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2B: Time Travel

"And…" a voice rang through the observation deck. "...They're through!"

Whoops and cheers rang across the great control room as the scientists and technicians clapped with shared excitement. A dozen or so people were gathered around computers, keyboards, dials and switchboards, and powerful radios through which they maintained contact with Pod 1 and Pod 2 through billions of years in time. Lemuria's Director Jonathan Conway stood proud at the center of it all. He was a man in late middle age, with smart streaks of grey along the temples of his otherwise thick dark hair. He wore a sleek dark suit and a satisfied, thin lipped smile.

Ginger and Doctor Tom were hunched over the duel screens of a computer terminal on the right side of the room, studying intricate diagrams of Earth's magnetic field and the spherical time portal that hung in the waters outside the facility.

"So, portals are born on 'x-points,'" Ginger clarified. "Electron diffusion regions, or 'flux transfer events,' where Earth's magnetic field and the sun's magnetic field connect and form a ninety-three million mile long uninterrupted pathway."

"Between us and the sun's atmosphere, correct," the doctor confirmed with an encouraging nod.

"So, most of these portals channel the lightspeed flow of magnetically charged particles from the sun to the earth. They're like magnetic 'stargates.'"

An abrupt laugh from behind made Ginger jump in her chair. Doctor Tom swiveled to look. Director Conway approached, hands clasped behind his back, with a look of wry humor in his eye.

"Stargates!" he echoed, with another chuckle that seemed to crackle like static through his voice. "I can see why you wanted this one to fill the latest co-op rotation, Doctor, even after Mister Jones's term was extended. It's good to have young blood around here. Fresh eyes for old mysteries."

"I'm still getting caught up on the science," Ginger hedged, rising from her seat respectfully. She and the director had been introduced only briefly once Ginger had decided to

stay with the team that would monitor the portal and expedition. “But so far it seems that all the portals do is cause geomagnetic storms. That’s cool if you wanna see the northern or southern lights sometime, but I still don’t see the connection to time travel.”

“That’s why it’s called a ‘mystery,’” Director Conway replied dryly. “Our latest theory is that the rare and powerful portals, such as our own Lemuria Portal, are the result of x-class solar flares supercharging a flux transfer event.”

“Which rips a hole in space-time?” Ginger’s tone was curious, but doubtful.

“So it would seem. The Lemuria portal fluctuates in the same way that x-point portals do, and the fluctuations seem to correspond with solar wind activity. The portal right now is the largest and longest sustained we’ve seen it grow yet. That’s why we need to take advantage and act fast, such as by sending today’s expedition teams.”

“Do you think the portal is a transversable wormhole?”

“Perhaps.” The director spread his hands. “That might be the best explanation from the evidence we’ve collected so far. However, don’t forget that we didn't create the portal. We found it, and built our facility here to access it, but we’re still learning how it exists.”

Ginger chewed on her lip a moment, thinking. She asked, “Director, why *was* Lemuria built here? What does the facility want with the portal?”

“Scientific advancement, of course. The ability to study something that until now has only existed in science fiction. It would be a crime to squander such an opportunity.”

“Right, but what I meant was, what would you *do* once you understood how the portal works? How would you use that knowledge in the future?”

“Ah, I see...” Director Conway’s thin brows lifted as he regarded the college student. They were almost the same height, Ginger being less than an inch shorter, which set them at eye level.

“Well, on a personal level, I suppose I’d like to answer an age old question: how did life begin? Humanity has been asking that question since before we painted animals, painted *life*, on cave walls. We have more knowledge today on the evolution of life on Earth than we’ve ever had before, but how does that compare with the ability to see the beginning of the world with our

own eyes? We can skip guessing and begin to *know*, beyond a shadow of a doubt, where we came from.

"On another level, understanding how the portals exist might open paths for us to explore other universes. Suppose we prove the existence of parallel universes. Maybe the portal leads us to Earth's past, but on a timeline separate from ours. That might enable us to change our own timeline, or at least escape to a timeline better than our own. Now, wouldn't that be a victory for humanity?"

The director's tone changed with a wink. "Did you know that I was an Antioch student myself, back in the day?"

"It's true!" Doctor Tom finally stood from his chair to join the conversation. "He was in my class, actually."

"I had no idea," Ginger admitted.

"I didn't graduate there," Director Conway qualified. "I transferred out in my junior year. Other opportunities presented themselves."

"Well, I'm pretty sure that even attending makes you part of the club," Ginger said. "It's that kind of place."

This earned an agreeable laugh all around, before the director excused himself. "I need to oversee the operations here," he said.

Ginger and Doctor Tom settled down in front of the computer terminal again and picked up where they had left off.

"So, an x-class solar flare connects to Earth's magnetic field through a flux transfer event," Ginger reiterated to Doctor Tom. "With enough power to charge past the speed of light? And the event results in a time portal?"

"That's at least one layer of the current theory, yes."

"What about negative energy?"

"You're sharp! That would be the next layer."

"And the teleportation aspect… when someone goes through the portal, is it their original atoms that arrive on the other side? Or would the result be more like quantum entanglement?"

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"What about the clocks? There were clocks sent through the portal and brought back, right?"

Ginger stood poised over a chaotic spread of scientific articles, narrative accounts, raw data, and photographs that had been collected since the portal's discovery. On the big wall behind her were two projection screens hung side by side. The left screen showed a diagram with the trail of radio transponders and the estimated locations of the expedition pods on the other side of the portal. It had been several hours, and the pods seemed to be making their return descent after having reached the surface and collecting data and samples.

The right screen projected a camera feed of the spherical portal itself from the present day's side of time. The portal was like a mirage, colorless in and of itself, but distorting the dim light around it in sporadic fluctuating waves. The edges of the sphere blended into the surrounding water smoothly, while the middle churned with chaos. Ginger glanced behind her at the portal, then spoke up again.

"Doctor Tom? The clocks?"

"Ah, right," the doctor said, blinking rapidly behind his round glasses. He'd begun to sag with fatigue in his seat while Ginger read about the portal and the hours drew on. He shook himself now and sat straighter. "Clocks. We sent clocks through, yes, and we always check the pod clocks before and after the expeditions. Four seconds."

The doctor held up four fingers for emphasis, "Four seconds behind is all the relative time difference after a clock has gone through the portal and returned. Two seconds per one-way trip. Time here and time there seems to otherwise sync up nicely."

"And that's been the result every time? Consistently?"

"Correct, give or take a variation of less than a quarter of a second."

Ginger's face lined with a deep frown as she glanced across the papers, thinking. She spoke haltingly, "So, a person who goes through the portal travels backward in time by billions of years, plus two seconds. When they come back through to our relative time, they've also traveled four seconds into the future?"

Doctor Tom simply nodded, his smile impressed. "It took me a long time to wrap my head around that. Fresh eyes, indeed."

Ginger pressed on, though the tips of her ears grew pink where they stuck out through her short sandy hair. “So, if a person were to travel through the portal round-trip fifteen times, rapidly back and forth, their final return would land them one minute into the future?”

“That’s correct.”

“Has anyone tried to hover *inside* the portal? Instead of moving straight through?”

The doctor studied her curiously. “What are you thinking, Ginger?”

She didn’t look at Doctor Tom immediately, taking her time as she collected her thoughts. When she did look up her eyes were distant, and she seemed to look over his shoulder rather than at his face.

“I’m not convinced that this portal leads backward in time. It doesn’t make any sense. Are we really so sure that the portal doesn’t just lead to a different part of the ocean?”

“You’ve seen the data,” the doctor said reasonably. “The environment through the portal matches what we’d expect of ancient Earth. The high temperature, excess iron ions in the water, the mineral content of the rock samples we’ve collected….”

“Yeah, but that’s all circumstantial evidence,” Ginger said doubtfully. Her frown deepened. “All the other known portals have only traveled through *space* at light speed. None of them lead backward on our own timeline. If the Lemuria portal *does* lead to an ancient Earth, it must be in a parallel universe. Maybe one with a time stream out of sync with our own. But, if that were so, then some of the other portals must also lead to other dimensions.”

She shook her head, refocusing on Doctor Tom as she reached her conclusion. “Even x-class solar flares still take eight minutes to reach Earth. I don’t think faster than light travel is involved here.”

“So…” Doctor Tom sumized. “You think the portal only leads forward in time? Not into the past.”

Ginger nodded slowly. “It’s still a time portal, but not the way Director Conway thinks it is.”

“Director!” Ginger approached Director Conway once there seemed to be a lull in his flow of work with the observation team. He saw her and nodded with a gesture.

"What can I do for you, Miss Reynolds?"

"I have a question. Doctor Tom- uh, Doctor *Tolbert*, he didn't know the answer." Ginger glanced at the live projection of the portal. The colorless sphere seemed more chaotic, churning more densely than since last she checked. "I was just wondering, when was the last time the portal wasn't being watched?"

The director glanced at the image, too. "Well, we don't have someone watching the surveillance feed all day, every day, if that's what you mean."

Ginger shook her head. "Right, what I meant was, when was the last time the portal wasn't being *observed*? By people, or cameras, or equipment?"

Director Conway raised an eyebrow, but considered for a moment before he answered. "We were monitoring the electromagnetic activity before we added the surveillance cameras. That was back when Lemuria was still under construction. Since the facility became operational, I can't recall any specific time that our feed might have been interrupted. Even if the cameras were down for technical repair or upgrades, we were still monitoring the electromagnetism."

Ginger nodded as though she'd suspected that answer.

"Have you considered how observation might be affecting the portal's behavior? Affecting the way it forms?"

"You're thinking about quantum mechanics…" Director Conway discerned.

"Yes, exactly. In quantum theory particles can behave like waves of probability, in which the particle exists in more than one place at a time. It behaves as though it's spread across a number of different possible locations. But, the act of of trying to *observe* the particle changes its behavior. As soon as someone is watching and trying to measure the particle's location, it only exists in one place at a time. *Observing* the particle changes its nature."

Director Conway nodded slowly, considering. "The observer effect…. Do you think the portal would change somehow if we stopped monitoring it?"

"I really think it would," she confirmed adamantly. "From what we know, the portal's activity is linked to electromagnetic energy. All those charged electrons are exactly the kind of particles used to discover the observer effect. Now, I don't know *how* the portal would change, but I think it would be worth the experiment to find out."

"Interesting…" The director's eyes were on projection screen, watching the portal shifting and churning.

"Also, I'd like to suggest another experiment," she added quickly. She was growing breathless as the excitement in her voice grew. "Along a different thread, I wonder if we could try sending something into the portal that could temporarily hover in place, instead of just moving through from one side to the other."

"And what do you think that would do?"

"I think it *might* cause the object to travel further forward in time than just two seconds. I'm not entirely sure, but if we were somehow able to slow down or temporarily pause the transition from one end of the portal to the other it might cause a stronger leap into the future. Or," she added ruefully. "If the object were caught in between one end and the other, it might end up lost in time entirely. Caught in transition, trapped, it might become timelocked on the portal's path in the form of pure energy, disassembled atoms."

The director's brow furrowed and his thin lips pursed. Abruptly, he turned to one of his technicians and asked, "Do you see that? Haven't you been monitoring the diameter?"

Ginger was confused for several seconds before she realized that the question didn't have anything to do with what she'd just said. She glanced at the image of the portal on the wall, and then did a double take.

The spherical portal was nearly half the size it had been when the two expedition pods had set out hours ago. The diagram on the left showed that the pods were minutes away from making contact and returning to the present day.

"Yes, sir," the technician responded with only a hint of tension in his voice. "The portal has been steadily shrinking over the course of the day, but it's still large enough for the pods to pass through. They should make it in time."

A few minutes later Pod 1 reemerged from portal safely, earning a gasp of relief from the observation team. The portal's edges had begun to flicker in and out, expanding and shrinking erratically. It's smallest flickering diameter had left less than half a meter's width for error in the pod's navigation.

Ginger was watching with wide, rapt eyes. Sweat was beading on her temples, catching in drops at the ends of her short hair. She was wringing her hands when she heard the director curse grimly behind her. The portal continued flickering and pulsing, expanding and shrinking, expanding and shrinking, back and forth. The expanding fluctuations were becoming less frequent as each second ticked by. The sphere was going to shrink soon, and stay that way. Even if Pod 2 made it into the portal while it was expanded, the portal might shrink again before they could come out the other side. Pod 2 would be crunched, with Malachi inside.

"Can we stall them?" one technician murmured to another with anxiety. "There's another solar wind storm due in the next hour. The portal will grow and stabilize again if they can just wait."

"They're cutting it too close already," was the strained reply. "The mission took longer than expected. They don't have enough oxygen for another hour. Pod 1 had more tanks and could have resupplied them, but it's too late for that now."

"Director Conway," Ginger said abruptly. There was surprise on her face as she turned to the man, as if she hadn't expected herself to speak. "I have an idea."

3C: Tell the director to turn off the observation equipment and instruct Pod 2 to enter the portal blind.

The hope is to remove the observer effect and increase the probability that the portal's quantum form will be large enough for Pod 2 to pass through.

3D: Tell the director to instruct Pod 2 enter the portal on the next expanding fluctuation, and then to halt or severely reduce their momentum once inside.

The hope is that lingering inside the portal before exiting will give Pod 2 an extra lag in their time jump, so they might reemerge while the end of the portal is again large enough for them to pass.