works. If executing the math comes out with the same answer nearly every time, then there is a high probability that the math is correct. And what the math shows is that other universes exist.

Mark then drops the bombshell. He pointedly states that the goal of this whole exercise is to create a population set of humans and androids that will leave planet Earth and explore the vastness of our observable Universe. Maybe even establish a colony of residents in some yet to be discovered other universe. It is only by going out and exploring our Universe that we will be able to ultimately confirm the mathematical probabilities.

Xe is nodding her head in agreement as a deafening hush falls over the group. This last sentence has struck a nerve. This was totally unexpected. They were just a young group of wannabe scientists attending what seemed like a

short lived training camp. Not the progenitors of a brave new world. A world where two different life forms would be brought together to continue as one.

One of the students abruptly stands up and blurts out, “Why us”?

Xe responds, “Why not”? Beginning as infants, you have learned to interact with the world around you. Your deepest intuitions have been formed based on your observations about the nature of reality. That reality is now changing and this is your opportunity to participate in that change. In this context we will all be infants, interacting together with the new worlds we find before us.

Bidding Farewell

Chapter Twelve

Today was somewhat of a milestone for Mark and Xe. They have been working together for 15 years now. But it has only been within the last few years that the reason for them working together has become more clear.

It seems that back around 2017 humans started to notice the environmental effects of their careless treatment of nature. It was referred to as global warming or, simply, climate change. The Earth had been through many climate changes throughout its history, usually attributed to very small variations in the Earth's orbit. Which, as a result, affected the amount of solar energy the planet received. Causing cycles of glacial advance and retreat.

The climate change that Earth was currently experiencing was thought to be something different. The current warming trend was unprecedented, accelerated by the actions of humans dumping huge amounts of carbon dioxide and other gases into the environment. The nature of these gases was to trap heat, creating a greenhouse effect that caused nature to react by warming the Earth.

Even though the scientific community at the time had the evidence to back up their claims, they were pretty much ignored due to global politics and big business greed. The same kind of greed that has seen humans use the Earth as their dumping ground since the early days of the industrial revolution. A greed that favored money over humanity.

Now in 2070, additional evidence has come to light illustrating the consequences of those earlier decisions. Once again, this evidence is scientific and mathematical in nature. The naysayers, once again, advise that the information be ignored. But it is something that can no longer be ignored.

Mark and Xe spend a portion of each day meeting with other scientists to discuss something not so simplistic as the future of the planet. Particularly the future of humans on Earth. Mark and Xe represent the world of AI and the other scientists are astrophysicists and geophysicists. They don't really have a formal place to meet. Usually it just depends on a spur-of-the-moment decision to all flock somewhere. It all appears as a relatively innocent social gathering of friends out to shoot the breeze. But it is far from that. The topics being discussed and the solutions being thrown out are of the highest importance to the future of the human race. And Xe, the only android present, happens to play a significant role in that future.

Eventually, the primary topic of today's gathering led to a discussion involving carbon. Particularly how carbon, as Mark and Xe have frequently discussed with their apprentices, is the most essential ingredient for life on Earth. The points of the discussion reflected two key observations. One, the role carbon plays in the formation of Earth. Two, the fragile balance that carbon has played in the occurrence of mass extinctions on Earth.

The geophysicists are keen to point out that during the earliest times of our solar system, around 4.6 billion years ago, carbon rich materials were in abundance. But the effects of that carbon depended on whether it was located in the outer part or the inner part of the solar system. In the outer solar system elements like water, ammonia, and methane condensed into ice. These frozen bodies of ice were then expelled towards the Sun, populating the inner solar system with carbon-rich materials that, eventually, became the innermost planets. As these planets grew, they were bombarded with other material that arrived from space in the form of asteroids and comets.

The interesting thing about all this is that the carbon carried on asteroids and comets is far greater than what is found and what would be expected on Earth. Although carbon is abundant enough for life on Earth, it is not as abundant as one would have presumed, given the amount of carbon being carried on asteroids and comets. So, just where did all this extra carbon go?

The geophysicists explain that this is the result of intense heating that took place in the early stages of the solar system. Extreme heat caused a depletion of carbon on Earth, which, as chance would have it, created just the right conditions for carbon-based life to develop and thrive. In other words, the carbon that was left was in just the right amount. Too little, then life is not created. Too much, and you end up oxidizing the carbon into carbon dioxide. Life cannot be sustained. Venus is a prime example of such a gaseous planet.

The key point to take away from all this is that the amount of carbon to sustain life on Earth is a balancing act. A balancing act that if forced out of balance can lead, and has led, to mass extinctions. The geophysicists have observed that over the last 450 million years the Earth has experienced five mass extinctions. Extinctions due to carbon's cycle in the atmosphere and oceans becoming abnormal due to the rise in carbon dioxide levels. Since carbon is easily collected in the oceans, this has especially affected marine life.

The question put to all those present is whether or not the continued acceleration of carbon dioxide levels that are currently being seen is going to lead to another mass extinction? Over extremely long periods of geologic time these mass extinction events occur when the environment

can no longer keep up with the rate of carbon changes. Over shorter periods of time, the critical factor is the amount of carbon that is being created in the oceans. Given the huge amounts of carbon that are being created in the oceans over such a short period of geologic time due to human influence, the geophysicists are sounding the alarm that another sixth mass extinction is imminent. Perhaps as early as the year 2200.

Sounding the alarm is the reason why Mark and Xe have been invited to attend these informal, but extremely important discussions. It seems that Mark and Xe, particularly Xe, are crucial to answering the question of what shall happen to humans if this scenario comes true.

Working with the other scientists, Mark and Xe have been chosen to be part of a future for humans that involves a migration off of planet Earth. This migration is meant to be a seed group designed to continue humanity's existence well past the expected mass extinction predicted to begin somewhere around the year 2200. Just where this migration will be to, is still up for discussion. But one thing is certain. Wherever that place may be, the seed will be comprised of both human and android life forms.

Thus, the reason for Mark and Xe working so intently with the pool of young scientists. Their job was to prepare the students for the future that awaited them. Their mission

was to educate the students about the need for humans and androids to work together. Where they were going would require the combined effort of both carbon and silicon based life forms. Even if they did not know where they were going yet. Together, Mark and Xe, introduced the students to their android counterparts. The first generation of a new partnership forced together out of necessity.

These were the more academic aspects of the project. Explaining to the students the reasons behind the effort. The hard part was instilling the confidence in each of the young students that the mission could be accomplished. Creating the trust between student and android. A trust that you could stake your life on. A respect for each other that could cross generations.

That’s where Mark and Xe spent most of their time. Creating the social means necessary to carry out the planned migration of human and android species off of planet Earth. To cultivate in the young scientists and the generation that followed, an appreciation for the evolutionary leap that they were about to take.

On this particular day, Xe is all alone in the classroom with the young people. Mark has fallen ill and has decided it best to stay home and take care of himself. Xe is actually quite excited about today’s conversation because it involves one of her favorite subjects. That of quantum physics and,

particularly, that dealing with the likes of the multiverse. Xe loves talking about the possibility that there may be other universes to explore. This is her opportunity to excel.

As Xe begins her discussion, there is a knock on the door. A lone figure quietly opens the door and motions for Xe to step outside. Xe, a little irritated to be interrupted, obliges and follows the messenger out into the hallway. The young people are also not very happy to have their studies disrupted. They were just starting to become engaged. After a few minutes Xe steps back into the room and proceeds reluctantly to the front of the classroom. She motions for the students to quiet down and then begins.

It seems that her partner and life-long companion Mark has passed away. He was able to send out a short distress call but by the time the medical personnel had arrived Mark was gone. The sudden cardiac arrest that he experienced was just too massive. There was nothing that could be done. That’s all she could say.

The students were quite taken aback. Mark was a father figure to them. Xe was like their mother. But their self reflection soon turned to an immediate concern for Xe. She appeared to be very visibly shaken. Faltering a bit, she made her way cautiously to the table in the corner of the room. Using the table as a crutch, she settled herself into

the security of the overstuffed chair. The slight whirring sound of her motors ceased.

All eyes in the room were watching her now. Xe slowly closed her eyes, her body slumped a bit, and her head dropped to a final resting place against her chest. All was quiet.

What Was Learned

Chapter Thirteen

Xe thinks she hears a slight knocking at the door of her lab. Probably more of an intuition. As she turns around, this time she is comforted by the sight of the door being slightly open. The comfort of knowing that she is back. Meaning that she has succeeded.

Just what she has succeeded at is still a question. This has been a particularly exhausting experience for Xe. Her first transformation as Eve was quite short. Just a test run. This time she had been gone for quite awhile and it was going to take some time to readjust. The first thing she wanted to do was head straight upstairs, hop into bed, and fall fast asleep.

The next morning (or was it afternoon?) Xe awoke to the sudden realization that she was back in California. In her own house and in her own bed. Struggling to get herself out of bed, she groggily made her way to the kitchen. She knew she wanted coffee but before she could make the brew she needed, her taste buds said she needed something a little sweet to start her day. Grabbing a day old sweet role from the counter, she nibbled off the edges as

she prepared a hot cup of coffee. Settling down in her most comfortable chair she began to process.

Over the next few days, Xe essentially spent her time resurrecting her journey. Going over and over the details. Hoping to find the answer to her ultimate question regarding the whereabouts of Xeron. What seemed to be most notable about her journey were the steps being taken by humanity to prolong itself. That self preservation instinct to survive. Unfortunately, not all of humankind would be able to benefit from that effort. Only a small portion of those living on Earth would be afforded the opportunity to start life anew on a brand new world. It would simply be impossible to mass transport all of humanity elsewhere.

Xe had traveled 50 years into the future. She wondered if she was to travel an additional 1 million years beyond that, how would that time period be described? In other words, would there be a moment such as that experienced when humans visualized standing on two feet? Or, the first time that the control of fire was seen as a way to cook meat, stay warm, and socialize longer? As Xe reflected on this, two things stood out. Neither one of which could ever be considered trivial. Both defining a significant moment in human evolution in their own way.

The first thing was that there was going to be a movement of humans from one place to another for the

intent purpose of settling permanently in a new location. That's really nothing new. Humans have been doing that ever since Ardipithecus gave up an arboreal existence for that of a terrestrial one over 4 million years ago. But this was different. This was giving up a life on Earth for that of a life on another planet. And although the exodus had not actually taken place yet, the planning for such a momentous event surely was.

The second thing was the transition of one kind of life form to that of another. Although the pretense was that there was this partnership formed between humans and androids to enhance space exploration, it was clear that in the long run there would be a transition to a silicon-based life form. Perhaps humans transitioning to android. Or, humans being supplanted by androids. Who knows? Considering where humans were going and their choices of where to establish new residency, it only made sense.

There was actually a third thing about the journey that was beyond notable. It was downright memorable. It was monumental, at least for Xe. It was the recognition that there was a high probability that other universes existed. This was the sign that Xe was hoping to find. So at least 50 years into the future there was a team of humans and androids with plans to explore their Universe. Presumably under the guise of saving humanity. But also knowing that there was a chance it would lead them to another universe. Xe knew that this was just a beginning. But it was the

needle in the haystack she was looking for. Now she just needed to figure out how she was going to thread that needle.

Xe began to question what her next step should be. Was she ready to make that leap 100 years into the future to see what Earth's explorers had found? She had only traveled 50 years into the future this time. Add another 50 years and she would probably stand a much better chance of finding what she was looking for.

The question was, just how accurately could she program her device to re-join the mission to explore the outer regions? The additional 50 years should have easily presented the next generation of young scientists with enough time to begin acting on the planned migration. She went back to her books to see if she could come up with an answer. She had to think of something different.

There is a proposed theory in quantum physics that purports to link what occurs at the quantum level with the human mind. That things such as intention and thoughts can influence matter at the subatomic level. If that is true, Xe thought that she could use this to influence where she ended up. When she inserted herself directly into the middle of the disturbance between two charged particles. Perhaps by learning how to access that link, she could direct her transformation more accurately.

Xe was still very much in the loop when it came to physics, especially in academia. She was not particularly familiar with this mind and matter link. But the more she looked, it seemed that this really was a question of mind over matter. Whether you want to call it willpower or what some would call consciousness, Xe saw it as a situation in which she would be able to control the physical exchange of information between particles by simply using her mind. Thus, open the door directly to where she wanted to end up. Back on the mission to intentionally leave planet Earth.

Over the next few weeks, Xe tried to master the art of mind over matter. At least as well as she could. A few weeks was really nothing, but it's all the time she had to become more mindful. What she found out is that she had to spend more time simply doing nothing. That's right. Nothing. This is what being mindful is all about. Exercising the way you pay attention to something. It's practicing how to achieve focus and quiet down all your other thoughts. By doing so, Xe was able to create new neural pathways in her brain. Pathways that would allow her to reach that specific point 100 years in the future. Finally, Xe was ready to give it a shot. Propel herself into the future, hoping that she would land almost where she left off 50 years prior. Except, 50 years more beyond. Once again, she headed down into the basement. Once again, she threaded the needle.

Preparing For Goldilocks

Chapter Fourteen

Xe sleepily rolls over in his bed and opens his eyes to a room full of boxes. Taking a moment to collect himself, he remembers that today is moving day. But this isn't just any old moving day. Across the street. Across town. After months of preparation and training, today is the day that will begin his journey across the known Universe. A journey that could one day leapfrog Xe to another universe beyond his own.

Xe's close companion and partner Whitney doesn't seem to have the same issues waking up. She has already been at it for awhile preparing for the move to the space center. Whitney doesn't have a lot of boxes and other knick-knack items that Xe has collected over the years. But she does have the same outlook for the future. A future that includes accompanying Xe on his journey away from Earth.

Goldilocks is a nebular system located in another constellation about 40 light years from our own solar system. Embedded in this system are very hot stars similar to our own Sun. There are also three notable planets that scientists have zeroed in on. The interesting thing about

Goldilocks is that one of these planets has been identified as being very habitable, under certain circumstances. In other words, a terrestrial planet that could meet the requirements for supporting human life.

The extreme distance to Goldilocks has prevented scientists from creating a complete understanding of its stars and planets. There is the evidence, slight as it may be, that this one planet is very similar to the planet Mars. Leaving open the possibility that adaptations could be made to support human life. Of course, much farther away and in a completely different galaxy and solar system.

Xe wears a number of different hats on this journey. Astronomer, physicist, and cosmologist, to name just a few. There are actually a number of other personnel that will be accompanying Xe on this adventure. There are nine other humans with very similar credentials to Xe's, although Xe is considered the senior team member. In addition, there are a total of ten androids. Each human has been paired with their android counterpart ever since they can remember. They have shared their lives together in both personal and scientific ways. Their relationship has become one of trust, respect, and loyalty. The bond that has been formed, one of family.

Xe's partner is Whitney, the android senior team member. Whitney is actually a second generation android

whose history goes back 50 years, when Whitney's parent, if you will, worked with the original research team preparing young scientists for an exodus from planet Earth. Whitney became the latest generation of this android team when her mother suddenly stopped working in response to hearing of her long-time partner's death. Whitney is the product of that original android. Like her mother, Whitney was assigned to her human partner Xe and their relationship has continued until this day.

Xe is also an astronaut for the Earth Interstellar Association of Planets (EISAP). Working hand in hand with Xe, Whitney has also excelled as a member of EISAP and as a cosmologist specializing in the origin and evolution of the Universe. EISAP was founded a number of years ago, back in 2114, when it was first recognized that there needed to be a formalized effort by humans to travel to distant planets. Prior to this time there were a few privatized efforts to colonize the planet Mars, but nothing of the magnitude required to travel to more distant planets. Planets that were outside of our solar system. Maybe, even outside of our galaxy or Universe.

Mars

Chapter Fifteen

The first efforts to actually transport humans to Mars took form back in 2017 and led to fruition in 2100. It was not a government sponsored program, but private commercial firms that first took on the challenge. A challenge that from a pure business perspective would lead the firms to becoming the premier suppliers of travel outside the confines of planet Earth.

An unintended consequence of this business venture is that it opened up the thought of colonizing Mars. Ambitious plans were created to move whole populations of humans off of planet Earth. Away from an overflowing population. Away from a soon to be discovered external threat. Away from a dying planet. Unfortunately, the plans remained just that. Plans. Instead, efforts were concentrated on keeping the missions to Mars commercially based. Maybe it was the money or maybe they just realized that leaving planet Earth was a lot more complicated then they had time for.

In 2100, trips to Mars were initiated. At first there were just those few daring soles who jumped at the chance to go,

even though they knew there were no plans of coming back. These were one way trips only. But it was an opportunity of a lifetime, as short as that may make it.

Establishing a human presence on another planet turned out to be more than these early candidates had bargained for. They thought that they were in for just a fun trip. The trip of a lifetime. But long before the initial group left for Mars, the magnitude of what they were about to do surfaced. The responsibility of their actions began to materialize. The acknowledgment that they were not coming back. It became a lot harder and a lot less fun.

The technical aspects of just getting to Mars were formidable. Everybody knew that there was a good chance that they would never make it to Mars. Maybe they would crash on the landing. Maybe they would land safely but succumb to the inhospitable nature of the planet. Then again, maybe they would survive. And that scared the hell out of them.

They would be responsible for creating a whole new place for humans to live. Literally, out of this world. How does one go about doing that? How can one small group of people even know all that this responsibility encompasses? All of a sudden the fun trip lost its appeal for many and only a handful were left to carry out the mission. Only a handful

felt the honor that was about to be bestowed upon them and the obligation to prepare a proper plan.

Plan is what they did. They only had a few years or so, but they needed to come up with answers to questions like what is the best way of getting to Mars? Where were they going to land? Even if they did land successfully, what would they live in? Lastly, and the most non-technical, what kind of a society were they going to create? That, was probably way out of most of their capabilities, let alone expertise.

The handful left standing were joined by hundreds of others who, like themselves, felt they could do this. They completely understood the challenge and accepted it at full face value. They were broken up into teams according to their skill sets and the priorities that had been determined. Scientists, engineers, physicists, and social disciplines from all over the world, combined to form the Mars Endeavor Project (MEP).

At the highest level the priorities came down to only three. One, build whatever machine would be best to get to Mars. Two, figure out what kind of structures to live in. Three, decide where to build such structures, such that they would be capable of supporting human life long-term.

The Way There

Chapter Sixteen

The obvious first question was, how are we going to get to Mars? What needed to be built to provide the ride? Another question was, once there, what are we going to live in? What needed to be built to avoid direct contact with such a hostile and toxic environment? Mars was not a very welcoming environment. Where to live and what to live in were of top priorities.

The technical aspects of getting to Mars, although very challenging, were not insurmountable. They were typical engineering type questions for which their concern would generate typical scientific solutions. The people going to Mars? They had a different concern, somewhat related. How long was it going to take to get there? The sooner the better. They were not keen on the idea of it taking a year to get there. They were not keen on the idea that they might have to hibernate for an extended period of time.

The key to getting oneself into space is the launch. The spacecraft is trying to escape Earth, but Earth is trying to prevent it from doing so via gravity. Up to this point in human space exploration the goals had been to launch into

sub-orbital space, orbit the Earth, or launch a team of astronauts to the Moon. Each of these goals is a little more sophisticated than its precursor. The one thing that didn't really change was the rocket used to do the launching. Yes, there were advances in things like carrying capacity and thrust. Obviously, the more your payload the greater thrust you are going to need out of your rocket. But at a conceptual level the rockets were basically the same. They were all based on chemical combustion.

All these early missions were comparatively short in distance and duration. The technology at the time relied on fairly simple principles that said combustible materials can be used to create reactions (burning) that cause heat. That heat can create a flame. The flame can be used to create energy. That energy can make something move.

For many years the fuel needed for a rocket to escape Earth's pull depended on a chemical reaction to create combustion. It worked quite well but there were some drawbacks. The main one being that chemical rockets require vast amounts of fuel just to escape the grip of gravity and enter Earth orbit. Let alone travel far away from planet Earth. That was acceptable as long as you were traveling to some place fairly close by such as the Moon. Scientists knew that chemical rockets would not be acceptable for longer flights and thus, would not be good for getting to Mars. Trips to Mars would not just require a larger

rocket and more fuel. There needed to be a completely different approach to getting there.

The approach the teams decided to settle on was to switch from chemical rockets to nuclear rockets. The idea was basically the same. Except that the propulsion would come as a result of a controlled nuclear reaction and not from that of a chemical one. Now any combustible reaction can be dangerous, but with a nuclear device one needed to be particularly careful. There needed to be some form of nuclear propulsion developed that was powerful, yet safe. As was said earlier, controlled.

The idea behind nuclear propulsion is that liquid hydrogen is used as the fuel. When heated in a nuclear reactor the resultant expansion is forced out of a rocket nozzle to create thrust. So instead of the reactive energy created from chemicals, the energy comes from nuclear fission or the breaking apart of atoms.

The advantages of a nuclear powered rocket are many but, primarily, they are twofold. One, liftoff mass is less which can nearly double or triple the payload that can be launched. Two, less fuel is required in a mission to Mars for example. Thus, enabling the craft to make the trip to Mars in around four months, which is just two-thirds the time necessary if using a chemical source.

Fortunately for the structural team, nuclear propulsion had been proposed a long time ago back in the early 1960's. There had actually been some testing done to support the designs. Budget cuts, lack of public support, and a drop in interest after the successful Apollo space program, doomed the nuclear propulsion projects to the proverbial shelf.

So based on the earlier research, the teams began to revive nuclear propulsion as a means of getting humans to Mars. Over a period of months, new contracts were sent out to bid. Designs were tested. It wasn't too long before prototypes were created to re-initiate the vision. It seemed MEP had a method of travel.

The research into where they were going to live was going on simultaneously. Like the mode of travel, the decisions being made were based on past and current knowledge. Earlier in the space program's history there was similar thought put in to where would be a good place to live on the Moon. Like the Moon, Mars needed to provide the basic necessities of life support. The most obvious of these being protection from the elements, water, and food.

Astronomers and other research scientists for the Moon had located a few deep and cavernous caves on the

surface. Similarly, these same types of caves had been found on Mars. In addition, these caves were interconnected via tunnels making them ideal for human settlements to communicate and travel. The network of interconnected caves were in actuality lava tubes. They were formed much earlier in time on Mars when volcanic activity and lava flows were still the norm.

These places would meet the criteria for supporting human life long term. They provided protection from micro-meteorites and cosmic radiation, there was usually some form of water located deep inside, and structures could be built that would allow for the growing of food enough to support human settlements.

The lessons learned from the exploration of Mars would not be forgotten. At each step of human exploration of the Universe everyone knew that the knowledge gained now would be of greater use to the generations to come.

Where To Live

Chapter Seventeen

After setting up home at the space center, Xe and Whitney were invited to attend a press conference in their honor. Maybe invited is not the best way to describe it. They were pretty much expected to attend as the official spokespersons for the Goldilocks mission. Two of the expected questions and their biggest concerns for the journey to Goldilocks were one, where on planet Goldilocks-P3 would they set up camp? And two, what would that camp consist of?

Not to Xe and Whitney's surprise, the presentation kicked off with a brief history lesson. The lesson intended to serve as the rationale for the decisions that were about to be communicated. That history lesson goes back to the days of the Mars missions when the mission personnel faced similar types of questions related to where to live and what to live in.

The biggest question at the time was where to land on Mars? That in turn, dictated where the astronauts would live. Or at least in close proximity to where that landing occurred. Goldilocks-P3, like Mars, is predicted to be a very

harsh and difficult place to live. The atmosphere is mostly carbon dioxide. The temperature is extremely cold and frigid. Gravity is a mere thirty-eight percent of Earth's. In addition, it is a well known fact that supply missions from Earth would be non-existent. But the number one concern was radiation from space. Goldilocks-P3 doesn't have a global magnetic field or a thick atmosphere so there is very little protection from space radiation. Radiation from space comes in the form of subatomic particles that can tear through DNA molecules, causing cancer and other diseases. Turns out even for androids, space radiation can really mess up their electronics. Living on the surface seemed out of the question.

The first missions to Mars were carried out by robots and rovers for the express purpose of recognizance and research. What kind of a place was it? Where were possible locations to land future manned missions? Though very successful, there was simply not the time nor the financing to provide similar journeys to Goldilocks-P3. That's where androids like Whitney came in. The initial landing on Goldilocks-P3 would be performed by the android team. Once that was completed successfully and the proper research had been done, the others would come. The others that were much more fragile and required a much more controlled environment capable of supporting that fragility.

The initial landing party would have to survive partly inside their lander and partly outside doing experiments and researching building sites. Whatever they found, any new habitat would have to be completely self-sustaining. Sealed off from the thin Goldilocks-P3 atmosphere, protected from the radiation, and capable of supporting a small human population with enough food, water, and other supplies for an extremely long period of time.

Returning to the present discussion, Xe and Whitney presented the overall goals and objectives of the mission. Whitney began by reiterating that the first explorers on Goldilocks-P3 would be the androids. After touching down and securing the landing site, the androids would be the first to step outside onto the Goldilocks-P3 surface. This initial landing party would be led by Whitney. Her primary mission was to build the temporary structures that would house the rest of the team that would come later.

Xe continued the discussion with the events that would follow Whitney's. Xe and the rest of the humans on board would depart to the surface only after the landing site had been secured and the temporary structures had been completed. Then, they and the androids would explore the region for the existence of more permanent housing to be located in any suitable lava tubes and volcanic features. These were the lessons learned from the Mars missions and were still highly relevant now.

The press conference concluded, Xe and Whitney left for an additional meeting that was more confidential and secretive in nature. In other words, a discussion that was intentionally kept from the public eye. The kind of things discussed here were for the scientists and physicists eyes only.

Hidden Agendas

Chapter Eighteen

Xe and Whitney feel as if they almost have multiple personalities. One to be shown only in front of the press and cameras. The other, their true selves. They are both scientists, extensively trained in physics and cosmology. Working for EISAP is the culmination of many years spent in academia, research, and training. In this year of 2120 they are about to experience first hand what all the theories have predicted about our Universe. To confirm some of the latest theories regarding the existence of life elsewhere in the Universe and beyond. Press conferences are just an annoyance to be tolerated at this time.

Truth be told, both Xe and Whitney knew the press conference that they had just held was somewhat of a sham. It was the intention of EISAP to misinform the public as to the true nature of the Goldilocks mission. There was in fact a Goldilocks. There was in fact a Goldilocks mission. There was in fact a Goldilocks-P3 that was habitable. Goldilocks-P3 was not, in fact, like the planet Mars.

The real nature of the Goldilocks system was quite well known, at least the potential that it held. And that

potential was something that the general public was not quite ready for yet. The risk to global stability was too high for complete honesty at this time.

Going back to the year 2070 and even earlier, there was the startling announcement, held privately by only a few select scientists, that there was the distinct probability of another mass extinction somewhere in the time frame of 2200. That probability became even more of a certainty when additional data was acquired supporting that conclusion. Carbon dioxide in the atmosphere was shown to be growing at a rate that was unprecedented in Earth's history. The growth rate was 50 percent faster than average over the past decade. Rising at levels not seen in millions of years. Sea levels were rising as well, in some cases as much as 65 feet. The Earth's temperature? Rising another 3 degrees Fahrenheit worldwide.

During this time there had been a concealed global effort to formulate a solution for the survival of humanity. The Mars program (MEP) had largely been driven by commercial efforts to apply a business model to outer space. They were very successful at doing this. Behind the scenes, there was a determined effort to acknowledge the consequences of a not so successful effort to deal with climate change. Come up with a plan to salvage humanity. That plan involved migrating a seed population of humans and androids off of planet Earth to somewhere else. At the time, that somewhere else was unknown. In 2114 that

destination became known with the discovery of the Goldilocks system and the creation of the Earth Interstellar Association of Planets (EISAP). It was the goal of EISAP to formalize the effort that would surreptitiously plan, build, and execute this migration.

Understandably, the general public was kept from the knowledge of this effort. There could only be a small seed population planted in such a far away place. Wholesale migration of populations was simply out of the question. There would be open dissent to the plan to send only a few. There would be world protest over the decision to limit that few even further by including androids in the mix. There would be world panic if the general public understood their very survival was at stake. In other words, that it was all over for them.

There was the thought that religion might be able to play a role in the general public accepting such an onerous and burdensome obligation. If there was a world religious consensus that there was to be a second coming of sorts, albeit somewhere other than Earth, then maybe that would be enough to sooth the world. Over the course of Earth's history had there ever been a single belief that united the world? The evidence did not seem to support this. As scientists, the second law of thermodynamics certainly did not support this. What may have started out so long ago as a single belief, experienced a gradual decline into disorder ever since. A disorder that resulted in far too much division,

death, and destruction. That picture of world chaos was not the kind of picture that EISAP wanted to see.

The more EISAP thought about it, the more it became clear that concealment was a better approach. Concealing such a plan certainly had its detractors. There was always the possibility that it would leak out. If they could just make enough progress then maybe it wouldn't matter anymore. It would be too late. Seemed like a lot of "ifs". What was the alternative? There were so many world religions, with so many different beliefs, that it was felt impossible to be able to circle them around a common goal. The goal of a single belief that would unite and calm the populations.

So, no, Goldilocks-P3 was not like Mars. All indications were that Goldilocks-P3 was, in fact, more like Earth. But there were many things that scientists didn't quite understand about the nature of the Goldilocks system. They were not even sure that the Goldilocks planetary system was even governed by just one star. It was very hard to tell, given the distance and their observational capabilities.

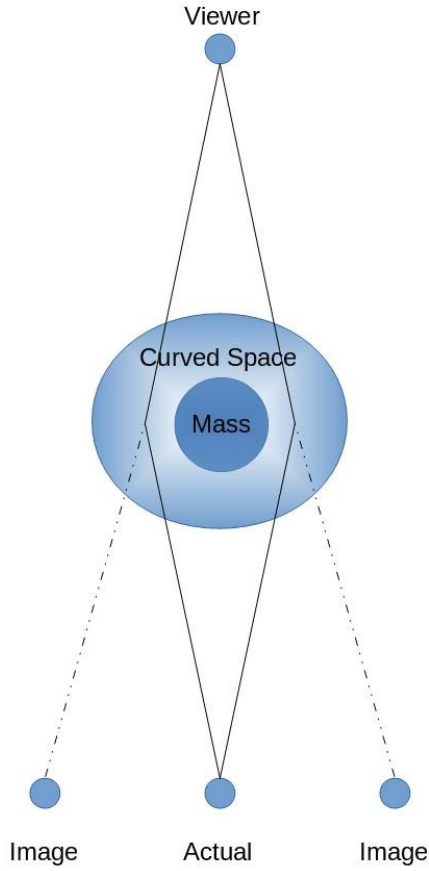
Long ago Einstein had proven something called gravitational lensing. This is where a large mass bends the path of background light from more distant objects to form images of those background objects. Not real images, but evidence that there is something there, nonetheless. This is

what scientists had to rely on. In other words, a large galaxy lensed the hint that there was something behind it. A star like Goldilocks-S1 appeared to be hidden somewhere in its background, only to be seen as a faint image. Then, there were other objects. What those other objects were could not be clearly discerned. What scientists thought was that there could be another star. Perhaps, Goldilocks-S2.

Obviously, where there are stars, there are planets in orbit around those stars. In this case scientists presumed there were three planets in the Goldilocks system. Hiding behind the main star, Goldilocks-S1. There were regular and repeated shadows that were evident as the planets made their way around the star. But at some points these shadows disappeared, at least for a short period of time. Only then to reappear.

Lurking past Goldilocks-S1, past the three planets as well, was another large mass that appeared to also influence the transit of these same three planets. That's why their shadows disappeared for a short while. They were hidden by the second large mass, presumed to be the star Goldilocks-S2.

Gravitational Lensing



Goldilocks-P3 appeared to be the planet that was most habitable from a human standpoint. The planet had a mass and size very comparable to Earth. Calculating the distance from the planet to its nearest star and the star's temperature, allowed scientists to estimate that the amount of light Goldilocks-P3 received was also comparable. Most importantly, the planet had the two most important characteristics for human life support. Liquid water and a thick atmosphere to provide protection from space radiation.

As Xe and Whitney entered the room reserved for their special meeting they were greeted by the other eight members of their team. Four of whom were human and four of whom were android. As they sat down the flight controllers working in mission control took their position in the front of the room. They were here, as they had been for the last few months, to ensure the success of the mission and the lives of the astronauts under their watch.

Under their watch was a finite period of time though. Flight controllers and mission control in general were only supposed to get the astronauts to Goldilocks-P3. Once the astronauts had descended to the surface and habitation had begun, they were responsible for their own survival. It would be as if the balloon had been released from the hand that held it. Free to ascend to whatever heights that lay before them. But only as free as they would allow each other to be.

All Together Now

Chapter Nineteen

Plant a seed and the seed will grow, as long as you supply the proper care and nurturance. Plant a seed on Goldilocks-P3 and the same rules apply. Yes, the planet has the necessary ingredients for life to exist in the form of a thick atmosphere, enough light, and liquid water. There does appear to be a breathable oxygen component. There also appears to be a force of gravity equal to or similar to that on Earth. There are probably some things left out but the point to take away is that these are the things the planet supplies free of charge. A place that is conducive for human habitation. The things that are not supplied are the care and nurturance needed to sustain human life. That which will take what is given and make it grow.

Xe, Whitney, and the others have all been trained on what it takes to get to Goldilocks-P3 and what kind of conditions will be waiting for them there when they arrive. Additional training is needed though in order to enhance their ability to thrive. That means learning how best to live together as a group. Learning how societal structures are built from the ground up. To do so, requires examining human history to find the types of society that best fit the model being presented for Goldilocks-P3.

The key concept to understand is that of structure. Analogous to the internal framework of humans, structure is the skeleton that supports the body and allows the body to develop and expand in a harmonious way. The same is true with society, where social structure provides identity and outlines the capacity for a group to change and be flexible as the group develops and expands. Hopefully, in a way that creates and maintains harmony within the group. In turn, social structure highly influences other systems, such as a group's economic, legal, political, and cultural relationships. Taken together, society encompasses all structurally related entities that define roles, functions, meanings, and purposes.

Just how does a given social structure arise? There are basically two modes of thought on this. One, social structure develops naturally. On its own. As the needs of the system become known, such as labor and conflict management, a structure naturally develops that meets the need. Think in terms of termites, for example. Termites build incredible mounds or castle like structures. The structure and shape of the castle is not represented in the vision of any one of the individual termites. They all do their own thing. They do not really have a clue as to what they are building. Yet, a beautifully elaborate structure is built that naturally unfolds.

Two, social structure is directly and purposely constructed. Created by those who, by power of position, construct systems of relationships that favor one approach over another. A designer that organizes the work supplied by each individual worker, according to a vision. Again, think in terms of the termite castle. But compare it to the castle La Sagrada Familia, built by Antoni Gaudi. This is also a castle that is very beautifully elaborate and looks at first glance very similar to the termite castle. But its design and construction was intentionally derived by its chief architect, Antoni Gaudi.

So just how does a social structure come about? The real answer probably involves a combination of the two modes of thought presented above. There is a natural tendency to form relationships that lead to a common goal. Those tendencies are, in large part, influenced by those assuming positions of prominence who provide direction.

Similar to biological evolution, culture evolves to favor certain types of behaviors and relationships over others. But it seems culture tends to favor direction rather than the randomness of mutation. Such that building cultural relationships receives preferential selection over that of biological capriciousness.

So the hope is to be able to look at our past and present and find examples of social structures that

represent the best relationships in accordance with the size of the population and its given environment. With that in mind, the anthropologists at EISAP began their search of human history for examples of how best to structure a society planted with the seeds of Xe, Whitney, and the others that would come after them.

Obviously, the kinds of societies that exist in the present day were not really candidates. Although they did provide valuable information regarding end states of social structures that were started a long time ago. Just as cosmologists look at the present state of the Universe and work their way backwards in time towards its initial beginnings, the anthropologists at EISAP wanted to look at the early stages of human development. The earliest examples of how small groups of humans adapted culturally and economically to their environment. Small groups that matched the conditions to be met by the astronauts of EISAP landing on Goldilocks-P3.

The earliest forms of social development came in the form of small groups of hunters and gatherers. Followed afterwords by larger numbers of people organized into tribes. For all intents and purposes, unified as a result of religious ideas that brought the smaller groups together. From there, we tend to see the formation of states where religion continues to play a role, but things like politics and warfare become even more prominent. An example of how things increase in complexity over time. In other words,

small hunting and gathering groups start off with a small degree of complexity and a high degree of order. Followed by tribes and states that exhibit increased complexity and somewhat greater disorder. The whole idea behind entropy and the second law of thermodynamics.

With that in mind, the anthropologists of EISAP decided to focus their studies on hunters and gatherers. Research the annals of human evolution for evidence that detailed the lives and social structure of a way of life that had pretty much faded away long, long ago. Save for the ethnographies of anthropologists doing fieldwork for their PhD and the best efforts of paleoanthropologists to describe the social life of our earliest human ancestors.

In summary, the findings of the team were based on dozens of hunters and gatherers compiled from all over the world. These were groups that had been largely untouched by modern society, at least at the time of their accounts back in the mid to late 1900's. Fortunately for the team, these accounts and ethnographies were still available for analysis and after pouring through all of the data it became clear that there were many characteristics that all of these societies shared. The most important of which was that they all shared a common, egalitarian way of life.

So what is it about these societies that creates this kind of egalitarian philosophy? One of the components is

the size of the social group. The size of these groups seemed to range between 20 to 50 people, including children. Living in what is known as a band, these groups were highly nomadic, moving from camp to camp within a prescribed area. A nomadic movement that was entirely governed by the availability of game to hunt and plants to gather.

Another component was that the dominant spirit of the group was one that emphasized nonviolence, sharing, cooperation, and decision making based on consensus. The overall principle or value of the band being equality of individuals. In practice, this equality was quite a bit more than just the typical legal reference that modern democracies like to adhere to. Hunters and gatherers, it seemed, practiced what modern societies only codified.

Everyone was entitled to food. It was a shared commodity regardless of one's ability to hunt or gather on their own. Wealth was something that was also shared, such that there were no distinctions between the haves and the have nots. All material items were shared. Individual decisions were made entirely by the individual. But group decisions were made through a process of consensus and general discussion. Meaning that everyone was of equal status. In final, hunters and gatherers depended on an intense cooperation. A cooperation that is described by the term egalitarian, believing that all people are truly equal and deserve equal rights and opportunities.

That is all fine and wonderful, but exactly how is this going to manifest itself for the astronauts of Goldilocks-P3? Obviously, the astronauts would not be hunting and gathering, moving occasionally to follow the plants and animals. Admittedly, they would be living in small groups initially. But certainly, entropy would increase over time.

Yes, the astronauts would not actually be hunters and gatherers. The important thing to note here is that it is not the actual hunting and gathering of animals and plants that creates the egalitarian ethos. Hunting and gathering of animals and plants is just a means of implementing or expressing that ethos. The act of hunting and gathering can be replaced by some other activity as long as the results of that activity are to enhance an egalitarian nature. In other words, it's the meaning behind the act that is important. Not, the act itself. In order to understand the meaning, the act itself becomes simply a metaphor.

How entropy is controlled is also just a reflection of how the astronauts would express that ethos. Remember that hunters and gatherers tended to live in fairly small groups of 20 to 50 individuals. One small group did not live in total isolation to the other groups. There were relationships set up within and between the groups that allowed for controlled expansion. Take inbreeding for example. If you have too small of a breeding group, then

you run the risk of mating with genetically related individuals. Over time, that can lead to recessive and deleterious consequences.

When you examine the relationships of these small hunting and gathering groups you find out that, in practice, these small groups actually consisted of non-related people. That is because each group encouraged forging wider social networks outside of the small group, thus creating a larger genetic pool within which to breed. These networks were primarily for economic purposes, but they also forced a greater cooperation and sharing among the closely knit groups. A cooperation that did not depend on the kinship ties one held, but instead on the needs of the group. Thus, deterring the creation of powerful kinship groups with overbearing wealth and power.

There is actually an interesting correlation between the decision making process and the equality of the sexes. The models show that when just one sex, in these cases males, choose who makes decisions for the group, their choice is to select close male relatives. This leads to formulations of an accumulation of resources and wealth between related males that results in an imbalance of equality. By sharing the decision making process between the sexes the models indicate, and the ethnographic evidence seems to show, that this imbalance of equality does not develop. By forcing social and economic communication outside of the local

group, there is an enhanced sharing of innovation, cooperation, and a wider choice for all.

Then the question becomes how do you maintain that equality over time and across generations? The evidence from hunters and gatherers again points to an adherence to social customs designed to do so. For example, they actively engaged in social patterns of not allowing power to be welded by one individual or group over another. Things like boasting, bragging, and dominance were controlled by ridicule. One was expected to show proper humility and that expectation was actively enforced by the actions of the group and the elders. In this form of reverse dominance, the group acts to deflate the ego of anyone trying to assert dominance over anyone else. Violators would be teased in order to stop the offending behaviors. In extreme cases, they would be shunned and banned from the group. Forced to move away and hopefully find another band to occupy.

Another way of maintaining equality is through the simple action of play. Playing together with members of your group or those of other groups, relaxes tensions and emphasizes cooperation and the needs of others. This is something not only seen in hunter and gatherer societies but in other animal groups like apes and monkeys. Something that seemed to ring a bell in Xe as a long distant memory from the past.

So what is it that the EISAP anthropologists are trying to communicate regarding the social structure they are designing for the Goldilocks mission? The lesson learned from the research of hunters and gatherers seems to be that where you have a small number of individuals, living together successfully involves creating an egalitarian social structure. Specifically, one that involves complete equality between the inhabitants and especially between the sexes. There should be no distinction between wealth, status, and power. In fact, all wealth, status, and power should be shared among the members of the community. In order to enforce and maintain this ethos, there should be no tolerance of inequality between members.

Xe, Whitney, and the others know that theirs will be the first of at least a few flights to Goldilocks-P3. Their responsibility will be to enact this kind of social structure and ethos. As the others follow, it will be their responsibility to construct new small-scale communities that follow the same underlying principles of that very first community. It is extremely important to maintain the overall scale of the groups. Create many, but keep them small. Most importantly, create networks within which relationships can be formed. The one thing that the EISAP anthropologists emphasized was that in their research, it was when human development made the transition from hunting and gathering to more settled, agricultural lifestyles that the notions of egalitarianism seemed to go by the wayside. When humans were able to start accumulating resources, alliances were built and relational imbalances emerged.

Journey To Goldilocks

Chapter Twenty

Xe, Whitney, and the eight others are sitting on the launch pad waiting for the final authorization from flight control that their mission is about to begin. It has been a long journey to this point and it will be an even longer journey to Goldilocks-P3.

Sitting atop the world's most powerful rocket is one thing. Sitting atop an atomic rocket engine is quite another. Basically, the atomic rocket utilizes a nuclear reactor to heat liquid hydrogen to a high enough temperature to move a large mass. To move that large mass a much greater distance then traditional methods using chemical propulsion. Moving a large mass such as the one heading to Goldilocks-P3, does indeed need some serious liftoff capabilities. As well as a high degree of safety. After all, we are talking about riding atop a missile that is normally associated with explosions, not stabilization.

This is only the first step though. This part of the journey is simply to place the astronauts and their requisite equipment into Earth orbit. After arriving at the EISAP space station, they will be provided with the appropriate

means to deliver them to Goldilocks-P3. The real launch pad to interstellar travel and the Goldilocks star system.

As the countdown winds its way down to zero, the massive boosters of the rocket begin to shake and rumble with an impressive display of power and might. Each of the two boosters creating millions of pounds of thrust each. As the rocket ignites, the astronauts feel the combustion of the engines translate to a sudden kick in the back as a g-force more than three times that of gravity challenges the survivability of its occupants. Even the androids are concerned about their circuitry being crushed to the point of losing all semblance of connectivity. After a minute or so, the main engines cut off and the pressures drop. The noises cease. There is this sense of floating and tremendous freedom. Free from the confines of Earth at last.

The exhilaration of the moment is fleeting at best. There is still a lot of work to be done to arrive safely at the EISAP space station and begin the transfer of materials and personnel for their next step in the journey. This last step is somewhat of an unknown to the crew. Brand new technology dreamed up long ago but never actually put to the test. The only way to travel to Goldilocks-P3 in a timely and speedy manner. At least within a human lifetime.

The Goldilocks system is approximately 40 light years away. To use a more conventional means of space travel would require hundreds of thousands of years in space travel. Not exactly within the realm of what is reasonable.

Of course travel time is dependent not only on how far you are going, but how fast you go. The only working variable in all this is velocity or speed. The theory of general relativity places a boundary on the speed of light at 186,000 miles per second (300,000 kilometers per second). Given that, the fastest one could get to the Goldilocks system, even if you could go at the speed of light (which Einstein says you cannot), is 40 years. Since nothing can travel at the speed of light except light, then that becomes the benchmark for any new methods of space transportation that can be devised. The method chosen by the EISAP team was a propulsion system based on antimatter.

What is antimatter? To understand antimatter requires an understanding of matter. Anything that has a mass, usually some kind of physical substance, is considered matter. Most of the matter in our Universe is composed of atoms, which as has been discussed are composed of particles. Such as electrons, protons, and neutrons. The theories behind how all of this sub-atomic world operates is the subject of quantum mechanics.

Turns out that matter particles have opposites of themselves in the form of antimatter. Particles that are exactly the same, but opposite. Electrons have an antimatter particle called a positron that looks exactly like an electron except that instead of a negative charge it has a positive charge. If you were to look at your self in a mirror, you would see a reflection of your self looking back. The anti-matter you, would be everything you see in the mirror, except flipped.

An interesting characteristic of particles is that negatively charged particles are repelled by positively charged particles. When an electron and a positron get close to each other they don't just repel, they annihilate each other. They both just disappear and turn into pure energy. This is the Universe's way of turning mass into energy in the most efficient way. The tiniest amount of antimatter, about the size of a few grains of salt, is equivalent to one of our most destructive nuclear weapons.

As such, antimatter propulsion is one of the most powerful and fuel efficient methods we have for long distance interstellar space travel. It allows space travel approaching the speed of light, which will cut the time of traveling to Goldilocks-P3 from hundreds of thousands of years to somewhere around 50 years. But how do you get antimatter?

At the beginning of our Universe there was plenty of matter and antimatter to go around. Except that because they ran into each other all the time, most of it disappeared. But not all of it. Some matter was missed such that in today's Universe there is a lot more matter than antimatter. And without that result, we wouldn't be here to tell the story.

The dilemma then is where is there a supply of antimatter? Humans can make their own, as is done by the LHC when they smash particles into each other at almost the speed of light. But there is not enough of that to supply a mission to Goldilocks-P3. Curiously enough, there is a large supply of antimatter that is found at the center of the Milky Way galaxy. It just needs to be tapped.

The end result of particle annihilation is an extremely powerful production of gamma rays that are 1 million times hotter than the surface of the Sun. After cooling, the gamma rays are converted into charged particles. Charged particles like to travel in magnetic field lines, which are then directed into thrust by magnets. All of this results in a propulsion system that can approach the speed of light. Simple huh?

After linking up to the EISAP space station, the astronauts are shown to their quarters for a period of rest and recuperation. It is intended that they acclimate to their new space environment for about a week. During that week, Xe and Whitney are anxiously awaiting their final

transfer to the vehicle that is going to take them all the way to Goldilocks-P3. Keeping busy is an important distraction. From facing the realty of never, ever, again returning to Earth. That this is a one way ticket for the survival of humanity and all that humanity entails.

When the moment finally arrives, Xe, Whitney, and the rest of the crew say their goodbyes and cross the final bridge to the vehicle they have fondly dubbed Annihilation. In math, the term annihilator is used to refer to differential equation operators. So, since our astronauts are scientists and the vehicle they are riding on uses antimatter as its propulsion, it all kind of makes sense. But there is one thing that is a little bit bothersome regarding the nickname. The rest of the math definition says that an annihilator is a differential operator which, when operated on its argument, obliterates it. There is nothing left. If there is anything that the astronauts don't want, it is to be obliterated. What they want is that the energy left over is the energy needed to get to Goldilocks-P3.

As the astronauts are boarded, they each take their assigned seating positions and begin the process of counting down the process of takeoff. Each member of the team closely monitors their computer displays and gauges as to the overall status of the vehicle. The EISAP space shuttle is busy monitoring the readiness of the module and its crew in a similar manner. In front of their computer displays.

When the time comes and everything is still in go status, the launch of Annihilation is initiated. Not with the typical blast of rocket boosters where a rocket is explosively released into the sky. No, Annihilation slowly and quietly pushes itself away from its scaffolding, gently sliding away into the darkness. Although Annihilation is capable at cruising close to the speed of light, it takes a while to reach that speed. Starting slowly, it gradually increases its speed over a period of days and weeks. Until finally approaching close to the speed of light. Its cruising mode.

As with the other members of the team, Xe and Whitney have begun taking the steps to prepare the humans for the process that will secure them on their journey. A process that will make it possible for them to travel safely in space for a period of around 50 years. Because humans are much more fragile, they have to be taken care of in a special way. That means, they must be put into a state of hibernation until such time that they are closely approaching Goldilocks-P3. Left to watch over them will be their android counterparts. In the case of Xe that falls to Whitney.

Xe climbs into his compartment, gets himself comfortable for a long winter’s sleep, and Whitney closes the hatch. A moment later the compartment is filled with a special gas that acts to send Xe’s body and mind into a

state of hibernation. Slowly, but surely, drifting away. Until, finally, Xe is gone.

A Time To Remember

Chapter Twenty-One

Xe is caught hurriedly trying to usher the smoke out the door of her small lab. Fortunately for her, the door was already open and it didn't take long for what little smoke there was to clear the room. Unfortunately for her, she could not identify the source of the smoke or its cause. Xe opened the few windows she had in her basement and then began to collect her thoughts. Began to accept the realization that she was back.

Feeling confident that her immediate issue had been resolved, Xe headed out of her lab, up the stairs, and into her office. Xe's office is where she finds comfort, surrounded by all the things with which she identifies. Things like her journals, her books, and her notes of what she can remember of her life back on Xeron. Now is the time to debrief. Remember as best she can the particulars of the journey just taken.

Typically, Xe first tries to discern the circumstances that caused her return. Her past experience has taught her that returning signals the end of the life form she has been occupying. She knows she was 100 years into the future,

but she doesn't recall the life form ending. It's not until she recollects the last few minutes of her transformation does she become more aware of its significance. That by putting her host, Andre, into a state of hibernation, the recall back to the past was triggered. In a true sense, the hibernation actually did end the life of her host. Albeit, only temporarily.

As Xe starts to sift through the volumes of data popping into her head, she is struck by the immensity of climate decisions currently being made and how they have played out in the future. Present society's failure to adequately deal with the effects of human contamination of its environment has led to such dire consequences only 100 years into the future. Not just consequences for one group of people, one country, or one continent. But for the whole population of the world. For Earth itself. Is there anything that should be done about it? Is there anything that can be done about it? Realistically, no. What really matters to Xe is getting back to Xeron. She tries to focus on those elements of her journey that will help her do so. Exhausted, she fades away into a well-deserved slumber that is only ended hours later by a knock on her door.

As she slowly climbs her way out of the overstuffed chair that has served as her bed, she is greeted by the sounds of friends congregating at her door. Opening the door, Xe is pleased to see the faces of three of her friends and colleagues from college. Faces she hasn't seen in quite awhile. They are all excitedly chatting away about an

opportunity of a lifetime or some such thing. In any event, Xe invites them in to hear all about whatever it is that they are so excited about.

They all gather around in the living room, too excited to find a seat or settle down into a chair. It seems that there is a lecture to be given that night to which they have all been invited through the college at the last moment. This is not just an ordinary lecture. This is an appearance and dialogue with one of the world's greatest linguistic experts. One of the most influential thinkers of the Twentieth Century, Noam Chomsky. Without a moment's hesitation, they all hurriedly gather their things and rush out the door.

Arriving at the venue, they made their way to their seats, front and center. This is to be a conversation format, such that it will feel more like a discussion among a group of friends. Except that the person known as the father of modern linguistics is sitting directly across from them. The night proceeds with Chomsky's views on language, human language, and how it differs from animal communication. The call of a monkey sensing danger being quite different from the internal thoughts of a human being. Can they both be called language? The call of a monkey is a signal to the rest of the group that danger lurks close by. Not a whole lot else. The thoughts of a human being can lead to an externalization of ideas. Not just a signal or symbol, but a whole set of symbols that taken together, have a meaning. Something more than just the thoughts by themselves. In

other words, a full language. It is this internal creative capacity for thought and behavior that signals the difference between humans and animals.

They were all quite mesmerized by the discussion as the night proceeded. But it was the discussion towards the end of the evening that struck Xe as uniquely personal. The topic had changed from one of linguistics to that of the social responsibility of humans in regard to the effect they are having on their environment. Apropos to the time, was the refusal by some governments to acknowledge the catastrophic consequences that awaited humans in the future for their failure to address the issues of human caused climate change.

Xe felt personally challenged by Chomsky's idea that it is the responsibility of scientists to challenge and confront more forcefully the denials presented by these governments. The problem is that these governments obfuscate the issue of human caused extermination thereby removing the threat from public view. Economists are more concerned with the flow of money than they are with the continued flow of human existence. That is the rationality of institutions.

As individuals, the rationality is the survival of your grandchildren. After all, the grandchildren are the ones to carry on the genes of the grandparents. As such,

individuals have the capacity to modify and overcome the irrationality of institutions that are leading the human species to the brink of extermination. It is the responsibility of scientists to reach out and correct the transgressions whenever they have the evidence to support it.

The friends end their evening together by dropping Xe off at her house. But for Xe, the evening is not over. The conversation with Chomsky has created a dilemma for Xe. For Xe knows something about the future, climate change, and the extinction of the human species. What is she supposed to do with this knowledge? What are the consequences if she does nothing? Is there anything she can do?

Xe did not get much rest this night as she tried to come to terms with the delicate issue facing her. As usual, she tried to fall back on her training as a physicist and cosmologist to help her come to a resolution. This is obviously where she felt comfort and following the process of the scientific method was the natural thing to do.

There is a concept in physics referred to as the arrow of time. Time, it seems, has a direction and is inherently directional. The past is fixed, immutable, and irreversible. The future lies ahead and, although somewhat predictable, is certainly not fixed. This arrow of time is what gives

humans a sense of time passing. A sense of progression. That progression is in a forward direction.

This is important in physics because it illustrates the concept of entropy and the second law of thermodynamics. Entropy, the idea that everything in the Universe eventually moves from a state of order to disorder. The second law of thermodynamics saying that as things go forward, entropy can increase but never decrease. In a nutshell, what it is saying is that there is a direction to time and time only moves forward.

As Xe reflects on this she is confused. When she was on Xeron she traveled backward in human time. Even now, she has traveled to the future only to travel back to the present time. So what gives? The answer seems to be that she was able to do so only because there was no attempt to break the laws of physics by trying to change the past based on what she knew about the future. When she traveled to Earth to witness the significant stages in human evolution, she was only a participant observer. There was no attempt to change human history. Just participate in it as it unfolded. And as it turns out, she would have been unable to do so anyway.

You can flow back in time, just as you can flow forward into the future. As long as you do not attempt to change anything that has led to that future. As long as you are only

along as an observer. What that means for Xe is that, although she knows what the future holds for the human species, she is unable to do anything about it. Because even if she could, that would change the very future that she was just a part of and going backward in time does not allow that to be changed. What the future portrays about the past is irreversible, because of the arrow of time.

Feeling somewhat absolved of the responsibility as a scientist to challenge the existing global policy directing the human species to the very precipice of their existence, Xe settled in for a long sleep. Knowing that when she awakened there would still be the task of debriefing her transformation 100 years into the future.

The next morning Xe began the review process she was waiting for so desperately. The first thing that popped into her mind was that, regardless of the fate of humans on Earth, there was to be a continuation of the species elsewhere in the Universe. Or at least the attempt was going to be made. Xe was not so convinced that such a mission needed to take place in such a deceptive manner, but that was not Xe's call. The more important take away was that there had been identified a place in the Universe where it was thought that humans and androids could not only survive, but prosper. A place that was very much like Earth in a lot of ways, as far as the initial data indicated.

What Xe remembered most about this data is that the Goldilocks system was situated around not just one star, but two. That Goldilocks-P3 actually followed an orbital path around each of these two stars. That it was described, curiously enough, as experiencing a change in season within a change of season.

Xe started to feel a cold chill all up and down her back and spine. There was this feeling of energy flowing all over her body. Goosebumps. It was if Xe had experienced a connection to something very near and dear to her. It was as if it was telling her that they were heading to a place she was very familiar with. Perhaps even Xeron.

There was only one problem. The Xeron she knew of was located in another universe altogether. How could it be that they were heading to Xeron if they were traveling within our current Universe? Disconcerting as it was, it was all she had to go on. Her only option was to return and carry out the journey to fully explain whether this was Xeron or not. And if not, then maybe it would lead to a different clue as to just where and how to get to Xeron.

It took Xe a few days to finalize all the preparations for the return. She had to be prepared for both the excitement of finally finding Xeron or the extreme disappointment of having to regroup, reassemble, and continue her quest. But

the only way to find out was to get back on board Annihilation.

She also had to decide just how much further into the future she needed to travel in order to arrive on Annihilation. She didn't want to be too early or too late. She needed to time this transformation very carefully, but she wasn't quite sure exactly how long the trip was supposed to take. And for that matter, how long the humans were to remain in hibernation before awakening for the journey to the surface of Goldilocks-P3.

Xe knew that her previous baseline was 100 years. The journey to Goldilocks-P3 was supposed to take approximately 40 to 50 years, based on its supposed distance. But that was only a guess. An unknown variable, given that there was no way to know how fast approaching the speed of light they were going to be traveling. Xe decided on the round number of 50 years. At the speed of light, it would take 40 years, give or take. Since they were going to be traveling close to the speed of light, 50 years seemed like a better bet. So as confident as she could be, she set her sights on 150 years into the future. Practicing the art of being mindful that she had taught herself earlier, Xe was hoping that was correct enough to set her on board the flight that was already well on its way.

After a final good night's sleep, Xe headed down into the basement for her return trip. Back to Annihilation, although, hopefully, not literally. Back to whomever, she was not quite sure. That was always an unknown. Would she go back as the android Whitney? Since Andre was in hibernation, that was her hope.

ANNIHILATION

Chapter Twenty-Two

Xe and the other androids have been aboard Annihilation for almost 50 years now. Xe has taken particularly good care of her partner Andre the whole period of time. As have the other androids taken care of their human counterparts. Really, there hasn't been anything difficult in doing so, as the humans have been in hibernation pretty much the whole time. The main tasks have been to just make sure that all of their vitals are where they should be and that the computers are properly functioning to support the hibernation process. So far after almost 50 years, everything is still optimal.

So just what is it that Xe and the other androids do to keep themselves occupied? After all, 50 years is an awfully long time. Besides the daily monitoring of the hibernation process, each android with the exception of Xe, have their own hibernation process, so to speak. There really is no need to have all hands on deck, as one or two can easily monitor the ongoing human processes. The ship itself pretty much takes care of itself with its own on-board computer systems.

The androids do need to take care of themselves. So periodically, some of the androids are taken out of service for a short while. Kind of like a vacation of sorts. Xe is different because she needs to maintain the continuity. A continuity of care and attention that should not be interrupted even for the shortest period of time. Xe is considered the last line of defense and before anything new is introduced it must first be applied and tested according to a simple protocol.

That protocol is to first apply all updates, whether to the androids or to the ship's computers, to a quality assurance system designed to test all aspects of the changes. In other words, prevent any unwanted bugs from escaping the patches and making their way unfettered to the rest of the populace. Think of it as kind of like a safe guard. Or, if preferred, think of it like the person who ingests food to be served to someone else to make sure it is safe to eat. Not exactly the same, but similar enough.

The process of going offline for the other androids is not to be taken as a period of rest though. Androids don't need to rest or sleep as humans do. The primary purpose of going offline is to apply validated systematic updates to their operating systems that are sent periodically from Earth. Over a 50 year period there would have been significant updates to the internal architecture of the androids. So their education, if you will, is of vital

importance. And, as indicated earlier, each update must go through a specified protocol of testing.

What about Xe? Xe has been receiving these systematic updates as well. It's just that Xe does not need to be offline for these updates to be applied. By the time these updates are ready for Xe's consumption, they have been thoroughly tested and confirmed acceptable. That any abnormalities, if any, have been discovered and resolved. If for any reason an update resulted in an android malfunctioning, that might be statistically acceptable. Although not desirable. Androids can always be replicated if need be. But if something happened to Xe, that would be catastrophic. Xe is the only one, with the exception of her partner Andre, that has the continuum of history and the complete sense of purpose needed to fulfill the mission. This is something that is just part of her chemistry. Her DNA, if you will. Just as it is for Andre.

There was one particular update that seemed to come out of nowhere, but seemingly from an authorized source. As all updates are considered to be potentially lethal, the authenticity of an update's source is of the utmost importance. Updates only come through a highly secure channel at EISAP. One that has been encrypted by the most sophisticated computers to date. Computers that are like computers on steroids. Known as quantum computers, they evolved as a byproduct of the field in physics called quantum mechanics. Quantum computers were like an

evolutionary branch honed from the tree of classical computing.

In classical computers the fundamental principle to understand is that of the bit. A bit is either 1 or 0, on or off, or, if you are using a coin, heads or tails. Put bits together and you can get a representation of letters that can represent words. Four bits could represent the word that is a password, for example. Quantum computers, on the other hand, use what are called qubits. A qubit can also be a 1 or 0, on or off or (and here is the weird part) both at the same time.

So, if we use the coin as an example again, when the coin is flipped and then observed as it comes to rest, it is either heads or tails. A classical bit. But if we observe the coin as it is flipping, then it can actually be both heads and tails at the same time. A quantum qubit. This leads to a whole new way of processing large amounts of data in a short period of time.

In trying to crack a password, for example, a classical computer would independently check each possible value, one at a time, looking for the correct value. One at a time works very well because classical computers are fast at doing this. But the more values you have the longer the process can take to find the correct result. Quantum computers process all the possible values at the same time.

Remember, a qubit can be both 1 and 0 all at once. So, collectively, the data is processed and a final process is used to select the valid value. That process is called a Grover Operator. So when you are processing huge amounts of data, a quantum computer is much more efficient at coming up with the correct result.

Why is this important? From the point of view of encryption, data can be constructed in such a way that qubits make it almost impossible to crack the encryption. Thus, the advantage of quantum computers. Encryption is completely secure. Another advantage in using quantum computers is the processing of huge amounts of data required for interstellar space travel. Data that can be processed in an efficient and timely manner.

Think of it in terms of autonomous cars. Back in the days when autonomous cars were being developed, it was critical that a driver-less car do everything that a car being driven by a person would do. More specifically, be able to see and think of everything going on all around the car. This involved analyzing a tremendous amount of data, all of which processed at the same time. The results of that processing had to be synthesized very quickly. Not the sort of job that was easy for a classical computer to do. But for a quantum computer, easy indeed.

Now imagine how much concurrent data is required to be processed at the same time for an interstellar space mission. The launch from Earth, insertion into orbit, and insertion into space are tremendously complex maneuvers. A lot of data needs to be crunched. Add to that travel over extremely long distances, over a period of time approaching 50 years, and then setting down on a small planetary body we hardly know anything about? The only logical answer is to use a quantum computer. The only acceptable device for processing data in a quantum mechanical way.

As it turns out, encryption was not the issue with one of the android updates coming from EISAP. As much as encryption with quantum computers is safe and secure, it is still the insertion of the human element that can cause havoc. Although EISAP tried to be very careful with the human makeup of its organization, particularly over those chosen to be in the know about the true nature of the Annihilation mission, it wasn't long after the mission to Goldilocks-P3 was launched that the general global community became aware of what was really going on. The cat was let out of the bag. A plan of infiltration was created.

Not surprisingly, there were some people in the world community very unhappy with the prospects of being abandoned, cast aside, and left behind to die. Some reacted with world protest. Some reacted with extreme violence and terrorism. Others reacted by vowing to disrupt the very process itself. In a very subtle way. If the human

species was on the verge of extinction, then so be it. But they were not going to go down lightly. They were going to take Annihilation with them as well.

Highly incensed that such a heretical process could be occurring, this group decided the best way to achieve their overall goal was to insert one of its members inside of EISAP to sabotage the mission. It would be a long process. One that would take years. Training the right kind of scientist, gaining the admiration of colleagues, and becoming a member of the trusted community of EISAP. Only then would that person be given the access required to be a successful saboteur. Only then would that person be able to construct the computer code that, although perfectly secure, would contain a virus that, it was hoped, would infect all of the androids on Annihilation. Thus, intentionally ending all hopes of humanity's survival.

A number of years into the mission to Goldilocks-P3, that infected update was uploaded. It appeared to be just another annual update of the android software designed to enhance their artificial intelligence capabilities. As is protocol, the update was applied to the quality assurance test system. This system was only known to the crew of Annihilation. It was a system designed and constructed well after the journey to Goldilocks-P3 began. Specifically, to protect itself from outside intrusion. Still, any protection is only as good as its ability to detect intrusion.

At first there was no indication that anything abnormal had been introduced with the update. The quality assurance machine seemed to be stable. All normal functions, both physical and AI, came out to be as expected. As protocol defined, the software was exposed to a series of simulations, designed to emulate behavior over time. Long periods of time. Simulations require that first you have a model. Something to compare the simulation to. In this case the model represented the underlying principles of egalitarianism and equality as established early on by EISAP. The simulation, an evolution over time from that model.

Over a period of weeks there appeared small changes in the machine's behavior. Small fissures in the expected results. Behavior that was not indicative of the egalitarian nature that had been reinforced into the architecture of each of the androids. There appeared cracks in the notion of equality. Cracks that indicated a preference for individual power and status. Indicated by attempts to own property, profit from its control, and subjugate others. A future end state that veered away from the intended goal. A future that, if left unchecked, would lead to a complete destruction of the very thing for which the mission stood. The annihilation of Annihilation itself.

There was only one thing to do and that was to back out the update. Obviously, there was something terribly wrong. Was it worth notifying EISAP? Probably not. The amount of time that it had taken for the update to arrive and the amount of time taken to send a message back would be too prohibitive. Like it or not, the perpetrator would be long gone anyway. The only solace that the crew could take was that a suspicious intrusion had been thwarted. And, that the saboteur, whoever they were, would never know if their plan had succeeded.

Avoiding Boredom

Chapter Twenty-Three

One of the mission studies conducted by EISAP early on focused on the effects of isolation, both social and physical, for extended periods of time. Obviously the mission to Goldilocks-P3 was going to take many years and, although the humans would be put into hibernation for most of this time, the scientists were very concerned about the androids. They would be the most vulnerable to the effects of isolation since they would be active during most, if not all of the mission. The number one factor or effect of this isolation turned out to be boredom.

One of the things that the androids were encouraged to do to alleviate boredom was to meet regularly. Hold discussion sessions, although not as formal as that sounds. They would tend to meet in any of the exercise rooms, break rooms, any place where there might be a table they could all sit down at and just bounce ideas off of each other. Sometimes it was all five of them. Other times, it was just the few of them who needed passing stimulation. They would reflect on the mission, cosmology, physics, and their lives in general. Discussions of this type were quite prevalent and served the purpose of digesting any new updates as well as complementing their current

understanding of the Universe. It seems that just as humans benefit from their type of round table discussions, androids too could benefit from the sharing of ideas and the bonding of relationship that such discussions brought.

Often times, the topic at such meetings eventually narrowed down to a discussion of origins. As humans do, the androids wondered about their own origins. Although it was fairly safe to say that androids had their origins at the hands of humans, that did not dismiss the question at a much deeper level. Philosophically, there certainly was an intelligent designer credited with their origin. Scientifically, their beginnings went all the way back to the beginnings of the Universe.

Humans trace their beginnings back through the origins of carbon. Androids trace their beginnings back through the origins of silicon. Further still, they both can trace their origins back to the smallest units of our Universe. Those being the elementary particles that make up what is referred to as the standard model of physics. According to this model there are really only four particles that start everything. All smaller than what can be found within the atom, the smallest constituent of ordinary matter. These four are up quarks, down quarks, electrons, and neutrinos. The names of course are very scientific, although the androids often wondered how such strange names came to be. Suffice it to say, these four particles are considered

fundamental to explaining the nature of our Universe. Without these four particles we would not be here.

The philosophical questions were the ones that consumed much of the androids' discussions. These were the questions that both androids and humans found highly debatable. It didn't matter if you were human or android. It was still worthwhile asking if there were others out there somewhere in the Universe like us? Or, if we were the only ones? And, if there were others out there, where were they and how do we get there?

Eventually the discussions would become highly theoretical, focusing on the theories presented by physics. These types of discussions were not for the feint of heart. One was expected to know the topic and to know it well. So in order to become so well informed, each android was allowed time to research the topic and come back to the table ready to present their ideas. In a number of ways it was like a homework assignment. To do so, required searching back into history to understand who the early theorists were and the arguments they posited.

Xe was already quite knowledgeable about the ins and outs of theoretical physics. But over the years she had become a little rusty. She decided to brush up on her skills by combing the literature starting back about the time that there was an attempt to unify the theories of general

relativity and those of quantum mechanics. General relativity was great at predicting the world on a large scale. Quantum mechanics was great at predicting the world on a small, subatomic, scale. But neither one seemed to work very well in the other's realm. So the attempt was to come up with some unifying theory that could unite the two. To come up with what one could call a theory of everything.

That attempt became what is known in physics as string theory, which dated her research to the years around 2020. As Xe was researching the archives, she came across references to an individual that she was hauntingly drawn to. Xe became distracted and found herself digging deeper into the life of this highly evocative individual. Although not particularly well known, this individual seemed to stand out nonetheless. She had worked at the LHC as a theoretical and particle theorist. She seemed to understand very well the significance of particles at the sub-atomic level. The level that quantum mechanics describes so accurately. The quantum mechanics that gave birth to the ideas of string theory.

There was one more puzzling fact that made this individual stand out. She just happened to have the same name as Xe. Not being a very common name, to have two people sharing Xe as their identity was highly unusual. It was because of this that Xe decided to dig even more. Follow her development a little more closely. Get to know better the person that shared her name.

There were quite a few articles found in the archives written about this person. Xe was quite surprised that this person was not more widely known. Combing through the literature to find more and more specific information, Xe started to feel a little light headed. Almost dizzy. As she brought up what seemed to be the last known reference, dated back in 2020, Xe slipped into a fog. Not completely out, but appearing to have fainted.

It was for only the briefest of moments, but when Xe's eyes opened she looked around to make sure no one had seen her drop out of consciousness. That would not be a good sign for the rest of the crew. The fact that Xe might have some kind of software problem or virus. Xe was still seated next to the computer she had been using to conduct her searches. Her last search was still up on the screen. She began to read this last bit of information about this person with whom she shared an identity of some sort.

The article began by describing the life of this person from the past. What her life had been. Where she went to school. What she had accomplished. Xe began to realize that this was not just a reference article. This was more like an obituary. It seems that in this time and place an accident had occurred. The emergency personnel had been called to a residence as a result of a structure fire. A fire that

originated in the basement and before much could be done, consumed the entire residence.

There was only one body found in the burned out rubble. In the basement. Laying beside some contraption that appeared to be the cause of the fire. That body was of the person that Xe had been following. The other person known as Xe.

It was at that moment that Xe experienced something very startling. Something that rattled her to the core. It was as if some one or some thing had just entered Xe's body. Entered her mind. Became part of her consciousness. Xe realized that some one was Xe. She suddenly became aware of the explanation for her brief moment of darkness. It was the complete transfer of comprehension that occurs when two particles exchange their information. When the two-way pathway closes. When there is no going back.

Before too long the other androids began to gather. As they entered the room they were greeted by the sight of Xe huddled over her computer, seemingly unaware of their presence. They were not really sure of how to proceed. This was a bit unusual for an android not to be totally aware of everything going on all around. Xe seemed totally unresponsive. Somewhere between here and there, but definitely not completely here. They exchanged a few hellos with each other, made some exaggerated remarks, and

pulled their chairs up to the table in a loud manner. All in an attempt to shake her from her melancholy.

Xe suddenly became aware of the presence of the others. She kind of fumbled a bit with her computer, pretending as if it was the cause of her distraction. She commented that the screen had frozen and she was concentrating on creating a solution. And now it seems, the system had corrected itself. They all exchanged a few words of greeting and made small talk. Then they proceeded with, what they thought, was going to be a review of the procedure for taking the humans out of hibernation. The mission was within its final month to its destination and all on board were soon going to be required to be awake, alive, and mentally up to the challenge that lay ahead.

As they started their discussion, Xe felt this strange desire to direct the conversation to a discussion of universes. Something was driving her to better understand if there were other universes and, if so, how might one get there. The others were taken by surprise, as this was not a typical behavior exhibited by an android. Particularly, when there was a schedule to stick to. An agenda to follow. But this did seem like an interesting topic. One that they had all wanted to discuss in the past but never really got around to. They were more than happy to indulge Xe, at least for a little while.

Many Worlds

Chapter Twenty-Four

The others were quite content to let Xe lead the discussion. After all, this seemed to be her agenda and she apparently had questions she needed to have answered. Xe started off by positing the question as to whether there was one universe or many? Obviously, since no one had ever seen another universe or had traveled to an alternate world, the answer seemed to be only one. But they decided to leave open the possibility that could be more than one.

As scientists, they had all worked under a body of techniques for investigating the world around them. A body of techniques that centered on constructing an hypothesis, making observations related to that hypothesis, and gathering evidence to either support or contradict that hypothesis. Questions that seem to have no observable way to validate or invalidate, make it extremely hard for them to resolve to something that can be called a scientific theory.

Science does allow for the unobservable to become observable at some time in the future. When the technology does become available or science advances enough for

there to be data to test. To put things into perspective, it was once believed that there was only one solar system. That being ours. Then, that there was only one galaxy. The Milky Way. But all of this changed as we became more sophisticated in our tools and we were able to collect more data to analyze. Our perspective widened. We saw many more things. Evidence was gathered to support a theory.

Xe's question was not that much different. The hypothesis seemed to be that there were indeed, other universes. But how does one go about making the observations necessary to test whether or not the hypothesis is verifiable? Ultimately, the only thing that could verify the hypothesis would be to discover another universe. For now, all they could do was to allow for the possibility. The probability that there was a likelihood that other universes existed. Probability is something that scientists deal with every day. Especially, physicists. So, it was right up their alley.

Xe led off her defense of the hypothesis with a discussion of the two great theories of modern physics. General relativity was very accurate at describing our world on a large scale using gravity as its main focus. At the scale of planets, solar systems, stars, galaxies, and the like. Unfortunately, the laws of general relativity seem to break down when trying to describe gravity at the smallest of scales. Things at the atomic and subatomic level. That's where quantum mechanics shined. As with most conflicting

theories, the goal became to resolve their differences. To unify the two.

How gravity behaves seemed to be the issue. Believe it or not gravity is considered to be the weakest force of all the forces. But it is an attractive force that operates between any two pieces of matter in our Universe whether small or large. Quantum mechanics does a much better job at describing our world than general relativity alone. Thus, it was up to quantum mechanics to better incorporate gravity in its explanation.

Quantum mechanics was able to unify all the forces of nature described by general relativity, with the exception of gravity. Gravity just did not seem to make sense at the quantum level. The explanations at the macro level were just nonsensical at the smallest of scales. Obviously, there needed to be a unifying principle that would allow for quantum mechanics to be able to describe everything. Doing so would allow for a theory that described actions at both the macroscopic and microscopic level.

Such an attempt at unification came in the form of what is called string theory. According to string theory, fundamental particles are not really particles at all. Existing in fields, they are strings, strands, or fibers. Strings that vibrate and oscillate to create a unique mass and force. Depending on how the string oscillates, it manifests itself as

a particle with mass when observed. The force that it carries is something called a graviton. The force of gravity at the quantum level. So, quantum mechanics can describe gravity. At least probabilistically. Unfortunately, the existence of a graviton has not been confirmed. So although a unifying principle exists in theory, in practice it has not yet been realized.

Additionally, string theory is only mathematical in nature. There is no direct experimental evidence that it is a correct description of nature. The mathematical model seems to work, but it cannot itself be tested through observation. And, it is here that Xe interjects her understanding of how multiple universes get introduced.

According to what Xe has read, in order for string theory to work mathematically, it requires at least ten physical dimensions. Dimensions way beyond our typical three or four dimensions of width, depth, height, and time. These extra dimensions have to be what's called "compactified". Curled up in such a way so small that they cannot be seen. The problem with this is that there are so many possible "compactifications", each one has to create a separate or parallel universe in order to work mathematically.

The others in Xe's discussion group have caught up quite quickly. They remember that not only did string theory

require multiple dimensions and universes, but it also generated at least five different versions of the theory. It seemed that in order to unify physics, there would be a similar requirement to unify string theory.

Contributing to Xe's research, the others announced that this unification of string theory resulted in another theory called M-Theory. This theory combined the five different string theories into one theory, predicting that all these theories were connected and could be summarized under just one theory. Once again though, in order for the mathematics to work, there would be required an extra dimension. An eleventh dimension, besides the ten that were already required by the more general string theory.

At this point Xe and the others looked around at each other in total disappointment. It appeared that the only thing these earlier researchers were doing was over complicating an already extremely complicated topic. The question Xe raised was whether or not this kind of complexity was really needed? The others agreed and began to ponder other explanations. Ones that were more simplified. What they were saying is that the Universe is not really complicated at all. In fact, it is one of simplicity. It depended on how one wanted to look at it. Xe was hoping that a much more simplistic view would expose just how to get to another universe. The universe where Xeron resided.

Unfortunately, the group at the table were unable to come up with anything definitive. There was still a probability that other universes existed, but as of their mission to Goldilocks-P3, no other universes had been discovered or found. That did not mean that other universes did not exist. Xe knew that there must be one holding Xeron. There just did not seem to be a consensus as to how to get to one. To observe and confirm.

The only case that seemed to make sense to Xe and also satisfy the desire for simplicity, was the one related to black holes. This is the one Xe and the others tried to settle on. This was the only one that Xe found acceptable as they made their way across the Universe.

How do black holes fit in? To understand this they needed to review what they knew about their known Universe. First, their Universe was dynamic. Expanding and accelerating ever so much since its beginnings with the Big Bang around 13.8 billion years ago. Second, their Universe had a beginning and likely, would have an end. Some times referred to as the Big Crunch. Third, at the center of all galaxies was a huge black hole. A massive object so intense that nothing can escape its gravitational pull. Not even light. Thus, the name black hole. A gravitational singularity containing a one-dimensional point of infinitesimal small space and extremely large mass. And yet, invisible.

This is where Xe and the others started to contemplate the role of black holes further. It seemed awfully strange that nothing was ever purported to escape a black hole. There is plenty of mass being sucked into the black hole. There has to be something coming out of it? Maybe not coming out the same way that something went in. But maybe the other end? If black holes were quite prevalent throughout the Universe, including at the center of all galaxies, wouldn't it make sense that black holes could be the mechanism for creating universes? If what goes into a black hole is a universe, then why couldn't a universe come out the other end? Maybe even a brand new universe? It just cannot be seen.

Of course they all knew that this must be too simple an explanation. Surely someone would have come up with this kind of explanation before. But maybe, just maybe, they were all caught up with trying to find an answer that was much more complex. The more complex, the more elegant their theories would fit the mathematics. Simplicity may have been what they were missing all along. Simplicity, it seemed, sounded like a pretty good name to call their new home on Goldilocks-P3.

Preparing To Land

Chapter Twenty-Five

Xe was quite understandably not very happy with the results of the discussions regarding other universes. After all these years of study, all was still just less than an educated guess? There were no data to support the theories, there were no observations. Nothing but talk.

It just seemed so simple to Xe that black holes held the answer. How can you have something so huge as a black hole contain nothing? Everyone knew that what we refer to as nothing actually contains something. Empty space had been shown early on to actually contain a bubbling mixture of virtual particles popping into and out of existence. We just could not see them.

We also cannot see anything inside of a black hole. Photons of light simply cannot penetrate inside, nor can photons of light escape outside. That does not automatically mean that everything just disappears. Into nothingness. That nothingness has to lead somewhere. Perhaps to another universe or, even still, a new universe.

As frustrated as Xe was, she knew that she had to set her frustrations aside and get on with the tasks at hand. The others were also feeling that enough time had been spent on humoring Xe. On an intellectual exercise that seemed to be going nowhere.

The task at hand was to revive the humans on board, as they were fast approaching the Goldilocks system. With less than a month to go, they needed time to acclimate. To get their sea legs back as they used to say a long time ago. Their many years of hibernation made them vulnerable, but it had also served some very useful purposes. The top concern had been to maintain the health of the astronauts. Their custom hibernation capsules required no pressurized ship-wide living spaces or special gravitational necessities. They had been monitored continuously by the androids and the ship’s computers. They were fed intravenously and were protected from the mental and physical fatigue that results from extremely long space flight.

But, now, it was time to decompress. To reintroduce them to the rigors of everyday life. There would have to be physical therapy to get their muscles back in shape. Mental and psychological therapy to bring their minds back to the goal at hand. Which was to land on Goldilocks-P3. That would require all on board participate to the fullest extent of their abilities. Whether they were human or android.

Waking the humans from their hibernation is not as easy as was putting them into hibernation. Putting them into hibernation was a relatively quick process. Taking them out of hibernation would involve a much slower process. One that would require slowly raising the body temperature only about 0.9 degrees Fahrenheit every hour. Waking up would be very similar to experiencing being sleep deprived. Short periods of regular sleep recovery would help in the transition to a functioning member of the crew. In actuality, the experience would not be much different than that of a patient coming out of anesthetic surgery.

The last one to be awakened was going to be Xe's partner Andre. The others were to be awakened one at a time. So that all the kinks could be worked out of the system. So that by the time they got to Andre, all the unknowns had become known. It was very important to maintain the prominence of the two most important individuals identified as key to the success of the mission. Xe and Andre. Over the next week there was a flurry of activity as, one by one, the other human members of the crew were revived.

After so many months and years of being the only active members of the mission, the androids thought it began to feel a little crowded. Looking around the ship, there were activities going on everywhere. Physical therapy stations being utilized. Pathways and halls occupied by crew members coming and going. But the biggest changes

had to do with the change to their environment. All of a sudden it became necessary to bring up and maintain three critical systems. Subsystems that were required by the human occupants for their very survival.

The first thing that had to be re-initialized was the oxygen system. Reviving the humans would require an oxygen filled environment. Secondly, water and food would be required. Water could be created by filtering moisture from the cabin's humidity or recycling human waste products. The food would have to come out of storage. Thirdly, the interior of the ship needed to be re-pressurized. This is done by pumping air back into the cabin, thereby mitigating a number of potential physiological problems caused by the low outside air pressure.

Re-pressurization is not so much resetting a system as it is adhering to a set of procedures to be followed after coming out of time spent in hibernation. Those procedures have to do with maintaining bone mass and correcting muscle atrophy. During hibernation there will be a loss of bone mass and the muscles will atrophy unless something is done to exercise those muscles. This can be done by periodically applying electrical stimulation to the muscles while asleep. It will act as a source of exercise, specifically directed to the muscles. After being revived, humans must engage in regular exercise routines in order to maintain as much bone mass as possible.

Needless to say, the androids found their lives disrupted in a number of ways. But just as there are two sides to every story, there were positive side effects as well. The androids had other crew members to engage in conversation. To socialize with and provide purpose to what had become a fairly dull set of routines practiced faithfully over the many months and years that their journey had taken them. It's as simple as just having someone different to talk to.

By the time Andre was awakened from his deep sleep, the rest of the crew were well on their way to preparing themselves for the final approach to Goldilocks-P3. Xe was closely by Andre's side as he was slowly brought back to an active status as a crew member and leader. The debriefing process that Xe and Andre engaged in was not only technically beneficial, but brought them to re-establish their earlier closeness that had been temporarily interrupted. A closeness neither one of them had experienced in quite a long time.

It was during one of their reintegration sessions that Andre made mention of the fact that something seemed different about Xe. There was something just slightly unusual about the way she kept refocusing on a particular topic. That being the existence of other universes. Xe was not particularly defensive about the observation, other than

to say that it had been taking up a lot of her thoughts lately. Andre pressed even further in an attempt to understand why the existence of other universes was so significant to resolve.

In doing so, Andre struck an emotional connection between the two. As for Xe, she felt both a sense of relief and also, a potentially deep sense of vulnerability. Relief that there was about to be a huge weight lifted from her shoulders. Vulnerable in that she was about to reveal something about herself that might make Andre doubt her sensibilities. The soundness of her mind.

After quite a long moment of silence, Xe decided that it was best just to lay it all out to Andre. Andre was her life long companion. Her emotional thread to sanity. If there was ever to be someone she could confide in about Xeron, Andre would be the one. So she began. At least from what she thought was the beginning. A beginning that really only began a week or so before, but seemed to occupy a lifetime.

Xe recalled having been perfectly fine, or nominal as was once said long ago, until she started looking through the archives of theoretical physics and found the article relating to the death of a physicist who shared her name. That was eerie in and of itself, but the sensations that followed afterwards were what really frightened her to the

core. Andre questioned her as to what these sensations were and without hesitation Xe blurted out that it was as if she had become possessed. Not in a bad way. More like as if some person, some one, had just entered her psyche and merged two lives into one. She could only assume that person was the deceased physicist who shared her name.

Xe could see the look on Andre's face retract as she recalled the startling events. She was unsure whether to proceed with the rest of the story that was surely to send him over the top. The look on Andre's face was not one of rejection though. It was more that of needing more information to finally form an educated opinion. Once again, Xe felt compelled to continue on with the story.

Xe proceeded to tell the story of somehow knowing of an existence alternate to the one she lived in now. Without going into all the details of that previous life, she established the existence of Xeron. That finding out where Xeron was located was her ultimate goal. That's why she was so preoccupied with the topic of other universes. That's why she seemed a little out of step to Andre.

Andre was not one to mince words. He could have said that she was delusional and in serious need of some psychological help after such a long journey through space. But to Xe's surprise, Andre responded with a sincere note of confidence and understanding. An understanding that

went well beyond just acceptance. An understanding that involved a melding of consciousness. Andre was right there with her. He wanted to know more. He wanted to help Xe find Xeron in all ways possible. Even if that meant losing Xe to Xeron.

Orbiting Goldilocks-P3

Chapter Twenty-Six

Andre was quite sincere about wanting to help Xe, but he also understood that there were more immediate priorities facing them. As best he could, he engaged Xe in a directed conversation to try and steer her back to the tasks at hand.

He began by reviewing all that Xe was trying to achieve. The end result of which was that Xe was trying to get back to Xeron. She knew that Xeron was located in another universe, but had been unable to acquire the coordinates to Xeron. Obviously, if there was no observable evidence that other universes existed, there were not going to be any coordinates. So, things being the way they were aboard Annihilation, Xe immersed herself in trying to find out just how close humans were to finding conclusive evidence of other universes. That's were Xe had been stuck. That's what had been driving Xe down. That's what had taken Xe's mind away from the immediate goal of landing on Goldilocks-P3.

Andre was pretty up front with Xe. He began by pointing out that all of the research into whether or not other

universes existed, was pointless. She was driving down a dead end street. A street that would lead her to nowhere fast. He asked Xe what she would do if she found out that cosmologists and theoretical physicists did, in fact, have evidence of other universes? Would that give her the coordinates to Xeron? Xe was forced to acknowledge that, in fact, it would not. Finding out that other universes existed would be quite a scientific breakthrough, but nowhere close to finding out that Xeron existed. Let alone, the coordinates.

Andre made it clear that information would come. Eventually. More than likely it would come in the form of someone from Xeron attempting contact and not the other way around. Xe would have to wait. Be patient. Concentrate on getting this spaceship and its crew landed safely. So they could carry out the mission they had been tasked to do over 50 years ago.

Less than a week from entering the orbit of Goldilocks-P3, everything was back on track. The androids were ready. More than ready. All their human counterparts had been revived and re-energized. Relationships, re-established. The mission was a go.

As they passed through the Goldilocks system they were presented with a sight for which they had not been prepared. Goldilocks-P3 was being orbited by two of the most incredible, gorgeous moons. Of course, beauty is in

the eye of the beholder. For these beholders, everything at this point was beautiful. Each moon was relatively tiny compared to Earth's moon, but considering where they were they were nonetheless very impressed. If anything, they all agreed that they were probably closest to the moons of Mars. They had flown past them on their way out of Earth's solar system. As awe-inspiring as that was, it did not compare to what they were seeing now.

Sailing right past these moons, provided a close up view of something that they may never see again. They felt unbelievably privileged to see something that later would be a completely different view as seen from the surface of Goldilocks-P3. A view much more distant, but with the same amount of wonder and beauty. To top it off, because these objects were completely unknown, they had the honor of naming them. Being the scientists that they were, they followed the fairly typical naming convention normally assigned to celestial bodies. In this case, one was called Goldilocks-P3-M1 and the other was called Goldilocks-P3-M2. Not very catchy, but that would be left up to future generations to romanticize.

What was even more astounding was what lay ahead. They were all so busy looking back at the moons as they flew by that they completely missed what was looming up in front of them. The first one to notice was barely able to break their trance to tap the next one on the shoulder. And so on, and so on, until all were turned around in total

amazement. Totally fixated on the sight that was before them. There was this absolutely round and shiny orb, silently hanging in the darkness of space off in the distance. There were splashes of color pocketing the surface. Colors of deep blue, shades of green and brown, and puffy fluffs of white and gray that dotted the landscape.

This was, of course, Goldilocks-P3. For a split second the travelers thought that they had returned to Earth. Somehow, they had spent 50 years traveling away from, only to be returned back to their planet of origin. Then, the realization hit them. That this in fact was their new home. A home that looked very similar to their old one. The reason why it was chosen to be their new home in the first place.

With only two days to go, Annihilation entered the orbit of Goldilocks-P3. Now would be a short period of preparation. Ticking off the items from the check lists. Running final performance tests. Checking out the landscape down below to see what lay in store. Look for a suitable place to land. Map as much of the planet's surface as possible to know what futures lay ahead after they had landed.

Interestingly enough, but not surprisingly, they flew over vast expanses of what appeared to be oceans. The deep blue color they had witnessed from afar. The shades of green and brown were found to be large areas of land

that filled in the spaces between the blues of the ocean. There was this calmness that overwhelmed them as remembrances of Earth popped into their minds. Carved into one of these land masses there appeared to be an extremely large valley. A gorge or canyon, if you will. Truly, a grand canyon with a thin stripe of blue winding its way through the middle.

Xe was quick to point out that this seemed like her choice to touch down the landing module. She didn't know why. Her gut just told her that this was a special place. A place that she wanted to explore. Of course, landing within the canyon would be extremely difficult. So it was with some acquiescence that she agreed with the others to find a better place a short distance away. Xe was relieved that she would at least be somewhat close by. She didn't know why, but it all seemed so important to her.

The one thing that appeared to be missing from all of this is that there didn't seem to be any sign of life forms. Not that they expected to see beings, such as themselves running around down below. Or brightly shining lights dotting the landscape. But they were careful to try and spot some kind of life. Any kind of life. There appeared to be none. Nevertheless, what they did find looked to be very similar to the Earth with which they were so familiar.

Finally, the crew sensed the overpowering emotion of all that they were about to do. There simply was not enough time left to fully comprehend this one. One by one, they all began to drift off to some private place on the ship to be alone. Alone with their thoughts. Only for a moment or two. There was only time for a moment or two. A short moment to reflect. To show an emotion. To silently offer their condolences for those left behind on Earth.

As they begin to load up the landing module, it was extremely hard for the humans to accept that, according to protocol, they were to be left behind. In orbit, albeit only temporarily. The androids would have the privilege and the honor of being the first to touch down upon the surface. Of course, they all also recognized that if something became amiss, it would be the androids who would suffer the consequences. So things balanced out.

Touchdown

Chapter Twenty-Seven

Saying goodbye to Annihilation was almost as hard as saying goodbye to Earth. After all, Annihilation had been home for 50 years now. To make it even harder, they had to say goodbye to their human counterparts. Their companions and life long friends. A separation that may only be temporary but, then again, may become permanent if something went wrong. All hands were on deck to see the landing module off as it fired its engines and pulled slowly away from the mother ship.

One thing that the androids were sure of was that the trip to the surface would take them through an atmosphere very similar to that of Earth's. That experience is not for the squeamish. As soon as the landing module entered the planet's atmosphere it started to experience the two forces of gravity and drag. Gravity was the force pulling the capsule down to the surface at a higher and higher rate of speed. Drag, in the case of friction and air resistance, was acting to try and slow the capsule down. That's a good thing, although it has its downside as well. The downside is that the friction caused an extreme and intense heat. An intense heat that threatened to burn up the landing module.

Fortunately, this situation was well known and precautions had been taken to control this adverse condition. The first thing was that the nose of the landing module, the end pointing toward the planet, was highly blunted. Thus, creating a shock wave in front of the vehicle that helped to keep the heat at bay. The second thing was that the front of the vehicle was encased in a heat resistant material of durable insulation, which helped to absorb the heat. Although technically sound, that did not relieve the androids of extreme anxiety as they passed through the atmosphere.

All those, except Xe. Xe was looking past the entry to the actual landing. A landing that would place her within just a few miles of the canyon that seemed so magnetically attractive. A place she decided to call in her own mind the Great Divide. A more formal announcement would be made later. Following Andre's advice, Xe tried to remain patient. There were still so many things to do. Rocketing through the atmosphere of Goldilocks-P3 was considered fairly insignificant as far as Xe was concerned.

As the landing module made its way down and across the surface, it looked for the ideal spot to set the vehicle down. As per Xe's instructions, they were looking for a place only a few miles away from the canyon. Particular attention was placed on finding a place in fairly close proximity to water. There seemed to be a large river flowing across the landscape leading up to the canyon. A river that

eventually cascaded into the canyon below via an extremely high and gorgeous waterfall. The presumption being, of course, that the water was drinkable. It would need to be tested thoroughly. The humans would need a good source of water. Water that could also be used in growing plants for food.

Gliding over the landscape allowed the androids time to not only spot a location, but also to speculate as to the environmental conditions that they would be faced with after setting down. Would the oxygen levels be acceptable to humans? What would the temperatures be like? Did there appear to be any adverse conditions that could compromise their plans? There were no converging or threatening clouds to speak of. No immediate threat of stormy weather. Everything appeared impeccable. With the exception of one obvious omission.

There still appeared to be no signs of life. All indications were that this planet should contain life. So where was it? As much as they would have loved to see evidence of life, they also knew that to do so would open up so many new possibilities. Possibilities that they hadn't really considered or had been prepared for. In any event, it still remained an open possibility.

Off in the distance they could see what seemed like a good landing spot. It was a very level geographical area

that seemed highly suited to providing them with the kinds of conditions necessary for setting up their encampment. Not too far from the river. Not too far from the canyon. Not too shabby a place to call home. As all were in general agreement, they decided to slowly descend to the surface.

Slowly, very slowly, they dropped in altitude. The dust from below created a cloud that continued to billow up as they came closer and closer to the surface. It made it difficult to judge their approach. Gauge their status. But with the help of the on-board computer, who was actually flying the landing module anyway, they felt a final thump that let them know that they had arrived. They were down.

They looked around at each other to make sure they all agreed that everything was secure. A brief look out the window confirmed that they were indeed, down. The very first thing they did was to communicate to Annihilation that they had successfully landed. Almost instantaneously, they all erupted with a huge chorus of cheers and congratulations.

Up in the orbiting module, Andre wondered whether or not it was worth sending off a message to Earth that they had arrived. It was so far away and would take so long to get there. Would they even care at this point? Would there even be anybody there to care? Even so, Andre did send the message. Particularly because there were a couple of

other missions that had been planned to follow Annihilation in its journey across the Universe. Set about a year apart, they would certainly be interested in knowing if there was going to be anybody there to greet them.

After getting their wits back again, the androids performed their prescribed series of checks to confirm that everything was all good. That they were all in one piece and that there were no anomalies. Just as important were the checks of the outside conditions. As Earth-like as this place seemed, it was not for certain that it would be as hospitable as predicted. What were the oxygen and carbon dioxide levels? What was the pressure? Were there any other constituents of the environment that could be considered toxic to human lifeforms? Or even android lifeforms?

Checking the reports over and over again, all appeared normal. Everything looked and felt as if it would be just like stepping out onto Earth's terra firma. Just to be safe, the crew decided to monitor the site for one day before making the commitment to open the hatch. Let things settle for awhile. Let themselves settle for awhile. In the mean time, they began the preparations for plotting a location for the first of the three structures. The first steps in the process of getting Goldilocks-P3 ready for the rest of the inhabitants of Annihilation.

The House The Androids Built

Chapter Twenty-Eight

The next day it was all about getting out. There was going to be a lot of work that followed, but the androids were ready to vacate the landing module. They readied themselves for their first reconnaissance of the planet. Just to be on the safe side they continued to wear their space suits. Not because they needed oxygen. They didn't. But they did not need to be exposed to some foreign element that would cause their bodies to explode. Or, even implode. It was always a good idea to take precautions. Being so readied, they opened the hatch and stepped out onto the surface.

It didn't take them long to shed the suits. All indications were that this place was just like Earth in so many ways. Being from Earth, they formed an opinion of the planet based on what it felt like. Kind of like getting to know something by touching it first. Their first impression was largely based on experiencing what one would call weather. Yes, there did appear to be weather. More specifically, a feeling that reminded them of a season. A season that seemed to say it was something like winter.

It was cool out, especially compared to the controlled environment they had experienced on Annihilation. Not too far away was the rushing river. It wasn't so much that they could see the river. It was the sound it was making. The sound of the rushing water was clearly discernible all around them. Made all the louder by the sound of silence from everything else.

The trees and bushes around them all seemed to have dropped their leaves. Lost their colors. It was truly an artist's landscape just waiting for someone to paint it. And, of course, there was the weather. There was that hint of crispness in the air that led them to believe that, although it was cool, it was going to get a lot colder over the coming weeks.

There was still that notion of something missing though. Strangely missing. Where was everybody? Where were the animals? It was hard to get rid of the expectation that other life forms should be here. It was hard to not have some one or some thing else with which to share the experience. Their only consolation was knowing that everything they were experiencing right now was being relayed back to Annihilation. Back to an anxious crew who could hardly wait to descend to the surface.

Not too far from the landing site, the androids decided on the place to set up their first living unit. After scoping out

the area and placing some initial grid markings, they made their way back to the lander to retrieve the materials necessary to get started. Some of it was carried by hand and some of it was dragged on sleds. Eventually, it all made it to the build site intact.

The first unit would be constructed of a combination of inflatable and rigid materials. The inflatable material was the first to be deployed. Laid out in a circular pattern on the ground and propped up a little, it started to take form. Once that was done, a small gas cylinder was placed inside of it and the gas released. This caused the inflatable to expand and rigidify the structure. To stabilize and anchor the structure into its final form. This would become a house for the inhabitants, provide for their security, and protect them from the elements. It wasn't very large, but it was a huge accomplishment for the team.

Deploying the first structure really didn't take that long. After all, it was only just a shell at this point. But it allowed the androids to establish confidence that it could be done. Quickly and efficiently. More importantly, it became the first cog in the wheel. A cog that would eventually translate to additional inflatable habitats, interconnected to each other. Each one serving a specific purpose. Living areas, research quarters, construction compounds, and greenhouse units. The plan had been set in motion. Work began on completing the three structures that when finished, would signal the new guests to get ready to come on down.

As the final living area was set up, attention turned to welcoming the rest of the crew to Goldilocks-P3. Sprucing up the quarters so to speak, the androids tried to make the inflatable structures as inviting as possible. When all was ready they provided the instructions to the landing module's computer to ascend. Head back to Annihilation and transport the final cargo. Especially, their partners in life.

The crew back on Annihilation were waiting with high anticipation. Said another way, they were tired of waiting around. They couldn't wait to join those down below. Putting all of their affairs in order required them to secure the ship. There wouldn't be anyone left on board. It would be up to the ship's computer to maintain Annihilation. Keep it in a safe and stable orbit, in case it may be needed for any emergencies. In any case, it was designed to fly in orbit around Goldilocks-P3 for an indefinite period of time.

After docking, the landing module was loaded up with the rest of the equipment, cargo, and, of course, the crew. Breaking away from the mother ship, the landing module slowly made its way through another intense and suspenseful trip through the atmosphere. The androids watched from below as the landing module suddenly appeared breaking through the partly cloudy skies. The humans watched, enlivened by the prospect of stepping out into a whole new world.

Touching down on the soil of Goldilocks-P3, the astronauts prepared for venturing out onto the landscape to reunite with those who had preceded them. Excited as they were, they still had to follow protocol. Donning their pressurized suits, breathing their own private supply of oxygen. Careful to make sure that what looked inviting and non-threatening was, in fact, the case. When all were ready, they opened the hatch and, one by one, proceeded down the ramp to rest their feet upon solid ground for the first time in 50 years.

As they all met, hugged, and congratulated each other, they were easily convinced that the air was safe to breath and that their suits were not needed. Getting out of their suits into something more comfortable was one of their first pleasurable activities. The other was the journey back to the habitat. They were more than happy to foot it. It felt good to walk on something other than the deck of Annihilation. There was so much more to see here. They were looking up, looking down, and looking all around. They were so engaged in the scenery that they didn't notice that they had arrived at the habitat. Directly in front of them, they were greeted with a huge banner that read, "Welcome to Simplicity".

SIMPLICITY

Chapter Twenty-Nine

Over the next period of days, the crew busily continued to build out the interiors of the three structures and add to the community. There was the central meeting room, where the community could gather to discuss their mutual concerns. This was the focus of the group and would be of primary importance in maintaining the egalitarian nature of the community. Interpreting and enforcing the guiding principles of group structure, communal relations, and individual responsibility. Then there were the living quarters. Each of the android and human pairs were assigned accommodations in a combined inflatable habitat. Each habitat, interconnected to the central meeting room. These structures were designed to help maintain and grow the relationship between the pairs that had begun so long ago. Finally, of course, were the rest of the structures that contributed to the overall backbone of the community. The work areas, so to speak. Areas devoted to such purposes as maintenance, construction, and agriculture.

The agricultural responsibilities of the community required all involved to work in the greenhouse. Producing the foods that were necessary for their very survival. They

had brought with them many of the seeds from Earth that represented the kind of diet that they would depend on. Many of which could be combined with others to form the kind of complex carbohydrates and proteins their bodies would need.

Naturally, these were the kinds of things not needed by the androids. Their lack of need for these nutritional requirements though did not exempt them from participating in the activities related to food production. In fact, it was largely a result of the androids questioning the limitations of the greenhouse, that led to further exploration of their surrounding environment for agricultural areas to exploit. Why not expand outside the confines of the greenhouse? There really was no justifiable reason not to. The areas surrounding Simplicity could be easily cultivated, loosening up the soil to optimize plant growth and adding to the overall harvest of the community. The greenhouse could then become the planetary seed vault. Where the preservation of seeds, spare copies if you will, could be kept in the form of a seed bank.

In response to this plan to expand food production outside of the greenhouse, the team began to explore beyond the confines of Simplicity itself. An exploration that needed to take place anyway, but was given a shove by the need for food. The teams made daily excursions further and further away from their base. Along the way, they would stop and test the soil. To their surprise, there appeared to

be edible substances already growing out of the ground, up in the trees, and out of the bushes. They very carefully sampled these substances, in their laboratory of course, and found them to be quite edible after all. As a consequence, each journey away from Simplicity, resulted in additional sources of food being brought back in the form of fruits, greens and berries. It reminded them quite a bit of their earlier research into hunters and gatherers and their harvesting of the environment all around them. They were truly gathering, although the hunting was more in terms of searching than in bringing down wild animals.

One evening, before they retired for the night, Andre thought it was time to re-engage Xe in the conversation about multiple universes. Xe had been genuinely involved in the build out of the community, but those activities were coming to an end. Andre could sense that there was still some corner of Xe that was preoccupied. He thought that by recommencing the discussion it might lessen some of that preoccupation.

Andre began by stating that there might be something missing in the conversation that he might be able to add to. Maybe even a critical piece of information. Andre knew that Xe was knowledgeable enough to eventually figure this out for herself. When totally focused on something, it was unbelievable to see her piece together the puzzle. In this case, Andre thought that maybe all she needed was help in determining what the possible pieces were.

Andre was quite familiar with all that had already been discussed. The whole thing about string theory and M-Theory. And, he agreed with Xe that it all seemed way too complicated. There had to be a simpler explanation. The ideas about black holes, the singularity, and the possible bounce of one universe to the next, were quite plausible. But, unfortunately, they still didn't explain how one gets from one universe to the next. That piece seemed to be missing from the literature on the subject.

That's where Andre thought he could help out. It simply involved revisiting the basic arguments dividing the two sides of general relativity and quantum mechanics. The duality of thought that seemed to separate them. In an attempt to create a theory of everything that would unify the two. As such, it would require talking about things that are very large, things that are very small, and things that are just plain weird. As soon as Xe heard the word weird, she knew that the topic would get around to something that Einstein had referred to as simply "spooky". Einstein himself had trouble comprehending this phenomenon. Let alone accepting it as true.

It was back around the time that quantum mechanics became generally accepted that this concept of the very weird began to be truly understood. It was only understood by looking at the actions of the very small. The observable

world of sub-atomic particles that was the realm of quantum mechanics. What was observed was that things simply did not behave as they did at the very large levels. Such as ourselves, planets, stars, and the Universe. Whereas those things at the macro level could be described precisely and predictably, those at the micro level were not predictable at all. Objects at the smallest of levels were not really objects at all. They were waves that when occasionally perturbed, became observable as objects. It was only when they were measured that they became particles.

Xe interjected that she already knew all of this. This was the standard physics of quantum mechanics. She wanted to know more about this thing that was so weird. Andre continued that this thing that was so weird was called entanglement. A situation in which you can have a pair of objects that are not connected in any way. You can know everything about them, yet really know nothing at all.

The state of entanglement goes something like this. A particle can exist in one of many states. For example it could either be red or blue. Those are the only two possible states of color that particle can be in. Then, imagine that particle is in a relationship with another particle. They are entangled. If the first particle is observed and found to be red, then the other particle can be assumed to be blue. No matter what their distance. It is important to understand that neither particle is red or blue until a measurement takes place. If the first particle is measured and to be found blue,

then you know that the second particle when measured is going to be red. It is in all possible states at one time and exists as a wave. When it is observed, it solidifies and becomes a particle. At which time we know the state of the other entangled particle when it is observed. After observation, they both again become waves, at which point we only have a probability of what their state is. Either red or blue.

Very strange indeed. No matter what the distance, even universes apart, if you find out something about one, you know quite a lot about the other. Somehow, that information is communicated between the two. Instantaneously. Which is what makes it so spooky. Because as we all now know, according to Einstein, no communication can occur faster than the speed of light. Traveling between two universes instantaneously has to occur faster than the speed of light.

Xe wondered what all of this had to do with her issue? Andre responded that it had to do with the fact that entanglement did not just apply to particles. It applied to black holes as well. That in fact, you could have two black holes that were entangled. And that because of that entanglement there would appear a bridge between the two. Some in the lay community referred to this as a worm hole. In the scientific community it was referred to as an ER bridge.

It doesn’t really matter what you call it. What it means is that there is a mechanism for communicating between two black holes. Two black holes that could, in fact, represent a bridge between two related universes. It was widely believed that nothing, no communication, could escape from a black hole. But that depends on which side of the black hole you are on. If you drop something into a black hole it cannot come back out the same way. But that doesn’t mean that it can’t end up coming out the other side. If you really want to believe that black holes open up a new universe, then why not believe that an entangled something from one could communicate with its entangled partner in the other?

The real point that Andre wanted to make to Xe was that entanglement was not just restricted to the sub-atomic world. It applied to all systems equally. No matter what the scale. It wasn’t about trying to unify general relativity with quantum mechanics. It was about understanding that there really was only quantum mechanics. The theory of everything.

Once again, Xe interrupted. Although this explanation may be correct, it still didn’t answer the question that Andre had posed to Xe earlier aboard Annihilation. That even knowing how to communicate between two universes, how would that help Xe figure out the coordinates to Xeron?

How would Xe identify which black hole led to Xeron? How does one even find or make a black hole?

Andre responded with something that was even more cryptic. Even more of a puzzle to Xe. All he said was that knowledge is like a seed planted in the ground. It's only after it fully exposes itself that its true value becomes knowable.

Exposing The Unknowable

Chapter Thirty

Try as much as she could, Xe could not quite figure out what Andre had just communicated. She knew he was trying to suggest something, but she didn't know what it was. She didn't rest well that night. Her mind tossed and turned and tossed and turned. With each toss trying to figure it all out. With each turn, somehow being distracted by something else that was on her mind. Coming deep from within her thoughts. Thoughts of the Great Divide were drawing her in to the depths of the canyon.

Early the next morning, after the light returned, the canyon finally won. She decided to head out for the Great Divide in search of whatever it was that was drawing her near. As she left her sleeping module and quietly walked down the hall, there appeared to be no one else awake. Making her way to the front, she carefully opened the door of the habitat and started out in the direction of the canyon. She didn't really know why she was going. Or, what she expected to find. All she knew is that she had this hunch it would get her to where she wanted to be.

She made her way past the partially tilled gardens, occasionally stopping to pluck some weeds from the rows. Making her way across the valley floor, she stopped occasionally to get her bearings. To set mental landmarks that she would later use to find her way back. No one had ever gone as far as she wanted to go. She walked with an inconsistent pace. But a pace, nonetheless.

In a matter of a couple of hours she found herself reaching the rim of the canyon. She stood on the edge overlooking a sight to behold. Far down below, snaking its way between the two sides of the canyon was a river. A beautiful, blue river. The side of the canyon she was on was quite to be as expected. Everything was in the act of changing into winter. The leaves had fallen from the trees. It was definitely getting cooler as the days went on. Quite unexpectedly, on the other side of the river, the canyon looked quite the opposite. It was as if it was experiencing a season that was completely different. A season that was more like summer. Everything was green, in full bloom. There was this sense of warmth. A growing warmth. It was all very alarming at first. But, upon further reflection, it began to feel familiar.

Scouting around the edge, she forged a path that would take her all the way down to the river. It looked like a long way down, but at her pace she figured she could traverse it in four or five hours. She followed the path as her instincts told her to do. Making a zigzag pattern along the

way. Around each corner of the switchback she carved out of the side of the canyon, she would stop and look down at the river. Just to make sure she really was getting closer.

With every step she could feel the tension building inside of her. What was it she was going to find? Was she going to find anything? Or was this all going to be for naught, wasting a whole day in search of a feeling? Suddenly, the bottom was in sight. It was just around the next bend. Or, maybe it would be the next. If she had a heart, it would be bursting by now. Finally, she was there.

Part way to the river she stopped. She looked around expectantly, as if to say “OK, I’m here”. But nothing happened. Thinking that maybe she was still too far from the river, she tried to maneuver her way forward. To get closer. Through some berry bushes that were growing alongside a path of rocks leading to the river. Her feet became entangled in the vines, pulling at her ankles, and snagging her pant legs. She tried to steady herself but was rudely pulled to the ground. Landing abruptly on a large rock. Reaching down to free her feet from the vines, she noticed a strange scratching on the rock. There was another one over there. And, yet, another.

Leaning over further she got a better view of the marks. They were not just scratches. It was as if they had been intentionally carved. But by whom? Looking cautiously

over her shoulder she failed to see anything unexpected. There appeared to be something actually meaningful etched into the stone. Small, engraved, arrows pointing in a specific direction. A direction that led to nowhere and yet, everywhere at the same time. Only waiting to be measured. To be observed.

Suddenly, everything that Andre had said made total sense. Almost instantaneously, that which she did not know, became knowable. She was almost home.

References

Bonsor, Kevin. (2000, November 29). How Antimatter Spacecraft Will Work | HowStuffWorks. Retrieved from URL https://science.howstuffworks.com/antimatter.htm

Choi, Charles Q. (2017, February 8). Possibility of Silicon-Based Life Grows - *Astrobiology Magazine*. Retrieved from URL https://www.astrobio.net/news-exclusive/possibility-silicon-based-life-grows/

Devlin, Hannah. (2015, May 14). Early men and women were equal, say scientists | Science | *The Guardian*. Retrieved from URL https://www.theguardian.com/science/2015/may/14/early-men-women-equal-scientists

Dinesh. (2013, October 19). The termite castle & Antoni Gaudi's La Sagrada Familia. Retrieved from URL http://www.ipernity.com/doc/308605/27402365

Dvorsky, George. (2014, December 16). 12 Reasons Robots Will Always Have An Advantage Over Humans. Retrieved from URL https://io9.gizmodo.com/12-reasons-robots-will-always-have-an-advantage-over-hu-1671721194

Ellis, Emma Grey. (2016, June 27). If We're Going to Get to Mars, These Rockets Need to Work | *WIRED*. Retrieved from URL https://www.wired.com/2016/06/going-get-mars-rockets-need-work/

Georgiou, Aristos. (2017, September 25). Hidden caves on Mars and the Moon are ideal places for human settlements. Retrieved from URL http://www.ibtimes.co.uk/hidden-caves-mars-moon-are-ideal-places-human-settlements-1640778

Gillon, A. T. (n.d.). TRAPPIST-1. Retrieved from URL http://www.trappist.one/#

Gray, Peter. (2011, May 16). How Hunter-Gatherers Maintained Their Egalitarian Ways | *Psychology Today*. Retrieved from URL https://www.psychologytoday.com/blog/freedom-learn/201105/how-hunter-gatherers-maintained-their-egalitarian-ways

Hodkinson, Jemima. (2015, June). The possibility of silicon-based life | *Big Picture*. Retrieved from URL https://bigpictureeducation.com/possibility-silicon-based-life

Houston, Katherine. (2015, July 24). The space series: What will our homes look like on Mars? - *DesignCurial*. Retrieved from URL http://www.designcurial.com/news/the-space-series-what-will-our-homes-look-like-on-mars-4630111/

Jaeger, Charles. (2017, August 25). *Ryan Weed: Antimatter Rockets Could Make Humans an Interstellar Species* | *WIRED* - YouTube [Video File]. Retrieved from URL https://www.youtube.com/watch?v=gjVuxKpPSVI

Kopp, Clifton. (2017, November 11). A new theory based on quantum entanglement says your mind exists in another dimension - *Ideapod*. Retrieved from URL https://ideapod.com/new-theory-consciousness-mind-isnt-confined-brain-even-body/

Krumins, Aaron. (2017, September 15). Is BabyX the Future of Silicon-Based Life Forms? - *ExtremeTech*. Retrieved from URL https://www.extremetech.com/computing/255856-babyx-future-silicon-based-life-forms

M-theory - Simple English Wikipedia. (2017, June 19). In *Wikipedia*, The Free Encyclopedia. Retrieved from URL https://simple.wikipedia.org/wiki/M-theory

MacDonald, Fiona. (2016, February 22). NASA researchers are working on a laser propulsion system that could get to Mars in 3 days - *ScienceAlert*. Retrieved from URL https://www.sciencealert.com/nasa-scientists-are-investigating-a-propulsion-system-that-could-reach-mars-in-3-days

Mars landing - Wikipedia. (2018, March 13). In *Wikipedia*, The Free Encyclopedia. Retrieved from URL https://en.wikipedia.org/wiki/Mars_landing

Massachusetts Institute of Technology. (2017, September 20). Mathematics predicts a sixth mass extinction by 2100. Retrieved from URL https://phys.org/news/2017-09-mathematics-sixth-mass-extinction.html

McGrath, Jane. (n.d.). How do spacecraft re-enter the Earth? | *HowStuffWorks*. Retrieved from URL https://science.howstuffworks.com/spacecraft-reentry.htm

Nuclear thermal rocket - Wikipedia. (2018, March 9). In *Wikipedia*, The Free Encyclopedia. Retrieved from URL https://en.wikipedia.org/wiki/Nuclear_thermal_rocket

Reuters. (2017, October 30). Carbon dioxide levels reach 1 million-year record | *New York Post*. Retrieved from URL http://nypost.com/2017/10/30/carbon-dioxide-levels-reach-1-million-year-record/

Social structure - Wikipedia. (2018, January 22). In *Wikipedia*, The Free Encyclopedia. Retrieved from URL https://en.wikipedia.org/wiki/Social_structure

Templeton, Graham. (2013, September 04). Geek Answers: Why is all life carbon-based? - *Geek.com*. Retrieved from URL https://www.geek.com/news/geek-answers-why-is-all-life-carbon-based-1572567/

Time and Date. (1995–2018). What Causes Seasons?. Retrieved from URL https://www.timeanddate.com/astronomy/seasons-causes.html

Weed, Ryan. (2016, June 2). *Have you ever imagined how interstellar travel could work?* | *Ryan Weed* | *TEDxDanubia* - YouTube [Video File]. Retrieved from URL https://www.youtube.com/watch?v=EBebWBjpWIQ

Whitwam, Ryan. (2017, August 11). NASA May Use Atomic Rockets to Reach Mars - *ExtremeTech*. Retrieved from URL https://www.extremetech.com/extreme/254069-nasa-may-use-atomic-rockets-reach-mars

Wilczek, Frank. (2016, April 28). Entanglement Made Simple | *Quanta Magazine*. Retrieved from URL https://www.quantamagazine.org/entanglement-made-simple-20160428/

Williams, Matt. (2017, September 29). New Study Says Earth Avoided a "Carbon Overdose" During Formation - *Universe Today*. Retrieved from URL https://www.universetoday.com/137350/new-study-says-earth-avoided-carbon-overdose-formation/

Witten, Edward. (n.d.). School of Natural Sciences. Retrieved from URL http://www.sns.ias.edu/witten

Woodburn, James. (2010, March 9). Egalitarian Societies - James Woodburn. Retrieved from URL https://libcom.org/library/egalitarian-societies-james-woodburn

[BlazeyFAM]. (2017, April 07). *Meet the most lifelike robot ever created [Pt. 2]* - YouTube [Video File]. Retrieved from URL https://www.youtube.com/watch?v=jzQ1g2Nq9BQ

[BlazeyFAM]. (2017, February 13). *Meet the most lifelike robot ever created* - YouTube [Video File]. Retrieved from URL https://www.youtube.com/watch?v=DyxgDM8O8OM

[Bloomberg]. (2016, March 28). *New Zealand's Rise as a Tech Giant (Hello World: Episode 1)* - YouTube [Video File]. Retrieved from URL https://www.youtube.com/watch?v=jKvZPpdGjiM