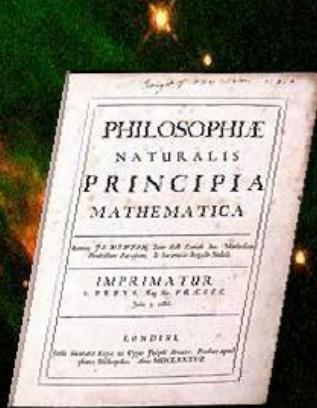




# The Newtonian Legacy

N.J. Evans

electron neutrino	muon neutrino	tau neutrino	photon
electron	muon	tau	gluon
up quark	charm quark	top quark	W & Z
bottom quark	strange quark	bottom quark	higgs boson



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## Chapter One

We live our lives immersed in the illusion that we are immortal souls. Only shocking events of mortality bring us back to the true frailty of our animal existence. The man's body slumped in the grassy ditch, unnaturally twisted, certainly brought Carl's thoughts to a dead halt. He was caught in the unflinching gaze of lifeless eyes turned up towards his face. There was something familiar ... Andreas. Dead.

A lazy afternoon of haphazard thoughts, matching the spirit of a gently warm late summer's day, had been coming to a pleasant end. Carl had closed up his office door, clattered down the marble stairs and headed for the main door of the Phi Institute. He passed through the corridors, immune to the charms of the modern art work on the walls, for his thoughts were obsessed with today's quandary. What is half a dimension of space? We live with three, able to move up and down, side to side and backwards and forwards. Physicists often sought insight through extending their calculations to worlds of four, five or more dimensions. Sometimes hidden beauties could even be found if the results were expressed in fractions of dimensions, though this had always seemed a mathematical trick. Well, it had until he'd idly read a new research paper on his computer that morning that proposed a concrete meaning for half a dimension. He shifted his jacket over his shoulder as he emerged into the sunshine dappling the driveway that passed through surrounding pristine gardens.

What would it be like to live in a world with half a dimension, Carl wondered? He couldn't imagine how to translate the mathematics to a reality. Sometimes thinking about the Universe seemed to make it less clear. He sighed out loud. He hadn't seen his girlfriend for over a week now either and he was missing her cheeky smiles, and the feel of her against him, and considerably more. No wonder he hadn't made much progress on his work today, he reflected, and tried to redirect his thoughts back to physics. It was then he was distracted from his self absorption by a slight acrid, chemical smell and the slumped form in the ditch on the side of the pebble drive.

The shock was instantaneous, an adrenaline rush pushing brutal fight and flight over the top of indulgent conscious thought. He stared at this unmoving mannequin of a man he knew so well, knowing instantly, yet unable to comprehend, that this was indeed Andreas. There was no blood or sign of injury but equally the essence of life was absent; when the machinery of life ends, colour drains, hair wilts, eyes dry and all that remains is a sickening parody of a man. Carl was still in the grip of his instincts which shifted from shock to fear. Startled, he suddenly glanced around looking for an assailant but the peaceful gardens about him were at odds with the harsh reality of death. A crow landed on the lawn nearby and gave a loud call, causing Carl to twitch and run panicking back up the drive.

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The *Physica et Philosophica*, Hampshire Institute, or Phi for short, was the result of a man's guilt over a short career in IT which he perceived as a distraction from his *raison d'être*. Geoffrey Montford had grown up dreaming of Neil Armstrong, Galileo Galilei, Isaac Newton, and then in his later teens moved on to revel in Albert Einstein, Marie Curie, Erwin Schrödinger, Alan Turing and the other greats of Western science. These men and women had seized a chaotic world and realized the dreams of magicians by understanding and controlling the natural order. Their spells replaced astrology with new mystic forces that bound planets and stars together. Their formulae could transform matter and even bend space and time. Almost as an aside medieval society was dragged into a new age. Now, as a result of their work, information and real time pictures could be beamed across the Earth. So all pervasive and so unchallengeable was their magic that technology, remarkably, had become dull and common place to most people. This science was Geoffrey's passion and he sucked up theorems and equations until he emerged as a member of the "magic order" with a degree in Natural Science from the hallowed halls of Cambridge.

Fate, though, intervened in Geoffrey's pursuit of his dreams to join the ranks of the modern sorcerers. These men he so respected had learnt to conjure with the tiniest atoms, the building blocks of matter, and with them to make computing machines the size of a finger nail. Linked together by simple rules of logic they produced the most marvellous of wizarding machines, the computer. The computer revolution of the early 90s held no particular fascination for Geoffrey but it was essentially easy. With just the knowledge he'd gathered from the idle playing of computer games and reading a first introduction to the appropriate computer language (provided by the internet itself), he could construct a web page in minutes. This knowledge would drag him from his passion for science. First his father's country toy store in a small Kent village would benefit from global exposure, as he wrote it a gaudy web page in the early summer after his graduation from Cambridge. Business contacts heard and asked, and by the end of the summer he discovered he had a small company. University friends visited and coded for him, as bewildered as he by the rate of cash flow. The gravy train continued and Geoffrey missed the opportunity to register as a research student back at University – well there would always be next year. Come the next year he had thirty employees and an international clientele.

Geoffrey's timing had been so accidentally perfect that by the age of 35 he was worth a cool £230 million. Geoffrey had little appetite to further enlarge his fortune though, so decided to realize his assets. He felt the business had done nothing but good. They had developed links for Indian farmers and connected African villages to the modern age as well as driving on the Western economy. Commerce had never been his passion though, and the internet had become so big it would not even notice his bowing out.

The Institute, Phi, was Geoffrey's penance for abandoning his youthful dreams. He bought the land, designed and built a million dollar mansion on the western hill overlooking the ancient city of Winchester in southern England. The city was laid out below with the medieval, squat cathedral that houses the bones of the pre-Norman

English kings as centre piece. A lazy river wound through the sports fields of King Alfred's School and the far horizon was blocked by the Iron Age hill fort of St Catherine's Hill. This backdrop was to provide inspiration for the great minds he planned to gather. The Institute would be a centre for theoretical physics, the grand intellectual construction that Newton and Einstein had set in motion. On its lawns the fundamental laws of nature would be laid bare and the origin and form of the Universe explained. Geoffrey would sit in the middle and taste the intellectual vintage he distilled.

He began by appointing six permanent staff from amongst the best minds in science. Then he supported, on short term contracts, a stream of the brightest young researchers from across the globe. All expenses were provided for visitors to come and add their thoughts to the intellectual melting pot. Salaries were the best in the world. The Phi was to become one of a select few Institutes around the world where research could be performed single mindedly, without the intrusion of students or worries about money that plague the academic world of Universities. For those who had earned the right, this was a haven of peaceful thought. The quiet was to be broken now though, by the mundane horrors of death and perhaps murder.

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The duty sergeant shifted his substantial bulk behind the imposing front desk at the Winchester central police station. The television in the corner quietly broadcasting the latest offering from the BBC had shifted from EastEnders to trailers. It was getting late into the evening and he was stuck in the station while his colleagues were up at the Phi Institute investigating a possible murder. He hadn't even had any calls. He discreetly surveyed the young man sat across the room on the sofa. The lad had his feet up along the seat, but then if he could find any comfortable position there, more power to him. The sergeant tried to decide if he looked like a science geek. Actually no - he was probably mid to late twenties, dressed in lightweight casual summer work clothes. Short, light brown hair, green eyes, slightly gangly yet a little under six foot, middle class and unremarkable – such people normally only ever entered the police world as victims, which of course in a sense this guy was. Still, no signs of latent Einstein syndrome; in fact he had the build of a decent cricket player, although the season was almost over. He was a bit skinny for recruitment to the sergeant's local rugby team. Then again the lad had been so thoroughly engrossed in his own thoughts that he hadn't noticed the Sergeant's interest. He might not pass muster in the bar after the game.

Carl was waiting for the investigating officer to return from the scene to take a witness statement. He was wondering whether imposed boredom was a deliberate police tactic. It had succeeded in removing his shakes and now Andreas' death seemed more abstract than real. Perhaps criminals lose the adrenaline focus in the same way and tell all. Not that that would explain using the process on innocent witnesses.

Andreas Born, the dead man, had come to Phi from Stanford in California. He'd moved from one, two-year postdoctoral position to another. Short term contracts, like that Carl also worked under, were the only ones available at the start of a career. This time of life

was for widening your experience and proving your worth. Originally Andreas had been from Hamburg. Carl suspected that the combination of a red light centre of Europe and Californian surf culture accounted for the wild life style Andreas had appeared to lead. Wild was perhaps a relative statement, simply not shaving and having a little more attitude than most physicists probably wouldn't cut it on the club scene. Andreas had found a surprisingly active circuit of parties in Southern Hampshire which seemed to fill most of his evenings, from Portsmouth to Basingstoke and beyond. He was always taking the foreign Phi postdocs off on trips to Glastonbury and to see dawn at Stonehenge. In common with all the Phi staff though, he had nothing but disdain for the desperate inventions of modern new age psycho-babble; these places were just archetype English historical sites to Andreas. He also smoked, which was a rarity now amongst academics. It seemed to be to his advantage since he could intercept the senior Phi staff, as they entered and left the building, for those all important exchanges of ideas. Carl didn't know if he had had a permanent girlfriend – a bit too domestic for Andreas probably.

Then there were academic interactions of which Carl knew considerably more. Andreas was very bright, very excited, very energetic. Everything he worked on was the new sliced bread that would lead to fame and fortune. They had talked daily about their work, and about the new ideas released by groups around the world that day. Typically Andreas raved and made connections to everything he'd ever learnt while Carl provided more measured views. They would have focused in on a bright idea, written papers soon, but now...

None of this seemed to suggest a reason for murder.

The desk sergeant decided the young man might be intimidated by the environment and perhaps it was his duty to put him at ease. In training they said you should begin on their home territory, so he'd try.

“You’re from the Institute, that right?” he started. Carl turned startled and regarded the sergeant. He was one of those tough, craggy looking middle aged men, with a heavy moustache, who made Carl a little bit unsettled. He wondered whether he would have to pretend to sound knowledgeable about beer or plumbing soon. Carl simply drank beer and bought widgets while a whole portion of the population seemed to consider these very much more important matters.

“Yes, I’m a junior staff member” said Carl, not sure if this was chat or interrogation.

“That’s physics, so gases and...” the Sergeant was also straying on to foreign soil, “stuff” he finished lamely, hoping the effort would be worth it. Carl paused before responding. This must be chat. Now for one of those forays into public explanation of science that normally left both sides in the conversation dissatisfied.

“Well, physics is about reductionism,” bad start, “understanding things on the smallest scales. So these days we work on the smallest building blocks of matter, like electrons and protons and neutrons that make up atoms. Different combinations of atoms make all

of the materials in day to day life. We study how these fundamental particles interact with each other.” Maybe not so bad.

“I’ve read about electrons. Never understood how you know they exist since you can’t see them.” This had always bothered the sergeant since school.

The question could be subtler than the desk Sergeant intended. Carl was plunged momentarily into a well explored yet unresolved philosophical quagmire. How after all do we know that anything exists? Seeing and hearing are just interpretations by the brain of signals from measuring apparatus, the eyes and ears. Can we trust these signals or interpretations to be a true representation of an absolute reality? Even if we accept existence in the experiment that does not necessarily imply existence at other times or places. Stop! Regroup, this is not what he means, Carl!

“That television,” Carl pointed towards the wall, “has a very hot piece of metal at the back. Then there’s a vacuum, just empty space, then the screen. The screen lights up because something coming out of the metal hits it. If you turn the power down you could see individual flashes as things hit. Those things being chucked out are electrons. We can describe where they go mathematically and get the time they hit the screen right and so on, so we are probably right. There are millions of other experiments done with them every day too, including every piece of electronic equipment in the world that all assume they are there. They seem to work. So it seems reasonable electrons exist.”

“Oh, right,” probably they know what they’re doing concluded the Sergeant. The television provided a distracting new theme tune and the Sergeant and Carl both let the conversation lapse.

## Chapter Two

The senior investigating officer never arrived to interview Carl. Instead, shortly after 9pm a subordinate police officer appeared to take Carl's statement. WPC Thatcher was rather younger than Carl had been expecting, which was perhaps a hint that the police's interest was already waning. He estimated her to be in her mid-twenties, although the harsh uniform, severely tied back blond hair and absence of make up served to provide her with the authority required. A radio buzzed intermittently on her belt as she escorted Carl to a plain room with a cheap Formica-covered table, and chair. She produced a set of papers and talked Carl through the boxes requesting names, addresses and phone numbers quickly and dispassionately. A number of sheets of paper were provided for his statement and he was left with a biro.

Carl filled in the information requested and then stared at a blank piece of paper. He wrote his name, Carl Vester, and that he was a postdoctoral research worker employed by the Phi Institute. He supposed they wouldn't want to know what he had worked on that day – it had been that digression about extra dimensions which he was still floundering with, so best not owned up to in writing. He had been working in his office on the first floor of the Institute since 3pm when he'd had coffee in the lounge downstairs with most of the other staff. Andreas had not been there though. Should he list who was? He wasn't precisely sure who had been on reflection, so thought he'd leave the Police to ask him to clarify should they need. Then he'd got up to go home a few minutes after 6pm and left the building without seeing anyone. He'd found the body on the verge of the drive. There was no one about nor, come to think of it, did he have any recollection of anything other than that it was Andreas and that he was dead. Carl was starting to feel a little embarrassed about his evidence; so much for his sharp intellectual capabilities. He took a deep breath and wrote that he had run back to the Institute (it sounded better than fled) and called for help. Morris Trant, a permanent member of staff whose office was on the ground floor, had thankfully been working late and taken control. Carl had pretty much sat on the sofa in the foyer after that, until the police arrived. It came to nine lines in his scrawled handwriting. He furrowed his brow and tried to imagine how he might elaborate.

The WPC returned and scrutinized Carl's paper work. Carl felt his cheeks begin to flush when she came to the statement.

"Erm, it's a bit short..." he muttered.

"To the point," the WPC proposed. She reached into a jacket pocket and withdrew a scrap of paper on which was drawn an heraldic shield. There was an inverted V shape separating three flowers in the lower part of the shield and across the top, a lion. The WPC had sketched this earlier off a shabby leather book mark the corpse had grasped in its fist. "Do you recognise this?" she asked.

"I don't think so." Carl couldn't imagine the connection.

The WPC returned to reading the statement, as if even she was unconvinced her question had been important.

“This will do, it doesn’t seem like there were suspicious circumstances, so it was probably a heart attack or some such. Well, we won’t know for sure until the autopsy. Thank you for reporting this to us, I don’t think we need take any more of your time.”

Carl absorbed this information. This was a minor matter then.

“Right,” was all he could think to say. The WPC suddenly seemed to have a switch thrown within and her face softened as she actually focused on Carl for the first time.

“I’m sorry, this must have been hard for you. You knew him?” she took in Carl’s nod with real sympathy, “Are you OK? We can provide the number of a free counsellor if you want.”

Carl had heard that people who received counselling after a trauma had been systematically shown to recover slower than those who went home and talked to their families, or, as he suspected, got blind drunk. Presumably the police still had to offer though or appear callous.

“No, it’s fine, I just need to wind down. So is that it as far as you’re concerned?”

This produced a wry smile from the WPC as she thought of the days of paper work ahead of her.

“No, I shall be up at the Institute taking statements tomorrow, just to be sure. I expect I’ll see you then. Let me at least run you home.”

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Home for Carl was a one bedroom flat in the roof of a modern apartment block in the centre of town just off the high street. It was one of those blocks that had been springing up all over the country since the mid-nineties to house the new generation of unmarried professionals. Magnolia paint sales must have rocketed even past their 1980s high!

The ornate iron clock on the high street had read 10pm when Carl had passed it. He had realized then that his girlfriend, Sasha, who was a junior medic on a fracture ward at a hospital in Birmingham, would be 25 hours into shift and wouldn’t want to hear from him even in these circumstances. They had met up as undergraduates and been together since. That they both were determined to commit to anti-social careers seemed to act as a bond, since blame was equally distributed for absences. They had agreed to “see how it goes” while she worked her way through the NHS sleep deprivation endurance course to surgeon and he anticipated short term physics positions across the globe until something more permanent was possible.

To Carl's pleased surprise they hadn't split up yet in spite of a steady stream of friends on both sides that one might have predicted would interfere. Maybe it was just the huge pool of people you meet at University that meant it was relatively unlikely that after you'd left you would find someone better. More depressingly, it might be that once they had taken on careers they had had to grow up and falling madly in love would never be the jubilant affair of youth again. Carl's main mechanism for the defeat of on-setting middle age depressions such as these and, as of today, coping with the death of friends was Amber and a bottle of good wine.

Amber lived on the floor below Carl and their friendship went back to the dexterous use of a magnet on a string to pick her key up from the window sill below. In fact Amber locked herself out rather regularly and had taken to deliberately leaving a spare key on the sill. She was an American from Seattle who was in Winchester to study at the School of Fine Arts. Carl would have been forced to describe her as pleasantly detached from reality. Her early paintings were, she had assured him, representations of people she had seen energised by the cosmic flux from ley lines crossing the North American continent. Carl had always found it hard to identify the people precisely, although the flows of energy were a little more apparent. Carl would normally have had no time for such talk but Amber was so clearly being honest to her own perception of reality that it was hard to hold it against her. The pictures were pretty good too.

When he knocked on the white, pseudo wood, plastic door of her flat she answered almost instantly.

"There you are sweetie! I've been knocking on your door all night." Amber was her usual seductive self with curling shoulder length black hair and large brown eyes in the centre of a beaming round face. She was tall and thin and dressed in a revealing black dress. "You look like your day has really sucked Carl, sugar!".

A few minutes later Carl was settling back on the sofa, his head on Amber's soft bosom with a glass of Chablis in his hand to explain just how much his day had in fact sucked. While she expressed her horror, he relaxed back enjoying the faint smell of her perfume over the top of the stronger smell of acrylic paints that permeated the flat. This was a pleasingly intricate relationship which offered up all the allure of an affair whilst in fact being perfectly moral and safe. Amber was attached to a graphic designer, Trevor, who worked in Reading fifty miles north of Winchester. Carl had Sasha. Both of these relationships were solid. In any case Carl and Amber's friendship was a mixing of opposites. The idea that they might make a serious go of a fling was entirely ludicrous to both of them. Carl had occasionally for fun tried to estimate how long it would take for some irreconcilable difference to escalate between them – certainly less than a day! On the other hand, safe flirtation was precisely what they needed to cope with the separation in their respective relationships.

Amber was lamenting the self destructive urge inherent in the human condition. She was expounding a theory that everyone deliberately rebels in some small part of their life just to prove their independence. In the US this accounted for the excessive eating of

hamburgers, in the UK for bad teeth and across Europe for smoking. In this particular instance her theory had Andreas ignoring chest pains to his own eventual demise. Carl clocked it up as the first theory, if unsubstantiated. His attention though was more taken by the canvas across the room, on which Amber had been painting that day.

The one bedroom flat was excessively cluttered with art. The living area was stacked six paintings deep along the walls and they overflowed into the kitchen and hall. The paintings were in a range of styles and a variety of media but typically contained the bold use of coloured streaks that apparently flowed forth from Amber's psyche. As you moved down the hall towards the front door the pictures began to compete with credit card slips, bills and parking tickets. The latter were Amber's small rebellion. In the US she would frequently amass parking tickets outside her own state, since liability was limited state by state. That Reading was in the same judicial region as the rest of the UK would surely come back to haunt her one day.

Today's canvas was a break from Amber's norm. The background was a moody purple and grey cloudscape whilst centre stage was a rather famous equation in bold black:

$$E = M C^2$$

"Am I starting to get to you Amber?" Carl queried pointing over at the canvas, "Or are you humouring me?"

Amber stared at the work in progress with a frustrated pout. "We have a visiting Fellow who's into bridging the science-art divide. He gave us all an equation to evoke an interplay. I started doing an explosion, you know nuclear energy and all that, but it's a bit obvious. What does it mean to you? Inspire me!"

The science-art divide - Carl had almost never met a scientist who didn't listen to music, like pictures or read fiction voraciously. The divide seemed a little one sided – it was artists who didn't understand science. Perhaps it was the striking of the muse he wasn't supposed to get, for example when Amber would come to a dead halt on the high street oblivious to all but some new image. Plenty of theoretical physicists, though, seemed to spend their day staring intently at a board full of equations in much the same way, seeking the mathematical spark to complete a proof (or as more often happened to find a minus sign that had gone astray three pages back in the computation!). Was it so different? But Amber's artistic flights of fancy were something definitely lacking from his life - as his presence here proved.

"Well, that's only part of the equation really," Carl clambered from the couch and awkwardly wielded the paint brush on the easel to add some extra symbols at the end. It now read

$$E = mc^2 \sqrt{\frac{1}{1 - v^2/c^2}}$$

“Eeek!” cried Amber, “help!”.

“The crucial thing in Relativity is that the speed of light is the same for everyone.”

Amber was eyeing him and the equation inscrutably from behind her wine glass with her legs up on the coffee table. Carl had a pleasant view quite a way up her skirt.

“OK”

“No! You should think that’s stupid!” Amber batted her eyes at him in amusement.

“Imagine you throw a ball, and then get in a car moving in the direction you threw, and throw another one with the same strength. The second one has the added speed from you and it being in the moving car so it’ll go much further and faster than the first one. But light doesn’t. It just goes at the same speed wherever it’s emitted from.”

“Really?”

“Really! You don’t notice in normal life because light goes so hugely fast you think it takes no time to travel, so you wouldn’t see small differences in its speed.”

“And that’s something to do with my poor equation you’ve mangled?”

“Yes,... if the speed of light is always the same then you can’t travel at the speed of light. If you did you’d be moving with the light and it would look stationary to you. Einstein had to change our understanding of the laws of physics so that you couldn’t ever go that fast. This is the equation that turns out to do that properly. If the speed of the particle,  $v$ , was to become equal to the speed of light,  $c$ , then there would be a zero on the bottom of the equation. Anything divided by zero is an infinitely big number. So you’d have to put in an infinitely large amount of energy to get something to go that fast! Which is why you can’t.”

“The squiggle thing is a square root?”

“Yeah, so you find the number that when you multiply by itself gives the thing inside the squiggle. It doesn’t matter here though, because the square root of infinity is infinite too.”

“Right, ish”

“Well, so that was what Einstein wanted. But then he saw that if you set the speed, that’s  $v$ , to zero then the square root is just one and you get the equation you had first. Remember,  $m$  is the object’s mass, and  $c$ , the speed of light, is just a constant number, so we find mass is just a form of energy. It just falls out.” Carl looked delighted at the conclusion.

“Erm... energy is what exactly?” She was pleased to see that that one made Carl pause.

“Gosh, well it’s sort of the dynamic stuff of nature. It’s heat and what you give more of to something when you throw it faster. The amazing thing is that there’s a fixed amount of it, it just changes form. So our equation says you can destroy stuff and its mass, or weight, turns into the heat and light of an explosion. That’s what makes the sun burn.”

“More wine?”

“More wine.”

## Chapter Three

WPC Thatcher parked her car on the gravel drive of the Phi Institute the next morning at ten to nine. Direct sunlight had not yet made it through the layer of misty cloud that had formed in the night. The grounds of the Institute were eerily still and deserted, in sharp contrast to the morning rush she had just left at the police station and on the roads of Winchester. She adjusted her jacket and regarded the Institute's main building, the central block and its two wings, with a sense of resignation. Above the main door she noticed for the first time the large dull metal shield stamped with a large  $\Phi$  and an artistic representation of the tracks left by sub-atomic particles in a detector. The emblem had a slightly Masonic overtone, she thought, reinforcing that she had to try to break down what she feared would be an impenetrable society.

The Chief Inspector's eyes had lit up the previous evening when he'd dredged from his memory that Thatcher had done a degree in Physics. Who better then to interview the staff? She had considered pointing out that her commitment to the subject was open to question since she had escaped from the shortest degree course with a scraped two two qualification and immediately changed career to policing. As always though, she reflected, she'd at least had the character to bully herself through hours of tedious revision to escape the classification of third, the degree result that appeared to be for those who had merely attended for the three years. That same determination had prevented her from turning down an important role in this investigation.

In fact, the truth was that she still harboured the interests that had led her to Physics. She still thought it was wonderful that the sun and stars are enormous balls of hydrogen which are crushed by gravity until the very atomic nuclei are forced to merge, liberating energy as light. She loved the elegance of the atomic model of matter and it truly underpinned the way she saw the world; gases are widely separated atoms all doing their own thing, while solids are those same atoms stacked close in rows like eggs in a box. She still played with water when she washed her hands trying to understand that this was half way between solid and gas, tiny atoms almost sticking yet sliding past each other. So perhaps the Inspector was right that she was at least on the fringes of the scientific club.

Physics though is more than thoughts of atoms swirling in the void. Such naïve images are no better than religion, her tutor had once eulogised. They must be underpinned by rigorous mathematics. That a ball thrown up, eventually falls as a result of its attraction to the Earth by gravity, are nice words. Unless though you can compute the moment of its fall to Earth to incredible precision your words were meaningless, she was assured. Only in this way could you refute a fool who claimed invisible fairies pushed the ball down! So to study Physics was to study algebra and proof. This had been her undoing. She did not have the sort of mind that could translate glyphs on a page to physical pictures. For her the slope of a hill was a very different thing from the arcane manipulations of calculus with its derivatives, even when the connection was there in the proof on the page before her. She hoped she had accepted her failings with good grace and moved on to a career that used her talents better. She also knew though that her dabbling in the precise waters of science had taught her something of the true nature of the world that was important to

her. Science's unbending insistence on the continual questioning of everything shared much with the art of detection too. Damn, she was coming round to sharing the Inspector's view that her past left her well equipped to bridge the gap from the Phi to the world outside. She let out a small sigh and headed for the door.

Ten minutes later she had discovered the first dislocation between the Institute and her world. There was nobody at work here yet. The corridors and offices of Phi were empty except for gently humming computers minding every desk. She did now have a good understanding of the layout of the building though. There was a central hub and two wings connected by corridors on each of the two floors. On the ground floor the central building was dominated by a large enclosed lecture theatre, with the most up to date data projectors and screens, faced by ranks of comfortable seats. The colour scheme was a tasteful mix of sombre reds and dark wood. This was no University lecture theatre. The two wings held the offices and meeting rooms used by the Institute's four research sub-groups. In these areas she passed countless white boards scrawled with an intimidating array of equations. She couldn't identify a single English word anywhere, certainly no sentences, although question and exclamation marks seemed de rigueur.

This wandering was not helping produce the accounts of interviews with the senior staff the Chief Inspector wanted so she returned to the front hall. On her way in she had had a brief word with the secretary perched behind a desk in the entrance. Her name was Alison Hughes and she at least seemed to work normal hours. She was smartly dressed with long, curly black hair and the WPC estimated her age at early thirties. She had seemed a bit flustered by the presence of a police officer and perhaps also a little tearful about events of the previous night. She had gone home before the body was found but had been telephoned with the news by Prof Clarke, the academic head of the Institute, that evening. Perhaps it had only seemed real the next morning though. WPC Thatcher had noted the absence of a wedding ring and briefly pursued the imagined line that there might be some more intimate relationship between Alison and the dead man, Born. Alison had had to go and look up his home address for her though and only seemed to be able to relate a series of encounters over expense claims.

"Alison, I'm not having much luck finding the senior staff. What time do they usually start work?" the WPC queried.

"Oh yes, it is a bit erratic. They just work when inspiration strikes." Alison seemed to consider this and conclude it didn't present the Phi in the best light so quickly added, "but they're very smart and productive. They write over a hundred scientific papers a year here. It's just that they're free to work where and when they like. There are often staff in after midnight."

"I see. Should I arrange meeting times with them then?"

"They'll all be in by lunch I'm sure. Oh, except for Prof Sinclair. He's at a conference in London today. Mr Montford, our founder, came in a few minutes ago – I said you'd probably be along soon. Shall I take you up to his office?"

Progress at last, thought the WPC, as they headed for the grand marble stairs to the second floor.

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Carl had gone to bed with the intention of remaining there until at least lunchtime the next day. Sleep, though, had been hard to achieve. His subconscious seemed to be perfecting the art of worry and stress, churning over the events of the evening. Sasha had once related the content of a seminar on stress in the army in which it had been claimed that frontline soldiers didn't suffer badly from stress. It was just the poor guys in reserve who chewed themselves to pieces worrying about what would eventually happen. This did not seem like a very cunning evolutionary strategy.

The workings of the brain, Carl reflected, were largely considered off subject in physics. The atomic constituents of a brain were hardly the issue. The interesting stuff was all in the connections and interactions. These sorts of problems involving many, many particles were well known to be inaccessible to simple reductionism. For example, it seemed clear to Carl that however much he studied gases, like those in the atmosphere, he would never have thought of rain and certainly not lightning without the prompt from reality. Similarly, consciousness and self awareness must just emerge from the complicated interactions of the vastly subtle arrangement of atoms in the brain, he supposed.

Carl's thoughts and dreams had intermingled through the night. As he had fallen asleep he had recalled with a jolt the strong chemical smell when he had found the body. He should have included that in his statement to the police. His conscious mind would have left the matter there but in sleep his brain preferred to extrapolate wildly. He dreamt of being on the evidence stand harangued by a very persistent lawyer. He had made this up after the event hadn't he? He was a liar. He was a murderer! Everyone knew the person who reported a murder was a prime suspect for having committed it. The judge's eyes were narrowing and the jury writing firm conclusions on their pads of paper. Carl struggled towards consciousness in the grey light of morning and processed his subconscious thoughts. They did not seem particularly helpful, so with a sigh he hauled himself to sitting and observed his alarm clock. Half past eight in the morning, not really early enough to justify more sleep.

He had only just staggered back from the bathroom and located some underwear when his phone rang. He muttered incoherently into it and listened for a reply.

"Hi sweetie, it's Amber. Are you up?" She must have heard the toilet flush above.

"Only in body."

"That's all I've ever wanted. Oh actually, no, I want your artistic appreciation too."

"Right, my muesli and I shall be down shortly".

Amber's artistic passion had apparently struck during the night and she had been up painting in her dressing gown. Carl tried hard to match her glowing enthusiasm at this ungodly hour. Occasional glimpses of tight silk across her buttocks were after all the best imaginable start to a day. The painting had changed from the night before. The brooding sky had only survived in the top right and the equation not at all. To the left a collection of animal shapes merged into each other. The trademark Amber streaks of light plunged across the canvas from the menagerie ending in bursts surrounded by glowing spherical bubbles.

"Light travelling at constant speed making spherical shells?" Carl pointed at the bubbles.  
"What about the polar bear, giraffe and.. is that a whale?"

"Mass." Carl studied some more.

"Well, I like it." Amber reacted with a cute unconvinced noise and wriggled her mouth.

"I don't like being restricted by explaining something so directly," she complained, "still it will serve... I'm trying for credit points by understanding more about relativity than the rest of them. I don't get why energy changes form though."

"Oh, well, the rule is that things like to have the smallest amount of energy they can. That's why things cool down for example – a hot thing has lots of energy which it gives away to its environment." Amber frowned in concentration,

"You physicists just make up these rules?"

"No nature does!"

She didn't look convinced but instead ended her consideration with a yawn.

"Time for bed," she declared

"Temptress"

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The staircase at Phi led up to a large landing area which doubled as a museum and art display. A number of bulky and peculiar pieces of machinery extracted from the bowels of some particle detector took pride of place. Geoffrey Montford's office was at the front of the main building with a view out over the driveway through a large round window. The room was lined with floor to ceiling bookcases packed with hard backed tomes. Whole shelves were filled with matching series of leather covered volumes; the display seemed to be more about show than function. WPC Thatcher entered past four lecterns that displayed old manuscripts, velvet dust covers hung down at the backs. As

everywhere at Phi, mathematical formulae leapt out from the pages, here written in spidery ink trails.

“That piece is an original Descartes manuscript, we’re very lucky to have it.” This had the air of a well rehearsed first line. WPC Thatcher made her initial evaluation of Geoffrey Montford. It was hard to reconcile the youth of this man with his position and wealth. He barely looked thirty. Well-cut, gingery blond hair and a welcoming smile that was half grin hinted at a younger man yet. He was casually dressed in a short sleeved, collared shirt and light trousers. Geoffrey was also sizing her up and in this he showed signs of the highly successful businessman that he really was. She could almost feel a hardness behind his eyes as he came to whatever conclusions he was reaching. One of the toughest parts of policing for the WPC was maintaining her authority in front of natural leaders like this. She summoned her courage, trusted to her uniform and tried to impose herself a little.

“Thank you for seeing me Mr Montford, I will try not to take up too much of your time. I had been hoping to speak to most of your permanent staff this morning but they seem to be absent.” She was pleased to see that her riposte to his opening line did seem to slightly irritate him. He responded with, what again, seemed a well prepared speech,

“Officer, you must realize that this is not a company. We do not produce baubles to order. We are a place of sanctuary for some of the greatest living minds. The professors here are uncovering the mysteries of the Universe; they are asking what, why and how about the very substance of space and matter. They do not do this as a job. They do it because they cannot stop themselves asking these questions. They are the epitome of the human spirit. What is the point of our existence if we merely eat and reproduce? We must explore new reaches. That is what these people are driven to do and far from having to force them to work, I cannot stop them working wherever they are. The only job here is mine – these men and women must be nurtured and protected because we need their flashes of insight. Even if just once in their lifetime they turn our thoughts on their head, it is the most precious gift they can give us. So I’m afraid you will not find my staff tied to their desks.” There was real passion here - but then to spend a fortune on the Phi, there would have to be, the WPC reflected.

“It’s not my place or intention to question what you do here Mr Montford. I just wish to complete my duties as quickly as I can, so...” she tried to steer the discussion to the matter in hand. Geoffrey had not yet let go though.

“But I see that you do question us, officer. We are not just an indulgence. The line of natural philosophers in whose footsteps these people walk, have made our world. They have driven out irrationality and religion from our day to day lives and replaced it with electricity and the silicon chip. The car you drove here in, your watch, radio, the fabrics of your clothes, your hair conditioner are all the product of science’s quest to understand what is this world. You will return to your police station and type your report onto a web page, a technology that was created by particle physicists to enable their data processing.” The WPC could not help but give an inward smile at this last assumption.

Montford at the front of the computer revolution clearly did not appreciate how far behind the Hampshire constabulary lagged. Well at least she would type the report on a computer. The proselytising had given way and she allowed a pause.

“Did you know Andreas, was he making an important contribution?” Montford’s demeanour turned more thoughtful, there seemed to be genuine sadness at the fate of one of his staff.

“I did not know him well. I do meet with each of my research groups monthly. They give a presentation for an hour on their progress and ideas. I’m afraid they must rather resent speaking to someone so far from the cutting edge but it is the small indulgence I allow myself. Andreas shared my passion for this subject. He spoke very well and with enthusiasm. He was in love with the idea of extra spatial dimensions that emerge from string theory.” He smiled at the WPC who had shifted in her chair, “I’m not the man to teach you the subtleties though, if you want to know about his work you must speak to Prof Fields or August. They are our resident string theorists with whom Andreas directly worked.”

“Were you here yesterday afternoon or evening, Sir?”

“No, no I wasn’t. I was attending a rather,” he paused to pick his word, “unedifying private meeting in town. I could provide witnesses if you need.”

“That won’t be necessary at this stage. You know of nothing in Andreas’ life that might connect to his death?”

“No. No I can’t imagine... you suspect foul play?” Montford seemed to have thought through the consequences of this latter possibility before, this was a controlled enquiry.

“We tread carefully until the facts are clear. Well I don’t think I need take any more of your time.” As a final thought she extracted the piece of paper she had shown to Carl the previous night with the sketch of the heraldic shield. “Oh, except do you recognise this at all?” Reading the response of somebody under questioning was now taught in Police psychology sessions but the WPC had never entirely trusted her own interpretations. Possibly she found the psychology she had been peddled a little simplistic, a little dismissive of the depth of our thoughts. Here though, she was almost certain Montford recognized the design and with excitement. The first response though had been hidden away beneath a more controlled demeanour in but a fraction of a second.

“I’m not sure... is it perhaps from the Guildhall in town?” She was pretty certain he did not think it was. Then as if he was only politely interested, “Is it related to Andreas?”

“He died holding an old leather book mark with this design embossed.” This time Montford developed a cough and brought his hand to his mouth. An interesting reaction, if not completely conclusive. “It seemed odd but probably is of no consequence.”

Montford did not want to keep her further and she allowed herself to be returned to the landing to ponder the significance of the bookmark.

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A second crucial strand in the Chief Inspector's investigative plan for the day, sketched out the evening before, involved searching the deceased's abode. This task had been handed to Police Constable Steven Martin, or Stu as the rest of the Station's staff called their newest recruit. Stu had found that the Police force was rather regimented in their levels of respect, based on length of service. Not that he minded informality; he was equally likely to forget the 'Sir' to his superiors.

This little house to house enquiry promised to be of more interest than the average. Normally he was trawling round the council estates with everyone he spoke to eager to be anywhere other than talking to the police. Today he was visiting the Cathedral Green in the centre of Winchester. Amazingly this Born, who'd been found dead at the Phi, had an address on the Green, at least according to the neatly printed card in his wallet. The Chief Inspector had attributed this meticulous attention to detail to a German upbringing.

Certainly most wallets you found had at most the name of the owner on the credit cards it contained. As Stu approached the address though, he began to doubt the information. The house was an old three story building buried in a row of houses that appeared to have slowly accreted over time. The terrace of houses ran parallel to the Green but back a little behind a high flint wall. The outside had the traditional white plaster with crisscrossing, black timbers that made the city centre so distinctive. The top floor looked to be a single room tucked between the sloping beams of the roof. This was the sort of cutesy property that tourists photographed, there were even flower boxes. It was also the sort of property that set you back astonishing amounts of capital. Capital, he suspected, no young scientist could muster.

The policeman re-examined the small piece of paper with the address as he passed through the black, iron gate before the front of the house, and noted the small "a" after the number 6. Now inside the flint wall, he could see that there was a side door on the edge of this, the sixth house, marked 6a. It looked as though there was a set of stairs up to the attic along the side wall. They may once, before the neighbouring houses were adjoined, have been external. This seemed slightly more plausible. He extracted the key that he had checked out from the evidence bag at the station this morning. It was a long solid piece of iron and matched the character of the house perfectly. He knocked smartly on the door and waited, timing two minutes on his watch. Then the key slotted easily into the lock and he turned it.

He had constructed his expectations of the place while he waited at the door; a cramped musty stair well; perhaps two tiny rooms in the roof with eaves claustrophobically leaning in. One room would have to be a bed sitting room, the other a small kitchen that

might only muster a hot plate. Surely at most there would be a shower in the bathroom. The rent he concluded would be the same as a place three times the size without the view of the cathedral. Stu would have opted for a bigger place with a double bed and a 42 inch plasma TV. Not that he could afford either option.

This prophecy was unfair on the reality of the third floor which was considerably larger. It would turn out the owner of the house below was a ninety year old man who rented out the top rooms in order to pay his council tax. Tax which, Stu got the distinct impression when he interviewed the man later, he, as a representative of the powers that be, was considered responsible for. The rent was therefore appalling low by modern standards and Andreas had, through his grapevine of friends, acquired a bargain.

Stu's whole vision of musty, cramped bedsit life also began to fail as he climbed the, admittedly tight, stairs. The place smelt of chemicals, as strongly as a factory. There were acrid odours that would turn out to be hydrochloric and nitric acid, sulphur and iodine solutions. When he arrived at the top of the stairs and looked within he gave a grunt of surprise. The place was a veritable magician's workshop. A long bench was covered in glass test tubes, beakers and flasks. There were pestles and mortars, spatulas and pipettes. Hanging from the beams were maps of the stars, charts of tides, tables of symbols and everywhere on the floor piles of books and heaps of ancient looking paper. There was a small mattress against a far wall piled high with clothes but no other concession to everyday life. The small front window allowed in a thin beam of sunlight that pierced the gloom. Looking out, the window framed the view of the front of the cathedral with its imposing pinnacles.

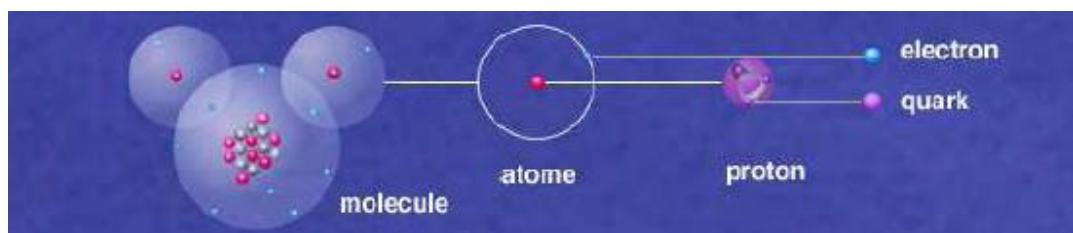
Stu knew his brief had been to report back that there was nothing of interest here so this case could be shut up as quickly as the Chief Inspector had hoped. This room, whatever it was, perhaps a drug manufacturing lab, did not fit into that scheme. He reached for his radio to report in what he'd found and call in his superiors.

## Chapter Four

An hour after her arrival, WPC Thatcher was still waiting to see her first Professor. All the permanent members of staff here seemed to be Professors. She suspected the US meaning of the word – a tenured member of academic staff - was in usage rather than the British - a very senior academic. She could believe Montford would have chosen the more vainglorious system.

She had roamed to the common room area, behind the lecture theatre at the back of the building. There was a stunning view through large glass windows over the lawns down to a modest ornamental lake. Half the room was a seating area with the usual white boards, here covered in sketches of interlocking circles and cones. The rest of this room had a pool table and bar stools. The bar against one wall was fronted by imposing stainless steel machines for producing coffee and tea but she was surprised to see behind on the wall a small array of spirit bottles and below fridges with soft drinks and beer. Apparently alcohol was on the house.

The coffee appeared to be for general consumption so she poured herself a plastic cup full. On the wall was a poster detailing the world of particle physics and here she found familiar concepts from her undergraduate studies. There was a picture of an atom, like a mini-Solar System; negatively charged electrons orbiting as a result of their electric attraction to the positively charge protons clustered with neutrons in the nucleus of the atom. The protons and neutrons were then shown themselves to be made up of those mysterious particles called quarks. A proton was made from two up quarks and a down quark, a neutron from two downs and an up. Here the quarks were held together by the strong nuclear force. She had always thought they would have been better sticking to Greek names but it had been the 60s – what was Greek for up she wondered?



Here also was the ethereal neutrino, a particle which essentially does not interact, the exception being through the peculiar weak force. The weak force could change up quarks into downs and electrons into these neutrinos. This was radio-activity, a down quark becoming an up quark and spitting out an electron and a neutrino. The electron caused the damage if it hit you. She had never understood how a force could change a particle's type though.

Still all simple enough: two quarks, an electron and a neutrino, plus electric forces, strong and weak nuclear forces. All you need to build a world. What about gravity she

wondered? Searching deep into her past studies she recalled that gravity was too weak for the effects between individual particles to be observable. You need a whole planet's worth of atoms all pulling together to notice gravity. Still the poster ought to mention it surely?

The next panel on the display talked about anti-matter. When she was young she'd always assumed that anti-matter was made up for Dr Who. It had been a little bit surreal to discover the stuff was real. A precise copy of every particle but with the opposite charge, and it really did blow up if brought together with normal matter. It still seemed a little too like science fiction to be true. Her thoughts were interrupted by the arrival of Carl, striding in from the hall outside.

After leaving Amber's Carl had decided to struggle into work. He hoped he could distract himself from Andreas' fate with the daily shock of seeing the great work other people around the world had produced today. He'd decided he needed a drink on arrival though. He was surprised to see the WPC absorbed by one of the Phi's posters. On hearing him enter she turned and regarded him. He looked more upright and confident than he had the previous evening. This was his territory not hers.

"Good morning," she said. She was still half distracted by the poster so took the opportunity to quiz an expert, "Anti-matter just seems to give you twice as many particles as you need."

"Oh no, you have to have them." Carl eyed the coffee machine he'd been making for across the room, wondering if he could make it before explaining - probably not. "When you study how particles move you find they are as capable of travelling backwards in time as forwards. We used to think that travelling backwards in time was silly but it isn't. Imagine a negatively charged electron sat somewhere and you choose to move it forward in time. Now take an electron at the same place and move it backwards in time. You've just undone your first move, so no charge moved through time. Except if they are different particles two things moved. If you insist on thinking only about things going forwards in time you had an electron and something identical but with precisely the opposite charge moving so that no net charge moved." WPC Thatcher watched Carl set the coffee machine going. His explanation was not what she'd been expecting and if it wasn't for his serious demeanour she would have wondered if she were being teased.

"Isn't going backwards in time forbidden?"

"Some people think information shouldn't go backwards. Here though you can always just talk about anti-particles going forwards in time so there's never a contradiction. Actually I don't see why information shouldn't go back either. People get into trouble when they think about going back in time and killing their mother. That just couldn't happen because it doesn't make any sense. The Universe would only allow examples where the time traveller consistently fits with events so that at each place and time only one thing happens logically whoever's fate you follow." WPC Thatcher wondered why

the poster presented such bald facts when all this fascinating philosophy lurked behind them.

“There was a film, *Twelve Monkeys*, that was like that wasn’t there?” she pondered, “A man goes back in time to find out information about a plague in the past and is killed in front of himself.”

“Yes... that was a great film.” Carl turned back after struggling with the sugar sachet. He was brought up a little short by the realization that he was chatting with a policewoman. There must be a real person under that intimidating uniform. “Why is Terry Gilliam always struggling to find money for films? They should make him a UNESCO world heritage site or something and just let him get on with it!”

WPC Thatcher smiled at such an idealist thought and offered, “Overly pampered artists become self indulgent.” Their thoughts were suddenly interrupted by a surge of noise on the WPCs radio. She had to come down to the Cathedral Green and bring a physicist to decipher what they’d found. Carl was the only physicist to hand.

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Police driving was a rather serene experience since the speed limits must be carefully obeyed and the traffic around was always immaculately behaved. As WPC Thatcher drove carefully down the hill towards the centre of town, therefore, she could ponder the brief description she had been given of the flat on the Green they were heading for. A chemical laboratory could not be more at odds with the Phi Institute. Modern particle physics experiments, she recalled from her studies, were no longer the preserve of local laboratories. Vast teams of hundreds or even thousands of international workers built these experiments in a few select sites world wide (carefully chosen to massage as many political egos as possible, presumably). You needed a significant fraction of the output of a whole power station to run the equipment needed to drive particles to the high energies where the forefront of the subject resided. So what had this Born been up to?

Carl was slumped in the passenger seat musing on recent events too. His job was all about quiet, stress free thought and innovation. He decided he’d better give up on any hope of making progress on physics. He’d just have to wait while events took their course. The WPC noticed his silence and wondered what he was thinking,

“Did you remember anything over night that you might want to add to your statement?” she queried. Carl jumped slightly,

“Oh, er, yes, there was a smell of chemicals near the body.”

“I noticed that too. We may be about to find out why.” She left that hanging. “How about any disputes Andreas was involved in – with colleagues perhaps?” Carl hadn’t even considered that his death might be the result of their work. Researchers in the field may

be passionate about their theories and hypotheses but there was no money to be made on a scale worth killing for. He gave a small chuckle,

“I don’t think mathematics and murder really mix.”

“Really? I thought academia was rife with brooding grudges, plagiarism and spite? You have to remember that people commit murder over matters the rest of us would consider trivial.” She was right on all accounts reflected Carl. There were very strongly held views and animosities throughout the field and the Phi was no different. He didn’t think he was ready to point a finger at any of the staff though – it seemed so implausible.

“You’re not the biggest fan of the Phi are you? Was that comment earlier about pampering and self indulgence really aimed at us?” he asked. WPC Thatcher did a quick review of her comments. After all she wasn’t supposed to be antagonising these people. Was she perhaps displaying a chip on her shoulder based on her past? She had better smooth things a little,

“No, I’m sorry, I didn’t mean to come across that way. I think what you do is amazing, in a sense. You spend your whole lives just thinking about the way the world is. I can’t really imagine what you actually do though, it’s so very alien. That’s even though I studied Physics for a few years,” Carl glanced across at her, so perhaps she had gained some Brownie points with that. “I guess I’d just had the promotion speech from your boss Mr Montford, it was a little self righteous.” Carl laughed openly at that,

“All is forgiven, I’ve sat through it myself. The quest to split infinitives and all that? Actually I think that while that might be why *we* study physics. I’m not sure it’s why society should fund us, at least any more than it does opera. I prefer to think of us as a living library. We know and use daily all these theories that drive science and engineering.”

“You have to understand that the Phi holds a very special place in academia. It’s sort of like winning the lottery to get a permanent job there. On the contrary, most particle physicists spend much of their time teaching physics to students. Their research is only one component of their job. The students they teach go off and do a vast array of things that are really important to the economy. Police work included apparently!”

“Yes, but you’re such smart people. Is particle physics really so important? Couldn’t you be doctors working in Africa for example?” Here was a doubt Carl had often had about his choice to pursue his interests. He tried out his response, carefully constructed over a number of years.

“You have to remember that you only know that doctors are needed in Africa because of science. Airplanes, mass media, instant communication is all a relatively recent creation based on scientific discovery. The medicine they need there is all modern science too. Maintaining and improving that scientific base is the crucial first step to helping the world as a whole. In any case, I don’t think that Africa lacks smart people. It lacks

money. Probably we're better off earning a salary in the West doing anything and then giving to charities. Imagine how different the world would be if we all gave even a fifth of our earnings away?" Carl paused, a little embarrassed, "Not that I do."

"No," ruefully smiled the WPC, "none of us do. How then do you justify spending billions of pounds on your accelerator experiments?"

"I don't think a billion pounds is as much as you think. Sky pay a billion pounds to show Premiership football for a few years. The movie *Titanic* grossed a billion. If you want to look for savings I should try the military – they easily spend billions a day world wide."

They had turned into a small cobbled street separated from the Cathedral Green by another towering, flint wall. The WPC brought her car to halt at the curb.

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An hour later, Carl was sat at a desk in Andreas' apartment in a state of slightly dazed distress. He stared distractedly at an old, knotted, length of cobweb hanging from an eave and blowing in the breeze. Two police officers were slowly working through the rooms recording and collecting evidence. Their growing bags contained chemical samples from blackened test tubes, shavings carved off the nib of a feather quill from the floor, and a growing pile of assorted papers. That Andreas had created this caricature of an alchemical laboratory was almost beyond belief. Surely this was a betrayal of the scientific worldview they were part of, thought Carl? Alchemy was an old, tried and thoroughly failed attempt to explain the world. He reflected that he was experiencing a vast magnification of the emotions he'd once felt when an undergraduate friend had suddenly, in all seriousness, pulled out a Tarot deck at a party. At least she'd been studying arts, English to be precise (and Carl would hold it against the subject forever more!).

The police at the scene had investigated sufficiently to have thrown open the windows by the time Carl and WPC Thatcher had arrived and the atmosphere was now breathable. It had been decided that Carl would be confined to the desk and asked for a first opinion of the writings around the room. WPC Thatcher had then been dispatched back to the Institute to continue taking statements. He had overheard them say that she would pick up a computer expert from the police station to trawl through the hard-drive of Andreas' computer up at the Phi.

Carl supposed it was a good sign that they let him into the crime scene. Hopefully he was not a suspect in spite of finding the body. Perhaps they were allowing him to incriminate himself though? Still, they were going to discover he had little to contribute. What he had looked at so far was weird gibberish. There were some reprints of old books with names such as *Semita Recta* and *Novum Lumen Chymicum*. There were notes in Andreas' hand on the rough pads they used at the Phi. These scribbles seemed to be quotes and shorthand versions of paragraphs taken from old texts, although he couldn't find where

they'd been copied from. Flicking his eyes over them he noted words and phrases from "Zeus", to "sophistic transmutation" to "ferment until the rede". No, this was definitely not modern science.

There were also longer tracts on what appeared to be historic, aged paper although there was such a quantity of it that it must be more modern. Most of this seemed to be written in historic German with a quill. The initials I.N. occurred frequently but Carl's German was essentially none existent. Finally, most enigmatically, there was a small modern journal, again in Andreas' hand, full of paragraphs of apparently entirely random letters. Each paragraph was separated by a string of numbers.

An exclamation of discovery from one of the police officers in the next room distracted Carl and he peered round the door to see what was going on. The officer was kneeling by the cream painted fireplace an arm extended up the chimney flue. The other officer was moving over.

"Secret shelf into the back of the mantel," said the first officer concentrating on gently exploring with his fingers. "It seems pretty old... here we go... plastic bag of powder!"

"I'm buying the beers if it's smack, you if it's Charlie," proposed the second officer. The first withdrew his hand and displayed a small bag of white powder. "Oh bad luck you loose," grinned his partner. They suddenly became aware of Carl's horrified gaze and exchanged looks.

"You're supposed to be reading mate," instructed the officer with the drugs, "and you should bag this," he proposed to his partner.

## Chapter Five

Prof Roy Fields radiated an aura of smug, self certainty. He was large in the way that only Americans seem capable, overflowing the computer chair he'd wheeled to his desk in great rolls of fat. He spun the chair seat on its bearing gently back and forth, exhibiting a slight nervous tension. WPC Thatcher couldn't help but wonder at the dedicated eating regime that must be needed to maintain such a bulk. His face was a reddish circle punctuated by a thin black moustache and glinting brown eyes. He was in the middle of a small monologue, boominly presented in a West coast accent, on the dominance of theoretical thought in physics. She had triggered this by a question on Andreas' studies. Fields seemed to be enjoying the points he was making, ending every sentence with a self satisfied smile.

The gist appeared to be that he, and his community of string theorists, already knew most of the answers to the ultimate questions of science. Apparently his experimental colleagues would switch on their next machine and find a particle called the Higgs boson. This would then require a whole slew of particles somehow associated with a "super" symmetry. This too was only a prelude to the remarkable fact that particles were really tiny strings, although experimentalists had little chance of ever looking on small enough scales to prove this. Andreas had been working on a subtle twist that would render the stringy nature of particles manifest soon, although Prof Fields clearly felt this was a remote possibility. It did "encourage our experimental colleagues" he smirked. The WPC's gaze drifted across the view of the gardens through the first floor office window and concluded that she would not provide any encouragement to the other staff by hinting at her physics background.

Fields seemed uninterested in the fate of his dead staff member. He confirmed that he was essentially Andreas' boss but was at pains to stress that everyone at the Phi was an independent researcher. His interests had not particularly coincided with Andreas'. His knowledge appeared to end at Andreas' CV and he had gone home before events unfolded last night, a fact that was emphasised with his peculiar Cheshire cat grin.

The police woman moved on to interview Prof Caroline August who was the other permanent staff member in the wing where Andreas had worked. Fields, August and their employees constituted the string theory research group. August though was a very different character from Fields. She was very English – pale, skinny and a little drab. Her office was just so, no piles of journal articles here, just neatly filed rows of exercise books. The single book open on her desk was filled with neatly scribed equations punctuated by occasional sentences. August seemed fretful discussing Andreas, delicately chewing her lower lip, as if his death did not fit her carefully plotted life. She too seemed to have little to contribute to the WPC's report.

"We do so strongly encourage junior staff to develop their own ideas," she offered as explanation in a quiet, slightly breathy, but precise voice, "Andreas was more in Roy's camp in any case. I'm much more interested in the mathematical foundations of string theory, less the immediate physics consequences. I think recently though that he had

more interaction with Norman Clark and his postdocs over in phenomenology. Apart from over coffee, it's been 10 days since I spoke with Andreas on... well, curved spaces. The details are..." she let the sentence fade out apologetically. Her contribution to the WPC's notes faded away too. She had left at five the previous night and had no explanations to offer.

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Carl couldn't bring himself to be too surprised that Andreas had been into something harder than cigarettes. He would have guessed just cannabis but perhaps that was a sign of how disconnected from real youth culture he had always been. Carl defined himself by his thoughts when awake and alert not by what happened under the influence, so drugs were a peripheral part of his self image. These days though even Tory politicians seemed to be into cocaine. He supposed the hard drugs angle made an unintentional but self inflicted death a more likely scenario. It made you wonder if Andreas had ever been high while they'd talked physics – could Carl really not have noticed? He felt uncomfortably naïve, so returned to the content of the desk in front of him to find distraction.

The journal full of random strings of letters was presumably in code. Most likely it was a simple replacement code with each letter representing another. Carl tried listing the occurrence of each letter in a paragraph. There weren't really enough letters to even pick out the vowels. He could try on all the sections with the same numeric codes. Well none were precisely the same but it looked like the first two digits were the date – 05/07 and so forth. Then there was one of 2.2 or 3.3 and so on up to 9.9. That was presumably the key to the code. Carl puzzled over it but nothing inspired came to mind. If it was in German he might not even spot that he'd got it right.

Carl's mobile phone trilled in his pocket, the simplest "ring, ring" tone. Digging the thing out, he waved it at the policeman in the next room and made for the door. It was Sasha, his girlfriend up in Birmingham.

"Hi love, you're up then?" at the other end Sasha gave a big Bagpuss yawn.

"Barely. Lying in bed contemplating getting up." Images of unkept blond hair and teddy bear nightshirts momentarily replaced the stress of the last day. "Still, deserved rest after the construction of robo-toddler!"

"Huh?"

"Four year old kid was on a trampoline when twelve year old big brother landed on her. She had this amazing spiral fracture of the tibia. I've never seen an x-ray like it. Anyway we bolted her back together with a bunch of iron. She'll be off without even a plaster by the time I go back in." Sasha had entered the ghoulish world of medicine and seemed to gleefully cope every day with events that would have Carl in shock for weeks.

“Great. Well I’ve been doing mortal injury too.” Carl proceeded to give Sasha a blow by blow account of the last 24 hours’ events. He had walked out onto the Cathedral Green by this point and sat in the dappled sunlight under a tree just off the path down to the Cathedral’s main door.

“Poor thing. Are you sure you want to be reading his stuff – you could just ask the police to get on with it.” He could hear the worry in her voice.

“No, it makes me feel like I’m doing something about it, so it’s OK.” Across the path, sat on a bench, a man, who Carl judged to be in his twenties with a startling array of swirling black tattoos on his arms, caught his attention. The man was wearing mirrored sunglasses and holding up a copy of the Daily Star. It seemed to Carl, though the shades made it hard to be sure, that his attention was not on the scantily clad women in his paper but squarely on Carl himself. Probably it was just the angle the man was sat but even so Carl felt uncomfortable. He levered himself to his feet and with a scowl in the man’s direction, began to wander away down the path.

Sasha was offering up more verbal sympathy though quiet and physical contact were what they were both yearning for. Words down a phone never filled that hole. Long distance relationships were not satisfactory even if they had become unavoidable, reflected Carl - another animal versus intellect conflict. Sasha was offering to come down to Winchester though she’d have to check her schedule next time she was on shift.

“That would be great,” it would be a few days yet then. The inadequacy of the contact left Carl a little deflated so he switched the conversation to more factual matters, “You up to anything tonight?” Sasha let out a groan,

“Andy,” she offered up glumly. “He’s just been dumped by his latest woman, Kate was it?”

“Last I heard he was still with Jo wasn’t he? Oh maybe not, it’s hard to keep track.” Andy was an old university friend whose love life was about the most convoluted they had ever encountered.

“Well a Kate has dumped him and his ex by three, Gail, she’s the nurse in geriatrics, says we have to take him out and get him drunk. At least he’s always late so I’ll get a good natter in with Gail first. How about you, are you out with the physics crowd this evening?” Carl had totally forgotten, given events, that Wednesday night was when the postdocs at Phi hit the pubs.

“Oh yes, I suppose I’ll never be forgiven if I don’t fill them in on all the gory details. We can exchange stories of drunken revels tomorrow then sweetheart.” As they exchanged final farewells Carl realized he’d wandered down the back of the cathedral amongst the gravestones. Turning he started to walk back across to the crime scene noting in passing

that the man he'd spotted staring earlier was now gone. Perhaps his scowl had registered.

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Prof Norman Clark positively launched himself across his office to shake WPC Thatcher's hand. He was tall and lanky, a little ill coordinated and dressed in old shorts and a tee-shirt.

"All I've heard is gossip!" he declared. "What on earth is going on?" Before the WPC could answer he had distracted himself by tugging a mountain of paper off a small chair buried against the wall. He proffered the seat bodily to her. While she positioned it on the floor amidst a host of other piles of office detritus, he manoeuvred to his desk on which he sat, knees up against his chest. He regarded her pointedly, still awaiting an explanation.

"We are at a preliminary stage of enquiry, but we have no reason to suspect any sinister involvement as yet. There are a few oddities to events that we are investigating though." Clark's eyes were fixed on her intently and combined with his thin face and unshaven jaw she couldn't help thinking of a rat.

"You know this really is a tragedy. Andreas had such promise... potential. He could take that stuff Fields and company do," he flapped his hand in the direction of the String theory wing, "and make connections to those of us at the coal face. Terribly important. This is such a crucial time for our field. There are so many possibilities for what we may find. We need novel thinkers and to lose one..." he seemed genuinely fraught with frustration. Apparently Prof Fields version of a few loose ends in particle physics to be tied up was not held by Clark.

"You were working with Andreas frequently then?"

"Yes, almost daily. Oh, but not yesterday. I don't think he was here yesterday, well until.... I'd wanted to talk to him about a scattering cross section result. It is a tragedy!" Clark picked distractedly at the edge of his sock where it was riding down into his trainers.

"Was there any tension with Fields about him working with you? He was employed by a different group," The WPC probed. Clark snorted,

"I'm sure Fields was pleased we'd seen the light of his work." The WPC was picking up on a pecking order in the Institute with the more mathematical theorists lording it over those more closely connected to experiment. She was still drawing a blank for the investigation though and learnt little more in the next ten minutes. Clark had left early yesterday to play squash in town and only heard of events from Prof Trant that morning. Prof Trant had phoned in finding the body for Carl and was the next on her list.

Trant won the WPC's award for the best turned out Phi professor. He sported a neat grey suit, dark blue bow-tie and immaculate grey hair. The WPC had taken his statement briefly the previous night. He had seemed affable and in control of himself and she had taken quite a liking to him. His office on the ground floor was dominated by an array of large computers and a collection of office toys, including a rather large Newton's cradle. She rechecked his memories of the previous night and his responses were thoughtful and precise. He had been in late the previous evening because he was preparing a talk for a conference in Poland the following week. He had encountered Carl in a bit of state on his way back from the rest room and assumed responsibility.

The professor said he had only known Andreas by sight and through the two seminars he had given. When she asked, he declined to express an opinion on Andreas' work saying that it was outside his expertise. Computer simulations of the strong nuclear forces between quarks were his speciality. The WPC rather doubted that such an obviously astute man would not have come to some judgment of Andreas' work. Trant's comment that he preferred to work within the confines of experimentally verified phenomena though provided a strong hint of his views. The WPC completed her notes and thanked him for his time concluding that should the need arise she would prefer to raise any further issues with him than the other staff members.

The WPC's immediate task was complete. The final downstairs wing of the Phi building housed the Cosmology group. It transpired though that the entire group had upped sticks and moved for the summer to Aspen in Colorado where they were running a long workshop on their studies. Aspen - mountain retreat for film stars and apparently physicists? WPC Thatcher reflected on her last day long course in Modern Community Policing held in the greyness of Basingstoke up the M3, before concluding that her investigation was helpfully reduced by their absence. As the day had progressed and the Phi's staff had filtered in she had come to realize just how many junior staff and visiting fellows there were here in addition. She fervently hoped that the need would not arise to interview everyone in the building. Before heading back to her car the WPC checked in with the computer techy she had left in Andreas' office. He seemed to think the 10,000 e-mails stored in a mass of directories was counterbalanced by the joy of the machine boasting Unix rather than Windows as its operating system. It didn't look like she was going to get anything useful from him until at least the next day.

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Carl was beginning to wonder if he had been forgotten, when, just before five, the WPC came up into Andreas' flat.

"Has our intrepid translator unearthed anything for us then?" she asked.

"Well, this isn't modern physics, none of the stuff in here is our work. My best guess, to be honest, is that Andreas was forging historical documents on alchemy." Carl wondered if he really did conclude this or whether he was explaining away something less rational.

“I can imagine it might have entertained him to try and bluff historians.” That certainly matched with Andreas’ character so perhaps his explanation was right.

“OK. That’s an interesting angle. I wonder who he might have been talking to about it? Perhaps I should take a look on Ebay to see if he was selling.” Simplicity was entirely lacking in this case reflected the WPC. She sat down on a wooden stool and tried to collect together the days events.

“While I’ve got you here can I get some more physics explanations from you?” she asked.

“You can try,” grinned Carl.

“It’s really what I said this morning – I don’t understand what the Phi staff actually do. I know that particle physicists build huge great machines that accelerate particles to vast energies and then smash them together to use that energy to make new particles. Obviously there’s a lot of work in building those machines. But the Phi staff don’t do that right?” Carl nodded in agreement, “So then there are the lists of particles that have been found in this way. But what do theorists do? The list of particles can’t need that much maintenance!”

Carl looked thoughtful for a moment. It was after all a perfectly valid question. What did they all do?

“The simplest answer is that the theories of particle physics that say how the particles move and interact are very hard to compute with. You have to spend several years learning how to calculate what the outcome of even two electrons hitting each other is. Somebody has to work out the expected outcome of every imaginable process in an accelerator machine. So a lot of people are doing that. Actually that’s not what most of us are doing though.”

“The theories we work with contain some astonishingly beautiful mathematical relations and we spend a lot of time trying to uncover those. That often means we calculate things in theories that don’t directly describe nature. That can be versions of our theories but in different numbers of dimensions, or with different types of particles and so forth. We’re just trying to understand the underlying structure because that often leads you to new ways of enlarging the theories that might become important for future discoveries.” Carl regarded the policewoman to see how he was doing and in the hope of a prompt.

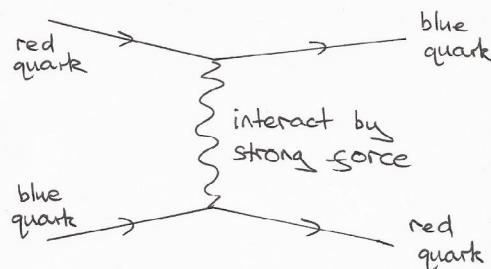
“Can you explain an example of one of these strange mathematical beauties?” she asked.

“Well the most important example is something called symmetry... a good example is that it turns out that there are three copies of every quark. They look completely identical but to remind us there are three copies we call them by colours – red, green and blue – not real colours just labels. Now we have to insist that our theory of these quarks gives

the same answer no matter which ones we call red, blue or green. There must be a symmetry, we must get the same answer if we, say, switch red and blue.”

“If they’re identical how do you know which one you’ve seen?” puzzled the policewoman.

“Ah that’s where the real fun is! It turns out the Universe has the same problem. In this room it might decide to call one quark type red but next door it might have made a different choice. Now when those quarks move and come together what happens to undo the confusion? Well the Universe has invented a force, the strong nuclear force, which the two quarks use to probe each others’ colour – they actually switch colours in the interaction – so they can reconcile the different choices made when they were apart.”



“Now the astonishing thing is that there’s only one way to make a theory like that and that’s the theory we have. The symmetry between the quarks determines the whole theory!” The WPC attempted to digest this idea but Carl was off on another track, “Once you’ve found a principle like that people try to construct the whole set of theories we have from a similar principle or set of them. That often only works if you include extra particles, so then they predict they will be seen in future experiments.”

“Oh and another fun game is to try to break theories! You can imagine calculating the results of experiments you can’t do – like unbelievably high energy scatterings for example. Gravity is one theory we know for sure doesn’t make sense at very high energy. So then you can try and fix the theory and guess the answer before it’s done.” It looked like he’d said enough from the WPC’s glazed expression. “So we just mathematically play in the space of all possible theories to see what we can find and what’s useful.”

“Right... it looks like you’ve been playing at something here judging by all those notes on the desk” she indicated the sheets Carl had been using to try to decipher the coded books. He briefed her on the diaries.

“Could I spend a little longer working on them? I feel like they shouldn’t be too hard to crack.”

“I don’t think I can let you take the book but you can copy the entries you’re interested in,” the policewoman offered. Carl set to copying some of the paragraphs marked 2.2 (it seemed as good a choice as any other) before heading for home.

## Chapter Six

The old grey plastic, standard police issue clock on the wall said 6pm when WPC Thatcher glanced up at it from her paper work. She'd be in trouble with her husband tonight. The preliminary autopsy report on Andreas had come in though and she wanted to give it a skip read before she left. Thankfully there was usually a one-sided summary to aid digestion of the rather technical full report. She dug it out of the manila leaf file and read.

*The subject had taken a small dose of cocaine before death indicated by blood levels and powder found in the nostrils. Mild intoxication would be expected.*

*The stomach was empty consistent with vomiting.*

They hadn't found his lunch at the site of the body or in the flat reflected the WPC. Thankfully it would probably be Stu who was sent to walk the route from the Green to the Phi in search of the evidence rather than her.

*Subject's shirt was soaked in saliva and gums grey with severe hemorrhaging. Teeth loose.*

Charming and weird she thought. The interpretation followed,

*First evidence of heavy metal poisoning. Proceeded to brain examination: outer brain engorged with blood and ventricles flooded. Consistent with mercury poisoning. Analysis of hair showed 200 ppm Hg – chronic poisoning. Mercury could have been breathed in as vapour or ingested as mercury salt (eg Hg(II) Cl<sub>2</sub>). Note: liquid mercury can not be ingested.*

*Subject would have been expected to display some of shakes, convulsive fits, or giddiness immediately after poisoning, although a wide spectrum of reaction strength possible. If long term poisoning, typical behavioral changes include lack of energy, unsteady gait, loss of memory, paranoia.*

Wow, so this alchemist had eaten his elixir of life! The WPC shook her head in amazement. A candidate for the Darwin awards for people who cleanse themselves from the gene pool? Time for home then, she decided, her sympathies evaporated.

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Access to the Royal Oak pub was down a narrow alley off Winchester's main shopping street. A 'ye olde' painted board at the mouth of the alley displayed the required regal deciduous and a claim to be the oldest pub in the country. Carl ducked into the passage

way and up the flight of stairs to enter. This was the usual Wednesday night drinking hole for the Phi postdocs.

A small gathering was already underway perched round a toadstool of a wooden table tucked up against a flashing electronic quiz machine. Carl noted there were the three hardcore of the group only tonight (well four including himself). Kay, wearing her customary denim jacket, was sat with her back to the window, hands grasping a pint glass. She exchanged waves with Carl as she saw him approach. Next to her on one side was the broad set Paulo in his fading, royal blue, Italian football shirt. He flicked his hand in recognition at Carl too, sending a small plume of smoke across the room from his cigarette. Judging by the grin on Paulo's face, he was involved in his favourite pursuit of goading the final member of the group Andre. Andre had his back to the door and was clearly vigorously arguing a point. From half way across the room Carl could see they were just embarking on the latest round of drinks so he veered off to the bar to catch up.

The seating areas were a collection of small rooms on various levels linked by wooden stairs. The oak beams and flooring at least hinted at the past unlike the chrome covered theme bars elsewhere in town. It was a quiet, midweek night and Carl barely had to wait to be served. He carried his pint glass across to the table where his colleagues were settled and manoeuvred a stool into place.

"Hi guys." Whatever they had been disputing when he arrived seemed to have been put aside. All three of them looked at him expectantly. Paulo, leant back against the game machine, blew a stream of smoke over his shoulder away from the table and with a grin got straight to the point,

"Tell all." Kay gave a small wince at the directness of the Italian but was clearly as eager to hear Carl's story as Paulo. Andre was more inscrutable. He was Dutch, tall, wore neat round wire glasses and had short cropped fair hair. He had that Germanic sense of self possession that always left Carl slightly unsure what the real Andre was thinking.

Carl had been trying to decide on his way to the pub how much he was allowed to make public of what he knew about the Andreas case. The police had not directly sworn him to secrecy. Had they just assumed it was obvious? Well, tough luck, they should have said, he decided! He gave a brief recap of what he knew to his friends; the finding of the body, Andreas' flat, drugs, alchemy books and codes. The atmosphere turned quite subdued and a little shocked. Everyone there knew Andreas well. Thankfully he'd barely ever come to these pub meets since he was always off on some other social call (or had he really been brewing potions at home Carl wondered?). It would be the events which Andreas had most participated in that would be hardest in the coming week or more.

The conversation's quiet but heart-felt platitudes could not damp Paulo's natural mischievous and provocative spirit for long though and he rather eagerly went for the heart of the conspiracy,

"What are all the police's theories then?"

“Number one is just natural causes I think,” Carl thought he should start down to earth, “heart attack or some such.”

“Nah too dull,” said Paulo, rubbing his unshaven jaw, “taken out by a drug dealer?”

“What in suburban Winchester?” scoffed Kay, “More likely drug induced natural causes.”

“If he was working with chemicals he might have poisoned himself,” suggested Andre.

“How about mugged for his alchemical treatise by a rabid collector?” Paulo was determined to think outside the box.

“Random mugging for cash perhaps..” proposed Kay.

“The police officer was asking about academic disputes,” said Carl. The rest of the group seemed not to have considered a murderer in Phi. “Anyone for Prof August with a knife in the garden?”

“Couldn’t have been Fields he’d never have been able to catch him,” Paulo was clearly scanning the Phi staff and assigning probabilities, “Heh Carl, was it you?” Kay spotted this was an upsetting line of enquiry for Carl, so interrupted,

“Enough! Keep that one to yourself Paulo. So anyway which are the police chasing the most?”

“I shouldn’t think they commit to a theory – that would harm the investigation,” Andre was considering the matter seriously, “They must just chase all the possible leads and see where they go,”

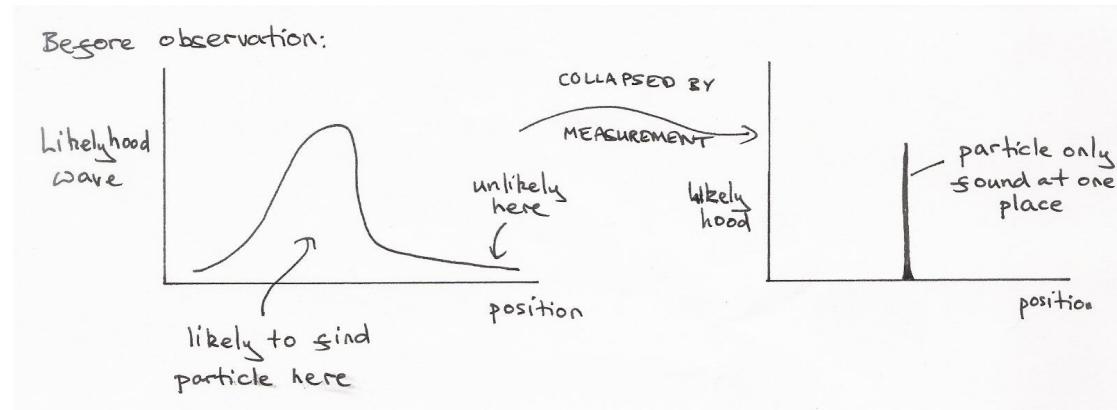
“Ah, all these explanations must be true in some part of the Universe’s wave function!” Paulo jumped in gleefully to Kay’s groan. Carl looked blankly round the group.

“Andre heard a radio show about quantum mechanics this morning,” explained Kay.

“Oh God, don’t tell me Melvyn Bragg or Andrew Marr were trying to prove they know science too.” Carl sunk his face theatrically into his hands. Andre was nodding confirmation. “Why do radio four presenters and New Scientist get so hung up on 1920s physics?” Carl bemoaned. “So what was the story?” Paulo sighed and gathered everyone’s glasses for a refill. He clearly wasn’t up for the repeat.

“They started with a guy from King’s College explaining that when travelling over very short lengths, such as the distance across an atom, particles don’t behave like billiard balls,” explained Andre. “Instead they’re described by a wave. The bigger the wave is somewhere the higher the chance that the particle will be found at that place. The

problem though is that if you have only one particle, the theory predicts the probability of various places it might end up. In practice though, it ends up in just a single place (of course). You have to do many copies of the experiment to see that the final outcome is random and described by the wave.”



“OK, so this is the usual wave function collapse discussion.” added Carl.

“Yes, but the physicist made a real hash of defending it because he insisted on using the Copenhagen interpretation that Bohr and Heisenberg proposed. Basically, he said that because quantum theory gets the answers right for the chance of the particle ending in different places, that the theory was the whole description. The outcome must be truly random and there’s no question to ask about how the particle chooses where to be in an individual experiment.”

“Well you can’t knock that view too hard. It is probably the favourite philosophy of working physicists and was as you say pioneered by the people who invented the theory!” Kay was showing signs of being a Copenhagenist. “The theory is also hugely successful describing all the properties of atoms; for example – if there was a hole in the theory it would show up somewhere in trying to do those sort of calculations.”

“But it makes no sense to forbid someone from asking the question how an individual particle decides where to end up. We don’t know the answer to that. And that’s what everyone else on the program said and frankly this guy was completely out-argued. He just kept repeating the same line and it didn’t win over anyone.” Andre pleaded.

Paulo returned with four pints and an array of packets of crisps which he opened and spread liberally over the table. He’d been thinking of new provocations while at the bar.

“You should listen more to Nature, Andre!” he plunged in. “Quantum theory works so quantum theory is right. If it says that many outcomes are possible for where a particle ends up, then there are many outcomes! In this case the right thing is the many worlds interpretation. The particle really ends up in every possible place and there are different Universes or bits of the quantum multi-verse (whatever you call it) in which each outcome happens. In each of those Universes there’s an Andre saying ‘why did it end up

there?" But really it didn't if you take all the Universes into account." Point made he set about lighting a new cigarette.

"It's just words though Paolo!" Kay thrusted back. Carl could see that Kay thought Andre was making serious points whilst she thought Paulo was just looking for an argument. Well, that was probably right.

"You haven't removed the collapse from probability to a particular outcome. You've just said that when it occurs you generate lots of parallel universes with different outcomes. If you then evolve those Universes forward, they pay no attention to the other Universes. In a truly quantum theory, in which the wave evolves, all possible past outcomes are taken into account to predict what will happen in the future. What happens in our future though depends only on the actual position of a particle, once we've measured it to be somewhere.

"Kay, I think I've won you into admitting there's something we don't understand because you're discussing the collapse which you shouldn't in the Copenhagen interpretation." Andre continued to be earnest about the issue. "I think we should just own up to there being something we don't have a theory of."

"But this has been really hugely explored." Kay was off again, "The obvious idea is that there are some hidden properties of particles that determine the outcome, and quantum theory somehow averages over your ignorance of those properties giving you chances of outcomes. But if you try to include those properties it's been proved you have to include something else insane. Information has to travel infinitely fast, faster than the speed of light, for example. So there is no acceptable resolution. Quantum mechanics must be the full answer. In any case this is a theory that gets the magnetic interactions of an electron correct to eleven significant figures – it's just correct! "

Andre looked morose and appealed to Carl instead,

"What do you think Carl?"

"I think I'm halfway between Kay and Paulo!"

"Sitting on the fence is not allowed," growled Paulo, this was one of his favourite English expressions.

"No, look the problem comes about when a person, a thing made of trillions of atoms, interacts with say an electron to ask where it is – that's a measurement. Now you should describe those trillions and one particles using quantum mechanics. But we can't because we don't have a big enough piece of paper to write it all on. So we don't really fully understand the problem in quantum mechanics. Lots of strange things happen when many particles interact like self awareness in human brains. I guess I think that if you could do that calculation in total you'd see how Paulo's view is basically right but that there is a good explanation for why different Universes don't mix after the measurement. It seems

like there's room within quantum theory to fix the problem. Since the theory gets everything so right, it must be all there is and so that must be the answer. Not much of a proof though." Andre shook his head giving up and headed for the toilet.

The conversation lapsed to allow some beer drinking.

## Chapter Seven

A late night dinner with Chief Inspector Bothridge of the Winchester police had been in Geoffrey Montford's diary for several weeks. They were supposed to be liaising over security for a street science festival. The previous day's events were foremost in their minds. Geoffrey cautioned himself against the thought that the meeting's timing was 'lucky'. He was also careful to let the Chief Inspector broach the issue first.

Bothridge was of a square build, with an expanse of chest that seemed designed for the display of medals. His light blue eyes had an appropriate steely character that must also have helped his rise in the ranks. Age was only reflected in his face through deepening jowls. When out of his regalia, on occasions such as this, he was a perfectly pleasant companion – sharp and intelligent but not bullying. He was quick to dive in to the matter on both their minds, only pausing to order a bottle of wine from the restaurant's waiter.

"The Phi was supposed to spiritually and intellectually enrich Winchester not provide us with sinister sounding stories for the news broadcasters wasn't it?" he began. Geoffrey winced in sympathy with the thought. The local television news reporter had tried his utmost to hint at dark goings on at the Phi though he had only had the bare facts of the case to report. Geoffrey was glad he had declined an interview.

"Your woman who spoke to me gave the impression the case was just an unfortunate accident. Has that changed?"

"No, no - drug overdose most likely. Not the image you want, I'm sure. But then it won't close you down, I suppose." The Chief Inspector's tone conveyed the impression the issue was not really a high priority and that they should move on. Geoffrey was happy to hear it. Presumably the Chief Inspector had felt he had to say something but their dinner was ill-timed from the investigation's view point. He thought he could risk a probe in the direction of his own interests,

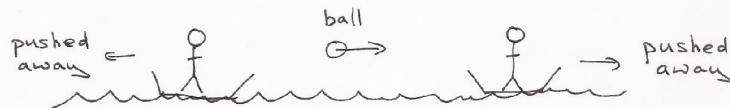
"There was an old bookmark, your officer told me. Manuscripts too?"

"Nothing worth getting excited about Geoffrey, I don't think," his eyes narrowed a little as if to say 'I've spotted your ways'. "My officer suspects there was some sort of hoax going on – a forgery or some such." Geoffrey carefully feigned disinterested surprise and muttered his ignorance. He'd better push no further he decided. In any case the waiter returned with the wine bottle and the ceremony of tasting and pouring naturally provided a break. After a few sips and a contented grunt Bothridge moved the conversation on,

"I think the Phi is making a very welcome impact Geoffrey. I even attended one of your public lectures myself. My son is doing physics A-level and seemed to get a lot out of it in any case. I became rather unstuck when the speaker started talking about forces being due to particle exchange." He scratched his eyebrow and developed a look of puzzlement. Geoffrey tried to hold up his side,

“Quantum theory always makes these matters seem peculiar,” he suggested. “When particles interact and exchange energy that energy must come in lumps or quanta – you can consider those as particles.” The Chief Inspector still looked unconvinced,

“He showed this video of two boats. A man in one threw a beach ball to the man in the other and the boats moved apart.” Geoffrey nodded pleased that the demonstration had been remembered somewhere. “So I can see repulsion, but what about attraction?”



“Ah yes, that’s awkward,” smiled Geoffrey. “In quantum theory all possible things can happen with some, often small, probability. One weird thing that can happen is that a particle that is moving from right to left can nevertheless end up further to the right! So in the analogy, the ball can give the boat that catches it motion back toward the first boat.”

“Well if you say so Geoffrey!”

“These sorts of weird things only happen rarely to elementary particles. As humans we are used to throwing balls made of many millions of atoms. The vast majority of the atoms behave as you expect and so therefore does the ball. The result is that our brains have evolved not knowing anything about such strangeness. That things can be so different from your expectations is part of the fun of studying these exotic parts of nature.”

“I hope your science festival will be a bit more well behaved,” Bothridge quipped and with that they got down to the business of the evening.

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Back in the Royal Oak, Paolo had been digesting the previous discussion of science on the radio and had come to one of his usual black conclusions,

“Rule is don’t get involved in popularising science.”

“That’s a bit harsh. We have to tell people what we’re doing if we want them to fund us,” said Carl.

“Yeah, but it’s all lies. The theories are all mathematics, yet we say all words. That’s why we get these nut cases writing to us sometimes with “new theories”. They’ve just read a popular science book and mistaken it for the core of science. They change some words and think they have a new theory. They don’t understand that you have to get the numbers right for every experiment you can think of. It’s just misleading.”

“Well, OK,” conceded Carl, “but you can make the point that you’re just reporting a simplification and that if people want the real thing, they’d need maths.” Everyone sought inspiration in their pints again.

“The closest I ever got to writing a book,” Carl mused, “was an idea for a science fiction thing. It was going to be an alternative history of the Earth where scientists had formed a society and didn’t share the technology with the uninitiated. They were going to be these super magicians amongst the serfs. It was all a rather unsubtle attempt to point out what a benevolent bunch we are, giving all our ideas away for free. Probably I was just feeling bitter about my pay packet at the time!”

“Oh God,” he continued, “and can you imagine – everyone you knew would think that they were one of the characters in the book. It would just be a pain!” Kay started giggling,

“You worry too much. I had this idea about rock stars being possessed by a God – Loki mostly likely. He’d pick them up and make them do amazing things. They’d become successful, then Loki would leave for the next up-and-coming guy. The old guys would then keep performing, thinking it had been their talent but just making fools of themselves. The ones Loki really liked he’d make commit suicide before he left so they remained great. The hero was going to be some sort of John Constantine-type who went round murdering rock stars to try to put an end to it all.” Kay started giggling again, “guess I was obsessed by a falling rock star in my teens, we won’t mention his name. Anyway I decided it would be better to hope Neil Gaiman picked up the idea through the ether because I’d rather read it than write it!”

“You ever thought of writing a book Andre?” asked Carl. Andre ruffled his brow.

“I was at the Trieste physics centre over in Italy a month back,” Andre began rather earnestly, “They’re a UNESCO centre who bring students to Trieste from around the third world to learn frontier physics. It’s a really striking atmosphere – there are Palestinians and Sudanese and Philippinos all studying away. These people have fought their way out of wars and famine to learn particle physics. It reminds you how lucky we are and how important what we do is to people all over the planet. Well anyway there was a guy from Somalia who had all these tales of hiding from militia and automatic machine gun fire every night. He has a story people should read.”

“OK you win,” Kay conceded, “gosh we are in a cheery mood this evening aren’t we?” Everyone round the table was reflecting on Andreas again.

“This was something else weird,” Carl had recalled the police’s questions about the heraldic crest, “Do any of you recognise this?” He split a beer mat in half and used a pen from his pocket to sketch the lion, roses and inverted V.

“That’s a relief, I thought that was going to be an equation,” joked Paolo, “what is it?”

“You tell me, the police asked.”

“I know,” said Kay and all eyes switched to her. “That is the Trinity College Cambridge crest. I had to walk under it daily when I was at Cambridge. What’s the relevance?”

“Beats me,” said Carl. A thought occurred, IN? “Was Newton at Trinity?”

“You bet.” Kay beamed as if boasting of a fellow sports team member. “Actually he didn’t speak much.” Her three colleagues looked at her startled and she started smirking at some private joke. “We tried to get him to do one of our undergrad problem sheets!” She enjoyed the blank looks that induced, “Nobody could touch this problem we’d been set, so we had this séance thing. Candles, all holding hands and someone read out extracts of the Principia. Didn’t work,” she grinned, “maybe we were laughing too much... I’d better get another round.”

Carl pondered the possibility that the IN in Andreas’ notes might indeed be Isaac Newton. Newton did dabble in alchemy but there hadn’t been any direct sign of his work in Andreas’ apartment. Could the police have found a book by him and not said?

Paolo and Andre had started discussing that week’s seminar speaker at Phi. Carl had forgotten than Ash Burnley, a famous American, who had pioneered many of the most popular models of particles that might be found in the future, was visiting on Friday. Apparently, Fields had declared that Andreas would want their work to go on, so the seminar was still going ahead. Well perhaps Andreas would have wanted that, or else for them all to get very drunk instead. Kay returned with a round of drinks and Carl inwardly dedicated his first sip to the latter possibility.

“I suppose all the Oxford, Imperial and Southampton academics will be down here,” interjected Kay into the conversation as she sat down, “I hope they don’t repeat that boring discussion of which of their universities lead in which league tables again. Ugh, dull.” Everyone round the table whole heartedly concurred and gave silent thanks for the benefits of the Phi Institute.

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WPC Thatcher’s husband emerged from the bathroom and clambered into bed next to her.

“Are you still working?” he demanded. His wife was peering intently at a brightly coloured leaflet.

“Sorry, love,” it’s just an ‘Introduction to Particle Physics’ handout I picked up from the front desk at the Phi. It was in my jacket pocket and I dumped it on the bedside table when I changed earlier. Put it in the bin!”

“Not worth the effort?” he scrunched the paper into a ball and hurled it across the room. It bounced off the rim of the wicker waste bin and disappeared behind a wardrobe.

“Stuff I already know – quarks and electrons and neutrinos,” she explained. “Actually it explained why the weak nuclear force is weak. Forces are the result of two particles exchanging another particle between them, apparently. Electric forces are due to the exchange of photons of light which are massless. Since  $E=mc^2$ , that means you don’t need any energy to make them and it’s easy to exchange them. The equivalent particles for the weak force are called the W and Z but they have a big mass. You have to use a lot of energy to make them so it’s less easy for particles to exchange them and that’s why the weak force is weak.” She received a blank stare from her partner.

“Are you going to pick that up and put it in the bin, Mike?” she asked sternly.

“Only in return for sexual favours,” he replied.

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Carl had finally bid farewell to his friends at the pub door around closing time and they had all trooped off in the directions of their homes. The sunshine of the day had ended in a warm night so Carl could wander back relaxed towards the part of town where he lived. The alcohol had left him pleasantly reflective and he idly retraced the evening’s conversations. He tried groggily to construct a more coherent interpretation of quantum mechanics. Ah well, generations of sober physicists had failed before him.

There was the usual dilemma of whether he should phone Sasha when he got back. She’d been going out tonight too he recalled. Half past eleven was an awkward time because she could still be out with her friends in Birmingham or she might be back and in bed. Probably best to wait until the next day Carl concluded.

The sound of someone scuffing their shoe on the pavement echoed down the street from behind Carl. He casually looked back over his shoulder expecting to see a fellow carouser heading for home. Adrenaline immediately began to charge around his veins though; there behind him was the man he had seen that afternoon on the Green, the man with the swirling tattoos all over his arms. The mirror shades were gone but his eyes still seemed to glare with menace. Carl’s drunken mind immediately leapt to the conclusion he was about to be attacked by this fearsome brute. As the previous day, his natural reaction to threat was to run.

Carl pounded off down the street, barely thinking at all, until he had fumbled his key into the lock of the main door of his apartment building. Relief flooded through him as he heard the lock reconnect with him inside. Sweat was pouring off him and he was barely able to do more than breathe. Finally he gathered himself enough to look outside for his pursuer. The man was walking still, now some way back down the street, acting oblivious to Carl. Those dark eyes must surely have seen where he had run though. Mentally Carl congratulated himself on so blatantly revealing where he lived. Great, he reflected.

As Carl climbed the stairs he was planning on calling the police in the hope they would send protection. When he tried to construct what he would say though, his confidence began to flag. He was a little drunk, he had simply seen the man twice in a day, and he had done nothing suspicious on either occasion. Yeah, great, protect me now! He crashed instead on to his bed for the night.

## Chapter Eight

Come Thursday morning Carl was still mulling over his encounter of the night before, even as he walked to work. He had taken to thinking of the man who had followed him as the 'Tattooed Man' with mental capital letters. Carl remained unsure precisely of what he could accuse the man. He was pulled from this reverie as he stepped through the Phi's main door. Geoffrey Montford was just inside to intercept him.

Geoffrey had heard from the secretaries that the police had whisked Carl away into town the previous day and was eager to hear from a new source of information. Sat at his desk he had been able to watch Carl traverse the driveway, timing the moment to appear on the stairs, as if coincidentally, to perfection.

"Carl, how are you doing?" he asked, then lamented, "It's a terrible thing." Carl's boss was emitting his usual aura of bonhomie reserved for the junior staff. Carl was always left with the disagreeable feeling that he was a slightly pampered pet. Still here was the source of his salary. Before Carl could conjure a response though his boss was on to his next question,

"Have the police made progress, do you know?"

Carl was somewhat surprised by the question since he had assumed the police would have briefed him. After his Tattooed Man conspiracies he had become a little wary. Then again, perhaps Montford should be expected to be rather keen for all the information he could gather, with the reputation of the Institute at stake. Carl provided a summary of what he had done the previous day though he made it general. He kept to himself details of the code and his speculations on forgery. Was he suspicious of Montford still or jealous of his own intellectual game? Montford opened his eyes wide at mention of alchemy and muttered "goodness" at appropriate points.

"He was studying historical books then?" mused Montford.

"Well copies of them." Carl wondered about the man's motives anew. Was he being probed on that point? Perhaps though, he was too wrapped up in a growing conspiracy theory of his own about a book by Newton. Montford seemed satisfied though and let him go with a request that Carl speak directly to him if anything disturbing came up or in any case if Carl felt he needed a period of leave. Carl headed on to his office wondering whether his quick response to decline a few days off had been the right one. The traditional stiff upper lip lived on and Carl's instinct was always to deny the need for a fuss.

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On the floor above, WPC Thatcher was sat on a desk corner in the office that had belonged to Andreas Born. The police computer geek was swinging smugly in the office

chair while she read the print out he had given her. He had highlighted several sentences in fluorescent yellow. First an e-mail from Norman Clarke to Andreas from six days ago:

*Your latest paper's introduction of a mini-hierarchy in an electroweak symmetry breaking model without reference to my own work on the Higgs is simply scandalous. I demand an immediate re-write of the appropriate sections with a clear statement of first authorship.*

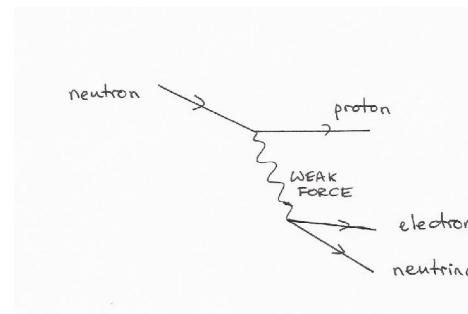
Then within Andreas' response

*Your claim to first authorship is preposterous not least because the introduction of a mini-hierarchy is both trivial and unavoidable to anyone with half a brain considering the problem. I don't doubt untold authors had considered the possibility and barely registered that it was worth recording. I have no intention of succumbing to your bullying tactics.*

The WPC sighed within. After reading the preliminary forensic report the previous night, she thought the case looked like it would wrap itself up as misadventure, leading to self poisoning. It seemed very likely that this correspondence was a distraction. She would have to follow up what was clearly a heated dispute though. So, she wondered, what on Earth did the first sentence Clarke had written actually mean? She tried to smile with good grace as she thanked her fellow officer and headed off in search of her preferred expert, Carl. It seemed a little late to worry about burdening him with so much of the investigative process.

“Can you briefly explain to me what an ‘electroweak symmetry breaking model’ is?” she asked once seated with Carl. He looked amused and appeared to consider for a while whether he could. He felt a little sympathy for the WPC – if she was really going to try to understand the work of everyone at Phi she might end up with a PhD!

“Well electroweak models are descriptions of the electric and magnetic forces but also the weak nuclear force. That’s the force that is responsible for radioactive decay.” The WPC nodded.



“Why models and not theory?”

“Because we don’t know the full answer yet. There are lots of ideas for what will turn out to be right, although they are all related to something called the Higgs mechanism.” The

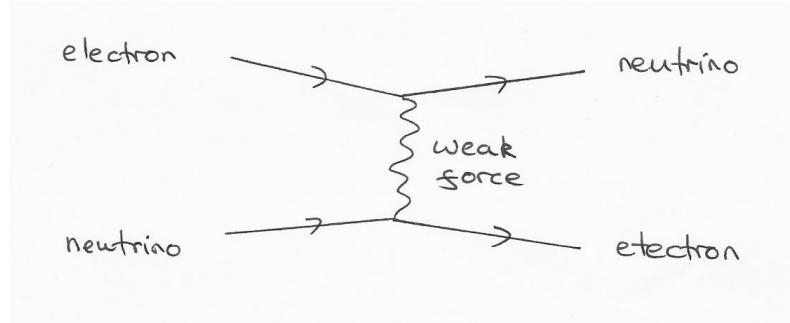
WPC mentally noted that 'Higgs' was another word she needed to pick up on and it was promising to have encountered it so soon, she hoped. "So, remember we talked about there being three copies of each quark and that the requirement that there was a symmetry between them generated the strong nuclear force?" Carl hoped something had stuck from the day before.

"Yes, I got the gist." Carl smiled, a happy teacher,

"In the theory of the weak force the electron and the neutrino are treated as two identical copies of the same particle (as opposed to the three colours of quarks in the theory of the strong nuclear force). The symmetry between these two particles generates the weak force interactions."

"Wait, how can that be? The electron has electric charge, so gets tied up in atoms, while neutrinos don't interact at all and disappear off into the blue yonder, don't they?"

"Ah yes! So that's why the symmetry is broken. We need to explain that. But first let me assure you that the idea works. Assuming the electron and neutrino are the same does generate a theory of the weak force. It explains why electrons can change by the weak force into neutrinos since it's an example of two identical particles probing each other to determine each other's type. And it works – remarkably well – at an experiment called the Large Electron Positron collider the weak force properties of the electron have been studied to huge accuracy. This theory correctly predicts all the weak force properties to around one tenth of a percent accuracy. It is just right."



"OK, I believe it works!" the WPC would allow herself to be bullied!

"So then why are electrons and neutrinos not identical? Well the idea, roughly, is that there are two possible states the Universe could be in. In one, the electron is bound in atoms and so forth whilst in the other, the two particles switch roles and the neutrino would look like the electron. So there is a symmetry between electrons and neutrinos, but it would only become clear if you had enough energy to switch the whole Universe from one state to the other. That's an unimaginable amount of energy incidentally, so don't worry about it ever happening."

"So what is the role of this Higgs thing?"

“The Higgs particle is the root cause of the symmetry breaking. The electron and neutrino are different only indirectly as a result of their interactions with the Higgs, which is where the real action is happening.” Carl paused before re-embarking on his explanation,

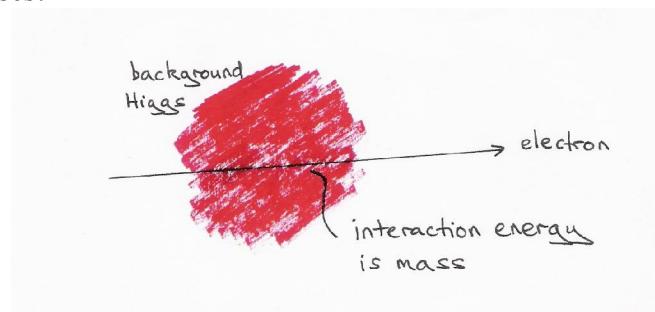
“So, we assume this particle exists, called the Higgs boson, and since it experiences the weak force, there must be two identical copies of it. Now, for some reason we only speculate on, the Universe likes to fill empty space with these particles. It can either fill space with one type of the particle or the identical other particle. Which one it chooses is random but that choice breaks the symmetry.”

“Why should space fill up with this stuff?”

“Well, presumably that’s just the lowest energy configuration so the one the Universe opts for. We don’t conclusively have a theory of all this yet, so I won’t offer an explanation as to why.”

“Well, OK but where is this stuff?”

“Everywhere! You have to remember this is a quantum theory. These particles actually have an equal probability of being everywhere. That makes it hard to see them because they’re just the background state of empty space. The reason we know they are there is that other particles passing through them, which interact by the weak force, get some energy as a result of the interaction. Energy is just mass and this stuff therefore creates all the particles’ masses!”



“But you don’t know this is true?”

“Well to see the Higgs in a detector you need to pump enough energy into some region of space to disturb the background. We haven’t made a powerful enough machine yet to do that so we can’t be certain. The theoretical understanding of this mechanism is pretty good though, so most people would bet on some variant of it being there in nature.”

“OK that’s enough for one session!” declared the WPC. “No wait,” she interrupted herself, “why do you need this new Higgs particle at all? Why not just fill space with electrons to make them directly different from the neutrino?”

“Electrons spin,” Carl responded, “Actually so do all the particles we’ve found so far. They’re like little spinning tops, rotating about some axis. If you filled space with those, then things would look different in the direction of the axis of rotation than in the

directions in the plane they are rotating. You'd weigh different amounts depending on which direction you move, for example! So that's no good. You need a new sort of matter that doesn't spin and hence doesn't pick out a direction in space. Hence the Higgs."

Invoking a new sort of matter, never seen before, seemed pretty radical to the WPC. She needed to digest the explanation. She also couldn't bring herself to raise the issue of "little hierarchies" that had been the centre of the e-mail dispute. She would try her new found knowledge out on Clarke and see if she survived. After she had excused herself, Carl was left wondering where her investigation could possibly be leading.

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By late morning the sunlight was particularly glaring and Carl's office was already heating up fast. He was sat at his desk idly picking over the encoded entries in Andreas' diary. He had no clear idea how to attack the code so was half heartedly flitting from one possible code to another. Mathematical problems were like this, you had to spend a good deal of time getting the feel of the problem before you could really move forward. It was like getting your eye in on the colours of a picture before you could link pieces together in a difficult jigsaw.

Outside Carl's window, which looked off to one side of the Phi building, was an area of rhododendron bushes which marked the edge of the grounds. A small strip of lawn provided a walk way to the back of the Institute. The view brought to mind the sunny mornings like this when Carl had seen Andreas meandering past the building. Walking quietly really did seem to aid the mental digestion of problems, so many of the staff could be seen from time to time ambling around in the grounds. Andreas always used to head down the side of the main building and then disappear along the edge of the lake which Carl could just see one end of from his window. In retrospect, that was an odd route to take because the back of the lake was a reed bed and he wouldn't have been able to loop round. So what path did he follow since he didn't used to come back the same way?

Carl had been looking for an excuse to leave off his unproductive decoding and decided, in the spirit of enlightened enquiry he assured himself, to try to reconstruct Andreas' path. It really was quite hot outside so he kept as much as possible to the shade under the trees. The track along the lakeside was a sparse affair, half animal track, and clearly not often travelled. Carl glanced back and could see a number of groups of his colleagues sat out on the patio at the back of the Institute talking physics and enjoying the gardens. Shortly though he was entering the reed bed. The view back to the Phi was lost and the ground underfoot became damp and even slightly submerged in places. Progress was a little slow but it was at least cooler here.

The track soon petered out at the back corner of the lake. The Phi grounds were not so huge and here you could see where it backed onto other palatial homes. To the back of the lake was a brick wall that delineated the property to the rear. To the left was a large drooping bush that marked the back corner. Where to now then, Andreas? The only option seemed to be to duck under the bush's branches into a dark cavernous hollow

around its trunk. The change in the light, with the sun almost completely blocked by the dense foliage above, provided an almost magical transition. Carl was feeling rather like an exploring child. Now there was a thinner patch of greenery out the other side, as if indeed children frequently used this as a den.

Stepping out from under the branches left Carl dazzled by the return from the Stygian gloom. He blinked a little trying to see where he was - in the corner of a lawn of a large garden. Ah! This was Geoffrey Montford's house, Carl realized. The Phi's owner had chosen to build his sprawling mansion on the hillside next to his Institute. Carl had been here before at Christmas when Montford had invited the whole Institute for a soiree. The house was enormous, with lounges, libraries, and even a cinema. Behind the house was a large swimming pool and several terraces.

Carl's visual exploration was suddenly brought up short by the realization that there was a woman lying on a deck chair up by the pool. He suddenly felt a little embarrassed. What was he doing randomly trespassing into someone else's garden? This can't have been where Andreas came. But then where else could he have gone? The woman was at least fifty yards away but she must have seen him standing there. Should he just duck back the way he'd come? Perhaps it would be politer to explain why he was here and apologise. Well at least that way he could ask if the woman had seen Andreas pass through. It would have been just like him to have befriended the neighbours and be tromping through the whole locale on his walks.

The woman reclining on the sturdy wooden deck chair was wearing only a flimsy yellow bikini and a pair of dark sun glasses. Carl recognised her as Geoffrey Montford's wife although he couldn't remember her name. He had seen her at a distance a few times before and been astonished by her glamour. She was American and possessed that US sitcom, Hollywood beauty that seemed completely detached from the reality of women Carl had ever met. In public, her blond hair waved and glowed with a multitude of tints, she wore a perfect variety of delicate touches of make up and her dresses were always flowing and mysteriously supported. She appeared to be the perfect example of a trophy wife. Carl started to feel a little uncertain of himself as he walked towards her; it was like being in a movie but wondering what your script would say. It didn't help that she appeared entirely unconcerned by his presence, although she did sit up and start rubbing suntan oil onto her legs whilst looking in his direction. He hoped she wouldn't be too irate about his intrusion.

As he approached closer he could see that the woman (what was her first name again?) was beautiful even without make up. She had a long nose, high cheek bones and unblemished skin. Her suntan was deep and unbroken, although by now Carl was trying hard to concentrate on her face rather than letting his eyes wander elsewhere. It seemed to take an age for him to walk across the lawn and then the patio to get within talking distance. She must be in her mid-thirties Carl decided. The woman seemed relaxed to await his arrival and took a large mouthful of drink from a shot glass on the table beside her. There was also a half full bottle of gin and a bucket of ice carefully to hand.

“Ah, erm, excuse me Mrs Montford for intruding,” Carl finally blurted out a little too fast on arriving close enough. “It’s silly really. I’m from the Phi incidentally. I was trying to work out where one of our staff, Andreas, used to walk... and ended up here. He’s dead... you might have heard.” James Bond would have done better, no doubt.

The woman regarded him for a short period that left Carl growing increasingly awkward. “Carl, isn’t it?” she queried in a quiet but assured voice, with a distinct west coast US accent. Carl nodded amazed. Why on Earth would she know his name? Perhaps he had been introduced at the party. And he still couldn’t remember her name! “I thought the police might come asking questions but why you?” she continued.

“I don’t know really. Well the police got me to look through some of his stuff to tell them whether it was work. So I’ve just been thinking about it all I suppose. I realized I knew he came up here and wondered.” Carl offered. He was struggling to find a place to centre his gaze, not feeling confident enough to keep his eyes on hers and struggling to keep them off her lithe frame.

“Right,” she sighed as if having decided to undertake something unpleasant, “you want to know about Andreas.” She sat up and grabbed the suntan oil bottle before tossing it across to Carl. “Make yourself useful then.” She then proceeded to take another large swig from her gin glass and rolled over onto her front. Carl stared at the bottle of oil and then her ill covered and petite bottom in equal confusion. Her face was now away from the sun so she tossed her sunglasses over the back of the lounger to the ground. Her eyes were reddened and a little puffy from crying. Carl was wondering what on earth he had stumbled into.

“Andreas used to come up here and we’d fuck!” she declared abruptly. She was staring at him angrily, tears starting to run, daring him to express an opinion. She glared at the bottle in his hands and as a clear challenge reached round and undid her bra strap. The strap had only been a string but its absence across her back made the act all the more intimate. Carl was mentally reeling, so did as he was told and started to apply the oil. He thought he ought to be finding a way out of this, not further in.

“You think I’m a bitch,” she almost spat out, “but you’ve no idea what it’s like with Geoffrey away at his bloody physics institute all the time,” Carl was trying to keep his hands in the middle of her small back. Was she seducing him or was he taking advantage or neither? Carl certainly didn’t know. He was outside his usual world. “He spends all his evenings with his damned Historical Society too,” she continued apparently unaware of his mental struggles, “And why Winchester? He could have built his stupid folly anywhere in the world. Why pick boring, cold, wet, grey, middle of the countryside, England?” This description seemed a little harsh on the glorious summer day around them. She seemed to wilt a little under his hands as the anger subsided. She turned her tearful eyes on Carl and continued,

“Andreas just came by and we talked and it happened. He was nice, and it was a way of spiting Geoffrey and...” she looked a little lost, “It just made me happy. Now I don’t

even have that. I don't know why Andreas is dead, I don't know anything." Carl couldn't begin to think what to say to this beautiful, distraught stranger.

Then, a little bit of defiance returning, she turned towards him, "You do just think I'm a bitch don't you?" The movement seemed entirely natural, to match what she was going to say, and even later he couldn't bring himself to think it was deliberately provocative. There she was though, naked, her breast against his arm, tear streaked face looking imploringly at him just inches from his face. Thinking back later he thought he might just have said, "no" before they moved together.

Their coupling was fast and furious, animal passion, and wilfully thoughtless. They grasped each other's sun baked flesh, their mouths devoured lips, shoulders and breasts until accommodatingly they arched against each other for release.

Carl lay panting over the woman's stretched out form, slowly realizing just what they had done. Mrs Montford (Geoffrey Montford's wife!) seemed a little dazed too. She briefly studied his face then brushed her lips on his cheek and closed her eyes, her forehead against his. Another pause, but now Carl could feel the wind across his naked buttocks and began to realize just where he was; this was not private. It was a miracle the deck chair was still standing come to that! He eased himself to standing and reached for his clothes thrown aside in the tumult.

Mrs Montford peeped out at him from between her eye lashes then languidly stretched into a more comfortable position to rest. There did not seem to be much regret on her side. Carl still felt immensely exposed so struggled into pants, trousers and shirt.

"You look like you're leaving me," Mrs Montford said teasingly. She seemed to be at ease with seduction although there was still no air of planning. Carl waved his hands out towards the lawn and house,

"It's not the best place.." he excused. She smiled,

"OK," she paused. "If you want to tell the police about Andreas... well you should, don't worry." Carl didn't suppose that he would now. Was she playing him? His uncertainty must have shown because with a hint of tears again she added, "and if you want to come again, well it would be nice, really."

Carl leant in and kissed her – a faint smell of suntan oil and gin. She lay back and closed her eyes. Time to go. Carl took in a final vision of rounded breasts before turning and heading back down the lawn.

As Carl passed under the overhanging leaves and into the darkness amongst the bushes on the edge of the Phi grounds, it was like leaving some dreamland. Were his memories reality? Already he realized that the events were slipping away. Sex is instinctive and does not lend itself to graphic recall. Had he compromised his relations with Sasha then for a few blurred half memories of flesh and sun? Right then, he didn't think so. The

passion had been natural and so divorced from his true feelings that it all seemed outside his normal life. He felt empowered still by the adrenaline and endorphin rushes. To have been one of two adults choosing this mutual form of pleasure seemed an extra step forward in life, another adult initiation passed through. Surely the encounter could lie forevermore in the dreams it felt like it had come from.

## Chapter Nine

WPC Thatcher finally tracked down Norman Clarke shortly before lunch. He was busily scribbling on a white board in the coffee lounge stopping occasionally for a mouthful of peanuts from a bag he held in one hand. The nuts did not help the policewoman dismiss her caricature of him as a rodent. When she interrupted his thoughts, he tossed the pen aside and collapsed onto a chair looking expectant.

“I’m afraid I’m going to have to pry into your affairs somewhat,” she tried to prepare him a little. She was also interested to see if he was expecting the conversation. He looked most surprised, so she continued. “I believe you were involved in a dispute with Andreas last week?” she pressed. He looked totally bemused then suddenly, the penny dropped.

“Oh goodness, about the citations?” the implications of her questions began to dawn on him and slightly panicked he continued, “But that was just a minor thing, robust defence of one’s work, nothing personal.” He looked a little pleadingly at her before deciding he was going to have to do better. “We had been discussing his latest paper and we talked about how my work overlapped. Then he didn’t reference me so I was irritated. But we thrashed it out and he was right that it was a little issue, not a thing of Nobel’s at all. Well we let it drop.” He seemed honest in his reaction but the WPC thought she might try to keep him on the back foot a little longer.

“It was an issue in an electroweak symmetry breaking model? That’s a Higgs model isn’t it?” She was pleased to see a look of utter surprise on the man’s face. “Can you give me a little detail?” she asked.

“Ah.. well..” flummoxed was a good word for it the WPC thought amused. “The problem with the Higgs is that quantum effects just keep on increasing its mass. Do you know that particles don’t obey everyday laws of physics because they can borrow a little energy for short periods of time in quantum theory?” he didn’t look convinced that she did, but she nodded as she vaguely remembered the Uncertainty Principle that he was referring to as one explanation of the weird behaviour of sub-atomic particles. In any case she was not about to give up her bluff now.

“Well the Higgs will borrow as much energy as is going and make itself very massive. It’s a problem because the Higgs then gives mass to everything else and if it’s too massive then everything else becomes so as well.” He was warming to his subject now. “So there must be some reason that it can’t borrow too much energy. Most likely that means that the theory must be changed into something different so that the computations stop the Higgs’ mass growth. It’s exciting because it means there must be lots of new particles to find in addition to the Higgs. There are lots of possibilities...” he paused as if contemplating listing the options.

“Anyway...” he had decided against and picked up a different line of thought, “the Hierarchy Problem is the problem that if you don’t have the new physics until very high energies then the only way for the Higgs to be much lighter than the new stuff is if there

are two bits of the computation which by chance cancel - very unnatural thing, not likely at all. The point is though it might happen a bit, I'd say. You know, it's a coincidence that the moon looks roughly the same size as the sun to us here on Earth so we get to see nice solar eclipses – that's two numbers accidentally turning out the same. So I commented years back that the extra particles beyond the Higgs might be a bit heavier than the Higgs, maybe ten times as heavy so two numbers around ten might cancel against each other to give one-ish. Well Andreas had a similar thing in a very different set up and I pointed out the link.. he said it was obvious." Clarke shrugged and looked thoughtful.

The WPC reckoned that she had conquered understanding the e-mail but it seemed unlikely Clarke had been so overcome by rage on the issue that he had become a heavy metal poisoner! Well she'd bear the remote possibility in mind.

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The accounts of the Winchester Historical Society were kept in bizarrely large tomes made of real vellum and encased in leather covers. Geoffrey Montford considered it excessively pompous and expensive. He said so.

The other man at the large baize-covered table looked up and regarded him uncomprehendingly through circular wire glasses.

"It's traditional, Geoffrey," was his offered explanation. Montford suppressed his slight distaste for the small man across from him. In a voluntary society like this you had to work with whoever was willing. In any case, he wryly reflected, Cyril Hayhurst fitted the society's tone better than Geoffrey's more modern perspective on history. The oak panelled walls of this office with their adornments of nineteenth century oil landscapes, were a piece of pure Victoriana. Geoffrey still hoped to introduce the members to new tools of study from magnetic resonance to gas chromatography.

"So, Geoffrey, the police have failed to find this work by Newton?" Cyril asked with the usual slight whine in his voice.

"They don't think it exists. Andreas was forging documents – it looks like it was all a fake." Montford had explained this before.

"No, I don't believe it. There was the bookmark."

"We don't know that was authentic either." There was a pause in which Cyril tapped five times at the base of a long column of numbers with his fore finger, before entering the total at the base. He was remarkably fast at addition.

"Well, I'll keep an eye on developments," he concluded.

Montford just shrugged and returned to his work.

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Carl had finally located a web page with a news item about the Phi that named Geoffrey Montford's wife. Georgina. Somehow the name seemed as alien as the morning's memories. Suddenly Carl became aware of someone at his office door and scuttled round quickly in his chair as if caught looking at something far more incriminating. Standing at the door was a gawky young man holding a coke can; Carl didn't recognise him from the staff.

"You, Carl Williams?" he asked, like he was a bored postman. When Carl nodded he thrust a battered piece of handwritten paper across the room, "I'm with the police computer team. We found this in the guy's waste bin. Louise," he paused, "WPC Thatcher said you were doing a code – this looks like it'll help."

"Right, thanks," Carl took the paper and the man slunk off taking a gulp from his can.

Georgina! Louise! Everyone was suddenly acquiring real names.

The writing on the piece of paper was clearly Andreas' and the page had been screwed up before being cast away. He smoothed it out a little. The police must have impounded Andreas' waste bin or this would have been long gone to the early morning cleaners. The top of the page was marked 3.3 and there were three handwritten five by five square grids of letters

A B C D E	U V W X Y	W X Y U V
F G H I J	A B C D E	C D E A B
K L M N O	-> F G H I J	-> H I J F G
P Q R S T	K L M N O	M N O K L
U V W X Y	P Q R S T	R S T P Q

Fascinating. A straight letter substitution from one block to the other Carl supposed. Z probably went along for the ride. Why does 3.3 mean shifting down by one row and then across by three? He couldn't see a link. A shift by five would leave the matrix the same, so it might be shift once down and eight across. Presumably the middle line was an intermediate working step and one just used the letters in the final block to represent the equivalent ones in the first. Well maybe. Of course he'd copied down the 2.2 blocks so he couldn't try it out. He'd need to see the 3.3 entries again to see if he could decipher those. Still, this was real progress. Today had thrown up all sorts of interesting successes.

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WPC Thatcher, for completeness, had set herself the task of finding out what Born had been working on. Her quest had led her to talk to Paolo, the Italian postdoc, in the office next to the one Andreas had occupied. Paolo was wearing a black and white striped Juventus shirt. When she had entered he had been leaning out of the window smoking a cigarette. He didn't appear in the least bothered about being found so close to violating

the no smoking status of the Institute, and in fact, tossed the cigarette butt out of the window before closing it and turning to speak to her.

The WPC put her query to the Italian who started at once on a rambling discussion of a variant of the Higgs mechanism. She was distracted enough by the recurrence of the subject to interrupt her own line of thought.

“Why are you all so convinced that this Higgs is real? Surely there must be other possibilities?” she interjected. Paolo came to a halt and considered. He grinned and replied,

“No, no other possibility.” His pause seemed deliberately provocative, so she just shrugged and was about to try to find a new foothold in his previous discourse when he continued, “we’ve found three quarters of it already.”

“How can you find three quarters of a particle?” she wondered, perplexed.

“Not one, four. It feels the weak force so there are two weak charges,” he was going on but the WPC leapt in to try to keep a grip,

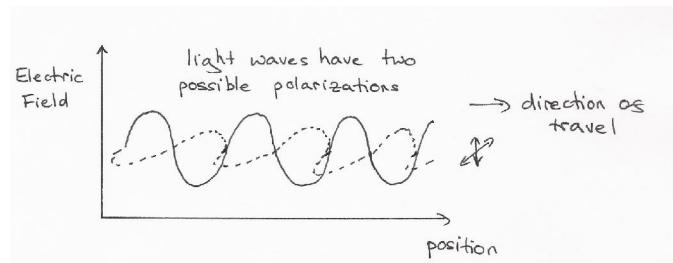
“You mean the two identical copies of the particle?”

“Uh huh,” the big Italian seemed willing to accept that. “Then there are their anti-particles too. Makes four.” Obviously, his expression added.

“And we’ve already found three of these?” the WPC couldn’t square this with the list of particles she’d met. Paolo frowned as if he didn’t really want to be going down this route.

“Do you know about the polarization of light?” he asked apparently at a tangent.

“Um, I think,” the WPC tried to drag up her old studies which seemed rather remote suddenly. “Light is a wave of electric field made by a charged particle oscillating? The wave can oscillate either up and down or side to side and those are the two polarizations.” Suddenly she remembered how this all connected to real life. “Oh yes, and light bouncing off water or a street or whatever tends to be polarized because the electrons in the material that emit the light naturally oscillate along the direction of the material’s surface. That’s why sunglasses are made to cut out one polarization to cut down the glare!” There’s something left in those old grey cells after all she thought. Paolo didn’t seem very impressed though.



“So why can’t it oscillate in the direction of motion of the light?” he asked smugly. She didn’t have an answer so he explained, “because light travels at the maximum speed possible so nothing in it can oscillate ahead of the light because it would have to go faster than light. A wave that travels slower always has the possibility of that extra oscillation” The WPC mouthed an ‘oh’.

“Anyway, the energy in light in a quantum theory comes in lumps, particles called photons, although you should really be talking about two different sorts of photon, lumps of energy associated with each polarization.” He didn’t appear very happy with the discussion. The WPC presumed he was desperate to write down an equation since he kept glancing at the ones spread out on the desk. “So, back to the weak force. It has three particles like the photon called the W plus, W minus and Z zero. They get a mass from the symmetry breaking.” His explanation was speeding up again but the WPC thought she was just about still holding on. The whole point of filling the vacuum with this Higgs had been to give weak charged particles masses she recalled.

“The massive W and Z particles don’t travel at the speed of light,” Paolo continued, “so can have three directions of oscillation. That means there’s effectively an extra particle because you can put energy into that polarization rather than just the two polarizations of a massless photon. So finding the three particles, W plus, W minus and Z zero with mass means each has an extra particle. Those are three of the four bits of the Higgs, yes?”

“Really?”

“Yes, yes, it’s very clever. So having found three parts with all the right properties to be the Higgs, there really has to be a fourth particle. It might have extra friends or decay so fast you can’t really see it but something like it must be there.” Paolo suddenly looked to the door as if relief forces had arrived. Carl was leaning in looking to interrupt.

“She’s all yours Carl,” Paolo said rather quickly, “I need coffee.” And he rapidly slipped past them both and headed off down the hall. The WPC was clearly going to have to find another source to discover what Andreas had been doing.

“Are you terrorizing Paolo?” asked Carl amused at the hasty departure.

“I’d thought he was terrorizing me!” muttered the WPC. “You were looking for me?”

“Yes, but why are you so interested in physics and the Phi? Isn’t Andreas’ private life a more likely source for a murderer?” Carl’s day had bred enough confidence to start questioning the police methods. The WPC returned a slightly patronising look,

“I’m not the only one investigating this case you know. I just got you lot as the short straw. My colleagues are having all the fun of breaking the news to Andreas’ battalion of women friends.” Yes, Carl should have realised that, he thought. He wondered if they had got to Georgina yet. “So what did you want?” the WPC prompted him.

“I think I’ve made progress on Andreas’ diary code.” Carl announced. The WPC’s face suddenly looked more interested,

“Well, that’s good – what does it say?”

He started briefing her on the whole 3.3 versus 2.2 saga but rapidly switched to the statement that he needed to see the full book again when he saw she had little patience for the details. The WPC looked at her watch – it was twenty past four – and screwed up her face.

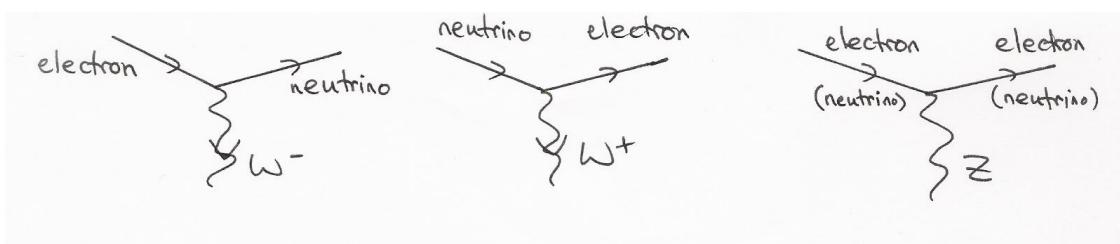
“Damn, I have to go and pick up my kid from nursery at five; I can’t take you down there now. Then this evening’s not possible either,” the WPC observed the surprised look on Carl’s face, “Police officers have real lives too, you know.” Carl was still adding up, Louise, child, presumably married. The WPC continued, “And I can’t get to the flat tomorrow morning – the whole investigative team is meeting first thing. Can we meet there at noon?” Carl mentally checked his diary before shaking his head,

“We’ve got a seminar speaker tomorrow – we go for lunch and then there’s the talk. Eleven thirty til three is bad.” The seminar series was the centre point of the Phi week so it didn’t cross Carl’s mind that it might not have priority. The WPC looked pensive,

“It would be good to know what’s in there for the meeting,” she was eyeing brownie points from her superiors. “I could lend you the flat key? You’d have to promise not to touch anything but the diary.” Carl was keen to do the decoding too, so readily agreed. The WPC handed him a card with her mobile number and a large iron key. “Phone me tomorrow morning by half nine whether you make progress or not,” she made him promise.

“Oh, and before we go... why are there three particles like the photon for the weak force when there’s only one in electric and magnetic theory?” her subconscious was still trying to digest Paolo’s explanations.

“Remember, we said that the weak force probes particle types by interchanging them? Well you need one type of force field that switches electrons to neutrinos and another that takes a neutrino to an electron – those are the two W particles. Then there’s the photon’s direct equivalent that doesn’t change the particle type



and that's the Z particle." Carl explained.

"OK, time to switch to thinking about finger painting and Teletubbies," she concluded heading for home.

## Chapter Ten

Back in his own apartment, Carl knew he was supposed to be phoning Sasha. The conversation to come felt like a chore though. He was still enjoying the afterglow of the liaison with Georgina Montford. That she had given him the option to return was particularly empowering. He knew that he wouldn't dare actually do so but one could imagine the scenario; carefully chosen first words on arrival, a discrete and longer encounter, desperate pleas for him to return. Well, these were becoming fantasies. He should phone Sasha. It was his turn. Another unfulfilling long distance discourse would just further emphasise the futility of their separated lives though. He'd put it off until after he'd eaten.

Carl started to bang pots about in the kitchen sub-space of his flat. The flat, bedroom and bathroom apart, was open plan with a swish row of modern kitchen appliances and cupboards across one end. The whole room had that stark modern feel provided by yet more magnolia paint and high powered spotlights. The living area was a little bleak since Carl only had a few untreated pine bookshelves and an old futon couch. Amber called it minimalist, Carl, under funded. The interior of the fridge was equally bare but there was just about the contents of a vegetable spaghetti Bolognese, and a yoghurt. Carl paused to wonder if Mrs Georgina was in to sex and food. Sasha wasn't, she just started giggling.

Inevitably his mobile rang just as he was dishing the meal onto his plate.

“Hi Carl,” Sasha sounded a little washed out, “it was your turn wasn’t it?”

“Um, sorry, I was getting there,” he tried to think of something upbeat but the day’s trespass was all there was in his head, so a pause grew.

“Right,” he could almost hear the depressed sigh, “look, I’m sorry but they’ve messed around with the shifts at work. I can’t do this weekend. I’m not going to have a long break until Tuesday. Can you live without me until then?” This was normal and it could equally be Carl who was away but that didn’t seem to help tonight.

“Sure. No fun for you either. You had an interesting day?” Sasha paused, did it sound that forced Carl wondered?

“Erm, just watched a video, did some food shopping, dozed. You?”

“I might have cracked the code Andreas was using in his diary,” and slept with my boss’ wife. This shouldn’t be so hard.

“Anything useful in the diary then?” Sasha seemed to be forcing interest too.

“I didn’t make it that far because I hadn’t copied down the bit I’ve got the code for. Assuming it will work that is.”

“I see...” they tapered off. “Guess nothing too much has happened today then?” Nothing too much, Carl cynically echoed internally.

“I was just about to eat, should I phone back?” Carl said it to back out before he’d really even thought it.

“No. Love you,” the last sounded a little fragile.

“Love you too,” he tried to add conviction, “really looking forward to Tuesday.”

“OK, bye then.” She called off. Great, thought Carl, well handled. Very cool and mature. Got a secret, Carl will keep it for you.

He slumped down onto the sofa and twirled luke warm spaghetti on his fork. Perhaps today was a signal that things weren’t working with Sasha after all. He tried to bring up feelings of love and excitement about her but there only seemed to be familiarity. Casual sex with your boss’ wife wasn’t going to exactly fill an emotional hole either. He finished the pasta feeling depressed. Trudging into town to, most likely, fail to translate Andreas’ diary suddenly didn’t appeal. Maybe he’d do it early in the morning instead. He could drop in on Amber, she’d have a cheery worldview for sale. He might even tell her about his afternoon. She was the arty type, so would understand wild swings of passion surely?

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“Men! Do you ever think with anything other than your dicks?” Amber was not proving to be the Bohemian, understanding and supportive ally Carl had hoped for. Her usual cute bubbliness had been replaced with a forbidding stern anger.

“Well, come on, there was a woman involved too and she was no less at fault!” Carl hit back.

“Really? It sounds like you took advantage of her when she was upset. Why don’t you just add her to a cage in your harem!”

“Oh come on...” Carl quenched his outrage. A stand up fight with Amber wasn’t what he needed. “Let’s just drop it and have some wine, huh?” Amber seemed to reconsider pushing the issue and instead picked up the bottle and refilled their glasses.

Carl was feeling a bit hurt. Modern women seemed to champion this world view in which men played the role of the oppressor they had won freedom from. To Carl’s eye the intellectual idea of equality for women had won, was winning, because it was right and both intelligent men and women wanted it. It was a victory as much for men over thuggish history as women. The courageous suffragette seizing power back from oppressive man just didn’t seem right – after all in the years when there might reasonably have been considered an open battle between the sexes the male brutes had the women

pretty well imprisoned. He didn't imagine he'd have come off to well at their hands either. Amber was still glowering as if she knew what he was thinking and was challenging him to dare say it. Maybe this was how Germans born after the war must feel – a sort of original sin? Men had landed that on women too. OK, so men are bastards, he concluded.

“Have you told Sasha yet?” Amber wasn’t done.

“No. How could that help?” he responded exasperated. Amber’s eyes seemed to darken with a new layer of fury.

“You’re supposed to be in love. You’re supposed to be sharing your lives.” The level of accusation that could be worked into the word ‘sharing’ was quite intimidating.

“Would you want to know if Trevor had strayed unintentionally? I mean you’d just read lots of things into it that weren’t there and everyone would get upset and messed up and..”

“Yes, Carl, I would want to know! It’s Sasha’s right what she chooses to read into it and frankly if you cared that much, you should have thought about it at the time.” Ouch, thought Carl, feeling pretty well pummelled. You can’t really argue with the moral high ground. A long silence developed. After what he hoped was a contrite and reflective pause, Carl tried to shift the conversation to safer ground

“How did your  $E = m c^2$  picture go down at college?”

“Quite well,” Amber seemed to have said what she had to say and was willing to relent. “They didn’t like the animals – they wanted black holes and... what were they? Top quarks I think. What are they?”

“Well, stuff is made of atoms. Atoms are made of electrons going round a nucleus. The nucleus is made of protons and neutrons. Protons and neutrons are made of quarks.”

“Oh, OK”

“They’re not top quarks! They’re called up and down quarks. The weird thing is that when we make particles in accelerators, there turn out to be two exact copies of the particles we’re used to, only they’re more massive. So the up, down, electron and a thing called a neutrino are the first family. The second family has the charm, and strange quarks and a heavy electron called the muon and a neutrino of its own. The third family are the top and bottom quark and the tau and another neutrino. The third family is the heaviest with the top quark the monster weighing almost 200 times as much as a hydrogen atom.” Carl was very pleased to be on to a new topic.

“What are they for then?”

“No idea. It’s a total mystery. They decay into the normal everyday stuff by the weak nuclear force, if you make them. Their existence is one of the big puzzles.”

Amber appeared to consider this before leaping up and grabbing his wine glass.

“What’s up?”

“You’re going to phone Sasha.” Amber pulled him up from the chair by his arm and dragged him towards the hall. Carl opened his mouth to appeal but was given a final stern command to go and pushed through the door.

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The temperature had fallen after sunset and the air was pleasantly cool as Carl walked briskly towards the centre of town. The streets were dark and quiet though he would probably not have noticed an elephant, so engrossed was he in his own thoughts. He was feeling mildly humiliated. He’d acted like a teenager so far this evening. The casual sex had boosted his ego until he was too full of himself. Then he had smugly told Amber, no doubt looking for her to be impressed, and, guess what, she had thought him childish and thoughtless. In retrospect it was clear that if you’re going to cheat on your lover you’d better be able to keep your mouth shut. He hadn’t even been able to look Sasha straight in the face down a telephone! So if it’s such a big deal that it’s going to dominate your thoughts you’d better run a mile from any such contact. It was too late for that so he’d better stop thinking of it as a big deal. Well, at least it was a plan. Forget the whole thing and grow up! Or was he simply justifying not phoning Sasha? And if an affair didn’t mean a lot why take the risk? He sighed and kicked a pebble into the brook alongside the footpath.

He took a short cut across a government building car park (the requisite 1960s concrete structure next to any British historic site), passed through a break in a looming high, flint wall and emerged onto the Cathedral Green. Here too the night was spookily quiet with no one about. It was late enough that everyone was at home or in a bar.

The stairs up to Andreas’ flat were claustrophobic and stark. Carl had flicked on a bare bulb on the wall that seemed more intent on darkening the shadows obscuring the steps than illuminating anything. There was still an acrid smell of chemicals although when he opened the door into the main room it was clear the police had cleared out anything that might be dangerous. Carl switched on the main light and then opened a window. The frames and latches were old, thin steel, streaked with dirt. He wedged the locks in place. Each window opened under a v-shaped gable in the roof. Looking up he could see a complicated web of struts supporting the tiles. Outside a car screeched past. So then, to the diary.

Carl hung his satchel over the back of the desk chair, removed the sheet of paper with the translation grids on it, sat down, and opened the diary to the last entry marked 3.3. This

was presumably the entry that had been made with the grids from Andreas' office. Taking a deep breath to savour the anticipation he began to interchange the letters.

*Out of C, must cut back – the bank and down to the Ferry tomorrow evening.  
Oxidised my first cinnabar – should impress the girls! Scouring more manuscript. S is still falling into the trap.*

Well that was clearly English. Carl was pleased that he'd made progress. C and S and bank and ferry though were all a bit mysterious. Could you really impress girls by oxidising chemicals, whatever cinnabar was? It was certainly interestingly conspiratorial. In fact, didn't it make a suspicious death seem more likely?

Carl turned to the next 3.3 but the translation came out garbage. Oh hell! The next worked though

*Beat the hierarchy problem today! With C made a 5d model with an arbitrarily light Higgs – up early to write up. Cool.*

That was a day Carl remembered. They thought they had a model where the Higgs couldn't become heavy. The model had had four spatial dimensions rather than the customary three and somehow that had seemed to help solve this big problem. Carl couldn't recall how they could have come to that conclusion; it had certainly turned out wrong and in retrospect how could extra dimensions have helped? Still it was fun to unearth the excitement of discovery even if it had been short lived and a false hope. So C was Carl himself? That didn't seem to match with the previous entry.

Working on he realized that the entries that wouldn't translate were actually marked 3.3, so there was a crucial underline. Perhaps it meant minus and he should shift the opposite way. He rattled off a new grid but generated more gobbledegook. There was one more 3.3 entry, longish, and again it translated neatly

*SukieG, SukieG, sexiest girl on Earth. Love the big tattoos. Too much vodka though.  
Spent all day on the web looking for IN alchemy – nobody's reproduced a word of it.  
Greatest man ever lived and just ignored. More room to manoeuvre less chance to be corroborated.*

Carl thought Andreas might have mentioned a girl called Sukie. Had she been down in Southampton? Maybe.

The greatest man that ever lived just had to mean IN was Newton. Newton had founded the fledgling scientific method in his mathematics of calculus. He had gone on to provide a precise description of gravity that unified the fall of an apple and the orbits of the planets. He had made the audacious and arrogant leaps that underlie the belief in science that all natural phenomena are open to inquiry, understanding and mathematical description. Almost every physicist Carl had ever met ranked him as the inspiration behind the radical changes that have occurred in our lives since the Elizabethan period

and so, as the most important man who has lived. Well, he'd met some American physicists who ranked Columbus as more important but that was a skewed cultural conclusion surely?

Carl stared at what he had translated for a few minutes longer. Why was 3.3 one shift down and three across in the table of letters? He was going to have to crack this or he'd go mad. He decided to copy down the 3.3 entries to work on in the morning.

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Before Carl knew where he was it was 2am in the morning and he really ought to be back home in bed. It was certainly too late to be phoning Sasha. He quietly descended the stairs from Andreas' flat aware that he was walking down the side of the house below.

He was trying to construct a compelling story, that fitted the translations he had, to present to WPC Thatcher. Andreas had been faking some documents. Maybe he had been practising the writing and inks on the old-looking paper that had been about his flat. That looked too mass-produced though, to be the basis of a forgery of something truly old. So must that be where the scouring of manuscripts came in? He could have been scraping old text off some real old paper. That seemed a bit sacrilegious and barbaric. Well, so be it, it still worked. Andreas was then writing about alchemy pretending to be Newton. He'd wanted to crib some real quotations from Newton's other work which is why he was searching the web. He'd need some elements in there that could be cross checked as being the sort of thing Newton really did say. The final act then was to flog the stuff to the mysterious S who was falling into the trap of thinking it was real. Was Andreas really that mercenary and after a quick buck? The plot sounded reasonable enough but who was S? Find S, find the murderer? There were signs of a motive emerging. Well, possibly.

Outside it was pitch black until his eyes adjusted. The sparkler image of the bulb's filament still danced across his retina. There was just about enough street lighting to let him see the doorhandle and keyhole. The catch was a peculiar old design and he had to use both hands and peer in close to secure the latch and turn the key. At that most vulnerable point he was alarmed by the sound of a footfall just behind him. A tattooed arm was forced across his throat and the whole force of the man behind him was thrust against his back. This attack was so unexpected Carl offered no response. His free arm was suddenly violently wrenched as his satchel was torn free, its strap giving way. Then a blow to the back of the head brutally pushed him forward into the house's wall, his cheek grazing badly on the whitewashed plaster, before he crashed to the ground.

Carl lay in a heap on a flower bed. His instincts were cowering and dazed. A small part of his brain was telling him to remember everything so he could tell the police. He fixated on the swirling black tattoos as if he thought they would provide a photo fit later. Uncountable time passed while he waited for the next part of the assault. Slowly the truth penetrated and it dawned on him that he was alone again.

Carl's mental faculties returned and he rolled over to a sitting position. His arm and side felt rather bruised, particularly where his satchel strap had been burst from him. There was blood on his cheek and now he felt the back of his head considerably more there too. Ouch. The satchel was gone. It had the translations in it and a text book he'd been working from. None of that was going to mean much to the thief. He should have been looking out for the man from the previous night though shouldn't he? To further the reprimand, his body generated a wave of nausea as he tried to stand. He collapsed back to his knees and vomited over the crushed rose bushes.

## Chapter Eleven

Carl phoned the WPC's mobile number at 8am the next day from his bed in a ward at the Winchester hospital. Somehow the previous night he had struggled up the hill from the city centre to the hospital under his own steam. He had definitely been concussed and his insistence to himself at the time that he'd have recovered way before he'd made it to the hospital now seemed implausible. The emergency ward had instructed him to stay overnight and rest where they could keep an eye on his status. Not that he'd managed much rest. The ward had been invaded at regular intervals by the maladies of drunken brawlers, a toddler who had swung once too many times on a stair gate and an old lady who had mislaid her tablets a week back. The morning shift of nurses seemed to take great glee in talking loudly from 6am too. Carl wondered if Sasha enacted these little rituals.

WPC Thatcher reacted with great alarm when Carl told her where he was. He could hear her unload her child onto her husband before she reconnected to the conversation suddenly very serious. Carl assured her he was fine this morning and that the doctors were expecting to release him as soon as the morning round happened. He briefed her on the previous nights events. She still didn't sound convinced of his good health and insisted on his calling over the duty nurse to confirm the diagnosis. The nurse handed him back the phone after giving her account with a look that suggested she thought he was a common thug who had been in a fight.

"Carl, I'm really sorry I've mixed you up in all this," the WPC took up again, "I didn't think there was anything so sinister going on in this case. I want you just to drop the whole thing. We'll try to find this man who attacked you. In the meantime just keep to public places and don't go out at night." The WPC was worrying now how letting Carl into a possible crime scene would wash with her superiors. "You're really fine?" Carl proffered more assurances that he was just a bit bruised.

"Don't you want to know what the diary said?" he asked as the WPC was about to close off the conversation.

"Well," she wasn't supposed to be encouraging anymore of this she was sure, "go on then."

"The guy nicked the precise translations and I only decoded three entries. There was a piece I didn't understand about a ferry – we'll have to retranslate that. Then there was a bit about a girl called SukieG, like she was a girlfriend. He was excited about some chemical reactions and some physics. The most important bits seemed to be that he was scraping down old manuscripts and trying to sell them to someone he just called S. Oh and there was some stuff about looking at Newton's alchemy work on the web. So maybe this S found out he was being ripped off?" There was a pause while the WPC digested this information. "I guess there may be some of my own interpretation in that account," Carl suddenly thought he might have overplayed his detective work, "we should retranslate it."

“I’ll bring the diary up to the Institute this afternoon and you can show me how the code works. I don’t want you any more involved. I’ve got to head for my meeting now – just take today easy,” and with that she rang off.

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The investigative team meeting, in a back room of the central Winchester police station, turned out to be considerably less traumatic than WPC Thatcher had feared. They began with the full report of the autopsy. It was now certain that Andreas had died from mercury poisoning. Said mercury was liberally present in his stomach lining so he had ingested it. Further there was clear evidence, both from blood samples and an investigation of his nasal passages, that he was fairly well stoked up on cocaine at the time of death. There was no evidence of a struggle or, indeed, anyone else even being present in his apartment. The conclusion was most certainly death by misadventure. Presumably, while high he had ingested something unwise from his chemical collection.

One of the young officers who had been going house to house had found an old lady, a Patricia Feltham, who clearly identified having seen Andreas walking to the Phi that day. She had described him as weaving as if intoxicated but assured them that he had not been seeking help or been under any apparent coercion. Another nail pounded into the case’s coffin. After this evidence Chief Inspector Bothridge pretty quickly leapt in to declare the verdict of their report clear. The body could be released to the family, who were already arranging the funeral, having flown in from Hamburg the previous day. Wrap up the loose ends by Wednesday was the instruction.

WPC Thatcher had to agree with the group’s conclusions and so when she came to report her findings, she was merely providing background. A typed summary of Andreas’ interactions at the Institute would be needed. The decoding of his diary was promising. She matter of factly revealed that Carl had been mugged on the Cathedral Green. A random mugging most likely, or perhaps someone who had been hanging about the crime scene the team thought. Everyone would be on the look out for a tattooed man but no one seemed excited by the prospect or, honestly, expected to make an arrest – just another nutter they supposed. The WPC inwardly sighed in relief that nobody had chosen to question her wisdom in involving Carl further. The evidence for misadventure was so strong that the mugger, whoever he was, did seem unlikely to be directly connected to Andreas’ death.

She relaxed back as much as the straight backed office chair would allow. She realized that she had been quite tense about how her news would be received. Now though she was more at ease, she could enjoy assimilating the evidence the rest of the team had accumulated. Crime shows on television would imagine them all pinning pictures on huge glass displays, or calling in the pathologist from the purpose built lab along the corridor. The reality was rather different with each of the team peering at photocopies of

the A to Z, part of the cascade of paper on the table in front of each of them, as different locations came up.

Two of her colleagues had teamed up to contact everyone in Andreas' address book. They had accumulated quite a list of dismayed women friends across the region. Amongst them was a Ms S Godstone the WPC noted – Carl's Sukie G perhaps? The chemical lab had provided them with a long list of the chemicals present in Andreas' apartment including mercuric sulphide of various forms as predicted by the autopsy. The WPC noticed the Chief Inspector starting to fidget as the clock hands approached half past ten; she surmised he had an imminent meeting elsewhere. Indeed two minutes before the half hour he broke in to the report details and concluded the meeting asking again for everyone's reports by 5pm the following Wednesday. He then positively flew from the room while the rest of the team mingled and collected papers. No one was talking about the case, which was considered all but wrapped up, and soon discussions turned to Portsmouth's fading hopes of remaining a Premiership football team that season.

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The interminable wait for the ward doctor to make his round had been soul destroying and Carl had almost wished he'd never admitted himself. The final verdict had taken less than 5 seconds. The swish of the doctor's pen and an uninterested sweep of the eyes over Carl's wounds told him more about the doctor's need for sleep than about his own health, but he had been freed. He'd then struggled home, showered and extracted the driest clothes from the pile of newly washed in the bathroom. He only finally made it to his office at the Phi at half past eleven that morning when he was looking forward to catching up on his e-mails.

His office chair though was occupied. It was seminar day and his friend, Tom Buchard, had come up from Southampton to attend. Tom had been a postdoc in Manchester when Carl was doing his PhD there. They had shared the marking on a particularly depressing thermodynamics course, then come together to form the core of a fortnightly pub quiz team. Tom was generally taciturn when not talking physics, only occasionally offering a cynical observation on the world. Any suggestion that his jaundiced view of life was a result of the pressures of short term positions were dispelled when he acquired a lectureship in Southampton. He seemed to consider students as a disease vector; to his mind they came to his University from all across the country solely to cough in his lectures. Inspite of this general scorn of humanity he was a trustworthy expert on all things soap operatic and had been the work horse behind several glorious quiz victories. He was also an extremely talented physicist.

Tom looked up from a newspaper he was scribbling on as Carl entered.

"A late start by even Phi's standards," he noted. He had a friendly, round face with light brown hair lapping around his collar. He regarded Carl and his new facial scars quizzically through his grey eyes, "Have you been in a fight without me?"

“It was a bit too one-sided to be called a fight.” Carl proceeded to give a quick recap of his sterling investigative work on behalf of the police.

“I’m not in danger of being dragged into this, I hope?”

“Not unless you get caught by the wandering policewoman. She seems determined to leave the investigation with a degree in particle physics. Actually I was worrying on the way in that she’d want to know what today’s seminar is about. It’s usually only 50:50 I can answer that, after I’ve sat through it.” Tom grunted in response

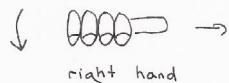
“Supersymmetry for the ignorant,” he suggested.

“Saying you add in a new particle for every particle we’ve already seen, so that unwanted quantum contributions to the Higgs mass neatly cancel particle by particle just invites too many questions about how the computations work,” Carl complained.

“I’d go for the symmetry angle. You add in new particles with different amounts of spin and put in a mathematical constraint that they must share properties like their mass with the particles already present. If you give the Higgs, which has no spin, a partner with the same spin properties as the electron then you can tie its mass to a scale as low as, well, as low as you like in principle I suppose.” Carl looked puzzled at this,

“Why do electrons and quarks get away with being so light?”

“If they’re massless they move at the speed of light. They spin relative to their motion,” Tom held up his right hand using the thumb to point in the direction of motion and curling his fingers in the direction he was imagining the particle’s spin,



“There’s nothing you can do to change that direction of spin relative to the motion.” He now used his left hand to show the opposite direction spin with his two thumbs aligned, indicating the motion - the two types of spin were distinct.



“If the particle is massive though, you can accelerate until you’re going faster than it and hence see its relative motion to you reversed. The spin which is unchanged is now the

other way relative to it's motion," he reversed his left hand so the thumb pointed in the opposite direction and the curving fingers on each hand now went the same way.



"So for a massive particle the two spin states get mixed up. If you don't actively do something to generate that mixing, it never happens, so the particles have to stay massless."

"And the Higgs mechanism is the active thing we do to make them get mass," Carl continued for him, "Two electrons can make a Higgs but only if they have opposite spin because the Higgs itself has no spin. So when the vacuum is full of Higgs if one spin component hits the Higgs, it is naturally the other that emerges."

"That's the easy bit to explain. It's why we have to call the spinless partner of a quark a squark I can't deal with," Tom was always railing against the adhoc nomenclature of modern physics.

"That and the fact that you carefully set up a theory with equal mass partners for all the particles we know, then have to mess up that symmetry to explain why we haven't seen the partners yet. They just magically appear at the same mass as the Higgs to stop it getting any heavier than we want it."

"That's not fair. In these models you're only going to find the Higgs at the supersymmetry breaking scale because without supersymmetry it makes itself as heavy as it can. So that coincidence would always appear to happen. Anyway I thought you were trying to avoid explaining all this?" grinned Tom. Carl raised his hands in surrender. Tom glanced down at his newspaper where he'd been doing the crossword.

"Worship, six letters, every odd one an e?"

"Revere. Probably. Not really worship though is it?" Tom wrote the answer in and pronounced,

"I don't normally do cross words. They reveal how little in control your consciousness is. You don't know the answer, you don't know some more and then suddenly you do know. You've no idea where it came from. Very disturbing." Tom looked vexed.

"OK, coffee, come on."

## Chapter Twelve

Seminar days at the Phi had their own special rituals. The centrepiece, perhaps even including the seminar itself, was lunch in town at a restaurant. To begin with, the site had changed from one eatery to another; Prof Fields would invite suggestions for that week's venue from everyone he passed. Although he still ritually took recommendations each week, over time Fields had settled on his favourite, a rather expensive fish restaurant just off the main street in the centre of town. It was a regular joke amongst the postdocs, as they sat down, to earnestly ask who had recommended fish and then list all the alternatives they had put forward to no avail. The Institute pretty much over-ran the place on these occasions with a single long table running the length of the dining room. The permanent staff, the speaker and Geoffrey Montford had tradition-enshrined places at the end nearest the kitchen. Then the visiting academics from the local Universities would cluster in the centre, before finally at the foot of the table the postdocs took their places.

Tom Buchard had opted for the less stuffy conversation at Carl's end of the table. Kay was swearing about the drive down into town; she'd had a sports car on her tail the whole way.

“I don't care if they speed in their own sweet world but they don't have to incite me to! It's like standing behind someone with a knife shouting ‘go on, stab him’!”

“Only a few years and they'll track every car by satellite,” cut in Tom, “then the socially required speeding will stop. Those yellow boxes for random road taxation can be scrapped too. Can we grab one of those bottles of wine from the other end so we can drink to that?” Discussions ensued up the table to recover a bottle.

Carl noticed that the visiting, academic contingent was amusing itself by discussing why aliens hadn't made contact yet. Apparently the Earth was either a nature reserve or, according to another, the only planet fool hardy enough to broadcast it's willingness to be enslaved. It didn't take long for the most depressing conclusion to come to the fore though. There are so many natural disasters that might strike a planet that no civilization ever makes it to first contact. Now everyone's favourite catastrophe circulated. Super-volcanoes periodically cover half the planet in ash. Asteroid impact would do the job too, of course. A single gamma ray burster in the galaxy would cleanse pretty much the whole galactic region. Prof Fields now jumped in with his usual joviality to try to cap even that,

“Of course whatever it is will almost certainly happen very soon,” he declared. “It's a simple fine-tuning argument; the population of Earth is growing wildly and there are more people alive than have ever lived. In a population growth like that most people will be alive when the world ends. Therefore if we are typical members of our species we should be alive to see it,” he grinned at the rest of the table enjoying his apocalyptic vision. Prof August chirped in a slight dig,

“Yet Roy, you were discussing the expense of life insurance only the other day. Surely you shouldn’t bother?” Although quiet, her voice still projected to the rest of the table. Fields took the comment in good spirits though and merely boomed a laugh in response.

For the first time their guest Prof Ash Burnley chose to enter the fray. Carl had been surreptitiously adding his features to his internal who’s who of physics. He was quite bulky in the face with large lips and a grey cast to his skin under slightly ginger hair. Carl couldn’t help making comparisons to the large trout head on the restaurant wall behind his chair. Like Fields, it was soon clear he too enjoyed the limelight and saw this as an opportunity to make a physics point,

“We’re lucky then that just such a fine tuning argument tells us that if the Higgs is light, supersymmetry must be close at hand. It would be a shame not to have found it before we perish.”

Tom raised his eyebrows knowingly at Carl across the table at this pronouncement. They were both clearly wondering what world someone could live in to make such an assured statement about the unknown. Well argued confidence seemed one path to success in physics though; Carl had been told once too often at conferences that such and such a theory was “obviously” correct to wish to enter such a battle. He was relieved to see that the food had arrived disrupting the possible combat. The speaker’s end of the table was amassing a variety of large seafood, including a lobster. Carl’s end of the table was marked more by chowders and calamari, reflecting the lower salaries of the postdocs. The battle to not split the bill evenly had been won by the postdocs before Carl had arrived at the Phi and he was always grateful for that rebellion.

Andre had brought up a new job advert for a permanent position in a New York university that had been posted on the net that morning. Tom was appealing to them all to stay postdocs as long as they could because the uncertain future was, he claimed, more than compensated for by never having to look an undergraduate’s work in the face. Carl suspected Tom protested a little too much and that he secretly enjoyed his teaching. The conversation seemed to have splintered around the table, when Prof Trant loudly and in his rather plummy voice returned everyone’s attention to what had gone before. Trant was renowned for having a bee in his bonnet about the supersymmetry and string theory crowd whom he considered not to show enough humility in their predictions.

“How Ash can you be so certain we will find supersymmetry?” he gently probed at his own wound. Prof Burnley smiled, like a spider luring a fly into his web. Oh God, here comes a monologue, thought Carl.

“Well, it’s really inevitable,” was the first gambit. “You know that supersymmetry is the biggest possible mathematical extension of the rotational symmetries of a relativistic space. For nature not to make use of it would be a dereliction of duty surely?” This Carl agreed was an emotional argument close to the heart of any theoretical physicist, yet not quite convincing of inevitability. “Supersymmetry combines particles with the different spins we see in nature into single manifestations of a super-particle with rotations in

superspace interchanging them. It's precisely the sort of unification a theory of everything must surely incorporate?" Yet it would be more compelling, thought Carl, if it could be made to actually link two observed particles rather than you having to add in a second particle of different spin for every one you see. "The mass of the Higgs must be stabilized too, of course, which supersymmetry does at a stroke – why complicate things by assuming that that isn't a clear signal?" Yet there are variant Higgs or Higgsless theories that don't need supersymmetry – Burnley was dismissing them as too complicated. More complicated than all the possible masses and interactions of the undiscovered superpartners, wondered Carl?

Prof Burnley went on, but Carl's headache had reached the point of throbbing and his prawns were rapidly cooling. Supersymmetry would be a beautiful discovery Carl conceded but it wasn't inevitable. He decided to leave it at that and started to eat.

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Norman Clark stood up at the front of the lecture theatre to introduce the seminar but before he could speak was interrupted by Geoffrey Montford. Their benefactor usually kept a low profile at these events partly because he could rarely follow the details of what was said. Today though he had a solemn announcement,

"We have had a rather unfortunate week here at the Phi. One of our excellent young talents, Andreas Born, has unfortunately passed away. His parents have asked me to invite everyone here to a short ceremony. I have arranged for it to be in the Cathedral at 11am on Monday. I hope we can all attend. I propose we should stand for a minute's silence before we continue with our work." Everyone rose to their feet leaning forward against the desktop in front of them or back against the raised seat base behind.

Carl stared at his shoes. It was typical Geoffrey theatricality to use the Cathedral, he thought. No doubt Geoffrey was pleased as punch he'd been able to use his contacts to arrange it.

This was not the preparation he needed to think physics. He was too tired, in any case, to take in much of the seminar that followed. The atmosphere was dark and hot in the lecture theatre with so many people crammed in. He watched the multi-coloured equations flying in from left and right on the powerpoint display and prayed for release. He was going to have to try to sort things out with Amber tonight he realized. Sasha was working over night but she was going to have to be faced soon too. Did he own a dark suit for Monday he wondered? Suddenly everyone was clapping and the presentation was over. A number of highly technical questions that were way over Carl's damaged head seemed to drag on interminably. Finally he could bolt for his office; he'd apologize to Tom for not saying good bye over e-mail in the morning.

As he turned into his office door he realized that there was no escape from life here either. WPC Thatcher was sat in his desk chair this time waiting for him to appear. She regarded his haggard and white face.

“Friday huh?” she reflected, “Sorry, but I need you to redo these translations.” Carl nodded accepting the inevitable. He pulled up the other chair in the room to the desk and reached for a pen. The WPC passed over Andreas’ diary and watched him write out the 3.3 grid.

“I know you were brewing all of these conspiracies this morning about forging documents being linked to Andreas’ death,” she said gently, “but the evidence is stacking up against anyone but Andreas being involved.” Carl looked up quizzically. “We’re pretty sure that he poisoned himself on the chemicals in his lab.”

“How sure is pretty sure?”

“Well, very, really. It means the attack on you last night may have been unrelated.”

“But it was the same guy who was hanging about outside Andreas’ flat,” Carl was starting to wonder if they believed what he told them.

“I know, but you were concussed so maybe you’ve misremembered?” Carl thought he was sure but he had to be honest that he might be confused; he shrugged, too tired to argue the point. “It might have been someone attracted by the police activity but otherwise unrelated to Andreas – it happens you know, far more than you’d think.” The WPC leaned back to let him translate. He passed over the first piece and she read it through.

“This bit, ‘Out of C, must cut back – the bank and down to the Ferry tomorrow evening’, sounds like C is cocaine,” she mused. “The Ferry is a pub down in Southampton by the Isle of Wight ferry docks. It’s a common haunt for pushers.”

Carl continued translating and the WPC read the remaining entries. Carl explained about their false physics dawn.

“SukieG is a girlfriend we’ve tracked down,” the WPC filled in. “As you say the rest reads as him selling fake documents to this S – not Sukie I guess. I haven’t managed to pick up a lead on another S though. It would be nice to tie up these trails. I guess the Ferry is really a lead for my colleagues,” she said this whilst clearly thinking something different.

“You look like you’re thinking evil thoughts,” laughed Carl. The WPC gave him a hard stare,

“Well, the diary is our find,” she smiled, “but you are quite beat up enough already. I wouldn’t want to check it out totally on my own and my husband will have to do baby

duty. So that makes it somebody else's problem." Carl was thinking of the diary as his part of the case, and a more important part than the police seemed willing to accept. He was surprised how quickly he leapt in to volunteer.

"Come on, it won't be dangerous just to go to a pub and ask whether they know Andreas? I bet he'd befriended the people there. They might want to know he's died, even if they were selling him drugs. I'll come to support." The WPC was torn between the desire to see through the lead and the nagging feeling that she'd already stepped outside the realms of good policing by involving Carl at all. Hadn't she resolved that he wasn't going to participate further? "We could go down tonight or tomorrow night," Carl pestered her.

"OK, OK," she didn't feel like she was making the right decision here, "it will have to be tomorrow night. I'll drive, but let's meet outside the train station at, what 9pm tomorrow?" Carl nodded confirmation.

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Carl's next attempt to leave for home was disrupted by a concerned Geoffrey Montford. He came through the door of Carl's office just as Carl was heading out.

"Carl, I saw the scrapes on your face. Are you alright?"

"I got mugged last night. I went back to Andreas' flat to read some more papers for the police and this guy jumped me as I left. It was pretty late so I guess I should have taken more care." Montford looked suitably appalled, perhaps even more concerned than was merited.

"You're sure you are alright though?" he pressed. Carl shrugged and nodded. "I'll let you get home – I'm sure you need the weekend's rest."

Montford set off down the corridor briskly. Carl watched him go, surprised at the speed of his departure. He would have been more surprised if he had known Montford returned straight to his office and hit the speed dial on his mobile.

"Cyril?" Montford spoke sharply as soon as his call was answered. "Do you know anything about the attack on one of my staff on the Green last night?" He listened to hasty denials, wondering if they were rather too quick and too prepared. "That had better be true." He clicked off the connection, hoping his fury had been communicated.

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Carl knocked on Amber's door that evening with some trepidation. He wasn't sure what reception would wait on the other side but desperately wanted a return to normality. His head wounds were throbbing and he felt in need of some unchallenging human contact. Amber opened the door slowly. Her hair was a little askew and she was wearing a paint flecked black top and scruffy jeans. She looked tired.

“Oh, you,” she said rather flatly, “come in then.” She was already on the wine and swung the glass gently in her hand as she headed into the main room. “What did you do to your face?” she asked.

“Someone mugged me.”

“You probably deserved it.” Great, thought Carl, she’s still mad at me.

“Heh! Come on, I spent last night in hospital with concussion. Can’t we just drop it?” Amber looked genuinely concerned and came over to examine his wounds.

“Shouldn’t they have stitched that?” she asked gently running her finger above the livid cut on the back of his head.

“They said not worth it.” The old Amber seemed to be back and it was comforting feeling her hands in his hair.

“Are you medicated or do you still want wine?” she asked. Carl made comic grabbing motions at the bottle which made her smile a little and head for the cabinet in which she kept her glasses. “What happened then?” Carl gave her the run down, accepting the full glass in the middle.

“Guess you didn’t phone Sasha then,” she observed although there didn’t seem to be any heat or compulsion in the comment.

“I want to work out where we stand, or where I stand with Sasha, before I decide what to do.” Amber looked at him bemused and laughed slightly in disbelief,

“God, men and their hormones! Stupid goose - you love her. I’ve seen you together.” Carl was too tired for this and just shrugged,

“I still need to think,” he said quietly. Amber just looked at him and suddenly there were tears in her eyes. There was something else going on here tonight, he thought.

“What’s up Amber?”

“Can I have a hug?” Tears were now streaming down her cheeks. Carl went over and put his arms round her. She let out a deep sob and steadied herself.

“I phoned Trevor after you left yesterday,” she volunteered. “I was really pissed at you and was telling him what a bastard I thought you were being to Sasha. Then he started down the same lines as you of what a bad idea it would be for you to tell her,” Carl feared he knew where this was going. “All high and mighty Miss Amber says she’d want to know. So the bastard only comes out and tells me he’s slept with two girls since we started seeing each other.” Shit, thought Carl.

“Oh Am, so have you split?” he asked with real alarm. This was his fault.

“I don’t know. I just put the phone down and unplugged it. We haven’t talked.” She smiled as if she thought herself being silly. “He said it didn’t mean anything and I don’t think it did. I understand it but that’s not really important.” She fell silent nestling into his shoulder and they both sunk into their gloomy thoughts. “Come on, we need another bottle of wine,” she said suddenly with false cheer and headed for the kitchen.

Carl slowly downed the last few mouthfuls from his glass. The problem with romance was that it was all emotional. Your conscious brain keeps trying to work through what has happened but that’s got nothing to do with what you feel.

Amber was banging about in the kitchen, he supposed she was trying to locate the corkscrew.

Presumably, he thought, there’s this sub-conscious measure of the distress involved and the signals needed for reconciliation that have been finely tuned to perfection by evolution to decide whether the mating should continue. It sure as hell doesn’t feel finely tuned. Oh to be a soul unfettered by a body! Except then there would be no close relationships and that sounded horrible too. What was Amber doing? All had gone quiet.

Amber was leaning against the kitchen doorframe watching him. She’d wiped her eyes dry and straightened her hair. She looked more relaxed than even a few seconds before as if she’d resolved to put the previous conversation from her mind.

“I,” she declared robustly, “have decided it’s my turn to be impulsive.” She then proceeded to start unbuttoning her shirt. Carl watched on stunned as her breasts first bulged against the loose black fabric then fell free as she undid the final buttons. She grabbed the bottle of wine she had opened and smiling broadly asked, “Would you like some?”

Carl had planned for such an eventuality, well perhaps not quite this one, but nevertheless his instincts had been pre-programmed. He was saying,

“No, Amber, no,” without even consciously thinking whether recent events should change his position on this infidelity, “bad idea. You’re drunk and upset and you’ll regret this.” He could see the anger and tears build in Amber’s face,

“So you’ll sleep with your boss’ wife who you’ve never met before and is fifteen years older than you but not me?” she screeched in disbelief.

“That’s not fair, Am. Look I’m going – you need time to think. This is just a mess.” Carl headed fast for the door, vaguely aware that Amber’s face was turning a furious red. As he headed down the hall he felt something fly his way and then a crash of shattering glass

as the wine bottle exploded against the wall behind him. Wine splattered wetly across the back of his shirt. He fled the flat.

A few minutes later he was sat on his bed, naked to the waist, feeling utterly depressed. Was there anything else in his life he could screw up he wondered? Surely an impulsive one off stand didn't deserve this much retribution? He sighed and fell over backwards so he was lying staring up at the peculiar swirling plaster patterns on the ceiling. Amber did have large breasts he reflected.

## Chapter Thirteen

The next morning was Saturday and Carl couldn't find the will power to get out of bed. His eyes, as the night before, traced the curves of the ceiling plaster. He really did need to sort his life out. He needed a plan. Did he want to stay with Sasha? This was a hard question because he was rapidly losing the ability to recall the time he'd spent with her. Most of the last two years were obscured by a tightness in his stomach as if he'd swallowed a large stone, and a primal screaming from his subconscious. He was going to have to assume that this meant he cared a great deal for her. OK. Could he suppress his infidelity and just get on with the relationship with Sasha? He thought about running his hands along Mrs Montford's bare thigh. No. Amber was right, he was going to have to tell Sasha. He should make up with Amber too. And suppress visions of her naked. He groaned and buried his head in a pillow.

Try again. He needed a way to really show Sasha how much he cared and was committed to her. She had to be so impressed that everything else would slip away. He contemplated for the first time in his life buying a ring. He could feel the blood drain to his feet and was even closer to being physically sick. Marriage was something other people did, or so he'd thought. Whatever part of his brain was pursuing this line of attack kept relentlessly on – he could transfer his savings between accounts on the computer today and buy the ring tomorrow. He could propose when Sasha arrived Tuesday morning. There has to be a flaw in this plan, begged his traumatised instincts. The ceiling whirled above him. The knot in his stomach relaxed a little. For the first time he had a plan to cling to and that seemed to help. He had a day to adjust to it. Or was it a hollow fantasy to appease his mind for a few hours?

Amber was a simpler case to resolve surely, a practice match. He had some chocolate fudge cakes he knew she adored that might act as a peace offering. So phone her and see if she would bite. He tried her number but there was no answer – she probably hadn't reconnected the phone yet. Up and at it then! He showered and dressed and padded downstairs to Amber's door, fudge cake in hand. No answer, however hard he knocked. It was eleven o'clock by this stage he noted, so she must be up. Well perhaps she was out or even gone to Reading to patch things up with Trevor. Good for her.

The "ring plan" was definitely providing comfort and purpose. He couldn't, after all, think of any greater act of redemptive sacrifice to offer Sasha. If she threw it back in his face he would at least know he'd tried his hardest to atone. He almost wished that he could phone Sasha now and confess and propose over the phone, but of course she was on ward duty. Would he actually have done it if she were free, he wondered? Yes, he thought he would.

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A long weekend anticipating the meeting with Sasha on Tuesday now faced Carl. He padded his living room with the pent up energy of delayed resolve. He needed a diversion. Andreas' death remained an issue, although not really one for him to solve. He

ought to think more about the code but he had had no more inspiration. There were only a limited number of possible permutations of the array of letters but he couldn't face writing them all down and using trial and error.

Where had Andreas' fascination with alchemy arisen, he wondered? Middle ages' magicians turning lead to gold? Or was there more to it? Here was a distraction - he could research the subject on the web. He moved across to his desk and twitched the mouse by his PC to clear the fishy screensaver. A dissolute, flat fish swam lazily off the side of the screen to reveal his desktop. The web browser filled the screen with the logout page from his bank account. A minor tremor of fear travelled up his back at the thought of buying that ring. That was tomorrow he chastised himself. Now alchemy.

Carl flitted between alchemical web pages for several hours. There were very many entries and most of questionable academic worth. As far as he could tell the historical field originated from a fascination with heating the compound called cinnabar which was a red powder, now classified as mercuric sulphide. Apparently when warmed the mercury emerges. Well that must be quite impressive to see a powder produce the only room temperature liquid metal. He could understand the puzzle it must have presented a few thousand years ago. Adding sulphur back to the mercury could reverse the process too apparently.

The authenticity of the web's content on the origin of alchemical studies worried Carl. Many pages were rather keen to link to ancient China and India and then quickly on to Taoism, and Tantric philosophy. This line of reasoning, all too often, ended up at sex and drugs. Fair enough for the modern lay reader who was more interested in such recreations Carl concluded, but was there really a basis in fact? There did seem to be court rulings from both civilizations against plagues of wandering charlatans offering to produce gold at the drop of a hat. The Chinese had entertaining book titles too such as *The Yellow Canon of the Nine Vessel Spiritual Elixir*. The guiding quotes were a little bizarre as well; "*Take the solid yang from water and with it restore the broken yin of fire to leave heaven*". Possibly.

Some of the more serious pages pointed out the trade links between China and India along the silk road. The cultures shared ideas about elements, (water, fire, air and so forth) being the constituents of all things. Maybe this flow of ideas was for real then.

The next port of call, in what was turning out to be a global tour, was Egypt. This origin looked pretty solid since the word alchemy derives from the ancient name of Egypt, Al-Kemia – the black land. Word supposedly passed from India, and into the rather wide ancient Egyptian magical tradition. The boom time for alchemy was in Alexandria under the Greek-derived pharaohs who had assumed the throne following Alexander the Great's invasion. The royal family seemed to consist of long lines of Ptolemys, Cleopatras and Berenices. Not very imaginative.

The famous library had acted as a magnet for the great philosophers from near and far. To confirm the speculation there was actually a papyrus manuscript now kept in Leiden

which consisted of 101 recipes for faking silver and gold effects. This was a reputable chemistry manual for fraudsters.

*Physika kai Mystika* on the other hand seemed to be a document of a more esoteric nature from the same era. The alchemical philosophy had a strong metaphysical aspect; the conversion of base matter into gold was a symbol for realizing a Nirvana like oneness with the Universe. There were several quotes about transmutation of the soul that did hint strongly at influence from eastern religions. Interesting. Distressingly, there were rather a lot of links on this page to modern day astrologers' web pages though.

The basic alchemical goal was loosely defined in terms of three stages. A base metal was first "broken down", then "whitened" with the addition of arsenic or mercury, before some final fermentation to leave gold. Possibly the final product was the Philosophers stone which could transform more lead to gold at later convenience. The master of all this was one Hermes "Thrice Great" who was possibly a confusion with the God Thoth. Carl had always liked the God of intellectual study being an Ibis with it's funny stick head! OK so much for Egypt.

The baton was passed next to the Medieval Islamic empire. They invaded Alexandria in the seventh century and started busily copying the books into Arabic before adding their own contributions. The Empire stretched at its peak from Spain to the far eastern islands and, with a shared language, academic progress was fast. At least lots of scholars were busily distilling and sublimating, and designing modern sounding chemistry gear such as flasks and alembics. Given alchemy was off on the wrong track it wasn't clear to Carl that the real discoveries could be put down to anything other than over enthusiasm.

One Al Razi developed the notion that different metals are simply mercury with variant amounts of added sulphur. Quaint, but wrong! Elements differ because of the number of electrons in the atoms, that number in turn being determined by the electrical charge of the atomic nucleus. The other big performer was called Jabir who tried to link in geometry and numerology. His name has been passed on to us through the word "gibberish"! It was at this time the Jewish scholars got in on the game and added in Kabbalistic ideas too.

Finally alchemy infected the European continent when the Moorish empire in Spain and the Sicilian Arabs were defeated by the crusading Europeans. The texts were translated once more but now mixed with a healthy dose of the bible. The stages of the ideal transformation could now be described as birth, crucifixion, and resurrection. Predictably, Carl was finding web pages that linked in the Knights Templar, Moses and finally the Rosicrucians. Alchemy seemed to be a unique combination of every piece of mystical claptrap and conspiracy the entire world had ever produced. Carl was tiring, although there was more information on the European phase than all the rest put together.

He encountered, for perhaps the tenth time in his search, a site commenting on how the ideas of alchemy had been shown to be true with the discovery of atomic fusion and fission. He let out a small scream. Alchemists were mixing materials at basically every

day temperatures. This was chemistry. Chemistry is the study of how the electrons in different atoms interact or are shared by neighbouring atoms. There is no way using these interactions to change lead into gold. To do that, we now know, you must penetrate the nucleus of the atoms. It has turned out that the nuclei of atoms are collections of protons and neutrons and you can turn one element into another by ripping out or adding in extra particles. To do this takes energies thousands of times greater than alchemists could conjure in their furnaces. They had never observed anything that was evidence for fusion and so, it seemed to Carl, their ideas could in no way be linked to the discoveries that followed – it could all have turned out very different for all they knew. He lent back in his chair frustrated at the stupidity of human kind.

The afternoon had almost passed by and he suddenly realized he had an evening meeting with WPC Thatcher to explore the drug scene in Southampton. He'd better eat.

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WPC Thatcher's Saturday had been more mundane. She had fed the ducks at the local pond with her daughter, then been round the supermarket. Her husband had provided lunch but the feeding and wiping child duties had again fallen to her. She had finally managed a little peace and quiet when her husband had brandished the foot pump and an uninflated play pool. her family were now out in the garden. She slumped on the slightly sagging sofa and tiredly eyed the wood effect floors that covered the ground floor of their semi. With some imagination she could believe they wouldn't need cleaning until the following weekend.

Closing her eyes, she let her mind wander. She really hadn't managed to find out what this Andreas had been working on at all. String theory. What was that? Perhaps their encyclopaedia could provide a nugget of clarity to bolster her chances in the interviews to come. There was a small (bless them) entry:

**String theory:** is a hypothesised description of the elementary particles of nature. The fundamental objects of the theory are not point particles but strings extended in one spatial dimension. Different oscillations of the strings generate the different properties and masses of the particles seen in experiment. In particular the strings can describe gravitons, the particles which are responsible for the gravitational force. String theory is therefore a leading candidate to unify Einstein's General Theory of Relativity and Quantum Theory.

The strings of the theory are predicted to have a length so short that the theory can not be tested at the present time. The theory is also required to have nine spatial dimensions. It is conjectured that the six dimensions we do not see are curled up (or compactified) so that they are too small to see. Again this aspect of the theory is not open to current experimental test. String theory therefore is only a promising conjecture within science.

Well, that was reasonably clear if a little bizarre, the WPC concluded. She was considering addressing the boxed add-on piece entitled *Compactification* when a cry came from the garden.

“Love, could you get a towel? This one’s been dunked.”

Time to be back on Mum duty, at least until the evening.

## Chapter Fourteen

Standing outside Winchester train station just before 9pm on a warm Saturday night was more rewarding than Carl would have expected. All sorts of interesting people, dressed both up and down, were coming into Winchester for the night life or leaving for Southampton or London. His gaze was attracted by a lithe young woman getting out of a car. The woman had fine blond hair falling down her back, and wore tight fitting black trousers and a revealing white top covered over by a minimal cut, pink leather jacket. As she came away from the car he realized she was heading his way and for a moment he wondered if his interest had been too blatant. His embarrassment rapidly faded before taking on a new air as he realized that the woman was WPC Thatcher. As she came up to him he noticed she had subtle traces of eyeliner that hinted at a heroin chic look. She looked much younger without the authority of her uniform. She smiled as she approached apparently seeing the slight confusion in his eyes.

“Do I scrub up alright then?” she asked cheekily.

“Um, Yeah. You look great.” In fact thought Carl she looked just like all those girls in nightclubs dressed to drain the ability to speak coherently from men. He’d never been able to cope with such hostile mating environments. The WPC seemed pleased with his response though. “I don’t think I’m going to be able to call you WPC tonight.” he observed, “Is Louise right?” She smiled and nodded.

“Come on then let’s make tracks.” She turned and headed back to her car parked on the curb. The vehicle was a sky blue family car with a child seat in the back. There was an associated menagerie of attached soft toys including a large koala bear. Catching the direction of his gaze she smiled and acknowledged, “Not super cool I’m afraid.”

The car smelt faintly of the WPC’s, Louise’s, perfume. Carl hadn’t really thought about dressing up, he was just in some old jeans and a dark blue sweatshirt. This wasn’t a date though. Absolutely it wasn’t, Carl reminded himself. This week’s track record with women was bad enough already. The policewoman moved the car out into the road and started to negotiate the one way system in search of entry onto the M3 motorway.

“Are you still happy to be doing this?” she asked seriously. “We’re probably not going to find anything out, you know.”

“Yes I want to,” he replied. “Helping investigate seems like a good way of coping with Andreas’ death still.” She seemed to accept that and the conversation tailed off. He couldn’t think of anything smart to say but the silence was awkward, so he asked about her child.

“She’s just over two, called Chloe. Tiring, but great fun too. Well, if you like singing nursery songs and banging things together,” she smiled.

“Not sure I’m at that stage yet,” admitted Carl. At University the only acceptable posture was anti-children and since then he’d been thinking physics and career.

“You’ll see; when you reach thirty, jobs suddenly seem to look endless and repetitive. You’ll swear you’ve seen the latest Hollywood film before, and be bored of eating out. Suddenly the chance to have a family as a new adventure is appealing – it’s like a chance to fall in love again, too,” she glanced across at him and obviously didn’t think he looked convinced, “Well, you’re a bloke, so maybe thirty-five!” Carl considered pointing out that the last woman he’d spoken to had thrown a bottle at him and other prospects looked a little low too. Louise’s mind had taken a different track though in the pause,

“I read somewhere that people are worried your particle accelerators might cause the whole Universe to end,” she remembered with furrowed brow. “Is that possible?”

“No!” Carl shot back. This was a standard media scare story that had little merit. “That’s like a caveman worrying about whether he should light a fire because the whole world might burn down!”

“Is that an unreasonable thing for a smart caveman to worry about?”

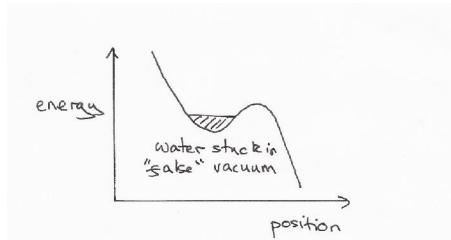
“Yes, it is – there are bigger fires in nature from lightning strikes and volcanoes than a caveman is ever going to manage. It’s exactly the same with our experiments. The Universe is full of lots of hugely high energy particles. They probably get accelerated by black holes or supernova or some such. There have been cosmic rays that have struck the Earth’s upper atmosphere with energies millions of times more than man has ever given to a particle! Collisions involving those reproduce experiments we can only dream of.”

“Why don’t you use those for your experiments then?”

“They’re too rare – you could never get enough of them together. We have to analyze billions of interactions to see all the rare collisions we’re interested in. You’d have to make them collide right in the centre of a detector too. There are a lot more low energy cosmic rays, so those were used originally to look for new particles – the muon was found by a detector in a balloon for example.”

“So the Universe is safe in your hands?”

“The idea is quite fun actually. The whole Universe could be stuck in a high energy state. Think about water running off a mountain. If there’s a local dip you get a tarn forming. Really the water wants to run to the base of the mountain but it gets trapped by a local hillock. So it could be that all the matter in the Universe could transform some way and give off huge amounts of energy. It just doesn’t have the kick needed to get over a local hill that’s stopping it. So maybe a particle interaction would put enough energy into some region of space to get it out of the dip. That bit of space would then give off energy and trip the neighbouring areas into collapse too. A wave of energy would rush out at the speed of light and the Universe would disintegrate!”



“Cheery! But since it hasn’t happened out near a black hole it’s not going to?”

“Yep. Actually you can constrain theories by the fact it hasn’t happened. For example if the Higgs were too light, then there would be a lower energy state with, as it happens, no limit on how much energy it can give out. So the Higgs has to be more than about 100 times the proton mass.”

They had reached the southern end of the M3 and they began to concentrate on reading the sign posts within Southampton.

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The route through town to the Southampton docks seemed overly complicated but the WPC knew at least roughly where she was headed. They emerged several minutes later on a road along the dock front. A big modern barn promoting itself as the portal to the Isle of Wight, from which the ferries left, dominated the waterfront. Suddenly there was a parking sign and they veered off into a half empty pay and display carpark.

Carl had never been to this end of the city. He had visited the shopping mall in the centre of town but had never heard of Southampton as a tourist centre. He was rather surprised therefore to see great chunks of medieval wall enclosing the city. The flat land at the base of the walls with the docks and car park were presumably land reclaimed from the sea.

“The Ferry pub is up that way, a short walk,” the policewoman indicated. She was pointing up a street that penetrated through the walls. “I’ve never understood why they don’t make more of this end of town. A few shops like the Lanes in Brighton might tempt the ferry passengers to actually spend time here. As it is it’s a bit grim though, especially at night.”

They soon found the pub they were after, a hundred yards in from the wall. The interior of the old city was a little confused with black and white board historical houses, the bombed-out remains of a cathedral and more modern “magnolia” apartment blocks randomly intermingled. The pub was part of a terrace of older buildings though not of notable age. Inside seemed pleasant enough, if suffocatingly smoky. There were the usual array of green upholstered seats and stools, dark wood tables and flashing games machines. The clientele were an assortment of older men, sat guarding their preferred seats, and younger mixed-sex groups standing, most likely stocking up on drinks and perhaps drugs before heading for the city centre nightclubs.

Carl bought drinks at the bar. Did the WPC normally drink alco-pops or was she playing a part he wondered? After he'd taken a sip of his beer he concluded she might just have tried the bitter here before. He settled on a stool next to her against a back wall.

"Thanks," she said as she took the glass. "Not that we should really be giving them money. I've seen two guys selling drugs in here already. They should be closed down." Carl was surprised, he'd not even thought to look for illegal activity yet,

"Really? I'm oblivious!"

"Keep it that way. Naivety is rather knocked out of you in my line of work."

"You're strongly anti drugs then I take it?" Carl was surprised how black her looks about the subject seemed.

"I've seen what they do. In fact you'd be horrified how much of the crime in this country is driven by drugs." Carl had more liberal leanings. He wondered if he should push the matter but they had to talk about something,

"I've always thought it was obvious drugs, all drugs, should be legalised. If you've got a good argument for why people shouldn't take them, then use it, don't make up a law. If they were legal you could tax the sale to pay for treatment for people too. And also, it's ridiculous the way we tromp into Afghanistan and so forth and beat up on very poor farmers, removing their living, when we can't even win the argument for not taking drugs back here." He got a pretty matronly look for that from his companion.

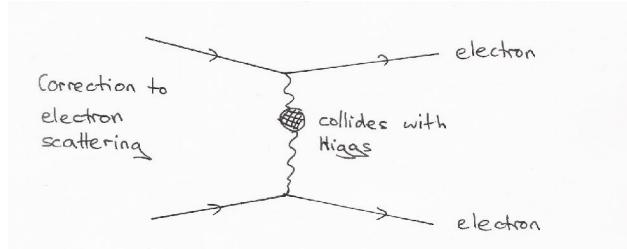
"Well maybe you're right, but can you convince the US and EU governments all to change tack? If you don't do that, you can't change the law. Given the law is what it is, these guys selling are the worst sort of scum. There aren't enough treatment programs, there is no monitoring of quality or the amounts people take. So they're profiting from deliberately inflicted misery. You can come with me some time and visit a mother on a housing estate to tell her that her son is dead of an overdose and was found lying in a pool of excrement some time if you like!"

"OK, I give in."

"Sorry, I'm becoming boring middle class Mum." Carl smiled and she grinned back. He realized he'd got out of the habit of going to a pub with just a female friend; he and Sasha tended to stay in, since they saw each other so infrequently. He wondered if Louise was thinking the same thing. She started up again with a physics question though, so perhaps she was just working.

"This Higgs is heavier than one hundred proton masses then. Could it be so large you'll never find it?"

“Well it depends what you think you’re going to find. There have been some very precise measurements of the interactions of two electrons. Because of the Uncertainty Principle very occasionally the Universe can borrow some energy and make a Higgs in between the electrons – it disappears again very fast. That changes the way the electrons interact though.”



“It’s a very small effect but with sufficiently precise measurements you can see the change. Using that technique we predict that the Higgs is no more massive than about 200 times the proton mass. That number depends on there only being a Higgs we don’t know about that might appear between the electrons though. If there is other stuff, which maybe there has to be, then the measurement is a mixture of lots of effects and it’s hard to tell what it means.”

The WPC nodded thoughtfully. Then she drained her drink and looked like she was getting ready to act. She turned a stern look on him again,

“I’m going to go talk to the pushers at the back by the pool table. You sit here and keep an eye open. Don’t stare though.” She dug into her pocket and pulled out a mobile. “If any trouble starts ring 999 but you’re not to get involved. Agreed?”

“Are you planning on starting a fight?”

“No, I’m going to try vapid.” She put on a slightly goofy smile that was a pretty good vapid and headed off.

Carl watched her walk over to the tables and wondered if the Winnie the Poo sticker on her mobile was the real Louise. Did she think he didn’t have his own mobile? He had switched it off this evening so Sasha couldn’t interrupt – one thing at a time. Louise had latched onto a pair of large guys doing the American pool player look with tight jeans, stubble and grubby baseball caps. At first they didn’t look pleased to see her but she kept her eyes down, flashed some winning smiles and twisted her hips; an awkward attempt at sexy. They seemed to buy it and she soon had four guys gathered close, offering up their own jokes and talking. Carl suspected they would have been somewhat alarmed to know who they were really hoping to bed down with. One of them already had an arm round her shoulder. The pushers’ designs were somewhat blatant but Carl couldn’t help envying how unembarrassed they were by their attempts. He would have been tongue tied by the horror of his own actions.

Carl was beginning to wonder if the WPC knew how to extract herself from the company she had so ably entered. Suddenly though they moved away still smiling but clearly decided to get back to their pool and she turned to head back towards Carl. She must definitely be on top of nightclub interaction rules he thought. Her walk back to him was purposeful and he didn't get a smile.

“Neatly done,” he complimented. “Did you learn anything?”

“Well, I take some of it back – those guys only have grass. The landlord kicked the lot selling harder stuff out when he found out what they were up to. Apparently that crew now hang around near one of the watch towers in the old wall to sell. Nobody here was offering to escort me to them though, in fact they dropped me like a stone when I suggested it. Probably these guys run a mile from the real gangs.”

“Down to the wall then?”

“How about another drink, to give me a chance to work up my courage again?”

## Chapter Fifteen

Carl followed the WPC as she purposefully headed away from The Ferry. They passed a small church, its steeple looming up into the dark above them. Carl had to pick up his pace to catch his pink clad companion, after he'd glanced around. She was making for a small alley between the bizarre juxtaposition of an old Tudor house, whose upper floors leaned out over the path, and modern red brick apartment buildings. The cobbled road stopped shortly after giving entry to a parking lot for the residents, but the path continued as steps descending into the shell of a medieval gate house. It smelt of litter and worse. At the base of the stairs there was an entry through the flint walls and the WPC halted. She discreetly peered out onto the road and surveyed the scene beyond.

"There's a sort of boat sculpture thing with a gang of blokes hanging out by it," she quietly directed at Carl. Her stern demeanour suggested it was time for Carl to re-engage his thoughts. The beer and the WPC's control had slipped him into following in sheep mode. "You stay here and phone 999 again if anything happens. No heroics." With that she had slipped round the corner.

Carl moved up to peer out of the opening, wondering, with distaste, what the puddle he'd have to stand in might be. The WPC had slowed her pace and was tentatively moving towards the group she had described. The boat sculpture consisted of a wooden dinghy apparently half embedded in the pavement. A plastic bag fluttered on the mast end. Around the base were four men in jeans and all sporting tattooed arms. One of them was actually pretty huge Carl realized. Not guys you would meet eyes with. Carl suddenly felt a wave of protectiveness come over him for his companion – did Louise really know what she was doing? She stopped a little away from the gang and twisted on her toes, a little suggestive, inviting permission to proceed. Is the phone on Carl suddenly wondered, guilty for eyeing her bottom? He glanced down at the glowing display.

Close up the WPC thought the group looked most like pit-bulls. Rather than fear though, she was suppressing the desire to start raging at the louts. Play the lost junkie girl, not the policewoman she reminded herself. One of them, the shortest of course, had been the one to engage eyes (the others had glowered). He just looked her over. She was going to have to begin this,

"Uh," she made herself swallow as if terrified, "erm there was this guy Andreas, Andreas Born. He was supplying me with smack." The guy was giving nothing away. He had a gaunt face and short, bristly hair which made him look like a shaved cat she thought. "Up in Winchester," she added. Still no response just blue eyes boring into her. "Well, he's dead, I don't know what, police all over his place... and I knew he came down here, and I need some," she finished in a rush. He glanced over her shoulder and up the street. She prayed Carl was well back. Finally he spoke, controlled and relaxed,

"Dead is he? Well, tough bollocks!" He didn't seem to care either way and the WPC bought that. "You're a lying bitch though," he continued, irritated. Not so good thought the WPC. "He wasn't supplying you, he was barely supplying himself. So you can take

your crap stories off my fucking patch before we find a better use for you.” Ouch! Well, she’d learnt Andreas wasn’t a serious player in the drug market which was probably all she’d wanted to know. He might just be trying to scare her. She could say she’d just tried the cocaine with Andreas and wanted more but what else would she learn? She decided to turn her growing pause into shocked fear,

“OK, OK I’m going,” and she started backing off fast like she was about to cry. He gave her a more suspicious look, perhaps turning tail like this made it look like she’d never been that interested in buying. It was done now though, so she turned and headed off at speed back towards where she’d left Carl.

The gateway in which Carl was hiding was deeply shadowed she noted gratefully. The moment’s panic when she’d thought the guy might get violent was subsiding and, as she turned back onto the stairs, she was commanding herself on a job slickly done.

“Not a nice bunch,” she reported calmly to Carl, “but anyway they laughed off the idea Andreas was dealing drugs for anyone. Let’s call this lead dead – I’ll file a report on these clowns with the city squad.”

Carl had been watching her retreat thinking the shortness of the encounter didn’t bode well. Louise seemed to think all was fine but he was watching the four guys talking and then with a laugh the biggest guy started to trot in their direction.

“Louise one of them’s coming after you,” he stuttered starting to feel queasy in his bowels. She glanced back fast and her eyes widened in shock.

“Shit, move!” she ordered in a whisper. They started legging it up the uneven steps of the gate house. The open shell of the old tower offered no hiding places so they found themselves in the alley above. Carl started rushing for the main street but was yanked from behind by the WPC into the parking quadrangle of the apartment complex.

“I can’t go as fast as you or him,” she whispered as she brought them to the ground behind a parked BMW, across from the entry to the alley. They crouched on their haunches waiting to see if their pursuer would go past. Carl could hear the breath hissing through his teeth and put his hand up as a block, certain he would give them away. Hiding like this was nerve wracking; if the thug decided to look amongst the cars they’d had it. The WPC had her arm across his shoulder and was gripping him as if she was going to knock him flat and give herself up if the worst came. The air he was gasping in was surreally tinged with her perfume. Could he really hide while she got beaten, or worse, he wondered?

Suddenly their nemesis was in the entry way, pausing his run to consider which way to go. They held their breath in dread. He was huge, well over six foot tall and built like a front row forward. Something glittered by his hand, was that a knife? Of course he would have a weapon wouldn’t he? But then the brute turned away from the parking area and

ran on towards the main street beyond. Carl collapsed against his companion and let out relieved thanks.

“We’re not out of this yet,” the WPC hissed, “when he gets to the road and sees no sign of us he’ll come back.” A new surge of terror permeated Carl’s veins. They were sitting ducks. The brute was between them and escape now.

“Come on there’s a pedestrian passage way out on the other side,” the WPC was still on the ball even if Carl wasn’t, “I think,” she added, trying to make out the building’s layout. The passageway was there though, between two brown wheelie bins and they could escape onto a main thorough fare. There were a few groups of people walking here and suddenly they felt safer. A pub fifty yards away offered well lit windows and the sound of a juke box.

“I need a drink,” said Carl urging the WPC towards the pub.

“Hang on, let me dump this pink jacket, it sticks out a mile.” She twisted out of the jacket and tossed it behind the wheelie bins. She would look very different now with just the white shirt. “Let’s act coupley; he’s expecting a lone woman,” she added, nestling into Carl and putting her arm round his waist. They walked towards the pub, the Hampshire Arms, as quickly as they could reconcile with their new act as lovers. The main door to the pub was three steps above street level in an alcove. Carl was just about to place his foot on the first step when the WPC pulled him across her and up against the side wall.

“He’s just come out of the passage,” she hurriedly whispered. “Excuse me,” with that she grabbed Carl and buried her face in his neck. Carl tried to process the double stimuli of a lithe woman pressed against him and the horror of impending doom coming from behind. Her hair smelt of peaches and under the perfume he could detect her faint musk. He imagined the knife sliding into his back and emerging through his stomach.

“Oh crap he’s going to walk right past us,” she whispered in his ear, before turning her face to his and kissing him squarely on the mouth. She still tasted of fruit from the drinks earlier in the evening. They were kissing for real, tongues entwined. Carl had acted instinctively, never having stage kissed before, and now wondered if he should stop. She didn’t. She had her eyes closed offering no guidance. Perhaps she was praying. Footsteps came by, then receded. She broke off and peaked round his face. He felt her relax against him seeming suddenly small and fragile. She turned back to him and placed her nose against his. “Phew,” she breathed, then grinned and nodded towards the pub.

Waiting to be served at the bar, Carl processed the evening’s events. He was, perhaps not surprisingly, feeling rather close to WPC Louise. Women seemed to be literally falling into his arms at the moment, after which events were hard to control. She was married though, with a child. His love life was a big enough mess already. They weren’t going to discuss events outside again then, he surmised. Somehow he wanted to just talk to her honestly about it, to hear her say she felt something too. Was that his ego just wanting to clock her up as conquered? Probably. He ordered the drinks from the barman and carried

them back to the table Louise had picked. She had tied here hair back and looked considerably more severe suddenly. No conversation here then, he confirmed.

“Have I got this right?” she asked serious faced, “the electron, muon and tau particles are all identical except that they have different masses?” That moment of intimacy had definitely gone; he almost laughed.

“That’s right.” He was rebooting his physics knowledge.

“And they get their mass from the Higgs particle?”

“Yes”

“So why do they have different masses? If they’re the same shouldn’t the Higgs treat them all the same?”

“You’d think so but it doesn’t. That’s an open question – we’ve no sure idea, not even any really compelling speculation.” He thought she looked pleased to have brought him to such an admission.

Suddenly the bulk of a large man loomed over the table. They had assumed themselves safe here in public and hadn’t paid attention to his entrance. It was the man who had been chasing them.

“I think you dropped this,” he spoke with a deep but not uncultured voice. He held out the WPC’s pink leather jacket. It looked rather small in his huge hand. Neither Carl nor the WPC dared say a word. He smiled at their petrified faces as if amused by the effect he was having. The tension lessened. “Sorry if I scared you.” The WPC reached out and took her jacket with a mouthed, ‘thank you!’

“Look if you really know Andreas, I want to talk.” He seemed wary of them suddenly. Perhaps he was wondering if they were the police.

“Go on,” encouraged the WPC.

“Well, he said he had this old manuscript – a laboratory log of Newton’s.” He looked for some confirmation and Carl nodded. “He wanted to know if it could be sold, on the black market. I found a buyer. If you have it or can find it you’ll get a five figure sum. Have you got it?”

“There’s some old stuff of his – we could look,” bluffed the WPC.

“You know where to find me alright. If you own up about it, it’ll just end up in a museum, worthless to you.” He paused as if he wanted them to start searching there and then. He couldn’t think of anything else to say, though so turned and walked from the pub.

Carl and the WPC looked at each other before both starting to giggle. All that game of hide and seek had just been to avoid that?

“I guess Andreas was hoping to unload his counterfeits on as many people as he could,” suggested the WPC.

“Yeah, maybe.” Carl still wondered if there was an original manuscript somewhere.

## Chapter Sixteen

Sunday morning arrived with the crash of thunder. Carl blinked as he opened his eyes to a blue haze, the remnant of lightning on his retina. His bedroom was still dark so he was surprised to see his clock reading 11am. Rain and hail rattled against the window panes and could be heard bouncing on the balcony outside. Refreshingly cool air was blowing through the door presumably from the bathroom window he had left open.

The cleansing spirit of the storm had brought with it a clarity of thought too. The nervous stress and tensions had evaporated and he could analyze his life rationally. He reflected that he did not like sex. Of course, he enjoyed it as much as everyone else. What he meant was that he objected to it intellectually. There is a fundamental contradiction between the instinct to fill a woman's every orifice with goo and the respect inherent in love. Every man knows in his heart that rape is only the end of a spectrum that contains his own desires, he lamented melodramatically. In fact, even one of Carl's previous girlfriends had commented that in orgasm it really didn't matter who you were sleeping with. Thinking like this was presumably what had got Englishmen labelled as useless lovers. Well, good for us, championing intellectual reason and compassion over animal lust, Carl concluded.

The plan of the day before, to propose to Sasha, did not stand up well when held to the light of clear analysis. How pitiful it would look to admit to infidelity and then attempt recompense through an expensive ring and promises of life-long devotion. He very much hoped Sasha would throw said ring back in the face of anyone crass enough to make such an offer. Great, so no plan. He was just going to have to humiliate himself by telling her the truth and submit to her verdict. What he wondered would that be? Would he forgive in her place? Probably she would feel used and stupid, particularly if she had passed up opportunities herself. Any feelings of virtue would be quickly replaced by humiliation. He wasn't sure at all he wouldn't show himself the door as a matter of pride. As Amber had said, it was not his decision.

He realized he'd still not seen or heard any sign of Amber. She hadn't left a message on his mobile. Now, if there was a woman capable of acting irrationally under trying circumstances it was Amber. She may very well have got a plane to Rio with no plan of return. He almost caught himself growing angry at Trevor.

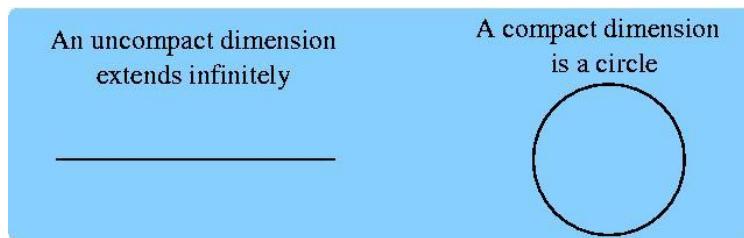
The will to rise from bed was not growing. He had to go and buy a black tie for the funeral the next day, he remembered. No wonder it was raining.

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WPC Thatcher had awoken earlier. Her body clock was locked into 7am as rise time since that was when her daughter normally began to shout the place down. This morning though, Chloe and her husband were miraculously both still asleep – she should leave them together for an evening more often! An uninterrupted bowl of cereal was a

considerable luxury. The encyclopaedia was still on the coffee table from the day before, so she flicked her eyes over the section she had passed up before

**Compactification:** *A dimension of space can be a circle. Essentially this means that if you travel westward in this direction then you will emerge from the east and return to the point you started. The three directions of space we know are believed to be infinite in extent and not compact. The six extra dimensions of space predicted by string theory may exist and be compact though. For this to be the case the distance before you return to the same point in space must be smaller than any distance so far measured in science since we have not observed the extra dimensions.*



This seemed a peculiar idea to the WPC. Again her period for reflection was cut short by a cry

“Mum! Imbles!”

With a sigh the WPC realized they were indeed missing the Fimbles on breakfast TV. The meaning of life, the Universe and everything would have to wait until later.

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Eventually Carl had dragged himself up, and while waiting for the remnants of the storm to pass outside, was trying to summon the motivation to continue his researches into alchemy. The field did not seem like one of Mankind’s greater intellectual achievements consisting, as it appeared, of the sloppy interpretation of experiment generously mixed with mysticism. How, Carl wondered, could Newton have been interested? Suddenly this seemed a worthwhile question and his enthusiasm re-emerged.

Carl agreed with many of his colleagues who considered Newton to be a genius and the founding father of modern physics. Newton had dared to propose an astonishingly simple model of gravitation. The accuracy of his predictions created belief in the idea that the Universe was open to simple, mathematical description. Everything else in science has followed from the precedent Newton set. So why had this man written more on alchemy than science? Perhaps, Carl decided, he should look a little more at the concepts in fifteenth and sixteenth century alchemy.

A few web pages later Carl’s frustrations were returning. There was John Dee who had tried to talk to spirits some passing con-man claimed to hear. Paracelsus invented the name Laudanum for the opium he took. Vast numbers of intricate woodcuts mixing

chemistry, erotica and mythological themes were produced that apparently held the secrets of the Universe if only you stared at them for long enough. And every practitioner was claiming others' failure was a lack of some undefined enlightenment. Yet still, there were discussions of Newton's attempts to reconstruct the floor plan of the temple of Solomon in search of clues. His library had contained more than 200 alchemical books and he had worked himself to a nervous breakdown and near poisoning in his laboratory. Why, why?

What Carl wondered was he missing? - most likely historical perspective. Alchemy was a mix of religion and an overly ambitious attempt to solve the properties of matter. So the first point was to approach the subject with a strong Christian world view, which after all would have been impossible to avoid in the 1600s. Perhaps if you believed that God had created everything, then the assumption of some "first matter" which could be transformed into anything seemed reasonable. That you would need to reach a state of being equivalent to God's to be able to make the transformations also seemed convincing (and blasphemous?). In this mind set, after seeing reactions that interchanged mercury with its powdered compounds, perhaps one would think one was close to the original transformations. It would require some arrogance to assert this though (it's turned out wrong after all!).

Suddenly Carl started grinning feeling he had understood at last. Of course Newton would have thought he could work out the answer. It was that arrogance that had led him to dare to try to unify all motion into a small set of mathematical rules. Without the presumption that you can understand anything, science could not function. There are all sorts of parallels even in modern physics research. His colleagues spent a great deal of their time trying to write down TOEs – theories of everything. Here they presumed that the current understanding of the particles and forces of nature were the sole ingredients needed to write down a complete theory of everything at all energy scales – these theories attempted to describe even collisions billions of times more energetic than man had ever observed.

He realized he'd failed to tell WPC Thatcher of this crucial aspect of the search for the Higgs boson. The strong and weak nuclear force theories are based on the existence of identical copies of the particles as he had explained to the WPC. For the strong force there are three copies of the quarks, in the weak force two, such as the electron and the neutrino. The force-carrying particles interchanged the particles in an interaction – a red quark becomes a blue quark and so on. The Higgs, though, makes the particles that interchange an electron and a neutrino heavy and hence the force weak. So then one could imagine a greater theory with five identical particles and force-carriers that flip each into the other in an interaction. Now a Higgs-like particle could make some of those force-carriers so heavy we would never have observed the forces. We might be left just seeing three of the particles interacting and call them quarks and another two interacting only with each other, and call this the weak force. There would be force-carriers that could convert a quark in a proton into a positron so that the proton would decay. No one had ever seen such an interaction so the force-carriers must be super heavy.

We should give thanks for that, reflected Carl, since the existence of eternal protons at the centre of atoms is rather crucial to the existence of everything we know.

Such an idea of a super theory might lead to the idea that all the particles of nature are just identical copies of each other and there is one overarching force that we see only part of. The mechanism for making force-carriers heavy, involving the Higgs boson, was therefore an essential ingredient of the dream of an ultimate theory.

Carl considered he had now placed alchemy correctly in the scientific endeavour. It was an example of a paradigm of theories that had been imagined by science, pursued experimentally, and then found wanting. That it had survived so long was a warning that scientific theories are driven by the very human beliefs and desires of the practitioners. Alchemy was the hanged man at the gate of a medieval city then? That's too harsh surely because the imagination and daring of the attempt had still to be cherished. Alchemy had nourished chemistry too – it wasn't all rubbish. Now Carl thought it would be fascinating to decipher Newton's alchemical work, to see the leaps he must have made to try to make this theory fly. There were parallels to the last years of Einstein's career. He too had tried to unify all the forces in the spirit of his General Theory of Relativity, yet lacked crucial ingredients we had since found in understanding forces in the quantum realm. Still, life is short and could one really bury oneself in recreating the confusions and despair of these failed endeavours? Carl would keep working at the frontier of what worked, he decided.

Had this interpretation of alchemy been shared by Andreas, Carl wondered?

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The sharp ring of the telephone suddenly cut through Carl's musings and researches. Sasha. He looked at the telephone in trepidation, his stomach freezing. Three rings, then four. He had to pick it up but he hadn't planned what to say.

“Carl?” It was her.

“Hello”

“I tried last night but you weren’t in,” a question clearly implied. Snogging a policewoman was not the right answer.

“Oh, I went to the Institute to catch up on some work – this week’s been rather interrupted.” So much for the new era of openness and honesty!

“You shouldn’t work so much.” A slight pause grew. Now was when he needed those carefully constructed chatty few lines to relax them both.

“Are you still OK for Tuesday?” Was there a bit too much forced enthusiasm there?

“Yes, it’s fine,” she sounded tired, “I’m really looking forward to it.”

“Me too.” Another pause which she followed with, “We need to talk face to face don’t we?” Oh shit. She knew something was wrong.

“Yeah, the phone’s hard,” he added lamely. Should he just tell her now?

“Well, OK, let’s leave it until Tuesday. Look after yourself until then, love.”

“You too – love you,” that last almost sounded pleading.

“Bye”

“Bye”

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Carl had finally made an expedition out to the shops in the later part of the afternoon after the rain had passed and fresher sunshine returned. The choice between a matt black or a silky black tie had almost been beyond him. He had finally found one that lay in between the extremes available and settled on that compromise. The day was slowly turning to evening and the only activity he had planned, to brush down his suit and check his dress shirt could escape without ironing, were already complete.

His morose contemplations were interrupted by the door bell. Amber? In fact it was Paolo seeking a companion for an evening coffee. Soon they were settled on light weight aluminium chairs that a somewhat trendy pub had provided out on the high street. Carl thought their coffee was OK so Paolo’s Italian sensibilities were presumably being assaulted.

Paolo seemed unusually on edge or at least not as completely laid back as normal. He was even sat up to the table rather than sprawled over his chair. The reason for this, and probably the whole point of the coffee, soon emerged,

“So, amazing thing! I’m on a shortlist at Indiana. They e-mailed yesterday.”

The transition from postdoc to postdoc who gets on shortlists for full time jobs was a big thing. The University of Indiana sounded grim though. He tried not to let on,

“Wow, that’s great!” Paolo looked unconvinced.

“Indiana is very flat,” he pointed out, “and they e-mail their job candidates on Saturdays.” Carl tried to remember the name of the state capital of Indiana.

“You should send your name to the US job rumour mill web page – you’ll start getting other offers then.” The winning of permanent positions in theoretical physics was a

sufficient matter of worry and gossip that web pages existed all over the world to spread any news as fast as possible.

“You think I should?” asked Paolo.

“Well, as I understand it, in the US, appearing on the rumour mill is crucial since it convinces other places to look at you more seriously – somewhere has rubber-stamped you as worthy. It’s a bit different over here. I even heard one guy saying he didn’t want to be on the UK board because to be seen to have been on the shortlist but not got the job would look bad. The US world view seems to make more sense to me.” Paolo shrugged apparently unconvinced either way.

“The interview is three days!” he snorted in disbelief.

“Ouch! You won’t be able to wear a football shirt the whole time!” Paolo looked pained. “In fact, when are you going to stop wearing that Italian shirt? Sure you won the world cup but it was only on penalties!”

“Penalties are a perfectly good way to win. The statistic that is most linked to winning a league is percentage of shots on target scored. Penalties test the same thing.”

“That’s a new one on me. I’ve always argued in favour of penalties on the basis that in football being the better team only seems to give you at most a 20% advantage. The random refereeing is worth 30% - you might as well have the lottery of penalties!” Paolo gave another big bear-like shrug.

They had finished their coffee and Paolo headed off to phone his brother with the news. Carl assumed the point of the evening had been to prompt him to spread the gossip around the Institute for Paolo.

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As Carl clattered back up the stairs to his flat, he passed Amber’s door. It was late – you’d think she would be back by now. His knock went unanswered though. He could get her spare key from her window ledge. Should he enter?

A few minutes later he returned, key in hand and opened the door. The place was dark and quiet. The broken bottle still lay in the hall in a soggy mess of carpet and red wine. No sign of Amber. No sign of packing although he didn’t want to start opening her drawers. Where the hell was she, he wondered? He started to imagine all sorts of worrying scenarios if she’d gone out alone on Friday night. He couldn’t think what to do though. She was an adult and free to go away if she wanted.

In an attempt to suppress some of his guilt he decided to clean up the wine. It took much of the rest of the evening to soak it up into paper towels and reduce the mark to a background stain. Amber had still not returned.

## Chapter Seventeen

The Phi grounds were becoming a welcome, peaceful oasis for WPC Thatcher. Nobody was ever running here. Instead one only encountered wandering staff lost in puzzled cogitation. She had begun the week in her office re-gathering her notes and thoughts from the previous investigations. She still wanted to conclude her report with a brief statement of what Andreas had been working on, so mid morning she had made her way up to the Institute. The secretary, Alison, was not in her office in the foyer. Presumably she was preparing to attend the service and reception for Andreas at the Cathedral later in the morning. The WPC was grateful that her superiors would be attending and she wouldn't have to.

Before passing into the building proper though, the WPC paused. Two young men were talking in the foyer out of her sight. For some reason, perhaps a nosiness born of police work, she paused to listen to them.

“You look very smart,” one of them was saying, “I didn’t know him so I can’t face the ceremony myself.”

“Beyond the call of duty for a visitor anyway, Pete,” responded the other. “Actually I wasn’t greatly connected either – he did strings, I’m lattice,” apparently a sufficient explanation of separated worlds, “but you have to go don’t you? Besides perhaps there will be some fireworks – if Geoffrey over hypes string theory Morris may feel the urge to get hot under the collar or storm out like he did in Andreas’ last seminar! One wouldn’t want to miss Phi history being made.”

Morris would be Morris Trant deduced the WPC. When they had spoken there had been a reluctance to comment on Andreas’ work but no suggestion of a public argument. Even the simplest of cases seemed to be dogged by half truths she reflected. The conversation she was listening to had finished and with a wry wish of good luck the two separated. One, a blond-haired young man in a suit and black tie crossed in front of the doorway, the other in shorts and t-shirt was disappearing the other way. Another interview with Prof Trant was called for, then.

First, though, she would stick to her plan of climbing to the second floor to see who she could find to explain Andreas’ work. The computer whizzes might have come up with something new too, she thought. As she crossed the carpeted museum area she saw that for the first time since she had been here Prof Sinclair’s office door was open. His room was strangely positioned out here away from the core areas of the main research groups. She had been intending to ask what he did and now was her chance, so she allowed herself to again be deflected from her main goal.

She knocked gently on the office door and it swung into the room. The sight that greeted her was a surprise. The desk and floor were covered in half filled cardboard boxes. A man, presumably Prof Sinclair, was practically hurling books from the room’s shelves into the boxes. He was well groomed in a sharp grey suit and with short trimmed hair.

His features were symmetric and attractive. He was in his early fifties she estimated but could have filled the role for a shaving advert in his youth. The first impression was marred by the fact he was clearly in a massive fury. He turned with a look suggesting he would bite her head off but it turned to a little surprise when he saw her uniform. Then he turned away with a scowl of irritation and snapped,

“Yes?”

“Prof Sinclair?” she queried in as controlled a voice as she could manage. He turned to her and nodded, his expression adding that she should get on with it. “I’m investigating the death of Andreas Born.... And I’d like to have a word about your relationship with him, please.”

“He was a nasty piece of malicious work and I can’t say I can find much sympathy for him, whatever happened. I was in London on Tuesday in any case at a conference - all day. I have a watertight alibi so there’s no point speculating on my having played a part.”

“You’re leaving the Phi I take it?”

“I most certainly am! I just handed Geoffrey my resignation. Not that it’s his fault.” The levels of venom were quite shockingly at odds with the environment. The WPC was intrigued as to what could have been the origin and probed in spite of her doubts that it was really relevant to the case.

“I think you had better calm down Professor and fill me in, given the circumstances.” Sinclair paused in exasperation and dropped the latest pile of books into a box apparently at random. He appeared to give in to the situation though and indicated her to have a seat while he retreated behind his desk. She closed the door and sat looking expectant.

“Geoffrey brought me here from Cambridge. He said that he and the Institute staff were all very keen to forge links with philosophers and historians of science. That’s what I study. It seemed like a super opportunity to participate in frontier science as it happens. What Geoffrey actually meant though, was that he was interested but nobody else gives a damn. Prof Clark lectures me on how philosophy is a dead subject. He says the only active parts of the field should be in social science, economics, and science departments. The rest should be considered part of history.” Sinclair clearly considered this view point such patent rubbish that there was no need to refute it. “Fields quotes Feynman at me every time I see him – working physicists need the philosophy of science like birds need ornithology,” this last he repeated in a sing song voice. He paused and regarded the WPC as if to discover whether she was one of these degenerates too. She kept her face entirely level. It wasn’t her place to express an opinion.

“And this is why you’re leaving?” she asked

“Yes, well that and the last bloody month.” He paused this time as if he was about to tread on thin ice, then picking his words carefully continued. “Andreas has spent the last

month playing a nasty prank on me. He came to me with some documents he said his grandfather had just discovered in the loft in his house in Lubeck, north Germany. They looked very authentic and contained a discourse on a book on alchemy by Newton. The quoted pieces, alleged to be Newton's words, were extremely convincing. The alleged first author was talking drivel, but that was possible. I was wary, but chemical checks on the paper showed it was contemporary and embedded with mercury fumes and so forth as if it had been in a laboratory. I became quite excited and even began to tell my colleagues. That it turns out was premature and I shall be living this down for years to come. The ink contains synthetic compounds of modern manufacture. He was winding me up and could have destroyed my reputation. This isn't without precedent I should add. There was a case, much revelled in by the physics community, of a spoof article being published by a philosophy journal only a few years ago. I was aware of the possibility you see. It's unacceptable though, as I'm sure you understand. I have found myself a position in Paris and, if you will allow me, intend to be gone by mid-afternoon."

Another piece of the jigsaw had fallen into place. Sinclair was S. Andreas had died over a practical joke on a colleague.

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The Epiphany chapel, situated in the North transept, was one of the more utilitarian sections of Winchester cathedral, normally set aside for quiet prayer away from the tourist crowds. The walls, bare stone which glowed a golden yellow in the morning sunlight, still boasted towering columns up to the vaulted ceiling far above. The chapel's decorations were otherwise minimal apart from the famed pre-Raphaelite stain glass windows. The altar was a simple table draped in a modern red cloth adorned with golden tapestry work of the city. A discreet, dark wooden cross sat in the middle of the altar flanked by two tall, white candles.

The congregation, a black-clad mix of Phi staff and friends and family of Andreas, were perched in rows on bare wooden chairs with wicker lattice seats. Carl was sat towards the back of the Phi group, his seat against one wall with Kay beside him looking earnestly forward at the proceedings. He was feeling strangely alienated by the service. The vicar, or priest (what would he be in a cathedral?) was speaking, gently giving thanks for Andreas' life and affirming their horror at his death.

The setting and the assumed belief in God being expressed here were almost surreally medieval to Carl. He realized that he hadn't been to a church for its true purpose since he was a child. The depiction of the crucified Jesus on the cross seemed simply distasteful to him – it was an effigy of man's inhumanity to man with none of the connotations of divine soul saving sacrifice. The stained glass window he could see showed Eve in the luxuriant Garden of Eden, a children's story that for him might as well have been of Robin Hood or even Goldilocks and the three bears. Strangely he began to feel guilt for his thoughts. He imagined all the people around him believed in this truth and he feared exposing his difference.

Kay, next to him, reached up to wipe a tear from her eye with a small handkerchief she had clasped there. Carl was brought back to the truth that he was supposed to be mourning for Andreas, not being self indulgent. He should concentrate on the sentiment, however it was expressed. They were being asked to pray so he bowed his head forward and stared at the back of the chair in front. The words of the prayer, which placed trust and at least shared responsibility for people's actions with the priest's mythical being, only distanced Carl more, though. The clergy in the church that Carl had met always seemed the most gentle and caring men and he always wanted to be open to their desire to help. The unbridgeable barrier, though, was that these men had, in Carl's eyes, made utterly the wrong decision on the first and simplest of questions about life. As you grow up you come to realize that Father Christmas and the tooth fairy are stories, that there aren't monsters under your bed and surely, finally, that there is no beneficent God watching out for you. How could you learn anything from a man who had hidden from that truth? So then, Carl decided, this was not the time for him to mourn Andreas. Perhaps though, his presence would support Andreas' family.

He felt a bit more comfortable now viewing proceedings as an interested observer. He began to survey the backs of people in front of him at the service. There was a small group of young men and women that were not connected to the Phi. He supposed these were friends from Andreas' social life. They all seemed very well presented, most middle class. He'd imagined a more Bohemian group with pony tails and tattoos. The thought of tattoos made him wonder which of the women was the infamous, sexy SukieG. As the service came to an end he realized how inappropriate it was to be undressing the mourners in his mind; Andreas would, no doubt, have been much amused!

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The reception after the ceremony was held not in the Cathedral proper but in a nearby cream coloured, stone house, once part of the Bishops' palatial abode, on the Cathedral close. An array of light snacks and drinks were laid on a table at one end of a large open room. A few dining chairs were placed against the walls but most of the group were expected to stand.

Carl had become separated from the other postdocs in his search for a glass of orange juice. He tried to avoid alcohol when the senior staff were around. After seizing a glass, he looked about to see where he should position himself in the room. He wondered if he should go and express his sympathies to Andreas' parents but they were surrounded by a group of the great and good both from the Phi and the Cathedral. Mr Montford would no doubt have everything carefully planned and wouldn't appreciate a postdoc barging in; a case for being seen but not heard.

He located his friends across the room. It looked as if Paolo was milking the others' interest in the job interview for all he could. Carl started to head over but suddenly found himself face to face with Georgina Montford. She was clearly in her element at such a social gathering. She wore a stylish black dress which somehow both accentuated her figure and yet was appropriately subdued for the occasion. Her make up and jewellery

were stylish but not flashy. She was intimidatingly beautiful. She appeared to have spotted Carl before he had her and blessed him with a Californian smile. With a slight glint in her eye she greeted him,

“Carl, isn’t it?” then with a hint of sauciness she added, “I haven’t seen you in ages.” Carl deduced that the offer was still open and began to flush. He searched for some quick words to excuse himself but she had an alternative plan. “Carl, let me introduce you to Mr Hayhurst,” she turned to a small man beside her whose hair was greying and thin and who wore circular wire framed glasses. He had a very triangular face that ended in the point of his chin.. “He’s the treasurer of the city’s Historical Society.” Did Carl pick up a slight tone of mocking boredom from her there?

“Cyril, this is Carl Vespers our most exciting young researcher at the Phi.” Carl flushed again. She was clearly enjoying embarrassing him. The man, Cyril, presented a pudgy hand and Carl had little choice but to be drawn further into their group. Cyril did though seem eager to meet him, smiling a little obsequiously.

“You must be the Carl who Geoffrey has told me about,” he started to Carl’s surprise, “You’re working with the police on..,” he paused as if not wishing to speak Andreas’ name here, “this case.”

Carl nodded a little warily. Georgina leapt into the slight pause and extracted herself with a fluttered motion of her hand in the direction of her husband. He was being used to help her abandon a dull guest Carl realized. As she left them she added, “I do hope to see you again soon, Carl.” Apparently oblivious to the snub, Cyril continued,

“Geoffrey has been telling me that there is the possibility of an important historic book being found. There was an old bookmark with a crest?” So that was where the crest of Trinity College had come from. If Montford knew that though why hadn’t he told Carl? Antique books and the secretary of the Historical Society was a clear enough link but Carl didn’t like being pumped in this way. The oozing nature of the man put his back up too.

“I’m not aware that any original book has been found – there are lots of reprints of alchemy texts and so forth though,” presumably Montford had already told him as much. Cyril Hayhurst considered this and then rather secretively whispered,

“If there was a book and the police haven’t found it then it must still be hidden in the apartment mustn’t it?” He paused eyebrows raised then added, “Interesting thought, heh? Interesting thought.” This appeared to be the message he wanted to get across because with a brief tap on Carl’s shoulder to further reinforce their conspiracy he headed off towards the drinks table. Carl watched him go somewhat non-plussed before, with a shrug, heading over to the gaggle of postdocs.

## Chapter Eighteen

Two O'clock was perhaps a bit early to hit the Royal Oak but Kay had said she needed to wind down after the service. Everyone was feeling a little worn and sank into their pints with pleasure. Carl reflected that a benefit of afternoon drinking was that you could claim a table which comfortably seated everyone. Andre started the conversation going and interestingly had been atheistically suffering through the service too.

"I find it a bit depressing that there's no secular way to mourn someone," he said, "Physicists at least should have found a way to free themselves from all the God speak." Paolo grunted in affirmation and Carl nodded. Only Kay seemed up for the fight,

"I thought the Dean did a very nice job. I find the religious stuff soothing. Physics and religion aren't incompatible anyway you know." Paolo snorted again at this. It was a provocation too much for him.

"Of course they are," he jumped in, "All that demonology and genealogy back to the creation have been banished by us. Religion is dead."

"No!" she retorted, "It's simple philosophy – experiments can never challenge belief systems. Science is itself a belief system; there's no logical, forced connection between observations you've made in the past and what happens in the future. You know all that stuff about how God could simply have set the world up a second ago – you can't disprove it."

"So philosophy is useless!" Paolo countered, "Look, I've never met someone who doesn't think it's dangerous to step in front of a car once they've seen someone knocked down by one. That's all the belief there is in science; you watch something, work out what's going on and assume it'll do the same again. We've explained everything that way and religion with its 'wind is a demon' and 'you've got to rip people's hearts out to make the sun come up' is dead. What's left is hiding in the holes – 'God happened earlier in the Universe than physics can so far explain' or 'he acts only when no one is watching'. Dead, dead, dead." Even Kay laughed at the end of the tirade. There wasn't much dispute from any of them.

"I don't know," contributed Carl, "I just can't understand how you pick your religion. It seems like there's an infinite set of religions where you can, say, get damned if you kill, or then not, if it's an infidel, or with an army, or in a cause you think is reasonable. Then you might have to worship on Sunday, or Monday or every nine days or once in a blue moon and so on. How do I know which set of arbitrary rules to follow? I guess you're supposed to 'look into your heart' and know the truth is that bread sometimes becomes immortal flesh. Damned if my heart knows anything about it though! Guess that's why all the new agey types just make it up for themselves!"

"Now you've reminded me of my mother," said Andre with a slight grimace. "She always asks 'How can you live in a world without a God?', as if I get to pick the

Universe I live in! Egotistical that is.” Everyone grinned again. Andre then added more seriously

“I’m coming to the conclusion that the idea of an after-life is the most evil thought mankind has ever had. You can use it to justify anything at all - kill, be nice, do the splits and you will go to heaven.” Carl wondered if this was Andre’s way of reflecting his feelings about Andreas. He was always a little too serious though.

“You’ve got to be careful though,” said Kay on a more conciliatory note, “we’re sounding like Richard Dawkin’s campaign against God. It just puts believers’ backs up and increases the divide. Religion does do a lot of good after all.”

“It’s fraudulent good though,” Paolo had no truck with any sort of compromise, “A Big Brother society could pump chemicals into the water that enforce charitable behaviour - no one I’ve met would support the idea.”

“Religion is a choice, not compulsory,” Kay bravely persevered.

“Not at my school it wasn’t,” Andre chimed in again, “Nobody said “Here’s a reading from the bible but remember you can choose to ignore everything in it if you think it’s stupid.” I was expected to nod wisely whatever ghost story came up.”

“OK, I agree schools should be secular,” said Kay raising her hands in defeat. Everyone nodded again in agreement on this point.

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The police’s computer guru was slowly packing his bag. A surprisingly large number of grey boxes and associated cables had been used to probe Andreas’ PC. The search was over though, and nothing more of note had turned up. WPC Thatcher, watching, considered that it was probably time for her to call an end to her investigation too.

She had just returned from briefing the Chief Inspector in town about her interview with Prof Sinclair. She’d almost expected him to hand her some shiny, coloured paper stars for her work, so pleased had he been. What Andreas had been up to in his home laboratory had been the outstanding question. Now all was clear and the case was as good as closed. She was pleased that she’d been the one to turn up the answer. The bookmark Andreas had been holding still slightly niggled in her mind, and also of course Carl’s mugging. Neither seemed strong enough to change the conclusions of the case though.

Through the window she saw a number of cars drive into the Phi’s grounds. The ceremony in town must have concluded. She wondered if it was worth the bother of talking to Prof Trant. It was generally considered in the police force to be a worthy thing to pursue suspects who had been economical with the truth so that in a future investigation they would not feel they could get away with lying and would be more helpful. Perhaps she should. She was also becoming exasperated about her continuing

failure to pin down Andreas' work. She would ask Carl, she concluded, for the quick précis when he returned.

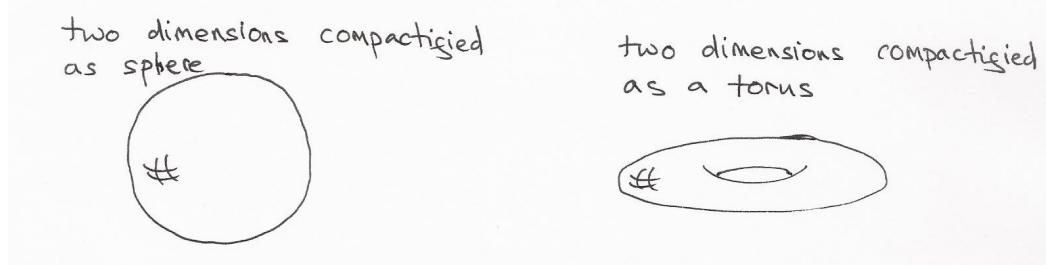
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The postdocs had settled for a second pint and more religion bashing. Paolo set it off again,

“Now if you’re looking for religious belief in science, there’s the string theory landscape.”

“Yeah, what is that?” asked Kay turning to Carl. Her work on the strong force was the most removed from string theory of any of them there.

“Well, string theory is a theory of quantum gravity but it lives in nine spatial dimensions. If you want it to describe the real world you have to get rid of the six you don’t want,” Carl explained and everyone nodded. “You can wrap them up very small but there are lots of ways to do it. For example, if you compactify two dimensions, then when you move in those directions it can be like moving on the surface of a ball or on the surface of a donut, you know a torus with a hole in the middle, or lots of other possibilities. Now in everyday life you can’t see these dimensions so any motion or oscillation of a string in those directions just looks like some intrinsic property of the thing in three dimensions. Thus every choice of compactification gives rise to a different three dimensional world.”



“So what chooses the particular compactification to give our world?” asked Kay

“Well, that’s the point. For a long time everyone hoped magic would happen and all of our world would fall out but that hasn’t happened. It now seems like all of these possibilities are equally likely.”

“So it’s just random we ended up in our world?” queried Kay dissatisfied.

“See it’s just religion – they’ve stopped trying to explain why the Universe is the way it is,” Paolo barged in.

“No wait,” interceded Carl before they leapt to conclusions, “in the whole infinite Universe there would be different bits that were like each of the possibilities. Why then do we see our bit of the Universe like it is?”

“Well?” they asked.

“The Anthropic Principle! That’s the idea that only in Universes with the correct conditions can life evolve to question why the Universe is the way it is. In most of those possible string theory worlds, everything is just a dull gas with nothing going on. The claim is that our Universe has to look like it does because we’re in it.” Everyone considered this but none of them seemed very convinced.

“It sounds very philosophical still,” said Kay cautiously.

“Sure but it’s an important observation about how the world could be,” continued Carl. “We’re expecting to find the Higgs particle. We’ve always argued it shouldn’t be light unless we find extra new particles to stabilize its mass. If they aren’t there, we’d have to pick our parameters to over 20 decimal places of precision to get our world. It seems too unlikely that we’d have been so lucky to get that number. We really need it spot on too, because if the Higgs was much lighter, radioactive decay would be very fast or equally if it was much heavier, we’d never observe the weak force at all. In both cases the interior processes of stars that make the elements we’re made of would fail – no humans!

Now though, imagine we do just find the Higgs and nothing else! Were we just stupidly lucky? Not in a theory like the string theory landscape of possible worlds – amongst those is every case. Only in the few with a Higgs of just the right mass do humans exist to look for it and be surprised. It’s an explanation of how that accident can happen and yet it be inevitable. If we do just find the Higgs then that’s a very important observation.

Well I think it’s a cool argument anyway!” His audience looked a bit glazed over. It had been a long day.

“I suppose we’d better go to work,” sighed Andre.

## Chapter Nineteen

There was a brief pause while Morris Trant digested WPC Thatcher's accusation of holding information. In the end he reposed with a show of humility,

"It's difficult to wilfully incriminate one's self," he ruefully admitted. The WPC had been charmed by Prof Trant's gentle but authoritative manner, as in her previous meetings with him, and she had felt a little guilty about challenging him. The job demanded it though, she reminded herself. He gave a brief explanation of his past interaction with Andreas that he had previously omitted,

"I'm probably old fashioned but I get rather frustrated with theorists who spend their time continually trying to guess the future. To justify their work they must come up with more and more radical extrapolations from what we know. It seems to me that a degree of sense is lost and the ideas become so implausible as to be ridiculous. They argue that they drive our experimental colleagues to search wider for new phenomena and I suppose that's true. Sometimes my conservative irritability overflows though." He seemed genuinely sad at his own failings.

"Well, anyway, Andreas presented a seminar on using gravity to explain aspects of the weak force. Now gravity is such a feeble force that it plays no role in particle physics. It is a force as a result of the energy two bodies have. To make the gravitational force between two electrons as powerful as their electric repulsion would require them to have an energy a million, million, million times higher than we have ever endowed one with. Gravity does not have anything to do with what we study. That doesn't stop my string theory colleagues studying theories of gravity of course. They hope to bend their theories so that they do become relevant to what we do – you'll have to speak to them if you want to know the details. This is just one of those implausible ideas it seems to me – an old man stuck in his ways perhaps. In that seminar all this boiled up and I let Andreas know what I think, then stalked out. Childish I fear. I apologised to him later." The WPC considered her point made, having forced him to own up to the incident. She had become interested in the wide variety of views within the field though,

"You expect the Higgs mechanism to generate the particle masses then?" Trant grimaced a little,

"I don't know, probably not. You see generating mass is not so hard. Do you know where the mass in your body comes from for example?" The WPC groped for an answer but Trant intervened apparently wishing to save her embarrassment,

"An indelicate question to ask a lady, I apologise. What I meant was that protons and neutrons are what give atoms mass." The WPC was keen to assert that she knew something of what they were talking about,

"Their mass comes from the quarks they're made of I presume."

“Ah, it’s not so simple. An up or a down quark is very light, little heavier than an electron. They gain extra mass from the strong nuclear force. The strong force is quite remarkable in that it becomes stronger as two quarks are separated. Compare that to an electric charge, which you could take to another galaxy and forget about!”

“So that’s why quarks are stuck in protons and neutrons?” questioned the WPC. “If you try to pull one out it just gets sucked back in?”

“Yes, precisely! That means that quarks are very strongly bound together or equivalently that you get a lot of energy out from pairing quarks together.” The WPC frowned at that so he added, “Think about what happens in a hot gas – as it cools electrons are attracted closer in to the nucleus of their atoms, where they want to be, and in doing so they emit energy as light or infra-red radiation. So binding things together gives you energy.” The WPC nodded unsure where they were heading.

“Now when you bind a quark and an anti-quark, because the strong nuclear force is so strong, the energy you get out is greater than the energy it cost you to make the quarks. So the Universe can create quark pairs like mad. It does! Remarkably the whole of space is very densely packed with quarks.”

“Why aren’t there an infinite number if they’re for free?” interrupted the WPC.

“Ah good question! The strong force becomes stronger if quarks are separated but weaker as they approach one another. If you create too many then they are all packed in so tight that there is no binding force and no energy back. So there’s a compromise.”

“How dense are they in space then?” This made Trant smile, pleased with what he was about to reveal,

“As dense as an atomic nucleus, my dear!” he waved his hand in front of him as if to emphasise the ridiculousness of his claim that this space was denser than lead. The WPC raised her eyebrows, she wasn’t going to walk into the trap of telling him this was impossible when he knew more. As she suspected he couldn’t resist explaining in any case,

“The protons in your body are heavy because they have to move through this super dense medium of quarks. They keep banging into them and that interaction generates the energy that makes the proton’s mass.” The WPC thought she saw the chance to wrap up the discussion,

“So you think these quarks in space are responsible for the W and Z masses then?”

“Alas, no, they are not dense enough to generate such big masses. The W mass is eighty times greater than a proton’s mass. But one can repeat the idea! There would be new, as yet undiscovered, quark-like particles with a new even stronger force.”

"Inventing a whole new sector sounds pretty ambitious too, doesn't it?" Trant smiled accepting the point,

"A new sector but a repeat of already discovered physics. In a sense it is just the Higgs mechanism – the quark anti-quark pairs are the Higgs, but the Higgs is not fundamental since it is made of the sorts of particles we're familiar with. The conservative solution!" Perhaps, thought the WPC.

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Rather comically, the dress code at the Phi Institute had turned to formal shirt, trousers and shoes for the afternoon. To a man the researchers had discarded their jackets and ties, although few of them looked comfortable even so. Carl had not made it back inside the building. He was tired, distracted and two pints the worse for wear. It was almost the end of the day anyway. Trying to work seemed a forlorn hope so instead he'd ambled off around the grounds.

Sasha was one unsolvable problem. He had pretty much given up hope by this stage. What was he going to say tomorrow? Georgina Montford must be back up the hill at her house by now. Tempting images of flesh and lingerie flitted through his mind. If Sasha was past history, why shouldn't he take Georgina up on her offer? His pulse quickened at the daring thought and half tempted he took a few steps towards the path by the lake. Any hope of arguing to Sasha he had acted impulsively would be dead and buried, though. His self respect seemed to be against it too. He veered back along the lake side.

Another thought competing to rise to the surface of his consciousness was Cyril Hayhurst's observation that if Andreas had a book by Newton it must still be in the flat on the Green. The idea was growing more plausible to Carl. Did he truly believe there was a real book and not just forgeries? Yes, or was he trying to write an apologist's history for Andreas? He realized that he still had the key to the flat – the WPC must have forgotten to ask him for it back. To find something the police search team had missed would be exciting. He'd better wait until the evening so there wouldn't be any police there. In fact perhaps he should quietly disappear right now before the WPC came looking for the key. He glanced around guiltily – there was no sign of her. Feeling a little like a naughty child he headed for the road home, his amble now increased to a purposeful walk.

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Only the faint acrid smell of chemicals remained in the flat to indicate its previous state. The police had cleared the rooms completely; presumably Andreas' parents would be taking his possessions home with them. The rough plastered walls with their patchy off white coating and the bare, chipped, wooden floor boards made the place stark and slightly creepy. There was almost sufficient light from the illuminated cathedral across the Green but Carl flicked the light switch and the bare bulb in the middle of the ceiling sprang on, over bright. You needed to be able to see to search.

What though was there left for him to search? He had envisaged tapping on desk drawers looking for hidden compartments or feeling under the base of a wardrobe. If the fabled book was in any of those places though, it was now beyond Carl's reach. There was a set of cupboards under the sink in the kitchen and he ran his hand around inside, pulling on every edge or wood knot. There were holes round the piping into the skirting but poking his fingers in produced only dead spiders and greasy grime.

The chance of there being a second hidey hole up the chimney seemed low but he arched himself up into the dank space. The shelf the police had found was ideally sized to store a book but he'd know if there had been one there, having seen the police locate it. It seemed to have been plastered over and only recently broken into; the edges of the plaster around the niche were still sharp. He couldn't induce any other bricks to shift or hear any sound of further holes behind the plaster when he gently rapped.

Loose floor boards? He had brought a screw driver with him to try to pry up boards. This had seemed a likely possibility but as he worked across the floor his enthusiasm waned. They were all secured down by long, solid iron nails that the wood had swollen round and damp had half rusted. None of them shifted even a fraction of an inch. He sat on the floorboards under the light bulb and surveyed the flat disconsolately. It had probably been foolish to think the police would have overlooked something anyway.

One last surge of defiance rose within him. If he had a book and had to hide it here in these barren rooms, where would he put it? Above people's line of sight was a standard good trick. There was no loft hatch though and the curtain rails were thin reeds of wood. Presumably the loft was accessed from the main building below, or more likely had been done away with when this apartment had been built. So there would just be narrow spaces under the roof tiles above. Suddenly he remembered looking out of the window a previous time and the hatch-work of wooden struts supporting the eaves. You could certainly reach up and tuck a book away amongst those he thought excitedly.

He tried the window he had peered from before. The other in the main room had been hard to access behind a worktop and the glassware and chemicals it had supported before the room was cleared. He had to sit up on the window ledge and half lean out. Three stories down looked much further to fall from above than below but he could hang onto the window frame securely enough. Reaching up between the struts of the roofing there was indeed a decent hole protected by the slates. He reached his arm up through several different holes before his fingers bumped a soft package. Grasping it, he realized, with astonishment, that it was indeed a book covered in a thin, soft, leather covering. He drew it gently out from its hiding place and retreated back inside.

Carl sat cross legged on the floor and surveyed his find with a grin. The loose leather wrapping looked old and stained. There were white streaks that reminded Carl of the plaster around the fireplace niche. Could Andreas really have just found the thing hidden in the fireplace when looking for a place to stash his drugs? It didn't seem to have been good luck though, Carl reflected. Unwrapping the cloth revealed a thin, plain book

roughly the size of a normal pad. It had a brown leather binding. That library smell of old paper rose from the book.

The paper within was thin and coarse. It looked like there were roughly eighty pages. The content was hand written notes in black ink, each page showing a shadow of the words on its back. The title page read

*Isacus Newton  
Trin: Coll Cambridge 4<sup>th</sup> March 1691*

Carl stared at the page for several moments astonished to be holding such a thing. The hand writing, Newton's hand writing, was fairly modern he observed. The capitals and the tails of letters were adorned with a slight heraldic flourish but it was very readable.

Gingerly turning the page revealed a mass of notes. There was a slight orange stain on the margin which looked chemical rather than mould. Carl realized this would be harder to decipher. There were words

*... gave a substance with a pit hemispherical and wrought with a net like hollow work...*

But also mixed in were an array of symbols. Male and female symbols he knew, but curly fours and calligraphic Rs in strings were a mystery. The bottom of the page had a section bracketed off by a strong pen stroke across the page and down its side

*A sea colour*

*Take privet berries when the sun entreth into Libra, about the 13<sup>th</sup> of September, dry them in the sunn; then bruise them and steppe them in Allum water, & strain them into an earthen porringer that is glazed.*

Maybe that was for an ink colour, wondered Carl? He flicked on through the pages of dense notes just enjoying the sense of discovery and the history that breathed out of the pages. After several minutes it dawned on him that perhaps he should be wearing gloves to avoid damaging the pages. Or had he read that gloves were even more damaging than fingers and were only used by librarians because of a sales scam? In any case, an historian would probably lynch him for what he was doing. Andreas must have been working through the text in detail though, doing far more harm as he repeated experiments. The tome seemed basically intact nevertheless. He remembered the tens of thousands of pounds, black market offer they had had for this book and decided to place it back in its cover.

What then should he do with it? The goal had been to find the book to uncover another clue as to Andreas' thinking. Should he give it to the police, or Andreas' family, or was it his since he'd found it? If it had been found in this flat maybe it belonged to the landlord? He sincerely hoped the absence of proof of its origins would preclude the latter. Well, he

wasn't going to leave it here so he'd better take it home with him to decide. He placed the book securely in his satchel with the screwdriver.

He climbed to his feet, switched off the main light and clattered down the narrow stairs onto the street below. He still couldn't believe this venture had turned out so perfectly. He turned the key in the lock. Suddenly a sense of *déjà vu* hit him - a shadow behind, a crunch of gravel under foot. In horror he realized he'd walked like some innocent lamb into the same trap as the previous night. This time a heavy bar smashed across the back of his head and as he lost consciousness with his only thought - I can't believe I gave him a practice run!

## Chapter Twenty

Silence and darkness surrounded Carl. His head was pounding excruciatingly, with waves of nausea over the top. He couldn't move – was he in a narrow space? The atmosphere felt like he was indoors. He could make out the grime at the foot of an oak panelled wall just in front of his face in the barest glimmer of light that was available. He tried to groan but there was cloth held tightly in his mouth. He must be bound! He struggled in panic only confirming that all he could do was squirm. His ankles wouldn't separate and his wrists were tied behind his back. The effort of moving induced a shower of sparks in his vision followed by an engulfing wave of darkness.

When next Carl came to, nothing had changed. He had no idea if he had been unconscious for seconds or hours. The nausea had retreated, though it still threatened. This time he flexed his muscles against his bindings more gently. They felt like strips of rough cloth, as if ripped from a sheet, and there was some give in them. Encouraged he began to work against the slack by twisting his wrists. His shoulder objected with a sharp shower of pins and needles. He kept worrying away for what felt like minutes.

While he worked, his mind tried to piece together events. The book and the assault came back to him. They, whoever they were, had the book, so why had they kidnapped him? How had this venture reached such a perilous point so fast, he wondered? Who would pay a ransom for him? Certainly they couldn't hope to match the book's worth. He began to worry about where 'they' were. He couldn't hear any sounds of his captors. The sliver of light, that lit the room he was in, was entering from under a door – the light was artificial so it must still be night he guessed. Visibility in the room was poor and he could only make out objects a few inches from his nose – just the wall at the moment. The room was about the size of a small office though, about twice his length from door to back wall.

The straps around his wrists had loosened considerably. The cloth was not intended for this purpose and he had been able to stretch the fibres apart so that it was just loose enough he could squeeze his wrist through. In seconds his hands were free and he brought his arms around from behind. He had to suppress the desire to cry out from the pain and pleasure of movement. He sat up and quickly wished he'd moved slower as another rolling tsunami of sickness threatened to crush him. He would have to take this more slowly. He forced himself to sit and breathe regularly until the pain receded.

As he rested, he noticed a shadow pass across the light under the door, as if someone had moved across the source. He couldn't hear footsteps but someone must be in the room outside. Silence then was paramount. He reached forward and untied his legs. There was hope, he reflected, in finding his captors had been slack about confining him. Of course maybe the room was prison enough – he'd have to see. He undid the gag and removed it from his mouth. The cloth had oil stains on it, most likely from a car. He gagged at the harsh smell and threw it down, disgusted it had been in his mouth.

The need to recover and that for a speedy escape competed for his attention. For a moment he wondered if his captors had left him his mobile phone but it was gone, along with his wallet. That would have been too much to hope for. Finally Carl couldn't stand inactivity anymore. He moved himself to a crawling position and began to explore the room. Hopefully he was less likely to knock things over this way. He began at the back wall furthest from the door. There were mops and buckets in a corner, so this must be a storage cupboard. How many buildings had oak panelling in their storage closets he wondered?

He felt up and down the walls in case there was another door handle or access hatch, though without much expectation of success. It was therefore with some astonishment that he did find a small catch that when turned released a section of the panelling at the rear of one side wall. Perhaps it was just a further storage space. The light didn't penetrate into this new void so he gingerly moved his foot inside. Immediately he found a set of stone steps going up – it was a very narrow flight, like a servants' stairwell in a stately home. His captors really must be amateurs, he thought, gleefully ready to make his escape. Suddenly a call came from outside the main door,

“Luke, where are you?” The voice was refined, nasal and familiar. The man also sounded nervously excited. “Oh there you are, I’ve come as quickly as I can.” Cyril Hayhurst.

“Here’s your book boss,” this was a younger, stronger voice, slightly cocky and uncouth. Hayhurst actually made a small sound of wonder, presumably when he saw the tome.

“What’s all this about the boy?” Hayhurst tone was almost whining.

“I told you on the phone, we should top him. I don’t know why you’re here, it’s just complicating the matter. Just let me put a bullet in him.” The man seemed angry. Carl’s bile churned anew. Why would they want to kill him? His captor explained to Hayhurst,

“Look, he’s the only guy who knows the book exists. If we top him, you can display it or sell it openly. If you let him go, it’s almost worthless.

“I never meant this to go to murder,” you could almost feel Hayhurst had gone white.  
“Where is he?”

“Out cold in there. I clubbed him with a wrench. He may even be dying already from internal bleeding for all I know. Just let me finish him.”

“What would you do with the body?” Oh crap, he was buying into it.

“You don’t want to know and I don’t want to tell you. I can keep my mouth shut. Like I say you shouldn’t be here, you’re just adding evidence and torturing yourself. Piss off and let me deal with it.”

“Well, I don’t know,” Hayhurst procrastinated.

Carl didn't want to wait for a decision! Time for a quick exit, he decided, and moved on to the staircase, gently closing the door behind him. He started to tip toe upwards in pitch darkness. The walls were rough stone and the steps old and uneven. They seemed to go up unendingly, surely at least two floors. Finally, they terminated at a tiny landing. Exploring the walls ahead he located another narrow doorway. Where would this open out? What if he crashed out on Hayhurst and his lackey? Inside the stairwell he had lost sound of their conversation. Surely he was well above them now?

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Taking a deep breath, Carl twisted the handle and the small door opened a crack. There was nobody in sight so Carl could pause to assess the view. The opening looked out on to the balcony of a large, ornate chamber. It was a substantial area like the upper gallery of a modern church. A carved oak balustrade bordered the view to whatever was in the room below. There were three rows of seats for viewing, then behind was a substantial library area. About twenty bookcases lined the walls, filled with a mixture of historic looking tomes and modern hardbacks and bound journals. Four reading desks, each centred under a mock candelabra light fitting, suggested the area was used for study.

In daylight the place would be light and airy with skylights and rows of tall thin windows on either side wall, out over the main shaft of the room. The windows were leaded and small stained glass crests adorned the central panes. In fact, Carl realized, this building, whatever it was, was essentially just this room. The stairs he had come up hugged the outer wall and emerged through a concealed door in the oak panelling. The main egress to this area was via two large, curving, wooden staircases that dropped down to the floor below.

Carl then heard faint voices drifting up from below.

“What do you mean he’s vanished?” That was Hayhurst, who apparently hadn’t left yet. They must have entered the storeroom to finish him off and found he’d escaped. “Was this really where you put him?” That sounded like Hayhurst was helping his wife find her keys and Carl almost laughed. The hired hitman was none too impressed either, snapping back,

“Of course, those are the bindings. How the hell did he get out of the room? Do these cupboards have storage compartments?” That last was followed by banging on the wooden closets and the sound of a tin bucket being upset.

“Oh wait, there’s a secret staircase in here I think,” volunteered Hayhurst. That dashed Carl’s immediate plan of hiding in the stairwell until everyone had left. He was going to have to find another hiding place fast before they were up here. The realization renewed the leaden sickness.

“Where? Where does it go?” queried the lackey.

Carl decided to survey the main body of the room. He went down on hands and knees hoping that would make him less obvious from below and also quieter. The green carpet had surprisingly thick pile. Lying flat in an aisle between two rows of seats he peered below. It was an auditorium with a stage and more seating on the floor of the chamber. A huge candelabra hung down from the roof arches above on a thick steel cord, it's multitude of candle light-bulbs glowing brightly. On the wall behind the stage was a tapestry, though it looked fairly modern. Carl realized it was a collection of Masonic symbols including stylized masons at work, anvils and the eye and pyramid design off US dollar bills. You weren't supposed to get abducted by the Bavarian Illuminati in the twenty first century! Carl swore gently to himself.

"It goes up to the balcony. It's hard to see, let me look." Carl just caught the sight of his unlikely persecutor, Hayhurst, going through a side door. Presumably they were both now in the storeroom. Could he dash down the stairs and out of the building before they could catch him? He couldn't see the main door – it must be beneath him. What if they'd locked it? He didn't think there would be time and, in any case, they only had to see him once to stick a bullet in him.

He had to hide right now because they would be up here one way or another pretty damn soon, he pushed himself. He started to look around a bit desperately. Under a desk? Behind a bookcase? They'd find him. Finally his gaze fixed on the window ledges. They were deep and if you crouched on them you'd be invisible from below. There was also an area on the two bays closest to the balcony where, if someone crouched up against the near wall, they'd be hidden from a viewer on the balcony too. How to get out over the void to them though? There was a narrow wooden ledge trim around the wall. It was only a few inches wide and there were no hand holds. He'd have to be mad to even consider it. In the current circumstances that became an appealing feature though – his pursuers would never think he'd dare attempt it. Voices drifted up from below again

"Drat it! Maybe it was the other side?" Cyril was clearly struggling - was there still hope they couldn't find the stairwell entrance? Carl realized that he'd probably been aided by the darkness because any camouflage used to hide the handle would have been wasted on him. In the end they'd just kick in the panel though, wouldn't they? So he only had the window ledge plan between him and a bullet, and he'd better enact it fast before they came out into the main room below.

He scurried across to where the balustrade met the wall. The ledge was about four inches across to be precise, he noted. It was smooth from multiple layers of paint. He also observed that the wall was slightly curving back into the chamber as it began it's rise to the roof above. The drop was a good storey and a half down onto the seats. This was suicidal.

"There you go!" Hayhurst had found the door. The guy with the gun would be pounding up the stairs in seconds. First he ordered,

“Cyril, go back out and check he doesn’t come down the stairs.”

He had to go now. He placed his foot on the balustrade and steadied himself against the wall to haul himself up. He placed his foot on the feeble ledge. His shoe’s sole slipped and he half fell down, gouging a big chuck out of his shin against the rails. He caught himself one leg either side of the barrier. The survival instinct adrenaline had overpowered his fear though and he tried again. Only in the days to come would he contemplate what that slip would have meant two steps later.

He dragged himself up again and pressed himself against the cold wall. His feet were this time more carefully positioned on the sliver of wood. Move! He started to gently slide his feet forward, first one then the other, all the while grinding his face and chest on the plaster as if he wanted to merge with it. This might work. Another few inches and another. Where was the window ledge? Don’t think, just move.

“I’m going up!” shouted the ruffian. Move, move, move! Finally his hand felt the edge of the window’s alcove and he almost threw himself round its corner. His legs flailed wildly over the drop but he grabbed the metal work at the base of the window and hauled himself in.

“I think I heard him up there,” called out Hayhurst. As long as you didn’t see me, I don’t care, thought Carl desperately. He dragged himself into a huddle, crouched in the corner, wedged between wall, window and ledge floor. His breath was gasping, close to panic. Calm! This had better work. If he was wrong and they could see part of him, he was dead, since now there was no escape.

He sat, a little ball of terror, as he heard the thug emerge on the balcony area, in truth just a few yards from his hiding position. His executioner called down,

“He’s not on the stairs. I can’t see him up here either. Did he come down?”

“No, no sign,” from Hayhurst below.

Carl watched blood streaming from his leg wound and wondered what on Earth he was doing here? He glumly imagined his own obituary; died due to ill considered adventure undertaken to take his mind off a thoughtless infidelity. Vester had barely begun a career in theoretical physics, effectively achieving nothing of note at the time of his death. Great!

Twenty heart stopping minutes passed while Hayhurst and his man searched the building in growing consternation and confusion. Every time the swearing got louder Carl started to hope a little more that he might just get away with this. He’d also realized he could spy out through the window he was up against and see a familiar street in central Winchester. So at least he hadn’t been taken too far. He’d even eaten at the kebab shop across the way. It was shut this late at night but easily visible under the street lighting.

Frustratingly, he still couldn't place the building he was in. Perhaps this whole auditorium was over some shop, hiding its function?

His persecutors had finally come to a confused stop,

“Well, he’s bloody gone!” declared the tough.

“How can he have?” moaned Hayhurst petulantly.

“Buggered if I know mate! You should have let me kill him back when I first phoned. Whatever, I’m not hanging around here any longer waiting for the cops to pick me up. You have your book, so I’m out of here.”

“He’s probably still hiding here though,” Hayhurst pleaded.

The younger man was apparently unimpressed by this thought and with a slam of the door he appeared to leave. So there was only Hayhurst now and without the gun, thought Carl, beginning to consider his options. He then realized just where he was. How was he going to get off this window ledge? He sneaked a look over the edge of the window alcove and the dizzying drop below made his head spin. He didn’t much fancy trying to lean round the corner and renegotiate the ledge. Would other people show up here in the morning who he could trust to rescue him he wondered? How binding were Masonic ties?

“Geoffrey, it’s Cyril,” Carl was momentarily confused as to who Hayhurst was talking to. He was on the phone of course. “Yes, I know it’s early. I have a problem. Luke got the book,” a pause then, “yes, yes it is.. but he also kidnapped the lad. He wanted to kill him!... I didn’t know what to do... but the lad’s escaped and is hiding in the auditorium. We can’t find him... Luke’s run off.” He seemed to listen for a long while. “Yes, OK I’ll wait,” was the conclusion.

Geoffrey. Geoffrey Montford? Had his boss been running this battery, theft and attempted murder? It was hard to imagine. Geoffrey was surely more civilized than that. Oh, but what if he knew about Carl and Georgina? Carl leaned his head back against the wall and inwardly groaned.

## Chapter Twenty One

Twenty minutes ticked by on Carl's watch. He feared he might be on the window ledge for hours yet. He dared a few times to steal a look down into the main room. Hayhurst was pacing nervously on the stage. His bald pate was red and shined under the light. Carl hoped he was seriously sweating. Newton's book lay on the front desk and Carl could see his own mobile phone and wallet next to it. Not much use to him down there.

Suddenly a door crashed open somewhere beneath the balcony. Geoffrey Montford strode in purposefully and crossed to where Hayhurst waited.

“You’re an idiot Cyril! Luke was a bad idea.” Hayhurst squirmed an apology. “Is this the book?” Montford flicked through a few pages but then pushed it away. “Not worth battering one of my staff over,” he commented icily. “So he’s hiding here somewhere is he?” Hayhurst nodded and both he and Montford surveyed the room. Carl leant back into his corner sharpish. “Right, leave me the book and get out of here Cyril. I’ll try to sort this out... and I’ll talk to you later.” The latter was definitely threatening. So was Geoffrey part of the scheme to steal the book or not? Carl wasn’t sure whether to trust him. The door slammed again below. That would be Hayhurst leaving or was this all a good crook, bad crook routine to make him show himself?

“Carl, are you here?” Montford called in a loud voice that echoed round the room. “Whatever Cyril and Luke were doing, it’s over. If you come out we can talk and try to find a sensible resolution to this mess.” Carl couldn’t bring himself to reply. Montford seemed genuine but to reveal himself and be shot at this juncture would be, well, not good.

“I’m just going to walk round in case you’re trapped somewhere where I can’t hear you,” said Montford. He proceeded to slowly circle the room below then progressed up the stairs onto the balcony. Carl reflected he was going to have to trust someone if he was going to get help getting down. If he passed over this offer and spent three days up here he’d look foolish.

“OK, so you’re well hidden. I guess intelligence is what I pay you for! I think I’m going to leave you on your own – the doors will be open so you can get out. The book and your things are down here on the desk. I’m writing my mobile number here too. If you want to phone the police that would be understandable. We could maybe sort this out better if we talk though. Your choice.”

Montford looked round the room one more time and started to head for the door. The sight of a familiar face leaving was too much for Carl. Maybe he’d regret this but he didn’t want to be left up on this ledge.

“Geoffrey, I’m up here!” he shouted down, leaning over the window ledge. Montford stopped and looked up.

“There you are!” he gave a friendly smile. “How did you get out there?” he probably couldn’t see the rim Carl had edged along and instead seemed to be imagining him swinging on the chandeliers.

“I just scrambled it – God knows how I made it. Being shot at by Cyril Hayhurst spurs you on, I guess.”

“Cyril was party to that then, was he? Let’s get you down and then discuss his penance. How are we going to get you down?” Carl held his arms out and shrugged. Looking back along the wall he didn’t even fancy hanging from the ledge never mind walking it.

“I think there’s a ladder they use for cleaning the windows. Stay put and I’ll be back.”

Carl swung his legs out over the drop and let out a huge sigh of relief.

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As soon as Carl was grounded, Geoffrey Montford had insisted upon a medical check up. With Geoffrey a multi-millionaire, this did not involve the night time casualty at the NHS hospital but, instead, an exclusive private clinic in the Hampshire countryside. They raced out of the city in Geoffrey’s red Ferrari. He did a pretty good impression of an ambulance in an emergency, though he just seemed to be enjoying the quiet night roads. Carl gave in to the urge to let down his guard and trust he was safe. His head lolled back against the head rest as they rushed along narrow lanes.

The clinic was highly secluded in its own forest. Within a minute of entering a doctor and a nurse had appeared in gleaming white coats whose cleanliness matched the surrounding polished beech wood furniture and crisp pastel walls. Carl was most impressed by their, at least feigned, lack of interest in where he had got his injuries from. They simply dealt with the symptoms. On reflection he wondered if that meant they were more used to serving millionaire drug dealers and their gun shot wounds. He wasn’t going to complain tonight, though.

The doctor took his blood pressure and temperature. A sharp light was shone deep into his eyes. The nurse applied something that stung with buds of cotton wool, first to his head wound and then his leg gouge. The doctor peered over at his cleaned scalp and ordered five stitches. When he had been sewn up they declared him fit, barring a night’s sleep. A private room was made available to him.

The room was not just a bedroom but had a sitting area too, with satellite TV and a games console. There was a large patio window that gave access to a wood-board terrace. The sun was just starting to rise and beginning to reveal a stunning view over a grass lawn leading down to a river. How the other half live, he thought!

Geoffrey knocked on his door just as he was wondering if he could collapse asleep.

“Do you want to rest or should we decide what to do now?” he asked.

“I suppose after coming here it would look a little strange to phone the police. Was that the intention?” Carl asked. Geoffrey put on a serious expression,

“The problem with court justice is that you need evidence,” he explained, “if you say Cyril was trying to kill you and he says he wasn’t, there’s not much further to go since he didn’t. I’m afraid I’m not really keen on standing up in public to support you either – it would not do me, the Phi or the Historical Society any favours.”

“So I just have to lump it then?” Carl was a bit annoyed by the sudden shift in attitude. How much was Geoffrey involved after all? Geoffrey smiled knowingly,

“On the contrary! Knowing how to publicly humiliate Cyril gives us a hefty bargaining chip I think. Let’s work out what to do with him!” He paused surveying the surroundings. “Shall we sit outside and watch the sunrise?”

They moved outside and sat on cushioned chairs around a wooden garden table. It was pleasantly fresh and Carl felt a little revived after all that had gone before.

“Let’s start with what’s going on,” Carl proposed. Geoffrey nodded and indicated for him to continue. Carl set about recounting the night’s events, back tracking to include Cyril’s none so subtle prompt after the Cathedral service. Geoffrey produced Newton’s work at the appropriate point and they both looked through it with reverence. When Carl had concluded his story he handed the baton to Geoffrey,

“What did you know of all this?” Geoffrey frowned, recollecting his memories,

“Well, I knew that Andreas had offered an old Newtonian text to Jonathan Sinclair. When Andreas died Jonathan thought the manuscripts were real, so I assumed there would be more found by the police. I had talked to Cyril about the Phi and the Historical Society trying to acquire them.” Carl assimilated the link to Sinclair he hadn’t previously heard, then queried,

“So that place I was holed up in is Winchester Historical Society, not the Masons then?”

“It’s an old Masonic building but we’re not… well, I’m not a Mason. I wouldn’t put anything past Cyril after tonight.” After a pause he continued, “When the police were reporting finding forgeries I began to wonder. That it was all apparently a hoax was confirmed yesterday morning when Jonathan dumped the news on me that he had been conned, along with his resignation unfortunately. Cyril was convinced all along there was an original text and apparently had Luke watching the Green to see if anyone found it. Luke works, well, past tense now, I’ll make sure, as the janitor of the Historical Society. He’s an ex-remand prisoner we took on to show our good will to society. More fool us! Anyway Cyril swore blind it wasn’t Luke who attacked you the first time, though I rather doubt that now. It looks like Cyril worked out a way to prompt you to search harder for

the book and that the plan was then to steal it from you and kill you.” They digested the story. “All that remains is for us to teach him a lesson. He’s worth several million, made from arms sales after the second world war I think - would you like some of it?”

Carl considered extorting a fortune for himself and was tempted. Somehow they ought to do something that was right if they were going outside the law, he felt.

“It’s Andreas and his family that have suffered,” Carl concluded out loud. “The book should be their’s really. That doesn’t really punish Hayhurst though.”

“OK, how about we tell Andreas’ parents we’ve found the book but that we offer them the market price for it, care of Cyril’s bank account, if they’ll let it stay in the Phi collection? It’ll be their choice.” Geoffrey proposed.

“Yeah, that sounds alright. Can you really make him pay?”

“We can dump the whole story in the press if he doesn’t and I’ll even tell him I’ll testify against him. He’s basically a coward so I bet he’ll pay anything. I think you should get at least a five percent finders fee though!” Carl’s righteousness was used up,

“Well OK, I won’t refuse it!”

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The cordon-bleu breakfast that the clinic served provided a new burst of energy and Carl suddenly remembered that Sasha was due into Winchester at 10am that morning. To cap everything he now had to face her without a night’s sleep. Geoffrey offered him a lift back to the Phi, and after checking out of the clinic, they careered off through the rush hour traffic in his sports car.

Geoffrey dumped Carl on the drive and drove off to impose his will on Cyril Hayhurst. As the engine’s roar faded away and the gravel finished ricocheting around, the Phi returned to its usual quiet. Carl thought he should check his e-mail just in case Sasha had been delayed. It was just before nine, so he didn’t expect to be waylaid. He had, of course, forgotten about WPC Thatcher who was roaming the corridors looking for him.

“Are you OK? You look rather pale,” she commented. Carl experienced yet more guilt at keeping the night’s events from her.

“I didn’t get much sleep last night,” he muttered. It looked like she was considering pressing the matter but decided against. “Are you up to a few more quick physics questions?” she asked. It was hard to say no.

“What do you need to know?”

“Basically, I want to know what Andreas was working on - something to do with gravity, extra spatial dimensions and the Higgs, I think. But everyone tells me gravity is so feeble it can’t even play a role in the weak nuclear force.”

“Yes, that’s right. What you have to do is make gravity stronger! One reason it’s weak is that as you go away from, say a planet, the energy in the gravitational field has to spread out. You can think of it being on the surface of a ball with the planet at the middle. As you make the ball bigger the surface area grows and the force gets weaker.”

“I remember that from university,” said the WPC, “the area of the sphere is given by the square of the radius of the ball so the force falls off like an inverse square. That’s Newton’s work right?”

“Yep! Now imagine if there were more than three spatial dimensions, you’d have to draw a higher dimensional equivalent of a ball around the planet. Its surface grows more rapidly than in three dimensions because there are more directions to expand into. So the force falls off more quickly.” He paused to let her assimilate the idea. “Well it turns out it’s possible to have these things called compact dimensions that only appear at very short distances.”

“Oh yes, I read about those the other day,” the WPC chipped in. Carl raised his eyebrows in surprise.

“Right, good. So if at some length scale you found there were actually more dimensions than our normal three, you’d realize you had miscalculated how strong gravity is. It would appear much weaker to us than it is because at short distances it was falling off much faster than an inverse square. In a world like that, if you went down to short distances, extra dimensions would open up and gravity might be much stronger than you expected.”

“How big would these dimensions have to be?”

“Well quite large. As much as a millimetre across would be nice,” he could see the WPCs disbelief so carried on quickly, “You have to do something clever to explain why people don’t live in more than three dimensions but gravity does! String theory has provided a mathematically allowed answer to that. It’s possible to have theories with entire groups of particles forced to live only in some of the dimensions. It’s like they exist only on a sheet spread through the space, a sort of membrane. String theory has ten dimensions so there are bigger - so called branes - that have three or four or higher dimensional surfaces. It’s possible that we are all made of stuff that is stuck to a three dimensional brane – the world we see – but gravity lives in a larger number of dimensions.”

“Is this likely?” the WPC had encountered yet another idea these people thought about that was completely outside her ken. Carl paused at that question as if unsure how to answer,

“Well, it’s possible. I don’t know if that makes it likely. Probably not.”

“Do I dare ask how this all ties into the Higgs?” she fearfully asked.

“The problem with the Higgs was that it likes to get as heavy as it can. We’ve always believed there was a very high energy scale, called the Planck scale, in physics – an electron would have to have this vast amount of energy for its gravitational interactions to become as strong as its other interactions. So why shouldn’t the Higgs be as heavy as that? Well, if you make gravity much stronger than we previously thought, this huge energy falls and you can cook things so that it’s the same as the mass of the Higgs, which we needed to correctly describe the weak force. It’s very radical because it’s a theory that says that when we can create a Higgs we have reached the highest important energy scale there is. The ultimate theory of everything would have to live at that scale and we’d have solved everything!” The WPC looked sceptical. “Well, yes, of course, that is the problem – we don’t have a theory of everything, so we don’t know if it’s possible.”

“Andreas was having fun thinking about how to construct such a complete theory though. If gravity suddenly becomes strong you can do all sorts of fun things like make tiny black holes in particle accelerators.”

“Would they swallow us up?”

“No, they explode. Well maybe. We don’t actually have a theory of them so we don’t really know. Remember that cosmic rays have already done everything we might do though, so it won’t be a catastrophe!” he paused and glanced at his watch. “I need to go and meet my girlfriend off a train. Was that enough?”

“More than!” she declared. As Carl disappeared off, she decided that this case was closed and she was going to try to write her report. She wished herself luck.

## Chapter Twenty Two

Carl waited outside the train station for Sasha in a cloud of gloom. His head throbbed from where he had been clubbed. After the terror of the previous night he now had to act through being dumped by his lover. He considered just departing and leaving Sasha to her own conclusions. His lack of sleep seemed to make the despair more bearable though. It would be a new experience to be humiliated by the person closest to him, he supposed.

The fluorescent orange numbers on the concourses' digital clock clicked over. He stared at them, numbed and eye lids drooping, part of a line of morose travellers. Suddenly there were passengers flowing past the ticket inspector and then Sasha.

She seemed to glow amongst the other passengers. She was only of average height but her build was athletic, curved and well-proportioned. Her gait bounced and glided where those around her dragged their feet. She was crisply dressed in thin black jeans and a loose, pale blue cotton top covered over with a black waistcoat. She held a floral patterned travel bag in one hand. Her hair was straight and naturally blond, cropped half way down her neck. It framed her impish, neat features that suddenly broke into an instinctive broad smile as she saw Carl.

Carl realized he was smiling back. The past days' illusions of Georginas and Louises dissolved in the presence of a woman who was actually his friend and who he loved. Happiness flickered, but now they were closer he could see the black smudges under Sasha's green sparkling eyes. She looked exhausted, more so than the hospital ward's usual grind. They hugged. Wouldn't they normally kiss, worried Carl? His smile seemed suddenly fake – he was about to hurt her. He'd better soldier on until a more appropriate place for that discussion though,

“Good trip?” he asked

“Yeah, almost on time,” she replied, “I could do with a coffee.”

“It's only five minutes to home. Let's make it there.” An agonised half hour in a coffee shop would be too much for him. She nodded and they headed across the car park towards the city centre. Their usual banter didn't kick start and they walked in long periods of silence interspersed with stuffed pleasantries. Why, oh why, have I messed this up wondered Carl?

At his flat Sasha dumped her bag in the hall. Hadn't she carried it through to the bedroom last time?

“Coffee then?” Carl made for the kitchen. She came too and busied herself finding mugs and sugar. He fumbled with the kettle lead and washed up a spoon. The conversation ahead loomed in Carl's mind and feelings of sickness washed up from his stomach. Finally they were done and they moved to the sitting area, choosing the two touching ends of different sofas. Sasha took a sip from her mug although it was too hot, then

placed it down on the table. She looked up at him directly for the first time since the meeting at the station. She looked pale and as if about to cry. Shit,

“Erm,” tried Carl but Sasha interrupted,

“No, let me,” there was a studiousness about her tone as if she was reciting something well practised. She took a small gulping breath and continued, “I’ve messed up, Carl.” He looked at her blankly, cast adrift by the sudden change of direction from his thoughts.

“You know Gail bullied me into going out with her and Andy last Wednesday? Well she didn’t show, the stupid bitch. So I was stuck with Andy – he was in a real state about being dumped again. He spent the whole evening just moaning about how useless he was, he was pretty depressed. We had a few drinks, and then we went back to his place for coffee. We always do after the pub, I didn’t think anything of it. Well, I don’t know, we ended up drinking his vodka and...,” she faltered, then with tears flowing added, “I slept with him. I don’t know why. I just felt sorry for him I think. It was totally stupid. I don’t even fancy him.” Carl stared at her shocked. “It didn’t, doesn’t mean anything. Oh God, maybe that’s worse.”

Sasha looked totally distraught, desperate to see some sign of understanding or forgiveness in Carl. Slowly his brain engaged; his first instinct was to laugh. How lucky was this coincidence of infidelities? He suppressed the smile, it wouldn’t look good. He was instantly guilty of his position of power in the conversation – he knew but she didn’t yet. In any case did it make everything OK or twice as bad? Any reaction he might have when her story had settled would only be hypocrisy though so he was going to have to live with it non-judgementally. Sasha’s strength suddenly seemed to give way and she looked down from his face dejected.

“Wait love,” he put his hand out on hers and she looked up hopeful and terrified, “my turn next,” he said quietly. He told her about Georgina Montford, just the bare bones. His story sounded much like Sasha’s to his own ears just different names and places, fleeting changes.

After he had finished Sasha sat back, pulling her hand away. She looked shell shocked, pale and fragile and beautiful. There ought to be an equality here thought Carl but he was just waiting on her judgement. He’d known since first seeing her on the station what he wanted and strangely the events they were discussing were an irrelevance. Neither of them dared say anything but Carl finally broke,

“What should we do, do you think?” he asked trying not to beg.

She gave a rueful smile and wiped a tear off her cheek. Perhaps she was seeing this as luck too, Carl hoped. Finally she timidly proposed,

“Fancy going to bed?”

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The early afternoon sunshine was a little disconcerting to wake to. Carl and Sasha had collapsed from exhaustion, entwined in each others arms. Once Carl had recalled recent events though, he smiled, more relaxed than for days. He snuggled closer to Sasha's gentle curves and smelled her hair. Thank goodness everything had worked out alright.

Sasha too was rousing and luxuriated in some contented stretches. Her eyes opened slowly and regarded him,

"Hello you," she smiled. They kissed long and gently. "Now, explain to me why you have a sore head," she prompted him. Carl began to explain the previous night's bizarre adventure. Sasha shifted onto her side, the sheet only half covering her, and regarded him seriously, her head resting on her hand, elbow on the bed. When he finished she shook her head in wonderment and horror,

"Didn't your Mum ever tell you about the cat?" he looked at her bemused, "The dead one," she prompted.

"Oh, curiosity!" Carl exclaimed, smiling. "Guess I always wanted to know how it felt!"

"So where's this great book?"

"Geoffrey ended up with it. I suppose that was his intention all along," Carl reflected. "Still I probably owe him one!" Sasha didn't look like she found that funny. It was a bit early for jokes about Georgina. He'd better change the subject.

"You know I almost bought an engagement ring to apologise to you. It seemed a bit crass though. Should I have done?" Sasha's frown melted into a smile. They should put that line in the dating manual thought Carl cheekily. You could only use it once, mind.

"It would have been a little brazen but very sweet," she concluded.

"You wouldn't have thrown it back at me then?"

"Probably not." They grinned at each other. Sasha was looking expectant.

"Er, did we just get engaged?"

"I think you do have to buy the ring for that."

"Oh yes, of course. Should we?"

"Yes."

The slightly stunned silence that followed between them was broken by the crash of a door close by in the building.

“Heh, that must be Amber back!” exclaimed Carl. He explained, “Her bloke cheated on her too and she was steaming about it. Then she just left. I’ve been wondering if she was OK for days. Perhaps we should go down and see?”

“Give her a chance to get home first,” suggested Sasha. “Anyway we should celebrate getting engaged shouldn’t we?” she batted her eyelids mock provocatively. Carl rolled over to her and regarded her face from a few inches away.

“I should warn you I’ve been having all sorts of existential and academic concerns about the male sex drive,” he said, deliberately over pompous. Sasha giggled and made an ‘oh’ shape of query with her mouth. A bit more seriously he added, “I don’t like the overtones of violence and possession.” Sasha laughed again,

“I do!” She paused and then added, “as long as they’re kept as overtones. I think of it as like eating.” Carl wasn’t sure that helped and looked quizzical. “Well, eating is pretty horrific – stuffing dead animal flesh and vegetable matter into your mouth doesn’t stand up to much academic scrutiny either. Instinctively it’s fun though! So it’s best just to swallow your pride and enjoy it.”

“Alright, I’ll soldier on!”

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Amber opened the door dressed in a flurry of reds and oranges. Bright colours usually reflected her good moods. She smiled on seeing Carl and positively beamed when she clocked Sasha in tow just behind.

“Come in. You two look happy,” she commented, part question.

“It’s traditional when you’re engaged,” revealed Carl.

“Oh my God, that’s wonderful.” Amber jumped with excitement and bounded over to embrace them both in a big hug.

“Wait, wait,” interrupted Sasha jovially. “I keep telling you Carl, it doesn’t count until you’ve actually bought the ring!” Carl shrugged and resisted muttering, “women”. He suppressed a smile. Before they had come down he had had an e-mail from Geoffrey which said simply ‘Cyril agrees – bring in a bank payment slip!’ Sasha was going to get a more expensive ring than she bargained on! That revelation could wait, so he diverted the conversation to a different track,

“Where have you been Amber? I’ve been really worried.” Amber performed a spin on the spot before stretching her arms out and declaring,

“Venice!”

“I’ve been worrying about you and all this time you’ve been swanning around Venice?”

“It is beautiful! The Grand Canal, the golden walls of the cathedral, gondoliers! It’s amazing what you Europeans get up to,” she pronounced.

“How did you end up in Venice?” queried Sasha.

“Trevor!” Amber responded. “He suddenly turned up,” she turned to Carl, “just ten minutes after you left! He had two tickets to Venice on the midnight flight from the airport. There was no time to pack so we jumped in his car and just made it.” Carl was still processing the very possible image of him and Amber in bed when Trevor came in. Amber could clearly read the thought in his face and turned to Sasha, “I was really upset and Carl was so sweet.” That seemed fairly discreet but Sasha apparently knew just what she meant and blessed him with a pleased, indulgent smile and a hug. Carl’s luck seemed to have switched from catastrophic to worryingly positive. He hoped it would last.

“Is it too early for a bottle of wine?” Amber asked, “I’ve got to tell you all about Venice. And Sasha, I had to buy all my clothes over there - you should see them!”

“Wine sounds lovely,” said Sasha for them both.

## Chapter Twenty Three

“You’re thinking about something,” Sasha accused Carl.

They were lying in bed again, this time for the night, comfortably fed on take away and pleasantly inebriated by a number of Amber’s bottles of wine - precisely how many neither of them could remember. Carl’s brain had indeed been mulling over past events. He replied,

“I’m still frustrated I can’t solve Andreas’ diary code. It’s just a product of two numbers that should tell you how much to shift the rows and columns in this grid of letters. It can’t be that hard.”

“I expect it’s something to do with particle physics,” suggested Sasha, “knowing you lot.” Carl considered this before suddenly jolting upright,

“You’re right. That must be it!”

“You’ve stolen the duvet!”

“It’s combinations of quark colours, must be.”

“I’m supposed to say ‘huh’ now?”

“Gluons, the particles that mediate the strong nuclear force, act by changing the three colours of quarks. If something has no colour they can’t interact. That’s why a proton consists of three quarks. If one is red, one blue and one green, then when a gluon tries to interchange two colours nothing changes. So that’s why protons are colour neutral and aren’t bound up into further things.”

“You mean if the gluon changes red into green and green into red then one red, one green, one blue stays the same?”

“Yes. Another easy one is a quark and an anti-quark.” He was about to explain but realized there was a subtlety. “Well, you have to remember that in quantum mechanics there’s a probabilistic description of particles. You can have a quark and an anti-quark pair that are red anti-red a third of the time, blue anti-blue a third of time and green anti-green a third of the time. So again a gluon leaves that the same and it’s neutral – those particles are called mesons. There are another eight combinations like red anti-green that all get mixed up by the gluons – they do change, so the gluons interact with them!”

“Did you say I had to remember this?” Carl sent a playful box on the nose in her direction and continued,

“So three times three with a bar under it will be one plus eight. That’s the two numbers for shifting the code grid.”



“Now if you combine two quarks there is no neutral combination but the combinations split into two groups. The gluons mix the different possibilities within a group of three and again within another group of six. But there’s no mixing between those groupings. So three times three is six plus three. Again two numbers for shifting the grid. I’ve got to go and check if it works.” He rolled out of bed taking the last corner of the duvet with him. Sasha lay back and gave a loud mock sigh.

“It works!” came the cry from next door. “At least it does on these three times three grids I translated before. I thought it was shift down by one but it must be shift down by six which is the same! So three times three is six plus three!”

“Hang on though what does four times four mean? There are only three quark colours,” queried Sasha.

“I guess it’s just the same maths but in an imagined world with more quark colours. I’ll have to try it out on the other grids. The Masons keep stealing my copies of other cases though. I’ll have to grab them off the police again tomorrow.”

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Next morning Carl and Sasha were having a leisurely breakfast and planning to do very little with the day, when the doorbell buzzed. WPC Thatcher identified herself over the intercom and Carl pressed the button to release the lock on the door below.

The WPC’s uniform as usual brought a serious air with her. She scrutinized Carl’s living room and said her formal hellos to Sasha.

“I’m just doing the final paper work for our case file,” she explained, “I realized that you still have one of the keys to Andreas’ flat, Carl. We need to return it to the landlord.” Carl went to dig the key out of his coat pocket in the hall. When he returned Sasha was doing the washing up while the WPC waited. He handed over the key.

“Thank you,” the WPC’s smile hinted at the woman he had kissed the previous Saturday, “And thank you for all your help on the case, Carl. I imposed more than I should have done on you.”

“I was glad to help,” he responded and then paused. He should tell the policewoman about his new revelation on the decoding front. That she wasn’t asking or pursuing it

herself discomfited him though. They were oblivious to the matter of Newton's book too he realized. How could they be closing the case? He tried to raise his disquiet. "I realize it's not really my place," he began, "but there still seems to be so much that we don't know about what Andreas was doing. Shouldn't you investigate more?" The WPC didn't seem offended but just smiled ruefully.

"I'm afraid that the victims' relatives and friends in these sorts of cases often feel unfulfilled at this stage," she replied. "We do know what happened really. Andreas was taking drugs and working with dangerous chemicals. Probably by mistake, he ate some mercury compounds. There is absolutely no evidence that anyone else was with him at the time and in any case it would be nigh on impossible to force feed someone the quantity he had swallowed. He then walked up to the Phi Institute, being sick on several occasions, before eventually succumbing to the mercury on the drive."

"We needed to understand why he was working with the chemicals but we know now, as you helped us uncover. He was playing a practical joke on one of your colleagues, Prof Sinclair, forging documents. He needed the paper to have chemical traces on them. Maybe he also enjoyed trying out the reactions he was writing about. That's what happened don't you think Carl?"

Carl considered this version of events. He didn't disagree with any of the conclusions but he still felt there were big holes in the narrative. He tried to explain,

"Yes, I do agree. But your version doesn't really explain his motives. Why was he doing all these things?"

"I'm sorry, Carl, but that's really beyond our ability. We can't read the minds of dead people. In any case what right do we, the police, have to probe further? Certainly if a murder happens we must pursue such intrusive lines of enquiry. In a simple case like this though, I think we're better to let friends and family know the facts of the case and hope they can then move on with their lives. We could do a lot of emotional harm to no end."

Carl sat and reflected on this response which seemed very sensible. He liked Lousie Thatcher; she was very down to earth and sensible. Just the sort of person he would want in the police, he concluded. The WPC decided to try a different track to allay his worries,

"Besides, Carl, in your job, you must be used to the idea of unknowable answers. I've spent the last week hearing different people's visions of the ultimate theory of everything! Will you ever know if there's a Higgs particle?" Carl suddenly laughed,

"I suppose that's the problem with a theoretical physics institute. You've missed out on the whole other side of particle physics. There are teams of thousands of people building a particle collider in a 25 kilometre round ring underneath Geneva right now. It's at a laboratory called CERN and the experiment is called the Large Hadron Collider or LHC for short. At the end of 2007 they're going to begin colliding protons together with ten

times more energy than we have ever collided particles before. It's a machine designed to search for the Higgs so we'll know all by the end of the decade."

"How can you be so sure?" asked the WPC, "you told me you didn't know how heavy the Higgs was. Anyway there might be some theory you haven't thought of in which everything is just out of the range of your experiment surely?" Now Carl beamed,

"No, actually, this experiment is the Holy Grail of science in that it is a 'no lose' machine! If you take our theories of particles and omit the Higgs, funny stuff happens. In particular if you scatter W particles, the ones responsible for the weak force, then the chance of them interacting grows with energy. Eventually the probability of interaction becomes bigger than one!"

"What does that mean?"

"It means the theory is rubbish! Something has to happen that's new. The LHC will be able to probe this behaviour for sure. So we're guaranteed to find another part of the puzzle." The WPC seemed impressed,

"Alright, I hadn't realized that, maybe you're not all as far from reality as I'd supposed! I'll listen out for the results."

"You're right though, that most likely big puzzles will remain," Carl sadly admitted, "Traditionally we've always believed that quantum gravity is beyond any hope of experimental probing. That's why the ideas Andreas was working on were so fun – if the gravitational force became strong in the LHC we might find the ultimate answer, whatever that could be." This final idea renewed his enthusiasm – at least there was a chance it seemed.

"So mostly in life there are things we can't know," gently concluded the WPC. Carl perked up again though,

"Not so fast! Actually I think I cracked Andreas' code! It was all to do with quark colours. If I can see the diaries again we can find out what he was thinking!" The WPC winced slightly,

"I'm afraid we gave the diaries to Andreas' parents. We can write to them and tell them your theory," suggested the WPC. Carl looked a little crestfallen and then theatrically collapsed onto the sofa,

"Life is all waiting for answers!"

# The Newtonian Legacy

## A popular science novel

A younger researcher, Andreas Born, is found dead at the particle physics institute where he works. A policewoman is assigned the job of penetrating the intellectually charged atmosphere his colleagues work in. She is forced to unravel the mysterious world of subatomic particles to understand the dead man's motivations.

Meanwhile, Carl, one of Andreas' collaborators embarks on an exploration of Andreas' murky life outside physics including sex, drug dealing and bizarre alchemical experiments. Carl is followed by a mysterious stranger and must fight to preserve both his life and the relationship with his girlfriend.

*Learn about the frontier of particle physics within a fast paced crime adventure.*

My thanks to the Hubble space telescope team and also to the National Portrait Gallery for the use of their images on the front page. Thanks for your support!



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