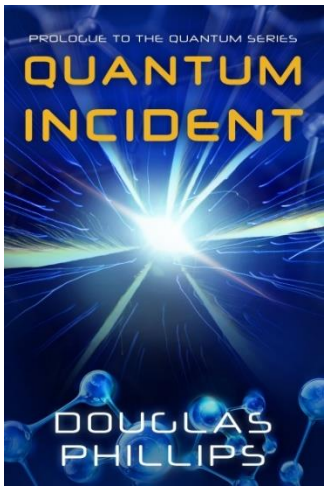
Quantum Incident

Prologue to the Quantum Series

By Douglas Phillips



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1 Hadrons

July 4, 2012
Conseil Européen pour la Recherche Nucléaire (CERN)
Geneva, Switzerland

In the warmth of a summer evening, the gala had spilled out of the ballroom and onto the outdoor patio. Cecily Johansson lifted a glass of wine from a waiter's tray and strolled through an open French door. She scanned the crowd, like a wolf looking for prey.

A lead physicist from the press conference was surrounded by adoring fans, in true rock-star fashion. *He won't do.* She'd never get him alone.

Her initial report had already been filed, but the editors in London wanted more. Of course they did; she did as well. The announcement at the press conference had been groundbreaking: the Higgs boson had been found. It was more than physics, beyond mere science—it was a discovery with consequences to the man on the street. At least, that's how she'd explained it in her article.

But there was more—beyond this newest of elementary particles, there was something unexplained, and unannounced. After the official press conference had ended, her conversations with the CERN scientists had been… odd. They were holding back, every one of them. She hadn't become the leading science correspondent in Britain by ignoring telltale signs.

Cecily searched the faces, filtering those with knowledge from everyone else. On the other side of the patio, Peter Higgs was in an animated discussion with several of the American reporters. *Too high up.* An administrator talked with one of the French reporters. *Maybe.*

Her gaze landed on the back of a young man with long blond hair and a reddish beard sitting alone at a table. *Got you.*

"Mathieu," she announced as she approached him. "Enjoying the celebration?"

He looked up. "Cecily. Nice to see you again."

She pulled out a chair and sat down. Mathieu was the perfect liaison, not high in rank but clearly at the center of the discovery. Their conversation at lunch had been like all the others—satisfaction in their accomplishment, yet leaving something unsaid. But unlike the others, Mathieu had shown a tendency to run at the mouth. She could work with that.

"Cheers," she said and lifted her glass.

"*A votre santé*," he replied, holding up his aperitif. There were two more glasses just like it on the table, both empty.

"You've completed your studies at precisely the right time, Mathieu. A postdoc at CERN, with all the secrets of the universe waiting to be discovered."

Mathieu leaned in closer. "You understand, then. Most journalists don't."

“I understand? What, exactly?” Her position put her in contact with all of the major programs across Europe, but that didn’t mean she grasped the details of every scientific announcement.

He smiled broadly. “You understand that discovering the Higgs boson is not the end. It’s just the beginning.”

She watched him carefully, lest she miss some nuance in his expression. “You must be excited to continue, then.”

His eyes lit up. “The plus-fourteen TeV test on Monday will be…” He stopped and lowered his head. “Yeah… um, I’m very excited.”

Strike while the iron is hot. She lowered her gaze, forcing him to make eye contact. “There’s something else, isn’t there, Mathieu?”

He remained still for a minute and then took a long drink from his glass. “Fucking bureaucrats.” He shook his head and waved his hands as if erasing what he had just said. “Sorry… sorry. Ignore me. I cannot speak about this.”

“I’m a good listener.” She was careful to be sympathetic.

“I can’t. Not here.”

“Then let’s get out of here.” She studied the deep concern on his face. She felt bad for him, but not enough to back away from a story. “Maybe I can help?”

He downed the rest of his drink in one gulp. “Do you have a jacket?”

A jacket? In July? She could think of only one reason. She’d heard the tunnel was cold.

“Never mind,” he said. “I have a spare you can borrow.”

They left through a patio gate, avoiding the main ballroom. If anyone noticed their departure they might assume the two were hooking up for the night.

Not a bad cover, she thought. *Less damaging for both of us.*

He headed straight for the parking lot and opened a tiny Citroen. “Hop in.” He revved the engine and the car sped off down a tree-lined street.

“Where are we going?” she yelled over the high-pitched drone of the three-cylinder engine.

“ATLAS. There is something I need to show you.”

“The ATLAS detector? For the collider?”

“Yes, the largest of several detectors on the ring. It’s where we discovered Higgs.”

“So, I heard. Today, in fact.” He wasn’t disclosing anything they hadn’t already said at the press conference. But she was thankful someone was finally ready to speak up about whatever they *hadn’t* disclosed. “I’ve never been in the tunnels.”

His eyes sparkled with boyish excitement. “Cecily, a collider virgin? Lucky girl, you’re in for a treat.”

She ignored the sexist remark. She'd probably ignore a lot more if it led to a good story. She was no physicist, but she had paid attention ever since CERN had begun digging in 2002. Deep underground, spanning provinces in both Switzerland and France, a large ring-shaped tunnel housed the world's largest particle accelerator—the Large Hadron Collider. It was a place where high-speed protons crashed into each other, resulting in chaotic explosions of matter that revealed the very nature of the universe. If there was a cathedral for fundamental science, this was it.

I get to see the LHC? In person? Her body tensed with anticipation.

The car hurtled through a roundabout. The comparison to protons moving at light speed around the collider ring was not lost on her. At this speed, she wouldn't need to wait long for whatever he was going to show her.

They passed through a security station and parked in front of a white building with four huge ventilation stacks on its roof. Mathieu pulled two jackets from the trunk and they walked across the empty lot. He tapped his badge at a glass door marked *ATLAS* and it slid open.

They walked alone through a quiet, dimly lit control room. Oversized computer displays covered one wall, mostly dark, except for one that revealed a closed-circuit camera view of the tunnel far below. A series of crescent-shaped workstations were crammed with dozens of smaller displays, keyboards, and other unidentifiable electronics. A large red warning light, thankfully not flashing, hung from the ceiling.

"No one working tonight?" she asked.

"Usually there's at least one operator, around the clock. But tonight—the party. It's probably only us."

Alone with a man she barely knew. She pushed the ridiculous thoughts of a sexual liaison out of her mind. He was upset about something, but at the same time anxious to show her. It was, no doubt, related to the Higgs discovery. But she might be expecting too much. It might be a technical detail, or a higher statistical certainty than had been announced—nothing more than a footnote in her article.

At least she was getting a personal tour, an offer no other reporter had received.

With another tap of Mathieu's badge, they passed through a second door and entered a small lift lobby, no different than any hotel or office building. There was only one button on the wall, marked with a down arrow. Someone had taped a small sign next to it.

Bottom quarks only, all others take the stairs.

"Very funny," she said, even though she didn't quite follow the humor. Physicists were sometimes too obscure for their own good.

Mathieu pressed the button. "Yeah, the sign changes regularly. An ongoing battle of wit between system operators and physicists." He raised his brow comically. "I think the physicists are winning."

The lift arrived and they entered an oversized compartment. As they descended, he narrated. "One hundred twenty meters down. Thirty floors. You'll notice it's getting colder." He handed her one of the jackets and she put it on. "The liquid helium remains inside the magnets, but even when we're not running, they're effective heat sinks." Finally, the lift came to rest and the doors opened.

“Welcome to Wonderland,” he said.

She peered out to a view she’d only seen in photographs. To the right, a gently curving concrete tunnel stretched indefinitely into the distance. An enormous blue pipe filled most of the space, leaving only a narrow walkway alongside it. The ceiling and walls were covered with smaller pipes and wiring conduits. The repeating nature of the pipe segments receded into the distant curve and gave an odd feeling of the infinite, like standing between two mirrors.

On the opposite wall, several international warning signs graphically depicted what *not* to do. The arms and legs of a stick figure were splayed in four directions as a thunderbolt struck him squarely in the chest. Another stick figure, sans hardhat, hit his head on an overhang.

“Don’t worry,” Mathieu said as he took two hardhats from a shelf and handed one to her. “It’s not as bad as they make it out to be. Still…” He gestured to the tangle of electrical wiring. “Try not to touch anything.”

“I’ll keep that in mind,” she said as she secured the hat.

They turned down the tunnel into a slight breeze. Compared to the warm summer evening above ground, it felt like someone had set the air conditioning on *frosty*. The confines of the tunnel soon opened into an enormous room filled with a confusing mesh of metal beams, scaffolding and machinery. The concrete path changed to a metal walkway at the room’s midlevel. She looked up at the ceiling, several stories above her head, and down to the floor, equally far below.

Almost filling the cavernous space was a supporting structure that housed the colossal ATLAS detector. The pictures she’d seen didn’t do it justice. Its gigantic cylindrical shape was apparent, though some of it was hidden by numerous metal beams. In one section, she could glimpse its interior, with copper-colored blades fanning out from the center like oversized petals on a giant sunflower.

The machine was magnificent, and impossibly large, as if viewing a cruise ship parked inside an auditorium more than a hundred meters underground.

“As massive as the Eiffel Tower,” he said with obvious pride.

They had come for a different purpose, but she couldn’t help but stop and stare—the virgin witnessing the grand collider. Mathieu didn’t disappoint. “The ATLAS detector, the largest on the ring.” He pointed back toward the tunnel. “Protons exit the tunnel at light speed. Every second, they make eleven thousand trips around the twenty-seven-kilometer loop. A second beam travels in the opposite direction and they collide here. Each proton collision is a microexplosion, creating quarks and muons that shower the detector. It generates an enormous amount of data, which takes months to analyze. We’re looking for specific types of collisions—only those that produce two bottom quarks.”

Cecily touched her forehead. “Ah, bottom quarks only. The joke on the lift? Now I get it.”

He nodded. “Finding two bottom quarks is good, but not enough. We plot every pair on a graph, sorted by energy level. It gives us a smooth curve, with one exception. There’s a bump on the curve in one spot—at

one hundred twenty-six giga electron volts. That bump is predicted by theory, and finding it in our data is how we found Higgs."

"We heard much of this explanation yesterday. You didn't bring me down here to reiterate the press conference."

"The graph is important," Mathieu exclaimed, displaying an intensity she hadn't yet seen in him. "You must understand it, or nothing else will make sense." He paused in thought and then spoke quietly. "There's more."

"More about Higgs?"

"No." He fidgeted with the zipper on his jacket.

"Mathieu, why the secrecy? What are you worried about?"

"There are EU government people here, from Brussels." His voice was tinged with distaste. "They tell us what we can explain to the public. And what we *cannot*."

"About the Higgs boson?"

"No… another discovery. Made simultaneously, from the same data." He looked nervous. "I need to show you."

The pain on his face was real and she became concerned. "Will you get into trouble?"

"I don't know. I hope not." It was clear he hadn't thought this through. She felt a touch of guilt and wished there had been no alcohol involved. After a shaky start, his voice solidified. "I don't believe that governments should decide what is shared and what is not. These are scientific discoveries, not military secrets."

Cecily put a hand on his shoulder. "Mathieu, I absolutely want to hear about it… but don't do something you'll regret." He was young and might be in over his head. She *did* have a code of ethics, even if it was entirely guilt-based.

He nodded diagonally as if not sure if he was agreeing or disagreeing. "Let me show you and you can decide what happens next. Just don't mention my name."

"My editors make publication decisions, not me. But I can withhold your name."

He shrugged. "Come." He turned and led her down the metal walkway to a small office, empty and dark. His badge opened the locked door and they entered what looked like a storage room. There were a few file cabinets along one wall. He opened one and pulled out a large folded sheet of paper.

He held the paper in his hands as if it were a treasure map. "What do you know about string theory?"

She was taken aback by the question. It didn't sound related to the Higgs boson. "Well, a little. I've seen summaries online. And I read a lot of science fiction."

"Fiction," he repeated. "An unproven theory of the ultra-small."

He laid the document on the table, still folded in half. “The theory says that quarks and bosons are built from even smaller particles. Strings. In particle physics, that’s the basement level; nothing is more fundamental than a string. But it’s a theory based only in mathematics—and someone’s active imagination.”

He unfolded the paper and turned on a lamp. It was a graph of thousands of data points with a smooth curve drawn through them. It looked a lot like the diagram she’d seen at the press conference, including the bump about midway down the curve.

“It’s the same graph from this morning, isn’t it?” she asked.

“Not quite. This is the original drawing. What you saw was cleaned up for the public.”

She looked back at the diagram. It was certainly much larger and more detailed than they had presented in the slides. But otherwise she didn’t notice anything obvious. “Show me.”

Mathieu pointed to the trailing edge of the smooth curve out at the highest energy levels. There were many dots in this area and another small bump in the curve itself.

He tapped a finger on the bump. “*This* was not predicted. But once we noticed it, we went back to the theorists to see if they could match it to their equations. The confidence level is not as high as Higgs—three sigma certainty instead of five, but high enough to merit further work.”

“What is it?”

“A string. A one-dimensional particle that vibrates in different ways to masquerade as every other type of particle. Every quark, every lepton, every bit of mass, every force, even the Higgs field itself. This bump… this data… is proof of string theory and, perhaps, everything that goes along with it.”

She shivered involuntarily. If this strangest of theories was confirmed, an entire world of science fiction had become real.

“Quantum gravity and the Theory of Everything?” she asked.

“Almost certainly.”

“Extra dimensions of space and time?”

“Highly likely.”

“Parallel universes?”

“Very possible. With wormholes between them.”

Her mind was a jumble of thoughts with a million questions forming. But one thing was certain.

This is way beyond Higgs. This is the biggest story of the century.

2 UFO

Washington State
Near future

Daniel Rice strained to complete the last few steps to the top of the snow covered peak. His breath crystallized in the cold air with each exhale. He relished the burn in his thighs – a good kind of hurt. A reminder of what it feels like to be alive.

His effort paid off as he cleared the last boulder and stood on the summit. Far to the south, Mt. Rainier towered above the rest of the Cascade peaks, its stark white glaciers in bold contrast to the cobalt sky. To the west, dark green forests eventually gave way to the city of Seattle and beyond it, Puget Sound.

He dropped his pack and waited for the panting to subside. Yesterday's snowfall had made the trail considerably harder than normal, but the fast-moving cold front had also cleared the sky of clouds and produced one of those perfect spring days that begged the prisoners of downtown office buildings to get outside.

Surveying the natural beauty, Daniel's mind instinctively switched to science mode. The blue sky was a product of Rayleigh scattering. The cold temperature was, of course, a natural consequence of a steep adiabatic lapse rate. Mt. Rainier itself was the result of an offshore subduction zone and rising magma beneath the Cascades. Physics, geology, astronomy; the subject didn't matter. Science was never far from his conscious thoughts.

He hadn't planned to be standing on a snowy mountain top; the hike was a last-minute addition to his travel itinerary. Bonding with nature was especially important whenever he returned to his western roots. Seattle would always be home, but career obligations had pulled him east. To the *other* Washington.

On cue, Daniel's phone rang. The top of a six-thousand-foot mountain provided surprisingly good coverage. *UHF radio signals travel line of sight*, the science in his head reminded.

The ring tone told him it was Spencer Bradley, the president's science advisor. Daniel never let those calls go to voicemail. For more than fifteen years, Bradley had been a mentor and a friend. Three months ago, he had offered a job on the White House staff. Daniel hadn't needed much time to decide.

"Spence, how are you?"

"Daniel, glad I caught you. You're heading back to D.C.?"

"Yeah, leaving tomorrow morning."

"Ah…" There was a pause. He knew Bradley well enough to translate it's hidden meaning. His travel plans were about to be interrupted. "I wonder if you could detour just slightly. Las Vegas."

Daniel laughed. "A night on the town, take in a show. No problem, I could handle that."

"Tonopah, actually. A few hours north of Vegas." Bradley had a unique way of making assignments. They were suggestions that guided the assignee to a single right answer.

“Tonopah, garden oasis of Nevada. I know it well,” Daniel answered. “I spent a couple hours there with a flat tire. I wasn’t planning on returning. Ever.”

Bradley sounded pleased. “Perfect. Get in, fix their situation and be on your way.”

“And their situation is?”

“UFOs, actually.”

There was only one reason that the president’s science advisor would be involved in a UFO report. “Something tells me there’s politics at play?” Daniel asked.

“Nevada’s Senator Maxwell called me today. Tonopah is going crazy with sightings. Lights in the sky, in broad daylight. State police are confirming, and there are photos. Proximity to Area 51 doesn’t help but the military denies any involvement.”

“Sounds like a police matter,” Daniel said. “How’d it get escalated to you?”

“Maxwell likes to throw his weight around and then crow to his constituents about how he gets things done. The guy’s a blowhard.” Bradley was every bit a realist and Daniel appreciated their plain-spoken relationship. “But in Maxwell’s defense, the sightings have been going on for a couple of weeks now and the police don’t have any answers. The town’s starting to look like a media circus. Sorry Daniel, but this is going to be a pain in the ass until we get somebody out there with the credentials and the analysis skills to chase it down.”

“I’m in. Sounds fun.” There was no sarcasm, Daniel enjoyed a good mystery. Of course, there were thousands of UFO sightings every year. Most were easily resolved; an odd-shaped cloud, a satellite at night, balloons. Venus and Jupiter were common culprits. But Daniel had learned to be careful with reports of unusual events. Quite a few meteor impacts had been found by interviewing eyewitnesses. And who doesn’t want to discover something recently arrived from space?

“Thanks, Daniel. Speak with the sheriff out there and see what you can do. But be ready to deal with the public relations aspect. I think the Senator is still out there.”

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Sheriff Pete Mahoney of Nye County, Nevada wore a broad hat and a highly polished six-point star on his uniform, but it was the handlebar mustache that sealed the classic image of a western sheriff.

Daniel introduced himself as they shook hands. The sheriff’s hand felt rough and his face had the texture of leather. His eyes squinted. “Office of Science and Technology Policy? That’s a new one on me, but I can never keep all those federal agencies straight.”

“We provide oversight to science programs. A direct arm of the White House.”

“White House. That’s easier,” the sheriff said, nodding. “Somebody called. A man named Bradley, I think? Said you were comin’.” The sheriff glanced at his watch. Daniel didn’t need to see its face to know it just past four. “Mr. Rice, right now all I can do is show you pictures or let you talk to some of the folks who’ve seen these lights. But if you come back in the mornin’ you can see them for yourself.”
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“They’re visible every day?”

“Every mornin’ for the past two weeks. Same location, pretty much due west over the mountains. They sparkle, kinda like those Fourth of July fireworks that crackle and pop. But there’s no sound, just lights. Colors too.”

Sparkling colored lights, but not at night. High altitude balloons were often made of reflective Mylar. And military aircraft sometimes dropped chaff, tiny strips metal foil as a countermeasure to confuse surface to air missiles. Aircraft strobes or landing lights were sometimes used in daylight. But none of these produced colors.

“What do you think they are, Sheriff?”

Sheriff Mahoney lifted his hat and rubbed his forehead. “Mr. Rice, I haven’t the foggiest idea. But it’s got a lot of people around here spooked. We’re used to the military, but this isn’t anything we’ve seen before. Some people are thinkin’ it’s some kinda spy platform. It just hovers in the same spot. Some people say it’s deliverin’ a message. You know, like a code.”

“And morning only?”

“Yes, sir. Starts about eight. By ten, it’s over.”

“Reflection,” Daniel stated firmly. “Eight to ten. Tied to the angle of the sun. Have you had any cloudy days in past two weeks?”

The sheriff shook his head. “Not this time of year. We get a few high streaks, but that’s about it. We see the lights every day, if that’s what you’re askin’.”

Daniel could speculate all day, but a direct observation would be a better place to start. “Thanks, Sheriff. Shall I meet you here at eight tomorrow morning?”

“That’d be fine. We don’t have to go far. The hill behind the office has a good view. I’ve got some binoculars, too.”

“Perfect. I’ll be here.” Daniel turned to go.

“Where you stayin’?” the sheriff asked.

“Tonopah Station, though I can’t say I’m much of a gambler.”

The sheriff pulled on his mustache. “The beer’s better at the Tap Room, but they do alright over at the Station. Don’t miss the blueberry pie.”

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Daniel finished his beef tenderloin and pushed the plate away. It might not be the Bellagio, but the food was good. Still, he might skip the blueberry pie.

The sounds of the casino spilled into the restaurant, a cacophony of irritatingly loud bells and the occasional screech of some animated creature. If the goal was to keep people in front of the machines, he wondered why casinos didn’t have a more pleasing soundtrack. A babbling brook would be nice.
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A waitress came by to pick up his plate. “In town for long, hon?” She had doe-like eyes, an attractive figure, and she offered a genuine smile.

“I guess it depends on what I find.” He lowered his voice, but mainly for effect. “I’m investigating the lights in the sky.”

The waitress set the plate down and leaned on the table. “Are you military? FBI?” Daniel shook his head to both. “There’s something bad going on out there. Watch out, hon, those lights are dangerous.”

“Dangerous? Why do say that?”

She pulled out a chair and sat down. “Lots of people think it’s an alien spaceship, but that’s just dumb. My friend, Joan, says some of ranches out west of town are losing livestock. She says it’s some new kind of laser weapon and they’re testing it on cows and sheep. I wouldn’t go out there if I were you. They might zap you, too.”

Burning holes in livestock was one possibility that hadn’t crossed his mind. He glanced at her name tag. “Terri, I worked with the Navy for years, including a stint examining their procedures for weapons testing. I wouldn’t worry too much about a killer laser.”

She didn’t seem convinced. “Everybody’s freaking out. Some are getting angry, too. Be careful.”

“Thanks, I will.” As she stood up, he added, “And stay tuned, we’ll figure it out.”

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The next morning, Daniel took the short drive to the sheriff’s office at a crawl. For a small town in Nevada at eight in the morning, there were a lot of people out. A group of men stood outside the hardware store beneath a banner that read, *Government Lies, People Die*. They looked like they might be arguing about the exact method of government-sponsored execution. Further down the main street, he passed a news van with a satellite dish on its roof. A crowd stood around the reporter as the cameraman maneuvered for the right angle.

The tops of several dirt hills and even a few rooftops were covered with people and camera tripods. Everyone faced west. Daniel looked in that direction but didn’t see anything beyond brown desert mountains and blue sky.

A few minutes later he stepped into the sheriff’s office. Sheriff Mahoney finished a conversation on the phone and hung up. “Mornin’ Mr. Rice, ready for our walk?” He grabbed a pair of binoculars off a shelf and put on his hat.

“Lead the way, Sheriff. I’m curious to see what everyone’s talking about.”

Just outside the building, a narrow dirt trail led through scattered sage to the top of a hill. As they neared the summit, Daniel glanced over his shoulder.

Hanging just above the peaks of a desert mountain range, a tight group of sparkling lights—reddish in color—stood out against the dark blue sky.

“Wow, performing on cue,” Daniel said.
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“Like clockwork, every day for the past two weeks,” the Sheriff replied. He handed the binoculars to Daniel.

Daniel peered through the binoculars and adjusted focus. He couldn’t make out any structure, no balloon, certainly not an airplane. Just three red lights in a tight group, flashing on and off—sparkling, just as the sheriff had described. They seemed to be holding in a steady position, so whatever was causing them wasn’t drifting. That ruled out chaff. It wasn’t a sun dog or similar atmospheric effects—those were always toward the sun, not away from it.

Daniel handed the binoculars back, took out his phone and noted the time. He started a compass app and noted the bearing and elevation angle to the lights. He withdrew a small telephoto lens from his pocket and attached it over the camera of his phone.

“That’s a neat little contraption,” the sheriff remarked. “Give you good pictures?”

“Not bad,” Daniel said. “We might need a telescope to pick up the detail, but let’s see what we can record with this.” He zoomed the lens to its maximum and started a video. As it recorded, he looked for patterns in the randomly flashing lights. If the lights represented a code, he didn’t see it.

Daniel noticed the color shifting—toward orange and then to yellow. “Ten bucks says the next color is green.”

“It is,” the sheriff replied. “Just as you suspect, we get a rainbow every morning. Green, then blue and maybe violet at the end. It gets harder to see against the blue sky.”

“And then it’s gone?”

“Nope. Then we wait for maybe twenty minutes and it comes back, bright white. Then the whole thing reverses, violet back to red.”

“Diffraction,” said Daniel. “Spectra are produced by a prism or a diffraction grating. One color band for a prism, two for a grating. Then again, it could be a natural effect in the upper atmosphere. Ice or rain can produce a double rainbow with the same reverse pattern of colors.”

“Probably not rain,” the Sheriff said dryly. “This *is* Nevada.”

As they watched, the yellow lights shifted to green. Daniel took the binoculars again and panned across the desert. “How high is that mountain range?”

The sheriff pointed. “The nearest one is Lone Mountain, that’s nine thousand feet, but beyond that is Boundary Peak at thirteen thousand, and then the Sierra Nevada. They go as high as fourteen.”

“How far is it to the Sierras?”

“Oh, maybe ninety miles.”

“Have you driven out that way since the lights appeared? There’s a rumor about lost livestock.”

“I’ve heard it, too,” the sheriff answered. “Yeah, I stopped by a few ranches out that way last week. A few dead sheep. A newborn calf that didn’t survive. It happens. Nothin’ out of the ordinary.”

“Can you see the lights out there?”

“I haven’t been on the road this time of mornin’, except around Tonopah. But I can tell you that a few people west of town have reported seein’ it. Not everybody, though. Some say they go outside and don’t see a thing.”

Daniel absorbed each bit of information and typed a few notes on his phone. The lights were now a deep blue and harder to distinguish from the sky, but still noticeable once you knew where to look.

“You said it was probably a reflection,” the sheriff said. “So, why do you think it sparkles?”

Daniel shook his head. “I don’t know. An uneven surface might do that. Or maybe multiple objects twisting in the wind. I think we’re going to need a telescope. Or more information. Somebody knows what this thing is, and I intend to find out.”

“I’d appreciate that,” the sheriff said. “The whole town would.”

Daniel looked out across the rugged landscape of the high desert. In the clean, dry air the view in every direction was sharp. He could make out individual pine trees on top of Lone Mountain and snow on the peaks beyond. The natural world was impressive and occasionally mysterious—a puzzle waiting to be solved by anyone willing to carefully observe.

Puzzles, natural or manmade, were Daniel’s specialty.

3 Lights

At midafternoon, the Tonopah Station restaurant was nearly empty. Daniel took a large booth to give himself room to work. He started his laptop and set a pad of paper next to it. Old school, but paper and pencil still had their advantages.

Visualize it first, he thought.

He drew a circle, marked two points on its perimeter and drew two radius lines from the center to each point. A glass of water appeared at the table and he looked up.

"Hi hon, you're back." It was the same waitress from the night before, and her brown eyes were just as engaging at lunch.

"Do you just work around the clock?" Daniel asked.

She tilted her eyebrows. "Don't get me started. Noon to eight this week, but we're open twenty-four, seven. Welcome to Nevada, nobody sleeps." She set a menu on the table. "What can I get for ya?"

He didn't need a menu. "How about a sandwich and coffee? Ham? Wheat bread?"

"Coming up." She disappeared, and Daniel returned to his drawing.

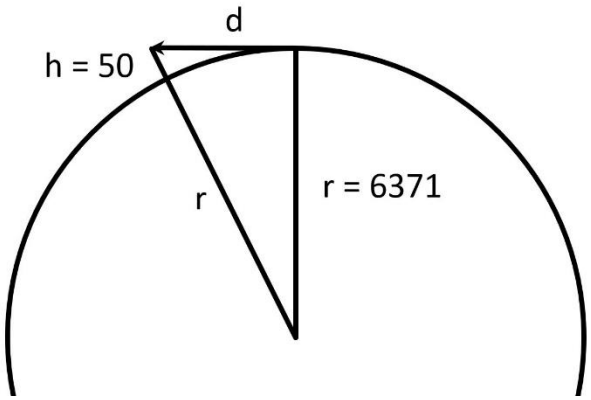
He extended one of the lines he'd drawn a little beyond the edge of the circle and marked the new segment, *h*.

Anything floating in the atmosphere can't be higher than about fifty kilometers.

He marked the two radius lines with *r* and then looked up a value on his computer.

Earth radius is 6,371 kilometers.

He drew an arrow connecting the first point on the circle to the top of the extended segment. He marked the arrow, *d*.



The pretty waitress returned and put a cup of coffee on the table. She twisted her head to examine the drawing. "Looks interesting, whatever you're doing."

Daniel looked up. "Just figuring out where those lights might be."

She looked puzzled. "You can do that on a piece of paper?"

Daniel nodded. “I can’t pin it down exactly, but I can narrow the search zone.”

She squinted her eyes. “You must be pretty smart. Mind if I watch? Not trying to be nosy… I just like to learn.”

Like to learn. It was like a passcode to the secrets stored inside his head. He’d never turned down an honest request to learn from anyone. Daniel motioned to the bench. “Have a seat. Terri, right? I’m Daniel.”

She looked around the empty restaurant and back to Daniel. “You don’t mind?” She sat on the booth bench.

He turned the drawing so she could see it. “It’s all in the geometry. The circle is the Earth and this little stick is the height of the stratosphere—about fifty kilometers. I don’t know what’s causing those lights yet, but it’s got to be in the atmosphere. Anything higher would be in orbit and moving rapidly.” She seemed to understand so far. “So, I need to calculate how far away it could be and still be visible from Tonopah.”

She studied the drawing with an intensity that he wouldn’t have suspected from any waitress. “You can figure that out from this?”

Daniel nodded. “Sure, let’s do it together. Did you take a geometry class in high school?”

She shook her head. “We didn’t even have a math teacher in my high school. Well, Mrs. Debolt, but she was Home Ec. They made her teach math too.”

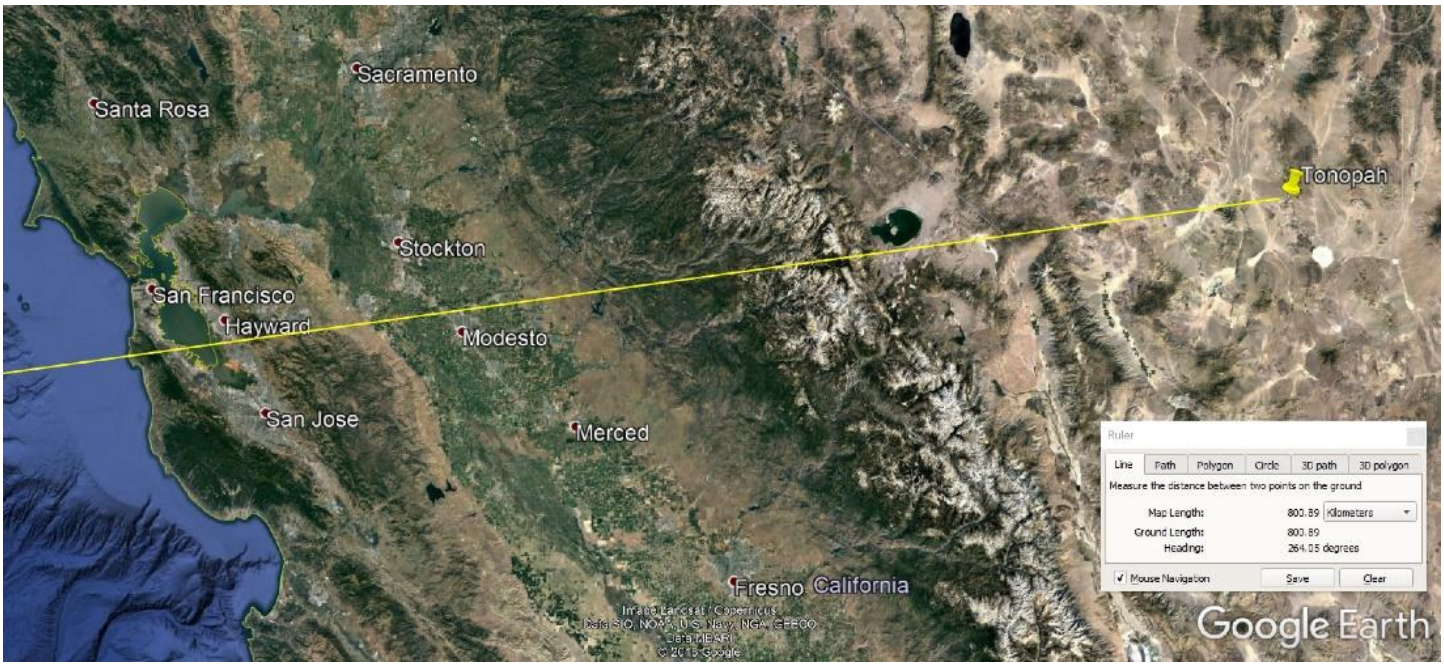
Daniel had heard the stories. It was a shame to leave a curious student without answers or the tools to get them. “No problem, I’ll show you a pretty good trick that a Greek guy named Pythagoras figured out a long time ago.”

Daniel wrote the famous equation, $\boldsymbol{a^2 + b^2 = c^2}$, and then wrote it once more using the labels from his drawing, $\boldsymbol{r^2 + d^2 = (r + h)^2}$. “This equation works for any triangle with a right angle and you can see I’ve got one in my drawing.” He outlined the triangle and her face lit up as though something hidden had been found. “Now, all I have to do is use algebra to solve for *d*. That will tell me how far away those lights might be.”

She watched intently as he reworked the equation. Her algebra skills might be negligible, but it probably didn’t matter. She seemed to be curious about the process and that was enough. In the end, he wrote, $\boldsymbol{d = 800\ km}$.

He switched to his laptop, started Google Earth and zoomed into Nevada. He picked a tool that allowed him to stretch a line starting from Tonopah.

“Let’s see, the lights were bearing two-six-four degrees.” He adjusted the line until the compass bearing matched and its length was eight hundred kilometers. He clicked, and a yellow line snapped to the map, stretching across California and out into the Pacific. He zoomed in to study it more closely. The line crossed Nevada, Mono Lake, Yosemite, the San Juaquin Valley and finally across San Francisco Bay.



Terri scooted around the bench seat to get a better look at the computer screen. Daniel tapped the map with his finger. “Somewhere along that line is something that’s very shiny.”

She beamed. “Wow. You *are* smart. How’d you know to do all this?”

“How do you know when a customer needs more coffee?”

“I pay attention.”

“There you go. I just pay attention, too.”

She looked at him like he might be Einstein. Or Pythagoras. “Daniel, you said? What’s your last name?”

“Rice. Daniel Rice.”

She patted his hand. “I’m going to tell everyone not to worry about those lights—Daniel Rice has got this whole thing figured out.”

“Well, not quite yet, but I’ll let you know.”

She scooted back around the booth seat and stood up, returning to waitress mode. “Back in a flash, hon.” A few minutes later she set a plate on the table. “Cook says your sandwich is on the house.” She pushed a small piece of paper across the table with a number written on it. “Call me.”

Daniel smiled at her suggestion and she gently slapped his hand. “No, not like that. I really want to know what you find out. Call me, would you?”

Some of his colleagues might have laughed at his attempt to explain geometry to a waitress, but in Daniel’s view an inquisitive person always deserved his full respect. “I will, I promise.”

Explaining math was a pleasure, even more so when the person has an interest in learning. Of course, she had stroked his ego. He didn’t mind.

A group of men entered the restaurant and headed straight for Daniel's table. Terri saw them and took a step back. She put a hand to her mouth. "Oh my…"

Daniel stood up and extended his hand as the contingent stopped at his table. "Senator?" He'd seen him on TV, but never in person.

"You must be Rice." Senator Maxwell wore a simple khaki shirt and jeans but with multiple dark suits lined up behind him, there was no question of his status. Terri stepped away, far enough to exit the group dynamic but still within eavesdropping range.

"Yes, sir. Daniel Rice. I'm a science investigator for OSTP."

"Yeah, I know who you are. I brought you here." The Senator stood uncomfortably close, his eyes squinting as he spoke. His entourage seemed to have no purpose other than to increase the senator's visibility. A few onlookers gathered at the restaurant entrance from the casino. "You're on the case. What've you got for me?"

"Well, Senator, no answers yet. But I made a good observation this morning."

Maxwell scowled. "Shit, half of Nevada has done that. I don't need any more observations, I need an answer. You're supposed to be the scientific expert. What the hell is this thing?"

The Senator's brusque manner was irritating, but Daniel kept cool. "I'm working on that, Senator. I'd be happy to go over what I've analyzed so far."

"No, I don't need to see all that crap. One simple answer. It's not any harder than that."

The ideas were forming, but he wasn't about to share them until he had solid evidence. Senator Maxwell didn't seem like the kind of person who dealt in nuance or probabilities. "I don't know what it is, yet, but I believe the problem is solvable."

The Senator twisted his mouth like he might spit on the floor. "Contact Jimmy when you've got something." He motioned to one of the suits, who handed a card to Daniel. "But, Mr. Rice… let's step on the gas. I got a lot of people who are pissing in their pants right now and I promised them I'd get to the bottom of this mess."

The entourage left as quickly as they arrived, with the Senator providing a campaign wave to the onlookers as he exited through the casino. Terri stood alone on the other side of the restaurant as if waiting for dust to settle. Daniel laughed to himself. The intellectual difference between the inquisitive waitress and the gruff senator was night and day. Curiosity, or lack of it, said a lot about a person.

Terri's eyes were wide as she approached Daniel. "Wow! Senator Maxwell right here in my restaurant. I had no idea you were so important. You really are going to fix this, aren't you?"

~~~~~~~~~~~~~~~~~~~~~~~~~~

Daniel spent the rest of the afternoon online. His search area had narrowed, and it wasn't long before he had the supporting evidence he was looking for, along with a specific destination. He even had a name.

William Sommers. Livermore, California, a city east of San Francisco, and precisely on the yellow line.
~~~~~~~~~~~~~~~~~~~~~~~~~~

Commercial flights from Tonopah were non-existent, requiring travel first to Las Vegas or Reno. But sometimes a limitation can be turned into an advantage. Daniel picked up his phone and dialed the local airport.

Early the next morning, Daniel sat in the right seat of a Cessna 182, climbing through eight thousand feet out of the Tonopah airport. With headsets on, the deafening roar of the powerful engine was little more than a background vibration.

“Will you be able to hold the two-six-four heading the whole way?” Daniel asked the man sitting in the left seat.

His charter pilot for the day, Jack Tilden, gave him a thumbs-up. “Should be fine. This aircraft has a service ceiling of thirteen thousand, but I doubt we’ll run into any peaks taller than that in our way. If we do, we’ll just zig-zag around them. We should be across the Sierras and in Livermore in about two hours.”

Daniel grinned. “Way better than commercial. I would have spent all day going through Reno and Oakland.”

Beyond time saved, there was the additional benefit of unrestrained flight. Just point the plane where you want to go. It had been a few years since Daniel had piloted planes himself, but his enthusiasm was still strong. The view alone was spectacular and grew better by the minute as they climbed. At ten thousand feet, they donned supplemental oxygen masks and Jack leveled off at twelve thousand five hundred.

Daniel searched for the lights ahead. There were none yet, but he was still hopeful. The calculation was nothing difficult, high school trigonometry. “At this altitude, we should cross the light path somewhere between Boundary Peak and Mono Lake,” Daniel said.

“Almost to Boundary Peak now.” Jack pointed out the window to a forested ridge looming ahead. At first glance it looked like they would clip the trees as they crossed, but Daniel knew from his own flying experience it was an optical illusion—compounded by the natural human fear of crashing into trees.

As expected, the plane skirted the ridge and beyond it the view opened up. Directly ahead, he could make out the blue-green circle of Mono Lake with the snow-capped Sierra Nevada mountains as a scenic backdrop. A minute later, sparkling violet lights appeared above the mountains right on schedule.

“Yeah, baby!” Daniel shouted, pumping his fist in the air. Math was a wonderful thing.

“Just like Tonopah!” Jack said. “I’ve flown a couple times recently, but I’ve never seen the lights from the air.”

“You wouldn’t, unless you were almost exactly on this line. It confirms a narrow transmission path. The lights are coming from a point source.”

Within seconds, the color changed to blue, and then to green, yellow and orange.

“It’s the opposite order, isn’t it?” Jack asked.

“Yeah. That also supports a reflection hypothesis. At Tonopah, the reflection beam moves across the ground, east to west, as the sun rises. But now we’re flying through the beam, catching up to its trailing edge. We’re seeing the colors in reverse order, and they’re cycling faster because of our speed.”

Jack help up a hand. “Nice work!”

Daniel slapped his hand. “Thanks.” The geometry of a narrow beam of sunlight glancing off *something* out there and hitting the ground near Tonopah lingered in his head. They’d just flown through the beam. Whatever was causing the reflection lay directly ahead.

The rest of the flight was routine, and they landed at Livermore Municipal where a taxi waited. Fifteen minutes later Daniel stood at the entrance to his destination, the sign out front announcing, *Sandia National Laboratory Combustion Research Facility.*

If Daniel had been wearing augmented reality glasses, he’d notice that he was standing right on the yellow line he had stretched across the map. There was no shiny mirror in the parking lot, but he didn’t expect to find it here. It would be higher, much higher.

He checked in with reception and a few minutes later was shaking hands with tall, heavy-set man, who introduced himself as William Sommers, the Director of Sequestration Research. His size was imposing, but his demeanor was gentle. “Welcome Dr. Rice, you said you needed some information about our CO_2 program?”

“Yeah, at least the high-altitude part. And then maybe you and I could do some brainstorming. That’s why I came out instead of talking on the phone.”

Sommers looked baffled. “What are we going to brainstorm?”

“Details, Mr. Sommers. We need to talk about how we can all do a better job of publishing the details of programs like this. Not just here at your facility, but across the country.”

Sommers shrugged and led the way to his office. He closed the door and offered the guest chair to Daniel. “The program is fairly simple, Dr. Rice, though the equipment itself is advanced. We operate three instrument packages to measure carbon dioxide in the stratosphere.”

Daniel interrupted, “Specifically at what altitudes?”

“Anywhere from about fifteen to forty kilometers. It’s all well above even the highest flight paths, if that’s your concern.”

“It’s not. These instrument packages, they’re located here at Livermore?”

“Yeah, they’re pretty much right overhead.”

“And they’re untethered?”

“Oh yeah. They’re much too high for a tether. They’re held aloft by an airfoil and two solar-powered electric turbines that keep the package moving directly into the wind. They can hold a steady position pretty accurately, day to day.”

Daniel thought about what such a device might look like. “Do you have any pictures?”

“Sure.” He reached into a drawer and pulled out a folder. He searched through several photos. “Here’s one that shows the whole thing.”

He slid the photo across the desk. It resembled an airplane, but mainly because of the wing. There was no fuselage and no tail. Two large rings hung from the bottom of the wing. Each ring surrounded a multibladed turbine with the shiniest of silver surfaces.

“The blades are polished like mirrors,” Daniel remarked.

“Yeah, a chrome coating on aluminum. Lightweight and durable.”

“And highly reflective.”

“Yeah, that too.” Sommers dismissed Daniel’s comment with a wave of the hand. “But reflectivity is not part of the turbine design. It doesn’t really affect anything.”

“You might be surprised.” Daniel slid the photo back. “Is there a diffraction grating involved in the design?”

“Diffraction? Yeah, you can’t see it very well in that picture because the mirror is locked in the horizontal position, just below the wing. The mirror *is* reflective, by design. We bounce a vertical laser off it and the return spectrum gives us a good measure of CO_2 composition from the surface all the way up.”

Mirrored surfaces plus diffraction.

Daniel took a deep breath. Reeling in the evidence was like bringing a fuzzy image into focus. Even better. It was like inserting a key to a treasure chest and turning the latch.

They actually pay me to do this.

His enthusiasm for the hunt peaked. The answer was very close. The pieces in this puzzle were on the table, just not fully assembled. “The mirror beneath the wing—can you reposition it?”

Sommers pinched his eyebrows together in a quizzical expression. “That’s not public information. You must have seen the design documentation.”

“No. Just what you’ve posted online.”

Sommers hesitated. “Yeah… we move the mirror all the time. Radio controlled. Horizontal for normal operations, vertical when stowed. We stow it so all the jokers out there with laser pointers don’t get any dumb ideas. They can’t hit it when the surface is positioned vertically.”

Rotating fan blades, a vertical mirrored surface, and a diffraction grating that spread white light into a spectrum of colors. The pieces were in place. Except one.

“Tell me about the changes you made two weeks ago.”

Sommers seemed astonished at the request. “Dr. Rice, you seem to know a lot about our program. We don’t announce that level of detail.”

“But something changed two weeks ago, didn’t it?”

“Yeah... it did. We moved all three instruments up to twenty-five kilometers. That’s where they are now.”

“With the mirror in its stowed, vertical position. Correct?”

“Yes. How’d you know?”

Daniel smiled as the last piece of the puzzle fell into place. “Mr. Sommers, there’s a whole lot of people in Tonopah, Nevada that are going to love to hear from you about those details.”

~~~~~~~~~~~~~~~~~~~~~~~~~

“Rice. Glad you called, they said you’d skipped town.” The Senator was certainly tuned in to the local gossip.

Daniel held the phone close to his ear. “You asked me to find a solution, Senator. Step on the gas, as I recall? The clues led me to California.”

The Senator’s voice was loud. “California? How the hell does something in California affect Tonopah?”

For politicians, the simplest explanation was best. If there were questions, Daniel would answer them as they came up. “Senator, you might be surprised how far away you can see lights in the sky. I’m at a lab in the east Bay Area. The scientists here operate three aerial instrument packages. Very high and very reflective. Your constituents are seeing the morning sun reflecting off a mirror. The mirror has what they call a diffraction grating etched into its surface—and that’s what’s producing the colors. The scientists out here were operating at lower altitudes until just two weeks ago, when they moved it higher. High enough for the reflection to peek over the Sierras.”

“You don’t say. Well, that’s a hellova lot better explanation than alien ships landing. Can you get a press release out about this?”

“Will do, Senator. I’ll also put the Nye County Sheriff in touch with the lab. The scientists here have agreed to publish more information from now on, particularly when they make operational changes.”

“I like it, Rice. Tied up, neat and clean. Call my office if you have anything else.”

Daniel’s next call was to the sheriff. He explained in greater detail, including the lab’s newest change in operating procedure that would flip the mirror to a face-up horizontal position when stowed. There would be no more lights in Tonopah.

Sheriff Mahoney was strong in his congratulations. “Mr. Rice, you’re going to be a popular man around here. You’ve solved the biggest disturbance to hit this county in twenty years. Come on back, we’ll buy you dinner.”

Tonopah might not have been on Daniel’s bucket list, but it was a town now firmly embedded in the story of his life. “Sheriff, I’d be delighted.”

There was one more phone call to make. He pulled the slip of paper from his pocket and dialed. Terri answered, and right away Daniel knew it would be his favorite call of the day. He could almost see those pretty brown eyes growing wide as he explained.
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Yeah. Dinner in Tonopah. Maybe overnight, too. No need to rush back to Washington.

4 Sorcery

Fermi National Accelerator Laboratory

Batavia, Illinois

Nala Pasquier pushed the keyboard away. “Shit,” she said under her breath. Her companion in the lab looked up briefly and then returned to his work.

She leaned forward and studied the image on her computer. The sinusoidal waves weren’t aligned and she was at a loss as to how to fix it. She’d tried everything.

She pushed back from the workbench and allowed her chair to roll to the center of the room. She took a deep breath. She needed a break, a change of pace to shake the cobwebs loose. Her chair slowly spun in a circle and her mind wandered.

Her eyes focused on the clear plexiglass box, not much larger than a microwave, mounted on the wall. Within the box was an ordinary Canon camera. For about two hundred dollars, anyone could pick one up at a discount store. But the lemon-colored pipe leading into the box—the one marked *Primary Neutrino Beam*—routinely made it the most extraordinary camera on Earth.

A slight vibration in the air and a noticeable background hum were the only clues to the power she controlled. A multibillion-dollar machine was only steps away, the second-most-powerful particle accelerator in the world. With a touch of the keyboard, she could unleash a high-energy beam of intensely focused neutrinos that would explode into the box and send the camera literally out of this world. The results were better than any magician’s trick. If only she could control it.

The door to the lab opened. “Morning, everyone.” Jan Spiegel was a physical opposite to Nala, man to woman, light-skinned to her dark, tall to her petite. But they shared an intellect that soared beyond even the most educated of their colleagues.

Nala glared at the new arrival and said nothing. Thomas, the system operator responded instead. “Donuts on the shelf, Jan.”

“Why else would I be here?” he answered. He plucked a donut from the box and took a bite. “It’s certainly not to check up on your work, which I’m sure is going swimmingly well.”

Nala turned to her colleague, her frustration unchecked. “Don’t fuck with me, Jan. We’re not there, and you know it. We’re close, but unless the phase alignment is perfect, the coherence falls apart and the neutrinos go back to random.”

Jan pulled another chair up next to her. Even sitting, their height difference was significant. “How long can you hold it before it decoheres? Any better than last week?”

“Same. Maybe ten seconds.”

“Something’s wrong with your software.” He produced an impish grin. “You might want to bring in a real programmer to check it.”

His dig at her skills was a regular part of their back-and-forth. “It couldn’t be your equations, could it, genius?”

Both were physicists, but opposites even in their specialization. He focused on theory, she worked in the lab, turning his thoughts into reality. His ideas had defined their work for more than eight years. Jan was quite possibly the most brilliant person she'd ever met.

He took the insult as he always did—like a friend. "You're having another bad day, Nala. Don't worry, it'll come." He turned to Thomas. "Has she been cursing again?"

Thomas looked over his shoulder. "No more than usual. I kind of like it—she's inventive sometimes." He looked up at Nala. "What did you call that manager who was in here last week?"

She couldn't help but soften. These guys were fun to work with. "A syphilitic cum dumpster."

"See?" Thomas said. "I don't even know what that means, but I like it."

Jan didn't appear to be too upset; he never was. He wasn't the boss, but he was the de facto lead. "Colorful words don't matter, at least not this week. But, Nala, we have a VIP arriving on Monday, so you might practice being polite."

The president's science advisor, Spencer Bradley. She was acutely aware of the schedule. "We're not ready for him. I can send an object ana or kata, but I can't hold it there, so there's no proof of its displacement. Sure, it disappears, but who's to say where it went?"

"We talked about this," Jan answered. "Gravity or electromagnetism. Take your pick. Demonstrate that bosons travel interdimensionally, any boson, and we've validated the 2012 CERN discovery."

"Even if we had a boson for gravity—which we don't—the demonstration isn't that useful. The target falls back to Kata Zero. So what?"

"Agreed, gravity is tricky," he said. "So, focus on electromagnetism. Show that photons propagate across dimensions."

He made everything sound easy. "Jan, I don't have beam stability. I can send the camera, but the pictures it returns are too random. Ten seconds later, it pops back into existence."

Jan put a hand on her shoulder. "Keep working on it, you'll get it. Turn the problem on its head. That's what you're good at, right?"

"Apparently not today," she griped. But as the words left her mouth, an idea followed.

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Nala wedged herself between shelves in the small storeroom, each shelf piled high with a tangle of electronic equipment, metal brackets and wires.

You'd think we'd have a simple shop light somewhere in this pigsty, she thought. She lifted a pile of computer cables and pulled on the end of a black extension cord.

"Sweet!" she said. The cord had a wire-caged lightbulb on one end. Better still, the bulb was one of those old-style incandescents that indiscriminately sent light in every direction.
~~~~~~~~~~~~~~~~~~~~

The mind worked in strange ways. Hers, at least. *Turn the problem on its head.* It was a technique she used frequently. She had been trying to gather photons, using the camera as a sensor. Why not broadcast them instead? Her own eyes would be the sensor. It solved the directional problem, and in multidimensional quantum space, direction was critical.

She rushed back to the lab, pushed open the door and dropped the cord on the workbench. “Screw the camera, this is what we need.”

“What?” Thomas asked.

“An omnidirectional light. With this, we don’t care where it points.”

He seemed confused. “Tell me in 2-D language. That’s usually when it makes more sense.”

She pulled a piece of paper from a stack on the shelf and placed it on the workbench. “Okay, say you have a 2-D light embedded on this page. It shines in all directions, but only within the plane of the page. Right?” He nodded. “Now you pick that light up, off the page. It still shines in all directions. The photons are no longer restricted to the two-dimensional page. They’re bosons, and all bosons are interdimensional, right? And even though the light is now shining in 3-D, some of the light still hits the 2-D page.”

A smile crept across his face. “Ah, I see,” he said. “So, if you put the light in the test box…”

“You got it.” She picked up the cord. “Let’s try it.”

She opened the lid to the box on the wall and placed the light inside. She stretched the cord to a nearby outlet and plugged it in. The bulb lit, shining brightly through the clear plastic.

“For the full effect, we need to make this room dark.” She looked around for the light switch.

“I got it.” Thomas reached over and flipped the lights off. Only the single bare bulb at the end of the extension cord provided illumination for the room.

“The accelerator’s still at full power, right?” she asked. Thomas checked the computer display and nodded.

She stepped directly in front of the plexiglass box, the front of her body lit by the light coming from the bulb. “Let’s just move it a little. Half a meter will do.”

Thomas nodded again and typed at the operator’s keyboard. “Got it. Ready when you are.”

“Make it so.”

Thomas hit a key. They both stared at the light inside the box. The background humming sound quickly ramped up to a loud buzz, filling the room. There was a pop, like a balloon bursting, and in a bright flash, the bulb disappeared.

They both stepped closer, their faces just inches from the clear box. The electrical cord passed through the open top of the box and ended abruptly. There was nothing inside.

Almost nothing. A soft glow gently lit their faces. It seemed to come from nowhere.

“Jan was right,” she breathed, her excitement building. “Behold, the world’s first interdimensional light.”

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You've finished the prologue but there's much more—the Quantum Series awaits. Each book is a full-length novel that dives headfirst into the strange but real world of the very small. It's a fast-paced adventure grounded in real science. But a word of warning: be ready for a few twists along the way!

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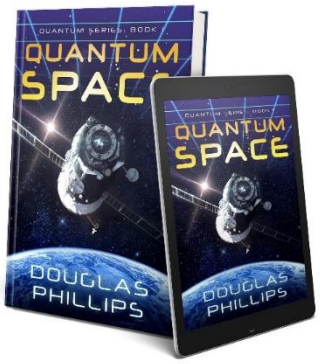

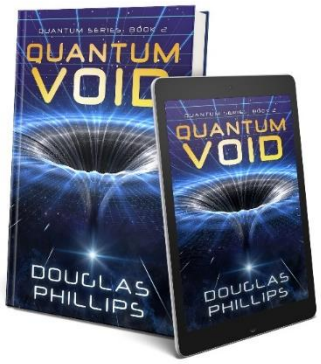

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By Jason Blackford on March 15, 2018

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Starting the second book now, and I'll definitely be keeping my eye out for future endeavors by Mr. Phillips.

★★★★★ **Perfect Science Fiction**

By Ian Adams on March 24, 2018

Format: Paperback

Damn near a perfect science fiction story. Douglas Phillips writes hard science fiction the way it should be done. Firmly rooted in real science, not the technological fantasy that passes for most of sci-fi these days. The story was well developed, good characters, great plot. My only complaint was that the novel read way too quick, I sat down to read the book expecting to pass an hour or so, next thing I know, six hours later and I'm done. Fortunately, there is a sequel and he has written more. I'll be spending the next week reading everything Douglas Phillips has written.

To get you started, here's the first chapter of Quantum Space:

1 Space

Sergei Koslov floated a few centimeters above his seat, enjoying the last few minutes of weightlessness. Soon enough, he would be back in the crushing gravity of Earth. Wobbly legs would be a small price to pay for the innumerable pleasures of returning home.

He glanced out the window. The gentle curve of Earth's blue-and-white horizon stood in sharp contrast to the blackness of space. Sunlight magnified the natural beauty of oceans and clouds, but it was the night side that revealed the lights of civilization. More than anything, Sergei missed the energy of a city at night—any city. He'd passed over most of them in the last three months.

Home. Almost there. The only thing separating him was a fiery ride down through the atmosphere.

Sergei and his two companions were wedged shoulder to shoulder in a space no larger than the backseat of a small car; cramped, but bearable for the short ride down from the International Space Station. A pencil gently tumbled in the air. Anton Golovkin grabbed it and secured it with a clip. In the center seat, Jeremy Taylor confirmed the computer trajectory, his reach to the control panel extended by means of a small stick.

A voice in their headsets interrupted the soundless cabin. "Soyuz, ISS. *Kak pashyevayesh?*"

Sergei keyed his microphone and replied in English, "Doing well, ISS. We're enjoying every minute. The view is much better down here. How are things with you, Nate?"

There was a slight delay in Nate's response. "Sergei, my friend. In your haste to get home it appears you've left something behind. A music CD? On the cover, there's a photograph of a beautiful young woman wearing a red scarf and… well, not much else."

Sergei laughed. "You found it quickly, Nate. A gift, to help you Puritans in America better understand the finer things in life. I hope you will enjoy."

"*Spasibo*, Sergei, very generous… I think. When I get home, I'll send you some of my favorite decadence from the West. Your view of me might improve."

The Russian glanced over at his two companions and lifted his hands in the air. "Nate Erasco? Decadence? Not possible."

"Tell it straight, Sergei," Jeremy said. "But you'll miss that Puritan. You know you will."

Three months aboard the International Space Station had been a life-changing experience that was now coming to an end. Jeremy was right. Sergei would miss waking up each day to the incredible view from orbit. He'd miss the comradery of the ISS team, especially the Americans, even Nate. Back on the ground, Russia and America were worlds apart.

Sergei shifted to his role as Soyuz Mission 74 commander. "ISS, six minutes until descent burn. Changing to frequency 922.763."

The voice on the other end also changed tone. "Copy Soyuz, 922.763. *Bezopasnoye puteshestviye*—safe trip, guys."

Anton pressed a key and a checklist appeared on his display. Each man flipped their helmet visor down, pulled on gloves and locked them in place.

Sergei peered once more through the small Soyuz window. Their orbital height had decreased substantially, and their speed of eight kilometers per second was now obvious. The clouds, ocean and land below raced by at high speed as if predicting the drama of atmospheric contact that would come soon.

Sergei reached out and pressed a button to engage the reentry sequence. From ports on Soyuz, tiny jets of nitrogen shot out into the silent vacuum of space, nudging them into perfect retrograde position for the final burn. A countdown clock appeared on the computer display, and as the clock reached zero, the big descent rocket behind their backs ignited and shook the spacecraft with a deep rumble. Sergei and Jeremy bumped fists. The deceleration was immediate, and they were pressed into their padded seats. A few minutes later, the burn stopped as quickly as it had started.

"Descent velocity within target envelope," Anton called out. "Six minutes to atmospheric contact."

The computer displayed a large yellow light, and two loud bangs reverberated from behind their seats, followed by two more ahead. Jeremy visibly twitched at the sound of the explosive bolts.

Sergei looked out the window to confirm their separation from the forward docking module and the aft rocket. The discarded parts would never make it to the ground, destined to become globs of melted metal, disintegrating in the intense heat of reentry. Their capsule would take the same path, but thermal shielding would make all the difference.

Sergei shifted in his seat, anticipating the final, but most dangerous leg of their journey. *Home. Nearly there*.

Five heart-pounding minutes passed until the first shudder rattled the spacecraft. The top of the atmosphere.

The bumps increased, and a minute later, their seats were shaking violently. The three men briefly held gloved hands and smiled through their helmet visors. The bounces were frequent and strong. Larger jolts caused the entire cabin to rattle like an old pickup truck on a washboard road. But their smiles didn't fade. They had been through worse, and home was within reach.

Sergei keyed his microphone, his voice jittery from the bumps. "Moscow, Soyuz. Atmospheric contact, descent normal. We're picking up light chop."

In his headset, a Russian voice replied. "Soyuz, Moscow, confirmed atmospheric contact, altitude one-seven-four kilometers, up range seven-two-zero kilometers. Status is green. See you in a few minutes."

Sergei's fingers dug into the armrests on his seat as the jolts increased in ferocity.

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Far below, on the flat, dusty plains of western Kazakhstan, a lonely Russian soldier stood outside his truck. He lifted his sunglasses and gazed upward. A beautiful day, and warm by Kazakh standards, with only a light coat needed to protect from the chill of the wind. The soldier picked up his binoculars and scanned the sky, looking for the object he expected to appear at any minute.

His job was simple: visually confirm reentry and contact the operations commander at Korolyov Mission Control. Radar and GPS would do the rest, providing descent vectors and computing the exact landing site, where recovery teams would be waiting. Soyuz landings were good, but with somewhat older technology, Russia still employed ground observers just to be sure.

The soldier's patience paid off as he noticed a thin contrail high in the atmosphere, streaking west to east at high speed. He grabbed his radio from the truck's seat and spoke with pride and excitement. "Moscow! Moscow! Soyuz reentry visual confirmation at Caspian Station."

The response was loud and clear. "Caspian, Moscow. Confirmed sighting. Maintain contact."

He lifted his binoculars and located the tip of the contrail once more. But now, something was different. The air at the tip began to shimmer, as if looking through the heat above a fire. The shimmer intensified, making the air opaque and partly obscuring the view. He squinted.

An intense flash of blue-white light, blindingly bright, exploded across the sky. Reflexively, the soldier dropped his binoculars and covered his eyes. Seconds passed as the brightness faded. A massive sonic boom shook the air and the ground.

His hands shaking, he lifted his binoculars and searched again. The long white contrail lingered in the high, thin air, marking the reentry track. But the contrail ended abruptly, and beyond it there was no spacecraft. No movement. No parachute. Nothing but empty sky.
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The spacecraft was gone, as if it had never been there.

Confusion overwhelmed the soldier. *The blue flash… what? The boom… an explosion?*

He dropped his binoculars and for a full minute scanned the sky with his own eyes. He could pick out the remains of the contrail, wisps of white but nothing more. A minute later, a demanding voice burst from his radio.

"Caspian, Moscow. We have lost radar contact. Report!"

The soldier picked up the radio, collecting his thoughts before keying the microphone. He shook his head and kicked the tire of his truck.

"*Blyad!*

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