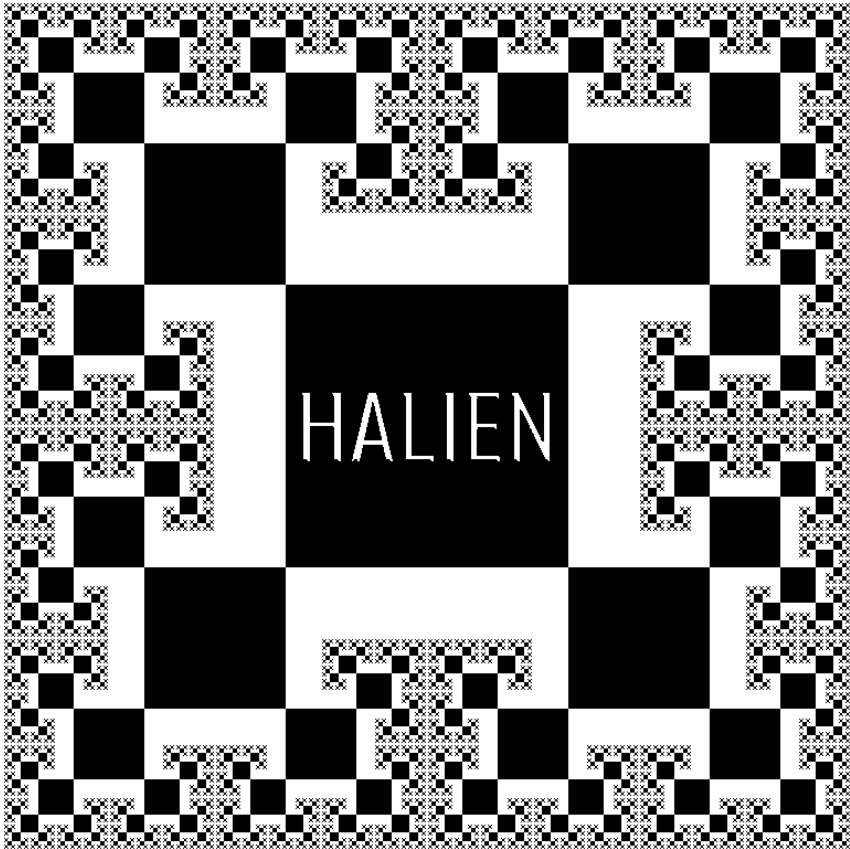


HALIEN AEON



Dave Norman
Chapter 1 and Synopsis

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This novel follows Interstellar Engel syntax 112.04

Engel's humanised form is being guided towards full compliance.
It still has some way yet to go

Although it is already, commendably .. *Engelish*

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Author Foreword

Studies of ancient history, mythology, legend and religion reveal a myriad strange stories of fantastical events, sacred places and amazing objects of wonder. Many show surprising similarities across diverse regions and cultures, perhaps hinting at common cause or provenance in ages even further past. In those ancient times, such wonders were often attributed to the mysterious moves of godly intent .. or, maybe, just to 'magic'. Yet mankind's ever-greater grasp of Universal Truth may now shed new scientific light on some of those Oddities of Old.

“HALIEN Aeon” launches a novel series that weaves a twisting thread through a selected sample of those stories. Some may once have held more truth than their mystical status implies. Others may hide far deeper meaning than is, at first, apparent. Above all, just a few global events, grounded in reality, may have sparked a vast swathe of subsequent myths and mysteries within the imagination of mankind.

The religious references and reinterpretation in this series are never intended to offend, but rather to suggest means by which many wondrously worded but oft-dismissed theological themes may, perhaps, be reconciled with current or future physical science. Who can say which keys of conjecture will ultimately open the locked safe of truth? After all, what we currently consider to be proven scientific 'fact' may, someday, be cast as merely the quaint musings of misguided belief.

This quest to crystallise the chaos of sub-conscious creativity into a cohesive story has spawned several supposedly original concepts that were subsequently revealed to be rooted in hidden historic reality or ancient mythology. So please conduct your own research into *and beyond* the scenarios and snippets of science upon these pages .. you may discover whole new worlds of wonder and wisdom waiting within!

Predominantly probing *prehistory*, this first novel lays the foundation for later works that will, ultimately, take the tale forward into far distant times ahead. This **first chapter** of that novel launches the outermost of several nested story arcs. All told, the HALIEN pentalogy will encompass over ten *billion* years of past, present and potential future. So I wish you well on this alternative journey through what *may* have been a series of key moments in our galactic and human history.

You really never know!

And please don't ever forget. *It's all just a work of fiction ...*

Dave Norman



Dave Norman is an aerospace software engineer and has served as chairman of Torbay Astronomical Society for most of this millennium(!).

In this fictional series he re-casts many mysterious aspects of ancient history, mythology and religion in the light of present day or plausible future science and technology.

1: New Moon

Four and a half *billion* Years Ago - in the young Solar System

It was truly a sight worthy of those who would look up at the night sky in wonder.

Yet no eyes would widen in awestruck terror at their impending demise. Nor would a single soul be sacrificed to the spectacle soon to be unleashed upon this planet. For only the most primitive *Hadronic Life Entities* would grace its about-to-be renewed surface in the next three *billion* years!

This was a promising new world. One in a million of a trillion in the galaxy, it already offered *two* of the primary properties needed to one day nurture advanced life.

Its orbit was reasonably circular, avoiding extremes of temperature swings over the course of each year. Furthermore, that orbit lay well within the 'habitable zone' of its young and relatively stable star .. neither too near to its searing stellar heat, nor too far out into the frigid void of space.

When the frenetic formation of this system's planets finally abated, the universal solvent of life .. liquid water .. would be free to flow within the streams, rivers, lakes, seas and oceans that would carve aqueous character into its surface scenery and subterranean caverns.

This was, indeed, a good start. But *three* basic improvements would far better suit it to the successful evolution of life, over geological time.

To start with, it needed to grow. Although already the largest rocky planet in its system, additional mass would give its surface gravity a vital boost. That would tighten its gravitational grip upon the tenuous atmospheric gases that could one day rain water upon the land, bring the breath of fresh air to surface life and shield its reproductive frenzy from the ravages of stellar radiation.

Atmospheric stability would greatly strengthen the long-term prospects of any future surface biosphere. Sadly, too many promising but less massive planets across the galaxy had vented potentially protective and life-sustaining atmospheres to their surfaces .. only for the energetic winds of their stellar hosts to blast those gases, slowly but surely, away into the depths of space. Along with any chance of such worlds ever hosting Life that would look up at the night sky in wonder ...

Oddly, this world's hopes would be heightened by a *heavy* heart! It craved a massive and mostly molten iron core, beneath a cooler, rocky mantle .. raising steep thermal gradients across which colossal core convection currents could surge and twist into vast vortices around its axial spin. That whirling electromagnetic dynamo would cast immense magnetic fields up through the surface and far into space beyond .. a global '*magnetosphere*' able to shield delicate new life from the sterilising wrath of stellar winds and coronal mass ejected by the fitful convulsions of its star.

A stable atmosphere and an extensive magnetosphere would work together to promote this planet's prolonged potential for synthesizing and sustaining primitive life. But, for any nascent biology to boom over truly evolutionary ages, its birth-world also needed the beneficial seasonal soothing .. of an *axial stabiliser*.

Left alone, the spin axis of even a sizeable planet could tilt and topple erratically over geological time, driven by the gyroscopic churning of its internal materials and gravitational perturbations instilled by its orbital neighbours. Such chronic axial chaos would severely constrain the subsequent evolution of latent life, with seasons wandering wildly, amid dramatic and unpredictable climatic changes. And the best way for a planet to gain eternal spin stability would be to share its stellar orbit with the calming gravitational tug .. of a single, substantial, *natural* satellite.

To achieve its promising potential to bring forth and foster advanced Life, this young planet desperately needed ... *a Moon*.

Yet the most *unnatural* of circumstances were about to confer mass, magnetosphere and Moon upon this planet .. all at once! A cascading chain of events, triggered centuries ago, would soon culminate in a cataclysm that would transform its *geological* nature to benefit *biological* Nature.

Looming ever larger, an orbital companion was on a closing course to a cosmic collision, akin to billions already witnessed by their young star.

Although the single most spectacular of those to follow, the coming catastrophe would complete just the first of several stages in a uniquely complex *and consciously 'creative'* coalescence of worlds. One whose outcome was deemed critical to the HaLiEn heritage of the entire galaxy.

So, no relic of random motion had been risked in setting the scene for this dynamically destructive dance to the orchestral overtones of orbital mechanics. For this impending impact had been driven, not by destiny .. but *by design*.

And it would *not* be the last ...

1.1 Lairs of Lagrange

As it swung along its orbit around a young Sun, the planet one day to be called “Earth” was not alone. The *twin* agents of its coming transformation into a Blue World of Life had long been in place, as loyal planetary neighbours. For its accretion from the tenuous mix of gas and dust in this new star's inner circumstellar disc had *not* happened in isolation.

The past fifty million years or so had seen a frenzy of planetary formation across the entire Solar System. Far out in the frozen depths of space, countless billions of prospective new worlds had been accreted from chaos .. as powerful but short-range electrostatic and weak but far-reaching gravitational forces forged dusty grains and icy crystals into ever-bulkier bodies, in a creative-destructive cycle of aggregation and collision.

Throughout its innermost realms, innumerable rocky proto-planets had grown within orbits both nearer to and further from their star than the prospective Earth. More distant still, colder and thicker bands of ice and dusty debris had quickly spawned far larger planetary cores, able to attract and retain deep and dense atmospheres of primordial gas.

The immense gravitational grasp of the Solar System's largest planet .. the mighty ‘gas giant’, Jupiter .. would someday direly *threaten* the orbital stability of the inner planets. But it would ultimately come to *protect* its rocky siblings from later bombardment, by sweeping up much of the debris left over from the turmoil of their collective birth. Yet the proto-Earth had *already* conjured a rather neat, gravitational debris-gathering trick of its very own ...

Of Nature's so-called 'fundamental' forces, *gravity* laid its ever-attractive qualities most clearly open to observation on the grandest scales. Easing off its far-reaching tug between two masses with the square of their separation, its effect often emerged in closed cosmic curves, along which gravitationally bound bodies would orbit each other in eternal embrace.

Pairs of such partners would trace their perpetual paths along more or less eccentric ellipses around their common centre of mass. A ‘barycentric’ point which, for bodies of vastly different scales .. such as a planet and its star or a moon .. would often rest deep *within* the more massive of the two.

Those gazing upon heaven's gyrations would gasp at the sheer geometric grace garnered from the formerly random motions of matter gripped by the remotely forceful grasp of gravity. Yet its seemingly simple laws concealed some surprisingly counter-intuitive consequences, that could turn a cosy company of two into a crowd of three, four .. or even more.

Earth's broadly circular solar orbit followed those of its more fortunate planetary peers across the galaxy. Likewise, as for the orbit of any body around an object more than about twenty-five times its mass, its annual path harboured *two* hidden, 'secret gardens'. These invisible realms could each turn gravity's grasp to nurturing the germination of new planetary growth from the cosmic seeds still strewn across the Solar System.

Centred sixty degrees, one sixth of its orbit, *ahead* of Earth lay a large swathe of space where its gravity conspired with that of the Sun to create a strangely stable and subtly seductive gravitational 'trap'. One mirrored by an identical region centred sixty degrees *behind* Earth, along its orbit.

The interplay between orbital mechanics and orbiting bodies transformed these twin *peaks* of gravitational potential into gently grasping *pits*, towards which matter might appear to fall. Each could collect and keep a fair fraction of the still growing Earth's mass in dynamically stable, orbital equilibrium. And these were two lairs into which much of their fill of the inner Solar System's birth debris had long since been lured ...

Billions of years hence, the human beneficiaries of these gravitational quirks would name these two regions, along with three others, after the mathematician Lagrange. For the Sun-*proto*-Earth system, the first three Lagrangian points lay along the line passing *through* both bodies. As if balancing their opposing gravitational pulls, the first Lagrangian point .. L1 .. rested one and a half million kilometres from Earth *towards* the Sun. Somewhat less intuitively, L2 lay roughly the same distance *further* from the Sun, with L3 mirroring Earth's location on the *far* side of the Sun.

For all their homely qualities, though, these 'unstable' Lagrangian points would ultimately fail as long-term traps of natural material. *Any* drift away from them would draw a body further out still into free solar orbit. Only around the two Lagrangian points *sharing* Earth's orbit .. L4 and L5 .. would the curving Coriolis effect gently guide any wandering worldlets back towards their confines. So, as eternally stable cradles for accretive body building, these twin cosmic corrals had long since coaxed gravity to grasp their shares of grit .. and grow from it two 'wrecking ball' worlds.

Patiently awaiting their cues in opposite orbital wings, these planetesimal stars of grandest ballet were both now poised to pirouette, in turn, onto centre stage.

There, each to play their part in an apocalyptic 'Pas de Deux' ...

"Mother of the Sun, Theia of many names, for your sake men honour gold as more powerful than anything else; and through the value you bestow on them, O queen, ships contending on the sea and yoked teams of horses in swift-whirling contests become marvels."

The Fifth Isthmian Ode of Pindar

Two months *ahead* of Earth along its orbit, at L4, lay **Theia**. By now packing almost six percent of Earth's mass, this substantial new world was already pushing the limit of its welcome within this proto-planetary crèche.

Sooner or later, it would be tempted out into its own orbit by gravitational tugs from the immense bulk of Jupiter. Ably assisted by attractive impulses from the still growing planet Venus, as it lapped its larger neighbour from the next orbit inward towards the Sun.

Should that happen, Theia's natural path would likely trace a long series of strangely 'horse-shoe'-shaped orbits, relative to Earth, as it repeatedly approached, recoiled from, returned towards and finally, fatally .. *impacted upon* its 'parent' planet!

Such an event would, indeed, serve to supplement Earth's mass down to its very core. The ultimate composition of a newly forming body varied broadly with orbital distance from its star. So, formed from the same primordial debris as Earth, Theia shared much of its elemental make-up .. including a substantial, nickel-iron nucleus.

However, the uncontrolled dumping of Theia's mass with effectively random impact location, incident angle and velocity would *not* likely guarantee the new Earth its much-desired magnetosphere.

Nor, for that matter, its vital new Moon.

Theia's orbital eviction and ultimate collision certainly *needed* to happen someday soon. Not least, to remove its clear and present threat to any future sparks of earthly Life.

But, to guarantee the rise of Gaia, the fall of Theia demanded a degree of *designed* direction truly worthy of those who might one day look up at their night sky in wonder ...

1.2 Moon Maker

Had the eyes of any biological intellect ever witnessed *this* enigmatic entity in their night sky, they would surely have drawn their owner's mind to the outer limits of both wonder and confusion.

Yet its billion year tour of the galaxy had not once cast its elusive light upon even the most primitive lifeform. For its duties drew it to the dusty disks of destructive creation around only *newborn* stars. Furthermore, its ghostly presence would barely register upon purely light-sensitive eyes .. and then only as a dark and non-sensically shifting geometric shadow.

Not that its reluctance to reflect or transmit light would have concealed its path among this boulder-strewn birthplace of planetary bodies. Its steady passage against the stellar background of deep space would have seemed blindingly obvious to any persistent onlooker. For it had long since swept completely clear of debris a band either side of its own original orbit around the infant Sun. And what this optically opted-out object lacked in luminosity, it could outweigh a trillion times over by the artificially amplified power of its sheer *gravitational* presence.

By any normal measure, its strangely dynamic physical form would seem to span less than two kilometres. Yet the constraints of conventional 'size' would fit loosely indeed upon the ethereal extent of an object that could shrink and stretch the sinews of space to suit its own purpose. With the span of even the most voluminous bodies dwarfed to insignificance against the infinite scale of space, it would soon show that *size* matters far less .. than *substance*.

This interstellar nomad needed to 'throw its weight' around the galaxy, from one stellar birth to another, in time to imbue life-bearing stability amid sterile, cosmic chaos. A task that demanded a universally unique form of 'agility' that no device of merely three-dimensional design could conceivably deliver.

During each multi-*millennial* transit from one stellar birth to the next, this multi-*dimensional* midwife would expose only a relatively modest mass, of barely three million tonnes. Although certainly demanding prodigious propulsive power, the trans-galactic movement of such mass, at near-light speeds, *was* perfectly possible with its billion-year old technology.

That had not been the 'weighty' problem with which its ancient creators had for so long wrestled, at first without success, to ultimately solve ...

It was not the motion, but the *magnitude* of its mass over which this object needed unnatural mastery. Within the colliding carnage of each new planetary crèche, only one force could gently but firmly coax the *creative* coalescence of so many sterile bodies into a few able to offer eternal homes for Life. The same fundamental force that had given the newborn Sun's outer bulk the unbearable weight to crush its core into fusion.

The 'force' .. of Gravity!

Although immense by any sentient standard, no mere three megatonne mass could project anywhere near enough gravitational pull to perturb the course of a significant planetesimal. So, this ancient object had audaciously amplified its culminating act of attraction, by *drawing down* a vast reserve of eternally 'missing mass'. It had rightly reclaimed, with interest, some of the essence of gravity that had long been leaking its potency from the realm of natural, three-dimensional space .. into an altogether 'higher' place.

One where neither the Sun, nor *any* star, had *ever* sought to shine ...

As future seekers of scientific truth across the galaxy strove to understand Nature's so-called 'fundamental forces', they would often find a full Theory of Gravity to be the most elusive of all. As it had once been, even to the creators of the object now so unnaturally usurping its power.

Somehow remarkably similar across species, early theories of gravity represented its effects well enough to predict planetary paths using 'laws' of motion distilled from the astronomical observations of sharp eyes and the intellectual inspiration of equally sharp minds. Even then, those first interpretations would soon be undermined by what seemed the subtly errant paths of planets seen passing through the inner gravitational fields of their stars .. as often first noticed during stellar eclipses by the large natural satellites .. their home planets nearly all seemed to have in common.

The 'relativistic' theories eventually proposed and then proven to precisely predict these pesky orbital perturbations would provide a far more profound insight into the fundamental nature of gravity. One which ceased even to consider it to be a genuine 'force' at all!

Rather, gravity could be re-cast as merely consequent to the geometric 'curvature' of four-dimensional 'spacetime' by energy and momentum, guiding massive bodies along mutually 'attractive' paths as if by their purely forward motion over a mass-pitted 'membrane'. Yet even as these insights into reality deepened, so did the equally profound paradoxes to which the proponents of ever-advancing science would soon be pointing ...

Often first to emerge from new insight into the infinitesimally small were the 'quantum' theories. Their powerful and precise predictions would propose ethereal *graviton* 'virtual' particles to constitute a gravitational field, much as the light-bearing *photon* did for its electromagnetic counterpart. But just how could the infinitesimal scale of subatomic particles conceptually enclose the infinite scale of curved spacetime?

Most species would struggle long and hard to unify theories that were each immensely successful on their own scales into a Grand Theory of, well .. Everything. Yet that there *was*, indeed, 'room' in reality for such apparently disparate ideas would testify to the existence of higher realms of 'space', across which those theories would ultimately unite.

However it worked at root, gravity was undeniably a true power player at the grandest scales of the Universe. To its attractive charm fell the motions of mighty galactic super-clusters, over immense spatial spans. But the gravitational quality empowering the alien object, now completing its first manoeuvre in a million years, was not one of might .. but of *meekness*.

Despite its pan-universal grasp, gravity outwardly appeared orders of magnitude *weaker* than its electromagnetic or so-called 'strong' and 'weak' nuclear force counterparts. Yet it was to the very cause of this strange cosmic conundrum that this device owed its own superlative *strength!*

Over nine billion years had passed since one *time* and three *spatial* dimensions had boldly burst forth from a singular point of birth. Their initial freedom to inflate had shown gravity's restraint in binding new-born matter and energy around the casual curves of four-dimensional spacetime. Indeed, like a baby-buttock-slapping midwife, gravity had actually given the Universe a sharp *repulsive* kick to get it going.

As if in gratitude for its benign inflationary boost at birth, Nature had then gifted gravity an exclusive grasp upon the far tighter curvature of *higher* spatial dimensions. *Into* which elusive realms the device had been granted access by its creators. And *from* which it had just gratefully replenished its reserves of gravitational grapple-force.

For a thousand millennia, the object had held a stable solar orbit, mid-way between those of the budding Earth and its next outermost planetary neighbour .. Mars. It had patiently monitored the ongoing formation of both planetary protégés, amid the maelstrom of gravitational interactions and catastrophic collisions still carving the unique character of this complex system. So it had *not* made its recent, inward move towards the ultimate planetary targets of its attention until it was fully satisfied that *another* potential future problem had been permanently put to rest ...

Developing far out beyond Earth's orbit was another interplanetary interplay. A gravitational game of gaseous giants, of a type that had spelt ultimate doom to many a planetary parade's life-bearing prospects. But which, if properly played out, would ultimately serve to *secure* Earth's future protection .. and help to make it a 'must-inhabit' world.

Far too many newborn gas giants had grown swiftly, by sweeping up vast swathes of their stellar systems' densest ice and dusty debris, only to then descend, in destructive spirals, from the frigid zones of their formation .. towards *and even into* the inner realms of rockier planets.

In doing so, their immense gravitational pulls had plunged those puny sibling planets into dire peril; often disrupting their orbits into highly eccentric and lifeless ellipses, smashing doomed bodies together, dumping them into their star .. or slinging them entirely out of their planetary system, to eventually freeze solid in the dark depths of interstellar space.

Had such a scenario been seen to have started here, the object would have devoted its attention to disarming its destructive outcome.

At least, *as best it could!*

Sadly, the entity had been forced to leave far too many failing planetary systems to their fate. Even its pan-dimensionally amplified powers of attraction had often been dwarfed by the unstoppable inward incursions of the mighty 'super-Jupiter' gas giants lurking therein. But, in *this* system, it had at last sensed a source of future hope. One set to eventually restrain what would still yet become a visibly clear and present danger.

Alarmingly, the device's first deep scan, on approaching this system, had found the predicted future orbit of Jupiter to be threatening the realm of the four sizeable, rocky, inner planets and their innumerable planetesimal companions. Formed first and fast from the densest dust and icy debris, Jupiter's immense natural gravity would someday stunt the future growth of Mars, by disrupting its nearby debris bands into what would become two parallel populations of inwardly rocky and outwardly icy asteroids.

Indeed, in its roving role as an interstellar sleuth, the device had even uncovered circumstantial, circumstellar evidence of past planeicide. Although far from proven guilty as charged, Jupiter *may* already have long since destroyed a first generation of super-sized, inner, rocky planets .. spawning the Earth and its companions from *their* re-cycled wreckage.

Yet the object's deeper orbital simulations had also discovered a potential source of planetary salvation waiting in the wings. A calming influence, poised to step in and restore ultimate stability to a Solar System over which anarchy would once have threatened to reign.

As ever, the device's recent decision to forge ahead with the three-into-two accretion of Earth's orbital occupants had been taken at considerable risk. Its billion year forecasts of future planetary orbits would prove accurate in nine of ten systems. But each failure of foresight could doom a potentially life-bearing system to eternal sterility.

It was powerless to prevent the catastrophic carnage that would be cast upon some of its past protégés by errant super-planets. But, perhaps, a few more promising candidate systems could have been picked out for protection, given true perfection of prediction.

Sadly, such future certainty was *in principle* beyond the reach of *any* entity, due to the inherently 'chaotic' character of circumstellar disc evolution. No amount of sensory ability or prodigious computing power could predict the precise path of a system's birth material from dusty debris to pristine planets.

Indeed, the future orbits even of long-formed major bodies would often prove surprisingly dynamic until the entire system had 'settled down', maybe a billion or more years beyond its birth. Even then, the most mature and stable of planetary systems could still be twisted into orbital knots by the gravitational perturbations of just a single passing star.

So, it was with long and hard-enforced caution that the device had predicted the eventual restraint of Jupiter's rampage by the calming influence of its next outward neighbour. The *second* largest of the Solar System's gas giants. Jupiter's smaller-yet-still-mighty sibling .. Saturn.

Not even Saturn's beautifully bloated bulk could directly drag its far more massive counterpart away from playing planetary pucks with their inner siblings. Instead, its gravity would apply subtle but systematic outward tugs as its own, still changing, orbital period passed through a series of resonances with that of Jupiter. The wonder was that such gentle but persistent gravitational persuasion could imbue the orbits of both gas giants with enough stability to see them through this system's birth throes.

The details of this prediction were immensely complex and still worryingly prone to the whims of chaotic uncertainty. But the device *had* seen many variations of this Saturnian 'saviour' scenario in other systems.

Most of which had, indeed, survived intact. So far, at least ...

Almost all long since departed on a trans-Universal quest and, already, over half a billion light-years beyond the galactic bounds, the creators of the device had, still longer ago, freed their collective mind from the constraints of syntactic language. Only in the course of a few, brief contacts with far inferior sentience had they condescended even to a hint of conventional communication. Within the *last ever message* of which, they had at least deigned to divulge two terse but onwardly communicable terms for the wondrous bearer *of their parting gift to the galaxy*.

That act of generosity promised, potentially, *several thousand* life-supporting planets. The awesome device tasked to deliver them was, apparently, known formally to its creators purely in conceptual thought, only very loosely approximated in linguistic terms, as .. **The "Accretor"**.

So it was that the galaxy's first and never-to-be surpassed planetary-scale mass-accretion device had, with renewed confidence, turned its attractive attention to another creative coalescence of multiple worlds into a single planet-moon pair.

Upon completion of which, it would yet again justify the rather *less* formal, but equally apt, alternative title once coined by its creators.

As the Accretor set upon its first orbital shift in a million years, the eight ethereal, *cubic* 'faces' of its four-dimensional *tesseract* hyper-surface each seemed to entwine the black bounds of their own space into something, somehow, 'beyond'.

The eerily elusive shape that the Accretor had set in motion towards **Earth was without form, and void; and darkness was upon the face of the deep** shadow cast by its ghostly projection onto the 'plane' of merely three-dimensional space.

So, the *spirit* of the Accretor moved upon the face of the waters; upon an interplanetary ocean of gravitational waves. Across which it now set sail, on a quest to grant the nascent Earth a *three hundred billion billion* tonne boost of gas-gripping mass.

This would be a geological gift of the grandest proportions. From the heart of which would someday spring forth the core-churning birth stirrings of a life-shielding magnetosphere. And which would benignly bind Earth to the latest in a long line of the axially calming cosmic companions that had so creatively marked the masterful motions of .. **The "Moon Maker"**.

1.3 Graviton Flux

Just decades had passed since the planetary accretor's initial orbital update. Not only had it left its original parking orbit, mid-way between Earth and Mars, it had also moved *inward* to carefully *cross* the shared path of the three bodies to which its attention was now dedicated. Dutifully sensing, as it went, the subtle, orbital drag still being induced upon them by dusty debris and fitfully gusting solar winds.

Settling in to a new orbit within that of Earth and, this time, mid-way out from Venus, it had lain in wait in contemplation of the perfect timing for its first, fateful 'perturbation pulse' ...

That short day of future earthly deliverance, through apparent doom, had dawned less than sixty years later. Rounding its faster inner track, the Accretor had once more reached the radius vector sweeping from the centre of the Sun .. out to Theia. But this time around that imaginary line had *also* hosted, on its still faster sunward orbital passage, the planetary partner in the Accretor's plan. A suitably massive 'anchor', against which its forthcoming attractive perturbation would very soon be perpetrated. The still red-glowing globe of the young planet Venus.

Slowly spiralling around L4, sixty degrees ahead of Earth along their common orbit, Theia had been more casually accreting matter from much the same primordial pool .. boasting barely six percent of Earth's mass. Even so, at almost forty percent of its diameter, Theia would someday cast a short-lived but scarily sinister shadow upon the face of its planetary peer.

At that time spanning less than twelve thousand kilometres, the still growing proto-Earth would behold the approach of a behemoth almost four thousand six hundred kilometres across! But *not* until Theia could at last be persuaded to leave its Lagrangian lair.

The critical moment of four-body *syzygy* had arrived. For just a few seconds, the Accretor straddled the same, sufficiently straight line through three-dimensional space as the Sun, Venus and Theia. Given its recent measurement of the orbital debris drag on its target, and the precise gravitational jolt it was about to generate, it had honed to perfection its exquisitely detailed set of orbital simulations.

So, as it primed its powers for that first perturbation pulse, the Accretor once again pondered the predicted end-point of Theia's future path.

And the Accretor saw that *it was good*.

Fifty million and more years of planet-making mayhem had passed since the ignition of nuclear fusion at its core had conferred truly stellar status upon the Sun. Yet the briefest blink, of barely *seventeen seconds*, would commence the orbital reconstruction of the entire inner Solar System, as its gravitational landscape lay open to the Accretor's trans-dimensional grasp upon gravitons gleaned from a 'higher place'.

Its unique ability to 'down-dimension' gravity's force-carrying *bosons* gave the Accretor the effective mass boost to actually make its influence upon planetary-scale objects felt. That attractive influence would now be applied between two bodies, as if by a gravitational 'winch'. The intent was to imbue the first of a few brief but intense pulses of fatal attraction upon the target of its attention, Theia, in one direction. Balanced against the planetary anchor of Venus, in the other.

Throughout those seventeen seconds of its first perturbation pulse, a truly prodigious graviton flux flowed 'down' through the Accretor, from the fourth spatial dimension and beyond. Flooding from opposite cubic facets of the Accretor's projection onto three-dimensional space, this immense graviton flux induced an intense, local distortion of spacetime.

Although common of forceful cause, that flux had *not* formed one of the all-round gravity 'wells' so often pressed into spacetime by the natural masses of astronomical bodies. Instead, directed through what advanced species would someday dub a 'G-lens', this was a 'focussed' distortion, directed primarily along a linear region through and to either side of the Accretor .. as a *pair* of transient, if rapidly deepening gravitational 'rifts'. One aimed inward, towards Venus; the other surging out, towards Theia.

Within just the first few seconds of the perturbation pulse, each of these seismic spacetime splits had delved many orders of magnitude deeper than that imprinted by the Accretor's own merely megatonne-scale mass. Such had been the efficiency of its graviton draw-down from higher-dimensional realms, that it had momentarily multiplied its mass-presence by a factor of some two billion trillion! Along the axis of each linear rift, a broad gravitational 'beam' had boosted the Accretor's interplanetary pulling power to mimic that of a body *three times the mass of the Sun!*

Travelling at light speed, it took little more than a minute for the *leading* edge of each gravitational rift to propagate out to its target, either side of the Accretor. Well before which, the seventeen seconds of perturbation pulse had ended .. leaving each rift's *trailing* edge racing outward behind the five million kilometre long abyss .. of a deep spacetime 'fissure'.

Fissures into which both Venus and Theia were each about to fall ...

Seconds later, both planet and planetesimal were simultaneously struck by their own spacetime equivalent of a shore-crashing tsunami. Yet these were waves from which there would be no escape to high ground, for each *gravitational* trough was travelling at light speed .. almost three hundred thousand kilometres per second! Furthermore, like any tsunami triggered by a seismic sea-floor slump, the first warning sign would be a sudden surge of suction *towards* its source.

As the leading edges of the focussed gravitational beams washed over both objects, each was dealt a sharp and irresistibly attractive jolt towards its creator. Yet little sense of acceleration would be 'felt' by either, as each was merely following its natural path through the space so sharply and suddenly curved by the intense graviton flux. Even so, both bodies *had* been deeply 'moved' by these twin shocks to the Solar System's status quo. The consequences of which would ripple down through spacetime for *billions* of years to come!

The ultimate results of those ripples were supremely sensitive to the new 'initial conditions' that their perpetrator had just imbued. Even the tiniest divergence from its plan could spell doom to Earth's life-bearing prospects, and the dashing of the Accretor's hopes for this entire stellar system. So, it next meticulously measured the match of Theia's new orbital motion, against that it had so carefully simulated.

And the Accretor saw that *it was* good.

Not only had this single momentous event commenced the countdown to Earth's transformation into a world worthy of Life, but it had also addressed another significant risk from the register of threats *to* that life. For both the strength *and the timing* of the perturbation pulse had been carefully chosen to boost the stability of the Sun's innermost offspring.

It had left Venus with a path around the Sun slightly *more* circular than it had been before .. indeed, with the least eccentric orbit of any planet in the Solar System. Future perturbations by other bodies would periodically change such factors, but this one tweak would at least reduce the effect of any future orbital interactions between Venus and Earth. However, it was the reaction of *Theia's* orbital path to the pulse that had become critical.

Like those of Venus, Theia's seventeen seconds of gravitational free-fall into the Accretor's spacetime fissure had barely changed its velocity *along* its orbit around the Sun, as this first pull on both bodies had been *across* their directions of motion. What it *had* done, though, was to nudge Theia into an orbit now marginally more eccentric than Earth's. One which left Theia lingering around the point of forever leaving its Lagrangian lair ...

With the first of several planned perturbation pulses propagated, the Accretor had one more vital check to make, before settling in to await its next raid on the hidden graviton wealth of higher dimensions. The creation of a new Moon for Earth would demand that Theia be impacted, not only within a precisely constrained approach path and velocity .. but also, at least until the very last moment, *with Theia still in one piece!*

After the physical shock of falling into such a deep gravitational rift, the continued structural integrity of any body could never be assumed. The Accretor had seen several structurally unsound impactors summarily shattered by the sheer 'tidal' stresses induced as its supercharged gravitational wave swept through their bodies.

Although such a messy mass *could* still be guided to its target, the effect of its distribution upon impact would be far less predictable. A fragmented impactor's mass would, indeed, be delivered. But the much needed angular momentum and moon-matter ejection plume might not.

To assuage its anxiety, the Accretor then set to scanning the inner integrity of the object it had so brutally shocked away from its natural course. From half way to Venus, it brought a billion years of body-shifting experience and interstellar insight to bear upon sensing the state of Theia's tidally stressed internal structure.

And the Accretor saw that *it was* good.

So ended the first 'day' in the Genesis of the Earth and its Moon. The critical die had been cast in a gravitational Game of Throws which would culminate, five geologically brief centuries hence, in the formation of an arena fit to foster an enduring firestorm of future evolution. A five hundred year blink of *geology*, set to spur a five billion year blaze of *biology*.

Over the next half millennium, three more perturbations of Theia would be administered and assessed by an Accretor growing ever more confident of this planetary system's prognosis for Life. Each new pulse aligned Venus and Theia either side of the Accretor, but with the Sun now well *off-axis*, so subtly shifting Theia's *orbital* velocity .. and slowly but steadily spiralling it ever further out from its birthplace.

Yet only as the Accretor punched forth its final and most powerfully perturbing pulse did the curving clutch of the Coriolis effect finally release its grasp upon Theia's orbital fate. Torn away from the stable cradle of L4, Theia could at last claim freedom to cruise away from its childhood crèche and follow its own orbital trajectory around the Sun.

Albeit, upon a path which would soon intersect that of Earth ...

1.4 Theia Fall

It was truly a sight worthy of those who would look up at the night sky in wonder.

Yet no sentient skywatcher would stare up in awe from the violently volcanic and acridly atmospheric surface of this young Earth. Looming large above the hellish horizons of which, Theia's visual transformation from bright but distant dot of light to broadening black disc of descending doom was close to its catastrophic culmination.

Theia had long held office as *the* high herald of earthly dawn. From its stable cradle, sixty degrees ahead of Earth along its orbit, it had served as the ever-shining, morning 'star'. Strangely static relative to the Sun, this heavenly beacon had *always* risen one sixth of a day *ahead* of its light. But the Mother of the Morning Sun; the Maternal Maker of the Dawn, had at last been seduced away from her watchpost .. and was irresistibly inbound towards the dramatic delivery of her final birth.

Precisely on the velocity and only three kilometres off the track laid by the Accretor almost five centuries earlier, Theia was in the final phase of its fall to Earth. From its projected point of fatal 'first contact', its beautiful but forebodingly magma-blooded bulk filled, in deep silhouette, a swathe of sky over thirty degrees across. Cast ahead in ever-sharpening relief along its sunward approach path, Theia's immense shadow swept in silence across the face of the Earth .. ominously swelling by the second.

Although still several thousand kilometres apart, the union of Theia and Earth had, in one very real sense, *already* started. Shaped in isolation into seemingly solid spheres by their own internal gravity, both bodies were really no more than crispy shells of thin crust around massive molten mantles and cores contained therein. Such fragility suited objects freely following their own stellar orbits, but both bodies were now bathing ever deeper in *each other's* gravity. And the nearer, closing face of Theia was feeling Earth's gravitational pull far more strongly than its trailing side.

Feebly resisted by its internal structural strength, Theia's formerly spherical shape was simultaneously slimming and stretching under the sheer 'tidal' stress of Earth's much greater gravity. Ever more visibly bereft of its billiard-ball body curves, Theia's leading and trailing faces were ballooning, respectively, forward and backward along its path of descent.

Suddenly unable to ignore Earth's incessant call to closure, the fractally fractured slopes of each bulge blossomed. As a web of rose red magmatic plumes exploded through a crazed maze of immense crustal cracks.

Such was the power of gravity's tidal pull, between two bodies of greatly different masses, that even *humans* would one day witness the wrathful yet wondrous effect of such a close encounter. Although, by then, long since retired from playing havoc upon its sibling inner planets, Jupiter would be seen to inflict its gravitational ire upon an errant comet, caught passing within what would then be termed its "Roche Radius".

Summarily torn asunder by the same gravitational tidal stresses now distorting Theia, the doomed debris of comet "Shoemaker-Levy 9" would be drawn out into a glorious 'string of pearls', gracefully adorning one last Jovian orbit. Then each piece would plunge, in turn, to dramatically depicted destruction .. on darkly pock-marking penetration of Jupiter's upper atmospheric clouds.

The Accretor's plan for Theia's impending demise also demanded *its* penetration deep into the body of its destructor. Not only would Theia soon donate the bulk of its nickel-iron heart to bolster Earth's own, but it would also impart *some* of its carefully controlled *linear* momentum towards boosting the *angular* momentum of the entire planet. That extra spin momentum would manifest as a step rise in Earth's rate of rotation which, in turn, would eventually kick-start the first life-preserving magnetospheric motions, deep within its newly massive core.

Yet, important as Earth's new spin rate was to the plan, the bulk of Theia's momentum would, instead, be turned to throwing an altogether more magnificent and messy party, literally .. out of this world! For as it ploughed sidelong into its molten mantle, the shattered bulk of Theia's former body would propel many Moon-masses of earthy magma onto an ascent path bound for space.

Well, that was the plan, anyway ...

After a billion years and more in the business, the Accretor knew, only too well, that the making of moons and magnetospheres was no mere matter of merging masses. What really mattered was *the manner* in which those masses met each other and mixed. Not to mention, sending some of that mixture *back out* into a stable orbit, to serve as a substantial new Moon.

Humans would one day hail Earth's thermally benign orbital range around the Sun as a planetary 'Goldilocks' zone. Not too hot, and not too cold. The coming accretion, though, was akin to throwing Mummy Bear's piping hot porridge into Daddy Bear's brimming bowl. While hoping to splat a bite-sized morsel across the breakfast table .. into Baby Bear's open mouth!

Yet that hope *was* realistic ...

Like a pan-galactic potter, poised to throw a lump of clay onto the wheel, the Accretor was *the* master of its craft. It was satisfied with Theia's approach profile and was sensing the first world-wide stirrings of flowing mantle beneath each body's cracking crust. Deeper down still, it had felt the heavy cores at their hearts irresistibly 'falling' for each other's attractive charm.

Such early signs were reassuringly reminiscent of successful past mergers of a thousand alien worlds. So, as the swiftly sharpening shadow of Theia moved upon the fractured face of its beckoning grave, the Accretor used these few remaining moments to make one final forecast of the looming magmatic maelstrom's likely outcome.

And the Accretor saw that *it was* good.

In the years prior to dispensing its first perturbation pulse, the Accretor had considered over sixty-seven sextillion simulated closing paths of Theia and Earth. All but a handful had been summarily discarded, as ultimately failing to deliver the essential conditions required for Life.

Even the path eventually chosen was about to leave one major and several minor aspects of the new system's desired motions still unsatisfied. *Those* targets would just have to wait .. for now. Indeed, perhaps the most 'undesirable' characteristic of Earth's current motion would soon be passed on to its new Moon. To leave a lunar legacy that would later help to inspire the awe and admiration of future humans.

In condensing from the primordial circumstellar debris, the Solar System's major planetary orbits had all formed within roughly the same disc, defining what would one day be termed the 'ecliptic plane'. Seen from any major planet, this constrained the Sun and other planets to forever patrol a restricted band of sky .. the 'Ecliptic'. Beyond the far-flung fate of those future planetesimals borne too close to Jupiter by their highly elliptical orbits, *that* would not change .. much.

However, the *spin* axes of several planets *had* previously been pushed this way and that from their natural equatorial alignment, perpendicular to the ecliptic plane. Such axial tweaks were mainly due to a mix of their internal magmatic motions, gravitational perturbations from other planets, and 'off-plane' collisions with a myriad impactors.

In that context, Earth had actually fared quite well, with its equator currently tilted less than six degrees from the ecliptic plane. So, it was along a path precisely within Earth's *equatorial* plane, that Theia bore down upon its point of impact ...

Among sentient species, moments of 'First Contact' would long be anticipated as the stuff of dreams .. or of nightmares. Of future fellowship between comparable cosmic partners .. or the fatal consumption of one by the overpowering presence of the other.

Albeit an inter-planetary rather than inter-species encounter, Theia's first contact with Earth would certainly count among the latter. Yet the collision of Theia with Earth would barely even register as a noteworthy spectacle on the true scale of cosmic calamities.

The last twenty million years or so had probably seen the passing peak of planetary pummelling. A myriad planetesimal cast-offs from the Sun's birth had long since swept up most of its discarded debris .. before bequeathing their own bulk to beefing up one or another of the Solar System's body-building finalists.

Future phases of heavy bombardment would, indeed, come to confer cratered character upon the faces of the surviving planets and their moons. But, long before setting its interstellar sail towards the Sun, the Accretor had chosen to arrive at *this* critical phase of the Solar System's development. In doing so, it had ensured ready access to the pre-accreted bodies it now needed to do its job .. without unduly risking the destruction of its hard-wrought handiwork in the far future.

So, barely a million years after the Accretor's arrival from afar, came the moment of cosmically creative contact between Theia and the body *into* which it would become forever bound.

And *to* whose cradle it was graciously bearing three geologically generous gifts of new mass, magnetosphere .. and Moon.

1.5 Ring o'Roses

When worlds collide, the mechanical *strength* of their matter pales into insignificance against the overpowering momentum and energy of their *mass*. Even had Theia been a body of solid rock, its impact with Earth would hardly have been less self-destructive. These were no colliding cosmic billiard balls, about to bounce benignly off one another, but bulging bags of then still fluid nickel-iron core and molten, rocky mantle .. encased within crispy, cracking crustal coats.

As the momentum of Theia's bulk drove it careering into Earth's still fragile crust, its mass began an equally crushing deceleration. Proportional to the square of its rapidly draining velocity, the immense and indestructible *kinetic* energy of that mass suddenly had to go somewhere, in some form. But, at least partly .. as *heat!*

A fraction of that thermal energy would broadcast news of this spectacle across the entire Solar System .. instantly boiling gigatonnes of rock into white-glowing vapour, and sending a blinding flash forth from a rapidly widening ring around the point of impact. A flash immediately followed, in all directions, by a first incandescent instalment of molten magma, blasted into orbit from the interiors of both bodies.

But a far larger fraction of Theia's energy had preceded its rapidly disintegrating body ever deeper into Earth's mantle. An immense thermo-mechanical shockwave had surged downward and outward from the impact point, almost instantly re-melting the fragile crust of Earth into a roiling ring of rock around the rapidly disappearing dome of Theia's remaining hemisphere. A dome that was also visibly distorting as it drove, not only downwards, but also *sideways* into Earth's yielding bulk.

With exquisite precision, the Accretor had directed Theia's descent along a curving final approach that had drawn its death shadow across Earth's daylight hemisphere, before plunging Theia obliquely into its equator at local sunset. Drawing heavily upon a billion years of moon-making mastership, it had carefully crafted that critical angle of impact to inject Theia's momentum to optimum effect .. both west-to-east *along* Earth's equator and, for now, deep *into* its interior.

Although grateful for the geologic gifts so generously conferred upon it, Earth was suddenly struggling to contain what was fast becoming too much of a good thing! But it would soon have some relief. For as Theia's core crashed into Earth's increasingly well-mixed upper mantle, its sloping shockwave surged ever further sideways .. *and deeper down.*

Mostly either missing or efficiently reflected by the surface of Earth's molten core, that shockwave had soon passed its greatest depth. It was now speeding towards the thin but still solid crust, almost a third of the way around the equator. This time, though .. rising rapidly *upward!*

Barely had the impact shockwave slammed up into Earth's crustal base from below, than the ripping bulge pushed ahead of Theia's sidelong entry reached the same point. A fallen world's worth of explosive energy could at last get behind a hundred quintillion tonnes of seething, molten mantle.

Setting the scene for the mightiest .. and messiest .. 'mass ejection' of material that planet Earth would ever make.

Had the Accretor ever been tempted to pass aesthetic judgement upon its own works, it might have considered Theia's impact and slanting burial to have been one of its 'tidiest' to date.

True, there *were* several huge plumes of incandescent impact ejecta heading out along wide, if mostly suborbital arcs that would bring them crashing back down to Earth. But this merger of minor body into major world had otherwise been commendably well contained. So far, at least.

That was good news, indeed, for Earth's future prospects, as it implied an efficient injection of much needed momentum from impactor to impactee. Yet as the core of what had once been Theia dove deeper into its new host, a sizeable fraction of that imparted momentum rebounded back into space.

This time around, though, *some* of that precious momentum-bearing matter would stay up .. for good!

Seconds later, the ascending shockwave shattered the surface of the Earth, instantly tearing a continent-sized strip of crust into vast, magma-coated shreds. Squeezed between the shockwave's direct path and its reflection off the liquid core, eighty billion cubic kilometres of glowing mantle were blasted spaceward through a gaping breach in Earth's crustal equator .. instantly turning its dark side to day.

Its velocity boosted west to east by Earth's newly raised rate of rotation, enough shattered crust and seething mantle to build *several* new Moons rose obliquely along a parabolic ascent path which would soon cast it over twenty thousand kilometres out into space.

But its permanent freedom from earthly confinement would be very hard won, indeed ...

Curving into a crimson fan as it wrapped itself gracefully around Earth's equatorial sky, the pulverised plume rode its roller-coaster path towards two very distinct destinies. Drained of orbital velocity by friction, gas release and mutual collisions, most of its energised ejecta would come crashing back down upon the newly enlarged planet, just hours later. But that sacrifice would not be in vain .. as it returned more, much needed momentum, to further raise Earth's rotation rate.

Even the looming loss of so much matter from the plume would not actually 'matter' at all to the success of the Accretor's plan. Almost nineteen billion cubic kilometres of mostly former proto-Earth *had* found itself with enough lateral velocity to 'miss' its home planet, altogether .. forever.

An amount that would suffice .. for now.

This job was still far from done, but the first instalment of Earth's new axial stabiliser had been duly delivered to its doorstep and unpacked for self-assembly. As a billion bright and radiantly rose-red mountains of molten magma spread themselves around their new eternal path, the half re-surfaced planet below played host to its very own circumplanetary ring.

But *this* 'Ring o'Roses' would *never* fall down!

1.6 Red Sky at Night

For the next century or so .. barely a tick in geological time .. the Accretor watched on. As the *two* actors of accretion under its direction each performed, to perfection, their own uniquely creative roles.

Deep within the Earth, the dense nickel-iron mass that had once marked Theia's heavy heart had soon sunk through the much lighter mantle. Merging both its mass and momentum with Earth's own, it had kick-started the first stirrings of the complex core Coriolis vortices that would ultimately forge a protective magnetosphere around this entire world.

Barely twenty thousand kilometres *above* Earth's still molten equator, a far more visually spectacular transformation had taken place. First fashioned into a roiling ring of red-glowing rocks within just a few of the days newly shortened by the impact of Theia, Earth's very own circumplanetary debris disc had then undergone a surprisingly rapid series of mergers.

Making what Earth could, at last, proudly proclaim as .. its New Moon!

That such a body could be formed by ring-matter accretion was down to the efficiency of the impact parameters set up by the Accretor. Had the ring been just a few thousand kilometres lower, within around three Earth radii of its surface, then any clumping together of its matter would have been overwhelmed by the same gravitational tides that had so deformed Theia on its final fall. Forces relentlessly determined to rip apart any growing moonlets might instead have left Earth as the Solar System's first, visually alluring, but biologically barren 'ringed planet'.

Yet, a substantial Moon *had*, indeed, grown from the seeds sown into a stable, if somewhat eccentric Earth orbit by Theia's impact. Those selenic seeds had been forged from the mixed mantles of both bodies, with a hint of errant Theian core thrown in to give the Moon a strong heart. But, as both worlds had originally accreted in the same solar orbit, from much the same mix of chemical compounds and elemental isotopes, the crustal compositions of Earth and Moon would exhibit only subtle differences.

A century of cooling had left both surfaces still radiating into space the thermal energy blasted into them by the Accretor-crafted collision. Intense shockwaves had reverberated around Earth for days afterwards, conspiring with the gravitational stresses induced by Theia's fatal approach to re-melt much of its crust. The seething surface of which was now being baked beneath a dense mist of silicate vapour, and scalded by superheated steam boiled off what had briefly been the dark waters of its first shallow seas.

Meanwhile, Earth's new Moon was racing around its orbit with all the eagerness of youth. Clocking almost four kilometres per second, it was completing a pole-positioning lap of its planetary anchor roughly every twelve hours .. its gravitational pull dragging behind two bulging 'rock tides', which would only be outpaced by Earth's even *more* rapid rotation.

Beyond its blistering bustle, its sheer visual scale would have mightily impressed any early Moon-Watcher. From Earth's surface, this speeding satellite's crimson red bulk projected a vast and menacing form upon the sky. A demonic disc, waxing to almost twenty times the width of the Sun!

Cast from an orbit inclined only a few degrees to the ecliptic plane, the immense selenic shadow was repeatedly plunging a sizeable area of Earth's daytime hemisphere deep into the darkness of a total solar eclipse on almost every pass. Matched only in fiery foreboding from its far side, as the Moon's molten surface cast the hellish hue .. of a Red Sky at Night.

The *first* phase of the Accretor's creative plan may have been over, but its work was still far from finished. Theia's equatorial plane approach had conferred Earth's six degree inclination upon the Moon's new orbit. Fortunately, such a modest lunar *orbital* slant would, ultimately, suffice for the efficient far-future stabilisation of Earth's *axial* tilt.

To which, however, the Accretor would next turn its attention.

After a billion years of manic moon-making, the Accretor had already left a trail of a thousand and more potentially habitable planet-moon systems in its pan-galactic wake. Yet it was still far too 'soon' for it to have seen much in the way of biological bounty from its handiwork. Such wonders would rarely evolve beyond primitive, single-celled organisms within a few billion years of their habitat's birth. Only with the volcanic and cometary delivery of ocean depths, growing geologic stability and higher energy atmospheric chemistry .. would advanced life then thrive.

It could easily have considered its task already well done for this system, too. But, beyond axially stabilizing each new home for that prospective life, the Accretor's own creators had programmed in *two* other target planetary parameters that would also help to progress its ultimate purpose.

Of those, one was deemed absolutely essential to the long term evolution of higher life.

The other, *if* at all achievable, was a 'nice to have' that might well someday help to lure future intelligence above the boundaries of its birth cradle .. and out into the beckoning blackness of boundless space beyond.

For almost eighty million years prior to their departure, the entities who would spawn the Accretor had surveyed, studied and sampled the entire pan-galactic panoply of biological species. Although their own collective consciousness had long since forged far beyond the bounds of biology, they knew that the very *fragility* of biochemical life was by far the best guarantee of its ultimate transformation to their form.

For only in the wake of innumerable extinctions could Life explore all the possible paths to the perfection which only they had yet achieved.

That galactic survey had uncovered a multitude of lifeforms, reflecting the extreme diversity of planetary habitats within which each had evolved. Almost all advanced evolution had required the universal solvent of life .. *liquid water*; aside accessible sources of stellar or geochemical energy. Preferably protected by a magnetospheric shield and an axially stabilising Moon, akin to those the Accretor was so kindly conferring upon Earth.

One other characteristic of a planet's spin axis had also been found to correlate strongly with evolutionary success. The heartbeats of higher life-cycles would so often be stronger when synchronised to the steady rhythm of their planet's orbit around its star .. *by the passage of seasons*.

Such life-clocking seasons demanded a decent tilt of a planet's equator, relative to its ecliptic plane. Not so far as to drive dangerous annual extremes of heat and cold. But rather more than the six degrees the Earth currently enjoyed.

So, endowing Earth with a set of stable seasons suited to the annual beat of biological rebirth would be the primary objective of the Accretor's next move. In the process, it would take aim at that other, 'nice to have' target.

However, to sadly mix sporting metaphors, hitting both bulls-eyes with the same dart would be the planetary equivalent of bouncing a curving cue ball around a billiard table .. and pocketing *all* the colours in one go!

That feat simply might not be physically possible in this case.

But the Accretor was once more about to carefully uncase its cosmic cue-stick .. and take its very best shot!

1.7 High Hyperion

Only as the orbital dynamics of the new Earth-Moon system settled down could the Accretor consider its next move. The undoubted success of its bid to dedicate Theia's fall to the cause of Earth's fertility had relied on its intimate knowledge of the initial conditions at the outset. That hope could so easily have been dashed by even the smallest of errors in sensing the starting position and motion of either body; the drag forces acting upon them due to circumstellar gas, dust and solar wind, or the gravitational pull of the Sun and other planets. But at least then the Accretor had been able to make its measurements 'at its leisure' .. over the previous million years!

Not only would there now be an extra degree of difficulty to the dance, but time was also of the essence. There were dynamic constraints upon the next phase that could put total success beyond the Accretor's reach if it waited too long. For a key player in the next event just would not stay put. The new Moon was on the move!

Unlike the Solar System's handful of *retrograde* moons, orbiting in the *opposite* direction to their planet's spin, Earth's *prograde* Moon would never be in any danger of falling back down upon its planet. Indeed, quite the opposite. The immense tidal bulges the Moon was dragging around the Earth took time to rise and fall, so would be twisted *ahead* of the Earth-Moon line by Earth's even more rapid rotation in the same direction. The nearer bulge's greater gravitational attraction towards the Moon was acting as a small but significant brake on Earth's spin rate. And, as Earth's rotation slowed .. it was *losing* angular momentum.

Conservation of momentum would be the primary physical principle behind the first rocket-propelled, off-world ventures of most emergent species. *Linear* momentum .. mass times velocity .. blasted behind a rocket would always match the momentum thrust ahead. Similarly, the *angular* momentum of the rotating Earth-Moon system would also be conserved.

So, as Earth's angular momentum slowly *drained*, that of the Moon would be *boosted*. Unable to change its mass, nor to increase its velocity, the Moon could only express its growing angular momentum through an enlarged orbit. It simply had no option other than to start moving *away* from Earth! Setting itself onto the ever more circular but outwardly spiralling path it would pursue for the next several billion years.

The orbital evolution of the Accretor's planet-moon creation severely constrained the time available to execute the second phase of its plan. So, barely had the last boulders of blasted rock embedded their mass within the Moon, than the Accretor set about preparing its next perturbations ...

The once steady dominance of distant Theia's light in *every* pre-dawn sky had finally fallen to the ferocious, if fickle, red glare of the Moon. But such had been the circumsolar bounty of dusty debris from which Earth and Theia had formed, that ample had been left over for *another* beacon. One which the maternal gravity of Earth had coaxed gently but firmly into its other cradle of co-orbital stability. The *fifth* point of Lagrange.

"Of Hyperion, we are told that he was the first to understand, by diligent attention and observation, the movement of both the sun and the moon and the other stars, and the seasons as well, in that they are caused by these bodies, and to make these facts known to others; and that for this reason he was called the father of these bodies, since he had begotten, so to speak, the speculation about them and their nature."

Diodorus Siculus (5.67.1)

Counterpoising Theia, some sixty degrees *behind* Earth along its orbit, Hyperion had long held the high ground of the heavens' daily march across the sky. Always setting one sixth of a day *after* the Sun, the "High One" had bathed Earth's darkening hemisphere in a stream of reflected sun-rays throughout the hours of evening sky beyond every dusk.

From its high, heavenly watchpost, Hyperion had observed its Mother Earth's first century-long embrace of the new Moon so selflessly created by the sacrifice of its sister. So, as the Accretor ran yet another seventy sextillion precision simulations, it would soon be to Theia's smaller sibling that would fittingly fall the honour of completing its plan. For not only would Hyperion one day sacrifice *itself* to one final touch of the Moon .. it would also add a vital pinch of 'seasoning' to Earth's recipe for future Life!

Although significantly less massive than its big sister, Hyperion's bulk still promised another benign boost of the metallic core and silicate mantle that Theia had donated, in death, to Earth. Those would soon supplement their respective earthly domains .. firmly pushing its core dynamics and gas-gripping mass well into the 'safe' zones for such life-sustaining qualities. Yet, welcome as they would be, material gains were *not* the first priority of the Accretor's next perturbations. Nor even, for that matter, the second.

The course set by the Accretor for Theia's voyage from L4 to Earth had never cast it far from the ecliptic plane. Only for its final approach had an 'off-plane' component been induced, to align its descent along Earth's equator. But, with the Moon now firmly established in that gently tilted orbit, a more radical re-alignment of Earth's *own* axis could be attempted.

And *that* would demand a lot more 'leverage'.

So began a long series of subtle tugs on Hyperion, each one timed to resonate with and incrementally accentuate its orbital inclination relative to Earth's. Only when fully satisfied with its off-plane orbital options did the Accretor finally see fit to administer the last, fateful pulse of gravitational grapple power in its programme for this planetary system.

When, with one gigantic jolt, it wrenched Hyperion forever from L5. Launching it onto a long, lonely and one way drift, into the grasp of Gaia.

Fifteen months later, it was Hyperion's own turn to sweep its sharpening shadow over the still fiery sunward face of the planet it had, for so long, been faithfully following from afar. But where Theia had dug deep upon arrival, its smaller sibling would settle for a swifter and far more 'superficial' swipe at its target. Or, at least .. at its *first* target.

This circumstellar stalker was about to strike a glancing blow upon its victim. It was running in to deliver a 'hit and run' assault that would leave Earth's spin axis forever askew. Although, actually .. in a 'good' way!

By increasing the tilt of Hyperion's orbit away from the ecliptic plane before launching it Earthward, the Accretor had set up a rather different end-path for its second impactor. Theia's deep plunge along Earth's equator had been designed both to speed up its rotation and to throw a decent mass of moon-matter skyward. Hyperion's descent to doom, though, would display a sizeable *north-south* velocity component, designed to endow upon Earth just a *little* more rotational speed .. and a *lot* more axial tilt.

The efficient delivery of that tilt would be akin to tipping a spinning top .. best performed by a deft, downward touch at its outermost edge. So, the coming assault would constitute a 'minimally invasive' surgical strike, driving Hyperion just deep enough below Earth's crust to dump its core and a little more than half of its own mantle. Leaving a huge slice of its former body free for what really *was* the Accretor's second target ...

On the day, the Accretor's profoundly precise predictions were subjected to the usual chaotic convolutions of physical reality. The mixing of rocky melts and metals .. as mantles, crusts and cores collided .. would often confound even the galaxy's most comprehensive simulations.

But the Accretor was no 'newbie' to these numerical games. And it had long since come to accept the corruption of its clinically clean aspirations by the greater realism of its expectations.

As if grinding grit into an already gaping wound, Hyperion hit Earth only around three thousand kilometres north-west of Theia's original impact point. That coincidence of collision points a century apart, whilst yet again melting almost half of Earth's mantle down to the core, actually spared a tiny region of *original* crust on the far side. Had the combined energy of both Theia and Hyperion been dumped in one go, then this battered body would now be bathed in the red incandescence of a global magma ocean.

Although significantly less energetic than Theia's fall, Hyperion's half-a-body blow still imparted another huge shockwave into Earth's mantle. More importantly, the large north-to-south component of its impact velocity had forever altered the rotational dynamics of the entire planet.

Over the subsequent years required for its ringing global deformations to subside, Earth's equatorial inclination swung around erratically. Before slowly settling from its once six degree tilt off the Solar System's plane .. to an oscillating 'obliquity of the ecliptic' exceeding twenty degrees.

The breaking of that tell-tale, formative bond between Earth's original axial tilt and the Moon's orbital plane would puzzle human scientists pondering the origin of their planet-moon pair. But, as the natural wobbles of Earth's newly tilted spin axis subsided, its poles would commence their respective annual nods towards and away from the heat of the Sun. Powering the yearly rhythm that would one day regulate the reproductive tick of higher lifeforms to the stable, cyclic certainty .. of the Seasons.

Its highest priority aim achieved, the Accretor could do little more than wait to see if its long shot at a second target was anywhere near the mark. Yet it knew it would *never* be a nearby witness to the ultimate culmination of that attempt .. destined to unfold many millions of years hence.

By then, the Accretor would be long gone from this system. For it was already well advanced in the selection of the *next* astral afterbirth to attract its attention. But it could, at least, witness the birth of the bizarre finale of its plan for *this* young star's best hope of bringing forth intelligent life.

Hyperion's glancing impact had done a surprisingly neat job of shearing away almost half of its mantle mass, to continue onwards and upwards from Earth. Its rocky remains had been left with just enough relative velocity to send its bisected bulk on a tangential ascent away from the seething maelstrom caused by its better half below.

That ascent had left it on a highly elongated orbit. Reaching 'apogee' .. its furthest point from Earth .. some nineteen thousand kilometres away.

Velocity spread within Hyperion's dizzily spinning, sheared and shattered remaining hemisphere would bring most of it crashing back down upon the planet, days later. Yet a huge mass *would* survive to join the product of Theia's demise in stable orbit. Devoid of close cosmic company little more than a century ago, Earth could now boast, not one .. but *two* new moons!

Within weeks, the rocky remains of Hyperion had re-formed into a loosely spherical body, on a promising *intercept* path. Leaving the Accretor to reassess, with rising hope, its chance of hitting that 'nice to have' target.

And the Accretor saw that *it was* good.

Even so, its experience of many similar scenarios had left the Accretor uncertain as to the eventual outcome of the interplay it had initiated. Its control of Hyperion's approach had been ultra-precise, but its *post-impact* predictions could only be coarse. By the time things came to a head, such devilish details could drift the Accretor's design from dream to disaster.

Earth's new dual-moon system had been created at the call of the Accretor. In pulling Theia and Hyperion from their birth sites before they reached orbital instability, it had cleared away the two greatest risks to future Life on Earth. But the Accretor would yet live up to its name one more time. As it persistently pursued the last planetary parameter needed for perfection.

By throwing material from an earthly equator tilted six degrees to the ecliptic, it had endowed both the lunar orbital plane *and equator* with that same inclination. That was fine for the Moon's roles of stabilizing Earth's own newly jolted axial tilt and guarding the steady cycling of earthly seasons over geologic and evolutionary time. So, what *more* could the Accretor hope to achieve by casting half of Hyperion onto this same path?

Well, it had given Hyperion's approach path a substantial 'off-plane' component, mainly to push Earth's equatorial tilt further *away* from the ecliptic plane, so as to strengthen those seasons. But it had also sought to apply one more throw of the dice .. or, more fittingly, *spin of the roulette wheel*, to the tilt of the *Moon's* equator. With the intention, this time, of *reducing* that tilt. So, why on the Moon would it want to do that?

The Accretor had already fulfilled its brief of creating another potentially habitable world from which Life could spring forth. Yet its own creators had chosen this parting gift to the galaxy in grateful celebration of *their* species' good fortune, spotted soon after its scientific emergence. For not only had their birth planet been endowed with the mass, magnetosphere and major moon needed to enable their evolution, but *that moon's equator had also been aligned to within a degree of their star's ecliptic plane.*

That fact had, of course, meant nothing at all to their species throughout its natural evolution and early nurturing of scientific knowledge. Only as they stood to stare up at their night sky in wonder, from the technological threshold of interplanetary exploration, had an important implication of their moon's low inclination been recognised .. to ever-rising anticipation.

Its *equator* lay virtually upon the ecliptic plane, so its *poles* were perpendicular to that plane. Which not only kept the powering light of their star in perpetual proximity to its polar horizons, but it also draped the inner realms of its deeper polar craters in equally perpetual *darkness*.

Although larger than Earth's Moon would ever be, theirs too had still lacked sufficient mass to retain an appreciable atmosphere. Most of the water wetting its airless surface from within, or dumped by cometary impacts from afar, had been boiled and blown away by the wild winds of their powerful star. Only upon the dark and ultra-frigid floors of its polar craters had vast volumes of water survived. In the hardy form .. of *ice*.

Driven by much the same early scientific insight as many later species, the discovery of water ice at the poles of their moon had spurred the first long-term settlements beyond the bounds of their birth world. The melting and hydrolysis of polar crater ice had been energized by the nearby perpetual light of their horizon-hugging star, sourcing water and fuel to sustain their bodies and power their spacecraft. Those first polar moon-bases had launched them onto the interplanetary exploration of their neighbourhood, followed by their *interstellar* spread across much of the galaxy .. as their biological bodies intellectually evolved into far more mobile *machines*.

Even as the worlds of their youth succumbed to the death throes of their brightly burning but relatively short-lived star, none would forget how the early survival of their ancient species had been assured, in part, by that unlikely alignment of their moon's equator along the ecliptic plane of their planetary system. So when, over eighty-two million future-Earth years later, the time and inspiration came to depart their birth galaxy, they had instilled that apparently incidental target inclination into the ultra-intelligent intent of the mighty machine created *in their own image*.

Only after the Accretor had been cast towards its first stellar birth, though, did a far-sighted few of the near-infinite facets of their collective consciousness pause to ponder upon one very profound proposition ...

That *they*, too, might once have been the blessed but unsuspecting beneficiaries of some ancient, alien ancestor .. of the Moon-Maker!

1.8 Moon of the Moon

The Accretor could never know for certain whether Earth's new Moon would ever find itself enticing future intelligence out to its icy, polar promise. The desired 'levelling' of its equatorial plane depended upon the chance outcome of the encounter looming just a few years after Hyperion's self-shearing swipe at Earth.

But the Accretor already knew that the game was, at least, *on!*

Hyperion's hemispherical remains had been launched into a highly elongated orbit. One which reached out almost to the slowly circularising path of the far more massive Moon. Even with its vertical excursions well above and below the plane of the Moon's orbit, some sort of interaction between the two was inevitable. Such had been the Accretor's plan.

It had aimed and timed Hyperion's earthward approach to *avoid* any danger of direct impact between the twin moons now entwining their orbits. That would have risked far too much unpredictable damage to what was the prized trophy of its primary mission, with little hope of gainful benefit. Moon and moon *would*, indeed, kiss face-to-face one day .. albeit, hopefully, in a rather less directly destructive embrace. But only after a long and intimate introduction to each other upon the orbital dance floor.

Most of the seventy sextillion simulations of Hyperion's possible paths to destruction had actually explored its motion *after* its impact with Earth. The Accretor could not control the precise dynamics of the shearing process. But it *had* been able to predict where virtually every feasible outcome would send Earth's second moon for years to come. So it had chosen the approach path with the greatest number of desirable end-points.

One of which was, finally, about to emerge ...

The gravitational 'capture' of one astronomical body by another would one day be proposed as the means by which Earth had acquired its own Moon. Although, at first, outwardly attractive, this idea would soon be rejected as requiring far too great a coincidence of relative path and velocity for earthly gravity to grasp such a large body, purely 'in passing'.

That rejection would be confirmed when mankind's first samples of the Moon's surface showed how similar its chemical and isotopic composition was to that of Earth's mantle. Yet the Accretor's prodigious predictive powers had set the otherwise unlikely conditions by which *not* Earth, but its *Moon* would actually come to capture a companion all of its very own!

Settled into a barely spherical shape after almost two years in its elongated orbit, the shattered moonlet once again approached its highest point above Earth. Earlier visits to this lonely spot had found it firmly beyond the gravitational grasp of a Moon busily going about its orbit elsewhere. But *this* apogee would see it soaring to within a few thousand kilometres of its earthly orbital companion.

Seen from above the 'northern' side of the ecliptic plane, Earth's new satellites were both spinning and orbiting in an *anti*-clockwise direction. Along with, for that matter, the rotation of the Sun and the axial spins and solar orbits of every major planet! That rotational preference reflected the original angular momentum trapped within the collapsing interstellar cloud from which the Sun and its entire planetary system had formed. It was a preference *not* lightly to be denied.

The grace to 'go with the flow' had long given the planets and moons of the galaxy and beyond the greatest chance of being around over geological time. Exceptions to that natural rotational orientation often indicated either the past incidence *of*, or a future invitation *to* cosmic calamity! To which the Accretor looked ahead with some *satisfaction*, as it hailed the steady convergence of its last-born moon's course and velocity with the orbit of its older sibling .. stalking it just a few thousand kilometres behind.

The relative arrival order of both bodies at this point had been critical. For as the moonlet felt the gravitational tug of the Moon grow to match that of the more distant Earth, its momentum carried it beyond its original apogee .. into a *clockwise curve around the Moon* that would soon close itself into a surprisingly circular orbit. Its path was now in the opposite, *retrograde* direction to the spin of the Moon. A fact designed to make a fundamental difference to its ultimate orbital fate ...

Contrary to the Moon's *prograde* path around the Earth, this rotational reverse-direction would *drain* angular momentum from the orbiting object, forcing it to *descend* ever closer to the body around which it circled. Millions of years hence, the doomed moonlet would first shatter under gravitationally induced tidal stresses .. and then splatter its matter onto the surface of the Moon below.

In doing so, its retrograde momentum would slow the Moon's own rotation, further boosting a trend that would eventually leave the same lucky lunar face forever 'tidally' locked in admiration of Earth's slowly blooming blue beauty. At the same time, its off-plane momentum would deliver a jolting prod at the Moon's axial tilt. Attempting another tip of the spinning top which might, *or might not*, cast both perpetual darkness and the promise of future icy bounty into its deeper polar craters.

It was, perhaps, fitting that this final phase of the Accretor's plan so uncannily conveyed the dynamics of a cosmic 'casino'. It had no way to predict, this far in advance, precisely when or where the decaying orbit of its recently released rolling 'ball' would spiral into and onto the contra-rotating 'wheel' at its centre.

So the Accretor had bravely, but with hope, placed its gambling chips firmly upon the table. It could now only calmly contemplate what it could no longer wait to witness. Its far future bet on the outcome of this half-a-billion year spin of the roulette wheel ...

From its high station at L5, through its shearing delivery of seasonal tilt, the heritage of Hyperion had arrived in orbit around the object born in the violent death throes of Theia. Its *body* had been sacrificed to the greater cause of fostering future Life in this Solar System. But the *name* of Hyperion would, someday, return .. to be celebrated *by* that life as an outer satellite of mighty Saturn.

This strange 'satellite of a satellite' just *might*, one distant day, deliver a single, supposedly 'natural' body, able to tempt future evolved intelligence from its earthly cradle with the promise of accessible polar ice. Until then, it would owe its ultimately doomed existence to the daring of the Accretor.

In *both* semantic senses, it was the moon of the Moon that the Moon-Maker made.

1.9 Seeds of Genesis

Over the billion year course of its cosmic mission, the Accretor had already created the *conditions* for potential life upon a myriad new worlds.

Its own creators had known the basic components of life were abundant across the galaxy. Chemical *elements* created both by fusion *within*, and the ultra-violent death *of* stellar cores had long been strewn far across interstellar space in vast, primordial clouds. Between, upon and inside the dusty grains of which, those elements had been forged into the fundamental chemical *compounds* of Life in the fiery light of nearby stars.

Sooner or later, some of those compounds would seed the surfaces of planetary systems also formed from the debris of long past stellar detonations. Given suitably benign conditions, such pre-biological substances would eventually spark reproductive rhythms able to render their form into future generations of early Life. Upon a rare few of those worlds, the evolutionary enablers of time, stability and biochemical energy would ultimately breach the biological bridge from single-celled bacteria to multi-celled beasts. Even, perhaps, bearing sentient intelligence beyond.

The Accretor's creators had also come to realise their own incredibly good fortune. Their species had barely evolved emergent intelligence, before their bright but fast-burning stellar host had started running dangerously low on fuel for fusion .. and set upon its own, ever more dramatic demise.

Scientific and technological enlightenment had dawned only just in time to enable their survival .. as that star fitfully shed a first shell of matter to briefly dampen down its deepening internal turmoil. A threatened extinction which had spurred their pan-galactic search for new homes.

That early history of their species had, ultimately, driven the Accretor's innate conviction to deliver not only the *conditions for* Life, but also the *seeds of* Life. It was *not* willing to entrust the biological exploitation of its efforts entirely to the long-chained, chance coincidences of mostly carbon-based chemistry. The Accretor, alone, could cast certainty over future fortune upon its cosmic creations. For its final call, upon completing yet another habitable world, would always be to .. "Let there be Life!"

The Accretor knew that it would be long gone and far distant before the new Earth could stand any chance at all of nurturing Life of its own. Tens of millions of years would yet pass before anything like a stable crust could cool above the ocean of openly molten mantle that now covered most of the planet. Even then, the outgassing of a substantial atmosphere would be needed to sustain the surface stability and liquid flow of the water already steaming from its interior, or yet to be delivered by comets.

Life would just have to wait until this awakening world's weather could rain its universal solvent into oceans, seas, lakes and rivers. So, activation of the *two* wondrous devices the Accretor was preparing would take a half-billion year 'rain check'. Which meant it would have to seek somewhere suitably stable and safe to store them in the meantime.

The Accretor needed to find two very special locations, one for each device, with specific and somewhat unusual characteristics. Both would have to remain inherently stable over immense timescales, whilst staying well within 'seeding' distance of the Earth. Furthermore, each would need to offer their sole occupant at least a fighting chance of survival over the ages of interplanetary bombardment yet to come.

Simply placing its precious new protégés upon the surface of the Earth itself was out of the question. Even after its crust had cooled, the endless global stirrings of plate tectonics would leave virtually no place untouched by deep geologic turmoil. Nor would Earth's new Moon offer a safe haven, given the impending descent to destruction of its own satellite.

The devices also had to keep clear of the complex and constantly shifting gravitational gradients permeating the space within the Earth-Moon-moon system. There would be no long term safety in orbit around any body here. But the Accretor had, of course, just 'evicted' two orbital tenants from prime locations which *could* indeed serve its purpose.

So, it would entrust its primary and backup devices to two well separated regions of space, at a safe and stable distance from Earth. It would populate the paired peaks of gravitational potential which had, until recently, harboured the seeds of Earth's *geological* transformation. The twin lairs of Lagrange which, alone, could offer long-term safety to the future bringers of Earth's *biological* transformation.

To its *Seeds of Genesis*.

Easing its two million tonne 'resting' mass outward from its orbit, midway between Venus and Earth, the Accretor rose towards the same, now lonely, Lagrangian lair from which it had gravitationally seduced Theia, just centuries ago.

However, it would not leave its precious cargo precisely *at* L4, but in a long, lazy 'orbit' *around* it. For there was still ample chance of debris aggregation within this region over the coming story of the Solar System.

And these were certainly *not* seeds to appreciate being buried!

As it neared the release point for its first device drop, the Accretor had one final but fundamentally 'life-changing' decision to make. In their survey of the galaxy's myriad lifeforms, its creators had found surprisingly *few* basic biological mechanisms by which evolution could achieve the best balance between two conflicting needs. On the one hand, the *advantages* of evolution could only accumulate across generations via a stable and accurate genetic 'copying' process. On the other, the *progress* of evolution perversely demanded *imperfection* in that very same process, so as to drive exploration of the ever-changing pitfalls and possibilities of Life's paths. The optimum genetic 'error rate' to balance accumulated advantage against agile adaptation was, arguably, the single most critical factor in any evolutionary system's success.

The Accretor would delegate *some* decisions, regarding which genetic bounty would someday seed Earth, to the intelligence and database bound within each of its devices. But it, alone, bore responsibility for the choice of basic biochemistry upon which this planetary system would build over the next several billion years. A decision dependant upon both the nature of its star .. and where its circum-*galactic* orbital path would likely take it.

Each orbit of the Sun and its planets *around the centre of the galaxy* would take well in excess of two hundred million years. During which time, the Sun, along with most stars, would both drift into and out of the galaxy's denser spiral arms and oscillate above and below the plane of its disc. Either of which would modulate Earth's exposure to a major driver of genetic variation over evolutionary time. The mighty 'cosmic' rays!

These immensely energetic particles could be cast clear across the cosmos by the cataclysmic collision of collapsed stellar cores or the merging of massive black holes. Accelerated virtually to light speed, many would traverse *intergalactic* space in what, *to them*, would seem mere milliseconds of 'dilated' time. Sometimes to then dump their colossal kinetic energy into crashing cascades of secondary particles down from the upper atmospheres of any planets in their path. Even, if rarely, to find *themselves* ripping through the genetic code of some unlucky lifeform.

Only the supreme predictive power of the Accretor itself could hope to gauge the exposure *to*, or protection *from* such particles that the Sun's future galactic path would offer over gigayears to come. That level would define which fundamental biochemistry best balanced biological stability against sensitivity to damage in the face of future cosmic ray barrages. Allowing Earth to remain within the *genetic* 'Goldilocks' zone that would, with luck, drive its budding Life to evolutionary success.

So, firmly focussed upon the Sun, the Accretor once again reset and re-ran its two trillion body, ten billion year simulation .. *of the entire galaxy!*

By this time it really *should* have known better, but the Accretor never ceased to be surprised by its own predictions of the future galactic paths of the stars it had visited .. even when they had been born in the same region of space. The Sun had been just the latest stellar stopover on its little local tour of a huge, collapsing cloud of interstellar gas and dust .. from which several other solar siblings would yet burst into life. Its next stellar target, born less than a hundred light-years away, harboured high hopes of hosting life on what would become its *three* habitable planets. *Upon which the Accretor had chosen to confer a truly spectacular orbital configuration.*

It was possible that the galactic orbit of its siblings would match the Sun's into the far future. There were, indeed, many sizeable clusters of stars that felt gravitationally bound to keep each other company on their travels. Further afield, a huge 'halo' of immense 'globular clusters' orbited often well away from the galactic plane .. some binding upwards of a million stars into a sparkling, spherical spectacle just a few light-years across.

But most simulations for its *previous* star, still only fifty light-years away, had predicted a dramatically divergent path over the course of its life. That star's galactic journey would expose its two newly habitable planets to considerably greater cosmic ray flux than that being forecast for the Sun. Which had led to a far more robust choice of its basic biology than would soon be selected for the seeding of Earth.

Billions of years hence, one of the greatest triumphs of future human science would be its unravelling of the organic strands which wove the sterile stuff of chemistry into the fertile fabric of Life. As that knowledge grew broader and deeper, it would even explore some of the same biochemical alternatives now being carefully considered, but all firmly dismissed by the Accretor .. as it pondered that fateful decision.

Under different predicted conditions, some of those options .. notably the so-called Xeno-Nucleic Acids (XNAs) .. might even have looked a little more attractive to the Accretor. Candidates such as Anhydrohexitol Nucleic Acid (HNA) and Threose Nucleic Acid (TNA) would be found to possess at least *some* of the qualities which could confer stable but steady long-term evolution upon earthly Life. But it would be upon *two* other, related, nucleic acids that the Accretor would place the burden of bearing this planet's biological evolution forward into the future.

Of those, the more primitive, single-stranded *Ribonucleic Acid* (RNA) would be cast to play a range of vital roles in the dramatic propagation of that life. Roles directed largely at the behest of its double-helical, gene-coding counterpart .. *Deoxyribonucleic Acid*, or DNA.

Its decision made, the Accretor could supply its first seed with the ultra-stable, crystalline forms of the basic elements of Life. Ingredients from which this device would, one distant day, 'print' self-sustaining samples of the complex biochemical compounds needed to launch evolution .. along with fully formed examples of the primitive Archaea that would come to characterise the most ancient of earthly biota. All of which could be cast onto any of many low-energy orbits destined to reach their, by that day hopefully hospitable home-world within just a few months.

Even then, the future success of this multi-million year mission could not be left to the whims of fortune. There was still a small chance that some wandering fragment of this system's formation could yet destroy a single device. So, soon after releasing the first of Earth's *two* Seeds of Genesis into a gentle orbit around L4, the Accretor set forth upon one final lap of the Sun. Once more 'going with the flow', the long way round .. to L5.

This second seed would be configured, primarily, as a backup to its sibling at L4. It would, though, also be provisioned with a biological 'plan B', as even the Accretor's simulations could not eliminate the possibility of a far future encounter between the Sun and an errant star that could cast this stellar system onto an entirely new and unpredicted path .. for which some other genetic mechanism might then become optimal. A call to which the 'B' seed would respond, with a long series of sample organisms chosen from its comprehensively pan-galactic, genetic treasure chest.

The release of that second seed left the Accretor fully confident that it had created yet another world which might, ultimately, conceive beings able to ponder their own origin. Such had been the task assigned to it, so long ago, by its own, ever more distant creators .. *towards whom it turned to transmit another in a long line of once-in-a-million year messages.*

The Accretor knew full well that, by the time their rapidly receding receivers registered its red-shifted report, the potential for Life on this world would already have been thoroughly tried and tested. There was now little more it could do for this planetary system. It was already planning its path to the next star to have flared into fusion from this same, immense molecular cloud. But it would not leave before making a first-and-last farewell visit to the worlds it had so fundamentally reformed.

Eager to perform a sign-off inspection of its mega-year handiwork, the Accretor slid its two megatonne mass into a once-around open orbit, high above the night side of an Earth still bathed in the red-tinted glow of its full Moon's sunlit face. There to savour the sheer sensational beauty of the cosmic scene created at its own command.

For all the ever-darkening majesty of the deepening crust coating both bodies, it was from their ever-shifting streams of *light* that the Accretor always drew the greatest satisfaction on these occasions. The glow of their radiant heat would subside over millennia to come, but any future Life on Earth would behold *two* stable sources of illumination. The directly life-fuelling fusion fire of its Sun, and the cool, cyclically reflected serenity of its Moon. The greater light to rule the day, the lesser light to rule the night.

Swinging slowly towards the sunward side of its orbit, the Accretor was already stirring space-curving forces deep within its form. It would soon again glean gravitons from the higher dimensions into which its existence was so enigmatically embedded. But it would not risk any direct exposure of Earth's delicately entwined twin satellites to such immense gravitational grasp. So, only as it crossed the Sun-Earth line opposite to *and hidden from* the Moon, did the Accretor's perturbation pulse rip an almighty rupture through the fabric of *interstellar* spacetime. As, for just a few fleeting moments, the first and final ethereal shadow of the Moon-Maker itself moved upon the face of the Earth.

Settled safely into orbit around their Lagrangian lairs, the twin Guardians of Genesis had set upon what would become a many-million year test of patience .. biding their time until they could, some distant day, cast upon the Earth the fruit whose seed *is* in itself. By the grace of the Accretor, those fragile seeds would fall upon a planet newly awash with the aqueous solvent of Life, rained from an atmosphere firmly grasped by gravity and protected from solar excess by an ever-strengthening magnetosphere.

They would be spawning life that could evolve to the steady tick of seasons stabilised by the calming gravitational call of its sizeable Moon. One which *might* even, some fateful day, entice intelligence out to its polar crater rims with the offer of icy sustenance and the energy of eternal light.

The Accretor had achieved everything asked of it by its own creators, in preparing this world for any foreseeable challenges, far into its future. Yet its predictive powers were ultimately limited. For *no* cosmic crystal-gazer could pre-conceive the darkly dire and calamitous challenges, *from beyond this galaxy*, that would curse *all* of its creations, four billion years hence.

So, suddenly *falling* at four hundred Earth 'g' towards its next stellar birth, the Accretor cast one last look back upon its latest worldly works. Ascending into its self-excavated spacetime crevasse, rising above the northern plane of the young Sun's planets, it beheld the long-laboured layout of its culminated plan .. spread out, in eternal glory, below.

And the Accretor saw every thing that it had made, and, behold, *it was very good.*

What Next? ...

You've finally made it, hopefully in one mental piece, through these first forty pages of Earth-and-Moon-making mayhem. That's more than the proto-Earth itself managed .. so, well done!

You are now psychologically prepared to press ahead with pursuing the first novel in the HALIEN pentalogy through into (relatively) recent times.

However, should you choose to go forward, no respite will be offered in growing the grand-galactic vista of the "HALIEN Aeon" adventure.

So, a brief synopsis of this ten *billion* year sci-fi epic's opening story is presented on the next page ...

This first novel joins those later in the HALIEN series, in seeking to stretch our perception of sometimes speculative but hopefully plausible scientific and technological principles. The aim is to inspire your imagination into casting supposedly established historic, mythological and theological 'facts' in an entirely new, but still 'logical' light.

And, who knows? .. maybe your *own* ability to assimilate the concepts concealed within its pages may help to mark Mankind's mental readiness for emergence into the greater galactic family of *Hadronic Life Entities* ...

Visit the "HALIEN Aeon" website, at ..

<http://www.halien.com/aeon>

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Synopsis

“**HALIEN Aeon**” launches at the Solar System’s birth, with the ongoing quest of the “**Accretor**” to create a myriad habitable planets across this galaxy. From its “**Moon-Maker**” mission emerges an axially-calming companion for the once-solitary world someday to be hailed .. as “**Earth**”.

Four billion years on, thirteen deathly **Dark Waves** of *pan-galactic* mass-extinction are inflicted by a **Black Beast** beyond the galactic bounds. The fight for *Life and revenge* rallies at the end of Earth’s last (ever) Ice Age .. as two mighty **Cosmic Cubes** arrive to set Mankind up for assisted self-protection from imminent demise in the *fourteenth* existential apocalypse.

While the **Venus Cube** commences the preparation of its planetary host to wreak revenge upon the galactic scourge, the **Earth Cube** sets to soothing the magnetospheric instability potentially threatening life on *this* planet. Its eight ‘seed’ cube progeny then coax the first steps of Humanity towards ultimate emergence into the pan-galactic family of *Hadronic Life Entities*.

The **Nile Seed Cube** creates a cadre of humans *transfigured* into **Aeons**, while enthusing and enabling the minds of Mankind to embark upon a first, foundational frenzy of megalithic monument-making. Projected from the **Giza Plateau**, above the subterranean **Temple of Thoth**, an awesome tour of worldly wonders in the Solar System sparks our innate curiosity for scientific truth. The event builds to an *interstellar* voyage out to a bizarre but breathtakingly beautiful, *tri-planetary* spectacle, born of the Accretor’s cosmic creativity. Three worlds that orbit both their star .. *and each other!*

Upon the vernal fields of **Elysium Six “Green”**, steeped in stellar eclipse, humans first step forward to face, in fear, hauntingly pallid yet profoundly black-eyed “**Kas**”. These immortal entities convey the quantum-entangled consciousness, accrued **Karma** and a**Kashic** records of all in**Karnate** souls, as they cruise the cosmos in cubically coalesced **Unified Fractal Octets**, from the vast **Ka** city hushedly hailed .. as “**She Who Shelters the Dead**”.

Their minds now attuned to astronomical cycles, humans are next readied for a profound life-style shift .. from hunter-gatherers to harvest-gatherers, as they meet for another mind-stretching session in the **Temple of “T”**, at the sacred site someday to be dubbed “**Göbekli Tepe**”. From where, centuries later, the mouth-less ‘**Mentor**’ **Kas** set Mankind a constructive challenge it *must not* fail. Even as they declare the Temple of “T” .. *taboo!*

Interred deep underground by seismic shock, the Nile Cube plans the rise of Mankind to its do-or-die challenge. A quest long to be led by the **Aeon Life Transition Agency (ALTA)**, as **Aeon Thoth** and **Archaeon Metatron** finally join forces during the high-heavenly spectacle .. of “**Auroraeon**”.