The Liberty Belt

by

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Chapter 1 (how did I get here?)

She was captivated by the scene before her; the nocturnal surface of a planet more than forty-thousand-billion kilometres from Earth, gently illuminated by stellar reflection from its two moons. The pale-blue hue of the planet's nitrogen-oxygen rich atmosphere visible around its horizon is key to vindicating her long-held belief that Darwin's theory of evolution is not limited to life on Earth.

Rosalind's IDV was hovering one-thousand kilometres above the third planet in the Alpha-Centauri A's solar system, having been instructed to relocate to its current position by a robot on the planet's surface, in order to evade an expected conflict with an unfriendly space-fleet.

She and her seven colleagues were staring out of her IDV's clear dome witnessing the fleet's systematic destruction in space before managing to land on Thrupple's surface. It was a spectacularly colourful display of what appeared to be the destruction of ten space-vehicles.

As she stood there staring at the surface of this strange and distant planet, she began to recall the sequence of events that had brought her here, on a journey she believed impossible a little over eighteen months ago. It was during the month of April last year that she remembered a question raised by her cousin John regarding interstellar travel

Chapter 2 (April last year)

The early morning sun rose through the trees surrounding Rosalind's chalet. As she woke, she switched its walls to transparent, filling her room with light. As with all virtual structures, Rosalind's chalet was designed by its resident and activated on a prepared plot within a natural landscape; Rosalind's was mostly wild grassland. Her nearest neighbour was a hundred and fifty metres away in any direction. Still occupying her mind as she woke, was the question raised by her cousin John the previous afternoon; "why is it impossible to travel to our nearest neighbour; Alpha Centauri?"
John, had apparently been discussing his IDV's performance with a friend and suggested that it would be great to use it to travel to the stars. His friend had replied, to John's disappointment, that according to someone else, it wasn't even possible to travel to our *nearest* stars in Alpha Centauri; in any vehicle. John wanted to know why.

To Rosalind, the answer is obvious. As a mathematician, she understood the rules of physics, which are simple, she had considered the problem many times in the past:

> *The energy needed to carry a neutron under constant acceleration for 4.1E+16 metres at 1g is 2.67E-09 Joules. But a neutron only stores 1.638E-13 Joules.*

There is insufficient energy in all the neutrons in any mass, to carry it under acceleration-deceleration all the way there. All matter would need to travel at a constant velocity for most of that distance, because constant velocity in space uses no energy. It doesn't matter how hard you accelerate to reach transit velocity; the atom needs more than 120 years to transport its own mass to Alpha Centauri at any velocity.'
But this morning, the question seemed a little more convoluted than it did yesterday.
It isn't that we couldn't travel to Alpha Centauri. We could, if we were willing to take a little longer than a human lifetime to do so, but why would we?

The more Rosalind considered the purity of physics, the more she became convinced that the universe seems far too well designed to have occurred by chance. The mathematics are just too perfect. When you consider that the minimum time required to travel the distance between us and our nearest neighbour is just over our lifespan, it's almost as if its designer is deliberately avoiding contamination between universal civilisations.

It was clear to all who knew her, that from an early age, Rosalind had an uncanny appreciation of mathematics. Her fascination in physics first emerged when, at the age of twelve, she had been given by a friend of her parents, a copy of a book; "*The Physical Constants*", written more than seven hundred years ago. More than any other, this book changed her life. It revealed the most beautiful mathematical relationship she had ever seen. Everything in the universe comprises just two particles that are related by two ratios; every physical constant ever created, throughout human history, can be explained mathematically using these two ratios. It blew her mind;
life the universe and everything, is composed of just 2.8E+75 identical electrons and a few more identical protons, both of which are related by two ratios. That's it. Nothing else. The entire universe. What's more it is provable using her own subject; mathematics. No-way is this accidental.
John's question, and its relationship to the neutron, brought it all back.
Why is it, she reflected, that every fundamental scientific discovery engenders such anger and bitterness in every extant academic? Yet this discovery did just that. It reminded her of another comprehensible theory that stimulated so much hatred; the theory of evolution.

Darwin believed that all life on Earth originated from a single source and mutated or evolved according to environment and the need to survive. But perhaps he was righter than he thought. His claim may not only apply to life here on Earth, but to all life, throughout the universe. The possibility that such a remarkable structure as a ribosome could occur by chance on every planet independently is a little too difficult to accept. But given that the

universe renews itself repeatedly, and that all universal matter originates from the same source, it could have occurred by chance on one planet, ended up in the ultimate body and subsequently spread to other planets as a result of numerous 'Big-Bangs'. After countless universal periods it could be everywhere by now.
And if all planetary life originates from the same source, it probably also comprises the same photo-synthetic oxygen emitting plants and oxygen breathing animals as here on Earth. Yes, there will be differences owing to environment, but essentially the same. So, a similar lifespan to ours - decay by oxidation. It would also mean that all life-supporting planets should possess a nitrogen-oxygen-rich atmosphere; suitable for human habitation.
When considered together with planetary spin, we know that only the life-supporting planets in any star-system will be capable of hosting intelligent life; the same 120-year lifespan intelligent life. And if we could travel to distant star systems, maybe we could wander the surface of their life supporting planets with impunity. We may even recognise ourselves in those living there. So, we know where to look for our intelligent neighbours, but that's all, we can't visit them.
The development time for the protein molecules stored in planetary matter during any universal period is sufficient to ensure that most intelligent civilisations are far enough apart to minimise cross-pollination, so to speak. Is this just a coincidence?
Rosalind needed someone with whom to discuss her thoughts.

She called Charles - an engineering friend - on her comms package, a hologram of whom appeared a few feet in front of her. He was apparently eating his breakfast, as he waved to her, his mouth full of food.

> "Hi Charles. I've been pondering a question I was posed yesterday. I need a sounding board. Do you have a few minutes? It's a physics problem. I don't have a problem with the physics, just with its implications ..."
> "Sure," he replied mouthing through the food he was still eating, "what's your problem?"
> "Well don't let me interrupt your breakfast. I'll explain the background first. You can listen."

Rosalind related the relevant science and then began to present her dilemma.

"Ok. From now on, I'll need your input." After a short pause and an accompanying sigh, she began. "All universal energy is held in neutrons. There is no greater energy source. Do you agree?"

"Yes," he agreed, having emptied his mouth.

"The impulse-drive is the most efficient form of travel. Do you agree?"

"Yes! As far as *I* know, anyway."

"I know that we can eliminate surface drag on vehicles travelling through an atmosphere. I don't need agreement with that, all our vehicles have that facility. But even with anti-drag, the most efficient and safest vehicle shape is a disk and its most practical feature is its dome. Ok?"

"Yes," he concurred.

"So far so good. I've explained why we can't travel to our nearest neighbouring star-system. Do you have any problem with my reasoning?"

"No, but I don't know as much about the subject as you. I'm happy to take your word for it though."

"I believe that life, intelligent life, exists out there. We're not alone. Do you agree?"

"Definitely!"

"It doesn't matter whether or not you believe that we have or have not been visited by aliens, but have you seen the shape and behaviour of the vehicles that were described by UFO observers?" she asked.

Disconcerting though the subject of UFOs can be for most people, Rosalind knew that Charles had an open and enquiring mind.

"Yes," he replied casually, "but they look like ours for a reason. The impulse-drive pretty much dictates their shape."

"*If*, and I admit it is a big '*if*', we have been visited, it seems a remarkable coincidence that their vehicles should look like ours, and that they can travel through our atmosphere with no atmospheric drag, and that they travel under constant acceleration, not constant velocity. *If* those UFOs were real, and *if* they did visit us, we also know that we've developed the optimum universal vehicle. Do you agree?"

"Yes," he replied confidently, "I doubt anyone would disagree with you today."

She paused for a few seconds, staring fixedly at Charles, and concluded with;

"ok, here's my problem; why then, can they visit us but we can't visit them?"

This was a question Charles had never previously considered. After a couple of seconds thought, he pushed the palm of his hand towards Rosalind;

"hang on; I need to think about this. Give me a couple of minutes."

He wandered up and down inside his residence contemplating Rosalind's question. The two of them remained in silence while he deliberated. Less than a minute later, he continued;

"firstly, your question presumes that we've been visited. I fully accept that the optimum vehicular shape is a disc with a dome and that the coincidence of circumstances *probably* indicates that we have been visited; but how? I've no idea. Why don't you release a game?"

Rosalind had released numerous games in the past, but most of them were of a frivolous nature. This one wouldn't be. It is a question that involves the belief or otherwise in UFOs; a very divisive subject, even today. She was a little apprehensive. Charles suggested that she should not refer to UFOs but simply ask the question; 'How to travel between stars in less than a human lifetime, given the limitations of neutron energy'.

Rosalind posted her game later that same day, giving a one-month window for all answers. She received the desired number of participants and closed the entries two days after posting. The participants fees entered an escrow account on the day the game began. A month later, Rosalind accepted a successful answer, released the prize credits and received the remainder into her own personal account. She was surprised to discover that the successful answer had been posted, one month ago, just a minute after the game was initiated; 'EME Storage'.

Chapter 3 (so that's how it's done!)

The following day, Rosalind contacted the successful contestant, Shia, to see if she would be willing to meet, to discuss her submission. She then asked Charles if he would like to come along for the ride;

> "she lives in Sicily. It's only fifteen minutes away!"
> "I didn't know EME storage was possible" he declared, "but I'd love to know how. When do we leave?"

Charles and Rosalind agreed to leave immediately in the same vehicle, Charles', as he would need to pass by Rosalind's Canterbury chalet. He took-off from his own, rather rudimentary virtual bungalow in the district of London and landed on Rosalind's plot; 60 miles away and four minutes later.
It had always been an anomaly to Rosalind why men always take so much care over their vehicles, but never their homes. As usual, she noticed as he landed, Charles' vehicle looked amazing. It actually glowed in daylight. Whereas, she knew from experience that his residence was a virtual pigsty. He didn't even take the time to finish its aesthetic programming; "*if it works, leave it alone*" is his philosophy, but apparently only for his residence, she mused as she watched his IDV land close to her. Before taking off for Shia's home, Charles programmed her coordinates into his IDV's positioning system, the accuracy of which permits automatic landing within a centimetre on any designated plot, and because in-transit collisions are impossible, an entire journey can be safely left to an IDV's automatic pilot.

When they were first introduced a long time ago, some wit at the factory classified IDVs after ancient naval vessels according to their capacity. It has stubbornly refused to go away. Personal vehicles were classified as warships; from cog to SOL, and goods vehicles as merchant ships; from ketch to galleon. Charles has a two-seater Corvette and Rosalind a four-seater Sloop. Charles claims to prefer performance over capacity, but it's difficult to argue this point given that neutron energy and the impulse-drive will accelerate any IDV at any rate. 'That's boys for you' she thought to herself as they took-off at what felt like 6g, although

probably wasn't. Thankfully he soon slowed to a little over 1g for the remainder of the journey.

Twelve minutes later, they landed beside Shia's residence - in the region of Mascalucia, on the island's east coast and within sight of Mount Etna - where she was waiting for them. After introductions, Rosalind explained her interest in mathematical physics and her thoughts regarding '*life the universe and everything*';

> "physics is simple," she declared. "My problem is with *metaphysics*. Hence my game."

Following Shia's disclosure that her own interests lay with programming and computer-graphics, Rosalind asked;

> "so, do you know how to do it?"
>
> "No," replied Shia, having anticipated the question, "but '*I know a man who does*'! Her name is Julia and she lives in Rome. I say 'does', but I actually mean probably does."

Rosalind then asked Shia to find out if Julia would be willing to meet with them;

> "what's your interest in interstellar travel," she replied.
>
> "You'd think I was daft if I told you."
>
> "Try me," suggested Shia, clearly intrigued.

Almost nobody believes in religion anymore, and such allusions can be embarrassing. Rosalind therefore needed to be careful. Picking her way through the subject, she related her thoughts regarding evolution and thereafter cautiously continued with;

> "I have a weird feeling that somebody actually created this universe. I'm not referring to a man-made god of old, but since the eventual acceptance of genuine physics during the twenty-first century, an 'almost' complete mathematical model of our universe has been created. And it is beyond perfection! Everything we see around us, from the air, to that plant, us, stars, galactic force-centres; everything, is composed of just two particles that are related by two ratios. It makes my head spin just to think about it. I find it impossible to believe that anything so sublime can occur by accident."
>
> "And you want to meet him. Ask him why? I believe Douglas Adams had the same idea!"

Trying to make light of Shia's response, Rosalind continued to explain that she simply wanted to know who could possibly have come up with such a concept and why. What's he looking for?

> "The only bit missing from our current mathematical model is the manipulation of time. The fourth dimension. I thought I needed to know how to manipulate time to solve my problem until I received your answer."

Shia agreed to see if her '*man*' would be available. She duly dispatched a message and returned to their discussion.
Looking at her comms less than a minute later, Shia confirmed that Julia would arrive in ten minutes.

A few minutes later, Julia appeared high in the sky above them. She had travelled by belt and landed perfectly, within a metre of the group.

> "Good shot!" declared Charles, obviously impressed. "You've done that before."

Without waiting for introductions, and focusing directly on Rosalind, Julia began,

> "hi! I'm told you're interested in EME storage."

Rosalind was surprised. How did she know *I* was asking, she thought to herself? Rosalind had seen the message Shia sent to Julia and it simply referred to *somebody*!

> "Well, it's a little more complicated than that," she replied uneasily, "but yes."
> "What would you like to know," continued Julia, still concentrating on Rosalind.
> "If it's possible to travel to the stars. I'm told it is, with EME storage," suggested Rosalind whilst eyeing Julia but nodding towards Shia.

Julia had been studying EME for many years and understood it well. She explained to Rosalind that if it is possible to split neutrons into their component parts and store the energy released, there would be no limit to the quantity of energy that could be harnessed for space travel.

> "Now; let's see if I've got this right," interrupted Charles, in genuine belief that he was about to blow a hole in Julia's

explanation; “EME from neutron energy is at the neutronic temperature. Or am I wrong?”

“No, you're not wrong,” confirmed Julia, turning to face him.

“Ok! So, we’re talking about storing something at the temperature of the core of a star,” he continued.

“Correct!”

“Surely there is no material capable of it?”

Julia then explained that EME 'intensity' causes materials to melt, not temperature. The EME released in our energy cells is almost at the neutronic temperature, but our belts and vehicles don't melt; ‘*and you don't store it in a box, you contain it using electro-magnetism*’. EME has no mass, so you can carry as much of it as you wish, she concluded.

It was evidently as clear as a bell to Julia, and also it appeared, to Rosalind now who was nodding in agreement.

“You're saying,” continued Charles, desperately trying to dig himself out of the hole he had just created, “that you release the EME before you take-off, so you don't have to carry the mass that contains it. In that way, because EME has no mass, you can take as much energy as you like. So, you can accelerate continually. You can get to your nearest star because you no longer need to travel at constant velocity. Is that right?”

“Yes.”

“Do you know how to do it? Store EME I mean,” asked Rosalind enthusiastically.

“Only the theory, and I could be wrong. I've no idea if anybody here on Earth knows how to do it, but I believe it’s the only way.”

“What about using time-travel,” continued Rosalind, already anticipating the answer she was about to get.

“Not possible,” replied Julia emphatically.

“Why?”

“Conservation of energy.”

Julia’s audience sat waiting for an explanation. Looking around at the group, she asked;

“are you all aware of '*frames of reference*'?"

"They're like matryoshka dolls," suggested Charles nervously, trying to avoid looking a fool again in front of the others. "The total velocity in any frame is an accumulation of the velocities in all the outer frames."

"That is quite correct," she replied smiling at Charles, who was visibly relieved, "and altering the velocity of a mass requires the input of kinetic energy."

Julia then paused for a few seconds before she began to explain the problem.

"All the energy in the universe, throughout any universal period, was generated during the last 'Big-Bang', which was dependent upon the coupling ratio, universal mass and neutron energy; all of which are constants. Therefore, the energy released by each 'Bang' must also be a constant. And as universal energy and mass are both constants, the time between 'Bangs' must also be a constant. You can't change it. Are you all ok with that," she asked surveying her audience?

All of whom nodded in reply.

"Time travel requires a change in the time taken for the mass to traverse it, which would require a change in PE and relative KE," she continued. "You would need to get this energy from frames of reference outside your own; i.e. changing a planet's KE; which would require a change in its orbital properties; which would require a change in its star's properties; which would require a change in the velocity of its galactic force-centre; which would require a change in universal PE; which would require a change in universal mass; which would require a change in the coupling ratio; which is impossible, it's a constant.

Transporting a mass through time would require a change in universal energy, which is a constant.

It doesn't matter how you work it out, time travel doesn't work within the conservation of energy."

She then concluded with;

"if somebody in the future has worked out how to do it, we would forever be jumping into different existences as they alter history."

"Ok," conceded Rosalind, "so, you're saying time-travel is impossible."

"But;" she continued; "whilst it may not be possible to transport mass through time, '*time-travel*', it may be possible to *see* through time, '*time-sight*', because it would not contravene the conservation of energy.

Shine a light from within any frame right through all the frames in the universe, irrespective of from where it is viewed, and the EME would always be travelling at the same velocity. But its velocity would appear different to observers in different frames.

By changing the energy of EME you only alter its frequency, wavelength, and amplitude, but not its velocity, which remains constant. The only constants in the particles generating EME - the proton-electron pair - are their base-charges; magnetic and electrical. Perhaps, altering one or both of the base-charges in the particles generating the EME will vary its velocity."

"Do you know how to change the charges in an electron or a proton," asked Rosalind, mystified at the revelation.

"Not yet," Julia replied with a glint in her eye.

Rosalind had the distinct, but bizarre impression that this entire meeting had been stage managed. The fact that Julia knew the original question was hers, Julia's quirky smile explicitly directed at her as she finished her presentation.

Looking towards Rosalind, Charles exclaimed;

"Phew! That's a bit out there, don't you think?"

After further chit-chat and agreeing to keep in touch, they all returned to their homes.

During their journey back to England, Rosalind and Charles discussed what they had just learned.

"Do you believe Julia," Charles asked sceptically?

"Nothing she said can be disproved," admitted Rosalind. "It all makes perfect sense. Which worries me."

"How so?"

"Think about it. Julia has confirmed that interstellar travel is possible, it's just that we haven't yet learned how to do it. Or have we?"

"What d'you mean?"

Rosalind, always the lateral thinker, then sat quietly staring at Charles before adding;

"how do we know that we haven't yet learnt how to do it? How do we know somebody on Earth doesn't have that capability, now, today, but is keeping it quiet? Think about our past. Our human race has never been exactly altruistic."

"I see what you mean," muttered Charles, almost to himself. "Something ominous could be going on somewhere and we will be unprepared for the consequences."

"It's not just the potential for uncontrolled interstellar travel that concerns me," she interjected, "harnessing EME could be applied to weapon systems."

They both sat in quiet contemplation for the remaining few minutes of their journey.