TIME, IT'S RELATIVE

A Novel

$$t = t_0 / \sqrt{(1 - v^2/c^2)}$$

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Full Manuscript

PART ONE

THE IMPOSSIBLE EXPERIMENT

Chapter 1

The Lorentz Ring

At four in the morning the desert south of Tucson belonged to the cold. JR killed the truck's headlights two miles short of the perimeter gate and let the Santa Rita Mountains guide him in, a black wall against a blacker sky. He knew every washout on the access road by feel. He had driven it most mornings for eleven years.

From the surface, Sector 4 looked like a gravel operation that had gone broke: a sheet-metal shed, a rusted conveyor, a chain-link fence with a Castellane Energy sign bleached almost blank. Nobody driving past on the frontage road would guess that half a mile beneath the basalt, inside a cavern blasted out of volcanic rock, a ring of track one mile around was waiting for him.

The elevator took ninety seconds. He used them to breathe. For the first time in eleven years his pocket was empty; his grandfather's watch, the hand-wound Hamilton with the scratched crystal that had crossed the Pacific in 1944 and never once run down, was riding in Bonnie's jacket, because they had decided last night that she would be the one to hand it to him.

The doors opened on light and noise. The control gallery overlooked the ring through a long window of laminated glass. Below, the track curved away into the dark in both directions, a polished channel of superconducting rail cradled in cryogenic jackets that breathed white vapor. The capsule sat at the loading cradle, a carbon-nanotube teardrop about the size of a small car. It looked too plain for what it was about to do.

Bonnie was bent over the primary console with a grease pencil stuck through the knot of her hair. She didn't look up. She slid a ceramic travel mug across the diagnostic ledge toward him.

"Black," she said.

"I know how I take it."

"I know you know. I'm telling you anyway."

JR caught the mug and set it down without drinking. She took the watch out of her jacket and laid it beside her keyboard, next to the atomic standard's readout, the way JR always did before a test, so it could keep honest company.

Bonnie's hand drifted toward the watch and stopped short. Then she stepped away from her monitors and reached up and straightened the collar of his flight suit. It didn't need straightening. They both knew it. JR put his hand over hers and held it there against his chest, and for a moment neither of them did anything at all.

They had agreed, weeks ago, not to say goodbye. Saying it would make it a fact.

"Enjoy it while you can," Caroline said from the back bench. She was half buried in a tensor plot three feet wide, printed on the old pin-feed paper she insisted on because she said she thought better with a pencil. "In about two hours you two become a long-distance relationship."

"Ten years isn't long distance," Bonnie said. "It's a geological era."

"From your side." Caroline didn't look up. "From his, it's forty-eight minutes. A little less than a sitcom with commercials."

That was the whole idea, and it still sounded insane when somebody said it out loud. The Lorentz Ring would accelerate the capsule until it was moving at all but a hair of the speed of light. At that velocity, time inside the capsule would slow relative to everything outside it by a factor of about one hundred and ten thousand. JR would sit in the seat for forty-eight minutes by his own heartbeat. Outside, the capsule would circle the ring for ten years. When the braking sequence brought him in, the calendar would read July 9, 2036.

He had come to the project in 2015, the year after Albuquerque, on Bonnie's recommendation. He had been fifty years old then, a power systems engineer with thirty years of substations and switchgear behind him, the kind of man utilities called when a transformer the size of a house did something nobody could explain. Castellane had wanted someone to design the ring's power architecture: the miles of superconducting bus, the capacitor banks, the substation that would feed a load no utility in Arizona had ever been asked to carry. He had read Caroline's first paper on the train to the interview and understood perhaps a third of it, and the third he understood had made the hair stand up on his arms.

He had stayed eleven years. He had designed the power system and then redesigned it and then, when the first pilot candidate washed out of training in 2023 with a heart murmur, he had volunteered to sit in the seat himself. He had passed every test. He had passed them, Dr. Navarro said, like a man who had been waiting his whole life to be asked.

"Why you?" Mary had asked him once, at the end of a long day. "You've got a pension. You've got a house. You've got Bonnie. Why would a fifty-eight-year-old power engineer want to be the first man to ride a time machine?"

He had thought about it.

"Because I built the thing that feeds it," he had said. "Every amp. Every breaker. If it fails, I want to be the one in the seat. Not some kid who trusted me."

Mary had looked at him a long time over her reading glasses. Then she had nodded and gone back to her paperwork, and the next morning his name had been on the flight roster.

It was Einstein, nothing more exotic than that. The physics had been sitting in textbooks for a century. What nobody had managed before Caroline was surviving it. A mile-around ring meant turning a corner a hundred and eighty thousand times a second; the forces

would have turned a human being into a thin film on the capsule wall. Caroline's answer was the Inertial Metric Generator, a field that let the capsule's contents ignore the acceleration acting on the hull. The IMG had taken her nine years and two nervous breakdowns. It had worked on mice, then on a rhesus monkey named Pickles who now lived at a sanctuary in Oregon and had no idea she was history.

JR would be the first person.

And the team would wait for him. That was the deal. Castellane had signed a ten-year operating guarantee to keep the ring powered, and Bonnie, Caroline and Mary had each signed personal commitments to stay with the project. When he stepped out in 2036 they would be standing at the bottom of the catwalk, ten years older, holding a cake. Bonnie had already threatened him with the cake.

Caroline finally put down her pencil. Her plastic architect's scale slipped off the edge of the plot and clattered across the desk and onto the floor, and she didn't pick it up.

"Can I tell you something stupid?" she said.

"Always."

"I've checked the equations a thousand times. I know they'll hold. I know the IMG will hold." She was looking at him with an expression he had seen on her face only once before, at her father's funeral. "I just wish they didn't have to work on you."

JR crossed the room and picked up the scale and put it back in her hand.

"There's one term I can't close," she said, more quietly. "You know the one."

He did. Deep in her field equations, where the IMG met extreme velocity, there was a leftover term the board's reviewers had called a rounding artifact and ordered her to drop. Caroline called it the seam. If it meant anything physical, it meant that a run

like this one would leave a mark on spacetime behind it—a thin thread joining the moment the capsule left to the moment it arrived.

"The reviewers said it's noise," JR said.

"The reviewers have never been wrong before," Caroline said, "in the sense that they've never done anything."

Chapter 2

A Bet Against Time

The safety review was held in the glass conference room off the gallery. It felt less like an engineering briefing than a deposition. The room smelled of scorched coffee and the ozone that seeped up from the cryogenic plant no matter how many filters they added.

Mary sat at the head of the table with her hands folded on a stack of red risk-mitigation binders from Castellane's Houston office. She was sixty-one, gray at the temples, and had spent thirty years running projects that other people swore could not be run. She had once kept a fusion test cell on schedule through a hurricane by sleeping in it.

"Today we decide whether JR becomes a working system," she said, "or a footnote in a lawsuit."

She went through it item by item. Cryogenic redundancy. IMG field-failure cascade. Power continuity. Abort criteria. On the last one she paused.

"There are none," she said. "Once the capsule passes four-tenths of light speed, we can't brake it without destroying the field. The sequence locks. From that point the only way out is the scheduled exit, in ten years." She looked at the binders. "Houston wants that in writing, twice, with your initials."

Then she checked her watch.

"Caroline, Bonnie. Before we initialize I want a manual verification on the helium jackets in the north arc. Eyes on gauges, not screens. Go now, please."

It was transparent, and the two of them went anyway. When the door sealed behind them Mary let her shoulders drop a quarter inch, which for her was a collapse.

"Houston sees an asset ledger, JR," she said. "Ten years of power. A man in a box. A guarantee their lawyers are already looking for a way out of." She leaned forward. "I see four people I've kept alive and mostly sane in a hole in the ground for a decade. There's no shame in a delay. There's no shame in sending the monkey again. Tell me you want another month and I'll take the heat."

"Another month won't change the math."

"It'll change the odds that Castellane is still honoring its guarantee in 2030. You read the same quarterly reports I do."

"Then the sooner the better."

Mary studied him the way she studied a schedule she didn't believe. Then she nodded once and sat back. The project director returned to her face like a visor coming down.

When the others came back, Caroline put the Lorentz factor on the wall screen, the old equation that started it all, t equals t-zero over the square root of one minus v squared over c squared. Under it she had written the number they needed: a velocity of 99.999999996 percent of the speed of light. The nines ran off the edge of the screen.

Bonnie sat down across from JR with both hands wrapped around her mug.

"Can I say the thing nobody's saying?"

"You will anyway," Mary said.

"Everyone in this building has spent ten years planning for what happens if the machine fails." Bonnie looked at JR. "No one is asking what happens if it actually works."

Nobody answered her. JR reached for the biometric pad at the center of the table and pressed his thumb down until it beeped.

* * *

Afterward, when the others had gone down to the cradle for the pre-flight walkaround, Caroline stayed behind in the conference room. JR found her there ten minutes later, sitting alone at the table with the Lorentz equation still glowing on the wall behind her and a printout in her hands.

It was a photograph of a rhesus monkey. A small, sharp-faced female with a pink face and a ruff of gray-brown fur, sitting in the open hatch of a scale-model capsule, looking at the camera with an expression of profound skepticism. Someone had written across the bottom in marker: *PICKLES — FIRST TO RIDE — 3/14/2024.*

"She went for eleven days," Caroline said, without looking up. "Eleven days outside. Fourteen seconds in the capsule. She came out and ate a banana and bit a technician." She smiled faintly. "We all cheered. The technician cheered. He was bleeding and he was cheering."

"I remember."

"I went to see her at the sanctuary in May. In Oregon. I didn't tell anyone." Caroline set the photograph down on the table. "She's fine. She's fat and old and she lives in a big enclosure with eleven other retired lab monkeys, and she has a tire swing, and she spends most of the day in it." She looked up at him. "She didn't remember me. Why would she? She didn't know anything had happened to her. Fourteen seconds. She blinked and the world was eleven days older and there was a banana."

JR sat down across from her.

"I keep thinking about that," Caroline said. "She didn't know. Nothing happened to her. She lost eleven days and she never noticed, because there was nobody waiting for her who had to live them." She turned the photograph over, face-down, on the table. "You're going to notice, JR. Everybody's going to have lived ten years except you. And you're going to climb out and see it in all our faces. And there's nothing in my equations for that."

"Bonnie said the same thing last night."

"Bonnie's smarter than me about most things that aren't tensors." Caroline stood up. She picked up the photograph and put it in the pocket of her lab coat. "I'm taking Pickles down to the cradle. For luck. Don't tell Mary."

At the door she stopped.

"For what it's worth," she said, "I hope you hate it. Coming out. I hope you hate every minute of seeing what ten years did to us." She tried to smile and didn't quite manage it. "Because that'll mean we were worth missing."

Chapter 3

The Night Before

JR's house sat at the end of a cul-de-sac in Green Valley, a low adobe-colored box with a carport, a lemon tree, and a view south to the mountains that he had paid too much for in 2009 and never once regretted. He had not slept in it more than four nights a week for years. The ring kept its own hours.

He got home at seven the evening before the launch. The sun was low and the light came across the desert sideways, turning the creosote gold and the Santa Ritas a bruised violet. Next door, Lupe Ochoa was out in her yard with a hose, watering a row of geraniums that had no business being alive in July.

"You're home early," she called over the wall. She was seventy-nine and had buried two husbands and outlived one hip. She considered it her responsibility to know where everyone on the street was at all times.

"Big day tomorrow."

"They always say that. Then you go back underground and I don't see you for a week." She squinted at him. "You look thin. Is Bonnie coming?"

"She's coming."

"Good. She'll feed you." Lupe turned off the hose and pointed the nozzle at his lemon tree like a pistol. "And somebody needs to water that. It's not a cactus, JR. It's a citrus. It has feelings."

"I'll water it."

"You said that in May."

He watered it. He stood in the yard with the hose and watched the water pool around the trunk and sink into the hard ground, and he tried to imagine that tree ten years from now. Taller. Maybe dead. Maybe somebody else's. He found he couldn't hold the picture.

The future was a word he had been using professionally for a decade, and now that it was twelve hours away it had become something he could not look at directly, like the sun.

Bonnie's truck turned into the cul-de-sac at seven-thirty. She got out with two bags of groceries and a bottle of wine and a look on her face that told him she had been crying in the truck and had fixed it in the mirror before she pulled in.

"Don't," she said, before he could say anything. "We agreed. Tonight is just dinner."

"Just dinner."

"I'm making the green chile thing."

"I love the green chile thing."

"I know you do. That's why I'm making it." She shoved a grocery bag at him. "Lupe says you look thin."

"Lupe has been talking to you?"

"Lupe texts me every time you come home. She's been doing it for three years. Did you think I just guessed?"

* * *

They had met at a conference in Albuquerque in 2014, on a panel about superconducting magnet failures that neither of them had wanted to be on. Bonnie had been the only person in the room who had actually welded a cryogenic joint with her own hands, and she had said so, at length, while a tenured professor from MIT tried to interrupt her. JR had found her in the hotel bar afterward and told her she had been right about the thermal contraction coefficients. She had looked at him over her beer and said, "I know I was right. Do you want to talk about something else?"

They had talked about something else until the bar closed.

She was a mechanical engineer by degree and a welder by temperament. She had grown up in Erie, Pennsylvania, the daughter of a shipyard fitter who had taught her to run a bead

before she could drive. She thought most engineers were afraid of their own materials. She was not afraid of anything that could be measured. The things that frightened her were the things that couldn't: the board in Houston, the weather in the stock market, the way JR got quiet when he was thinking about the ring.

Castellane had hired her in 2016 to design the ring's mechanical supports, the thousands of brackets and anchors that held a mile of superconducting track steady against forces that would otherwise peel it off the floor. She had redesigned every one of them three times. She called them her children, and she knew which ones were difficult.

They had never married. They had talked about it once, in 2019, and agreed that marriage was something people did when they had time, and they would do it when the ring was finished. The ring had not finished. Now it was about to, in a way neither of them had planned for.

* * *

She cooked. He set the table on the back patio, under the string lights he'd hung for a party in 2017 and never taken down. The heat had broken a little. A pair of Gambel's quail ran along the top of the wall with their topknots bobbing, and somewhere out past the golf course a coyote started up and was answered by three more.

They ate. The green chile thing was as good as it always was. They talked about nothing on purpose: Lupe's geraniums, a show Bonnie was watching about people who restored old boats, whether the neighbor across the street was ever going to finish the addition he'd started in 2022. It was a performance and they both knew it was a performance and it helped anyway.

Halfway through the second glass of wine Bonnie put her fork down.

"I'm going to break the rule," she said. "Just once."

"Okay."

"I'm going to be fifty-nine when you come out."

"I know."

"You'll be the same age you are right now. You'll have a forty-eight-minute-old haircut." She turned her glass slowly on the table. "I keep thinking about the day you climb out. I'm standing at the bottom of the catwalk with Mary and Caroline and a cake. And you look at me. And I'm going to see you see it."

"See what?"

"Ten years." Her voice was very steady. "Ten years of my face that you missed. I'm going to watch you add it up."

He reached across the table and took her hand.

"I'm going to see you," he said. "That's all I'm going to see. I promise you. I'm going to climb out of that thing and see you and I won't do any arithmetic at all."

"You're an electrical engineer. You do arithmetic in your sleep."

"Not that kind."

She laughed, a little wet. "Liar."

"Maybe." He held on to her hand. "Do you want me to not go?"

She looked at him a long time.

"No," she said finally. "No. I don't want you to not go. I want you to go, and I want it to work, and I want to be standing there. I want all of it. I just want it to not cost anything." She pulled her hand back and wiped her eyes with the heel of it. "Which is stupid. Everything costs something. That's what I design for. I just never had to design for this."

* * *

Later, after the dishes, he went into the bedroom and opened the top drawer of the dresser and took out the watch.

It was a Hamilton, a 1943 military-issue wristwatch that someone, sometime after the war, had converted into a pocket

watch by removing the lugs and fitting a bow and a short steel chain. The case was nickel and worn down to brass at the edges. The crystal had a scratch across it from roughly ten o'clock to two, as if someone had drawn a line under the top of the dial. His grandfather had told him the scratch came from a coral reef off Peleliu in September 1944, when he had gone over the side of a landing craft and come up holding the watch over his head like a torch.

"I didn't care about the rifle," his grandfather had said. "I could get another rifle. That watch was keeping my time."

He had worn it every day of his life. He had wound it every morning at the same hour, first thing, before coffee. When JR was eleven he had stayed with his grandparents for a summer in Fresno, and every morning he had watched the old man sit on the edge of the bed in his undershirt and wind the watch, twenty turns exactly, and hold it to his ear, and nod.

"What are you listening for?" JR had asked once.

"To make sure it's still keeping my time and nobody else's."

JR hadn't understood that until much later. He was not sure he understood it now. But when his grandfather died in 2001, the watch had come to him in a shoebox with a note that said only *Keep it wound*, and he had kept it wound every day for twenty-five years.

Bonnie came and stood in the bedroom doorway, drying her hands on a dish towel.

"You're taking it," she said.

"I wasn't going to. Caroline says every gram counts."

"Caroline weighs every gram of everything. She once made Pickles lose two ounces." Bonnie came over and looked at the watch in his palm. "You should take it."

"Why?"

"Because it's never missed a day." She touched the scratch on the crystal with one fingertip. "Your grandfather wound it every day of

his life, and you've wound it every day of yours. If you go without it, then tomorrow it stops. And then for ten years it's just sitting in this drawer, stopped. I don't want to come in here and see it stopped."

He closed his hand around it.

"I'll give it to you in the morning," he said. "At the cradle. You hand it to me."

"Why me?"

"Because then you're the last person who touched it before I left. And when I come out, it'll be the first thing I check. And it'll be keeping your time."

She looked at him with an expression he couldn't read, and then she put her arms around his neck and her face against his shoulder and they stood like that in the middle of the bedroom for a long time, with the dish towel still in her hand.

* * *

At eleven-thirty his phone rang. It was Caroline.

"I know," she said, before he could say anything. "I know what time it is. I know you're supposed to be asleep. I can't sleep."

"Neither can I."

"Is Bonnie there?"

"She's asleep."

"Good. One of us should be." He could hear paper rustling on her end, the pin-feed kind. He could picture her at her kitchen table in her apartment in Tucson, three cups of tea gone cold beside her, the pages fanned across the table and onto the floor. "I ran the seam term again."

"Caroline."

"I know. I know. The board said drop it. I dropped it. It's not in the flight model. It's not in anything that touches the capsule. I'm just—I'm running it. In my own time. On my own paper." A pause.

"It's not going away, JR. Every time I tighten the solution it gets cleaner. It's not noise. Noise doesn't converge."

"What does it mean? Physically."

"I don't know. That's the problem. I know what it would mean in a different theory. In a different theory it would mean that a worldline under extreme dilation doesn't just bend. It leaves a—" She stopped. "I keep wanting to say a wake. Like a boat. But a wake spreads out and dies. This doesn't. This stays narrow. It's a thread."

"Between what and what?"

"Between where you start and where you finish. Launch and arrival. Ten years apart outside, forty-eight minutes apart inside." He heard her pencil tapping. "A thread that's exactly forty-eight minutes long, in your time, and runs right through the ring."

He sat on the edge of the bed in the dark. Bonnie breathed slowly beside him.

"Is it dangerous?"

"I don't know. I don't think so. I think if it's real, it just sits there. A scar. Like the scratch on your watch." She laughed a little, at herself. "You see what I mean? I'm not making sense. I've been up for twenty hours."

"You're making sense."

"I put something in the cockpit," Caroline said abruptly. "I want to tell you because I don't want you to find it and think I was hiding it."

"What kind of something?"

"A cover plate. Left side, under the field-state display, about knee height. Under it there's a manual pad wired straight into the IMG phase controller. It bypasses Vera and it bypasses the flight model. It does exactly one thing: it inverts the field phase." She was quiet. "It's useless, JR. On a normal run it does nothing but abort you and probably kill you. I put it in because if the seam is real, and if anybody ever needed to drive the field backward against it, that

pad is the only way to do it. And I couldn't stand the idea of it being needed and not being there."

"Did you tell Mary?"

"I told Mary it was a diagnostic port." A long breath. "Please don't touch it."

"I won't."

"Promise me."

"I promise." He looked at the dark outline of the dresser, where the watch lay on top now instead of inside the drawer. "Caroline. Go to sleep."

"I will. I'll try." A pause. "JR?"

"Yeah."

"It's going to work. The IMG. I know it's going to work."

"I know it is."

"I just—" She stopped. "Never mind. I'll see you at four."

She hung up. He sat holding the phone for a while. Then he lay down beside Bonnie and watched the ceiling until the alarm went off at three-fifteen, and he never closed his eyes once, and when he got up he found that he felt fine. Better than fine. Clear and light and ready, the way he had felt before every first test in his life.

He wound the watch at three-twenty, twenty turns exactly, and held it to his ear.

Still keeping his time.

He handed it to Bonnie, and she put it in the pocket of her jacket, and they drove to the ring in two trucks because they would need two trucks afterward. Lupe Ochoa's kitchen light was on as they passed. She was standing at the window in her robe, and she raised a coffee cup to them as they went by.

Chapter 4

First Light

At five-forty a.m. the sun cleared the Santa Ritas, and half a mile underground nobody saw it.

At the foot of the cradle Bonnie stopped him and pressed his grandfather's watch into his palm. "Take it," she said. "Somebody should keep your time."

He zipped it into the chest pocket of the flight suit. Then he lowered himself into the molded seat of the capsule. The five-point harness closed across his chest with a series of pneumatic clicks, each one a little more final than the last.

Through the canopy he could see Bonnie at the edge of the loading cradle, behind the yellow line. She raised a hand. Her voice came through his headset with a faint metallic edge.

"See you in forty-eight minutes."

"Your minutes or mine?"

"Yours. Don't touch the radio."

"There is no radio."

"Then you'll have no trouble not touching it."

He smiled, because she needed him to, and because he needed to. Then she was gone behind the blast door and it was only the control voice, the synthetic launch controller the team had nicknamed Vera, reading off field states in her unhurried contralto.

The coils woke one after another around the mile of track, a rising chord he felt in his teeth before he heard it. JR closed his eyes. He had trained for this part too. Don't fight the noise. Put your mind somewhere else and leave it there.

He put it where he had decided to put it, weeks ago: a night in April, four overturned crates under the maintenance lights, and a pot of coffee so bad that Mary had laughed until she cried. He held

on to it like a hand on a railing.

"IMG field nominal," Vera said. "Inertial decoupling confirmed. Launch in three. Two. One."

The capsule moved.

There was no slam of acceleration. That was the miracle Caroline had bought with nine years: the hull surged and the field ate the force before it reached him. He felt only a deep pressure in his chest, as if someone were sitting quietly on his ribs. Outside the canopy the white tunnel walls smeared into a gray blur, then into a single continuous band of slate-colored light that did not seem to be moving at all.

On his display, the external drift counter began to climb.

EXTERNAL ELAPSED: 3 HOURS.

11 HOURS.

1 DAY.

4 DAYS.

In the gallery, behind the blast door, Bonnie stood at the window with her hands flat on the laminated glass and watched the capsule disappear.

It didn't speed away. That was what she would remember. She had thought it would streak off down the track like a bullet, and instead it simply wasn't there anymore: one moment a teardrop of carbon on the rails, the next a faint gray smear along the curve of the ring, steady, unmoving, as if someone had drawn a line with a soft pencil and then rubbed it with a thumb. The coils sang. The cryo jackets breathed. The smear hung there in the white light of the cavern and did not change.

"He's in it," Caroline said beside her, in a small voice. "That's him. That line. That's him going around a hundred and eighty thousand times a second."

Bonnie didn't say anything.

Mary came up behind them and stood there too. After a while she put one hand on Bonnie's shoulder and one hand on Caroline's, and the three of them stood at the window and looked at the gray line, and nobody said anything at all.

On the console behind them, her own ceramic mug sat beside her keyboard, half full, the coffee in it already going cold. She didn't pick it up. She would think about that, much later, in a different life: that she had meant to come back and finish it.

Somewhere outside that gray light, Bonnie was going home tonight without him. Tomorrow she would come back to work. In a month it would be August. JR watched the counter and tried to understand that every digit was a day of her life that he would never see.

End of Sample

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