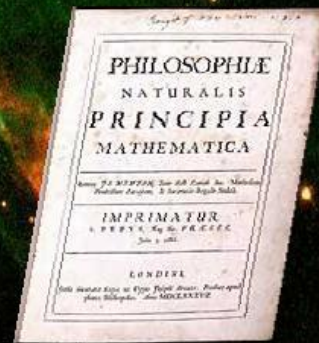




The Newtonian Legacy

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.

The Physica and 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 Galilee, 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.

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.