

# The Matterhorn Paradox

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**Charles deAnne**

*Gary and Deanne Johnson*

# The Matterhorn Paradox

Charles deAnne

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## DEDICATION

In memory of Ensign Mike Nickel, USN

A life cut short by a drunk driver



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## PROLOGUE

Stockholm, December 11, 1965

Richard Feynman's Nobel lecture (an excerpt):

*...I received a telephone call one day at the graduate college at Princeton from Professor Wheeler, in which he said, "Feynman, I know why all electrons have the same charge and the same mass." "Why?" "Because, they are all the same electron!" And, then he explained on the telephone, "Suppose that the world lines which we were ordinarily considering before in time and space—instead of only going up in time were a tremendous knot, and then, when we cut through the knot, by the plane corresponding to a fixed time, we would see many, many world lines and that would represent many electrons, except for one thing. If in one section this is an ordinary electron world line, in the section in which it reversed itself and is coming back from the future we have the wrong sign to the proper time—to the proper four velocities—and that's equivalent to changing the sign of the charge, and, therefore, that part*

*of a path would act like a positron." "But, Professor," I said, "there aren't as many positrons as electrons." "Well, maybe they are hidden in the protons or something," he said. I did not take the idea that all the electrons were the same one from him as seriously as I took the observation that positrons could simply be [represented as] electrons going from the future to the past in a back section of their world lines. That, I stole!*

This story is based on the premise that Professor Feynman could have just as well omitted the two words in brackets.

## Chapter 1

Nand crossed the thin boundary between being and not being. A brilliant light shattered the void. Splitting, two lights spiraled outward, streaming brilliant wakes of jagged fragments. Pure, vivid colors formed fractal patterns. Spirals within spirals, small swirls feeding on larger swirls. Shapes emerged and morphed, becoming more complex. Simple geometric solids mutated rapidly: triangles into rotating tetrahedrons, rectangles and polygons into spinning geodesics.

The scene expanded and contracted simultaneously, spiraling outward while receding. Geometric objects were replaced by more organic structures. Surfaces warped and spun and twisted into tunnels and knots.

Now the surfaces were developing their own fractal geometry, quickly evolving serpent-like scales. Twisting, slithering, intertwining; each in turn lost its identity as the entire mass receded. Each mutation brought forth new, higher-order, more complex organic forms.

Strangely familiar organisms appeared—receding as they multiplied: tens, hundreds, thousands, merging into a single mass of indistinguishable entities before shrinking back into the black void from which they came.

Silent voices beyond language—knowledge and understanding flooded Nand’s consciousness.

Now a feeling—a feeling of being watched.

#

Nand awoke to a more stable reality. Self awareness started to form. *Where am I? What am I?*

Opening her eyes, Nand reacted with slow reflexes to painfully intense light. Seven lights, six equally spaced around one in the center, had already etched their images onto both retinas. Even with eyelids clenched, the two overlapping hexagons of deep purple spots persisted, floating against a bright red background.

Nand played with the phantom spots, focusing on one, then another. Each spot she tried to examine caused the whole pattern to slew rapidly to the edge of her field of vision. She entertained herself this way until the after-images of the bright lights began to fade.

Nand tried again, this time squinting to shield her sensitive eyes from the light. She focused on the support structure without looking directly at the light. The light was suspended above her on long shiny beams—the beams connected by joints, which looked like they could swivel and bend at any angle. As she realized the light was designed to move and aim in any direction, she wondered who—or what—had designed this strange light and why it was focused on her.

## MATTERHORN PARADOX

Each new fragment of awareness led to a new question—  
each question to new awareness.

*Faces looking down at me— faces mostly covered with  
white material, both above and below a pair of eyes. They're  
watching me. Are they friendly?*

*I feel naked under crisp fabric—I am naked—completely  
vulnerable—helpless. Nand's eyes closed.*

#

Nand was now a newborn baby. The light, the faces, the fear—all  
vaguely familiar. She relived her past, rebuilding memories in  
chronological order, each successive layer wrapping like a shell  
around the previous one.

Now a toddler in her bed, Nand didn't want to sleep—too  
many new and wondrous things she would miss out on. Her bed  
had tall sides of vertical bars and soft toys scattered around. *If I  
stack my toys, I can climb them and maybe get my leg over the top.  
Success! Free to explore.*

Her bed was different now. Papa had fastened a panel on  
top so she couldn't climb out, but one side could still be lowered.  
She studied the locking mechanism—two spring-loaded pins that  
Papa pulled on before lowering the side. *The latches are at each  
end—too far apart to reach both at the same time. Wait, if I can get  
one end unlocked, I can push it so the pin won't go back in its hole.  
Now I can work on the other end. Free again!*

Nand loved the escape as much as the freedom. It gave her a sense of power and control—a feeling in pitifully short supply for a child only two orbits of age. *Nothing can cage me! I can break out of anything.* From that time on she would scan for security weaknesses everywhere she went. Picking locks and cracking codes became her hobby and her obsession.

Nand heard Papa's voice. "Look for the easy answer, Nand." He had just finished a magic trick. Papa loved magic and never told his secrets. He always made her figure it out for herself. When she did, he never showed her the trick again.

#

*Nand! My name is Nand! The realization snapped her back to the bright light, the antiseptic smell, and the masked faces surrounding her. If these observers meant me harm, would I still be alive? My nose and mouth are covered by a cup made of soft, pliable material. How am I able to breath? There's a flexible tube suspended from a hook at the top of a vertical pole.*

Nand's mind raced to make sense out of her situation. *Is the tube connected to the cup? Are my hands restrained? I'll lift my left hand and try to touch the cup. Fascinating! When I lift what should be my left hand, my right hand rises. I'll try moving it to the left. It moves right! I'll try right. It moves left! OK. Stop thinking left / right. Start thinking closer to the cup / further from the cup.*

## MATTERHORN PARADOX

After a few seconds, Nand discovered she could manipulate her right hand towards the cup quite naturally. *Yes, the tube is connected to the cup. This is why I can breathe. They are keeping me alive, but for what purpose?*

She experimented with her left hand, first by pretending it was her right hand to get it started, then maneuvering it towards the cup, concentrating only on reducing the distance between her hand and the cup. Soon she was able to manipulate either hand, putting them exactly where she intended.

Nand's awareness that she was human and female gave new urgency to the question of what her observers were. *Definitely primates. Their eyes look almost human—a bit small perhaps.*

Voices. Her observers. A language she understood—not her first, but one she must have studied. Phrases echoed back her own thoughts: “Definitely a primate. Her eyes look almost human—much too large, of course.”

Nand decided. *Yes, humans. They’ll know about pain. Will they feel empathy? Are they female or male?* She was hoping for female.

She examined each pair of eyes, trying to read the thoughts behind them. She saw curiosity—a little apprehension, if not fear. She saw no malice or aggression, nor the kindness and understanding she was hoping for. *Male. All of them.*

Scanning again, the eyes watching her, she dwelled on the pair above the uniformed figure with the name tag “Dabney.” The youngest of the four, he had friendly, sympathetic eyes—wider set and slightly larger than the others. *What is it I’m feeling? A connection? Does he feel it too?* Focusing on Dabney’s eyes, she felt herself relax. Nand fell back into her past.

#

Papa had a long string tied in a loop. He put it behind his head with a finger of each hand inside the loop, pulling it tight. He jerked on the string a few times, and then it was in front of his neck, like it had cut all the way through.

“What would be easier, Nand? Pulling a string through my neck or tricking your eyes?”

Now Papa was putting a small object in one ear with one hand and pulling it out of the other ear with the other hand.

“What would be easier, Nand? Pushing something through my head or tricking your eyes?” It was very strange. Everything was as vivid as if it were happening right now, but she was observing from a more mature perspective.

Papa pulled the stem from a vishnya, the small red sour fruit with a hard seed inside. He put the stem in his mouth and, in a short time, after moving his jaw and tongue in all kinds of contortions, he pulled the stem from his mouth, tied in a knot. Not

a loose knot either—it had been pulled tight. Nand had never figured that one out and had tried hundreds of times. All of a sudden she got it.

*I know how to tie a vishnya stem in a knot with my tongue!  
I can't wait to show Xor. My baby brother is Xor! I remember  
Mama and Papa and Xor. Mama has another name—Gluon—  
that's what everyone calls her. They call Papa Professor Argon.*

#

Xor had a toy spaceship—it was almost a quarter the size of his body. The door of his spaceship could be opened, and he was sure he could fly it if he could just get inside.

“Papa, Xor is trying to get in his toy spaceship again. He keeps trying over and over. Sometimes he gets his foot stuck, and it hurts him when I help him. Shouldn't we tell him that it's impossible?”

“No, Nand. Never tell him that. He might, in the future, find a way to make his body smaller, or his spaceship bigger, or he might decide on his own that it's impossible. If he does that, Xor, like us, will limit his imagination to what he thinks is possible.”

It was understandable that Xor would think his spaceship could fly. Uncle Cray had built it for him. He had duplicated every detail in miniature. Uncle Cray, a space shuttle commander, had taken both Nand and Xor in the simulator many times.

Looking inside his toy ship through the windows to the command deck, it looked exactly like the simulator. *Why shouldn't it work the same way?*

#

Salty drops formed in the corners of Nand's eyes. She felt cold droplets creeping down her temples towards her ears and she heard one of her observers. "I think she's crying."

Nand couldn't make sense of her strange mixture of emotions. She had a great admiration and love for Uncle Cray—but at the same time a great anger, and along with the anger, guilt about her anger.

In the next instant, a few hundred thousand more neurons found their connections. It all came back in a flood of sadness and remorse.

Uncle Cray and Papa worked together. Cray was the shuttle commander and Papa was the science officer. On their last mission together, Uncle Cray had come back without Papa.

Everyone said Papa was a hero—he had saved the lives of the entire crew. There was something about an antimatter propulsion system they were testing. Papa had gone to the propulsion pod to check out a problem—a thermal runaway that would destroy the ship. Papa had disconnected the pod and fired its

thrust motor. The pod had exploded far enough away from the ship that it was not destroyed, but close enough to cause serious damage.

When contact was lost with the ship, everyone had blamed Cray. Nand felt again the embarrassment and humiliation. She could hear the whispers as if she were back in school. Her uncle had gone crazy, they said—deliberately crashed the space ship. They had examined the recordings from his past simulator sessions. He'd had a habit of inhibiting the auto-flight system and putting the ship in dangerous situations. They'd said he was practicing ways of crashing. There was a girlfriend of Cray's that said he had told her he was going to be famous.

*I wonder if anyone ever told Cray what they had said about him? Probably not—they would have been too embarrassed—I know I was.*

After he had brought the spaceship back, of course, no one had blamed Cray except Nand, and, as she saw clearly now, Cray himself. Secretly she wished that it had been the other way around—that Papa had returned without Cray. Every time she had these thoughts, however, she was overcome with guilt for wishing her uncle dead. Then her mind would twist things around until she blamed Cray for not going out to the pod instead of Papa. Everyone had thought Cray was the only one who could have piloted the ship back to Z504 in its crippled state.

*Papa could have done it—I know that—and Cray does too. Yes, Z504 is my home planet. The question is, where am I now?*

#

Nand's memory continued to rebuild her past in chronological order. With no perception of the current passage of time, Nand relived in a flash the darkest two orbits of her life.

Mama seldom got out of bed, and Nand became Xor's de facto Mama—and Mama's caretaker too. *I was only twelve orbits when Papa died and Mama went to bed. Xor was three.*

The next two orbits were a blur to Nand. *When was it that Mama got out of her bed?* It all came back.

Xor had run away. It was the second orbit after the accident. Xor had gone to school crying and couldn't stop. A teacher, meaning well, had told him that his Papa was in a better place. Xor had gone to find him.

Nand was frantic when he didn't come home from school. She went to Mama, and Mama got out of bed and took charge.

Mama and Nand rode the school transporter along the same route that took Xor to school. As soon as she saw it, Mama knew where they would find Xor. The transporter went along a fence—a high fence made from strong extruded metal strands, interwoven in a zigzag pattern. On top were coils of similar strands with sharp barbs; on the other side, an expanse of hard, smooth, grey surface—in the distance a space shuttle in position for launch.

The leading edge of night had chased the setting sun below the haze, leaving a horizontal blood-red wake. Silhouetted against the bright horizon, a disk-shaped craft. It was dark and void of detail, save its flashing strobes. Just above, in the now purple darkness, the grinning thin crescent of Big Moon appeared briefly for this first night after its invisible syzygy.

Mama directed the driver to the main access gate. “There’s no way a five-orbit-old kid could get over that fence!” the guard was saying.

“His father was a shuttle science officer. He could have taken a portable cutter from...” Gluon interrupted herself as she stared at the shuttle. Flashing red lights rimmed its circular edge. “Is there a launch scheduled for today?”

“No, they’re just getting ready for one tomorrow.”

“Well that ship has its rotating beacons on! It has been switched over to ship’s power.”

The guard turned to see what she was talking about. “I’ve never seen that before—we’re always inside the bunker for a launch—just in case something goes wrong.” The guard was processing this new information. He glanced at the heavy metal door covering the entire vertical wall of a small triangular structure just a few paces to his left. The top of the structure sloped steeply down behind the door, covering the stairs leading to the maze of underground tunnels with access to any part of the launch complex. He appeared to be contemplating running towards it.

This female stranger obviously knew more than he did about the launch protocol. Knowledge meant authority. Access to sensitive information was only given on a need-to-know basis. *Security through obscurity*. He weighed the consequences of his choices: giving access against his standing orders or denying access, gambling that she was wrong or didn't have proper authority.

"Trust me, he knows how to launch that thing! He's been in the simulator many times."

The guard's decision process suddenly flipped in Gluon's favor. *Access to the simulator is one thing, but to take kids in must require a rank that I'm not going to mess with*. "OK, go check it out."

Gluon turned to the transporter driver. "As soon as the gate's high enough, get us over to that ladder to the personnel access bridge."

The driver complied. As the angle of the orange and black diagonally striped bar cleared the transporter, he accelerated smoothly towards the shuttle. Nand stood just inside the open door, ready to jump off. She pulled on a shiny vertical bar as her body resisted the increasing velocity of the transporter. She heard the low growl of the magnetic motor.

Nand had no awareness that what she was now experiencing had actually happened long ago.

## MATTERHORN PARADOX

After closing half the distance, the driver reversed the acceleration. The growl was the same, if not louder, but Nand was now pushing on the smooth shiny bar to keep from falling forward.

Nand jumped from the door before the transporter stopped. She ran the short distance to the ladder and took it two rungs at a time. At the top she found herself facing a security door with a combination keypad—five buttons forming the corners of a pentagon. Three of the five were more worn than the others.

Nand quickly did the math—*if it's a three-button code on a five-button pad, there are a hundred and twenty-five combinations, but only six combinations if the three buttons are known. But what if it's a four button code? Is there one that looks more worn than the others?*

Then she saw it—the edge of a small sheet of thin polymer in the gap between the door and its frame. She pulled on the door and it opened; the thin sheet was stuck to the door frame and covered the hole that accommodated the bolt. It was the cover of Xor's notepad. *So that's how he got in. He must have hid until one of the ground crew went through the door, then scrambled up the ladder and put this in the door to keep it from latching. Clever brother.*

As Nand entered the square tube, a horn started beeping. Was it another security sensor she had tripped? Then she saw that the tube was telescoping towards her, away from the open shuttle

hatch. She ran towards the shuttle and leaped across the full stride gap that had opened between the soft bumper at the bottom edge of the bridge and the hatch.

Nand lost her balance as she landed, going down on one knee to keep from falling. The pressure hatch hissed as it closed behind her. *He's ready to do it!* Nand scrambled to the command deck and found Xor standing in the pilot's seat, his fingers on a shiny switch on the overhead panel. A bright red cap that protected the switch from accidental movement had been flipped to its open position. "Xor, no!"

"Nand, let's find Papa."

"We can't, Xor—not this way." Her heart was pounding. "We'll be killed and Mama will be alone. She won't have anyone to take care of her."

Xor lowered his hand and Nand ran to him and hugged him. With Xor standing on the seat, they were the same height.

#

All of Nand's memories came back in a sudden rush. She opened her eyes to an abrupt awareness. Bright lights—naked—male observers—a more primitive time—a more primitive planet.

Nand felt her face flush with sudden embarrassment. *Perhaps they won't notice.* Through squinted eyes she scanned their eyes. Which one had removed her flight suit, peeling open the

micro-hook strip from the micro-loops that ran down the full length of her torso centerline? *Of course—Dabney!*

Nand looked at her observers with renewed curiosity. Even though their eyes were smaller than hers, she knew they were her ancestors. This was why she was here. Sometime in the distant future of this planet, Earth, there would be an expedition to colonize her planet, Z504. These were dangerous times, however. Without intervention, these humans would destroy their future—and her past—her very existence.

It felt so weird. The weirdest part was that she had not prepared herself emotionally. She hadn't given the slightest thought to what this moment would feel like—being examined by humans who are over a hundred generations in her ancestry. Given the binary expansion of her parental tree, it was probable that almost everyone now alive on Earth had contributed some small part to her genetic code.

*Do these observers—my ancestors—find me attractive, or grotesque?* Nand realized she was the product of countless mating decisions—each generation putting its own indelible stamp on her helical biological instructions. *Over a hundred generations separate me from these observers. With ever-changing standards of beauty and desirable traits—some adopted out of conformance, others out of rebellious defiance—will these Earth men approve of the path human evolution has taken?*

Another thought crossed her mind, followed by a new source of embarrassment. She imagined a role-reversal. What if she were the hundredth-generation ancestor? Would she find these humans attractive?

The thought stirred a flurry of electrical activity in a small cluster of neurons deep in a primitive part of her brain—a part that knew nothing of social norms or cultural taboos—a part that knew only of hunger, and of that, only two types. Nand felt the tips of her breasts pushing up against crisp fabric. She tried to take control of her body and will her breasts back to a softer state. They stubbornly pressed up harder.

*Perhaps they won't notice.*

Nand raised a hand to shield her eyes from the painful light. The observer, Dabney, spoke. “The light—I think it’s too bright for her.”

Nand’s mouth felt like it was full of sand. She pushed a dry tongue forward to pry her glued lips apart. Through the mask covering her nose and mouth, she forced a clear “Yes!” Against the pressure, she forced one more word from the dry stickiness: “Water!”

Four synchronized gasps came from her observers as they realized this alien female understood and spoke their language. Nand had used her travel time wisely. With access to an archive of Earth’s information, she had learned English. *The truth is too absurd*, Nand thought. *They will never believe that I learned their language from the internet—even the term doesn’t yet exist.*

## MATTERHORN PARADOX

Nand was now fully cognizant of where she was and why.  
Planet Earth, a place called Roswell. Earth-year 1947.

Why? To find the one Earth man who might save his planet  
and hers.

The light was now aimed away from her face. She again  
scanned the observers looking down at her.

*He's here!*

#

To be continued ...

## Chapter 2

A distinctive three-note chime announced the arrival of a new video file. Warnok, grand master of the science council, swiveled his chair toward the holographic viewer. Floating in the space before him, a familiar scene: a miniature lectern complete with a comparably sized lecturer, frozen in space and time. In front of the podium, an opaque triangle floated on an invisible vertical plane. Beneath the triangle was a caption: *Professor Argon, Antimatter Lecture*. The date on the caption was a half-orbit prior to the professor's untimely death.

Warnok slid a finger on a small control pad in his left armrest, smoothly gliding his chair across the polished stone floor to within reach of the floating triangle. The main lecture hall at the academy had not changed in the twenty orbits since he and Argon had been cadets. *Ah, my favorite place to sleep after a night of experimentation with forbidden vapor. Forbidden, that is, for commoners like Argon.*

Warnok's last thought reminded him of a growing discontent he sensed. On too many occasions to be accidental, he had overheard plebes mockingly refer to authorities as "IEs,"

initials he knew well. **Inherited Entitlement**—the restricted-access warning that greeted anyone attempting to retrieve his own personal records. This open display of insolence and contempt was disturbing to Warnok. *Wouldn't have been tolerated when I was a cadet.*

The authority of the academy's masters (including the grand master), had indeed eroded since he and Argon had been cadets. Serious discipline issues now had to be referred to higher authority. There were only two ways to become a cadet at the academy: one was to score exceptionally high on the entrance exam, the other was to belong to the privileged IE class. Exam scores were closely guarded; cadets weren't allowed to know their own score. Only the grand master and Root have privilege to that information. Root, the collective name of the anonymous rulers above him and all grand masters, have access to everyone's privilege-credit balances and retina-scan files—information blocked even from the grand master of finance and the grand master of security.

Everyone on Z504 thought the grand masters were the highest authorities on the planet. Even the name *Root* was known only to the grand masters, who had no idea how many individuals were in that group.

Inherited Entitlement appointments were dwindling due to Root's increasing demand for technical excellence. Warnok now assumed that any cadet with a low exam score must have an IE rank well above his own. The others, the ones demonstrating

promise in mathematics and physics, now received deference previously reserved only for IEs. Personally, Warnok felt that Z504 could do with a little less technology and a lot more discipline and respect for authority.

While concerned that his authority was being usurped by test scores, one particular part of the test worried Warnok. It worried him because he didn't know why it was of interest. Why extrasensory perception? Scattered throughout the test were ESP questions in which the applicant must choose between three different geometric shapes, or sometimes between three of the same shape but with different colors. Half of the correct ESP answers were determined at the time the test was created, the other half just before the test was graded—after the test was taken!

Most applicants scored about one third on the ESP questions—no better than guessing. Occasionally there would be a high score on post-cognitive questions, and sometimes a high score on pre-cognitive questions. Rarely, an individual scored high across all ESP questions. Both the late Professor Argon and his brother-in-law, Captain Cray, had this uncanny and inexplicable ability to select correct answers of both types—those which had already been determined and those which had not.

Above the solid white triangle, a rectangular-framed note had been inserted by the sender, Commander Dorque, the grand master's nephew: *I think you will find Argon's last lecture interesting—especially his closing remark.*

Warnok reached out and pushed a finger through the floating triangle, animating the lecturer. The same finger slid a phantom audio icon to its mid-range:

“As you all know, our ability to convert normal matter to antimatter has brought about many new technologies. The scale of this conversion process is increasing exponentially, driven by the availability of gold/anti-gold alloy. The super-conducting property of this material can be rapidly switched on and off—a critical requirement for the conversion chambers.

“The gold/anti-gold alloy is also a key component in the thin, high-tensile-strength membranes that have made possible the large resort bubbles now proliferating on Big Moon. Even more important to our long-term health and survival are the agricultural bubbles, which protect our food supply from contamination by well-meaning, but disastrous, experiments to improve the genetic code of crops. Those attempts were extremely successful in developing insect-resistant plants—insects don’t even recognize them as food. But I digress.

“Our subject today is the anti-gravity property of antimatter and its implications for deep-space exploration.” Professor Argon paused. “The key to galactic travel is antimatter and its gravitational repulsion from normal matter. Gold, the most abundant metal on our planet, when converted to anti-gold, makes a great negative ballast because of its high density and chemical stability. Of course, we cannot yet produce enough anti-gold to....”

“Blah, blah, blah!” Warnok interrupted aloud, even though he was alone in his office. He poked a finger through two vertical bars floating beneath the holographic scene. Miniature Argon froze with a contorted expression of excitement, his mouth open. Warnok perceived more than excitement: a menacing confidence—a warrior with a secret weapon, welcoming any opponent. With his outburst, Warnok felt a wave of embarrassment. He rationalized his hatred. *Even dead he taunts me—not just me, theoretical physicists too.*

Warnok closed his eyes against Argon’s haunting image. Silently, he recounted Argon’s offenses toward the theoretical establishment as if preparing a court case. Yes, they had valid reasons to hate Argon. He was just an experimenter. He had stumbled accidentally on his matter-conversion process while studiously ignoring their most revered esoteric theories.

## MATTERHORN PARADOX

Time reversal for antimatter was an acknowledged analytical tool, but few really believed it. As for the anti-gravity and anti-inertia properties that Argon had demonstrated, they were a complete surprise and embarrassment. Then, the final disgrace was to prove that matter and antimatter atoms could coexist in an alloy without catastrophic annihilation.

But Argon hadn't stopped there. After his success, he suddenly fancied himself to be a theorist. He hypothesized the existence of antimatter star systems, including antimatter planets and potentially antimatter civilizations. Outrageous blasphemy!

Warnok was not a theoretical physicist—far from it. Argon had not discredited a lifetime of his work, nor had he left his reputation in shambles. Warnok's hatred of Argon was based on fear: a paranoid projection of what *he* would do with the power Argon might have been on the verge of acquiring. Even with Argon dead, he was still afraid of what he didn't know.

Had Argon achieved total conversion of matter to antimatter? If he had, he certainly would have tried to convert lifeforms. Had he already done it? Insects? Small animals? How long would it be before a human could be converted? An antimatter human going backwards in time!

Warnok imagined diabolical scenarios. Suspended animation chambers already exist. Several high-level IEs with incurable illness were in suspended animation awaiting a cure.

Could a conversion chamber be built large enough to convert a human, a suspended animation chamber, and a smaller matter conversion chamber to change the antimatter human back to normal matter and normal time?

Might someone like Argon know of a secret cave he had explored in his youth? Might he use such a place as a reverse time capsule in which he could go into suspended animation with an automatic wake-up set for, say, twenty orbits in the past? On awakening from his suspended state, he could use the conversion chamber brought back in time and emerge an older version of himself—an older Argon with complete knowledge of the next twenty orbits.

*He wouldn't even have to worry about someone discovering the cave!* Argon's hypothesis that antimatter is invisible was not disputed by physicists. Warnok didn't understand it, but apparently it had something to do with nature preventing us from receiving information from the future. An atom only emits or reflects light into its future. The short of it is—light from antimatter travels into *its* future and *from* our future. We can't see it!

All of Warnok's assumptions were being turned upside down. *What if they're wrong? What if there's a loophole in nature that allows information to leak into the past? Is that why Root is interested in ESP? Do they want to detect any leakage and exploit it?*

## MATTERHORN PARADOX

*Yes, there would be two Argons when he emerged from the cave, but even if they met face-to-face, the younger Argon probably wouldn't recognize his older self. Warnok often looked in the mirror and wondered what his younger self would think if they met. I'd probably see a family resemblance—maybe even notice how much this person reminded me of my uncle. Even if we spoke I wouldn't recognize my own voice. Recordings of my voice never sound like me.*

*Warnok played out his worst fears. What kind of mischief would the older Argon do? What advantage might he provide his younger self—perhaps, even, without the young Argon's knowledge. What would I do if I went back twenty orbits? How could I avoid getting caught? There are retina scanners everywhere—Root would detect that I was a duplicate.*

*As Warnok opened his eyes to scrutinize the floating Argon, he remembered something. He's a programmer—he was always modifying his communicator when we were cadets! Of course! With knowledge of the future twenty orbits, his programming skills would be so advanced he'd certainly play a key role in the design of the retina scan system. Programmers have been known to hide backdoors in their code. He could create multiple secret identities for himself—blink his eyes in a special sequence—he could be anybody—impersonate anyone—even me.*

Beads of sweat formed on Warnok's forehead. *Get a grip! Argon is space dust!* Warnok poked three times at a pair of triangles. Argon became animated—miniature arms flailing, miniature lips oscillating in a silent blur. Cryptic equations flashed and disappeared. As a progress bar approached the right limit of its range, Warnok poked the larger single triangle. *Let's see what Dorque found.*

The flurry of motion in the holographic scene stopped. Argon was grinning with lips stationary. A voice from the audience became audible:

“Is there any evidence that matter waves travel at the speed of gravity?”

Still grinning, Argon responded, “The cadet behind you has a question.”

“Professor, is it possible to convert animals to antimatter?”

From the future, Warnok yelled at the holograph. “Yes! Answer that, Argon.”

The professor was no longer grinning. “Theoretically, any atom or molecule can be converted to its antimatter twin.”

“Have you converted any animals?”

“It is not allowed to convert living organisms.”

“That's not what I asked.”

## MATTERHORN PARADOX

“I know what you asked, and you have my answer. Our time is up. Lecture adjourned.”

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Warnok poked the opaque floating square. *Just as I suspected! You were going there. My conscience is clear. You brought your fate on yourself!*

### Chapter 3

Chief Pilot Dorque's personal secretary stood timidly just inside his office door, waiting to be acknowledged. The thing that irritated Dorque more than anything was a subordinate speaking without being invited to do so. Dorque pretended she was invisible.

*At least he's not in one of his moods, Ishka thought. His stupid magnets are still in the cube I made last night. After counting silently to one number less than the last time, she decided to go back to her desk and try again later.*

Dorque sensed it. "What is it?" he said gruffly, without looking up. In the three orbits Ishka had worked for Dorque, he had never once said her name. She was quite sure he didn't know it.

"Grand Master Warnok is calling on Secure-View channel three."

Dorque checked the small corner frame of his display for the best camera angle. He glided his large chair slightly left, and the auto-tracking camera kept Dorque's face centered in the small frame. A model of a high-performance academy training aircraft was clearly visible over his right shoulder. Satisfied with the composition of his own image, he clicked the connect icon, and instantly his uncle's face filled the display, except for his own image, which remained in the small corner rectangle. It took Dorque by surprise. His uncle, like himself, rarely initiated or answered his own calls.

"Grand Master Warnok, it's you...I mean...I was expecting your secretary. What can I do for you?"

"For one thing, you can start answering when I call! Are you alone?"

"Yes...of course." Dorque felt awkward. *Did that sound like of course I'm alone or of course I'll answer?*

Warnok continued. "I think we have another chance to get rid of that subvert, Captain Cray."

"What happened?"

"That breach of security at the launch pad. We finally got to the bottom of it. It was Cray's nephew trying to find his papa—almost managed to launch. Turns out Cray has been taking the kid in the simulator. I'm thinking we've got a good reason to demote Captain Cray to captain of the academy cleaning crew."

Beads of sweat popped out on Dorque's forehead. "I don't know. I mean, I think a more permanent solution would be better."

“You already tried that. You said there would be no survivors. Instead, you ended up making heroes out of both Argon and Cray.”

Dorque was searching for a defense. “Well, at least we got rid of Argon. He was the most immediate threat. We had credible intelligence that he was converting living organisms to antimatter. Did you watch the video I sent you?”

Warnok was losing patience with his nephew. “Yes, but we don’t know how close he was to being able to convert humans—or how much of the technology he passed on to Cray or Gluon. I think we should demote the whole family while we have a good reason.”

Dorque was on the verge of panic. He started stammering. “I...I uh, don’t know. If we demote him, he wouldn’t have anything to lose. I mean, he knows too much. He could cause trouble.”

Grand Master Warnok picked up on Dorque’s panic. “What else have you done Dorque? What does he have on you?”

“Well, I don’t know if he has any proof, but I know he knows that I...uh...didn’t do any solo flights when we were cadets.” Dorque flipped to indignation. “They’re obsolete! It’s a stupid requirement—has nothing to do with flying modern craft.”

What Dorque didn't tell his uncle was that Cray had seen him using the miniature ultra-violet light that was set in the stone of his ring—a ring his uncle had given him. Dorque had shined it on his test answer sheet as Cray walked by, causing normally invisible little circles to fluoresce around the correct answers. It was no accident. Dorque couldn't pass up the opportunity to brag about being on the fast track. It was also his way of daring Cray: *If you say anything, guess which one of us will get the boot?*

“Oh, great! You mean to tell me that you never actually flew that aircraft you have a model of? The one you always have visible behind you? You're really something, Dorque! Does he know I'm your uncle?” Warnok answered his own question. “Of course he does. Everyone does. It's what you use to intimidate people.”

Dorque picked up the cube of small spherical magnets on his desk. Some days the magnets remained in their stable, but fragile, cubic lattice—this was not one of those days. Dorque closed his fist around the cube and felt its corners and edges collapse into chaos. “Just give me a little more time. I'll take care of Cray without embarrassing you—I promise.”

“OK, I won't do anything about Cray for now. I'll leave him up to you, but whatever you do, make sure it can't be connected to me. One more thing—there is something you should know about Captain Cray, but you can never let anyone know I told you.”

“What is it? Of course I won't tell anyone.”

“Both Cray and Argon had the highest scores ever seen at the academy on the ESP questions.”

“Pre-cognizance, or post-cognizance?”

“Both.”

Dorque paused, “Well, it didn’t do Argon much good.”

“Just be careful!” *Dorque knows nothing of Root—the invisible, ruthless power I answer to.*

“I will. I promise.”

Warnok feared the cultural and social crisis he saw looming on the horizon. With each generation, the privileged become more addicted to technology and more dependent on those who have mastered it. *The last thing we need is more evidence that positions of power are filled by pedigree over competence. It leads to insubordination—and that to loss of control.*

While the grand master defended forcefully the existing class structure, part of him was morally conflicted. Unlike most of his peers, he recognized that positions of power, including his own, and especially his nephew’s, come not from the consequences of good decisions but often from immunity to the consequences of bad decisions. Warnok disconnected the video link.

Dorque sat at his desk, still squeezing the cluster of magnetic spheres. He pulled a sphere from the clump and others followed in a long string of shiny beads. Pinching the end sphere, he separated it from the string and examined it.

He smirked. *I might not know how to fly that obsolete contraption, but I know how to make it un-flyable. Even for the great Captain Cray.*

## Chapter 4

Cray rang the buzzer at first light. He wanted to break the news to his sister before she heard it from someone else.

Gluon looked at her communicator. Seeing her brother's face, she tapped the screen, and her gold apartment door slid into its hidden slot silently.

“You’re up early for a holiday.”

“I had a great day yesterday. Thought I’d celebrate with a few corkscrews and spins in one of the academy trainers. I need an adrenaline fix. Want to come along?”

“You have a weird idea of fun. Remember last time? I came back with a glove full of vomit.”

“I’ll take that as a no then.”

“So why did you stop by? Just to tell me about the fun I’m not going to miss?”

“No, I’ve got great news, Gluon. I went before the council yesterday. They’ve agreed to reinstate you to your old position on a trial basis.”

“Wow! Are you sure you heard it right? I thought for sure we’d get kicked out of our academic apartment after what Xor did—or almost did. How about you? Aren’t you in trouble for teaching him so much in the simulator?”

“I don’t know what happened. I thought we were in trouble too. But when I told them that Xor was trying to find his papa, they just dropped the whole thing. They said there was no way I could have anticipated that. They are going to change some security procedures though, and no more kids in the simulators. I’m not cleared for space flight yet, but at least I haven’t been demoted. Commander Dorque even encouraged me to stay current in the Trojan.”

“That’s great, Cray.” Gluon was trying to absorb this sudden shift in fortune. “How did you charm them into giving me my job back?”

Cray’s mouth spread into a wide grin. “Just my irresistible personality, I guess. I told them that the Xor incident snapped you back to your old self and that you’re the only one with the expertise needed for the new radio telescope array.”

Having heard Cray’s voice, Xor came running in the room with a big smile. Nand entered more slowly and more tentatively. She avoided eye contact with her uncle.

“Hey, Xor! I have to leave for a while, but I’ll be back. What would you like to do with Uncle Cray today?”

“Can we fly the simulator?”

“No, I’m afraid not. You scared everyone. They thought you were going to fly that shuttle.”

Xor started to cloud up. Gluon had told him that Uncle Cray might get in trouble for what he’d done. “Hey, aren’t you five orbits now? I think they have some virtual reality games at the rec center that you’re old enough for.”

“I’ve never done that. Is it scary?” Xor had heard older kids talking about being chased by monsters.

“No! I’ll be there with you. We’ll just play hide and seek. It’ll be fun.”

“Will there be monsters in there?”

“No, I promise. No monsters!” Cray looked at Nand. She was still in the doorway. “You want to come, Nand?”

Nand was barely audible. “No thanks.”

Cray felt awkward. He and Nand had a special connection—as if they could hear each other’s thoughts. They both thought it should have been Argon who had flown that crippled shuttle home, and they both knew he could have done it.

“OK then. I’ll be back before dark, Xor. We’ll go play a VR game.”

“OK.” Xor spoke softly. He still wasn’t sure what he was getting into, but he trusted his uncle. Uncle Cray had never lied to him.

## Chapter 5

With a finger tap on his communicator, Cray's vintage mag-lev surface cruiser rose from its parking pad until the gap underneath it came halfway up to his knees. While the cruiser was rising, its large door on the left side opened at the bottom and swung upward, pivoting around its roof hinge. Cray climbed in and pulled the door down with his left hand and twisted the handle a quarter turn to lock it.

Cray touched the second destination on a long list that appeared to float in midair in front of him. The list was immediately replaced by a virtual image, which overlaid the real scene. The virtual overlay lacked much of the detail, but it was good enough to confirm the accuracy of the navigation computer. Every time Cray called up a virtual scene, he marveled at the resolution of reality. He silently joked that the real world must use some kind of supercomputer.

Cray eased up to a gate across from an access ramp. After a few moments, the gate rose. He merged into light holiday traffic.

## MATTERHORN PARADOX

Cray was 10 km from the academy airfield when he detected a traffic blip on his heads-up screen. Looking up, he made visual contact—a rapidly expanding bright red dot on the horizon. It exploded to full size and disappeared along the left side of his surface cruiser, but not before he recognized it: a newly minted NaZumi sport cruiser.

The new NaZumi was fully automatic—no manual override. At half sonic speed, human reaction time is too slow. Cray had only seen one other like it. Dorque, chief pilot of the space transport wing, had purchased one just a few tenths orbit earlier.

“It must be someone else,” Cray said out loud, even though he was alone. The last place Dorque would be hanging out on a holiday was their old training airfield. Cray was probably the only person on the planet who knew Dorque had totally blown off that part of his training when he was a cadet.

Cray and Dorque had been classmates at the academy, and Cray just happened to be scheduled for all of his solo flights in the Trojan immediately after Dorque. Cray always arrived at the flight line early. Each time, Dorque’s assigned aircraft would be sitting on the ramp, engine cold.

Cray hadn't told anyone, not even, (and especially not) Argon, his instructor and future brother-in-law. If he had, Argon would have been duty-bound to report it. Dorque's family had immense wealth, influence, and power. While the ensuing scandal might have derailed Dorque's flight training, he would've just slid over to another career path and still ended up as the head of some powerful enterprise. For both Argon and Cray, however, the blowback would have certainly extinguished any chance of a meaningful future career. Cray could not put Argon in such a no-win dilemma.

There was another reason Cray couldn't approach Argon with his suspicions. Cray suspected that Dorque had cheated on an orbital mechanics test. When he had walked by Dorque's desk, it had appeared that the answers were already highlighted on his answer sheet. Cray wasn't sure if Dorque had had a special answer sheet or if the marks had been on all the sheets and Dorque had had some way of making them visible. Either way it seemed to require faculty involvement. Cray had a rule: don't ask a question if you don't want to hear the answer.

Cray was not jealous. In fact, he felt sorry for Dorque. Everyone knew that his rapid rise was purely political. Dorque, however, had the delusion that it was due to his skill and prudent choices. Cray often wondered if Dorque's hubris was just a cover for a deep insecurity.

Thoughts of Dorque quickly vanished as the precise row of Trojans came into view, with their bright red-orange training stripes around the fuselage. The Trojans were new machines, built (printed actually) from specifications retrieved from ROM archives that had survived from antiquity. As parts become worn, new ones were printed, and the old parts recycled. The Trojans were manufactured by the same 3-D printers that had been invented by Cray's grandfather.

Everything about the Trojan, including its name, was copied from the archive documents. The nomenclature was strange, as it comes from a deprecated technology. Oddly, the craft was supported by imparting a downward momentum change to the atmosphere. This momentum change was accomplished with "wings," which extended out on both sides of the "fuselage."

Months of ground school were devoted to learning the arcane language of aerodynamics before cadets were allowed to start flight training.

Cray could hear Argon lecturing: *Lift is the vertical reaction force on the wing, proportional to two factors: the kinetic energy density of the air flow and the angle between the flight path and the plane of the wing, referred to as angle of attack.*

The tricky thing is that increasing the angle of attack to increase lift only works up to a point; beyond that, lift suddenly vanishes and the wing stalls. If one wing stalls first, the aircraft enters a violent, uncontrolled spin—the first part of the dreaded stall-spin-crash-burn-die maneuver.

Cray loved the Trojan. When he climbed into the cockpit, he felt like he was wearing it. The craft became an extension of his body—together they were a hybrid life form—a man-machine: man providing the brain, finesse, and coordination—the machine providing the brute power, speed, and intense throbbing sound.

The air was still cool at the academy field, the analog temperature meter on the line-shack pointing less than one-fifth the distance from freeze point to boiling. A short distance from the field, the waves of a warm sea washed over brilliant white beaches. Cray positioned his Trojan at the end of a long hard surface strip, facing the water-saturated sea breeze head on.

Cray wrapped his left hand around a molded grip just forward of the left armrest. As he pushed the lever forward, the throbbing changed to a deafening roar. Cray instinctively pressed on the right floor pedal—hard at first, then gradually less as the speed increased, but always just enough to keep the craft pointing straight down the white line painted in the center of the strip. It was a delicate eye-foot coordination exercise, which Cray had mastered. An untrained observer wouldn't be aware of the subtle complexity and skill involved in this seemingly simple process.

Another arm length forward of Cray's instrument panel, buried inside a shell called a cowling, was the Trojan's power plant: its eighteen combustion chambers arranged in two nine-chamber circles around a shaft. With each rotation of the shaft, nine of the chambers inhaled an explosive mixture of liquid hydrocarbon fuel mist and oxygen; the other nine, with perfectly timed explosions, delivered their inward impulses to an offset portion of the shaft.

The power plant was the only deviation from the original design, which only had one circle of nine cylinders. When the first craft was built, it was grossly under-powered—it was a mystery why the original designers had specified such a small engine. Luckily, the engine design was easily modified by adding another set of nine cylinders on the same shaft.

At the front of the Trojan, the shaft terminated into a hub with three thin blades extending radially and perpendicular to the shaft. This “propeller” as it was called, was the recipient of the engine's rapidly pulsating torque.

Now at full power, the drop in pressure and temperature at the prop tips condensed the saturated sea breeze, making it faintly visible. Cray found himself enveloped inside a wispy white tunnel as the Trojan accelerated.

At just the right speed (too fast, increased risk of tire failure—too slow, not enough lift), Cray pulled back on the control stick, which came up from the floor of the cockpit just behind his knees. The craft's nose pitched skyward. Cray subtly adjusted the pressure on the foot pedals, canceling the propeller's gyroscopic resistance to the pitch rate.

The Trojan crossed the thin white line of sand between the dark blue sea and lush green jungle surrounding the academy and entered a dense cloud layer. Cray tended to all the tedious details of human-controlled flight—things that are now automatic on the spaceships he flew on his real job: retracting the wheels, adjusting cooling ports, managing engine fuel mixture, prop pitch, and power.

With control forces trimmed out and power set, Cray settled into his instrument scan. Flying with slight, almost imperceptible pressures on the control stick, it was as if the craft responded to his thoughts. Flying blind—in the clouds—this is when Cray felt most connected to the Trojan.

Cray thought about how his life had changed in the two orbits since the accident. *How did I go from being treated like a hero to being ostracized? I always thought my position was secure. Not so sure anymore. Sure of one thing: if I get demoted, I won't be flying the Trojan anymore—better make the most of it while I can.*

Cray broke out above the cloud layer. The brilliant rising sun reflecting off the rolling hills of white cloud tops was blinding. He reached up to the front of his flight helmet and pulled down a visor. He thought of his late brother-in-law and mentor. Argon had given up flying when it became too automated. It wasn't fun anymore, and Argon always said, *If it's not fun, why do it?* Argon had found the design of the antimatter converters more of a challenge than flying spaceships, and his idea of "fun" was pushing the boundary of accepted science.

With enough air below him for at least five turns in a spin, Cray pulled the power lever in his left hand all the way back. With a few pops, the big radial engine was no longer pulling the Trojan forward. Cray pulled back on the long control stick just enough to hold altitude. As the aircraft slowed, Cray had to keep pitching the nose higher above the horizon to generate enough lift. Just before the wing stalled, he pulled the stick all the way aft and left and stepped hard on the right pedal.

With full left stick demanding the impossible, the already maxed out right wing rebelled with a deep stall—the right wing and nose dropped like a rock. The Trojan's flight path was now a vertical downward spiral. Cray planned to recover after three complete turns of the intentional spin.

The Trojan's cockpit was deep. The pilot's seat was held in its vertical position by a bullet-shaped pin that locked the seat in position when fully inserted into one of several evenly spaced holes in the seat track. The Trojan had barely turned once, and the pin slipped out of the seat track—his seat fell to the bottom of the cockpit. With the canopy rails now above his head, Cray could see nothing but a blur of clouds spinning wildly over his head.

Cray had never recovered from a spin while flying blind—he was at the bottom of the deep cockpit—totally dependent on instruments for guidance. He focused on the gauges in front of him: rate-of-turn needle pegged right—black ball, the slip indicator, at the far left end of its curved glass tube.

*Step on the ball*, Cray heard Argon saying. He pressed on the left foot pedal. With the ball centered, the rotation stopped, and Cray shifted his attention to the attitude indicator.

*Nose low, left bank, airspeed needle in the red arc*. Cray pulled back on the stick and tried to level the wings. *Oops—pulled too hard—too much left rudder—ball now on the right—not responding to right stick—still rolling left*.

Cray knew he was in trouble. The Trojan was entering an accelerated stall spin in the other direction. He thought about Xor and the promise he had made. *I know Xor will be disappointed many times, but not today, and not by me! I need to unload the wing!*

## MATTERHORN PARADOX

Cray popped the speed brake with his left thumb, then threw the landing gear out with his left hand. His right hand jammed the stick forward as he centered the ball with his feet. Again, the rotation stopped.

Gently this time, he pulled the nose to the horizon, carefully keeping the ball centered. Across time and space, Cray was hearing Argon again: *An aircraft won't spin with the ball centered.* Argon was adamant about maintaining balanced flight. How many times had he heard his lecture? *We turn an aircraft by banking, which tilts the lift vector in the direction of turn—the trick is to keep just enough rudder into the turn so that centrifugal force exactly balances the horizontal component of lift. Too much rudder causes too much rate of turn, and centrifugal force throws the ball toward the high wing, indicating a skid. With too little rudder there's not enough centrifugal force to keep the ball centered against the slope of the bank angle—it falls toward the low wing, indicating a slip.*

Sometimes Cray had felt Argon tapping on the pedal that needed attention. On one flight, when Cray had been oblivious to a skid, Argon had started knocking on the side of the cockpit in the back seat. “What’s that?” Cray had inquired over the intercom.

“It’s the damned ball—it wants back in the cockpit!”

Cray leveled the wings and adjusted the pitch to hold altitude. As the airspeed needle dropped onto the green arc, Cray pushed the throttle forward. The airspeed kept dropping. Cray pushed the throttle to the stop. *Airspeed still dropping. What's going on? Did I bend something? What was the airspeed when I threw the gear out? The gear!* Cray pulled the gear handle out of its detent, and flipped it to “UP.”

With the gear up, the Trojan accelerated to 150. Good enough to keep from stalling, but not nearly what it should be with max power. *Check the engine—good oil pressure—good temps—good fuel pressure. Maybe I messed up the airframe.*

Cray was still sitting at the bottom of the cockpit flying on instruments, but he was in level flight! He trimmed the airplane so it would fly hands off. Tested it a few times—let go of everything—watched it—tweaked the trim.

Satisfied that the airplane would fly unattended for a few seconds, he went to work on the seat. Cray pulled the lever on the seat pin mechanism. A small shiny magnetic sphere dropped to the cockpit floor and rolled briefly before finding another magnetic part to cling to. Cray didn't hear it. He hoisted the pilot seat to its proper height and released the lever. The pin fully engaged, locking the seat.

## MATTERHORN PARADOX

Cray was soaked. Sweat stung his eyes. *Where am I? Which way is base?* Cray tuned the NAV receiver to the academy's frequency. The arrow pointed at the left wing. Cray pushed the stick left and held a 30-degree bank angle until the arrow was almost straight up before rolling out of the turn.

Cray started to relax and take inventory. *OK, engine running good at max continuous. Aircraft responding normally, just slow—but fast enough. I'm going to make it! That was close. Nothing in the manual about recovering from a spin on instruments. I'll have to write this one up. Who would have guessed the Trojan would recover all by itself just by throwing out the gear and speed brake. Speed brake!*

With his left thumb, Cray pushed the speed brake switch forward and pulled the throttle aft as the Trojan accelerated. He heard Argon's voice again. "Adrenalin is your worst enemy in the cockpit—it makes you strong, fast, and stupid."

## Chapter 6

After parking the Trojan, Cray climbed out onto the black non-skid paint on top of the left wing. Folding his torso over the canopy rail, he dove headfirst into the darkness. With a small light held in his teeth, he explored the floor of the cockpit. A comical sight: a Trojan with legs sticking up out of the cockpit. When Cray finally righted himself, he unzipped the pocket on the right arm of his flight suit. Removing the light from his mouth, he switched it off and stowed it in the arm pocket—along with a small shiny magnetic sphere.

Cray drove out of the academy ramp and turned right onto the main road leading back to the space research complex. There was no traffic, but his metallic green mag-lev cruiser accelerated to a speed considerably less than what was normal—at least for Cray. Cray replayed the stall-spin maneuver and the recovery on instruments from the bottom of the cockpit. *Wouldn't want to do that again—not sure I could pull it off twice.*

Cray's thoughts turned to the space accident that had taken Argon's life—and how it had changed his. People seemed to treat him differently now. It was hard to put his finger on it. *What's changed between me and Ishka? I've always been in love with her—I should have told her. I thought she felt the same about me.*

*Since I returned she avoids looking at me.*

At the fork—left to Space Shuttle Command, right to the research campus where his sister lived—Cray went left. *I'll just swing by Dorque's office for a few minutes. There will still be plenty of time to take Xor to the VR arcade.* Cray knew that Dorque wouldn't be there on a holiday, but he was pretty sure Ishka would be.

Cray parked his cruiser next to the elevator in the empty parking garage. He scanned his retina by looking into the eyepiece above the array of destination buttons. Holding his breath, no longer sure of his status, it seemed to take longer than usual before green lights illuminated in all of the buttons, including number five. *Well, at least they haven't locked me out of the pilot offices.*

Ishka was not in the reception area, but the door to Dorque's office was open, and Cray could see the bottoms of two delicate feet, toes on the floor and heels directly above them. *What the....*

Cray peeked around the edge of the door and saw the bottom half of Ishka. She was on her hands and knees, apparently looking for something under Dorque's desk. On top of the desk was a cubic array of magnetic spheres. A perfect cube except for one corner.

*I don't want to startle her. I'll just back up into the reception area before I make any noise.* Cray backed up away from the door far enough that he could no longer see Ishka's feet. He pretended to clear his throat, "Ahem...."

From inside Dorque's office came a loud crack followed by "Ouch!" Cray considered making a quick exit, but he didn't.

In a few moments, Ishka came out of Dorque's office holding the back of her head. "What do *you* want? You scared me!"

"I'm sorry. I've been meaning to stop by, but things have been so busy lately." Cray was a bad liar. Besides, Ishka knew that he was off space flight status, pending the results of his psychological exams.

Ishka couldn't resist sarcasm. "Busy with your girlfriend no doubt."

"What girlfriend?" Cray looked genuinely confused.

"When communication was lost with your ship, they said your girlfriend remembered you acting weird before the flight. You told her you were going to be famous."

"Who's *they*? Does this girlfriend have a name?"

Ishka looked down. "Everyone was saying it came from the investigators. They wouldn't release her name. They had to protect her privacy."

"They didn't release her name because she doesn't exist! There is no girlfriend!" *So that's what's going on. They thought the ship was lost and they wanted to claim pilot error. No, even better—they were claiming pilot crazy. It's easy to convince people that someone's crazy—especially if they're not around.*

Cray took two steps towards Ishka. He put his hand gently under her chin. "Ishka, please look at me."

She looked up at Cray with tears in her eyes.

Cray put his arm around her, tilted his head and kissed her.

“Does that feel like I have a girlfriend?”

“Cray, I was so hurt.” She returned his kiss with soft open lips. “I’m sorry I believed them.”

Cray took Ishka’s hand and led her into Dorque’s office, closing the door behind him. The pilot area was deserted at mid-day—normal holiday routine—and silent, except for the synchronized breathing of two lovers: two bodies and two minds melding into one—both with the same thought: *The entire universe was created just for this moment. Surely, no one in human history has ever felt like this!*

#

Cray picked up the clump of magnetic spheres from the floor, squeezed it to maximize its disorder, then unceremoniously dropped it on Dorque’s empty desk.

“I should put it back into a cube before we leave.”

“Don’t worry about it, Ishka. It will give him something to do to keep him out of trouble. I don’t think he will say anything about it. As a matter of fact, I’ll bet you never see these magnets again.”

“That would be nice, but I’m not counting on it.” As Ishka and Cray left Dorque’s office, Ishka talked quietly, almost

whispering. “We have to be very careful, Cray, or you’ll never get reinstated.”

“I’m not sure that’s going to happen, Ishka. I feel like I’m on a fast track to nowhere. Everyone stops talking when I walk into a room—like they’re afraid of guilt by association. I’m not sure of anything right now except how I feel about you. I might be getting spooked, but...” Cray stopped. If he didn’t want to worry Ishka, it was too late.

“But what?”

“I almost got killed in the Trojan today. Seat bottomed out at the worst possible time. A freak accident.”

“Have you ever been afraid to fly, Cray?”

“Not yet. But if I ever am, I’ll quit.”

“Promise?”

“I promise.” Cray choked words out in short bursts. “Had a friend...long time ago...pride killed him...never told anyone but me...he’d become afraid to fly, but was ashamed to admit it.”

“What happened?”

“Don’t know exactly. Routine training flight. He lost it. Made a big hole in the planet.”

Ishka looked up into wet eyes. “What are we going to do, Cray? Where will we be safe?”

“The simulator. Every other night at midnight! I’ll log in with the retina scanner and you can tag along. You have to work late a lot and they know I often fly the sim in the middle of the night.”

“How about every third night? A girl needs her rest!”

“OK, every third night. We’ll visit the stars together. You’ll love it—it’s the next best thing to being there.”

Cray and Ishka went in opposite directions. They took separate elevators: Cray’s to the flight crew parking garage, Ishka’s to the public tram platform.

As Cray’s elevator door swished shut, he remembered. *Oh, crap!* Tapping his communicator a few times, he heard Gluon’s voice.

“Where are you Cray? Xor thinks you forgot about him.”

“I...ah...had some trouble with the Trojan—had to check something out. I’ll be there in half a deca. We’ll still have time to do the VR if I can keep him out a bit late.”

Gluon paused. “OK, but hurry. He has school tomorrow.”

“OK, on my way.” Cray settled into the cockpit of his metallic green cruiser. As the side door seal pressurized with its familiar pneumatic *phup*, Cray was suddenly apprehensive about seeing his sister. *She’s so damn perceptive. Will she know? How could she? No, I don’t think she will.... I don’t know, though.... Sometimes I think she can read my mind.*

## Chapter 7

One orbit later

Nand and her brother were playing in the corner of Gluon's office. She had set up some spare equipment to keep her two children entertained while she worked. Six-orbit-old Xor was scanning for radio signals from deep space. Nand, fifteen, was more interested in browsing the ancient ROM archives.

It had been a hundred orbits since the purge by the inquisitors. Books had been burned, scientists tortured, and the old symbolic language banned. Occasionally, Nand came across a familiar word that she could cross-reference. She delighted in every clue.

Much knowledge was lost during the purge. The inquisitors held on to absolute power through superstition and fear. Knowledge, especially the scientific kind, was, of course, a threat, as it inevitably leads to the development of more effective weapons, which could be used against the ruling class. Even now,

in this more enlightened time, there are strict limits on the scope of scientific research.

Eventually, the heirs to power became addicted to conveniences that were only possible through technology. When matter-antimatter conversion became possible, research was encouraged, with the stipulation that it could only to be used on inanimate objects—absolutely *no* life forms.

One of the most persistent superstitions was that life is only possible in the version of matter that exists on Z504. This particular superstition had a corollary: if an antimatter life form did exist, it must be the essence of evil.

Xor wore an antique pair of headphones. He randomly turned two knobs, which adjusted the celestial coordinates of the telescope. Once in awhile he would pick up strange emissions from deep space. Some he recorded and used as sound effects for his mechanical toys<sup>1</sup>; others he pretended were the voices of his imaginary space friends.

Suddenly Xor stopped. He fine-tuned the knobs and listened. He yelled across the lab, “Nand!” Nand turned away from her display. Xor had a look of disbelief in his eyes. He removed his headset and held it towards his sister.

“What is it?”

“I don’t know. It sounds like your name.”

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<sup>1</sup> <http://www.dd1us.de/sounds/vela.mp3>

Puzzled, Nand went over to Xor, took the headset, and spread its earmuffs over her head. She couldn't believe what she heard. "...om one three...message for Nand on StarCom one three...message for Nand on StarCom one three...message for Nand on StarCom one three..." Nand's skin broke out in small bumps, and she felt a cold chill flow through her body.

Nand looked around for something to write on. She picked up a marker and wrote on her hand, copying the coordinates displayed above the two knobs.

The use of StarCom frequencies required an access code. Nand would have to wait for her mother to return from her meeting. She wondered how long the message would continue to run. *How will I ever convince my friends that someone in outer space knows my name?* She ran to the display she had been using and retrieved her portable communicator. She ran back, spoke a verbal command into the device, then pressed it against one of the ear pads to record the transmission.

Nand and Xor took turns listening to the message. Xor finally said, "It's from Papa! It has to be from Papa!" Xor started to cry. "Why doesn't he have a message for me?"

"No, Xor, it's not from Papa."

Recognizing Gluon's retinas from a few paces away, the heavy gold door hissed as its pneumatic assist mechanism activated. The shiny yellow panel slid silently into a thick wall. Gluon was barely through the opening when her children came running to her, both talking breathlessly.

“Wait, wait! One at a time please! Nand, what’s going on?” She put her hand on Xor’s shoulder to let him know he would have his turn.

“Xor heard a message that was for me!”

“I was trying to find funny space sounds. The voice kept asking for Nand.”

Gluon said, “Show me,” wondering who might be playing a prank on her children.

Xor and Nand led their mother to the radio telescope panel Xor had been using.

Gluon looked at the digital numbers displaying the two galactic angles of the signal source. “Declination zero. The signal source is in the galactic plane. It’s probably in our galaxy. Are you sure about the azimuth? We’ve never received signals from that direction.”

“I haven't changed anything.” Xor put his headphones back on for a moment, then handed them to his mother. “Here, listen.”

She put them on and frowned as she listened to the repetitive mysterious invitation to her daughter. While her mother listened to the message, Nand typed on her communicator with her thumbs.

Noticing the puzzled look on her daughter’s face, Gluon spread the earphones and handed them back to Xor. “What’s wrong, Nand?”

“The sensors that are correlating the signal—they’re on the wrong side of the planet. From those sensors the signal’s source is towards Z504, not outer space. Is someone playing a trick on us?”

“That’s what I thought at first, but the galactic coordinates are constant. If the signal was coming from the surface of Z504, the coordinates would change as the planet rotates. I don’t know anyone that could pull off a trick like that. Let’s see if there’s a message on StarCom.” Gluon peeled her own communicator from its micro-loop patch on her left shoulder. With a few finger pokes and a couple of thumb slides, a large screen lit up with the StarCom logo. Gluon maneuvered a graphic arrow over a box labelled “13.” The box lit up, but the text box was empty: no incoming message.

Gluon placed the arrow over a box labeled “history.” A list suddenly appeared. At the top of the list were ten files of approximately equal size, all from sender “Unknown.” Eight of the ten were in red with the note: “PARITY ERROR.” The other two were green, and the note changed to “PARITY OK.” Both green files were the same size.

Gluon clicked on the first green file. The screen filled with unencrypted text.

The file was too long and complicated to comprehend from the screen. Gluon clicked the print button. A machine on the far left side of the lab came to life with a green light flashing, fans whirring, and servo motors humming. While the machine served

up pages of hard copy, Gluon scrolled down the screen slow enough for her and her two children to get the gist of the text.

It contained detailed instructions for programming an interpreter called a “browser” that could convert a sequential code, called “HTML,” into graphics and text. There were also details about frequencies and protocols for sending requests to something called a “URL.”

*Very strange indeed.* Gluon was incredulous. There was much emphasis on the fact that a block of HTML code would be received first, and it would contain the request and target URL, which must be parsed out and sent back immediately. *The reply comes in before the request is sent? This makes no sense at all.*

Gluon’s eyes brightened. “Of course! That’s why the direction doesn’t make sense!”

“Why?” Nand was glad to look away from the scrolling text. It was giving her a headache.

“Reverse time! The signal is coming from our future.”

Nand couldn't share her mother’s excitement. “What difference does that make?”

“Our receiver array correlates the signal for each pair of receivers and measures the time delay from the phase shift.” Gluon was talking faster than Nand could follow.

“I still don’t get it.”

Gluon slowed a little. “Well, normally, the further a receiver is from the source, the later the signal will be received.”

Nand's face lit up. "You mean because the signals are coming backwards in time our computers think the further receivers are actually closer?"

"Exactly! Remember the algorithm you helped program, Nand? Each unique pair of receivers define a cone of possible directions.

"OK. I get it! The axis of the cone is the line between the two receivers. Since the phase shift time delay is reversed, the cone spreads out in the wrong direction."

Xor kicked an imaginary spot on the floor. "Wait! If these signals come from the future, maybe it's Nand herself sending the signals back just to trick us."

Gluon was surprised. She hadn't thought Xor was paying attention. "I don't think your sister would—or will—do that, Xor. I don't even know if that's possible—but then this is so strange. Who knows what is possible?"

Nand's face flushed from anger. "Well I can tell you right now that even if it is possible in the future to send a radio signal backwards in time, I will not do it. This signal is NOT from me."

"Of course it's not, Nand, and I'm sure Xor knows that too. Xor, would you keep listening for any more messages while Nand and I study this printout?"

Xor put his headphones back on while Gluon and Nand walked across the lab to the printer. Gluon read each page, then handed it to Nand. Nand was a faster reader but waited patiently for her mother to finish each page.

## MATTERHORN PARADOX

The stack of paper contained instructions for programming a computer for two-way communications. The computer would parse out the URL from each block of HTML, then send it back as a request. The request, of course would go out into Z504's future, which was in this other world's past. Apparently it would all work out. The request, even though sent later on Z504, would arrive earlier in the world that devised this scheme.

Each HTML block was to be saved in the computer's memory and keyed to the URL. This computer program was called a "crawler" and would build a mirror image of a huge information system called an "internet."

## Chapter 8

One orbit later

The 26 scientists on Gluon's research team straggled into the conference room with its U-shaped solid gold table, which was too heavy to be moved or rearranged in any manner. It was a subtle reminder of the low budget she had to work with. High-priority projects have the lighter, but extremely expensive, aluminum conference tables.

Gluon, Nand, Xor, and Cray were already seated at the end of the U. As each member of the team entered, they assessed the number of seats available on each of the sides. When all 13 seats on each side were occupied, Gluon poked her communicator. The pneumatic door slid silently out of the wall. At the end of its travel, as it sealed the opening, the door emitted a barely audible *pfsh*.

Gluon gave her team a few minutes to settle down before opening the meeting. "It's been five Big Moons since we downloaded the internet system that Nand received the protocol

for. I asked you all to explore it separately to get as many independent impressions as possible. It seemed so incredible that we would receive such a message specifically addressed to Nand; I needed to eliminate any possibility of a hoax.”

She continued, “From the reports you have submitted, it appears that we are unanimous in the opinion that the system does in fact document the history of an alien civilization. It is too vast, with too many corroborating, yet varying, perspectives to be a hoax. Are we all in agreement on that?” Scanning the table, Gluon noted 26 nods of affirmation. “I think we are also in agreement that the direction of time for this world runs opposite to ours. Their future is our past. Our future is their past. This is apparent from the internet protocol—the fact that we have to send the correct request for a data block we’ve already received. Not only that, these data blocks only make sense if we reverse the binary data stream.”

Again, Gluon saw unanimous agreement. “We have all reported similar findings, but Cray and Nand have found some especially interesting things.” She turned to Cray and motioned for him to take over.

“Yes, well, as some of you may know, I fly the academy's Trojan trainers for proficiency...OK, for fun. Anyway, I searched for ‘Trojan’ on the internet and discovered it was a trainer used on Google Earth by one of its naval militaries. It had another designation: T-28. It’s amazing! They actually landed them on ships. That’s what the steel hook on the tail is all about.

We couldn't figure that out. They used it to snag a cable and jerk the aircraft to a stop on the short deck."

"Are you sure it's the same aircraft?" The question came from the right side of the table.

Cray turned toward the voice, not sure which person it belonged to. "Yes. Absolutely. Down to the smallest detail. Well, except for the radial engine. Their T-28s only have nine cylinders; ours have another row of nine—a modification that compensates for our stronger gravitational field. Our planes weigh more, so we need more power."

Cray waited for another question. Finally, he broke the silence himself. "Another interesting thing is that our units of distance and time, the meter and second, appear to have come from Google Earth. They measure the speed of light as being three hundred million meters per second, same as us."

"That just means they're proportional, Cray. If both their meter and second were, say twice ours, the speed of light would still be the same. Besides, even if the units are the same, why do you think our units were copied from them? Maybe they copied us." Cray didn't have to guess this time. Ercu was his new copilot, or as Cray suspected, his babysitter. Ercu had more command experience than Cray but was now over the age limit for command.

"Good point, Ercu. We know their second is the same because it's defined the same as ours: nine-point-two billion times longer than the period of a specific cesium atom emission. As far as which came first, I think the clue is in the way we divide our

solar day into ten decas, one hundred centas per deca, and fifty-seconds per centa—a total of 50,000 seconds. But we have to add a second every day that the day count is divisible by three, but not divisible by seven. This is necessary to keep the sun’s position in sync with our time of day. Google Earth divides their day even stranger, but they end up with eighty-six thousand four hundred seconds in their day. That syncs so good with the spin rate of their planet, they only have to add a second every few orbits. That seems to indicate the second was invented on Earth.”

Gluon looked around the room and realized her brother was losing the group. She turned to Nand. “There is something Nand found that makes a similar connection.”

Nand had never talked to the entire group before. She knew all of the scientists, and had talked with them one-on-one or in small groups, but this was a little intimidating. Her first few words came out in cracked fragments. “I was searching for some of our science terms and discovered that the legendary Einstein was not only a real person, he actually lived on Earth, just a hundred orbits before our copy of their internet was transmitted. Oh, by the way, we all have been exploring the images of this planet and assumed its name was Google Earth. It’s actually just Earth. Google must be their word for a satellite image.”

Gluon gave the group a few moments to absorb the implications. “The conclusion is obvious, I think.

Our planet must have been colonized by these Earth humans sometime in their future. Perhaps thousands of orbits after the time of our internet snapshot.”

Gluon continued, “Here is my main concern: Many of you have studied the recent history of this planet. They emerged from a global conflict called World War Two just sixty orbits in their past. The country called United States and its allies were victorious in large part because they were the first to develop a nuclear fission bomb.”

“Immediately after World War Two, the United States started developing a fusion bomb, or H-bomb. At the same time, their world split into two geo-political factions. An all-out arms race and propaganda war broke out between the United States and a huge country called Russia.”

Gluon paused to drink from her flexible water bottle. “Everyone in the United States was taught that everything about Russia was evil. Everyone in Russia was taught that everything about the United States was evil. The problem that I see for us is that the United States developed the H-bomb first. With the prevailing anti-Russian paranoia and their military still in all-out war mode, I’m afraid they would have made a preemptive strike.”

“Would have? They obviously didn't from the history we're reading. Anyway, how would that have possibly had an effect on us?” The question came from the end of the row on Gluon’s left. Again, it was First Officer Ercu, the oldest in the room.

“The internet that we have been studying is a global system. We are finding many similarities between our symbolic language and the one used in Russia. If our ancestors were an international mix of Earth’s cultures, I don’t think we can risk letting the United States wipe out the entire population of Russia.”

Gluon looked around the table. “We need to intervene to make sure that doesn’t happen.”

Ercu frowned. “Wait a minute! Aren’t we living proof that it didn’t happen? Besides, if we change Google Earth’s—sorry, Earth’s past, won’t we just be messing things up? Remember the grandfather paradox. If you travel into the past and kill your grandfather, don’t you kill yourself?”

Gluon didn’t hesitate. “I’ve thought long and hard about just that, Ercu. I think the message Nand received is proof that we *did* intervene. We never could have figured out how to access their internet without it, especially with the time reversal. We had to program our computers to interpret a response to a request we had not yet sent. We had to reverse the temporal bit stream of a data block and parse out the request that needed to be sent. Then we had to send a reverse copy of the request so they receive it at the proper time in the proper sequence. Constructing a complete image of their internet was a recursive process. It was like building a tree from the leaves down.”

Gluon took another sip of water. “Putting that together with the message being in plain text in our language—the conclusion is inescapable—we must have gone to Earth. If we decide not to do it, *that* might change history, and *that* might trigger a grandfather paradox.”

“What exactly are you proposing, Gluon?” Ercu planted both elbows on the table and rested his chin on clasped hands.

“I think we need to go on a mission to this planet, Earth. As you all know, the deep space exploration project on Big Moon was cancelled five orbits ago—shortly after my husband, Argon, quit teaching to join the project. What none of you know, except Cray, is that Argon organized a small group of scientists to secretly continue work on the ship. With the help of the Director of Procurement for Big Moon Resorts, they were able to get everything they needed—the ship is now fully operational.

“Currently, light-speed signals we transmit arrive on Earth in their orbit count two thousand five from some reference called common era, or CE. As many of you have noted, they refer to their orbit period as a year. By the way, the Earth year is very close to the same duration as a Z504 orbit, except, of course, that their year count runs backwards—it’s counting down. Anyway, Cray has determined that we will be able to accelerate to a maximum speed of ninety-nine percent of light-speed, with an average velocity slightly less. With relativistic time-dilation, this will take fifty-eight years of ship-time.”

Ercu was trying not to interrupt, but he couldn't help it. "Well, that leaves me out. I don't think I'll be much use to you at a hundred and twenty-three orbits."

Gluon smiled. "I'm not so sure about that, Ercu, but we're going to shorten the biological time to ten years using suspended animation. If we can get twenty-four volunteers, we can have six crews of four. Each crew will only be on duty for ten years."

"That adds up to sixty years. I thought you said it would only take fifty-eight years. How accurate is your calculation? I mean, is it fifty-eight years, or fifty-eight give or take a few years?"

Cray answered for his sister. "The navigation precision is within one tenth of a year. We've added a few years to the schedule for crew-change briefings and training. Like Gluon said, if we could travel at light speed, we would arrive in their year two thousand and five, and we wouldn't age at all—the entire trip would seem instantaneous. Since we can't quite get to light speed, however, our ship's clock will advance fifty-eight years, while Goo...I mean, Earth clocks retreat fifty-eight years. That gives us an estimated arrival sometime in the middle of Earth year nineteen forty-seven."

Dresda, the newest member of Gluon's team, raised her arm, and Gluon nodded at her. "How do we know that the Earth year and the Z504 orbit have the same duration?" Dresda, a recent graduate of the academy, was a brilliant linguist.

Gluon had selected her from hundreds of applicants specifically to help translate the cryptic audio files they had found on the internet.

Cray looked at Gluon. He could tell she wanted him to continue. “We knew it had to be close to give them a habitable temperature. Using orbital mechanics, Argon once proved that if two stars have equal density and equal surface radiation intensity, planets of the two stars would receive equal radiation intensity if their orbit periods were equal. We discovered through definitions found on the internet that there is actually a few percent difference. Their year is thirty-one and a half million seconds. Our orbit period is slightly longer at thirty-two million seconds.”

Cray scanned the group and realized their eyes were glazing over. These were not physicists. Some were researchers specializing in the life sciences, but most were engineers and technicians with practical skills: they knew how to build computers, 3-dimensional manufacturing printers, and test equipment. “You won’t have to worry about the details—time on the ship will be measured in Earth time. The ten years your body will age will be a little less in Z504 time, but not enough to notice.”

“Goldilocks! We’re on a Goldilocks planet.” Everyone turned toward Qwerty. “I’ve been looking at sites about their search for alien life. They are looking for planets that might be at the right temperature. They call them Goldilocks planets. I have no idea why.”

Xor started yelling. “I know! I know! It’s because of the three bears. The porridge can’t be too hot, or too cold—it has to be just right.” No one thought Xor had been paying attention.

Gluon looked at her son with astonishment. “How do you know that?”

“Everyone on sez-a-me street knows that.”

Gluon turned her palms toward the ceiling. “Well, I guess that solves one mystery.”

Nand had pushed her chair back slightly. Gluon leaned back to make eye contact with her daughter behind Xor. “I didn’t know Xor had access to the internet.”

Nand’s face was turning red. She could feel it. “It’s OK. I tricked his communicator so he can only access appropriate sites.”

“We might have to discuss how one tells the difference.” Gluon returned her attention to the group as if nothing had happened. No one spoke.

Dresda broke the awkward silence. “I think I should start watching what Xor watches to learn their language.”

Broff, at the end, on the right, had lagged behind to sit beside Dresda. Barely above a whisper, so only she could hear, he said, “I’m going to start watching what Nand watches.” Broff could tell from the snickers that his voice had carried further than intended.

Qwerty had been contemplating the mounting evidence that Z504 and this planet Earth were intimately linked, in spite of being constructed of diametrically opposite types of matter. “OK, so let’s say that these Earth people will, sometime in their future, colonize our planet sometime in our past. I guess we also have to assume that we have somehow arranged to get the information we needed to decipher the internet. My question is, what makes it so imminent? What’s the rush?”

Cray didn’t have to look at Gluon to know that this one was his. “The longer we wait, the earlier we will arrive. World War Two ended in their year nineteen forty-five. If we get there too close to the war, or before it ends, their war mentality will be dominant. I’ve studied everything I could find about their development of airplanes and air warfare.”

Cray paused to construct his argument. “Desperate times call for desperate means, and this was a desperate fight against a cruel and ruthless enemy. Crazy generals, drunk generals, religious generals, and corrupt generals...all are judged in the crucible of war by one test: their effectiveness in the art of killing, terrorizing, and demoralizing the enemy. Even before they had the nuclear bomb, the United States had one particular general who had perfected his art beyond all other generals in the history of their planet.”

Cray wasn’t sure he had made the point. “If he had been on the losing side, he undoubtedly would have been a war criminal. But since he was on the winning side, he was a hero. He advocated

bombing as the first and preferred solution to every conflict encountered after World War Two. I'm convinced that he would not have been held in check without our intervention."

From the right side of the U: "So what happens to us if you're right and we choose not to intervene? Do we just cease to exist?"

"I don't know." Gluon was trying to be as honest about her ignorance as she was about her knowledge. "Maybe we are in some kind of closed time loop. If so, I don't know what will happen if we break the loop. Are any of you willing to risk it?"

Ercu chimed in. "It seems to me that we cease to exist *if* we go on this mission, at least on this planet, in this time. Even at the speed of light it would be an eight hundred-orbit round trip in Z504 time."

"That's true. It's a one-way trip as far as everything we know." Cray wasn't going to sugarcoat it. "There's no return to anything here that exists now. But we here have already passed the point of no return. We already know too much about a forbidden technology and a planet that shouldn't even exist in the accepted paradigm. It will not go well for those of us who choose to stay behind."

"Why would we want to leave our home planet on a one-way trip with an uncertain fate?"

Cray couldn't tell who had asked the question: someone on the right side of the U. "Life is uncertain. Death is certain. I choose life. Argon often said that as a species, we are nothing, if not explorers. It's the essence of being human."

"I admit my reasons are not all philosophical." Cray continued. "I'm pretty sure I'm on—what would be called on Earth—a shit-list. It's only a matter of time before I'm demoted."

Cray looked around the table. "If you think about it realistically, we're all in the same boat. You all know how the system works. It's impossible to get promoted to a higher privilege status but easy to get demoted unless you have Inherited Entitlement. The authorities have made it pretty clear that we're pushing the boundaries of acceptable science here."

"But there are cases of people getting promoted even after working on defunded projects." This time from the left side.

"Yes, but only by lying, cheating, and demonstrating your capacity to be ruthless. That's why the worst traits of the human race keep rising to the top. Our system is a natural filter. It exploits our selfishness and our desire to maximize personal rewards. The higher your status, the less time you're required to clock, and the more privilege credits you're allotted. At the very top, the IEs never have to clock computer based indoctrination. Their privilege credits are, as far as I can see, infinite. I don't think they even keep a record. They just get whatever they want."

Ercu laughed. "Why don't you tell us how you really feel, Cray?"

“OK, I will. Here’s an example of what I’m talking about.” Cray’s face was getting red. “I used to fly tourists to the resort on Big Moon before I started flying research shuttles. For the IEs, the fare was inconsequential, but for someone even in this group, you’d have to save privilege credits for more than two orbits. They always oversell the flights because so many IEs just reserve a flight on a whim and then change their mind. Of course, if you get bumped you get a full refund and a guaranteed seat on the next flight.”

Cray was getting angrier the more he talked. “I was waiting to board my flight one time when the load agent bumped a three-orbit-old kid. When the parents asked if they were getting bumped too, the load agent told them no. They could get off if they wanted to, but they would be volunteering. They would be standby passengers on the next flight. When I got back, I asked the agent what happened to the family. He laughed and said they finally gave up and forfeited the fare. I heard later he’d been promoted.”

Ercu objected. “Sure, we all know that if we get in a dispute with an IE we’re going to lose. But everyone in this room is better off than ninety percent of the population. If you count the outsiders, it’s over ninety-nine percent. Outsiders can’t even imagine the conveniences and privileges we have.” Ercu waved his hand toward the head of the gold table. “It’s easy for you.

It's just the four of you left in your family, and I assume you will all be going. But most of us have family who will be left behind. What will happen to them? Couldn't we at least try to get the mission sanctioned? If the council were presented with all the evidence, wouldn't they come to the same conclusions we have?"

Gluon was quite sure of the futility of it but realized that many in the group would need to see that for themselves. "OK, you have a valid point, Ercu. I'll set up a presentation for the council. In the meantime, we are going to continue with preparations for the mission—with or without sanction. If we end up stealing a spaceship, we can make it look like we kidnaped those of you who want cover. Those of you who choose not to go can claim ignorance."

Monas, the lead biologist in the group, raised her arm. "I don't understand the physics of it, but from what I've heard, it sounds like antimatter behaves just like normal matter except for a reversal of all properties that can be measured in space or time—kind of a four-dimensional mirror image."

Gluon nodded her head. "That's a pretty good simplified explanation."

"Well, wouldn't that imply that molecules built from antimatter atoms are mirror images of the same molecules built from normal atoms? The double helix molecule that carries the operating instructions for our bodies is chiral: its mirror image spirals in the opposite direction. Wouldn't that require our normal

left-hand spirals to switch to right hand spirals if we converted our body to antimatter?”

“That is one of the findings of my late husband, Argon. His calculations indicated that the double helix molecule, called DNA on Earth, will unwind and rewind in the opposite direction.”

“Calculations? You mean it hasn’t been tested?”

“No, Monas, it has been tested...in a sense. Argon converted many organisms to antimatter. Analysis of his data indicated it was successful. He also ran countless simulations. Direct observation, of course, requires that the observer and the observed be on the same temporal path. Once an organism is converted, it disappears from the researcher’s future time path.”

Monas looked even more concerned. “The disappearance of an organism might be a good indication that it was converted to antimatter, but how do we know it survived? I mean, it seems to me that the unwinding of the DNA molecule would be equivalent to death.”

“Yes, that was one of Argon’s major problems—proof of life after conversion. He finally solved it by carefully recording the temperature of the chamber. The metabolism of living organisms gives off heat. Since antimatter organisms are going backwards in time, their metabolism registers as a cooling effect just prior to the conversion.”

“Monas shook her head in a gesture of disbelief. “How can that be? Even with all the cells reconstructed, death is irreversible. What could possibly bring it back to life?”

Gluon looked around the room as if checking for spies.

“That was the main obstacle. Even after the antimatter conversion was perfected, it was another full orbit before he got proof of life.”

The room was silent. Gluon scanned the faces again. “OK, I guess it’s time for full disclosure. The breakthrough came only when Argon started flooding the chamber with the forbidden vapor just before conversion.”

“The color drained from Monas’ face. What? Didn’t he realize the danger? The penalty for messing with that stuff is death.”

Cray turned sarcastic. “Well, I guess he’s already paid that price.”

Ercu raised his hand but didn’t wait for any acknowledgement. “What’s this forbidden vapor? I’m the oldest one here and I’ve never heard of it.”

Monas turned to him. “That’s because no one talks about it. Besides, if you’re not a biochemist you couldn’t make it even if you wanted to. It’s a very simple molecule: basically a six-atom ring of carbon with a five atom ring attached. The five-atom ring has one atom of nitrogen on one side, and on the other, a little tail of two carbons, a nitrogen, and two more carbons.”

Ercu’s mouth curled in a wry smile. “You seem to have much forbidden knowledge.”

The color returned to Monas' face with a vengeance. "Well! I am a biochemist and it's found in all living organisms in varying degrees, mostly in plants, but also small amounts in animals. We don't know its exact biological function."

Gluon took back the discussion. "Since it is vital to our mission, I've done some searching on Goo—I mean Earth's internet. They know it as the spirit molecule; their chemical name for it is dimethyl-tryptamine, or DMT."

"Perhaps..." Monas seemed to be thinking out loud, "I mean, if Argon's findings are correct, this DMT molecule might acts as a stimulant for DNA. Maybe it's a catalyst that restarts the process of assembling amino acid sequences—the defining feature of life! Wow! But that's quite a leap of faith you're asking us to take."

"No, we are not asking any of you to convert to antimatter and land on the planet. It will only be the four of us in the landing party. However, we are asking for your help in getting us there."

"Wait, let me get this straight." Monas was getting another bad feeling about this. "We will age ten orbits, or years, going to Earth, then another ten years coming back to Z504, which will be, like, nine hundred years in the future?"

"I'm not going to minimize what we're asking. Yes, our planet will have aged over eight hundred years when you return. The return trip can be completely automated so you will only have aged the ten years that you are awake for the trip to Earth.

We need a crew on watch for the outbound trip because the manufacturing process for the conversion pods is not fully automatic.”

Ercu spoke up again. “Unbelievable! You’ve never even built a conversion pod?”

“Well, not a full-sized one. Small ones for proof of concept, but not one large enough for a human. We will manufacture the full-size pods en route. One of the first things we commandeered from Big Moon Resorts was a universal 3-D manufacturing printer.”

“So what has it been manufacturing all this time?”

“It’s been a slow process, Ercu. First we had to program it to duplicate itself. The original and its duplicate have been duplicating themselves for the last two orbits and will have most of the components ready by now. There will, of course, be some final assembly that will need to be done manually. We should have four fully functioning 3-D printers within a year of launching.”

“Why do we need four?” Ercu had his arms crossed. His posture exuded defiance.

“One, the oldest one, will be used to manufacture replacements for equipment that is starting to show routine signs of wear. The second will manufacture spares for the most critical components. The third will be building the conversion pods.”

Ercu, still defiant, “And the fourth?”

“The fourth, Ercu, will be working on another 3-D printer to replace the oldest. All worn out equipment, including the printers, will be recycled and their component elements returned to the print cartridges.”

Qwerty was hung up on something Gluon had said. “I’m confused. You said we couldn’t observe antimatter organisms, but haven’t we been creating antimatter gold for many orbits? Why doesn’t it just disappear?”

Cray again took over for his sister. “When we convert gold to anti-gold, it is trapped inside a shell of visible gold/anti-gold alloy. If we did a complete conversion, you’re right, it would vanish. Light is a special kind of electro-magnetic wave. It is only emitted by atoms and can only be absorbed by atoms. Both the emitter and the absorber must be going in the same temporal direction.”

Gluon scanned the room for signs of more questions. “I think you all know where Cray and I stand and the decision we’ve made for our family. I know most of you have a lot to discuss. Feel free to use this room anytime it’s available. Please don’t talk about it outside this room—it is the only place we have that is completely shielded.

Gluon pushed her chair back and was followed by Nand. Nand nudged Xor to get his attention.

Ruggel, third from the end on the right side of the table, pushed back and stood. “I don’t have to discuss anything! Count me in. I think this has to be done! For those of us who don’t have to convert, sure, we spend ten years of our life, but we get to time-travel nine hundred years into the future. That’s as close to being immortal as you can get.”

Ruggel sensed that he was alone in his enthusiasm. “Think of it. We’ll be legends when we return. We can program the nav computer to send back progress reports timed to arrive on the same date every orbit. Of course, our ship’s time will be red-shifted, so the computer will need to compress the message and send it in a burst of high frequency so it will be readable in Z504 time.”

Cray cupped his chin in his hand and propped it up with his elbow. *Ruggel must be very brave or very naive. He always struck me as being timid and calculating; maybe I was wrong.*

Even Gluon was surprised by Ruggel’s argument. She hadn’t even considered that there might be a self-serving motive for the risky adventure they were proposing. Ruggel walked around the table and was at the door before Gluon had commanded it open. He could have opened it himself with the red button, but he waited for Gluon to tap her device. The door hissed open and Ruggel filed out behind Gluon, Nand, and Xor.

Over the rustle of chairs being pushed back, murmurs, and gathering of communicators from the gold table, Ercu spoke up. “Cray, we need to talk!”

“OK. Let’s stay awhile.” A collective understanding that they were being dismissed filled the room. Cray knew he needed Ercu's support. If he couldn’t convince his first officer, he would have no chance with the others.

As the door hissed shut, leaving only the two pilots, Ercu looked directly into Cray’s eyes. “You’ve indicated that we will be traveling close to the speed of light across four hundred light-orbits of space. Have you considered the immense energy that even a speck of space dust will have at those speeds?”

Cray’s eyes lit up. “Of course I have, Ercu. We will have a shield: a large asteroid in front of our ship.”

“That’s good, but it also creates other problems. The fuel needed to locate and rendezvous with a suitable asteroid will be tremendous. When that’s done, what about the fuel required to accelerate the extra mass? Not to mention the relativistic increase in effective mass as we approach light-speed. I hate to throw cold water on this adventure, but....”

“Ercu, have you ever heard of the floating rock?”

“There’s a reference to something like that in the ancient ROM archives. I’ve also heard rumors that some pilots claim to have seen it on Small Moon, but you and I both know how pilots lie to each other in a bar.”

“I can tell you for a fact that it exists, Ercu, and I know exactly where it is. Argon and I found it on our last flight.”

“Do you know what makes it float?”

“Argon was convinced that it’s actually two asteroids. The one on top is normal matter and it’s holding down an antimatter asteroid. It’s spooky. The dark space between the floating rock and the crater rim is ominous—it goes all the way around except for a rock bridge connecting the floating rock to Small Moon’s surface. It’s like looking into a hole in the universe, no light coming out, no clue about where the surface is, or even if there is a surface.”

“How big is it?” Ercu suddenly acted interested, but his expression still displayed suspicion.”

“Hard to say exactly. The crater is small, only about fifteen meters across, but much of the antimatter might be buried. The floating rock covers almost all of the crater. There’s just a narrow ring of blackness surrounding it. The top rock must have more positive mass than the negative mass underneath—the rock bridge looks way too fragile to resist any up-load. How much more is hard to say until we get there and survey it accurately.”

Ercu was trying to wrap his head around what Cray was saying. “How do you think it got there? It couldn’t have happened accidentally.”

“I think it makes sense in light of the discovery that we were colonized by Earth humans. The antimatter asteroid must have been their shield on their trip here. I think they stashed it on Small Moon just in case things didn’t work out. Maybe they weren’t too sure about being able to convert to our matter.”

“You mean it was their ticket home?” Ercu was contemplating the large antimatter rock’s natural instinct to accelerate away from Z504 and towards Planet Earth. If it could be attached to the front of the ship, it would pull the ship forward the whole way, at the same time, shielding the ship from relativistic dust. “Wait a minute! How are you going to shield the ship when we have to slow down? Won’t you have to turn the ship around? What good will the shield be if it’s behind the ship?”

Cray shook his head. “That’s the beauty of going to an antimatter system, Ercu. When we get into their star system, we will be the antimatter. Our rocket motors provide forward thrust in our system, but they will create reverse thrust in theirs.”

“What are you talking about? That sounds crazy.”

“I know. It took Argon a long time to convince me. Think of it this way, our time will be going backwards in their system. A push observed in reverse time is equivalent to a pull. Our rocket motors will continue to eject our type of matter, but the resulting thrust in our time is a drag in their time. We don’t have to turn the ship around or do anything different to decelerate.”

“You’re giving me a headache.... OK, let’s assume Argon is right, what’s your plan?”

“Well, all we need to do is figure out a way to release that antimatter rock from the crater it’s buried in and get it attached to the front of our spaceship before it can drift away.”

“I should have guessed you wouldn’t want to spoil the fun by having an actual plan.”

Cray grinned. “I’ve found that the best plans come together on their own. I get in trouble when I overthink a problem. It locks me into a preconceived notion of how things are going to be. Things never happen exactly the way you think they will.”

Coming from anyone but Cray, Ercu would have scoffed at the hubris of suggesting that the best plan was no plan, but he had seen Cray’s talent for solving problems on the fly, something like a sixth sense, an uncanny habit of surviving impossible situations. “I have to admit an antimatter asteroid in front of our ship would make your scheme possible. Not sure that your non-plan plan works for me though. If you don’t mind, I’m going to start trying to figure out how we can pull this off.”

“Knock yourself out. I’m just saying there’s no way to anticipate everything that might go wrong.” *I might be overplaying the casual attitude.* “If you think I don’t do any planning, Ercu, you’re wrong. I’ll let you in on a little secret—I spend most of my awake time visualizing emergency situations. The subconscious mind can’t tell the difference between what’s imagined vividly and what’s real. It’s like free sim time.”

Ercu shook his head. “So that’s how you do it. I knew you were cheating, just didn’t know how.”

“OK, so now you know. Let’s keep it just between us. Don’t ruin my reputation.”

## Chapter 9

Dorque personally answered his secure video line on the first chime—a recently acquired habit. “You were right, Commander. Argon was converting life forms to antimatter. He had a design to convert humans, but it hasn’t been built yet.”

“Interesting.” Dorque was fully engaged. He hadn’t even bothered to adjust his camera angle to catch the Trojan model.

“You’re not going to believe what Cray and his crazy sister are doing. They’re planning a mission to that reverse-time planet I told you about. She’s going to try to get authorization from the council, but it sounds like they intend to do it even if they have to steal a ship.”

“OK. Pretend to go along with it.”

At a younger age, before acquiring the skill of manipulating power to his advantage, the caller would have said, “I’m way ahead of you. I’m already on it.”

Instead, he said, “Great idea, Commander. I’ll get right on it.”

## **Chapter 10**

There was a buzz of excitement in the Grand Council for Deep Space Research. A team led by Research Director Gluon had reported the reception of video signals emanating from within their spiral galaxy, just 400 light-orbits away. Given the thousand light-orbit diameter of the galaxy, the source is a relatively close neighbor.

Grand Master Warnok opened the meeting. “We are privileged to have Research Director Gluon with us today. She is going to present her group’s interpretation of radio signals they have intercepted. I would also like to welcome her daughter, Nand, who is in the audience. I understand that she has personally contributed to the project.”

*What a liar!* Gluon thought. Warnok had let her know in all ways possible that he despised her and her project. From his introduction, of course, no one would suspect. Gluon had requested that her daughter, Nand, be present for the breaking of the historic news. She wasn't quite sure why Warnok had allowed it. *Perhaps he wants to discredit and embarrass me in front of Nand.*

Nand was 16 orbits old and had completed her physics and math curriculum. It was her knowledge of ancient history, however, that turned out to be her most valuable asset. In particular, it was her knowledge of the ancient symbolic language that brought it all together. The true extent of Nand's contribution, however, she must keep to herself. She was having enough trouble understanding it herself. For strangers who didn't know Nand, it would be impossible. They would assume it was an elaborate hoax.

A voice transmission from outer space asking for Nand by name? That message leading to another, which provided the protocol for an interactive communications network? Explicit instructions in the second message allowing us to construct a mirror image of the network, giving us the history, culture, and current knowledge of an entire alien planet?

No. The results of their findings would be difficult enough. The truth would only jeopardize her already fragile credibility. Gluon wisely decided to let the council think they had decoded the protocol with pure skill and brilliance. Gluon scanned the audience. *How will they react to the time-reversal news? I'll delay as long as I can; I expect a quick ending to my presentation after I drop that on them.*

Nand had a front row seat.

After the requisite introductions, Gluon acknowledged two new technologies that were essential to the success of her project. Large-scale matter-antimatter conversion now allowed their antenna arrays to float stationary in space at high altitudes, while the new ultra-sensitive nanotube radio frequency detectors eliminated the need to aim large parabolic antennas.

“We are now able to detect extremely weak signals using twenty arrays of non-directional nanotube detectors. These arrays form the vertices of a dodecahedron with fixed galactic coordinates. Signals from any direction of space are always visible to at least nineteen of the twenty high-altitude arrays.”

Gluon explained how the radio receivers are focused by applying a light-time delay to receivers closest to the target so that only the signals from the aimed direction will correlate.

Still pretending they had deciphered the signals from scratch, she said, “While we were successful in decoding the video signals, audio signals were completely unintelligible. They are unlike any dialect in our entire star cluster. The video sequences, however, portray some very strange physics.” Gluon waved a hand, and a large screen lit up in the front of the auditorium. “Here is a sample video that will demonstrate.”

The video started out with a view from above of a rectangular table. The table had a wide frame, which was shinier and more reflective than the flat green interior surface. There appeared to be six small round holes in the shiny frame: one in each corner, and one in the center of each of the long sides. A primate with a long stick was leaning over the table.

There was a single white sphere on the surface. It started moving and accelerated in a straight line for no apparent reason.

A fraction of a second later, a black sphere of about the same size popped out of a corner hole and accelerated in a straight line on a collision course with the white sphere. Then, in a weirdly improbable collision, the black sphere transferred all of its momentum to the white sphere. The black sphere stopped dead in its tracks, while the white sphere continued to accelerate away.

Then it got even stranger. The white sphere hit the tip of the stick held by the primate. Its momentum was totally absorbed by the tip of the stick, which was quickly withdrawn, leaving the white sphere stationary.

The video continued, with each sequence being more complicated and even more improbable than the preceding one. Each started out with the white sphere and other spheres of varying colors moving spontaneously. Sometimes they would appear suddenly at one of the holes, sometimes spheres already on the surface would just start moving.

Around the inside edge of the frame was some kind of energy boosting barrier. Spheres collided with each other and with the barrier, each collision increasing the sphere's velocity. The sequence of collisions always progressed to the same end. One by one, each colored sphere would lose all of its momentum in a collision. At the end of each sequence, only the white sphere was in motion, accelerating straight towards the tip of the primate's stick.

The last sequence was the most improbable of all. All of the colored balls came together to form a stationary equilateral triangle. The white ball again came straight out of the formation and accelerated towards the stick.

Gluon clicked her communicator and the display blanked. "We have observed similar physics taking place in all videos. This behavior obviously violates the fundamental principle that random collisions should cause a system to progress from orderly states towards more chaotic states. Our conclusion is that time is running backwards on the planet where these videos originated."

The buzz and mumbling resumed. Red faced, Warnok stood up. “Gluon, I can’t believe you expect us to take you seriously. Isn’t it much more likely that you are interpreting the video signals backwards?”

The mumbling in the council conveyed obvious agreement with the grand master. Everyone in the council recognized the implications. It is well known that antiparticles behave as if they are normal particles moving backwards in time. The discovery of a planet with reversed time would mean that it consisted of antimatter. This would undermine the established belief that the universe has a preference for the version of matter that exists on Z504.

Gluon knew her findings would not be welcome. “We have checked and rechecked, your excellency. It is not just these observations—there is other evidence that our time and Earth’s time are running in opposite directions.”

The grand master visibly flushed with anger. Taking his seat, he waved the back of his hand. “Please proceed, Research Group Leader.”

The phrase: Please proceed, (followed by a person’s official position or rank) has a very explicit and well-understood meaning. It is at once a warning, an invitation, and a threat. A warning that you are already in a hole, an invitation to keep digging, and a threat that you will be held responsible for your answer.

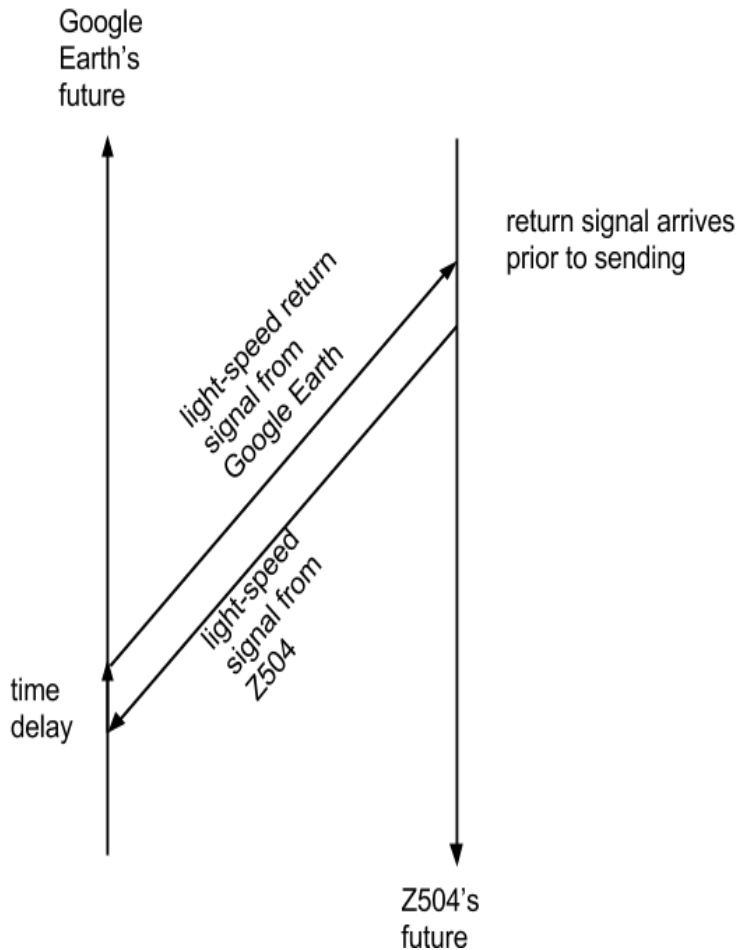
Gluon's voice cracked. She knew there would be blowback, but she wasn't expecting such a strong admonishment so early. "One orbit ago, we discovered the protocol required to connect into a computer network referred to as the internet on a planet named Earth—the planet that is the origin of these signals. The behavior of this communication link is absolutely bizarre. We send out packets of code—a request. And, we receive packets of code—the response to our request. The weird part is that we receive the return packets slightly before we send our packets." The audience was mumbling again.

What Gluon didn't say, and couldn't say, was the truth about decoding the protocol. As impossible as it must sound that her team had figured it out for themselves, the truth would have been even more unbelievable: an invitation—in plain text—on one of our standard frequencies. The message even provided the passcode needed to establish a connection: NROHRETTAM.

It was best to let the council marvel at the genius of her team. "When we send a light-speed request to Earth, the signal travels 400 orbits into our future, but also 400 orbits into Earth's past. After a short delay into Earth's future, our past, a return signal is sent 400 orbits into Earth's future, and it arrives slightly before our request was sent."

Gluon clicked her remote. A diagram filled the large screen:

## MATTERHORN PARADOX



Gluon's face flushed with embarrassment when she looked at the diagram. "I apologize for the captions. This diagram was made when we thought the planet was named Google Earth. It's actually just Earth."

Trying to recover gracefully, she continued. “We are now interacting with their internet in Earth orbit count two thousand five from an arbitrary starting point called CE. When we first started deciphering their radio signals, their orbit count was two thousand six. That’s right! Their orbit count is actually decreasing! Interestingly, the elapsed time for one Earth orbit is almost identical to ours, except for the fact that it’s going backwards.”

The grand master appeared even more agitated. Gluon sensed that she only had a few more seconds before she would be cut off. “I know this is a lot to absorb, but I want to quickly address our main conclusion. My daughter, Nand, discovered that several of the symbolic languages of Earth have familiar symbols and words. She even found a reference to our star group, Subaru, the same name we use. One of their surface vehicles was apparently named in honor of us.”

Gluon pressed on before Warnok could articulate his rage. “Our star cluster, also known as Pleiades, has attracted considerable interest from the inhabitants of Earth. Six of our stars are visible with their unaided eyes. Their ancient militaries used us to test the vision of warriors.”

Gluon knew she was past the point of no return. She had to talk fast. “It is our unanimous conclusion that at some time in the distant future of Earth, which will be sometime in our distant past, the people of Earth will develop a transporter and colonize our planet. In short, we believe that we are observing, on Earth, our own ancestors.”

The grand master was on his feet. “This is an outrage! You suggest that these beady-eyed primates are related to us? You insult our deepest core beliefs—beliefs, I might add, which have held our society together for the past 5,000 orbits.”

Yes, Gluon thought, *and also held back scientific progress for the past 100 orbits. Even with all the technology found in the ancient ROM archives, arrogance rejects the possibility that we’ve received help from outside our system.*

The grand master’s face was crimson. “This presentation is terminated! No one present here will discuss these absurd ideas with anyone. As for you, Gluon, the counsel will be deciding the future direction of your work. You will be contacted soon.”

Gluon stood silently looking at the floor.

“Did you hear me Gluon?”

“Yes, Grand Master. All good.” Gluon put the remote on the podium and walked off the stage. *I didn’t even get a chance to suggest a mission to Earth. I think the others will see it would have been futile.*

On Z504, success in science depends on a combination of competence and political correctness, with the latter always taking precedence. Any new discovery has little chance of acceptance if it is an embarrassment to the establishment. Gluon knew this going into the presentation, yet some in her group needed convincing.

Gluon was not without political influence. She was, after all, the granddaughter of Nor, who had invented the universal 3-D printer. It was the backbone of Z504's economy. With its bins of pure elements in various phases, it could construct any molecular structure or alloy on the fly as needed.

Gluon's status came from her grandfather's achievements. Warnok's, like all IEs, came from immense family wealth. Achievements fade. Wealth is forever. She had crossed an invisible line. Gluon's pedigree notwithstanding, she had clearly burned her bridges. There was no going back.

Gluon had anticipated the council's reaction, and she had accomplished her purpose. She had demonstrated to the few holdouts on her team that the establishment was not ready for the truth—at least not *this* truth.

From studying the history of Earth from their vantage point of Earth-year 2005, the evidence should be clear to the council that an immediate mission to Earth was vital for the very existence of their planet. Gluon had not even gotten to that argument.

While a sanctioned mission was preferable to her group, most had already volunteered to go without it. They had secretly prepared their spaceship. Gluon reviewed their options. *The faster we travel through space, the slower we travel through time. As our velocity approaches the speed of light, we become more light-like in our measurement of time. This is time-dilation. With our current technology, ship-time will advance fifty-eight orbits during the four-hundred light-orbit voyage. Our radio signals currently reach Earth in their “year” two thousand five. Since our fifty-eight orbit spaceship time runs opposite to Earth time, our estimated time of arrival will be in Earth-year 1947—if we launch now.*

There was a very small window of opportunity. *The longer we delay our launch, the closer we will be arriving to their global war, and the less chance we have of brokering a peaceful course.*

Gluon’s presentation to the council had not gone well. It was apparent to her entire group that their careers as scientists were over. It was certain that the project would be defunded and they would all be reassigned. They all knew how it would unfold. The new positions would be short term, followed by a series of reassignments, each one a demotion to a more menial job and fewer privilege credits. This was the fate of anyone associated with a project that had fallen out of favor.

The grand master was not pleased. They had discovered an antimatter world, not only in their own galaxy, but a very close neighbor, considering the size of the galaxy. This was in direct contradiction to many papers he himself had published, papers that supported the views of his teachers and their teachers before them.

Warnok was the last to leave the auditorium. *This cannot be*, he thought. *Where are the high-energy emissions from annihilations in the boundaries between opposite types of matter?* He could not entertain the notion that perhaps matter and antimatter don't come in contact because of something simple—like repulsive gravity.

He had too much at stake: his career, his reputation, his legacy, his position as the highest authority on scientific matters—all would disintegrate. Warnok's fear blinded him to the beautiful symmetry it suggested: that gravity, the perfect compliment to the electric force, creates two realities, each accelerating in opposite directions through time and space.

The grand master was not interested in either truth or beauty. Like so many before him who had achieved great prominence, his main priority was self-preservation. The idea of antimatter worlds coexisting in the universe, let alone in our own galaxy, was not an option for Warnok.

The fallout from the grand master's displeasure would be swift.

## Chapter 11

Cray burst into Gluon's office out of breath. "We've got a problem!"

Gluon swiveled her chair away from the large wall display. From Cray's red face and bulging neck veins, she knew he had run up the nine flights of stairs from the parking garage rather than waiting for the elevator; the elevator that had mysteriously become agonizingly slow in recent days. "What's up?"

"Just found out they're moving up our maintenance check to five days from now. I think they'd do it today if they had an empty bay. They're getting suspicious, Gluon."

"Take a deep breath. Let's think this through. Do we have time to remove the provisions we've stockpiled and get the ship back to standard configuration?"

"I don't think so. Even if we did they'd put the new batteries in—the same ones we were testing when Argon...." Cray couldn't say it; his vocal cords locked up for several seconds. "Anyway, the company claims they fixed the problem, but I don't trust them."

"The company or the batteries?"

"Both! You know how it is, Gluon. There's so much political pressure to make those damned things work. I've seen a lot of bad engineering decisions made under duress. I'll never know the full truth about that accident, but the batteries were part of it—they did fail!"

“You have a point. From what I’ve heard, the fix just mitigates the damage when they do fail. We need them to work, not just fail safely.”

Gluon thought for a moment. “We have to launch tonight; it’s the only way!”

“We have another problem, Gluon. Since Xor tried to launch, they changed the code for the ramp access doors. They’re now using an eight-digit code on an octagon keypad. No digit is repeated, so they will all show equal wear. They think Xor might have used the worn keys to figure out the code. They haven’t given me the new code. I’m locked out of the ramp, but I need access for the final pre-flight.”

Nand was working at a display screen nearby. Cray had her full attention with the word *code*. She spun her chair a quarter circle to face them. “I can crack it!”

“What? Are you sure? It has to be right the first time—there’s a penalty for making a mistake—alarms go off and everyone is locked out until it’s reset.”

“I can do it. Trust me. First try!”

“How can you be so sure, Nand?” Cray couldn’t believe her hubris. “Do you realize how many possible codes there are?”

“Of course, eight factorial: eight choices for the first digit, times seven for the next, times six for the next, and so on. They were too clever. By not duplicating any digit, they created an improbable special case.”

“But Nand, eight factorial is still a very large number.”

“Forty thousand three hundred twenty.” Nand had memorized the first ten factorials. “That might seem like a large number, but it is very small compared to the eight-to-the-eighth total combinations.”

“So it’s rare in the overall scheme of things. I still don’t see how you can be so sure you can pick the right one out of forty thousand.”

“Well, by making it such a long sequence without duplicate numbers, they’ve made it too hard to memorize. They don’t want people writing down access codes, even in their communicators. It’s against protocol. It must be written someplace visible from the keypad. We’ll recognize it when we see it.”

Gluon looked at Nand for several seconds and saw that her confidence was unwavering. She turned to her brother. “OK, let’s go tonight. Everyone has agreed to be ready on short notice.”

Cray was no longer hyperventilating. “Are you sure? Have you forgotten that perihelion and double new moons occur simultaneously tonight?”

“No, I haven’t. I think tonight might actually be the best time. Security will be at minimum staffing so people can be with their families. Everyone is going to be hunkered down trying to protect themselves from the quakes.

Cray saw that it was the only way. “You’re right! The sooner the better. Hopefully they haven’t locked the entire group out of the passenger bridge. I’m the only one that needs access to the ramp, and they’ve locked me out. They probably think that’s good enough. “I’ll take Nand with me to crack the code.”

“OK. I’ll send the signal. What time do you want to launch?” Gluon had her communicator in her hand.

Cray thought for a few seconds. “Let’s shoot for two decas after midnight—halfway to sunrise—halfway between high tide and low tide. Maximum rate of change in the planet’s tidal stress creates maximum chaos. Nand and I will try to beat the first wave of quakes. We’ll be there right after sundown. Get everyone else on board right after things settle down. Everyone should be on board by midnight.”

## Chapter 12

Dorque was preparing to leave his office for a more secure location. Only his secretary would remain overnight in the area. All other personnel had been dismissed.

The secure video chime prompted him to check the time. *Would Warnok expect him to still be in the office?* He decided to answer. Clicking the connect icon, a face filled the screen. It was not his uncle's.

"They're going to launch tonight Commander—well, in the morning actually—a few decas before sunrise. They want us all on board right after the first quakes to start the launch sequence. Do you want me to contact security and have them arrested?"

"No! I want to do this one personally. Meet me outside the personnel bridge right after midnight. I'll bring my secretary. She's the only one here now."

"Ishka?"

"That sounds right."

## Chapter 13

Cray parked out of sight from the main roadway. He threw both proximity keys on the pilot's seat and pulled the door down, leaving it unlocked. As he and his niece walked away, he thought, *Tomorrow is going to be someone's lucky day.* Cray stopped and turned back toward the cruiser for a brief moment.

It was too dark to see the cruiser's ocean-green glossy surface with imbedded iridescent metallic flecks, but Cray saw it in his mind. How could he forget the countless days of hand rubbing the surface!

Cray turned away from his mag-lev cruiser for what he knew was the last time. He felt suddenly euphoric: lighter, as if he were being lifted by a strange invisible force. He had just broken his last emotional bond to Planet Z504.

Cray had given away hundreds of exotic and expensive tools in the past few days, and not just his. Gluon had asked him to dispose of Argon's tools and lab equipment. He gave most of it to Argon's ex-students. He couldn't sell them. Transfer of credits into his privilege account would have attracted attention. *Besides*, he thought, *either way things go tonight, I won't be needing any more credits.*

At first the process had been agonizing. He would run his hand over each tool and try to remember the last time he'd used it. Moving to the next and leaving a small void in its place, he began to appreciate the order that was gradually replacing chaos. Only by getting rid of everything could he make his workshop as organized as Argon's.

"Simplify, simplify, simplify," had been Argon's mantra. It had showed in everything he'd done and everything he'd left behind. His passion and talent for simplification had not endeared him with the establishment. They had much invested in the complexity of their esoteric art.

What seemed to anger authorities even more than Argon's mastery of physics was his philosophy. So great was the ridicule and criticism that Argon stopped talking about it in public.

Cray looked at Nand. She looked too mature for a girl of only 16 orbits. Certainly she had endured Argon's long lectures on how freedom of choice creates order in the universe. Maybe she understood it better than he had. Cray couldn't quite make the connection between particle physics and the choices we make in our lives, but Argon had insisted that both were part of a universal principle.

Cray could hear Argon as if he were still walking beside them. *"Particles only form interference patterns when they are given a choice of paths; remove that choice and order gives way to random scattering."*

*Maybe Nand can explain it. Cray thought. If we pull this off, we'll certainly have time to discuss it.*

#

Cray and Nand approached the same section of zigzag-stranded fence that Xor had cut through two orbits ago. It had been replaced with a new fence, and as Nand had noticed three days earlier, new security lights. Yet those lights were not on tonight. *The new lights must be on the power grid that went down with the afternoon quakes. They must not have shifted the new lights to the backup system.*

The yellow light from the distant launch pad barely made a dent in the darkness. Cray selected the darkest location.

Nand removed her backpack. "I brought a power snipper from Papa's workshop. I hid it before you could give it away. Before we cut the fence we need to attach this." She pulled a meter-long wire from the backpack. The wire had two spring clips, one at each end.

"I've been studying this new security fence from the school transporter." Nand held her communicator over her head and pointed it down before switching its light on. "Notice the vertical zigzag strands have a black coating, except for the shiny tips where they're twisted together at the top and the bottom."

“Good eye, Nand. The coating is probably dielectric to insulate the strands from each other except where they’re connected at the top and bottom.”

“That’s what I’m thinking—each strand must be part of a closed circuit that runs all around the launch complex. There’s probably a continuity monitor that sets off an alarm if any of the strands are cut. Show me where you want the hole.”

Cray traced an imaginary rectangle with his finger. “How about here? That should be big enough to get through.”

Nand pinched one of the clips, opening its jagged metal teeth. After clipping it on one of the shiny pigtails to the right of the rectangle Cray had traced, she wiggled it back and forth to ensure a good connection. She ran the wire along the ground and attached the other clip to a pig-tail on the left side of their intended opening. “There! If we don’t trip on this jumper wire and disconnect it, we should be able to cut an opening without setting off an alarm.”

Cray made his first cut, then held his breath. There were no flashing lights—no sirens. Cray worked quickly, snipping each strand of fence where it crossed his imaginary rectangular boundary. Throwing the cut section of fence aside, uncle and niece carefully stepped through the opening.

Cray and Nand walked slowly so that there wouldn't be any fast changes on the security monitors. Watching a wall of video screens is a boring job. If the scenes don't change, there's nothing to attract the attention of a tired security guard. Nand hoped that the monitors had not been upgraded. Newer security monitors exaggerate the brightness of any pixel that changes from one scan to the next. It gives any moving object a bright border on its leading and trailing boundaries even if the motion is slow.

The pair went straight to the metal stairs below the same door that Xor had used. They climbed the stairs and looked at the key pad. Sure enough, it was now eight buttons forming the corners of an octagon.

Nand examined the door and its surrounding surface. No numbers were written anywhere. "It has to be here, Cray. It just has to be."

Nand turned around and looked across the ramp. Large maintenance buildings stood in a row across the expanse of hard black surface. Each had large stenciled numbers high on their left sides. The numbers must have been huge to be readable at that distance. Perhaps three times the height of a person.

Nand was about to turn back toward the door when Cray saw it. "Look at that one building. Its number is on the right side. All of the others are on the left. And look at the building on its right—its numbers are all different. Taken together they make eight digits—all unique."

"That must be it, Cray!"

“OK, we’ll go with that.” Cray turned back to the key pad to refresh its layout in his mind. Then he turned back to the buildings to memorize the first four numbers then back to the keypad. Cray reached out and put his finger on a key.

“Wait! Don’t start yet. When you turned around to look at the buildings it was too obvious. Anyone watching with a high-power scope would be able to figure it out.”

“You’re right, and I only had the first four numbers memorized. I was going to turn around again to get the second set. I think most people would do the same thing.”

“That would be a dead giveaway. Let me think.” After a few silent moments, Nand asked, “Can you see the reflection of the numbers in the glass?”

“Yes. They’re backwards, of course.”

“OK, that’s it. Punch in the numbers left to right in the reflection. It’s easy to recognize the mirror image of individual numbers, but if you try reading them right to left, it’s hard to keep track of where you are in the sequence.”

“Are you sure, Nand? Once I start, we’re committed.”

“I’m sure!” ...*I think.*

Cray punched in the first number, the one on the left end of the reflected sequence. They listened. No sirens. Cray punched in the next three. Still no sirens. He switched to the reflected numbers on the next building and punched them in.

The lock clicked.

## Chapter 14

Perihelion midnight—always an ominous time on Z504. With the planet swinging around its sun at maximum angular rate, centrifugal forces from spin and orbit conspire to thrust the surface of the planet upward toward the darkness. The combined force is greater than the sum of its parts. But this is no ordinary perihelion; it coincides with a rare alignment. The sun and both moons are in syzygy. On the opposite, mid-day side of the planet, Big Moon, Little Moon, and Sun are all lined up, pulling upward together on Z504's surface.

Tidal tension between these opposing forces has pulled the planet into an egg shape. Now, at midnight, the launch site is on a sharp end of the egg. The planet's surface is at maximum curvature. Compression forces deep below the surface lock and stabilize the planet's crust. It is quiet—the calm before the storm.

Midnight is just a few decas before the most dangerous time. When the planet's surface flattens, the compression locks release. This is when the planet's solid crust, floating on a core of molten gold, will have its precarious fissures and faults tested.

The commandeered ship survived the initial quakes that accompanied the setting sun and invisible moons. Only a few electronic cards had been jostled enough in their sockets to interrupt their performance. One caught fire and had already been replaced.

The spacecraft stood in darkness on its launch pad. From a security perspective, there were no external signs to betray the pirate crew already on board. The personnel bridge was intact, and standby generators had come on-line to keep the launch area flooded in sodium light—a glowing yellow island in a black sea.

Commander Dorque moved slowly around the ship, occasionally holding his communicator light close to the craft's surface. One by one, he found his targets. Six of them, equally spaced around the ship just above the top of his head in easy reach. Six small holes, each in the center of its own little circular patch of gray, smooth metal. He smiled as he saw that their protective magnetic covers had been removed. *I'm right; they're getting ready to launch. Cray has completed his exterior inspection.*

Dorque fished a small roll of transparent tape from the patch pocket on the arm of his flight suit. Peeling off a small piece as he located each of the static ports, he tore it against the jagged edge of its clear dispenser. Carefully, he pressed the tape over the hole and smoothed it so it disappeared.

*Sometimes simple, low-tech solutions are the best. Such is the case for automatic control of the six stabilizing thrusters that rely on these static pressure sensors. With the static ports sealed, the ship will become unstable and crash almost immediately after launch.* A fatal backup plan in case he failed to stop the launch.

Dorque made his way back to the boarding area, carefully avoiding the field of view of the ship's cameras.

## Chapter 15

The command deck was flooded in red light to preserve night vision. Xor read from a virtual checklist. As he verbalized each item, Cray responded by touching the switch and announcing its position.

Gluon closed the hatch behind her as quietly as she could. Cray turned to see who had entered, then back to Xor. “Mark inertial alignment checklist incomplete. We’ll redo it from the top.”

He turned again to Gluon. “Is there a problem?”

“Ruggel didn’t show up. It’s way past midnight, and everyone else got here over two decas ago. I don’t understand it. He was the most enthusiastic and the first to sign on. Maybe he got cold feet after he thought about it more. You know, easy to talk big before you’ve considered all the consequences.”

Cray sounded unconcerned. “Don’t worry about it Gluon. We’ll get along fine without him.”

Gluon was imagining the worst-case scenarios. “Do you think he ran into trouble? Maybe he got caught.”

Cray moved his hand across the space in front of him. A holographic image of the launch pad appeared around him. All was quiet. “Actually, I would have been surprised if everyone had shown up.”

Gluon squinted suspiciously at her younger brother. “What do you mean?”

Cray continued to turn slowly, examining the hologram he was immersed in. “I’ve suspected that someone in your crew had other plans—just didn’t know who.”

“Why didn’t you say something?”

“Because I wanted whoever it was to think we trusted him.”

Gluon and Xor watched as Cray, bathed in red light, bent and twisted, as if trying to look around every shadowy corner of the spaceship’s exterior.

Xor broke the silence. “Do you want me to start the alignment checklist again?”

Cray made a hand motion and the hologram disappeared. “No, I have to do another walk-around first.” At the exit hatch, he turned back. “If I’m not back in one-half deca, lock the entry hatch. You and Ercu finish the checklist and launch without me.”

“Are you kidding?”

“No, I’m not kidding. Ercu and I have already talked about training you in SIM mode before the DECEL phase.”

“Why are you leaving, Cray? What do you mean, *if* you don’t come back?”

“It’s probably nothing, Xor. I just need to make sure. Call Ercu now. You can watch me on the exterior viewer. If every thing’s OK, I’ll give you a thumbs up.”

From the passenger bridge, the door out to the secure ramp area had a new octagon key pad. Looking through the small window in the door, Cray could see the buildings with the large numbers. *OK, on the other door I was reading the code from a mirror image, so now I need to enter them backwards. At least the numbers are not mirror images now, so they're easier to read.*

As he touched the first button, he stopped. *Wait, what was it Nand said? Too easy to lose your place reading backwards. There's no reason for this lock to have the same code as the one out on the ramp.*

Cray looked out the window again and punched the numbers in their normal sequence left to right.

The door clicked...no sirens.

## Chapter 16

For a second time, Cray climbed the ten steps from the secure preflight ramp around the spaceship. At the top of the stairs, the door to the passenger bridge was on his left. To his right was the door to the steps leading down to the less-secure ramp and the buildings with the stenciled numbers, all awash in monochrome yellow. Beyond the buildings and the hole in the wire fence sat his abandoned mag-lev cruiser. Cray cupped his hands around his face to block reflections and pressed against the glass, straining at the distant darkness beyond reach of the yellow sodium light. *Good, no sign of the breach Nand and I made in the fence. More important, no flashing lights. It hasn't been discovered yet.*

Cray turned half-circle and approached the door to the passenger bridge—the same door he had come through so recently. No code needed this time. Key pads were only on the sides with the lower security level. The door was hinged on the left and opened into the square tube. As the door swung through an eighth-circle, the reflection of three figures flashed briefly in the glass window. Cray pretended not to notice. He pivoted left around the open edge of the door, letting the heavy security door close silently. Cray stepped towards the ship's main entry hatch.

From behind, a commanding voice yelled, “Stop right there, *Captain Cray!*” The emphasis on the word captain exuded sarcasm. Cray recognized the voice instantly—too deep for a female, but higher pitch than expected from an adult male, as if it’s owner’s vocal chords had gotten stuck halfway through puberty.

Cray crossed his right leg behind his left and planted his right toe. A crisp half-circle pivot on his left heel put him facing the threesome. Dorque was in the center of the square tube, flanked by Ruggel on the left and Ishka on the right. Dorque was unarmed, his stance slightly wider than his shoulders, with his arms crossed in front of him.

The least intimidating of the three was Ishka. Her paralyzer’s safety lever was up and her thumb wasn’t on it. Ruggel’s, on the other hand, was armed. He looked anxious to try the weapon on a human target.

“Ishka! Nice to see you again.” Cray put on his most charming grin and acted as if she were the only one there.

Cray pretended Ruggel had just materialized from thin air. Still ignoring Dorque, he continued. “Ruggel, does this mean you changed your mind?”

Dorque was furious. “You’re not going anywhere, you insolent imbecile! You’re under arrest.”

“Oh, I didn’t recognize you in a *flight suit*, Commander.” Cray tried to match Dorque’s sarcasm. “Alright, you caught me. Call security. I won’t give Ruggel an excuse to shoot me.”

Commander Dorque raised his communicator, but before his finger could touch the call icon, Cray continued. “There’s something you should know before you make that call, though, Commander.”

Dorque switched from anger back to sarcasm. “And what would that be, Captain?”

Cray reached across his body with his left hand and opened the patch pocket on his right arm. Ruggel raised his weapon. Cray raised both hands empty. “It’s not a weapon. I’ll pull it out real slow.”

Ruggel kept his paralyzer aimed at Cray’s chest. “OK, Captain, but if you make a fast move, I’ll drop you.”

Cray slowly moved his left hand back to the pocket. Agonizingly slow, much slower than was necessary to keep Ruggel calm, Cray gradually pulled a transparent container, of the type used to store computer-readable chips.

“I said, what would that be?” Dorque tried to duplicate his earlier sarcasm, but his voice betrayed uncertainty.

“It’s proof that you cheated at the academy. I’m not sure what happens to people in your elite world who become an embarrassment. We mortals never hear about them again. Maybe there’s a luxury resort somewhere just for screwup’s like you—or maybe not.”

“You’re bluffing! There’s no way you have proof.”

“I also have something else I think is yours.” Cray put the container in his right hand and again slowly moved his left hand towards the pocket. He dug to the bottom of the pocket with his thumb and first finger. When he withdrew them, they were pinching a small shiny sphere.

Ishka looked at Commander Dorque suspiciously. “What’s this about? Your cube of magnets has a missing corner. Is that it?”

Cray answered for Dorque. “I found this in my Trojan cockpit after it almost killed me. I can’t prove it, of course, but I think you put it in the seat track to make it bottom out in a high-g maneuver.”

“You tried to kill him!” Ishka pointed her weapon at the floor.

Cray continued. “I think you also had something to do with the accident that killed Argon. I can’t prove that either, but it won’t matter to a lot of people, after I introduce them to the real Commander Dorque.”

Dorque was weighing his options. He was certain Cray was lying about having proof of his cheating, but like Ishka, many would turn against him anyway. “You know what, Cray? I’ve decided to just let you leave with your little band of misfits. Why should I have to defend myself against your lies?”

Dorque turned to Ishka. “You might as well go with him. It’s pretty obvious whose side you’re on.”

Ishka walked to Cray's side, and as she pivoted, she leveled her weapon at Ruggel and expertly clicked the safety off with her thumb. "I was already planning on it, Commander. Cray wanted *you* to get me through security, since I'm not an authorized crew member."

"Good riddance to both of you. Let's get out of here, Ruggel." With an almost imperceptible grin, Dorque thought to himself, *Good riddance, indeed. I just need to get far enough away from this crash before it happens.*

As the pair walked away, Cray yelled after them. "Oh, Commander, would you like to keep this?"

Dorque turned around just as Cray held out a small wad of transparent tape.

The blood drained from Dorque's face. He did another half-turn and stormed off the passenger bridge. His face changed from ghost white to bright crimson.

As the two lovers entered the spaceship, Ishka put her arm around Cray's waist. "Do you think they will launch interceptors?"

"I doubt it, Ishka. Dorque doesn't want it known that he let us get away. He'll probably have his Uncle Warnok delete the retina scan file."

"But even if Dorque doesn't report us, won't they come after a missing ship?"

“Not after the massive destruction from the quakes. The upper echelon of IEs will be scrambling to claim the best locations for new luxury villas in the areas hardest hit—the ones with the most deaths and displaced residents. They won’t want to interrupt their feeding frenzy to chase after us.”

## Chapter 17

Beads of sweat formed on Cray's forehead. He could feel them, hanging, tickling. *Damned micro-gravity! Can't even move sweat.* Driving the exo-bug was normally Cray's idea of fun—but this was not fun. The remote claw grips were slippery under his fingers. The stereoscopic scene projected into Cray's goggles could have been mistaken for a visual display in a virtual reality game. Cray knew it was all too real—and deadly.

“OK, Ercu. I think I found a good crack. It looks like a charge stuffed in here will blow the rock bridge and disconnect this thing from Big Moon.”

“Looks good from here, Cray.” Ercu was looking at the same 3-D image from the safety of the mother ship command deck. “Is the surface stable?”

“It feels solid enough—a little creepy, though, knowing there's no visible means of support. It might be my nerves, but once in awhile I feel a slight tremor—kind of a low-frequency vibration.”

“Check your knees.” Ercu released the transmit button. *If it were me, I'd know where the tremors were coming from.*

“Very funny, Ercu. I’m going silent. Don’t be bashful if it looks like I’ve missed something.” Cray clamped his claws on two jagged protrusions on either side of the small crevasse. Setting the squeeze lock to free his hands, he then switched controls, and another arm came into view. At its end, a fully articulated hand gently cradled a fist-size ball of gray putty.

Except for obvious mechanical joints, an observer would find it hard to distinguish the hand from a human’s. Cray pushed the ball of putty into the crack. Tactile feedback sensors reported a pliable squeezing into the gap, then rock-hard resistance, as the asteroid sucked all thermal activity from the explosive. For Cray, the illusion of the hand being human was complete—it was his. *Amazing, my brain has already accepted it as part of my body.* Cray shifted his hand back to the claw controller. *Strange, not pain, but definitely a tingling from the mechanical hand. My brain still feels it as a phantom appendage.*

Cray pushed away from the explosive. He adjusted his headlight to inspect his handiwork. *Good. Locked in solid between the two walls. Detonator still buried, just its thin antenna wire growing out of the blob like a long, wild hair.*

Cray walked the claws backwards along a flat ledge until the crack and explosive charge were barely visible. Pivoting to the opposite direction, Cray clawed the exo-bug forward, away from the explosive, towards the black abyss.

The surface contours of the ledge were magnified by the exaggerated parallax between the two external cameras slaved to Cray's eyeballs. The scene looked exactly like the view of Small Moon's surface from the mother ship. *A perfect fractal*, he thought, *it looks the same at any scale*. Across the pocked but generally level surface, the exo-bug crawled toward a sharp edge, beyond which the rim of the crater was visible in the distance.

Stretched out in its mobile configuration, the seven armor plates of the exo-bug arched over its back, slightly overlapping at the top, the trailing edge of each forward plate hiding the leading edge of the one behind. Down each side, the plates tapered away from each other, exposing a wedge of flexible membrane. At the bottom, almost touching the asteroid surface, the plates swept aft, each forming an angle equal to a seventh of a complete circle. In full defensive mode, the bottom of the seven plates converged on each side as the exo-bug rolled into a closed armor-plated sphere, a design copied from nature: a scaled-up version of the small exoskeleton bug that Cray played with as a child.

The exo-bug was a construction machine. From inside, Cray had super-human strength. Powerful claws magnified gentle forces on the controls; yet tactile feedback was so sensitive he could feel the texture of everything he touched. The seven articulated sections forming the bug's armor shell were composed of pure gold/anti-gold alloy. This indestructible shell could be re-fitted with a new internal module ('guts') whenever there was a design improvement or need for a specialized module. The old guts could be jettisoned and new guts snapped in.

As a crawler, it was slow, but as a flying machine, the bug could be repositioned quickly. The bug's flight controls were similar to the Earth helicopters Cray had so recently studied. Force from four thrusters (front/back, left/right) were controlled differentially for pitch and roll with the control stick in Cray's right hand. Equal forces from all four thrusters provided gravity-defying lift—controlled directly by a horizontal lever, the collective, located beside Cray's left thigh. Pulling up on the collective increased lift. Velocity in any direction was controlled by tilting the exo-bug in the direction of the desired motion. Yaw control was provided by foot pedals.

Thanks to thousands of small adjustments automatically taking place in the background, the bug was stable and easy to fly. Cray started to relax now that the explosive charge was in place; the more distance he put between himself and the charge, the better he felt. He was confident and comfortable—until—he looked over the edge.

Cray felt a sudden wave of panic. A floating sensation—his stomach muscles tightened. Grabbing for any anchor, he felt rock crumbling between the powerful jaws of his claws. He felt as if he had instantly been propelled into space—vertigo brought on by complete and total nothingness: a darkness so black, so ominous, so frightening, Cray was momentarily paralyzed.

It was night at Floating Rock. Both Big Moon and Z504 were still in full phase, casting a blanket of white light on the asteroid behind him and the moonscape beyond the crater rim. Above the horizon was the blackness of space sprinkled with bright points of light and the almost overlapping full circles of Z504 and Big Moon. Straight down, it was even blacker than space. It caught Cray by surprise—even though it shouldn't have. The floating rock and the crater around it had been thoroughly mapped from the mother ship. The virtual reality model built from these data clearly showed the thin black ring, void of reflection, surrounding the floating asteroid. Looking down at the void through the bug's stereoscopic viewer made it all too real.

The visual impact challenged Cray's perception of material reality in a way he had not anticipated. He tried to wrap his head around it. *What happens to the light? Does it go in and never come out? What would happen if I touched it? Would the atoms in my body merge into a super strong antimatter/matter structure? Or is gold/anti-gold alloy, the stuff that makes this bug's armor so strong, the only possible matter/antimatter compound? No one has experienced antimatter on this scale. Will the old assumptions turn out to be true? If this amount of antimatter annihilated, it would be a supernova—it would wipe out the entire star system.*

Cray inhaled deeply. He took inventory. *I'm not floating. I'm not falling.* Gradually, he released his grip on the claw controls. Logic slowly displaced fear. *This thing has been here for a very long time. It is gravitationally clamped between this asteroid and the bottom of the crater, if it were going to annihilate, it would have done so long ago.*

In the recesses of Cray's neural network, there still lurked a fear of the unknown. *I'm not going to touch that thing if I can help it! I'll fly over to the crater rim and then around the rim to the other side. I hope Ercu's calculations are right. Sure don't want to do this again. If this blast doesn't disconnect the bridge, the next one might take off too much weight—if this thing escapes and floats away, we'll lose it.*

Cray leaned forward and looked down again. The external cameras extended out over the ledge and matched the aim of his eyes. Keying his mic, he said, "Ercu, are you getting this video?"

“I’m looking at it, Cray.”

“Isn’t that the spookiest thing you ever saw?”

“How so?”

“Look at it, Ercu. Like it’s not really there—just a force field—pure, cold, invisible energy.”

“Well, you knew you couldn’t see it, right?”

“Yes, but some things you can’t really believe until you see them up close and personal—or don’t see them in this case.”

“You want me to pick you up before you detonate the charge?”

“No, I’m good. Let’s get it done. I’ll fly the bug over to the opposite edge of the crater....” Cray checked his compass. “I’ll be zero-niner-zero from crater center. Suggest you stand off on same bearing. After we shed the extra weight you can bring the superconducting loop to my position with the other bug.”

The superconducting loop was part of the cargo intended for the new resort project on Big Moon, a 1 km length of mag-lev cable containing thousands of microscopic strands of superconducting filament. A smart connector was already attached to one end. When the other end of the cable was pushed into the smart connector, it automatically made superconducting connections between unique pairs of filaments. Cray didn't know exactly how it worked, but apparently one of the two terminals on the smart connector was pre-attached to one of the filaments. It transmitted a signal to the other end of the filament, causing it to seek out any random unconnected filament. When no unconnected filaments remain, the last filament would connect to the other terminal. Instantly, a continuous superconducting coil would be formed with thousands of loops.

“Will do, Cray. Give me a call when you’re ready to detonate so I can watch the show.”

Cray reviewed the plan. Ercu’s plan. The survey of the floating asteroid had revealed a magnetic field, its poles vertically aligned. The plan was straightforward. Lay ten loops of mag-lev cable around the perimeter of the crater and connect the two ends. Ercu had estimated the net weight of the floating asteroid and the antimatter underneath it. Blowing the rock bridge should set the asteroid free. Ercu calculated they would have enough battery energy from both bugs to lift the whole combination about five meters, enough to pull tethers underneath it and moor it to the front of the mother ship.

“OK, Ercu, I’ll call when I’m in position.” *It sounds like a lot of ifs, but I can’t think of any other way. It sounds crazy. Even if we have enough battery energy to lift this thing, how can we keep it elevated long enough to position the tethers? I hope Ercu’s right; he insists that it only requires energy while lifting it—force moving through distance, he says. Once it’s in position, the batteries will be replaced with a superconducting short circuit. Theoretically, it should stay put. Force without movement requires no energy. Argon always said that Ercu was one of the smartest people he knew, and I trust Argon.*

Cray switched his visual display to the virtual model—it was less frightening than reality. Pulling up slowly on the collective and pushing the control stick slightly forward, the bug rose above the ledge and drifted forward over the edge. Cray felt a tightening in his gut. *Don’t look down. Don’t look down.* Cray kept his eyes on the horizon beyond the crater rim. Tilting the lift vector further forward, the bug accelerated.

Over the crater rim, Cray pulled back on the stick to check his forward velocity. Swinging the bug’s nose parallel to the rim with left foot pressure, he resumed his forward velocity, this time with just enough left bank to stay over the crater rim. The tail of a graphic arrow approached zero-nine-zero. Cray leveled the bug and lowered the collective. *Argon’s secret for a perfect landing works on any craft. Cray smiled. Just level off a finger width above the surface, then let it down easy.*

Cray pivoted another quarter turn left and clawed forward toward the crater. Back on real-time visual from the binocular cameras, he looked at the floating rock from a new perspective. *Strange rubble field: smooth oval stones, all the same size. From here they look slightly smaller than my fist. Weird. They look like they have been tumbled in heavy surf for eons—impossible on Small Moon, devoid of water or fluid of any kind.*

There was something else strange about the rocks. It was the way they appeared to be stacked: a uniform annular ring of rocks stood about a meter inside the edge of the crater, not rounded at the top, but sharp. A single row of stones at the top seemed to be balanced precariously on the sharp circular ridge. The sides of the stack were concave, shallow slope at the base, but becoming steeper at the peak, like an ocean wave about to break. Total vertical height from the base of the wave of stones to its peak was maybe two meters.

Cray looked at the trench between the steep drop-off of the crater rim and the wave-shaped stack of stones and suddenly questioned his own judgement. *What made me decide this trench would be a good place to hang out? Gluon would probably attribute it to the missing strand of genetic code that distinguishes the male gender, but I need to check out that wave of stone, and the trench looks well protected from flying debris.*

Cray pivoted the bug a half circle to face away from the crater center. Clawing backwards, the tail of the bug snaked over the lip of the crater like a slow-motion waterfall. When finally the full length of the bug was hanging over the cliff, only the claws remained gripping the top surface. Side-stepping, the claws walked a large arc down the vertical crater wall.

At the bottom of the trench, Cray felt the smooth stones with his claws. *They vibrate!* Cray tried to climb up the stacked wave of stone. *No traction—no friction between the rocks!* Every place pressure was applied, the rocks gave way, offering no resistance.

In a tricky balancing act, he walked backwards with his front claws while curling the body of the bug into almost a closed sphere. Balancing on its tail, Cray unfolded the bug, extending to full length before falling gently—in slow motion—against the slope of the wave. With its light, micro-gravity weight distributed, the bug lay against the side of the wave and didn't cave in. Inside the bug, Cray couldn't feel the vibration, but he could hear it; it sounded like millions of insects, the kind that frantically rub their serrated legs together when the temperature is just right for a mass mating frenzy.

Suddenly, Cray understood. The alien antimatter asteroid wants out. *Wants? It seems alive!* Cray felt a strange empathy for the invisible asteroid. It had not come here on its own volition. It had been coerced. It had been brought here by clever people who had entombed it in this alien and hostile moon. On some level, Cray was talking to it. *It's OK. You're going home!*

*Of course! Inertia is gravity! Gravity is the glue that keeps mass in its place—the stuff that maintains the status quo and discourages velocity change. This mass has antigravity; it must have anti-inertia. Instead of resisting acceleration, it welcomes it. No wonder it vibrates—it's trapped: squeezed by the gravitational attraction between the asteroid above and the moon below. Gravity everywhere, nearby moons, planets, stars. Our neighborhood is not friendly to this lonely marooned piece of antimatter, pushed and shoved and gravitationally rejected from everything around it.*

Cray again felt the vibration of the stones through his claws. It was more than just a natural oscillation between opposing forces; it felt like a shiver. *No! It's not alive! It's just inert matter from a very different place.* Cray regained his objectivity. He smiled. *Inert? As in inertia? Whatever this thing is it is definitely not inert.*

Cray focused on the crest of the standing wave, the narrow ridge where there was a single row of small, smooth stones. He picked up one of the stones in his claw. Removed from the wave, the stone was instantly quieted. Amazingly, another stone appeared out of nowhere to take its place. The crest of the wave looked exactly as it did before. *It's like a liquid*, Cray thought. *Like taking a scoop of water out of the ocean.*

Cray plunged his claw through the wave. *Almost no resistance. Only a slight even pressure and vibration as the claw goes through. Strange stuff!* Undisturbed, the steep sides of the wave's crest and the single row of stones along the top continued over the claw's arm as if it were not even there.

"Are you getting this, Ercu?"

"Yes, I'm watching it."

"What do you make of this stuff? All these stones are vibrating. I think this antimatter rock is some kind of oscillator, probably been vibrating for thousands of orbits, ever since it was put here. I think that's why the stones are so smooth. But what's with this wave? Can you see my claw coming out the other side?"

"I've been watching that too. I think you're right about the antimatter being an oscillator. I think those rocks are stacked by some kind of standing wave reflecting off the crater rim."

"Can you tell if it goes all the way around the crater?"

“I’ll check, Cray. Call you right back.” On the mother ship’s command deck, Ercu manipulated a small control stick to slew his vantage point along the rim of the crater. “Yes, all the way around. Constant distance from the edge of the crater and constant shape.”

A wave of doubt swept over Cray. *This might be the dumbest thing I’ve ever done. But I’ve never been one to overthink things—why start now?* “Ercu, are you in a safe location?”

“Ready anytime you are.”

Cray pulled his claw from the wave and positioned the bug at the bottom of the trench. Switching to flight controls for a fast getaway, he called Ercu. “OK. Detonation NOW.” Cray swiveled a small cover to the side, exposing a button. He pressed it. Nothing. Cray started counting. *One, two...did the explosive fail?* Then he felt the stones collapsing beneath him, towards the center of the crater. *Where are the rocks going?*

“Cray! Look out!”

Before Ercu finished his name, Cray cranked his head and eyes up. High above the now collapsing stone wave, the visible asteroid, the one he had just blasted free, was overhead—falling—slowly, but steadily faster, directly towards Cray. Cray understood two things in that moment: the blast had upset a delicate equilibrium, and as the visible asteroid was falling towards him, the invisible one was going away. *That’s where the stones are going! The antimatter is rising out of the crater, leaving a giant cave!*

*Too late to fly out—the bug’s rolling inverted!* Cray reached out and hit a large red button with the palm of his hand. Instantly, but in slow motion for Cray, claws, cameras, drills—all the exo-bug’s accessories retracted into its under belly. Simultaneously, the bug’s armor plates expanded at the top and curled under at the bottom. Inside, Cray’s binocular viewer snapped away from his head and locked into a small compartment in the overhead. Pneumatic shock-absorbing tubes wrapped around Cray’s arms, legs, torso, and head. Cray was along for the ride.

A deafening roar. A shock took Cray’s breath away and grayed his vision. Then tumbling—violent tumbling—an angry surf—not of water, but of thousands of stones battering the now spherical bug. *This is it!*

A violent vertical shock compressed Cray’s seat cushion and stretched his skin downward in all the triangular areas not held in place by restraint tubes. Cray blacked out. He couldn’t feel the immediate reversal of the upward acceleration—the blow from above that sloshed his brain against the top of his skull. Silence.

*Am I dead? If I’m dead, how can I contemplate being dead?*

Cray saw a white light surrounded by iridescent rings. Standing in the light, a woman holding a baby. The light came closer. Ishka spoke without words. “Our son.”

Without words, Cray queried, “Are you pregnant?”

Silently, she said, “Not yet. Go back. Go back now!”

The light receded, Ishka and the baby along with it.

Cray awoke to silence and the red glow of emergency lighting. *Headache—blurred vision—how long have I been out?* With the absence of violent accelerations, the restraint tubes had automatically deflated. Cray reached out and groped for the large red button. Hooking his fingers behind its edge, he pulled. The button snapped out and the exo-bug came to life. The binocular viewer swiveled back to its position in front of Cray's eyes. The sharp points of the armor plates started to separate. The unfurling seemed much faster than usual. Cray heard six distinct clunks overhead as the bug's shell segments stretched out.

Cray tried to focus his eyes. *Can't see crap. Maybe the cameras are broken.*

Cray selected virtual mode and moved his head. The binocular display followed. Up, down, left, right—nothing. *It must be broken too.*

Cray's vision of the interior of the bug started to clear. *I'll try the cameras one more time.* Back in real time, the display still showed total darkness both above and below. At level elevation, however, Cray could see what looked like falling water all around him. It was like being inside a circular waterfall. *It can't be water; it must be rocks.* Cray checked his attitude gyro. *Level—blue side up—at least I'm not inverted. Vertical speed: up one meter per second. I must be stuck to the bottom of the antimatter—it's pulling me up!*

As the waterfall illusion expanded, it also faded. At its base, the bright horizon of Small Moon formed a thin white line, separating two worlds of blackness. The line was getting thicker. *I'm above the crater rim.*

Cray put his hands in the claw controllers and felt around. *Nothing, just empty space around me. What's above?* Cray knew the answer to his question but was afraid to confirm it. *Might as well check. If the claws stick to it, so what? They aren't doing me any good anyway.*

Cray reached up over the front of the bug where the claw arms had enough vertical freedom to reach above the armor plates. The claws hit something solid. Not just solid: smooth solid. More than smooth—slippery—not even touching the surface. No friction. As Cray glided his claws against the surface above him, he could feel no bumps.

*I know why it's so smooth! The very fact that it is still here—that it has survived—proves it must have an impervious shield. Like the gold/antigold in the bug's armor; the tensile bonds must be millions of times stronger than normal molecular bonds—I think the surface tension in the shell has pulled the entire asteroid into a perfect sphere!*

*That's why my claws don't stick! The same reason the rocks aren't sticking—the shell is physically impenetrable. Normal matter, rocks and claws, anything—can't even touch it—it feels like a repulsive force when a claw gets close to it, like forcing two magnets together. The gold/anti-gold armor of the bug is just the opposite. Of course! Opposite magnetic poles!*

*I'm running out of time and ideas—at least practical ideas. Wonder if the radio works.* “Ercu, Cray. Do you read?”

Cray was surprised—he wasn't expecting an answer. “Where are you, Cray? It looked like the top asteroid fell right on you.”

“It would have, but this antimatter thing went out the other side leaving a void. I rolled the bug into a sphere and rode it out.”

“We saw it coming out of the crater while debris was sliding off— looked like a perfect sphere. It's invisible now. Where are you?”

“I'm directly under it. My bug's shell is stuck to it—some kind of magnetic attraction. I can see stars above the moon's horizon, but they disappear when I look up.”

“Are you OK?”

“Headache—a little dizzy—not too bad for a dead man.”

Ercu paused with his finger on the transmit button. *That doesn't sound like Cray. OK, if he's seeing stars, he must be using the cameras.* “Cray, can you see the moon in the virtual display?”

“I think it’s broken, but I’ll try again, wait one...still can’t see...wait! It just came on. It looks like I just popped up out of the top asteroid—the one that’s not even there!”

“OK, that makes sense, Cray. The virtual display was mapped before....” *Before what? An accident? No! A giant screw-up! Stupidity! I was so focused on trying to figure out how to lift that thing I didn’t even consider the obvious—normal matter on top wants to get closer to the moon—antimatter on the bottom wants to get away. If it hadn’t gone unstable when Cray set off the blast, it would have as soon as we lifted it.* “What’s your altitude and vertical speed?”

“Forty-five meters, three meters per second up. What’s the elapsed time from the blast, Ercu?”

“Thirty-five seconds. I’ll call forty—give me altitude and vertical speed...mark!”

“Eighty above crater rim, four up.”

“OK. Wait one...got it. You’re accelerating at zero-point-one meters per second squared. Same as Small Moon’s surface gravity.”

“I’m showing one twenty-five above, up five. Just looked down. Crater is looking mighty small, Ercu!”

“Cray, can you use your thrusters to oppose the acceleration—maybe stop it?”

“My thrusters are pointed straight down, Ercu. That means they can only push up—unless you can think of some brilliant way to roll this thing halfway around to put me on top, I don’t see how they would help.”

*I guess I deserve that. Still, I wasn’t alone in missing the obvious flaw in the plan. I didn’t hear any objections from Cray.*

“OK, Cray. Let’s back up a little and think this thing through.”

*Right—easy for you.* “OK, Ercu, I’m listening.”

“You’ve been telling me that antimatter operates in reverse time, right?”

“So?”

“So you said that a push in forward time is equivalent to a pull in reverse time. If you push up on the antimatter with your lift thrusters, shouldn’t that pull down on it?”

*It seemed so clear when Argon explained it: in reversed time, a thruster would appear to be sucking up matter and pulling, instead of pushing. But this is not reversed time. I’m in “real” time. Why would my thrusters now behave backwards?* After a long pause, Cray answered. “What I believed back then is one thing. What I believe right now is something else.”

“Look, you and Argon always argued that the only thing that makes antimatter different from matter is time reversal. Right?”

“Yes, but...”

“Cray, we know that that antimatter sphere on your back is being repelled by the moon— maybe the downward pull of gravity is pushing up on the antimatter in reverse time. Maybe anti-inertia and anti-gravity go together—maybe antimatter senses force backwards and accelerates in the opposite direction. Anyway, what do you have to lose?”

*This is the craziest thing I’ve ever done!* Cray paused before answering. “You’re right, Ercu. Worst case, it eliminates the suspense. I’m giving it a try now.” Cray switched the thrust mode selector from MICRO-G to MAX THR and pulled the collective. “I’m at one-third max thrust, altitude three thirty above, going eight-point-one up.”

“Three sixty above, still eight-point-one up. I think it’s working! Vertical speed steady at eight-point-one. Going to double the thrust.” Cray pulled the collective up to  $\frac{2}{3}$  max.

“Say altitude and speed, Cray.”

“Four eighty above, seven-point-six up. Vertical speed slowing, but still going up too fast. Almost five fifty above, now. I’m going to max thrust.” Cray pulled the collective against the stop.

“Give me your vertical speed and altitude on my marks, Cray.”

Cray double-clicked his mic.

“Mark!”

“Two-point-six up, six forty-five above.”

Ten seconds later, “Mark!”

“Zero vertical speed, six sixty above. I’m coming down!”

“I’ll be right back, Cray—I’m running the numbers.”

Cray started to feel optimistic. His altitude was now in the five hundreds.

“Cray, recommend you reduce thrust before you go below five-hundred meters.”

“Too late. I’m approaching four-fifty.”

“ZERO THRUST NOW!”

“Zero thrust.” Cray pushed the collective all the way down and watched the virtual floating rock and the crater getting bigger.

“Say your numbers, Cray.”

“Eight-point-five down, three fifty above.”

“Wait one.”

Cray watched his altitude go through 100 meters with vertical speed negative five meters per second squared. He looked down with magnified depth perception and saw Floating Rock expanding rapidly.

“Cray, you’re going to be OK!”

“Nice try, Ercu. I’m going to hit the rock.”

“It’s OK, Cray. It’s not real! Remember, that’s just what you’re seeing in the monitor—an image of how it used to be.”

“Damn, it looks real!” *It’s not real. It’s not real. It’s not real.* Cray’s muscles tightened as he plunged into darkness.

“Talk to me, Cray. Give me numbers.”

“Eight meters above, still going down two.”

“It’s OK, Cray. You should bottom out at minus one-point-five meters. Remember, the crater is deeper now.”

“OK, Ercu, you’re right! I’m on my way up again. When I break out of the virtual floating rock, I’m going to try to hover right on it. It’s a good visual reference. I think I can dampen out the vertical oscillations.”

“I’m launching in the other bug, Cray. Got a big roll of tie-down and an explosive cleat driver. I’ll plant six cleats around the crater rim. If you can hold that thing steady, I’ll throw three tethers over it. Our techs are working on a rescue plan for you.”

“OK, but hurry. I’m not feeling too good. Might have to vomit.”

“Hang in there. I’m on my way.” Ercu’s bug came out of the docking station and straight to the edge of the crater. Flying the rim with the crater on his right side, the bug landed as the tail of the compass arrow hit zero. The point of the arrow was locked on the center of the crater. Ercu felt under his bug with the mechanical hands. Finding the two handles of the explosive driver, he released it from its stowage mount. Pulling it to the front of the bug, he placed it vertically. With its business end flat against the surface of the crater rim, Ercu squeezed both triggers, one on each handle. The driver jumped slightly and a puff of dust shot out from underneath. Ercu lifted the driver and set it to the side. He examined the TEE cleat sticking out of the crater rim—top of the T, about 1/4 meter above the surface.

Ercu felt under the bug again and the hand produced a small box. He placed the box beside the cleat and flicked a switch. The box started flashing a brilliant white light.

Ercu continued around the crater, repeating the ritual as the tail of the compass needle hit multiples of six: 6, 12, 18, 24, 30. Ercu pushed the explosive driver off to the side, leaving it abandoned like a piece of junk. “How are you doing Cray?”

“I’ve got this down to a fine science, Ercu. Keeping it right on top of this phantom rock—like I could step out and walk home. Where have you been?”

“I got all six cleats in, all marked with strobes. Hang in there—I’m going to start strapping this thing down.”

“I’m right at the top of what used to be Floating Rock. Thirty meters above reference. How high do you think the top is?”

“I’m thinking another twenty above you. I’ll stay high though.”

“Good! Make sure you don’t touch it—we’d both be stuck. Go straight up until you see the moon’s horizon over the top.”

“Good idea! How you doing, Cray?”

“Don’t ask. Just get it done!”

“OK. I’m going to be too busy to talk.”

Cray acknowledged with two clicks on the transmit button. *That’s two of us.*

Ercu maneuvered his bug until he was facing the crater with the cleat directly in front of him. Compass heading: 12. A mechanical hand brought forth a half meter long bar from under the bug. Streaming behind the bar was an almost invisible sheet of film—almost, except for pastel colors dancing along the film—interference bands in the reflections off of barely separated surfaces. *It looks like a long soap bubble*, Ercu thought.

Pulling the film out to a full arm extension with one mechanical hand, Ercu grabbed it and crumpled it with the other. It turned a frosty white as he squeezed the fist. Hand over hand, he pulled out three arm lengths. With his left hand, he held the bar firmly down. With his right hand, he grabbed the crumpled film about a meter from the bar. His right hand guided the film forward under the left crossbar of the T—then back over the top to the right. Forward under the right crossbar—back over the top to the left. Six quick infinity symbols—each crossing at the top of the T and looping under the horizontal crossbar on each side.

Ercu abandoned the hand controllers and switched to flight controls. Holding a level attitude, he pulled up the collective and rose straight above the crater rim. He could feel the whirring vibration of the spinning spool of tie-down film streaming out under the bug. *I must look like a giant spider building a web—too bad no one is watching.*

Holding the bug's heading on 12, the homing arrow was at the top of his compass—the center of the crater was straight ahead. Ercu kept climbing until he could see the horizon of Small Moon above the black arc that defined the top of the giant antimatter sphere. *Altitude: fifty-five meters. Cray's at thirty. I'm guessing this thing is twenty-one meters in diameter. If I hold altitude I should clear the top by four meters...maybe I should go up a little more.* Ercu leveled off at 60 meters.

Flying level towards the top of the sphere, the glistening film whirled out, offering no resistance. As Ercu flew over the top of the sphere, his compass needle waved back and forth a few times, then flipped. Now the tail of the needle was at the top. *OK—keep the tail of the needle on 12. Should be a cleat straight ahead.* As the black arc of the antimatter sphere dropped, exposing the rim of the crater, Ercu saw three strobes in his viewer. The one straight down split the distance between the other two. With his thumb, Ercu maneuvered a target cursor over the center strobe and clicked a trigger. Three concentric circles appeared in his viewer, all centered around the strobe—a virtual tunnel that would guide him straight to it.

Ercu kept his flight path vector, FPV, in the center of the circles. The outer circle expanded to fill his entire field of view, then disappeared. The next circle did the same. As the last circle expanded, Ercu brought up the collective and leveled off one meter above the surface. *That'll work. Now I need to swing around to the other side of the cleat.* Ercu locked altitude, then banked the bug to keep the FPV tangent to the circle. With his feet, he kept the strobe straight ahead. When 30 centered at the top of his compass, he landed.

His half turn had put a twist in the film. Ercu could see the shimmering rainbow narrow to a frosty strand in front of him and then re-expand into a full width long soap bubble, stretching up and out of sight. Beyond the soap bubble film—nothing—just the total blackness of the antimatter sphere. *I see what Cray meant. That is spooky.*

Ercu clawed forward to the cleat. With his mechanical hands, he crumpled the ribbon of film and quickly threw six infinity-symbol wraps around the cleat. Without pausing to admire his work, Ercu switched to the flight controls, and brought the bug up to five meters above the rim of the crater. With the black sphere looming over the crater on his left, the bug flew around the rim of the crater until reaching the next strobe. Finding the cleat, Ercu again positioned the bug outside the cleat.

Ercu was getting faster now. Six infinity-symbol loops. Back to flight controls. Straight up until the moon's horizon rose above the black arc of the sphere. Over the top—heading steady—find the strobe—find the cleat—tie it off with another set of infinity loops.

As Ercu threw the last of his loops around the sixth cleat, he felt a sudden tautness in the tether. *Something's wrong!* “Cray! Are you OK?”

Silence.

“Matterhorn...Ercu. Do you read?”

“Go ahead, Ercu.” Ercu recognized Gluon's voice.

“Prepare the docking station. I'm inbound. Cray's in trouble.” Ercu jettisoned the half-used spool of tie-down ribbon. Climbing above the black, and now tethered, sphere, Ercu engaged AUTO-DOCK.

## Chapter 18

Cray opened his eyes. The ceiling came into focus slowly—shiny rails—wires—tubes. Thousands of tightly bundled wires snaked around, connecting equipment modules he had never seen before.

“Can you hear me, Cray?”

He tried to turn his head to Ishka and became aware of his restraints. His head wouldn't move. He tried to talk...no sound. There were tubes in his mouth. There were tubes in his nose. He lifted his arm to feel his face. Tubes and wires tangled and stopped his hand short.

“You're going to be fine, Cray. Just relax. I'm going to disconnect some of this stuff.” Ishka removed the mouth and nose tubes and went to work untangling his arms. She moved her head over his body so he could see her without moving his head.

“Where am I?”

“You're on board Matterhorn.” Then, not sure how much Cray remembered, she continued. “That's the name Nand gave our mother ship. You've been unconscious three days. What's the last thing you remember, Cray?”

Cray tried to focus on Ishka's face. “I was on Small Moon. We were going to try to capture the antimatter under the floating rock. I think it got away.”

A man's voice responded. “No, it didn't get away, Cray.”

Cray recognized Ercu's voice. “What happened?”

“It’s a long story.” Ercu wondered how much he should tell Cray—how much he was ready for. He decided on what he would want to know if he were in Cray’s condition. He decided on everything. “It will take a long time to fill in all the details, Cray, but basically you got stuck—well, your exo-bug got stuck to the bottom of that thing. It was like a super magnet—you got a bad concussion from it when it snapped you up—you kept it under control long enough for us to get it tied down before you blacked out. We have audio and video of the whole thing.”

“I don’t remember any of that. Where is it now?”

“The antimatter sphere? It’s strapped to the front of Matterhorn. It’s towing us home. Well, at least its home.”

“It’s a sphere? What’s it made of?”

“It’s water. I calculated its mass from the accelerations you were able to impart with your bug. Now that we have accurate dimensions, the density calculation is precise—it’s pure water!”

“Water? You mean ice, right?”

“No. Water! Apparently the shell it’s encased in creates so much pressure from surface tension, the water can’t expand into ice. There’s no doubt—it’s super-cooled water. That shell couldn’t have formed accidentally. It must have been designed by whoever brought it here.”

“How did you get my bug unstuck?”

## MATTERHORN PARADOX

“We didn’t. The shell is still there. Our techs were able to jettison the shell remotely and link its guts, which included you, into the bug simulator. I flew you back to Matterhorn from the simulator.”

“Ishka. I remember something.”

“What’s that, Cray?”

“We’re going to have a baby.”

## Chapter 19

As Matterhorn approached Earth, Cray discovered the capacitor banks were not fully charged. If all four cap banks were put in series, there would only be enough voltage to convert one person to antimatter.

It was agreed that Nand would be the only person to land on Earth. After all, the message that initiated their mission had been addressed to her.

#

Nand stood before the entrance hatch of the exercise chamber. This was where she started each day. The ship was now using Earth time, with its light/dark cycle synced to their planned arrival site. All over the ship there were displays of the weird Earth-style clocks, with 12 numbers and two dark pointers radiating from the center.

The display above the exercise hatch had its short pointer at seven and its longer pointer at 12. The interior walls of all the passageways and chambers were now glowing with white light—a gradual process that had started when the short pointer was straight down.

*Dawn. Daybreak. Morning.* Nand rehearsed the new language she would soon need. *It's seven o'clock in the morning for ordinary citizens—oh-seven hundred in their military lingo. I know I'm going to be using that soon.*

*What strange logic these clocks have. The long line marks off the short period of time and the short line indicates the long period of time. What were they thinking?*

*I need to shorten my exercise period. Cray wants me in the briefing chamber at oh-eight hundred, so I need to be putting my suit back on when the long pointer is two ticks above the nine—that will give me ten minutes to get to the briefing chamber with three minutes to spare. It takes seven minutes to purify my flight suit, then another five to recharge it. OK—I need to stop running when the long pointer is on seven. I'll do the lifting sky exercise until the pointer is on three. That will give me twenty minutes of intense running in the chamber.*

All of a sudden the analog clock made perfect sense. *These Earthlings aren't as dumb as they look. Their minute pointer is longer so its outer end is close to the marks that indicate the exact minute count.* Nand decided not to underestimate the cleverness of these primitive Earth humans.

Nand remembered Cray marveling at their ability to build the clocks using physical matter—machines, actually—with notched wheels interlocked with other notched wheels to make the pointers move at different speeds—pendulums and inertial torsion wheels to regulate the machine’s speed. He said our duplicates were simple in comparison—just a few lines of code to make a digital simulation, a few more lines of graphic instructions to duplicate their displays.

*Fifty-eight years since we left Z504.* She couldn’t remember what the ship was like back then. Even in the last ten years since she had awakened, the configuration had changed—new modules added—obsolete ones recycled.

Not only had the physical layout evolved; the new technology was amazing. *How could such a small group of scientists develop what seemed like magic when they woke me?*

Nand tried to remember what it had been like back when she had a hand-held communicator. *How primitive was that? It occupied both hands and all of my attention to use it.* Now, of course, she had a small microscopic chip implanted in her brain. The display, superimposed on her field of vision, could be summoned and manipulated at will.

It was awkward at first—she had to concentrate on the part of the display she would have touched with a finger and then blink one eye or the other, or both, to get the desired function. When she closed her eyes, the display remained visible since it was being fed directly into her optic nerve. Nand remembered how dizzy she had felt right after the procedure.

It amazed Nand how fast her brain had adapted to the implant. She could now control all of its functions with pure thought. She could move the display or make it disappear anytime she needed to concentrate on her real environment.

Inside the exercise chamber, it would be her real environment that she would make invisible. Nand felt exhilarated. This was her favorite part of the day—she would soon be immersed in a virtual copy of the planet Earth.

Her implant contained a mirror image of Earth's internet—an image that wouldn't be sent to Z504 for another 58 years of Earth's backward-flowing time. It was the same image they had downloaded ten years earlier, biological time; 58 years earlier ship's time; and a mind boggling 458 years earlier on Z504.

Nand still couldn't wrap her brain around the fact that her home planet had continued on to an unknown future at such a fast pace. Yet she knew it had to be true. Here she was in another part of the galaxy—light from Z504 would have left 400 years ago—light they send back wouldn't get there for another 400 years. *No way we can beat that! Even at the speed of light we couldn't get back to Z504 sooner than eight hundred years after we left.*

Nand put it out of her mind. It gave her a headache. She was anxious to get in the exercise chamber, but first she wanted to achieve a state of calm. It was a ritual she had found on Earth's internet—a standing chi-gong meditation called lifting the sky.

Nand stood silently, rhythmically and slowly raising and lowering her arms. She concentrated her mind on the warm, slippery, glowing energy flowing into her feet, up her spine, and eventually out through her fingers. The spray of energy from her fingers arched back down under her feet, making closed loops that kept getting stronger.

When the long pointer of the Earth clock pointed at three, Nand stood still for a few moments and touched a small luminous pad; the hatch hissed open.

Nand stepped into the two footpads near the center of the geodesic chamber. After a few purposeful eye motions, she blinked on a symbol floating in her retinal display. The hatch closed with the same hiss as the retention straps looped over her feet. She snapped them snugly in. The footpads were attached to complex mechanical linkages but felt solid, as if she were standing on solid ground.

A few more selections on her retinal display filled Nand's field of vision with a familiar scene. She was now standing at the end of a long smooth surface—a *runway they call it*—for the launching and return of Earth's most advanced and secret aircraft. Nand wondered how much different this scene might look now—58 years before her virtual image was downloaded.

Nand's usual workout would have been to run one of the trails she had found through the rugged mountains beyond the distant point on the basin, where the edges of the runway converged to a point. She didn't have time for that today—her alarm was set for 20 minutes—just time to make it to the far end of the runway and back—not that it was necessary to return to the starting point before ending the simulation, but she always did.

*I don't know why I always return to the starting point.* Nand mused. *Does it give my workout closure to finish what I start? Or does it just give a sense of reality to the simulation—returning to these black skid lines made by the landings of hundreds of advanced craft—craft that do not yet exist.*

Nand started slow, walking at first. The footpads offered no resistance as she lifted a foot above the virtual surface of the runway. When a foot was lowered to where it appeared to touch the virtual surface, however, it was met with solid vertical resistance and horizontal resistance appropriate for her speed, her acceleration, and the slope of the virtual terrain.

After just a few steps, Nand gained confidence in the simulation, and she increased her pace to a full run. As her speed increased, the illusion was completed by a fan blowing air in her face with her virtual velocity. She was now immersed in this virtual world—a copy of a secret base on planet Earth.

Nand smiled as she remembered. *I'm copying Cray! He always returns the simulator to the same launch pad he starts at.*

## Chapter 20

Nand entered the ready room at five minutes before eight.

Cray was flipping through Wikipedia pages. He heard Nand come into the room but didn't look up. "You have to be careful about how much you tell them about physics. They're still at a phase where they weaponize everything."

"I know—I just need to keep them from blowing themselves up with the knowledge they already have."

"Don't tell them too much about the matter conversion chamber. In their first world war they weaponized chemistry—in their second—the atomic nucleus. If they could convert matter to antimatter, I have no doubt they would use it to invent more efficient ways of killing."

Nand smiled. "You don't have to worry, I don't know enough to help them build one, even if I wanted to."

"That's probably just as well. Once they realize that you are from a world where time flows opposite to theirs, they will want our technology. The ability to build conversion equipment might put you in jeopardy."

"Cray, I don't even understand why flipping matter to antimatter reverses time, let alone why reversing time reverses the direction of forces. What I'm trying to figure out is whether I will be safer if they think I know more than I do."

“I don’t know, Nand, it’s going to be a balancing act. You need to give them enough to keep them interested, but not enough to advance their technology beyond what we know it will be in their year 2005. I should brief you on their 2005 theoretical physics—what they have right—what they have wrong.”

“Are you sure, Cray? I wouldn’t have to worry about telling something I don’t know.”

“Knowledge is power, Nand. I want to give you as much as I can.”

“Thanks...I think.”

“One thing you have going for you is that they wouldn’t believe the truth anyway—it’s too simple.” Cray frowned. “Their scientists profess a belief in the simplicity of nature—they call it Occam’s razor. But there seems to be a disconnect between that principle and their obvious preference for complex and esoteric theories.”

Nand thought for a few seconds. “Maybe they just haven’t stumbled onto the simple alternative.”

Cray shook his head. “No, when simpler descriptions are proposed, they’re rejected. I think complexity creates resistance to change—it puts those who have mastered it in an exclusive club.”

Nand didn’t say anything; she knew Cray wasn’t through with his rant.

“I guess we haven’t changed that much either. I mean, the culture we escaped from on Z504 was in the same rut. Even with all of our knowledge about antimatter and matter and how to convert one to the other; there is still the persistent belief that nature has a preference for our type of matter.”

“Most people aren’t like you, Cray. They don’t challenge absolutely everything they’re told.”

Cray shook his head. “No it’s more than that. I think we all have a deep desire to hang on to beliefs. It takes overwhelming evidence to change a previously formed perception. There’s probably an evolutionary bias for first impressions—safer to mistake a stick for a snake, than a snake for a stick.”

Nand smiled. “You sound like Papa. By the way, I had a dream about Papa.”

Cray was apprehensive. This was the first time Nand had mentioned Argon to him. He suspected she still blamed him for her father’s death. “What kind of dream, Nand?”

“Papa and you were on a spaceship. You were going to go out to check on a problem, but Papa got his pressure suit on first. He locked you out of the transition chamber and dumped the air.”

Cray looked shocked. “That’s incredible, Nand. That’s exactly how it happened.”

“I know. Papa asked me to stop blaming you. I’m sorry, Cray.”

“I feel so guilty, Nand. It should have been me.” Cray turned to hide the tear that had broken its surface tension and was making its way down his cheek.

Nand stood up and went to her uncle. She put her arms around him. “It’s not your fault, Cray. I know that now, and you need to know that too.”

After a few moments, they disengaged, and Cray spoke first. “What were we talking about?”

“About what I can tell Earth’s scientists, and how a society can be smart enough to destroy their planet, but dumb enough to actually do it?”

“I think it’s all about power, Nand. Power comes from wealth or knowledge. Those with power are always greedy for more power. Whenever humans acquire an advantage over others, they develop an insatiable appetite for whatever gives them that advantage.”

“It must be something deep in our primitive genetic code, Cray. After all, our ancestors survived by always exploiting any advantage to its fullest. Altruism, cooperation, and sharing are traits that give a subtler advantage and came along much later. Maybe the old selfish code is stronger than the new code.”

Nand had been thinking a lot about the genetic code and how it held the instructions for every process in her body. The double spiral strands, connected at regular intervals by one of four possible chemical structures—like rungs on a twisted ladder—each rung was one letter in a four-letter alphabet. The code was written in a deceptively simple language—all words were three letters long, making a vocabulary of only 64 words. But many of the words have duplicate meanings; only 21 meanings in all—20 for the synthesis of specific amino acids, and one for a stop signal or period. About 20,000 unique sentences, or genes, link the 20 amino acids into proteins that define all aspects of her body's form and function.

Nand knew that the natural process of duplicating this vast library of code was extremely reliable and robust. It was the new method of duplication she was worried about. When she would convert to Earth-type matter, every rung of that twisted ladder in every cell would have to unwind and recombine perfectly—her life would depend on it.

Cray was looking at the large potted tree that occupied a corner of the compartment. Each compartment on the spaceship had one; mostly for aesthetics, as the primary plants used to scrub carbon dioxide and replace oxygen were the beds of blue-green algae in the farming modules. “Have you noticed how a tree’s structure is almost identical to our lungs? Come to think of it, they have the same function—the tree absorbs carbon dioxide from the air and releases oxygen back into the air. Our lungs absorb carbon dioxide from the blood and release oxygen back into the blood.”

Nand turned to look at the tree. “You’re right—same structure, same job. I’m guessing that somewhere within the genetic code of both humans and trees lurks the same algorithm.”

“So why is that principle so hard to accept, Nand? I mean, look at the structure of our galaxy and compare it to a large vortex storm.”

Nand interrupted. “They call them hurricanes or typhoons. I’m trying to practice their language.”

Cray looked apologetic. “Sorry, hurricanes. But really, even our people on Z504 refuse to see the connection. How can people be so blind to the obvious?”

Nand smiled. “Can you imagine their reaction if I told these Earth men that the reason a spiral galaxy has the same structure as a hurricane is because they are driven by similar mechanisms?”

Cray opened his arms like he was catching a big ball. “And who would you tell? One of their weather scientists who might understand hurricanes but would have no credibility with their physicists? Or, maybe go directly to a physicist? Good luck convincing him that instead of a huge, dark gravitational mass at the center of the galaxy, there’s quite the opposite: a void, a region of extremely low gravitational pressure—just like the eye of a hurricane.”

Cray was trying to put himself in the Earth man’s current state of knowledge. “Nothing you could say would make any sense. Low gravitational pressure? Low relative to what? That would imply that there’s such a thing as high gravitational pressure. How could they even imagine that without knowing that there is a mix of matter and antimatter in the galaxy, and even then, only if they knew that matter and antimatter repel each other.”

Nand nodded. “It’s going to be a delicate discussion. I need to give them enough to convince them I know what I’m talking about but not enough to make them even more dangerous than they already are. I’ll definitely avoid referring to the galaxy as a giant cosmic vortex.”

Cray and Nand were quiet for several minutes, both trying to define, in their own mind, the fine line between too little and too much information.

When Nand broke the silence, it was like she was still just thinking out loud. “Beliefs long held and deeply rooted are almost impossible to change. Take the assumption that nature always increases disorder—what they call entropy. It comes from thermodynamics—systems driven by random collisions—particles colliding, exchanging energy and momentum—systems dominated by push forces. Increasing entropy is the compass for the direction of time.”

Cray nodded agreement. “It’s easier to understand explosions than implosions—easier to visualize a big bang than a big crunch. I think that’s why they have so much trouble understanding gravity. It’s a pull system. Pull systems self-organize. Self-organization implies time reversal. Time reversal messes with causality, and that messes with our heads.”

Nand was still deep in thought. “I think stability is at the bottom of it. Push forces are unstable, so it’s hard to predict future states from initial conditions. Like trying to force repelling magnetic poles together—they’re slippery and might go off in any direction. With attracting magnetic poles, it’s easy to predict where they will end up if they get too close to each other.”

Cray had his own revelation. “That’s it exactly! Stable systems reverse the law of increasing entropy. We understand unstable systems, where a small difference in initial conditions can make a huge difference in final conditions. On Earth, they call it

the butterfly effect. In stable systems, it's just the opposite—huge differences in initial conditions result in identical final conditions. It's a reverse butterfly effect.”

Nand was thinking out loud again. “Two diametric mechanisms coexisting in the same space. That confuses the human mind! It's impossible to simultaneously perceive two opposite models of reality. One of their artists understood it—M. C. Escher. My favorite is his tiling of birds and fishes. You can either see the birds going one way, or the fishes going the other, but not both at the same time. There must be a simple principle of physics at work here.”

“Don't try too hard to put it together for them, Nand. If you tell them that antimatter has antigravity and anti-inertia, they'll know too much too soon. I have been studying some of their advances. They already, or will, by the time of our internet image—yes, tenses are confusing—anyway, they did, or will, send two space probes outside their star system named Pioneers. The telemetry from those probes tell them that they slowed down too fast after leaving their star system.”

“Solar system,” Nand corrected.

“Right, but if they knew that there are antimatter clusters out here putting anti-gravity pressure on the probes, they would figure it out. They're not ready!” Cray paused, then continued. “No, they're not ready for antigravity. Whoever you contact, don't tell him about that.”

“I've already decided who my contact will be.”

Cray looked surprised. “Really? It’s a big planet. How will you find him?”

“The reverse butterfly effect, Cray. He’ll find me, but it will help if I can pick my landing spot accurately. Is that possible?”

“Absolutely! Just show me where you want to be put down. Your landing pod will be extremely light—almost neutral gravity—slightly more Earth-type mass than our type, so you will essentially float down.”

“But won’t that cause me to drift at the whim of the atmosphere?”

“That’s true, but we will have the atmospheric currents mapped accurately from frequency shifts in radio reflections. Earth scientists call it the Doppler effect. Also you will have thrusters for fine-tuning your trajectory—they’ll be fully automatic to keep you on course and fire briefly just before touchdown for a soft landing.”

“When will I convert to Earth mass?”

“Right after we separate. Since your pod will be close to neutral gravitational mass, it will also be close to zero inertial mass. By starting your approach in space, where there is no atmospheric drag, the thrusters will be very efficient at positioning you anywhere above the planet. A very small thrust will give you a very large acceleration.”

Cray's face switched from confident teacher to concerned uncle. "Have you been able to get a clue from the internet archives about what happens to you?"

"Not really. There is much written about the incident, but it is shrouded in misinformation, contradictions, and secrecy. There isn't even a consensus on whether there was a spaceship."

"That's not surprising, Nand. The only surviving evidence will be the thin superconducting shell of the antimatter converter, which to an Earthling will appear to be some kind of exotic weather balloon."

"Don't worry, Cray. I'm proficient in their language now, and with my knowledge of their future, I think they will consider me to be a valuable asset."

"That may be, Nand, but I don't trust the people in power on this planet any more than those on ours. Whoever's in control of the privilege credits always becomes fearful of anyone who could disrupt the system. I think we should make contingency plans in case your first contact turns out to be less than friendly."

"They call it money, Cray, but it works the same way. They don't have the technology to automatically recognize individuals and get their privilege-credit balance instantly, so they have physical things they use for exchange—usually it's printed pieces of paper or little metal discs manufactured by their government."

“Well, you will need to get some of this money stuff if it becomes necessary to survive on your own. You can't have anything in your possession—you might be unconscious for awhile. Anything of value could be gone by the time you wake up—they might be short on inter-galactic courtesy. We have to drop some Earth mass ballast when you convert. Maybe we could drop something of value along with it—something you could exchange for this money stuff?”

“Actually, Cray, as strange as it seems, gold is very rare on Earth and highly valued all over the planet. It's kind of a global privilege credit outside the control of any government. I think that's why it's valued—governments can just print as much money as they need, but they can't make gold.”

“That's weird, but we sure have plenty of that crap. We'll just use Earth gold for the ballast we need to jettison.”

“That's great! They have an expression—‘worth your weight in gold’—I think I'll be able to get along quite nicely on that.”

“Actually, Nand, we need to jettison twice your weight.”

Nand frowned. “How's that? I would have guessed just an equal amount.”

“Well if you just left the pod all of a sudden we would need to jettison your weight to keep the pod at the same weight. But you aren't going to leave. You're going to stay in the pod after you convert to Earth mass, so we need to jettison another equivalent

mass. Think of yourself as going from negative weight to positive weight. We need to jettison twice your weight in Earth gold to keep the same pod weight.”

“I’m glad you’re doing the math.”

“That’s what uncles are for. What you need to do next is figure out exactly where you want to land and where you want the gold.”

“I already know, Cray. I know from their documented history where I will land. Or did land. You’re right—things get kind of confusing when it comes to past and future. I think I know where they will take me also. Can you pull up a map?”

“Sure.” Cray moved his hands around in the space in front of him, poking a finger at symbols in the holographic display. A blue spherical replica of planet Earth appeared floating in front of them.

Nand reached out with her fingers and thumb close together and touched the surface of the image. Moving her hand, the sphere rotated as if the surface were stuck to her fingers. After several adjustments, she spread her fingers to magnify the image. She repeated this action several times. With each enlargement, the image became less convex until a detailed flat surface appeared.

The bleak, desolate landscape of this small piece of Earth’s surface was featureless except for two narrow roads: one, a nearly vertical path on the right side of the image, the other, even smaller, teed off to the left and lay horizontal across the center of the

floating map. Nand pointed just below the less-traveled road. “Can you put the gold right here?”

Cray marked the position on the map. With a few finger strokes he made a box appear with numbers in it. “OK, got it!” He clicked on the boxed Earth coordinates, 37.397N, 115.451W.<sup>2</sup>

Cray busied himself with manipulating hieroglyphic symbols on the screen as Nand watched silently. After staring at one screen of symbols for several minutes, Cray spoke without looking at Nand. “Are you afraid?”

“A little. I’m more afraid for you, Xor, and Momma, though. After all, I’m going to a world that I’ve studied in its future. I don’t know the details concerning me and my fate, but I know about their important events. That should give me power and control.”

Nand looked at her uncle with sad eyes. “The world you will return to is going to be unimaginably different than the one we left—almost a thousand orbits in our future—who knows how things might evolve? You might not even understand their language. And the skills that made you valuable to society? They might be obsolete and irrelevant.”

Cray laughed. “Maybe obsolete, but never irrelevant! But you’re right, it’s hard to tell who’s taking the bigger risk. I think it’s weird, though, that you can’t find more details about your

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<sup>2</sup> Don’t bother looking for this place on Google Earth. There’s nothing to see here.

landing. Do you think there is some kind of natural law that we don't understand yet? Something that forbids us from knowing our own future?"

"I've thought that too, Cray. If we know our own future, then we can change it. That means we didn't know our future after all—but could we know and modify our new modified future? A paradox of infinite possibilities—it might put a knot in the flow of time that would keep getting tighter and tighter. The universe, at least any rational universe, wouldn't be able to get past the knot. But then, how do we know the universe is rational?"

Cray laughed. "Now your making *my* head hurt. That reminds me. Talking about things that will mess with your head, Monas has been extracting and purifying DMT, the spirit molecule that you will be inhaling just before you convert to Earth matter. If you feel up to it, I think she wants to brief you."

"I've been curious about that. From what I've found on the internet it sounds a little scary. If she can do it now that's great."

Cray poked his fingers at his communicator and Monas' voice answered. "Hi Cray. What's up?"

"Nand says she's ready for your briefing if you can do it now. We're in the ready room."

"Great. I'll be right there."

Nand looked amused. Cray noticed. "What?"

"You and that old clunky communicator. When are you going to get an implant?"

"OK, laugh, but nothing unnatural goes inside this body."

“How did you get to be a spaceship captain, being so old fashioned?”

“By being the bloody best pilot on the planet!”

“And humble.” Nand heard her father’s voice from the distant past. *Don’t trust any pilot who doesn’t think he’s the best.*

Cray grinned boyishly, “Of course! That too.”

“I wouldn’t want it any other way, Uncle.” Nand looked at Cray and thought, *He looks more immature than Xor. Well, at least less serious. I wonder if he’s really as cool and confident as he seems.* She paused, then added, “Sometimes I think you actually believe you’re going to live forever.”

Cray grinned. “So far, so good.”

Monas entered the ready room. “Hi, Cray.” Then, turning to Nand, “I know you must be a little afraid of this DMT stuff. I’ve got to tell you though, I’m envious.”

“Why?”

“I’ve tried a small sample of it. That’s the only way I could be sure of its purity. You’re going to have an amazing experience.”

“How can we be sure that I’ll react the same as you? And won’t my dosage be huge compared to yours?”

Monas nodded agreement. “I’ve been studying everything I could find on the internet about it. All of the reports are similar in certain aspects. They all describe a vivid perception of an alternate reality—like being immersed in a space-filled with amazing

geometrically intricate objects: not fuzzy, hard to define things like we see in dreams, but complex objects with vivid colors. Much too real to be randomly firing neurons.”

Nand looked puzzled. “Do you think they're right? Do you think it actually is an alternate reality that is being exposed?”

Moanas rotated her head from one side to the other. “As a biologist, I have a different take on it. There are many species that demonstrate instinctive behavior—fish for example, whose offspring return to the same stream to spawn. Butterflies are another example. I’ve been studying Earth’s Monarch butterfly; it takes four generations to make their intercontinental migration. It seems clear to me that memory is being passed on genetically.”

“So, what are you saying? That DMT allows access to hidden genetic memories?”

Monas nodded her head. “I think so. We know from your father’s experiments that this DMT molecule must somehow stimulate the DNA molecule—bring it back to life, so to speak. If memories are passed on to our offspring, they must be coded in DNA. Perhaps DMT releases these genetically coded memories. The double helix molecule is immense—we have only identified the function of a tiny fraction of it.”

“I know you’re trying to reassure me, Monas, but this is pretty scary. I mean, think of the countless ancestors we’ve all had just since we emerged as human. They are the survivors of wars and famines, plagues, floods, and fires. They have been hunted by

both beasts and fellow humans. If all of these memories came flooding back, how could anyone survive the emotional trauma?"

Monas thought about it for a few seconds. "I think you said the operative word—survivors. At least you won't have ancestral memories of any fatal events."

"Well that's reassuring."

"I don't know whether it's possible for all those memories to flood into your consciousness like you're worried about, Nand. From my experience, they seem too vivid to be overlapped—like there's something that only allows one memory at a time into your consciousness. Of course, I haven't had anything close to the amount you will be taking."

Nand smiled. "Now I really would be scared, except for one thing."

"What's that?"

Nand pointed to her abdomen—a point level with her navel, but a few centimeters to the side. "I recorded the message we received from Earth that gave us the protocol for their internet. I reversed the recording and put it on a little chip that is formatted to be readable by their computers in their year two thousand five, the time of our internet image. I think the fact that we received this message is proof that I will survive—at least long enough to give this disc to someone who will send the message at the right time."

## Chapter 21

Washington, DC

November 21, 1952

President Harry Truman, in early afternoon, secretly stole away from the White House at the invitation of General Walter Bedell Smith, director of Central Intelligence. After his impromptu talk to a new class of CIA recruits, Truman asked his secret-service aid to drive around Washington so he could get used to being a regular citizen again.

His car traveled northwest, with the Potomac River on the left. Through the rain spatters on the left side window, he could see the river bank just beyond the parkway. Approaching Virginia Avenue, which came in at a sharp angle from the right, Truman spotted a gas station. The station was a stone block structure with two symmetrical pitched gable roofs and occupied the sharp V-shaped wedge on the southeast side of the intersection. “Pull into that gas station on the right, please. I have an emergency in progress. You two stay in the car—I don’t need a damned posse to pee.”

His driver complied, making the sharp right turn and then continuing into the triangular pad. He expressed his reluctance. “I don’t know if this is a good idea, Mr. President.”

“Hell, it’s all about Ike now. Everyone’s already forgotten my name—no one will even recognize me.”

“OK, you’re the boss. You certainly won’t be expected.”

“I’ll be right back—I want to see what it feels like to walk into a place all by myself again.” Harry Truman flipped up his raincoat collar, pulled his hat brim down in front, and got out of the car.

As he walked into the stone walled building, there was a lone attendant behind a counter. “Do you have a pay phone?” The president was surprised at how cramped the space was between the counter and the racks of automotive products. *Funny, this building seems bigger on the outside than it is on the inside.*

Truman was right about being incognito. The attendant motioned toward the men’s room without looking up.

Truman walked to the phone. He picked up the handset from its cradle and let it spin around its tangled cord a half-dozen turns to get enough slack to reach his ear. He put a nickel in the slot and waited for the dial tone. The president put his right index finger in the hole over the zero. Cranking the dial clockwise until his finger was blocked by the stop, he withdrew his finger and listened to the ten clicks.

A nasal female voice answered. “Operator. How may I help you?”

“I’d like to make a collect call to Archie Wheeler in Hightstown, New Jersey.”

“Who shall I say is calling?”

“His old friend, Harry.”

“One moment please.”

After a long minute, the president heard the operator saying, "I have a collect call for Archie Wheeler from Harry in Washington, DC. Will you accept the charges?"

"Yes, of course," said a man's voice.

The indifferent nasal voice said, "Go ahead, Washington." Then a click indicated she had disconnected.

"Hello, Johnny. I have to make this quick. I assume, since you listed this number, that you too have opened the correspondence from our mutual friend.

"Yes, Mister...."

"Just Harry," the caller interrupted, then continued, "I just need to know if you've made any travel plans."

"Yes, I've been invited to make a presentation in Washington. I'm going up on the night train from Trenton on the third of January—reserved the last compartment on the last sleeper car."

"Fine, fine. I have to hang up now. My handlers will be looking for me." The president hung up the phone and took two steps as his secret service agents entered. It appeared he was coming from the men's room. Harry Truman reached down inside his open raincoat, pretending to check his fly.

## Chapter 22

White House, Oval Office

Friday, January 2, 1953

The secretary of state stuck his head tentatively through the partially open door. “Did you want to see me, Mr. President?”

“Yes, come on in Dean. Have a seat.” A lone envelope, neatly opened, with razor sharp edges, was on the desk in front of President Truman.

Dean Acheson had perfected the art of keenly observing while pretending to take no interest. As he sat down, he read, upside down, the handwritten date on the envelope. *November 1st—the day after the H-bomb test. Confusing—the newspapers said it was on the 1st, but we knew about it on Halloween. Oh, right—west of the dateline. Monday in Manilla is Sunday in San Francisco. What a fast two months. Strange, the envelope looks older.*

Truman gave him a moment to get comfortable. “Less than three weeks and we’ll both be out of work, Dean. How do you feel about that?”

“I’m actually looking forward to it. How about you? You’ll be back to being just Harry Truman.”

“I’ll get used to it. Might have to get some smaller hats though.”

Before the secretary could think of an appropriate response, Truman continued. “I’m OK with turning the country over to Ike. Good man—didn’t get addicted to war like some generals do. A little uneasy with that snake-oil salesman, Nixon, though—being a heartbeat away from this chair.”

Harry Truman was on a rant. “Of course, McCarthy is a total nut-case—thinks everyone is a goddamn commie—including you and me—but Nixon is an opportunist. He jumped on the Alger Hiss bandwagon just to get on Ike’s ticket. I think they framed Hiss with that typewriter bullshit.”

Acheson joined in. “Pretty sure you’re right. Alger’s lawyer even demonstrated that possibility—he had a typewriter built from scratch that could duplicate the documents. They ignored that because of the paranoia about Russia getting the H-bomb. You know, better to lock up a few innocents than let one commie slip through.”

“What we ought to be afraid of is Russia *not* getting the bomb.”

“How’s that, Mr. President?”

“We’ve got enough crazies who would actually use it if there were no threat of retaliation. Like LeMay—I think he enjoyed the war a little too much. War is war—and hell, I know better than most that you do what you have to do, but there are those who start getting off on the body count.”

Truman picked up the envelope. “LeMay is just itching to drop the big one—and if it were only limp Dick Nixon between him and the button, he’d do it in a heart beat.”

“Why don’t you fire him while you still can?”

“In the middle of this feeding frenzy? Hell, they’d impeach me before Ike’s inauguration. The real problem as I see it is the dysfunctional state of our intelligence community. We’re trying to kludge together an agency from defense, state, and the existing counter-intelligence people. They’re all jockeying for position and trying to protect their turf.”

Truman paused, but Acheson stayed silent, sensing the president wanted to get more off his chest.

“The world is becoming very dangerous, Dean. Our useful warning time is shrinking, while the lag time before I get information seems to be increasing. The intel guys want to analyze the crap out of everything before they pass it up the chain.

I don’t think it’s just me—it’s going to be the same with Ike. I can envision a scenario in which World War Three gets started and is over with before the president even hears about it. The excuse will be that they couldn’t afford to wait.”

Acheson stayed silent, knowing that Truman’s rants had three parts.

“You know the H-bomb test we did two months ago?”

“Yes, Mr. President.”

“Well, the thing you might not know is that it was at least thirty percent more powerful than our scientists predicted—even our top physicists don’t understand the awesome power they’ve unleashed. It was a thousand times more powerful than the bombs we dropped on Japan, and there’s no way of slowing this geometric progression. At this rate we’ll have the capability to blow up the entire planet in just a few years.”

Before he could say anything, the president started again. *Maybe this is a four-part rant*, Acheson thought.

“The military has a plenty fast reaction time—but that’s like hitting your knee with a rubber hammer—the leg kicks without a signal ever reaching the brain. No, we need to make sure that even a crazy, paranoid, blood-thirsty general won’t short-circuit presidential authority. We need an absolute and certain balance of power.”

The president looked at his secretary of state for a long, serious ten seconds. “Dean, I need you to do something for me.”

“What’s that?”

“I need you to go to Trenton tomorrow and buy a ticket for the night train to D.C. Go alone and drive yourself.”

Acheson looked puzzled. “Leave my car at the train station?”

“No, no, you’re not going on the train—just buy a ticket so you can board the last sleeper compartment. It will be unlocked. There’ll be an open briefcase with a manila envelope sticking out.”

Secretary Acheson was studying Harry Truman's face for some sign that he was joking. The president looked dead serious. "Bring the envelope back to D.C. Don't open it. The less you know, the better."

"Set up a one-on-one with Zarubin at their embassy. Just make small talk with Georgy. Tell him you're resigning at the end of my term. Nice working with you—shit like that. Figure out a way to put the envelope on your chair without it being seen by their hidden cameras."

Dean Acheson was reeling from what the president was asking him to do. "Ike will have me in front of a firing squad if I get caught."

"Don't get caught then." The president noticed beads of sweat forming along Acheson's receding hairline. He wondered how long it would take for a drop of sweat to reach one of his bushy eyebrows. I've already written two pardons—one of them is for you, but I'm hoping I won't need either one."

## Chapter 23

Trenton Station, New Jersey

Saturday evening, January 3, 1953

Professor John Archibald Wheeler of Princeton University boarded the night train to Washington, DC. He made his way to the rearmost stateroom in the last car—accommodations he had reserved almost two months earlier. In his briefcase was a ten-page report detailing the most secret aspects of the fusion bomb, the first of which had been tested at Enewetak, exactly two months and two days earlier. Professor Wheeler, one of the principal physicists developing the H-bomb, had been present to witness the test.

The result had been an embarrassment to Professor Wheeler and his colleagues—it was thirty percent more powerful than they had calculated. As he entered his stateroom, he was thinking about a conversation he had recently had with the president of the United States. *Truman was right. He's not even a physicist and he recognized it before I did—our knowledge has outpaced our understanding. Maybe that's because he's not a physicist.*

He settled in for the night train ride—put his leather briefcase on the small writing desk and unbuckled its single strap. He started to remove a manila envelope, then, feeling an urgent

need for a restroom, left things as they were and went straight away to the nearest W.C.

When he returned a few minutes later, the train was pulling out of the station.

#

Union Station, Washington, DC

Sunday morning, January 4, 1953

On arrival at Union Station in Washington, DC, Professor Wheeler discovered that the documents were missing. He frantically asked porters and other passengers if they had seen them, but none had.

Professor Wheeler disembarked and rushed straight to the first phone booth he saw in Union Station. Pulling a note from his wallet, he dropped a nickel in the top of the phone and dialed the home of William Borden, staff secretary of Senator Jackson, chairman of the Joint Congressional Committee on Atomic Energy. "Bill, I've got bad news. Those documents you compiled are missing—I had them when I got on the train in Trenton last night—just got into Washington, and I can't find them."

“Holy shit!” Bill Borden knew immediately the seriousness of the security breach—especially the information about lithium-6, which can be fissioned into the fusion-fuel hydrogen-3, also known as tritium. “Stay right where you are—no wait! Go tell a conductor that it’s a matter of national security—they can’t let anyone on that car and they can’t move it! I’m hanging up now and calling the FBI. Don’t leave the station!”

*Click.*

#

Washington, DC

FBI Headquarters

Three minutes later.

“FBI duty office, Agent Tullo.”

“This is William Borden, chief of staff for Senator Jackson, chairman of the Atomic Energy Committee. There has been a serious security breach involving nuclear weapon information. Secret information has been lost on the night train from Trenton to Washington! The train is at Union Station. Dr. John Wheeler of Princeton is there now and he’s trying to get the railroad to secure the train car.”

“What’s your number, Mr. Borden?”

Borden rattled off the number, somewhat irritated by the irrelevance.

## MATTERHORN PARADOX

“OK, hang up now Mr. Borden. I’ll take care of it.”

*Click.*

#

Washington, DC

William Borden’s residence

15 seconds later

Borden’s phone rang before he removed his hand from the receiver. “Bill Borden.”

“Yes, Mr. Borden, this is Agent Tullo, FBI. Just wanted to make sure we can reach you—we get a lot of crank calls. By the way, was it Professor Wheeler who lost the documents?”

“Yes.”

“OK, I’ll get right on it.”

*Click.*

#

Washington, DC

FBI Headquarters

One second later

Agent Tullo spun his swivel chair 90 degrees to his right. “Denise,

get me the emergency number for Union Station police. No, make the call yourself—faster that way—connect me when it rings. Then get ahold of the closest field agent to Union Station.”

The young dispatcher was already spinning a circular index card file. Agent Tullo noted her calm efficiency as she homed in on the number—he had noted her other attributes many times before, which couldn’t be disguised by her conservative dress, librarian-bun hairstyle, and lack of makeup on what little skin was left exposed. Of course, he was a skilled observer. That’s why the FBI had hired him, no doubt.

“It’s ringing now, sir. You can pick up.” Denise turned her attention to a large Washington, DC, map beneath a clear plastic sheet.

#

Washington, DC

Union Station Police Station

Two seconds later

The red phone rang. Sergeant Duncan had never heard the red phone ring. It was an unlisted number only available to those way up the food chain. "Union Station Police Station, Sergeant Duncan speaking." As he said the word *station* the second time, he wondered if it sounded as redundant to the caller as it did to him.

## MATTERHORN PARADOX

“This is FBI Agent Tullo. We have a national security emergency. You need to find a Professor Wheeler who arrived on the last train from Trenton—more important, you need to locate the car he was in and secure it. Don’t let anyone on or off, and don’t let it move. There will be an FBI agent there soon to take charge. Don’t let Professor Wheeler leave either.”

Sergeant Duncan stammered, “I, ah, I’m the only one here.”

“Then leave, Duncan! Get out there and do what needs to be done!”

“Yes sir!”

*Click.*

#

Washington, DC

FBI Headquarters

One second later

As soon as Denise saw the duty officer hang up, she said, “I have Field Agent Henderson on your line. He’s just a few minutes from Union Station.”

“Good!” Then, picking up the phone, he said, “This is Agent Tullo, duty officer at headquarters. I need you to get over to Union Station and take charge of a situation. Locate a Professor

Wheeler and the car he was on from Trenton. Seems the genius lost the plans for an atomic bomb. A Union Station cop named Duncan is supposed to be getting things started. We'll get some more agents over there to help—they'll know both our names."

"OK, I'm on it."

"Good, keep us posted."

"OK."

*Click.*

"Denise, get the director on his home emergency number. After I'm connected, find as many agents as you can close to Union Station. Have them report to Henderson. Give them my name for ID."

#

Washington, DC

J. Edgar Hoover's residence

Thirty seconds later

The secure phone rang five times. "Hoover speaking—what's happening?" The FBI director knew the call had to be important—at least it had better be.

"This is Duty Officer Tullo, sir. We have some missing atomic bomb documents. A Professor John Wheeler of Princeton lost them on the night train from Trenton to DC."

"Holy shit! What's been done so far?"

## MATTERHORN PARADOX

“I’ve called the Union Station cops and told them to secure the train and detain Professor Wheeler. We have a field agent on the way to take charge, and we’re dispatching agents in the vicinity of Union Station to assist.”

“Good, good. Also find out where his home and office are. Organize a couple of search teams: one for his office and one for his home. Use agents in the area so they don’t waste time traveling. Oh, and let’s get some eyeballs on every foot of the track. Put one team at each end and two in the middle.”

“I’ll get right on it, Sir. Is there anything else?”

Director J. Edgar Hoover started thinking about the possibility of foreign espionage. “Yes. I’m going to call the CIA, and I don’t want any turf wars. Brief our people—if they show up and want to take charge, let them.” *This is going to be one hot potato when Ike takes over as president. If those documents aren’t found, I’d just as soon it be the CIA that can’t find them.*

“Yes sir.”

“OK, Tullo, good work. Keep me updated.”

“I will, sir.”

*Click.*

#

Washington, D.C.

General Walter Bedell Smith's residence

Thirty seconds later

The secure phone rang three times. "General Smith, DCI." The CIA director knew the call had to be important—at least it had better be.

"General Smith, this is J. Edgar Hoover. We have a security breach involving nuclear weapons. A Professor John Wheeler of Princeton lost top-secret documents on the train last night from Trenton to DC."

"Holy shit! What assets do you have in place?"

"We're securing the train car and detaining Wheeler—also sending teams to his residence and office. Getting four teams started on searching the tracks."

General Smith was trying to calculate how long it would take to walk the track between Trenton and Washington. "It's a long shot that it would be on the track, but just in case, we should put enough people on it to complete the search within the next few hours. Do you need help with that?"

"That would help a lot. Do you want jurisdiction?"

"No, we'll get some people out there to help, but they'll be working for you."

The FBI director was disappointed. "I was afraid of that—what about Wheeler?"

"He's a U.S. citizen on U.S. soil. He's all yours."

“OK, but there is one thing I’d like you to take off my hands.”

Dreading the answer, General Smith asked, “What’s that?”

“Since you were Ike’s chief of staff, would you break the news to him?”

“Don’t blame you for not wanting that job. If the documents aren’t found, Ike’s going to bring on a real shit storm. Tell you what, if the papers aren’t found by tomorrow, I’ll brief Truman and leave it up to him whether to tell Ike before his inauguration.”

“OK, thanks for taking that one off my plate.” *Ike might be the type to kill the messenger.* “Have your agents check in with Agent Tullo—he’s the duty officer at FBI headquarters.”

“OK, I’ll get things started here. Keep me informed of any progress.”

The FBI director acknowledged, “Will do. Do you need my number?”

“Are you serious? We’re the CIA! We’ll be in touch.”

“OK.”

*Click.*

Gen. Walter Bedell Smith, director of Central Intelligence, had a mind like a steel trap, but it didn’t require his extraordinary mental abilities to know immediately who Professor John Archibald Wheeler was. Anyone who knew anything about the

secret development of the hydrogen bomb (and as DCI, he knew plenty) knew that Wheeler was in the very top echelon of scientists working on it.

There was somewhere else he had seen Professor Wheeler mentioned—recently. It was out of context—nothing to do with nuclear weapons.

Snap, went his steel trap. *I'll be damned. Now if that isn't a damned coincidence! Exactly one month ago to the day. The fourth of December—the Intelligence Advisory Committee sent me a memorandum.* General Smith read it's first recommendation verbatim in his photographic memory:

*The Director of Central Intelligence will:*

*a. Enlist the services of selected scientists to review and appraise the available evidence in the light of pertinent scientific theories.*

“That’s it! Professor Wheeler was on the list of scientists who had expressed interest in studying UFOs.” General Smith recalled that he had acted on the recommendation, and a panel would be convening in about a week.

“Who was it I put in charge of documenting the proceedings? Someone from OSI. Yes, Fred Durant.” The director reached across the walnut desk in his walnut-paneled study and spun his index card file.

Dialing the phone reminded the general of how much weight he had lost since the operation, which had removed a good part of his stomach. The ulcer attacks were gone, and now his finger fit loosely into the holes in the rotary dial.

The phone answered on the first ring. “Central Intelligence, Office of Scientific Intelligence, Agent Nash speaking.”

“This is General Walter Bedell Smith. I need to get ahold of one of your OSI people: Fred Durant, middle initial ‘C.’”

“Yes sir! I’ll get his home number for you.”

“No, I need to talk to him ASAP. You track him down and have him call me.”

“Yes sir! I’ll get right on it.”

The general gave Agent Nash his secure home number and hung up. He figured it would take Nash at least as much time to locate Durant as it would for him to call headquarters and get as many agents as possible mobilized to assist the FBI. This time he didn’t need his index card file to find the number.

As the DCI dialed the phone, he was thinking about how secrecy now dominated every aspect of his life. He thought about the war, when secrecy from the enemy was essential. Now everything had to be kept secret from everybody, including the American public. It affected attitudes inside the agency. In a way, the American public had become the enemy as much as the Soviets.

General Smith hung up the phone after getting the ball rolling assisting the FBI in the search for Wheeler's missing documents. As he waited for Durant's call, he returned to contemplating his current life of deception.

Officially, the CIA had no interest in UFOs; they were either optical illusions or hoaxes. Unofficially, they were intensely interested and took them very seriously.

It was the same with paranormal psychology. Officially there was no interest, since it didn't exist. Unofficially there was much interest, especially in telepathic viewing. There were many secret experiments being conducted to find out if the phenomenon was real, and if so, if it could be exploited for espionage. The Agency had to make sure that they would always be the exploiters and not the exploited.

The phone rang. "General Smith, DCI."

"Yes, General, this is Fred Durant in OSI. I understand you want to talk to me."

"There's something I need to know about the UFO panel you're organizing. Is Professor John Wheeler of Princeton one of the participating scientists?"

"Yes he is."

"We have a problem with that. Professor Wheeler just lost some secret documents about nuclear weapons. He's one of the top brains in Project Matterhorn developing the H-bomb."

## MATTERHORN PARADOX

“Holy shit!” Durant’s reaction came out before he processed who he was speaking with. *Oops, I should have said holy shit, sir!*

“My thoughts exactly. If I know Ike, which I do, this is going to be a bigger dust-up than Alger Hiss and the Rosenbergs combined. I don’t want this shit rubbing off on the agency. No guilt by association.”

“What do you want me to do?”

“Search our files for any and all involvement with Wheeler. Be in my office tomorrow at eleven-hundred hours with the results. I’ll decide then on the best way to distance the agency from Wheeler.”

“Yes sir! I’ll head into headquarters right now and report to you tomorrow.”

“Good, see you tomorrow, Durant. Good luck.”

*Click.*

#

Langley, Virginia

CIA Headquarters

January 5, 1953, 1100 hours

Gen. Walter Bedell Smith, director of Central Intelligence, sat at his black walnut desk, an identical twin to the one in his study at home. In place of the index card file, there was an intercom box with several push-buttons with embedded lights—a very modern, state-of-the-art system.

One of the intercom buttons lit up, and he pushed it. “Go ahead.”

“Agent Durant of OSI is here.”

“Good, send him in.”

Frederick C. Durant entered a few seconds later with a manila folder in his hand. Smith was relieved to see it was not very thick. He motioned to a chair on the victim side of the desk; Durant pulled it out to make room for his knees and sat down.

“What did you find?” It was obvious the DCI had no time for small talk.

“Just his request to participate in the UFO defense study—couldn’t find any other contact or involvement with the Agency.” Durant looked like shit. It was obvious he had been working all night.

“Good. You need to get ahold of him and decline his offer. Tell him his work on Matterhorn is too important to interrupt.”

## MATTERHORN PARADOX

“I’ve already done that, General. I had a heck of a time tracking him down—called his home to find out what hotel he’s staying at in D.C. He hadn’t checked in, so I called the FBI to find out if they were holding him. They said he would be at his hotel by fourteen-hundred hours and I could talk to him then.”

“OK, good, you need to document that phone call for the record.”

“I’ve taken the liberty to do that also, sir.” Durant placed a single sheet of paper on the desk, positioned so the DCI could read it. He waited a few seconds as Smith read the memorandum, then offered an apology. “I typed it myself early this morning—made a few typos. I’ll redo it before I file it.”

The DCI was silent while he finished reading the two page document:

*Title: TELEPHONE CONVERSATION WITH DR. JOHN  
A. WHEELER*

*Abstract:*

*Pages: 0002*

***Pub Date: January 5, 1953***

*Keywords: UFO|WHEELER JOHN*

*Case Number: F-1975-03653*

*Classification: TS*

***MEMORANDUM FOR RECORD***

*SUBJECT: Telephone Conversation with Dr. John A. Wheeler*

- 1. At 1430 today I called Dr. Wheeler at Princeton, New Jersey ([phone number elided]) to thank him for his interest in possible affiliation as a consultant in the CIA attack on the "flying saucer" problem. I told him we regretted that the urgency of his current work for AEC (MATTERHORN) prevented association at this time.*
- 2. Dr. Wheeler stated that he might not be able to actively assist even after March 1953 because of his work on "particle research." However, he would be pleased at any time to discuss the matter briefly. He mentioned two foreign nationals who were currently outstanding in related fields. One was Dr. Chapman, a British subject who is an authority on the aurorae and its associated "mysterious problems" of "ion path" and "magnetic focussing." Dr. O'Day (director of Research at Cambridge, Massachusetts USAF Research Center) might be able to suggest U.S. subjects in this field. It appears that the Air Force has been studying upper atmospheric phenomena there with considerable vigor. Dr. Chapman's believed to be currently at Cambridge University, England.*

*3. Another suggestion was Dr. Hannes Alfvén, an "original thinker and outstanding researcher." He has written "Cosmological Electrodynamics," Oxford University Press. Dr. Wheeler thought some method of using one or both of these men might be devised through a "cut out," assuming the problem continued for an appreciable length of time and scientific attack was warranted.*

*F. C. DURANT*

*OSI/FCDurant*

General Smith shook his head, "No, that's good enough for government work. File it as is." He looked at Durant and noticed for the first time his disheveled condition. "Good work, Durant. Why don't you take the rest of the day off."

"Thank you, Sir. I will."

## Chapter 24

White House

Wednesday, January 28, 1953

This was the first private meeting between President Dwight D. Eisenhower and newly sworn in secretary of defense, Charles Erwin Wilson, aka ‘Engine’ Charlie, who had stepped down as the president of General Motors to take this appointment. (The nickname ‘Engine’ was to avoid confusion with ‘Electric’ Charlie, the ex-CEO of General Electric, Charles Edward Wilson.)

The two men entered the oval office together, but Wilson wisely remained standing until the president sat down and motioned him to take a seat.

“They beat you up pretty good in the confirmation hearings.”

“I guess I put my foot in my mouth with that ‘What’s good for the country is good for General Motors’ comment. It didn’t come out quite the way I meant it.”

Ike grinned. "Don't revise history with me, Charlie—especially newly minted history. It's the 'and vice versa' that's going to be remembered—'What's good for General Motors is good for the country?' Really?"

Charles Wilson was feeling uncomfortable, and Charles Wilson was not accustomed to feeling uncomfortable. “Uh, like I said, it didn’t come out right.”

Ike didn't waste time with small talk. "From all accounts, you're a good manager and you know how to get people to do what you tell them to do. That's why I appointed you."

"Yes, Mr. President."

"Do you have any questions?"

Wilson was eager to shift the focus of the conversation. "Well, yes, as a matter of fact. I am curious about what you want to do about Professor Wheeler?"

"I've decided to just give him a reprimand—not too high up—maybe just from the AEC. Keep it low profile so it'll blow over quickly."

"Really? I thought you wanted to hang him from the yardarm? Was it something in the EYE'S ONLY file that Truman left you?" For the second time in less than a week, Wilson regretted his words even as he said them.

Ike felt his first flash of anger as president. "Are you referring to some fictional file that doesn't exist or do you know something I don't?"

Eisenhower didn't expect an answer and didn't wait for one. "Last week I was a general; today I'm the president. Last week I was all about winning wars; today I'm all about preventing them. Last week nobody was indispensable; today nobody is a lost cause—they can always be a bad example."

The new secretary of defense felt his own body heat reflecting off his starched collar onto the back of his neck. He had the impression that Ike's last remark was not directed toward Professor Wheeler.

"Speaking of bad examples, your first official assignment as secretary of defense is to give General LeMay a message from me. If one of his SAC B-47s gets within forty miles of Russian airspace without my explicit authorization, I'll personally rip his stars off."

President Eisenhower stood up, signaling the end of the meeting. The secretary of defense did the same a microsecond later.

"I'll get right on it, Mr. President." Charles Erwin Wilson left the oval office. *That went well.*

As the secretary was leaving the oval office, the president was having his own silent conversation. *That went well. I think I did a pretty good job of masking how I really feel about these fat-cat industrial moguls who made millions during the war while I was watching thousands of boys die in muddy trenches. And now that the war is over, they want to keep the party going. Why would a gazillionaire even want this job, knowing what a ration of shit I'm going to give him in private? Oh wait, 'What's good for General Motors is good for the country'—sometimes even politicians accidentally say what they really mean.*

## Chapter 25

Hyannis Port, Massachusetts

Sunday, October 21, 1962

President John F. Kennedy and Attorney General Robert Kennedy walked across the manicured lawn after their family's traditional Sunday touch football game.

"I met with the joint chiefs Friday. LeMay tried to goad me into bombing Cuba—made a snide remark about it being worse than Munich—an obvious reference to Dad."

"I guess we'll never live that down, Jack, but to LeMay, anything short of dropping the Big One on Moscow is appeasement. He's still bragging at parties about his firebombing of Tokyo. Says he scorched, boiled, and baked to death more people in a six-hour period than any other time on the planet. Who would boast about that? Most guys try to forget the horrors of war."

"I don't know, Bobby, maybe it's an aphrodisiac for him—or maybe he just got addicted to war and wants to top the high he got from the Tokyo raid. I've just got to make sure he can't start World War Three when my back is turned."

"Why don't you fire him?"

"Sun Tzu said we should keep our friends close and our enemies closer. I've extended LeMay's active duty until sixty-four. I want him where I have some control over him."

"You should make it sixty-five—that'd keep him out of the next election. He's a loose cannon, but there's so much paranoia out there—the crazies like his tough talk. Can you imagine him in your job? Or even VP with a weak president?"

"There's much fear out there, Bobby. LeMay and Dulles have people convinced that nuclear war with Russia is inevitable and that sooner instead of later would give us the advantage. They've been pushing hard for a massive preemptive thermonuclear strike for over a year—I think they were salivating when the Vienna talks failed."

"Christ, Jack, do they have any idea what that might do? I mean to the planet, not just to Russia. It's not as though we have a good track record getting it right with the H-bomb. The first one in fifty-two was thirty percent more powerful than they expected. Then instead of getting better, we devastated the Marshall Islands and killed some innocent people in fifty-four with the 'Castle Bravo' test. I think it was something like three-hundred percent more powerful than they calculated!"

Jack Kennedy had his head down and kicked leaves as he walked. "I don't know whether they even care, Bobby. They just want their damned war. I think Khrushchev is being backed into the same corner by his own hawks. We're both in danger of losing control."

The brothers walked in silence, except for the crunching of fall leaves. The president's brother spoke quietly and put his hand up to shield his mouth from any surveillance cameras. "Should I

## MATTERHORN PARADOX

ask Bolshakov if pulling our missiles out of Turkey would give Nikita some wiggle room?"

"OK."

## Chapter 26

January 19, 1964

Camp David

Crackling wood fire and thick stone walls completely erased all evidence of the raging Nor'easter sweeping across the eastern seaboard. Lyndon Baines Johnson and Robert Strange McNamara were sitting in burgundy leather chairs, both angled to each other and the massive stone fireplace. Large crystal brandy snifters with presidential seals were cradled in their palms, fingers straddling the stems.

"Dammit, Mac, I feel like I'm playing a goddamned 'heads they win, tails I lose' game. Khrushchev is making nice with his non-aggression pact bullshit, trying to make me look like a war-monger if I don't sign on—and LeMay is bullying the joint chiefs—calling anyone who doesn't want to bomb North Vietnam back to the stone age a pussy."

"If I may speak frankly, Mr. President, I think General LeMay is a sadistic sociopath. We have reliable assets in Cuba who tell us that the Kremlin gave launch authority to local commanders. If Kennedy had taken LeMay's advice, it would have triggered World War Three before his bombers were feet-dry. They had over twenty nukes that would have reached all major population centers on the East Coast and about nine that would have wiped out Florida."

The president nodded agreement. "He's been a pain in the ass since the end of *his* war. Even Ike had a hard time keeping him under control. A damned one-trick pony— isn't any damned problem in the world that he couldn't solve with bombs."

"I'm sure you're aware, Sir, that General LeMay's tour of active duty expires next month."

"Yeah—I've tried to feel him out about his plans—he's been pretty damn coy about it. While he's on active duty he can't snipe at us publicly, but once he's a civilian, Katie bar the door. Trouble is, his 'shit-or-get-off-the-pot' talk plays well with the hawks. If he teamed up with his Air Force buddy, Goldwater, the election could get dicey."

"You might offer him an ambassadorship. That way he'd still be obligated to support you, or at least not publicly criticize."

"OK, I'll try that first—doubt if he'll take it though. If he doesn't, I'll extend his ass for another year. You can give him a desk in the basement of the Pentagon and take away his phone."

## Chapter 27

December 3, 1964

Pentagon

General Curtis LeMay, four-star general and Air Force chief of staff, was in his typical bad mood when his phone rang. “LeMay!” Just the tone would have intimidated most callers into a quick hang-up.

His caller, a two-star general and long-time friend, was not deterred. “Barry Goldwater here, General.”

“Yes, what can I do for you?” LeMay mellowed a little—after all, they had more in common than both being generals and friends from WWII. They both had a hatred of Lyndon Johnson. LeMay had had his active duty extended almost a year earlier, only to be marginalized and ignored. Goldwater, of course, had just been brutalized in the presidential election only a month ago.

“Well, I guess it’s no secret that I’m not going to be the next president.”

“Yeah, that’s what I’ve heard.”

“Well, one of the things I was looking forward to—I mean, if I won—there’s something I’ve been curious about for some time and I was wondering if you would help me out.”

“What’s that, Barry?”

“I know there's a secret room at Wright Pat where some UFO debris is kept. I was wondering if you could let me see it for myself.”

“That’s not a no—it’s a hell no! If you had won the election you could go anywhere, but as it is you’re just another nosey SOB—and if you ever ask about it again, you’ll be an ex-major general SOB, to go along with ex-senator SOB, and ex-presidential candidate SOB.”

“Uh—OK. I didn’t mean to offend.”

“I’m busy,” LeMay lied. “I don’t have time to chit-chat, Goldwater.”

LeMay summarily hung up the phone.

## Chapter 28

November 29, 1968

Hightstown, New Jersey

Professor John Archibald Wheeler answered the phone at his home near Princeton, New Jersey. “John Wheeler.”

“Dr. Wheeler, this is Lyndon Johnson. I hope you had a great Thanksgiving yesterday with your family.”

For the second time in his life, Professor Wheeler had answered a telephone call from a POTUS. “Thank you, I did, Mr. President—and yours?”

“Fine, fine—ate too much though.” After a short pause, he continued, “Well I guess you already know that you’re getting that Enrico Fermi award. I just wanted to call and give you my personal congratulations and invite you up here to the White House next week.”

“That’s very thoughtful of you, Mr. President. Our entire family is looking forward to it.”

“And there’s one other thing I want you to know...and this is just between you and me...I mean there are things that get passed down from one president to the next that can’t be acknowledged officially. What I’m trying to say, I guess, is that your loyalty to your country was never in question, and dammit Johnny, neither was your competence.”

The president paused, but not long enough for John Wheeler to compose a response. “I know how that reprimand Ike ordered must have pained you over the past sixteen years, and I just hope you’ll see this award as vindication.”

“That’s very kind of you to tell me that.”

“Well, you know Ike was between a rock and a hard place on that one. I mean, he’d made such a goddamned big deal about it before his inauguration, it would have looked really fishy if he had just dropped it.”

“I understand.”

“OK then. I’ll see you up here Monday, and I hope you can put that whole thing to bed.”

“I will, Mr. President, and thank you for calling.”

## Chapter 29

Princeton University

Professor Patrick Reilly's office, D-wing, E-Quad

Friday, September 23, 2005

The phone rang twice. "Pat Reilly."

"Yes, Dr. Reilly, this is Johnny Wheeler over at the theoretical physics department."

Pat Reilly had to catch his breath. John Archibald Wheeler was the world's most famous living physicist, protege of the great Niels Bohr and colleague of Albert Einstein—it was rumored that Princeton still provided him with unofficial privileges. "Professor Wheeler—it's an honor to speak with you. Are you sure you have the right number?"

"I think so. Are you the father of the Megan Reilly who presented a homemade radio telescope at the science fair?"

*It figures. Twenty years at Princeton, and my first phone call from a famous physicist is all about my daughter.* "Yes, Megan is my daughter."

"I was very impressed with the results she got using a satellite TV dish. I think she might be interested in a research experiment I'm planning. I thought I should introduce myself, though, and talk with you first. Didn't want you to think I was some dirty old man."

“I’m sure she’ll be very excited, Professor Wheeler, but why a sixteen-year-old? What kind of experiment is it?”

“I’d like to discuss that with both of you—she’ll probably need your help with the equipment, but I’d like the design to be hers. I’m looking for a fresh approach—for someone who doesn’t have preconceived ideas about what’s possible. Could we possibly meet tomorrow at Peyton Hall? Maybe ten AM?”

Pat Reilly knew John Wheeler’s reputation for absent-mindedness. He thought he should reinforce the details. “OK, tomorrow, Saturday, at ten in the morning. We’ll meet you in front of Peyton Hall.”

“That’s great, Dr. Reilly. Oh, let’s meet on the back side—away from Ivy Lane. I’m looking forward to meeting both you and your daughter.”

## Chapter 30

Saturday, September 24, 2005

Peyton Hall, Princeton University

Professor Wheeler contemplated the best way to explain his experiment without coming off like a complete kook. He knew that most people thought he'd gone a little crazy with his "delayed choice" thought experiment. Everyone, including physicists, have an intuitive and strong perception of the past being indelible—fixed and permanently immune from manipulation in the future. This new experiment stretched his "delayed choice" idea by several orders of magnitude.

Standing at the bottom of the south steps to Peyton Hall, he looked with disgust at the new football stadium just a few tens of meters to the southeast—its bank of high-intensity floodlights high above the stadium walls. The professor looked back at the low profile of Peyton Hall and realized that the stadium lights appeared to be higher than the green tarnished copper telescope domes. *I guess that tells you where Princeton's priorities are. Astronomical observation free from light pollution, or football—no contest!*

There was a bustle of activity around the stadium. Four workmen with fluorescent green vests were removing two large ladders from the sides of the stadium entrance. Over the entrance, the newly hung banner read “WELCOME SAN DIEGO TOREROS.” Professor Wheeler wondered if the ancient Romans had painted signs on the coliseum: “WELCOME GLADIATORS,” or at some events, maybe, “WELCOME CHRISTIANS.”

Farther east, on the walkway between Ivy Lane and two stylized steel tiger sculptures, Professor Riley and Megan turned slightly south, leaving the main sidewalk. Despite his poor eyesight, John Wheeler recognized them as soon as they cleared the menacing stainless-steel monsters, which reflected spears of sunlight off their disjointed, polished body parts. Even in the gathering crowd, the father and daughter pair stood out. The young girl had wavy red hair flowing out from a kelly green beret. The man was obviously faculty: definitely too conservative, even in fall casual, to be a student.

Always an awkward decision—when to display recognition. John Wheeler waited until they were about ten feet from him and then took a few steps towards them with his hand extended. “I’m Johnny Wheeler. Pat and Megan Reilly, I’m guessing. Please call me Johnny. I forgot about the game today.” He lied. You can’t forget what you never knew. “This won’t take long though. We should be done before it gets too crazy.”

Pat Reilly took the offered hand. “Not to worry, Professor Wheeler. Megan and I are going to the game anyway, so this works out great.” Not comfortable with calling this icon of quantum physics “Johnny,” he ignored the professor’s request.

“Let’s go up to the observatory and I’ll explain what I’m up to.” Johnny Wheeler led the way up the right side of the iron railing bisecting the wide concrete steps. Under an oversized tinted arched window, he opened and held the entry door, allowing his guests to pass through first. *How much did that piece of glass cost?* he thought as he went through the door. The huge arch over the entrance seemed to have no purpose except to advertise a complete absence of budgetary constraints for keeping the theme of the closely spaced, thin, arched windows forming the outer walls of the main floor.

A left turn down the main corridor then another left put the threesome on the stairs leading to the observatory. Even though Peyton Hall was almost fifty years old, it seemed to Pat Reilly too new and modern for Princeton—he preferred the musty smell of oil-soaped oak that permeated the old buildings. *What gives those old school buildings their unique smell?* he wondered. *Maybe there's only one manufacturer of janitorial products.*

At the door to the observatory, Wheeler entered a pass code into a keypad, referring to a crumpled sticky note. He handed the note to Dr. Reilly. “You need to enter this code followed by a *one* when you enter, but you follow it with a *two* when you leave. I have the observatory reserved during daylight each Saturday and Sunday until winter break, then every night from December fifteenth to January fifth.”

In the center of the observatory was a twelve-inch Meade telescope. Dr. Reilly had never been in the Peyton observatory—he was surprised by the size of the telescope. It was large for an amateur instrument but much smaller than he expected for a university as prestigious as Princeton.

Professor Wheeler pointed at the telescope’s lens cap. “Your mission, Megan, should you choose to accept it, is to build an aluminum replacement for the lens cap and use it as a mounting plate for your TV dish antenna. I’d like you to connect a wireless internet router to your dish antenna.”

Megan, while not as intimidated as her father, also could not address this famous elderly scientist as Johnny. Wrinkling her forehead, she asked, “What, exactly, are you trying to do, Professor?”

“I’m trying to communicate with space aliens. Well, to be precise, allow them to communicate with our internet.”

“Cool!” Megan’s wry smile grew into a grin. “That’s funny!” she added.

Her expression reminded John Wheeler of a girl from his distant past. “How’s that?” he asked, as if he hadn’t said anything out of the ordinary.

Excitedly, Meagan said, “The reason I got interested in radio astronomy was to listen to pulsars. They used to called them LGMs—know why?”

Wheeler was a master at playing dumb so his students could teach him. “No, why?”

“Little green men! Some sounded like music.” Then she added, “Pulsars were discovered by a woman, you know.”

“Interesting!” Faking surprise, John Wheeler knew he had chosen well. He could have talked for hours about Jocelyn Bell and how her advisor received the Nobel Prize instead of her because she was just a graduate student when she discovered the first pulsar. *The politics of science*, he thought. *Jocelyn might have won after all—I don’t remember the name of her advisor.*

Megan thought about it for a few seconds and got a puzzled look. “How far away will these aliens be?”

“In the Pleiades, about four hundred light years.”

Her eyes lit up. Megan Reilly saw an obvious flaw. “But Professor, the internet requires a two-way signal— request going out, response coming back. Wouldn’t that take eight hundred years?”

“That is common sense; however, light doesn’t behave according to common sense—and, as you know, radio waves are simply very low frequency light waves. So the quantum weirdness we observe for light in the laboratory should hold for radio waves traveling across vast expanses of space. Everything about light violates common sense, Megan. Take the fact that it always appears to have the same speed for any observer—it’s been proven over and over, and even physicists can’t fit that into common sense.”

“How does that get around an eight-hundred-year round trip, Professor?”

John Wheeler had hoped to avoid, or at least postpone, talking about time reversal. *If I’m going to convince this smart cookie, I need to be honest.* “In my career as a teacher, I’ve had the good fortune of having many students much cleverer than me. One of these students, Richard Feynman, figured out that antiparticles behave just like normal particles that are traveling backwards in time, crazy as it might sound. What if the stars in the Pleiades are made up of antimatter? Antimatter forms the same atomic structures as normal matter, so these antimatter stars might have antimatter planets, with antimatter atmospheres and antimatter life forms. The only difference would be that their time runs opposite to ours.”

He weaved the thread of logic as he talked, hoping Megan could follow it. “Light waves and radio waves always travel into the future of the emitter, so when they send us a light-speed signal, it travels four hundred years into their future, which is four hundred years into our past. We have no way of determining whether radio signals are coming from our future or our past.”

Professor Wheeler paused to assess Meagan’s expression. “If your server receives a request from an antimatter planet, it will be coming from our future. Your server sends its response back into our future, where it came from. Our response gets back to them at approximately the same time it left.”

Johnny decided to not mention quite yet that the response from Megan’s router will actually be received prior to the aliens sending their request, since our processing delay is into our future and their past. He had learned to recognize when a student had reached information overload. Megan had all the symptoms.

Pat Reilly automatically raised his hand, as if he were a student in a classroom. “Wait a minute! Since the processing delay between their request and our reply is forward in our time, which is backwards in Pleiades time, won’t they get the web page before they send the request?”

*So much for avoiding that issue.* “You’re right, of course. I’m counting on the aliens being much more advanced than we are, and they will have to deal with that wrinkle. To make it easier, though, we’re going to send them a message that one of my

students devised years ago. Any advanced alien should be able to decode it. The message will give them the protocol of the internet. We will send it *after* the wireless router has been running for awhile—so they will get it *before* they need it.”

Megan was already in planning mode. “That will be easy on our end. I’ll get a request for a URL and send the page. They will get the bit stream in reverse— a backwards HTML page. They’ll have to parse out the URL from the page and then echo it back as a request. Since their time is reversed it should be in correct sequence for us, right?”

“That’s the plan.” Wheeler was surprised that she was not only keeping up, she was anticipating the consequences.

“But Professor, if the Pleiades is only four hundred light years away, isn’t it still in the Milky Way?”

Wheeler saw immediately where Megan was going. “That’s true, and you’re probably thinking that antimatter in a normal-matter galaxy would create gamma rays from the annihilation events where the two types of matter collide.”

Megan nodded, “That’s what I’ve been told. Isn’t that right?”

“Well, that *is* why the scientific establishment currently believes that there’s very little antimatter in the universe—because we don’t observe the gamma rays. But this creates another dilemma—we’ve never been able to create a particle without creating its antiparticle mate, and our theories tell us that matter and antimatter should always be created in equal amounts.”

Megan frowned, “How can both of these be true?”

Professor Wheeler pointed to an imaginary blackboard.

“There is one possible explanation—I haven’t told anyone—no one pays any attention to new ideas from old men. Besides, they already think I’m crazy, why make them think I’m crazier? It’s not actually a new idea—it’s almost as old as the idea of antimatter itself. But one thing physicists hate more than new ideas from old men is old ideas that resurface long after they’ve been rejected.”

Wheeler now had both hands in front of him with palms facing each other as if the answer was in the space between them. “Imagine that gravitational fields and electric fields have opposite symmetries. Like charges repel, while opposite charges attract. Could it be that like matter attracts, while opposite matter repels?”

Wheeler was excited to finally be trying out the idea on a live person. “If that’s the case, both matter and antimatter would gravitate to their own kind to form stars, planets, and star clusters. The antimatter systems and normal matter systems, however, would gravitationally repel each other. This might be what’s preventing them from coming in contact with each other.”

Megan was also excited to hear the professor talk about something she could understand and visualize. After processing a few seconds her eyes lit up. “Wow, could that be what’s making everything fly apart so fast? I mean, if we have repulsive gravity systems mixed in with everything else—could that explain what they call dark energy?”

Wheeler pretended he hadn't extrapolated the idea that far. "Hmm...you might be on to something, Megan. If you decided to pursue it, though, do it for yourself. For your own personal quest—I mean, don't expect recognition. Once the science establishment has locked onto a theory, they have little interest in scrapping it and starting over. They would rather keep patching it up and adding new exotic mechanisms to explain new observations."

That sounded more negative than he had intended. Johnny Wheeler would never discourage a bright young student. He couldn't leave it like that, but he also wanted her to appreciate the inertial resistance to new ideas. Unrealistic expectations can lead to disappointment and discouragement.

"One of the most brilliant inventors of my generation never got proper recognition for her contribution. Hedy Lamarr, a famous movie star, invented what she called *frequency hopping*, which we now know as *spread spectrum technology*. She came up with the idea of switching the frequency of radio control signals in a secret sequence known only by both the transmitter and receiver. It makes the signal very robust, immune to either intentional or accidental jamming.

"Hedy came up with the main idea, and her co-inventor was a musician who provided a method for switching the frequency using player piano rolls. They offered their invention to the military, but it wasn't used in World War Two. Too bad—it might have saved thousands of lives. Anyway, the technology was

only used after their patent expired. It's now used in cell phones, GPS, drones, missiles, and yes, even wireless internet.

"Hedy never received a dime for her invention, but I know—at least I hope—that she had a great sense of satisfaction, knowing that it was her invention that made all of these modern miracles possible."

"I guess what I'm trying to say, Megan, is that if you care more about your idea than taking the credit, you should probably find someone with credibility and make him think it's his idea."

Megan stepped closer to the telescope. "I guess I could hook a wireless router into my antenna. I'd need to amplify the signal—I'll probably have to hack it to increase the gain. That shouldn't be too hard."

Dr. Reilly was frowning. "I think that's illegal—there are strict limits on the power output of wireless routers. I don't know if they even sell amplifiers for them."

Johnny Wheeler was unfazed. "Well, if they make them you can probably get one—tell them it's for research. If they don't, you'll have to build it from scratch. I don't think it will be detectable anyway—you will be focusing the beam in the direction of the Pleiades, and during December and January, that will be in the middle of the night."

Pat Reilly had been studying the lens cover. "The machining is pretty straight forward—I can duplicate the lens cover and retaining screws in about a day."

Megan was getting more enthused. “This is going to be fun. I can monitor the server traffic to see if the aliens use it!”

“No!” Wheeler was glad she brought it up—he might have forgotten to warn her. “I’m absolutely sure of one thing—if we try to observe it, it won’t work. Don’t monitor it or even record the server activity. It would be like observing which slit an electron goes through—it would de-cohere the connection.”

Megan looked disappointed. “You mean we’ll never know if it works?”

“I know I’m asking you to put in a lot of work on a project you’ll never see the results from. I’m hoping you’ll humor an old man though. I’m ninety-four and I’m thinking this is my last great experiment.” John Wheeler regretted that he couldn’t tell her why he knew the experiment would work.

“I’ll do my best, Professor Wheeler.”

“Oh, just one more thing, Megan.”

Megan’s father was thinking with a chuckle, *Now he sounds like Columbo!*

Professor Wheeler removed an SD card from a business-size envelope. “After you’ve had the internet connected during winter recess until the end of the year, then you need to broadcast the two files on this card. The frequencies are in the envelope. Broadcast continuously when the Pleiades are visible from the first of January to the end of winter break.”

Megan looked at the envelope. In blue ink, the current year, “2005.” The envelope had dog-eared corners, worn edges, graphite smudges, and coffee stains all over it. It looked like it had been in Professor Wheeler’s desk drawer for years. “How long have you had this SD card, Professor? It’s a really new format, but the envelope looks so old.”

“Oh this is just an old envelope I had laying around. The card was programmed by one of my students. It’s kind of a universal Rosetta Stone for our internet protocol. She’s pretty sure any advanced civilization will be able to decode it.”

Dr. Reilly entered the exit code from the crumpled sticky note. The threesome retraced their path through Peyton Hall. Megan and her father turned left toward the steel tigers. Professor Wheeler turned right, away from the growing crowd of football fans.

## Chapter 1, continued

Roswell, New Mexico

July 1947

Biologically, Nand was 27 years old when she arrived on Earth. Her spaceship had traveled at 95 percent light speed. Relativistic time dilation condensed the 400-light-year trip into only 58 years of elapsed time on the spaceship. For all but 10 years, Nand was in suspended animation, which insulated her from biological aging. Her conversion to Earth-compatible matter, however, was more traumatic than expected. She had lost consciousness immediately.

Her return to full cognizance had been excruciating—she now realized why—all her left-handed DNA molecules had unwound and then rewound into right-handed helices to conform to the new bond angles in the Earth-matter phosphate chains. The DMT vapor had reanimated her new mirror image DNA but had also taken her on a wild psychedelic ride.

Now fully conscious, Nand was aware of who she was, where she was, and why. Standing over her were four Earthlings, three in military-looking uniforms, the other in plainer clothes, lacking name tag, insignia, and patches. Nand remembered her mission.

It was on her shoulders not just to save her planet, but to actually bring her civilization into existence. She had studied Earth's history from the vantage point of 58 years in the future. She had read the accounts of her own arrival on Earth. They were shrouded in secrecy and conflicting information. Official reports even denied her existence. Nand felt her heart rate quicken as a wave of fear washed over her. *Why did I volunteer for this, with my fate so uncertain?*

Nand knew that future Earthlings would only be able to colonize her home planet if everything happened the way it was supposed to. In particular, she had to divert the trajectory towards self-destruction that these Earthlings were currently on.

She was also aware that this nation she had landed in had just emerged from a global and desperate war for survival. Paranoia, suspicion, and secrecy ruled the psychic landscape. A former ally had quickly become the new enemy, even before the ink was dry on the declarations of peace.

There was one person of whom Nand was particularly afraid of: General Curtis LeMay. Nand was certain that if LeMay got his hands on her, she would be tortured. She had studied this ruthless and blood-thirsty general. He would employ any means necessary to extract information from her that might allow him to annihilate his new enemy, the Soviet Union.

Nand reminded herself that there were other, less easily identified dangers. She was aware that the medical profession, especially the military faction, was much more interested in studying the long-term effects of their new nuclear weapons than on preventing exposure or treating people already exposed.

She had also read about their willingness—no, eagerness—to conduct cruel medical experiments on people who differed from the norm of their privileged class—and she would definitely be viewed as different. *If these researchers could treat their own citizens with the callous cruelty that they used in the Tuskegee experiment, what atrocities could they invent for me?*

Suddenly, Nand remembered her micro-chip implant. *Does it still work? Did the logic circuits all convert to Earth-matter? Can I still control it?* Nand closed her eyes and concentrated on the upper right corner of her field of vision. Nothing. Then she shifted her attention to the upper left. Instantly her personalized menu came into view as if it were an after-image that had been burned into her retina by an intense light.

*Yes! I still have access to Earth's internet—at least a static copy of it as it will be in the year 2005, 58 years in the future. The question is, will this knowledge be my greatest asset or my greatest liability?*

Nand's senses came back in stages—first her vision (along with vertigo from her newly acquired dyslexia)—then awareness of sharp antiseptic smells—and now her hearing. She heard the Earth men talking, and she understood them.

The voices seemed somewhat slower and lower pitched than those she had studied for the past ten years. Perhaps Cray had made an error in converting the audio files into Z504 rates. The difference was slight, and she could understand their slow speech perfectly. Would they understand me? She made a mental note: *I need to speak slowly so these Earth men can understand me—not too slowly—I don't want to appear to be insulting their intelligence.*

Nand raised her left hand and removed the oxygen mask. “John Wheeler?”

Professor John Archibald Wheeler looked down at his jacket to see if he had a nametag on. He did not. Visibly shaken, his jaw went slack. “How do you know my name?”

“It was a guess. You were involved with the development of the bomb that ended your recent war. You sometimes work at Los Alamos not far from here. You were the logical choice to investigate the UFO crash: security clearance, technical expertise, and geographical proximity.”

The professor's mouth was open but no sound was coming out. Before he could organize a response, Nand continued, “I have much to tell you, Professor.”

The situation's full implication suddenly overwhelmed Professor Wheeler's consciousness. This strange female, alien or not, knew way too much about his top-secret activities. Wheeler turned to the officer. "Clear this room of all personnel! My apologies, Colonel, but that includes you. This conversation has gone way beyond your security clearance."

Nand tried to raise her head. "Wait. Secret base...north of Las Vegas...take me there, please. I'll need a hyperbaric chamber—your atmosphere is much thinner than what I'm used to."

Nand grappled with the oxygen mask and tried to put it back over her mouth and nose. Dabney reached down, lifted her head with one hand, and positioned the straps with the other. She closed her eyes.

Professor Wheeler modified his orders. "Tear some seats out of the Gooney Bird that brought me here. Find the pilot. Have him plan a flight to Groom Lake, Nevada. I need a secure phone line to the Atomic Energy Commission!"

#

24 hours later, Groom Lake, Nevada

John Wheeler patiently watched Nand through the glass window in her hyperbaric chamber. The professor anxiously waited in a chair, wearing a set of pilot headphones. A hand mic clipped on the side of the chamber was within easy reach.

Inside the chamber, near the top right corner of the window, a small electric fan with soft rubber blades was held in place with a suction cup. A clear parabolic area radiated from the fan, expanding and shrinking rhythmically. With each exhalation, the clear area became a narrow swath, as the condensation of warm moist breath against the cold glass overwhelmed the fan's effort. With each inhalation, the fan caught up, widening the clear area to the full height of the window. Each time Nand moved, John Wheeler grabbed the mic from its clip, ready to resume their conversation.

Nand opened her eyes and looked around her cocoon-like chamber. She knew instantly where she was—these Earth men had complied with her request. *They must have carried me to and from that deafening aircraft, but I can't remember that.* Nand tried to remember something, anything, about her brief exposure to Earth. A vague odor—the dusty smell of new rain on a hot day—then a replay of the traumatic takeoff with the plane jerking side to side.

There had been a cross-wind, and the C-47, a "tail dragger," was directionally unstable on takeoff, while still rolling on its forward wheels but its tail wheel elevated to minimize drag. The pilot had done a skilled rapid dance on the rudder pedals to keep the craft's forward end pointing down the runway. Nand remembered her apprehension about the primitive craft. It seemed so fragile and obviously unsafe as it swayed side to side and rattled

along the runway, trying to attain flying speed. She had calmed herself by thinking of how Uncle Cray would have loved it. Once airborne, the drone of the radial engines had soothed her back to sleep.

*Yes, Cray would have loved that contraption.* Nand smiled as she thought about her uncle and how he took perverse joy in the imperfections of primitive technology: the smoke and smell of raw fuel, byproducts of incomplete chemical reactions inside the engines, and the deafening roar from the inefficient conversion of explosive energy into useful propulsion. More than anything else, Cray would have loved the flawed stability of that rickety craft, making the pilot's skill an integral part of the machine. Cray found modern crafts boring—their silent perfect efficiency—their artificial, hands-off stability. Countless, invisible logic gates had reduced the pilot to a passive observer. Click an icon. Watch the show.

Wheeler, seeing her eyes open, grabbed the mic. "I can hear you if you wish to talk."

Nand turned her head to Professor Wheeler, his face framed by the parabolic boundary of condensation. She smiled. "I see that you are sitting down. That is good. My name is Nand. Take me to your leader."

"What?"

"I was trying to make a joke. That's what I'm supposed to say according to the cartoons I've seen." Nand decided she needed more interaction with real Earth people before trying humor again.

"At some point, I *will* need to talk with President Truman, though."

The alien and the professor made eye contact. John Wheeler immediately sensed a warm empathy and deep understanding. "How do you know these things?"

"I come from a world where matter is both similar and opposite to yours. The nuclei of our atoms have what you call a negative electric charge. The particles surrounding a nucleus have the same mass as your electrons but have a positive charge, what you call positrons."

"You mean antimatter? All your subatomic particles are antiparticles?"

Nand was struck by how strange it felt to hear the matter she had grown up with referred to as antimatter. She had considered the matter on Z504 to be normal and Earth's matter to be the antimatter. She decided not to take issue with the semantics. After all, she was the guest.

She merely replied, "Yes," then added, "I can confirm, Professor, what you once proposed to your ex-student, Feynman—that antimatter obeys the same laws of physics as normal matter, but in reverse time. We view the same cosmological events with opposite temporal interpretations. What you see as a big bang, we see as a big crunch—a gravitational collapse, or black hole."

Nand felt panic as she heard the words 'black hole' come out of her mouth. She wished she could suck the sound waves back into her lungs, but it was too late. *The term black hole is not yet part of John Wheeler's language—it will be another twenty years*

*before he himself will coin the term at a public conference. Have I just changed history? Will Professor Wheeler start using this descriptive phrase right away?* Nand searched his face for clues about the impact of her blunder. She detected no expression of enlightenment—only deep contemplation. *Perhaps he will wait twenty years.*

The one thing she knew for certain about John Wheeler was that his modesty and intellectual honesty would never allow him to take credit for something that came from someone else. She remembered reading that he had attributed ‘black hole’ to an anonymous student blurting it out during one of his lectures. *Am I that anonymous student?* She had wondered why the true author—the student who first said ‘black hole’—hadn’t come forward to claim such a famous idiom.

*Am I putting him into an intellectual state of shock? Maybe some of the things I’m telling him will be suppressed until he’s ready.* Nand watched as her comment bounced around in the professor’s brain.

Finally he was able to construct another question. “So you would see a gravitationally collapsing star as an exploding supernova?”

Nand felt relieved. He was still too wrapped up in the reverse flow of time to process the black hole comment. “That’s right. You perceive the universe to be expanding from a big

bang—the beginning of the universe. In my world, we see that same great gate of time as a grand finale—the death of the universe."

"So you know the future?"

"Well, some of it. While my ship's time advanced fifty-eight years on my trip, your time backed up fifty-eight years. Before we launched, I downloaded thousands of hours of video files and Earth's history from your year, two thousand five."

"What do you mean, downloaded? What's a video file?"

"Sorry, these are terms you are not yet familiar with. In two thousand five, there will be a vast archive of knowledge available to everyone. It will be kind of like radio, but interactive—everyone can request exactly what they're interested in."

Wheeler, the skeptical scientist, had a sudden sense of suspicion. He had just thought of something incredibly improbable. "Am I to assume, then, that everyone on this planet of yours just happens to speak English?"

"No, your audio signals were so strange we could not even duplicate the sounds with our vocal cords. Of course, we were hearing it backwards. Even our own language sounds weird backwards."

Still not ready to abandon his challenge, Wheeler said, "How is it then that you speak such good English?"

"Well, aside from being modest, I *am* very gifted." Nand noted the Professor's blank expression. *One of us is definitely not yet ready for humor yet—probably me.* "In Earth's future, there will

be many educational programs. On my journey, I studied all episodes of *The Electric Company* and *Sesame Street*."

"Never heard of them."

"You will."

Wheeler was quiet for a long, awkward minute. "So you can tell me when I am going to die?"

Nand grinned, "Not exactly, Johnny. You were still alive last I heard."

John Wheeler didn't feel any sense of relief. *If I'm alive in two thousand five that will make me ninety-four, I think. What would it be like to know the future? She says I'll be alive at ninety-four! Maybe crippled or in constant pain. Do I want to know that? I envy her space flight, but her knowledge of the future? I don't think so. My first choice has always been to get off this rock alive; my second choice is to die healthy. I won't probably get my first choice if I'm still here at ninety-four.* He decided against pressing her for any more details about his future. "Wait! What did you call me? How do you know I go by Johnny?"

"I have read everything I could find about you. You will play a central role in the development of theoretical physics."

He looked at Nand and thought about the 58-year trip she claimed to have had. Either she had been extremely young when she'd started or had aged really well, or both. Then, he thought of another possibility. "The fifty-eight years on your trip—was that Earth years or your home planet years?"

"Actually, our orbital period around our star is almost identical to yours. It turns out to be a feature of any Goldilocks planet. Between the extreme cold of outer space and the unimaginably hot stars, there is a very thin temperature range that allows life. Like in the story of the three bears, it has to be not too hot, not too cold, but just right." Nand suddenly understood the real question Wheeler was asking. "I aged only ten years because I was in a biological suspended state for most of the trip."

Professor Wheeler combed his hair with his fingers. "How can all Goldilocks planets have the same orbital period? There's a huge spectrum of possible star sizes and orbits."

"It is counterintuitive but really quite simple the way it was explained to me. A Goldilocks planet must receive the same radiation intensity as Earth. It turns out that for two stars with equal mass density and surface intensity, the orbital period increases inversely with radiation intensity raised to the three-fourths power. So orbital periods are uniquely defined by radiation intensity."

"Give me a minute to think about that one." John Wheeler focused on an invisible blackboard over Nand's head as he combed his hair with his fingers. *Hmm...if the stars have equal surface intensity, then intensity increases with the square of star radius but decreases by the square of orbital radius. Period squared is proportional to orbital radius cubed over mass, which is*

*proportional to the star radius cubed. Let's see...  $T$  squared times little  $r$  cubed over big  $R$  cubed is constant, and little  $r$  cubed over big  $R$  cubed is proportional to intensity to the  $3/2$ . This young lady is a smart cookie, but how could she know about my work?*

“OK, I’ll concede that’s plausible, but how do you know about my work at Los Alamos? It is *top secret*, and as far as I know, always will be. So even if you’re from the future.... Wait! How do you know about Feynman?”

Nand was tiring of the cross-examination. “There are many secret records that will someday be released—something your government will call the Freedom of Information Act. As for Feynman, he will become one of your nation’s most famous physicists.”

Before Wheeler could ask another question, Nand continued, “I’m getting very tired, Professor. Before I tell you any more, I need to speak personally with President Truman. I’m thinking they’re not going to let me travel, so could you please bring him here?”

John Wheeler’s eyes opened wide, and he cleared his throat with a half cough. “You might know a lot about me, but you overestimate my importance if you think I can just go into the Oval Office and talk to the president any time I want. And as far as getting him to come here, most people who know about you think you’re a Russian spy. Since they don’t trust you, I don’t think they’re going to allow an up close and personal meeting with the president.”

Nand was not fazed. “From what I’ve read about President Truman, he will make his own decision about that. Just send the president a message through your secret research organization. Tell him I came to discuss an entry he made in his personal diary on July 25, 1945. It starts out: *We met at 11 AM today.*”

Before John Wheeler could object, Nand continued. “I need some clothes, Professor—could you please arrange that?”

John Wheeler’s face flushed as he was hit by the fact that she was stark-naked under the sheet covering her. “Yes, of course, I’ll see what I can do.”

“Thank you Profethor.” Nand realized that her mouth had become so dry, she couldn’t pronounce the *ess* sound. Curling her tongue under, she found a few drops of saliva, which she pushed forward against her teeth and then onto the roof of her mouth. “I’m sorry, Professor, but my conversion to anti...uh...*your* type of matter has been traumatic. I don’t think I can talk any more. Can I get a drink of water?”

“Yes, I’ll get corpsman Dabney.” Wheeler hesitated. “Do you want to take a break?”

“That would be good. Can we continue on another day?” Nand flashed a mischievous smile. Teasingly, she added, “Return with President Truman, and I’ll tell you everything you need to know about the future.”

It was obvious the alien was terminating the conversation. Professor Wheeler left the room. *What does she think I need to know? Clever wording. My need to know might not correspond to my desire to know.*

#

One week later.

Nand was now spending most of the time outside the hyperbaric chamber. As Dabney entered, however, she was inside the chamber. Corporal Dabney picked up the mic outside the hyperbaric chamber. “President Truman and Professor Wheeler will be arriving in two hours, Ma'am.”

“Thanks Dabney, could you help me get cleaned up and out of this contraption? I can’t meet the president looking like this.” As Nand started to pull herself up, she grimaced and put a hand on the right side of her abdomen.

“Is it still hurting?”

“A little, but it’ll be all right.” Nand had already checked the incision she had asked Dabney to make three days earlier to remove the postage stamp sized memory card she had been carrying under her skin for almost a year. “By the way, what happened to my flight suit?”

“I haven’t seen it since I, uh...” Dabney’s face felt warm. He hoped his face wasn’t red.

“Since you took it off?” Nand’s face felt warm. She hoped her face wasn’t red.

*How did she know I removed her flight suit? Was she guessing, or did I betray myself in some subtle way?* He remembered every second of the process, having relived it hundreds of times since. He remembered peeling apart the mysterious overlapping strip that ran down the front center line of the suit from her neck to—well, as far as it could.

He remembered the tearing sound it made and the faint aroma of vanilla as he exposed a thin wedge of flesh. He remembered slipping his right arm down her back inside the flight suit so he could support her weight while he slipped the suit off her shoulders. Had he held her too close? Was he trying to shield her from the eyes of the others as he tried to convince himself, or did he just want to be closer to her? She was beautiful. Flawless, almost translucent skin covering strong lean muscle—she was intoxicating.

Dabney had tasted vanilla extract in his mother’s kitchen when he was very young. *How can something smell that good and taste so vile? Would it be the same with Nand?* He had been tempted many times in the past week while she had been sleeping. *I could just put my tongue on her arm to check. But what if she woke up? How would I explain such deviant Earth man behavior?*

Dabney struggled to bring his brain back to say something relevant. *What did she ask? Oh, the flight suit.* “They were very

interested in your flight suit. What's it made from? What gives it all those pretty colors? It reminds me of mallard feathers."

Nand made a mental note to google *mallard*. "It's made of gold nano-threads. The whole suit works together as a biofeedback machine—but it will only work for me. It's tuned to my body. They won't be able to find out how it works by taking it apart. Do you think I'll get it back?"

"I don't think so. When things get taken away like that they don't usually come back. I heard the Colonel order it sealed and sent to Wright-Pat—I mean Wright-Patterson—it's an air base."

"I understand. The less scientists know about something, the more secretive they are. They don't want anyone to know how ignorant they are."

"If it's made from gold, why is it so light? It almost floats."

She was relieved that it just *almost* floats. That meant the conversion of matter to antimatter, and vice versa, was complete. If some of the Z504 matter had not converted to Earth matter, the suit would have floated. They would have needed a ladder to get it off the ceiling. Of course the same went for her; she would have floated away before they had found her.

Nand hesitated; she was thinking about her answer very carefully. *Have I already given Dabney too much information?* She decided no one would pay any attention to him, and besides, she had a sudden urge to impress him.

“Well, it’s not all regular gold—almost half of it is anti-gold—gold atoms with positrons swarming around negative nuclei of antiprotons and antineutrons. That’s what gives it its colors—the electrons and positrons are mixed together in a sea of cold plasma, vibrating like ocean waves.” Nand looked at Dabney. “What?”

“What, what?”

“You’re looking at me like I’m from another planet.”

“Well, now that you mention it....” Dabney didn’t understand anything that she was saying, but there was something about the way she was saying the things he didn’t understand. *Is she flirting with me?*

Nand thought she might have overdone it. The last thing she wanted was to intimidate him. “If you think my people know everything there is to know about science, you’re wrong. The quest for knowledge is like counting snakes. For every one you see, there is one hiding. For every one you don’t see, there are two hiding. The stuff we don’t know, Love, will always be vast compared to the stuff we know.” *Why did I call him Love? It just came out without thinking.*

Dabney didn’t know what to make of it—she hadn’t called him *that* before. *Is she feeling the same way I am?*

#

When her visitors were at the door, Nand was dressed in a highly modified WAC officer's uniform, minus any rank insignia.

She was sitting at a table that had been set up with a dark blue felt tablecloth with the presidential seal perfectly centered on it.

As the door opened, Nand saw four people: Professor Wheeler, President Truman, whom she recognized from internet pictures, and two uniformed guards. The president was gesturing for the guards to remain outside. They seemed reluctant, but the president was insistent.

She stood erect but poised as President Truman entered, with Wheeler just slightly behind to his left. The president looked more nervous than Nand. Truman walked straight toward her and extended his hand. "I'm Harry Truman."

"It's a pleasure to meet you, Mister President. I'm Nand from Suba...I mean the Pleiades." Without any hesitation, they shook hands with a light grip. Wheeler was embarrassed. He realized he had not asked her where she was from.

After the three were seated, the President spoke first. "That was a pretty neat trick you pulled off with my diary, Nand. Professor Wheeler is convinced that you are from the future, but I don't know if I can swallow that one. I'm from Missouri. Does that mean anything to you?"

"Yes sir. It means I have to show you."

"That's exactly right. Do you know where you are?"

"I think so. During your recent war, there were two practice runways built at Groom Lake, a dry lake bed north of Las Vegas. Everyone thinks they have been abandoned, but there is a secret underground facility built for testing new technologies. In the future it will be known as Area Fifty-One. I'm not sure that name exists yet. My guess is that we are in that underground facility."

"That's pretty good guessing, Nand. So, what do you think of Earth? Are they treating you OK?" *This feels awkward—I'm the president of the United States, chitchatting with an alien. Should I offer tea or whiskey?*

"Yes, very well. Thank you. I love the shower. Never experienced that before. Haven't seen your planet—not the real thing that is, and not the way it is now. I've explored much of Earth virtually, though."

"Don't know much about virtual exploring. Might take awhile to get my Missouri mind around that." Truman looked intensely at Nand. *If she's putting me on, she sure has a good act.* "If you know all about me from the future, you know I'm not one to beat around the bush. So, why did you come here, Nand, and what do you want to talk to me about?"

"Before starting my space trip, we had access to Earth's history from the vantage point of your year two thousand five. My mission is critical to the future of both our planets. From studying your recent history, or what will be history in two thousand five, it became clear that there is an impending urgent threat: one that only you can mitigate, Mr. President."

“And what is this threat that is so urgent?”

“It is the thermonuclear fusion weapon, the hydrogen bomb that your country is developing. It is a weapon that must never be used. Your current theories of physics are inadequate—you have no concept of the awesome power of these new weapons.”

Professor Wheeler bristled visibly. “Oh, I think we have a pretty good handle on the physics!”

“I’m not here to argue with you, Professor. All I can say is that you don’t know what you don’t know.”

“OK, what is it we’ve got wrong?”

“I can’t tell you that without changing history. Besides, your current knowledge is already too dangerous. I would, however, like to suggest a test so you can judge for yourself.”

“What kind of test?”

“Two months before you and President Truman need to do what I will ask of you, the first test of your fusion bomb will take place. I think you will agree that the test will be much safer if you overestimate its power, or yield as you call it—as if it were a beneficial crop for the good of humanity.” Nand instantly realized her sarcasm was counter-productive.

Professor Wheeler became defensive. “I didn’t come up with that term, Nand, but like I said, what kind of test?”

“Well, given that you will overstate the expected yield to ensure that the military will keep everyone at a safe distance—what would you think about your calculations if they turn out to be ten percent too low?”

"Well, ten percent would normally be within the range of uncertainty—but since, as you say, we are going to bias our estimate to the high side, it might give some concern. That wouldn't mean we don't understand the physics, though."

"How about thirty percent?"

"That's not going to happen!" Wheeler looked at the president, expressing absolute certainty.

Nand wouldn't let it go. "But what if it turns out to be thirty percent?"

Still looking at President Truman, Wheeler continued. "I will personally ensure that the yield of our first test will not be underestimated, and I will be there to observe it." Wheeler looked back at Nand. "To answer your question: yes—if we end up underestimating by thirty percent—that would be physics we don't understand."

"OK. I want you both to remember this conversation."

Truman laughed. "I don't think you need to worry about that!"

Truman turned serious again. "So you say that the H-bomb must never be used. That's why we're building it, Nand—so it won't be used against us. The Russians are certainly working on it too. We need to get it first."

"If I may be blunt, Mr. President, you have a sociopathic general named Curtis LeMay. He will absolutely make a preemptive strike while your country still has the advantage—he will find an excuse, real or imaginary."

“That’s an easy one. I’ll just fire him. End of problem.”

“LeMay would be more of a political danger outside the military. You need to keep him where you have control over him. There is a general you need to fire, but it’s not LeMay.”

“Who is it?”

“You will know when the time comes—he will become overtly insubordinate in a way you cannot ignore. When you fire him, it will show LeMay and the Russians that you are firmly in control. Demonstrating that you have absolute authority will help stabilize the situation, but there is really only one way to insure the H-bomb will not be used.”

The president looked at Nand suspiciously. “So you think we should scrap the project? Well, I can tell you for damn sure that’s not going to happen.”

“No, it’s too late for that. The bomb will be built. No doubt about that. The only way it will never be used is if there is a balance of power—if Russia has the bomb also.”

“That’s madness!”

“Yes, Mr. President, and MAD is the perfect acronym for what I am proposing: mutually assured destruction.”

“What exactly are you suggesting?”

Nand pushed two envelopes across the table, one in front of the President, one in front of Wheeler. Both envelopes had the same handwritten date: November 1, 1952.

"I don't want you to decide now without the advantage of the hindsight you will have in another five years. All I ask is that you don't open these envelopes until the date I've written."

The president looked at the envelope. "So you think I'm going to win the election next year?"

Nand smiled knowingly. "Don't believe everything you read in the papers, Mr. President."

President Truman put the envelope in his inside suit pocket. "Well, I guess it's not too much to promise to open my mail in five years, seeing how you came so far to deliver it. That's all I'm promising though. Can't promise something I haven't read yet."

"Fair enough, Mr. President, and please don't fire General LeMay. The Russians know he has the personality of a pissed-off python. He will be an effective deterrent."

Harry Truman winked at Nand. "It's only been five minutes, and you're starting to talk like me."

Nand grinned. "You must be contagious."

President Truman stood up and the other two copied. "Well, I've got a country to run. It's a lousy job, but somebody has to do it."

President Truman reached his hand out and Nand took it. She said, "There is one other thing I need you to do for me before you leave. I know things that I can't trust myself with—things I might try to change. I can't be allowed to do that. I respectfully request that I be euthanized. I have become friends with the staff here. It will only happen if it's a direct order from you."

## MATTERHORN PARADOX

"That's a tough one to lay on me."

"I know. I'm sorry, but it must be that way. I cannot return. Even if I had a spaceship, I would not arrive in my proper time. It's the grandfather paradox. No time traveler can be allowed to change the past."

"Haven't you already done that?"

"Not really. What I have done is only what has already happened. This visit is a part of your history—I had to come here to prevent a change." While the president still held her hand, she added. "I don't expect Dabney to do it. Just order him to leave an injection in the room."

After a few long seconds, Truman withdrew his hand. "It's been a pleasure meeting you, Nand." He turned and walked out of the room. One of the uniformed guards must have been watching through the glass window with the embedded hexagonal wire. The door opened as the president approached.

#

Wheeler and Nand sat down as the president left the room. Wheeler crossed his arms. "So, I guess we're too dumb to understand nuclear physics." The professor was surprised by his own tone and immediately regretted the sarcasm.

Nand examined Wheeler's face for any sign of the great teacher who would someday define universities as places that give professors the opportunity to learn from their students. He wasn't

there yet. "Unless you can drop the defensive attitude, Professor, I think it would be a waste of time to talk further."

John Wheeler was taken aback by Nand's terse reaction. He suddenly realized that his ego, hubris, and male pride were about to blow the chance of a lifetime. Here was a young woman who had traveled 400 light years in reverse time and had only aged 10 years. If he wanted her to share any of the secrets that made that possible, he should get off his high horse.

"I'm sorry, Nand. I guess I've become too used to being the teacher—it's hard to switch roles, but I'll try." Wheeler paused and then added, "If you're still willing."

Nand let the professor's plea hang for a few awkward seconds. "OK, but you have to understand that I'm not a theoretical physicist, and the mathematics I've seen in some of your papers is way beyond me. That said, my father was a great physicist, and he taught me at an early age that everything in the observable universe is derived from just a few fundamental truths."

Nand looked into John Wheelers' eyes and saw the man she had read about—a scientist whose personal quest for understanding was more important than popularity, peer pressure, or even reputation. "Your friend, Dr. Einstein, discovered two of these truths—that the measurement of the speed of light will always have the same result and that inertial mass and gravitational mass are exactly the same property. There is, however, something even more basic. It is so simple, its profound implications can be missed."

Nand saw no benefit to prolonging the suspense. "It is simply that elemental particles can only push on each other—there is no mechanism for a pair of particles to pull on each other."

Professor Wheeler ran his fingers through his hair. "For situations that involve variations in atmospheric pressure, I can certainly agree—we all know that the low-pressure region at the center of a tornado or hurricane doesn't pull air inward. Rather it is the higher pressure surrounding air that pushes new air inward, feeding the storm."

Wheeler looked over at the hyperbaric chamber. "And it is not the low pressure between that suction cup and the glass that pulls the two together—it is the higher pressure in the hyperbaric chamber pushing on the surface of the suction cup that clamps the fan firmly to the glass. But, to extend this idea as a universal principle seems to contradict experimental evidence."

"If there is a contradiction, Professor, it is your interpretation of the evidence that is flawed, not the principle."

"So, Nand, we observe that two parallel wires attract each other when carrying current in the same direction. Would you interpret that as the wires being pushed together instead of being pulled together?"

Nand nodded. "Exactly! It's because of the way like charges push on one another. Can we agree that the push of one electron on another is not instantaneous but occurs at the speed of light?"

Wheeler nodded, "I can agree with that. We know the interaction between charged particles is due to the exchange of virtual photons, which travel at the speed of light."

Professor Wheeler recognized that Nand was carefully developing her argument. He waited patiently. Nand continued, "OK, let's consider parallel currents, each flowing at the speed of light. If we divide each current by the speed of light, we can find their linear charge densities."

Professor Wheeler objected, "That's not possible, Nand. Electrons can't travel at light speed."

"No, Professor, they can't, but since your equation for the magnetic attraction doesn't define the speed of the current, any combination of charge density and velocity that gives the same current should give the same answer. I choose the speed of light for my current."

"Well, I guess your impossible light-speed current would generate the same magnetic field at the other parallel wire, where a similarly impossible light-speed current would feel the same side force."

"Actually, Professor, this demonstrates that the invention of the magnetic field is not even necessary. Both currents are already traveling at the speed of light, so it is impossible to exchange virtual photons between any two light-speed charges without exceeding their speed limit. The two charge densities become invisible to each other and are no longer able to push on each other."

Wheeler's eyes brightened. "I see where you're going. You're saying that this loss of push between the two light-speed charge densities creates a low-pressure region between the wires."

"You've got it! Before these charge densities were moving, their push forces on each other were components of the equilibrium condition. The loss of this push force makes the wires appear to attract each other. When you calculate the static push force between the two light-speed charge densities, it is exactly the same as the pull force calculated from your magnetic equation."

Professor Wheeler did his fingers-through-the-hair thing again. "OK, I can see where some attractions might be caused by local variations in pressure, but it's hard to imagine that the attraction between a proton and an electron could be explained that way."

"Besides local variations in pressure, Professor, there is another way for a push to be perceived to be a pull: observe it in reverse time."

"How would that explain the attraction between an electron and a proton?"

"Simple—opposite charges sense opposite directions of time. Both the electron and proton send their virtual photons out into their respective futures. A particle of charge will perceive a virtual photon coming from its future in reverse time. Its push will be felt as a pull."

Nand remembered the video of the billiard table her mother had presented to the council. “It’s like watching a movie in reverse of someone throwing a ball—it would look like the ball was somehow attracted to the thrower’s hand.”

“That’s a tough sell, Nand.”

“It would be if I were selling it to anyone but you, Professor Wheeler. You and Feynman have already anticipated the need for waves going backwards in time in a paper you published two years ago. You obscured the issue with the math and tried to make it more acceptable by referring to them as advanced waves. You were on the right track, though, but you made it way too complicated.”

"You read that paper?"

"Not in detail. As I said, your math is much too complicated for me. I did scan it for the basic ideas though. I've read much about you, Professor, and it's because your ideas are so far ahead of your time that I was hoping that you would be the one chosen to investigate my arrival."

“What else do you know about me?”

“I know that you called Feynman in 1940 and told him that there is only one electron in the entire universe—its world line loops around in a knot, and when it crosses the present, going forward in time, we see it as an electron. When it comes back through the present, going backwards in time, we see it as a positron.”

“Yea, and he thought I was crazy.”

"Yes, for suggesting there is only one electron, but he will see the brilliance in using reverse time to describe antiparticle behavior. He will weave that idea into a Nobel prize."

"So I gave Feynman an idea and he will get the Nobel prize. What do I get?"

"You get to mentor the next three generations of Earth's leading physicists. In this way, you propagate your ideas into the future, where they will be nurtured and refined. Yes, Feynman wins the Nobel prize, but you, John Archibald Wheeler, will win immortality." Nand looked at the envelope. "Oh yes, you might also save both our civilizations."

John Wheeler wasn't listening. He was recalling the paper he had co-authored with Feynman. *This is crazy—she not only doesn't understand the complex math, she doesn't understand why it was necessary. We had to preserve temporal causality. That's why we split the radiation; one half being a normal wave going forward in time, the other half being the advanced wave reflected back from the future. That way the emitter is still the trigger—the cause. I have to challenge her on that.* "So Nand, what does this time reversal do to causality? Cause must always precede effect!"

"Causality depends on perception, Professor. Consider a photon emitted by one atom and absorbed by another. Although we can measure a photon's apparent speed, it doesn't *move* in the normal sense—it is more of an event than a thing—it connects the emitter's space-time position with the absorber's space-time position. It exists simultaneously at both positions and along all

possible paths between. From the perspective of this phantom piece of light, there is no before or after—no distance between start and finish. With no separation in time or space, information is shared in both directions."

Nand saw that the professor was having difficulty grasping the full implications of his own ideas. "Consider the basic premise of your paper two years ago—that radiation is as dependent on the absorber as it is on the emitter. That can be proved without math."

"I'm listening."

"Do you believe in conservation of energy?"

"Well, if you extend it to the equivalence of mass and energy, then yes, energy is always conserved."

"OK, if you shine a battery-powered light at the darkest part of the night sky and leave it on, will the battery be dead the next morning?"

"Of course."

"I rest my case. The energy of the battery must not be lost. If the universe was just taking a chance that each photon emitted will sometime in the distant future hit an atom willing to absorb its energy, the probability would be extremely small. There is much more empty space in the universe than there is stuff for photons to hit."

Nand let that soak in before continuing. "Einstein was right about a lot of things—for one, the universe doesn't gamble with the important things. No photon will leave your flashlight unless there is a negotiated agreement with an absorber."

"How can there be an agreement?" Wheeler objected as if thinking aloud. "The absorption occurs later."

"I don't know any other way of saying it, Professor. For a photon, there is no time delay and no distance between the emitter and the absorber."

"I'm having trouble wrapping my head around the implications for causality. If what you say is true, why don't we observe future events causing past events?"

Nand smiled. "Oh, but we do, Professor. We just don't recognize them. Obviously, we can't set up an experiment in the future and observe the results before the experiment is performed. When we do observe time-reversed correlations, like *déjà vu*, we attribute it to coincidence. They're not repeatable; therefore, not provable. But remember, Professor, a push observed in reverse time will appear to be a pull. When we observe a system driven by pull forces, we are observing future causality."

"How's that?" Professor Wheeler was again running his fingers through his hair.

Nand realized she was flirting with the grandfather paradox again. *I've piqued his curiosity. How can I walk this back?* She remembered Cray's rope analogy. "Well, take a rope for example. If you pull on a rope, it becomes straight and more organized. It could be argued that all parts of the rope are being attracted to future positions. I'm just saying that the tendency of a system to organize is another indication of reverse causality." *I did it again!*

Nand stopped and watched the professor's reaction. She had just suggested that gravitation is an example of future causality.

Professor Wheeler wasn't listening. *Cause after effect? Impossible! But could the emission be determined only after it is cemented into reality by the future absorption? This is going to take awhile to work out.*

"Not to change the subject, Nand, but I'm curious about the constants of physics. Are they the same in your antimatter world as they are here? I know you said you are not a physicist, but does the number one thirty-seven mean anything to you?"

Nand smiled. "You don't have to be a physicist to recognize that! It's the approximate reciprocal of what you call the fine structure constant. It's misleading that it's so close to a whole number." Nand produced another envelope, this one unsealed. "Could I borrow your writing instrument?"

Wheeler paused to process Nand's strange syntax. "Oh. Yes. Of course." He pulled his black fountain pen out of his shirt pocket and pushed it across the table.

Nand picked up the pen and turned it to examine it from every angle. The professor reached out and said, "Sorry, let me open it for you." He unscrewed the threaded cap and handed the pen back. "Hold it at this angle. Don't press down on it. It's quite fragile and very valuable."

Nand continued to talk as she wrote on the envelope. "If you are interested in whole numbers associated with  $\alpha$ , it divides into two- $\pi$  exactly 861 times." She pushed the envelope and the pen back across the table.

John Wheeler turned the envelope around with great expectations. In neat lettering that looked as if it were typeset, he read: 2005. He was visibly disappointed. "Are you implying that the fine structure constant is just an angle in radians?"

"That is one interpretation—there are eight hundred sixty-one of your  $\alpha$ s in a complete circle. You might also consider that eight hundred sixty-one is the product of three primes, and that a Bohr radius wavelength of light vibrates at the eight hundred sixty-first harmonic of hydrogen's ground state orbital frequency."

"So which of those interesting facts have any theoretical significance?"

"I'm sorry professor. I can't tell you any more without...you know... changing history."

"I'm not convinced you haven't done that already."

Nand shook her head. "No. As far as I can tell, my visit is part of your planet's history going forward." Nand suddenly regretted bragging about her knowledge. She had already given John Wheeler more information than his scientific establishment could accept. She felt a tinge of guilt about that. He would always seem a bit strange to his contemporaries. Even his protege,

Feynman, would quip back at someone who said Wheeler was getting a little crazy in his old age: “No, John has always been crazy.”

Nand looked at John Wheeler sympathetically, knowing he would never receive the full measure of respect and fame he deserved. *Should I tell him about the speed of gravity? She immediately rejected the temptation. No! It would bring a cascade of advancement that is not supposed to happen yet. They aren't ready for it. That would positively change history.*

Nand was now anxious to end the conversation. A new plan was hatching, and she needed time alone to work out the details. Besides, she was afraid of what else she might tell John Wheeler. She was standing on a precipice—so close to catastrophe—the dreaded grandfather paradox. "There is another thing I would like to ask of you, Professor."

"I hope I'm not your backup plan for what you asked Truman to do."

"No. It's in that envelope. You don't have to wait until two thousand five to read it, but it won't make sense until the late nineteen hundreds. It contains instructions for how to set up what will be called a wireless router with the password 'MATTERHORN', all in caps."

"Find a teenager to help you when the time comes. Your contemporaries will be as clueless as you about the new technology. You will need to connect the router's antenna to a

parabolic dish aimed at celestial coordinates: three hours, forty-seven minutes, twenty-four seconds right ascension; twenty-four degrees, seven minutes north declination. Use a polar axis mount with a sidereal rate drive. As I said, find a teenager to help you."

Wheeler looked at Nand and tried to visualize her as a young girl. With her smooth translucent skin and petite but athletic frame, he couldn't imagine her looking much differently. Maybe a little less wise and a little less sad. "What am I supposed to tell her I'm doing?" John Wheeler was unaware that he had already decided his future assistant would be a girl.

Nand noticed. She smiled. "Tell her you're trying to communicate with space aliens."

"She'll think I'm crazy—but I'll probably be used to that by then."

"No, she'll probably say 'Cool!'." Nand pulled a small black object, the size of a postage stamp, from her uniform breast pocket. "Take very good care of this, John. It is what one day will be called an SD memory card. Give it to your teenage assistant in two thousand five. In the envelope, there are instructions on how and when to broadcast the two binary files on the disk."

Wheeler sensed that Nand wanted him to leave. "OK." He dropped the black plastic memory chip into the envelope and turned to leave.

The professor was halfway to the door when Nand added another instruction. "Oh, by the way, please set up a Netflix account. Use the same password. I'll need a Gmail account too. Instructions are in the envelope."

John Wheeler turned his head and held up one hand. "Yea, I know—I'll find a teenager."

A uniformed guard opened the door as Professor Wheeler approached. The lock clicked. Through the wire-reinforced glass, Nand saw both men depart to the left. *There's no guard outside when Dabney is here.*

#

On his way to the elevator, John Wheeler met Dabney carrying a stainless-steel tray. Both men avoided eye contact.

Alone, Nand's mind raced over her new theory. It explained everything—from entanglement to the double slit experiment. It was so clear to her now. It all came down to a false perception of time. We think of the past as being something that no longer exists and the future as something that does not yet exist. *We have it backwards!*

Nand now realized why Wheeler hadn't reacted to her 'black hole' comment. *I can't change the future even if I try. If I tell someone something they're not ready for, or their culture is not ready for, it will fall on deaf ears.*

*The future can't be changed because the future already exists—it draws us like a moth to flame and works backwards to create itself in the most efficient way. This is why the interference pattern can't be tricked. It is the past that remains pliable—just the opposite of what common sense tells us. It is the future we have no control over and the past that can still be changed.*

Hearing Dabney's footsteps in the hall, Nand's emotions flipped from bright optimism to dark despair. *What if I'm wrong? What if my self-preservation instinct has conspired with my subconscious to conjure up an escape strategy?*

Only seconds ago it had been so clear cut. Now, her mind was flooded with horrible scenarios. *What if I've tricked myself into making a disastrous choice? Dabney will eventually move on, and her next caretaker might be more like a jailer and less like a friend. What if these Earthlings come to fear me? Will they torture me for information about their stock market?*

From all the accounts she had read, and she had read everything she could find, her fate after crashing in Roswell was extremely secret. Being that secret meant that only a very few knew of her existence. *This, by itself, is not good*, Nand thought. *They can do as they wish with me. What about that weird video of an alien autopsy? The cadaver was grotesque. That certainly wasn't me, so at least that part was propaganda. But why? Maybe*

*they don't want people to think I could blend in. Does that mean I will escape? Or are they afraid people will panic just knowing aliens exist who look like them? It might cause mass paranoia. It wouldn't be the first time. These people have gone mob-crazy before, like in their town of Salem.*

Dabney came in the room with his eyes down. He made his way to the table and set the tray on the presidential seal. Nand's mind was in total chaos. She was incapable of making a rational decision.

"Dabney, do you have a coin I can borrow?" The question came out of nowhere, without any pre-planning or thought behind it.

Dabney looked at her for the first time since entering the room and understood. "Sure, you can use Mike." He reached in his pocket and produced a five-cent coin and handed it to her. "It's my lucky nickel. I got it in change at the PX. It was minted the year my dad was born."

Dabney felt awkward. Everything he said seemed to require another explanation.

"He died before I was born. Hit by a drunk college kid with a fancy roadster. My mom remarried. Eventually. Nice guy. We both kept my dad's last name though. My dad's first name was Mike."

Nand examined the five-cent coin. It was well worn from thousands, maybe millions, of pockets. The date was worn down almost flush with its background, but its outline was still clear—1898—almost 50 Earth orbits old. Nand wondered if the coin might have actually been minted on Mike Dabney’s birthday.

One chance out of 365 was almost complete certainty compared to the probability of that coin finding its way into Corporal Dabney’s pocket—the result of countless decisions, any of which, made differently, would have put the coin on a different trajectory, and Dabney would not have come to possess his lucky nickel. Nand no longer believed in coincidences. She was certain the coin had been minted on his father’s birthday.

“This will do quite nicely, Dabney. Thank you.” *Yes, quite nicely indeed. I will turn my decision over to Dabney’s lucky nickel.*

Dabney’s head was down, hiding his tears. Nand noticed. “Are you going to be OK?”

“Yes. It’s all good.”

A chill came over Nand as she heard the phrase—her knees almost buckled.

Dabney suddenly felt very uncomfortable. “When should I come back?”

“Give me an hour.” She sounded distant, as if she were talking to herself.

Dabney left the room without further words. There was no click.

Nand inhaled slowly. As her lungs filled with the antiseptic sterile air of her underground quarters, she wondered what this planet Earth smelled like outside. *I cannot allow myself curiosity—it might prejudice my decision.* She could feel her heart pumping deep in her chest. Nand looked at the large, circular, glass-covered analog clock above the door through which Dabney had just disappeared. She realized her heartbeat was synchronized with the small, almost imperceptible jerks of the longest pointer behind the glass.

*Sixty beats in an Earth minute. That's faster than when I'm running,* she thought. *I have to do this now, or not at all. Time to decide—which side of the coin will it be?* Nand examined both sides. On one side was the profile of a woman's head. All details were worn off except for a small crater where her ear should be. On the other side was a V, presumably the ancient Roman symbol for five.

*OK, that's it. Lady equals life. V equals vein.*

Nand hooked her left thumb under a curled finger. After carefully balancing Dabney's nickel on her thumb, she flicked the coin into the air, inducing a tumbling spin along with its upward velocity. At the apex of its parabolic arc, where its upward velocity had stopped and its downward fall not yet begun, when, for an instant, the coin named for a father who never knew his son was suspended between the cosmos and this alien planet Earth, she made her decision.

*Einstein was right: God does not play dice with the universe and neither will I.* Nand reached out and intercepted the trajectory. Catching the coin with her left hand, she closed her fingers around it. *Papa was right, too. Freedom of choice creates order in the universe. If I let Dabney's coin decide my fate, it will be like closing one slit in the double-slit experiment. The interference pattern only appears if the path is unknown and unknowable.*

Nand stood motionless. *Wheeler will send the message because I'm here! I'm here because Wheeler sent the message! Two events inextricably linked across time and space—each causing the other—but only if all possible paths are left open!*

After several minutes, Nand opened her eyes and fist simultaneously. Pinching the lucky nickel between her thumb and index finger she heard Cray's voice. *In matters of life and death, choose life.*

Nand placed the coin on the stainless steel tray.

