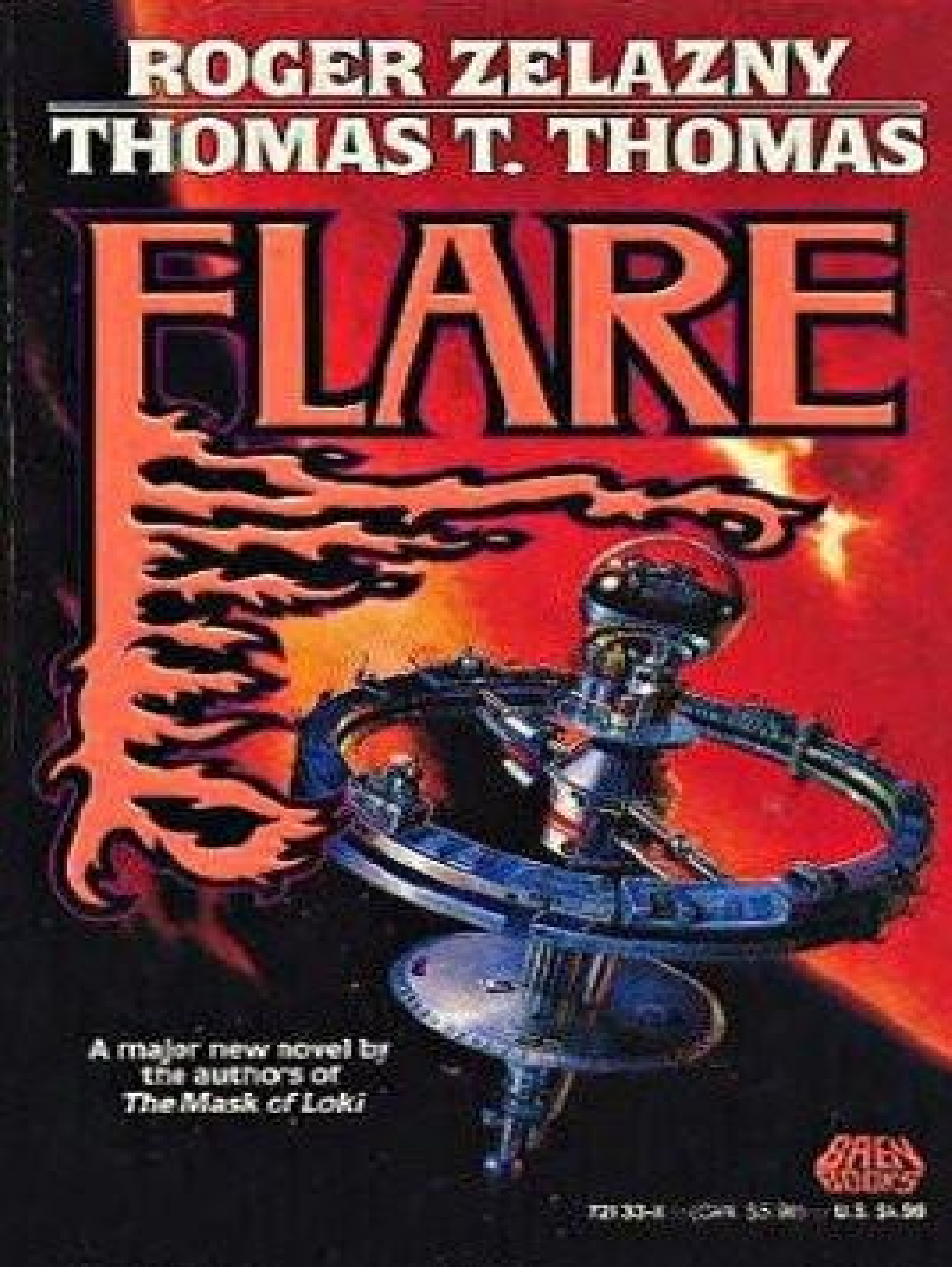
ROGER ZELAZNY
THOMAS T. THOMAS
FLARE
A major new novel by
the authors of
The Mask of Loki

Roger Zelazny and Tomas T. Thomas

This book is dedicated with respect and admiration
to the memory of GEORGE R. STEWART...
His work abides.

Part 1

Minus Ten Million Years… and Counting

The day comes lovely to the sky's edge,
living Aton, opener of life's gate.
Rising at the eastern rim of the world,
you fill the lands with your glory....

Great, glowing, high above the Earth,
you send rays to brighten the land,
filling with light all that you have made.
You are Re, making all things captive,
binding them with your love.
Distant, you shed your light upon us.
Striding on high, your footprints are the day.

—From "Hymn to the Sun" by Pharaoh Amenhotep IV (later Ikhnato

Chapter 1

Concatenating Bangs

Ping!

Ping!

Ping!

Ping!

Or whatever the sound might be when two hydrogen nuclei—in effect, a pair of stripped protons-collide repeatedly at pressures of two hundred billion atmospheres and temperatures of fifteen millio degrees Kelvin.

Conditions of such pressure and temperature exist within the cores of G-type yellow star However, the scales for measuring them, expressed in "atmospheres" and "degrees," only hav relevance to the temporary environmental stability of a small green planet which orbits at one hundre and fifty million kilometers from the surface of such a star.

Ping!

Ping!

Ping!

Ping!

Protons are tough little nuts, even under such extremes of temperature and pressure. Each one welded together as a simple combination of quarks, which are various and not simple at all. Quark are, depending on your point of view, either the building blocks of matter, or the slippery interfac between matter and energy. Take your pick.

Because protons have a positive charge—a descriptive quality of matter that, again, only h relevance in an Earthside laboratory or an electronic circuit—and because particles having simil charges repel each other with a ferocity beyond all human understanding, the colliding proton immediately spring apart, unscathed.

In fact, any single proton must collide, on average, forty trillion *trillion* times with one of i associates before anything will happen. At the rate of one hundred million collisions per second, und the jostlings of extreme pressure and with the agitations of extreme temperature, one proton in th star's core will suffer a physical change once in fourteen billion years. On average. And fourtee billion years is three times longer than the star itself is likely to remain active. So the average proto loose in a star's core, can expect to lead a hectic but otherwise uneventful life. Such as it is.

Ping!

Ping!

Ping!

Pong!

But once in forty trillion trillion times, a collision will fuse the two protons together. One of the sheds its charge with the release of a positron (or positively charged electron) and a neutrino (which like a little fragment of subatomic glue), becoming a bare neutron. Because positively and neutral charged particles *can* stick together, they do, forming a nucleus of deuterium. This is called "heavy hydrogen because the nucleus is freighted with an unaccustomed neutron.

Anyone might suppose that, because the instance of fusion is so rare among protons, the next ste might be dissolution. With the next jostling *ping*!, in the next hundred-millionth of a second, th deuterium nucleus will fall apart. Then, from the dense crowd of particles surrounding it, the neutro will collect its positron and neutrino, which cannot have gone far in such a short time; it will patc itself together and resume its life as a proton.

But that is not what happens. The proton-neutron marriage endures for an average of six second or only six hundred million more collisions, before another proton joins up.

BANG!

This collision leaves each of the partners individually unchanged, but releases a unit of energy- the chargeless, massless photon, vibrating at the extreme frequencies of gamma radiation. This phot goes on its way, leaving a ménage à trois, the helium nucleus. This is called "light" helium because it missing a second neutron to complete its normal structure.

After another million years or so of further bumping on the crowded proton dancefloor, two o these light helium nuclei will themselves chance to collide. Their collective four protons and tw neutrons will swing around each other, *dos-si-dos*, and form a new configuration. This will be a stab nucleus of regular helium—with two protons, two neutrons—and a pair of free protons, which go bac into the dance and begin looking for other partners.

Meanwhile, the photon that had emerged from the second fusion collision radiating like a gamm ray will take part in no more combinations. The positron that was ejected from the first collision wi soon meet a free electron, its antiparticle, in the plasma soup and annihilate it. The product of th mutual destruction is a pair of energetic photons, which are also radiating up in the gamma region the electromagnetic spectrum.

So, in all, while six protons slowly turn themselves into a helium nucleus and a pair of straggle down in the core of an average yellow star, three high-energy photons are created and released.

Three tiny sparks of light are produced in three separate collisions that are relatively widely space over time and distance, among trillions of other collisions that produce not so much visible energy our archetypal *ping*! These tiny sparks spring forth into a crush of matter so dense and opaque th atoms themselves must shed their electron clouds and flow as a kinetic plasma. Is it any wonder th the core of a G-type yellow is blacker than the darkest edge of space?

Blacker, but not colder. These three energetic protons will contribute their energy to the heat of th star's core as they pass, bouncing off protons and light helium nuclei alike, on their way through th shuffling crowd.

In this pitch and toss of photons moving back and forth across the core, none has a preference f direction. Each photon strikes a larger particle and rebounds—or, in technical terms, is absorbed an immediately reradiated—like wild dancers slamming their way across the floor. Their direction random. That is, none can *choose* to move toward the sidelines and spin away from the dance. An anyway, each photon will move only a fraction of a centimeter—one more measure valid only Earthly terms—before striking another particle and reradiating in another direction.

While none of these photons has the thought of escaping the core and moving out into the star higher layers, still some—a small fraction—happen to do just that. These represent the "exces energy in the core; that is, the amount of heat greater than is needed to keep up the pressure and ho the core from collapsing under the inward push of gravity from the overlying material. These fe excess photons do reach the dancefloor's sidelines and are shed upward, toward the star's surface.

In the dense, opaque layers above the core, each photon continues the game of absorption an reradiation, bouncing one step forward and two steps back. And as the photon encounters the cool layers above, it may also lose some of its energy; the frequency of its vibration becomes slower, i wavelength longer. On average. A few photons may maintain their potency over the long haul, but no all of them, certainly. In general, gamma rays at the core become x-rays in the intervening layers, the ~~ultraviolet rays just below the surface, and then mostly visible light—again an Earthly, human term~~— at the surface.

In the outer region, about two-thirds of the way to the surface, the stellar gases cool from fifte million degrees to about two million. These cool gases become nearly opaque, so the distance that an photon can travel by bouncing around becomes insignificant. At the same time, however, in th region the temperature difference between the bottom, innermost layers and the top, outermost laye becomes much greater. Also, the cooler gases throughout this region are less dense, and so less stabl Thus, hotter material from the star's innermost depths flies upward like steam bubbles in a saucepa in a process called "convection." This action then drives the cooler, relatively denser material near th star's surface downward in an endless, rolling boil.

So, in the opaque region of the star's interior, the photons stop traveling by their bounces ov centimeters and fractions; instead they ride with the roiling atoms of the convection layer. It is as they were taking express elevators up to the surface regions of the sun.

Any single photon—or, to be precise, the track of multiply absorbed and reradiated photons- spends about ten million years in passing from an initial fusion collision in the core to its visible-lig escape at the surface. For most of this immense time, the photon is bouncing forward and back in th packed interior, and for a shorter time the photon rises effortlessly in dark columns of boiling gas.

At the surface these columns—like thunderhead cells along a stormfront, or bubbles rising in a p of porridge—shape the outward face of the sun. These upwelling fountains of gas form flattene mushroom caps that are the size of the Earthly state of Texas. Existing in constant motion, thes columns thrust up the spicules of hot gas which feed the chromosphere; they also push around th magnetically active regions which control the shape of the superheated solar corona.

In short, these granulated columns of rising gas direct the divergent flow of electromagnet energies that most affects the lives of humans on that little green world. If not for the movement these convection cells beneath the surface, the star would shed its energy in a single, impartia uniform glow.

In fact, that was how, for thousands of years, the humans of that green world thought about the "daystar," their sun, their god Aton: as a single, unchanging beacon, uniform in its benevolenc unswerving in its outpourings, impartial in its gift of energy, consistent in its love.

Of course, they were wrong.

Ping!

Pang!

Pong!

Pong!

The initiatory collision of one proton with another—that once-in-a-forty-trillion-trillion eve which sheds a positronic charge and ultimately gives birth to a triplet of wandering photons—is on the usual sequence in the sun's core. It represents, over time, only the average of all possib interactions.

This dance of separate particles and photons is controlled by the workings of probability, a scien which will be much studied on the small green planet. Probability and the laws of chance say tha over all time, in the universe taken as a whole, the high points and the low match up and cancel eac other out. They level all possible experiences to a nice, stable median point in a smooth curve.

But this is only one picture of reality. It's a working conceptual definition—not reality itself.

Now and then, here and there, the framework of probability breaks down. Sometimes the real wor swings wide and deep in establishing that balanced median. And so, in that particular time and plac the long run and the universe as a whole are temporarily forgotten.

More and more of those initial ping-collisions may happen to produce many more nuclei deuterium and loose photons than the forty-trillion-trillionth of a chance would indicate. At that poin the consequences can be immediate and astounding.

BANG!

BANG!

BANG!

BANG!

Then highly unusual things can start happening.

Chapter 2

The Dolphin League

Have news!

Good fortune!

Glad tidings!

Good news!

Among the convection cells in the upper layers of the solar atmosphere, the creature slide buoyant as a soap bubble. He passes the rising columns of superheated gases and the falling sheets freshly cooled gases, all the while maintaining his equilibrium.

Of course, the atmosphere is not really a gas made up of free-roaming atoms and molecules. At i ambient temperature of about 5,800 degrees, the sun's photosphere is far too hot for that. The he strips the simple molecules of their atomic structure, reducing them to a plasma, a bath of charge particles: ions, positively charged protons and hydrogen nuclei, negatively charged electrons. All them shudder and dance under the bombardment of high-energy photons. The photosphere is a fluxin soup of activity and potential.

Warmth!

Flow!

Energy!

Lift!

Against the blast-furnace, jet-engine, fire-bell scream of hot plasma rising from the convecti zone, the creature's voice booms out in organized subsonics. The mechanism for these pulsing cries a simple bladder, twanged rhythmically against the relatively lighter mass of the surrounding plasma

The wonder is that any structure can exist in that high-energy hell. But between the dense, ho ~~gamma-ray core and the thin, still hotter, visible-light corona lies this region of comparative stabilit~~ Here the attraction between positive ion and negative ion can occasionally override the disruptions pressure and heat.

Electrons and protons align themselves, negative to positive, under a static charge—not quite a atomic bonding but not a fluid plasma, either. Call it a confederation of potentials and influences. An call the creature a "plasmote." The seed of his structure is a magnetic field, of which many and vari configurations race and swirl through the solar atmosphere.

Once joined, these ion webs build to form membranes and envelopes, pockets of quiet against th storms of gamma energy, magnetic flux, and convective flow. So the plasmotes harbor regions o greater and lesser density, achieving sustainable dimensions in the writhing soup. They accomplis their motility with the pump and thrust of bellows or the thrash of a loose and raveling ion whi depending on their individual natures.

And deeper within the relative quiet of the plasmotes' envelopes, more subtle structures a allowed to form and grow. The deep silence of these pockets enables coded sequences, yes-and-no, or and-off, which carry and maintain a complex matrix of information. Scores of captured neutron interrupt and punctuate these numerical values and strings, giving them phrasing and meaning. Th free energy flux of gamma radiation, rising from below, excites these coded sequences, passin electron pointers through them and directly driving the processes of consciousness.

The plasmote is a creature of pure, scintillating awareness, with his only available expression voice and movement. His only activity is to propel himself ahead of his world's delights and danger crying news of them, so that others of his kind may hear and respond.

Cold!

Flow!

Plunge!

Danger!

If the plasmote finds delight in the upwelling lamination of warm, energy-laden juices surroundin a rising column of gas, then his greatest danger is found in the narrower regions on either side.

To venture too far within the column, seeking out its radiant core, is to risk disruption of th plasmote's delicate membranes and sacs. There the turbulent fountain of unequal pressures yiel rending velocities and certain death.

But to venture too far outside the column is to risk capture by the downdraft of cooled material th moves within the interstices between the rising, granular cells. These convection drafts can carry th plasmote down toward the core, where rising temperature and pressure will as surely interrupt h tender, magnetically oriented structure.

So, like booming dolphins of the temperate zone, the plasmotes navigate the hexagonal borders the convection fountains. There they pass, exulting in stability and warning each other of the perils hand on either side.

Come!

Feel!

Expand!

Rejoice!

Like dolphins and whales, the plasmotes gambol in the photosphere and know no equal themselves. They exist in many forms: as pulsing sacks, writhing whips, or funneling jets, contemplative, near-stationary billows full of densely matching logics, or as hyperactive kites wi almost no logic at all. But all plasmotes are concurrent. All are viable. And all are mutually exclusiv mutually supportive.

The plasmotes form no families or tribes, no states or principalities. They share no secrets, crea no religions, forge no bonds, work no magic. They build no lasting relationships among themselv other than a joyous passing acquaintance.

No plasmote has ever been seen to be born of another, either by partition or conjunction. None, fact, has ever been created anew. Neither has one ever died of old age, or disease, or the stresses movement and life. None has died at all—except by a carelessness that leads to sudden rupture on o side or to the long plunge into pressure and heat and darkness on the other.

The sun boasts no lesser forms from which these beings might have evolved. No *plasmites*, as were. So there exist no backwater swamps of obsolete, failed plasmotes. And they can find no fres spawning ground for hopeful, future plasmotes. These simple beings have only the rupture and t plunge, and the safe path they dance between those alternatives.

The plasmotes can trace no evolution in themselves, nor have any idea of how or where they com from. Like dolphins and whales, they are simply unique in their environment. A thoughtful observ then might wonder if their antecedents were introduced from another place, another time. But if this so, the plasmotes do not remember or record it. They only swim forward, singing.

Chapter 3

On the Green World

Ramapithecus

Australopithecus

Pithecanthropus erectus

Homo neanderthalensis

East Africa, circa One Million B.C.

Ga-ah chased the little lizard on the ground, because that was where it went. She knew she cou move faster up in the trees, where she could use both her gripping fingers and her curling toes for a in the scramble, where she could literally fly from limb to vine to limb. But the lizard was on t ground, down among the leaf clutter, and she did not want it to escape. Lizards were good to eat. B lizards could also burrow down in the leaves and disappear, so Ga-ah had to chase it where it went, keep it from getting away.

Dart left, dart right, the lizard was quick. It knew Ga-ah was after it, and so it ran fast. So Ga-a had to run fast. The lizard darted under a wall of bushes, and Ga-ah used her strong hands to bend bac their branches, clearing space for her legs and hips.

Her large, wide-set eyes, adapted to the shading of the high forest layers, could pick out subt flashes of color. Lizard gray-and-green against the broader pattern of leaf gray-and-green. Ga-ah deeply cupped ears, which stood away from her head, adapted to the conflicting breezes of the fore canopy, could detect the scuffling of lizard claws from the plainer rattle of leaves on the wind. But h snub nose, which was not adapted for anything special, could tell her little about the lizard's line flight. Lizards did not have much smell, anyway, or they did not smell much different from the lea molds of the forest floor. So Ga-ah looked and listened, ignored her nose, and followed.

Through the lowlying brush she went, her arms batting away the clutches of leaves, her fe stomping the hard soil. Was she following the lizard? Or was she driving it forward? Ga-ah could onl tell that it was moving deeper into the bushes and moving more slowly, more warily now.

The air around her became brighter, hotter… whiter. Sweat trickled down her face and stung h lips, tasting like blood but slightly sour. Tasting like fresh lizard. Ga-ah eagerly shoved anoth branch aside and pushed herself forward.

Then she stopped.

The world was still green, but it was a burning, whitely glaring green. The bushes faded out into t spiky stalks that Ga-ah sometimes found beside the forest streams. But these stalks, bending to a wi which did not flutter but blew straight, went on forever, as far as the eye could see, then even farther.

Ga-ah covered her face with long, curling fingers. Too bright. This was like climbing to the ve top of the forest, where the tree limbs became loose and springy and would not hold her weigh Where the great white showered down on the cool green, offending her eyes. Where the wind sang loud, steady, thrashing song, offending her ears.

She widened the space between one finger and another, peeking out through the thin shade. Still t bright, but at least Ga-ah could see for a little ways. She could see the lizard, a dark gray blot again the bright green of the bending stalks. It was running over their suppleness without any sound s could hear above the deep sighs of the dry wind.

As if knowing it had won, the lizard stopped. Supporting its body upright on back legs and tail fo moment, it turned one eye over a sloping shoulder and flicked its tongue at her. Then the lizard rac on, incredibly staying on its rear legs, as if it drew energy and courage from the white-gold lig falling all around it.

Ga-ah looked up, past the lizard, to the half-dome of sky above. So big here. So hard and blue. O side was bounded by the trees at her back, the other side by nothing. This was a great piece of s here. In the forest, she could only see little bits of this sky, revealed only when the wind tossed asi the branches, way high in the treetops.

Something else was in that sky, too. Up higher, where she could not look. It was too bright for G ah's wide-set, delicate eyes. Too bright. Pure white. Hurtful. It was something the lizard did not fe but she did.

Ga-ah put her hand back over her eyes, turned around, and pushed her way back through the scre of bushes. She disappeared into the more friendly forest gloom that was her heritage.

But not her future.

Bringing dogs and goats inside the fence

Planting wheat and barley in the fields

Harnessing horses and oxen to the plow

Pulling cotton fibers and weaving fabrics

Parsumash, circa 6500 B.C.

Haddad watched his apprentices pound the green rocks to powder. Under his breath, he counted th ritual strokes of their pestles against the stone basin. He studied the flexing and tightening of th smooth, brown skin over their arms, the whip-snapping of tendons, the writhing of veins as those arn chopped at the fragments of malachite. Only when the green powder was as fine as the river silt cou the next stage of the process begin.

Then slaves brought out jars of charcoal—wood burned under a blanket of soil, so that it turned hard, black nuggets instead of fragile, white ashes. These nuggets, too, had been ground to a fi powder. The slaves added handfuls of the charcoal to the malachite, still in its basin, and th apprentices mixed it evenly with their pestles. When the joining was done to his satisfaction, Hadda directed them to take up their reed pipes while theslaves ran to get torches of pitch pine.

Breathe in through gapped mouths, blow out through hollow reeds. The apprentices exhaled the life-force gently, steadily into the pipes, whose ends were buried under the green-black mixture at th sides of the bowl. Meanwhile the torchbearers passed their burning wands over the powder's surfac Tiny sparks of charcoal flew up and ignited. The bearers dipped their flame lower, and the embedde grains began to glow.

Soon the blowers were puffing out their cheeks, and their brows were furrowing, glinting swe with their exertions. One of them weakened. Haddad looked up sharply, saw the man's eyes cross his face, his mouth slacken, his hands flutter on the reed tube.

Haddad gestured impatiently to one who stood in reserve. That one pulled the sagging man out line, caught up the pipe, and resumed the steady blowing.

In a few moments, the mixture in the basin caught fire.

It always went like this. But only Haddad understood and directed the sequence, because he alor knew the numbers of handfuls of malachite and charcoal to mix, of strokes to make, of breaths to tak of torches to light. That knowledge was his contribution to the magic.

The river watered the land's grasses, making them green, one of the colors of life. From the sky th sun's red fire—another life color—slew those grasses in the field, making them pale and brown, one the colors of death.

Sparks struck from the river rocks ignited those dried grasses, making them burn yellow-hot- more life color—like the sun. The rains watered the forest's trees, making them green, while th yellow-hot fire under the earth blackened their flesh, turning it the color of corruption.

The malachite stone under the earth was green, color of life. When malachite mixed with the de trees, in the presence of the body's breath and the yellow fire, then a new thing would be born. Ar behold, it would have the red color of life and of the sun.

That was the principle: life and death, body and breath, in constant revolution, driven by the sur everlasting power.

Haddad concentrated hard on this burning mixture, furrowing his own brows. By expecting, hopin and waiting, he tried to make the change come. And he was always vastly thrilled when it did.

There!

Death and corruption burned away in a thick smoke. It left, scattered across the bottom of th basin, a cluster of shimmering beads. These beads glowed first yellow like the newborn sun morning, then red like the tired sun of evening. As the apprentices continued to blow and the last o the corrupt powders burned away, the beads scurried around on the smooth stone like live thing When one met another, they joined, forming a larger bead, red and yellow.

Breathe in, breathe out, the apprentices continued to feed a fire that was no more. In its wake, th sunlike beads flowed together into a single, reddening lump. As their breath failed and the pipe sagged out of their mouths one and all, the lump flattened and grew darker yet.

But that darkness was illusory, as Haddad knew. In a few more moments, when it was cool, h could take up the lump and pound it against the face of the stone. And then, unlike any other substanc of Haddad's experience, this "firerock" could be worked into smooth shapes. It would take thes shapes more readily than a chip of flint or piece of river stone; it would hold them more certainly tha a sliver of bone or cattle horn.

Haddad could draw it into fine threads that were just as smooth but stronger than yarns of sheep hair. He could make the metal into funny faces, or bowls, or bits of ornament. And, also unlike an other substance, the more he worked it, the brighter and redder and more like the evening sun became. It would glitter and shine like nothing else, except perhaps the setting sun on the face of th river.

That was the magic, and Haddad was extraordinarily proud of it.

It would be another thousand years before Haddad's distant descendants would beg experimenting with the magic that he passed down to them. They would mix various sands and rock with the base green malachite, altering the cycle of life and death. In the course of these additions, on artisan would sprinkle in a measure of tin—a soft, white metal with even less practical use than th copper that Haddad's magic created. Added in the right proportion, however—anywhere from five t twenty percent of the mix—the white metal would stiffen and strengthen the red copper, making tough, durable slab that Haddad's descendants would call "bronze."

This new metal was harder to work than the other, and it did not turn the same satisfying, sunlik red in return for their effort. But in just a few years more, another of Haddad's descendants wou discover how easily this bronze took and held a cutting edge.

Then the fun would begin.

Invasion of Egypt by Hyksos horsemen

Invasion of India by Aryan nomads

Invasion of Britain by Celtic tribesmen

Invasion of Greece by Achaean noblemen

Thebes, 1374 B.C.

If he was wrong about this, the Lord Osiris would surely eat him. Or feed him alive to jacka headed Anubis.

Amenhotep stared moodily outward from his seat in the shade, his eyes sweeping across th palace's inner courtyard.

There, in the sun, upon the surface of packed sand, his women were playing. Each woman had thre balls of leather stuffed with bran and tied up with string, all about as wide as Amenhotep's fist. Th women threw them in the air in intricate patterns, sometimes crossing their arms between one thro and the next, sometimes jumping and kicking out with their legs before a throw. The object of th game, as Amenhotep understood it, was to catch the balls in succession. Anyone who failed at th then had to bend down and let another ride on her back as on an ass. The more skillful rode and thre their balls, until one of them also failed in the catching. Then she, too, bent and was ridden humiliation.

Women's games, played in idleness.

Under the stern, ever-watchful eye of the sun.

Amenhotep had been taught that the gods of his land were many and divided, like those flying sk balls. Their affairs were many and complex, like the game of tossing and catching, with arms crosse or legs kicking. And the forfeits in those affairs were complicated, like being ridden as an ass. All o this was because Khem, the land divided by the river and the flood, was a complex place and neede subtle and complicated guardians.

Like Osiris, ruler of the underworld. Whose brother Set had killed him and scattered the pieces his body into fourteen sacred places across the land. Whose sister-wife Isis gathered up the pieces an made him whole again. Whose son Horus in turn killed Set and became ruler of the divided lan becoming father-many-times to Amenhotep himself.

But if the godhead were truly divided—like Osiris' body, like the community of Isis and Horu Anubis and Maat, Nut and Set—then the land would also be divided. As the desert is separate from th fields of grain. As one bank of the river is separate from another. As the water is separate from th land. Yet Amenhotep knew this was not so.

Could a man not walk from the wet fields into the dry desert and his feet never leave the lan itself? Did the river not rise each year, in the great flood, covering the land with its body? Could man not walk down the bank of the river into water rising above his knees, above his waist, and sti his feet be upon the solid land? Was not the distant sea still more water that covered the land of th sea bottom, and did not the sailors feel the anchor stones *thunk* against it when they tethered the ships for the night?

The land was all one thing, in flood or in drought.

The cup of the land and its river of water was for the people, whether they were at work or at pla or at rest.

The dome of the sky with its river of stars was for the sun, whether he rose and lighted the land, slept and iarkened the day.

The land and its people were mortal and divided.

The sky and its sun were immortal and singular.

And, as the land went on under the river and beneath the sea, so the sky went under the land. Th sun followed it down below when he disappeared for the night. Thus night and day were all one thin they might appear to be divided only because the sun was in hiding for part of the time.

Only the sun went on forever, unchanging.

Only the sun was supremely powerful.

Shining as Aton, he was merciful in his fruitfulness, drawing the green shoots from the mud. H was terrible in his heat, drawing the blowflies out of an improperly tended corpse. He was the rising the river and the baking of the land. And, when he hid beneath the world, then men slept and for a tim joined the dead in their blind confusions.

Amenhotep had long understood this in his belly. Yet now the knowledge was also clear in hi head, for he had worked it out by himself. The new idea stood in opposition to everything his fath and his priests had told him about the gods. But still, he could see it so clearly.

Only, if Amenhotep were wrong about it, Osiris would eat him with a great and toothful smile. An perhaps Osiris would not even wait for him to die and surrender himself for, judgment. So a prude man, however much he believed in his newfound wisdom, would do well to take steps that wou guard himself against calamity.

Any peasant of the fields might smear mud on his doorpost, untell his name in the rolls of th priests, travel to another town, and be done with it. With another name, that man would then escap the wrath of the gods, unmade as they were.

But Pharaoh's name was everywhere. The cartouche of Amenhotep-his-father, and no Amenhotep-the-son, was carved into every wall of the temples and cut on the steles at eve crossroads and in every marketplace.

What was Pharaoh to do?

Change the name. For good luck and succor, he would take a new name under his new belief. H would call himself "Aton Is Pleased," and thereby seek protection and guidance from the all-rule And to make this conversion complete, he would strike the old name and add the new on eve papyrus roll, incise it on every stone and into every wall. And thus the old gods, unmade as they wer would look and look for Amenhotep—and never find him.

The change, such an amount of writing and carving, would require a great deal of work. But the did not Pharaoh have slaves to command? And would not the scale of effort impress all the people Khem with his sincerity?

Still, the change would deface the stone of the temple walls, marring the royal likeness with th blot of scratching out and etching anew. But then, did not Pharaoh command the hands of the mason They would simply have to cut a little deeper into the rock. Then the new name, "Ikhnaton," wou cast a longer shadow among the blessings that Aton showered down upon his Pharaoh.

And that was as it should be.

Empire of the Persians

Empire of the Athenians

Empire of the Carthaginians

Empire of the Romans

Rome, 477 A.D.

Beowin was busy smashing noses when Roderic found him.

"Come on! There's gold still to get here," Roderic called. "And Alaric has a temple he wants to pu down. We need your strong back for that."

Beowin squinted up at him. "In a minute. Have to finish this."

He had set the marble bust at a slight angle, tipped back on its base, with the nape of its nec resting firmly against a piece of stone. Beowin eyed the angle critically. "Needs to be just right," h explained. Then he hefted his war axe, taking a measured two-hand grip, with the blunt edge facin forward.

If it was Roderic who was going to smash the statue, he'd have hit it from the side. And he'd hav left it on the pedestal in the first place. Then one hard blow against the temple, reinforced by a coup of running steps, would shatter the whole thing. Or one sideways blow against the nostril if, lik Beowin, he just wanted to take off the nose.

But Beowin was doing it differently. And that made a kind of sense, for Beowin had a lot o practice at this.

"Why do you spend so much time with the faces?" Roderic had once asked his friend. "And why th noses, particularly? Why not the eyes? Or the ears or lips?"

Beowin paused to consider the matter seriously. "Someone will find them, one day," he said at las "Maybe a friend or relative. Maybe someone who never knew them at all. And there they are, thes Caesars, with their fancy noses all broken off." Beowin clamped his own nostrils between two finger "Abd den dey talk like dis!" He undamped his nose and laughed out loud.

Evidently, Beowin imagined these stone forms were somehow spiritually linked to the bones of th dead. Maybe the Romans had thought so, to have made so many of them. Then one day the spiri would rise up and become abashed by their new deformities. So Beowin had made an art of breakin off just the noses.

So he always took the bust down carefully, set it on the ground and braced it with a stone, the checked all the angles. Like an old Greek philosopher with a straight-edge and a compass. Now he w standing beside the statue's ear, bending over the face with great attention. His two-handed gr extended just the right length along the haft on his axe. He tapped the flat end against the tip of th cold, white nose. Then Beowin drew the axehead up in a high, half-circle swing, twisting his who body with the effort. He brought it around and down.

The nose exploded off the face in a cloud of white dust. The blow left a deep gouge between th cheekbones and under the eyes.

Beowin spat into the hole. He left the bust lying against the stone. If Roderic had been doing th himself, he would have set the head back on its column, for show.

"A temple, you say?" Beowin looked up with a grin. "Any pretty priestesses?"

"All gone, I'm afraid.... But Alaric thinks they might have hidden gold under the roof, in the eaves

"Well then, priests? Their men are kind of delicate and not at all strong."

"Gone, too."

"Damn!"

But Beowin came along with him anyway—that is, until he saw another statue with a whole nos Then his friend's attention wandered immediately. So Roderic left him in the Forum, trying to low the full-body statue without breaking off the head or hands. Clearly he wanted just the nose to b missing when someone found it. Roderic went on to the temple site alone.

The whole world was moving. Alaric and his band of Goths, as well as the Vandals, the Lombard the Saxons, and a dozen other tribes that Roderic knew only by reputation, all were loose in th vineyards and fields which the old Romans had kept for themselves so long.

Beowin was a fool to bother with the statues and their noses—Roderic understood that clear enough. A man had no time to waste on artworks and such windy considerations as what a dea Roman's friends would think when they saw him "widoubt hid dose."

The thing to do was get the gold, the jewels if any, now and then a cup or plate of polished meta any weapons that would fit a horseman's hand, and ride on. Leave the furniture. Leave the statues. U any women they found for a night at most, and then leave them, too. And ride.

For there were worse things in the world than rape and pillage, Roderic knew. Pushing in behin the Goths and Vandals, raiding hard against the Celts and the Saxons to the north, came anothe people. Dark-clothed riders from the steppes. People of the dawnlands. Small people, bowlegged fro sitting their horses for weeks at a time. Smelly people who lived in skin tents. Who knew nothing gold or women. Who'd kill you soon as look at you, and they'd do it for the pure pleasure of killin Who drank the blood of their enemies—which was to say everyone who came in their path—and le the bones for wild animals to pick over. Who spoke no tongue that anyone could understand. Wh stopped at nothing.

The only wise course for men like Alaric and his band was to gather all *the gelt* they could la hands on, take a day's provisions, and then ride ahead of the storm. Somewhere, probably in the sout they might find safety from the marauders. But until then, to linger here was to invite danger. And t waste time breaking up statues was purest folly.

For the world had gone mad.

Edward the Confessor

William the Conqueror

Henry the Navigator

Elizabeth the Great

London, 1688 A.D.

Lord Effenberry had already put enough of his money in ship bottoms or their cargoes. He did n see any reason to place more of his money at risk in trade.

"But think of the good of the nation!" Shadwell exclaimed.

"How so?" Effenberry rumbled.

"You're a rich man, my lord. You can afford to risk the losses of a sea voyage. Natural losses t storm and tide, unnatural losses due to piracy and the ruthlessness of barbarian princes."

"Of course," Effenberry replied. "That's reasonable. There can be no great profit witho commensurate risk."

"But that is the whole issue of Mister Lloyd's proposition. We all have money in the ocean trad and ~~we each of us have reached a sticking point—because of the risk. Some men, whose capital~~ sorely needed to float new ventures, will not place any of it—again, because of the risk."

"I never said the American trade was for weaklings," Effenberry said stoutly.

"Ah, but that is just the point, my lord! If we can halve the risk, quarter it, chase it away by tenth and twentieths, then we can draw the shy ones into the game again. There is need enough and mor We create vaster amounts of wealth. And you will benefit, too, when your own risk is diminished.... I fact, did you not participate, you might be left out and put at a severe disadvantage."

Effenberry did not like the sound of that. It seemed to be a threat. "Explain the scheme to m again," was all he would say.

"It's simple enough, my lord. The owner of a vessel asks our Society to take a share in it, not profit from the sale, but to pay fair value for hull and cargo should they come to harm. He, the owne places a value on the whole and asks us to pledge to cover the loss, should such a disaster occur. The because each of us risks only a fraction of the total value, and because the greater probability is th the vessel will arrive safely to port, the risks of ocean trade are greatly reduced."

"Sounds a daft sort of proposition to me! Why should I openly encourage my competitor? And wh should I care to make good on *his* losses?"

"Because, my lord," Shadwell said patiently, "he will *pay* you for the service. In return for yo pledge, he will give you a proportionate share of the commission he offers. He puts up a part of th potential profit, in order to get relief from all of the potential loss. No longer will the foundering one ship rob him of the profits from the ten that do come home. And all of us make money when th wind is fair."

"And when the wind blows foul? What then? There will be folly in men's hearts where there is n risk."

"Why, when the wind is foul or pirates be afoot, then our prudent captains will delay their voyage as always. After all, sir, we but wager our fortunes. They wager their very lives—and we profit fron their innate caution."

"So the wind will always blow fair, is that it?"

"And the profit always increase."

It always did that, as Lord Effenberry knew.

Since the discovery of the Americas, two hundred years ago, a circular trade had developed acro the Atlantic.

Cheap English cloth and dull steel knives were shipped to Africa and offered in exchange for prim slaves, who were chained and taken to the Caribbean in trade for Jamaican sugar and molasses an their byproduct rum, which were valued in the northern colonies and paid for with Carolina cotton an Virginia tobacco, which in turn were prized in the textile mills and smoking rooms of England.

And then, eighty-nine years ago, with the wealth of the East Indies reliably proved by the craf Dutch, the Honorable Company had established a more distant commercial empire. There were on rumors as yet—no facts, but resounding rumors—of the possibility for developing a similar tradin circle there. Opium might be grown in India and traded with the Chinese pirates for silver. Th bullion could in turn buy the teas and silks reserved for the Chinese emperors. And those trade good might bring a fancy price in England and on the Continent.

That was a bad business, Effenberry believed, dealing directly with pirates. It would increase th ~~risks out of all proportion. And greater risk would bring increased fear—more need for a prudent~~ ma to hedge his bets.

So… yes… perhaps this Society of Names that was growing up in the coffeehouses would be a avenue for making money, after all.

"And what of this man Lloyd?" Effenberry asked at last "What does he get out of it?"

"Why, as we of the Society negotiate our pledges and the value we place upon hull and cargo, w will drink his coffee, eat his food, use up his quills and paper, and bring into his house the custom o those who can talk knowledgeably with us about winds and tides and the trade in foreign bazaar Edward Lloyd says he hopes only to make a profit on our customary usages."

"Is that all? No urge to dip his own hand?"

"Lloyd claims he's only a purveyor of food and fellowship, with no head for larger business."

"Then the more fool he… Yes, Shadwell, I shall visit this coffeehouse with you."

"You'll not be disappointed, my lord."

James Watt

Thomas Edison

Robert Goddard

William Shockley

Palo Alto, California, 2018 A.D.

"Mr. Morrissey, come quickly!" the voice exclaimed over the phone. "Contamination alert i Laboratory Two!"

Sean Morrissey pushed back from his desk and went out of the office at a run, not caring if th sudden exertion caused him to sweat through the armpits of his dress shirt. He left his suitco hanging in the concealed closet behind the office's executive veneer.

As soon as Morrissey hit the long corridor leading down to the laboratory complex, the muscles his legs, abdomen, and shoulders fell into the familiar loping pattern of his morning jog. That was th best way to cover ground while conserving wind and energy.

Sean Morrissey's run had nothing of panic in it—just sober urgency. And the reason for his urgenc was simple. This was the third contamination problem at Morrissey Bio Designs in one week, an Sean knew what he could expect to find when he came up against the double-glass doors and th cardkey circuits guarding the labs.

The source of contamination would probably be nothing more than a dropped petri dish, or faile seals on an incubator, or the careless misrouting of a specimen. But down in the labs he would fin two or three rooms of interrupted activity, isolated from the rest of the world with steel drop doors an flashing red lights. In the corners would be frightened people huddled around oxygen caniste breathing through yellow masks. Their eyes would be rolling around, searching across tile floors an over gleaming steel benches, as if they could actually see the mutated bacteria, the fragmente

viruses, the virulently altered protozoa escaping from their cultures in a flood of plague. See them ar
flee, before the eyeless mites could spot the lab technicians themselves and swarm into expos
respiratory systems, into eyes and ears, into the other moist pathways of the human body.

Even those who worked in the lab every day were not immune to fearful fantasies.

By the time Morrissey actually arrived at the card station, the Red Team—with its inevitab inspector from the Environmental Protection Agency—was already in control of the situation.

"You cannot pass, sir," the team leader told him.

"I'm Sean Morrissey."

"I know that, sir. But it's out of your hands now."

And that was true enough. From this point onward, the protocols were immutably set: individu evacuation, personal decontamination, medical evaluation, and extended observation. Then, after th people had been extracted one by one from the affected areas, there would be the sequential courses fumigation, ultraviolet irradiation, sterilization, ablution, and certification. Then the program direct on the series that had gone wrong would determine what steps in the genetic construction ar culturing procedure had failed, write up his or her report, and try to put the whole process back o schedule.

In all of this, Morrissey himself was just window dressing. He was a polite face in a suit, p forward to explain to the media why the public was not, and never could be, in any serious dange And explain this while taking the inevitable shots from all sides about the lab's previous safety recor its meager budget for preventive measures, its few contracts that were actually initiated by th Department of Defense, and all the other silliness that these accidents always stirred up.

It was Morrissey's responsibility to face the cameras because this was his company—his and th clique of venture capitalists and investment bankers who constituted its board of directors. But th firm had his name on it. Besides, Sean had once been a research geneticist and so he could appear talk knowledgeably about the eyeless mites that were creeping around inside—even if he was now dozen years out of the lab and his education obsolete by his own company's current hiring standards.

Given these realities, while he waited for the Red Team to launch its protocols, Sean Morrisse made the decision that had been hanging fire on his desk for three months now.

After all, the technology was in place. In just the past ten years, the gene baths, electro micromanipulators, and amino acid spoolers that were once the pride of Morrissey Bio Designs ha already become laughably antiquated. Newer equipment which was now on the market combined the separate procedures into an integrated stream under full computer control. No one any longer neede the racks of test tubes and stacks of petri dishes, carried by human hands from one machine to anothe fumbling about with storage protocols, batch labeling, inventory, and inspection.

The new way involved staining and spooling the genetic material into ever-flowing fluid channe which were capillaried through silicon control blocks no wider than a human hair. Instead of prolonged period of natural culturing, the machines spun the viral protein coat or the cell wall ar cytoplasm directly over the freshly spooled DNA chains. Target strains no longer *grew;* they we immediately and continuously *manufactured*.

This had many significant advantages over older methods.

First, quality control. The computers created exact replicas of the target genotype, without th possibility of mutation. The strain would be guaranteed pure from the beginning of the run to the end

Second, greater phenotype accessibility. The spoolers could weave new patterns, especially thos that ~~might not be viable in nature or capable of reproducing as an independent organism~~. Th characteristic also lowered the potential for future wildfire contaminations.

Third, simplicity. Because the virus or bacterium did not have to survive in the traditional sens the laboratory could dispense with much of the genetic machinery of a life-form. The product could b shipped as inert capsules, set to trigger into a simulacrum of life and function under the precis client-specified conditions. Otherwise, they were a harmless combination of complex chemical endowed with an extended shelf life.

Morrissey Bio Designs had to acquire the new equipment and change its production capabili soon. And when it did so, why should the company be limited to a new building in *Palo* Alto, or o any other patch of Earthside real estate?

Sean Morrissey had already received two offers for engineering his next factory in orbit, wi prefabricated modules launched from the magnetic catapult at Whitney Center in the Sierras. Then h staff and their computers would sit on the ground in Palo Alto, working in an office environment th was free from any possible contamination. The computers would direct the automated baths an spoolers that were suspended in orbit, drawing on protein and amino acid stocks that were replenishe by regularly scheduled shuttle missions. The products of the assembly line would return to Earth b drop box.

And, if anything living or potentially living were to leak, then Morrissey could open the satelli and its machines to vacuum and solar radiation. Clean, simple, sanitary. End of problem.

Or, if something really vicious were to get out of hand—a toxic anaerobe, say, or some bug th thrived on the energy in direct sunlight—then he could write off the whole complex with a sma nuclear warhead, without loss of human life or damage to the company's irreplaceable working files.

Let the people do their brainwork on Earth; the messy physical part could be done high up and f away. And besides, would the all-invasive Environmental Protection Agency even *have* jurisdictio over a facility that spent only a fraction of its workday above U.S. territory?

The prospect was looking better and better to Morrissey.

So, he decided, he would propose it to his board of directors at their next meeting.

Part 2

Minus Fourteen Days… and Counting

Bright is the Earth when you rise.
When you shine as Aton by day
you drive away the darkness.
You light the Two Lands into daily festivity,
awakening them, raising them up.

The people bathe and dress themselves,
raise up their arms in thanks to the dawn
for a new day in which to do their work.

—From Ikhnaton's "Hymn to the Su

Chapter 4

Tangled Fields

Rise
Expand
Rush
Explode

The unbalanced bulge of thermal energy, generated by that non-probabilistic surge of fusic explosions in the core more than a million years ago, now blasts its way out toward the radia surface. The overflow rises like a bubble of sour gas through the star's convective layers, causin havoc.

Throughout a region of the sun extending across twenty-two degrees of arc, the naturally upwellin columns of ionized gas in the photosphere suddenly bloat and expand. Laminar flows, caught betwe the radiant center and the outer edges, create waves of turbulence and peel tornadoes of white fire o the walls of each convection cell. The orderly structure of the columns, packed like organ pipes in choir loft, collapses as the heatsurge pushes its way outward.

The bloom of energy, expressed largely as high-frequency photons, fountains up into the sol corona. There the tenuous plasma, whose ambient temperature already exceeds two million degree siphons off the bulge of excess radiation and dissipates it harmlessly into space.

The passage of the heat wave, however, has left a massive wound in the convective layers and weakness in the structure of the photosphere.

Loop
Coil
Loop
Coil

Any globe of churning, electrically charged particles—which is all a star can claim to be—creat its own pumpkin-shaped magnetic field. The field lines associated with the sun are vast, extending f beyond the visible photosphere, beyond the chromosphere and the wisps of corona, connecting loops that curve into the space claimed by the orbital paths of the planets.

Like most rotating bodies, the sun's field lines run approximately parallel to its axis of rotatio That is, they emerge from the area around one pole, loop outside into empty space, and reconver near the opposite pole. South to north, positive to negative, and usually strongest and most collected the top and bottom of the globe. The magnetic field arises from the sun's huge physical mass and th agitation of all those charged particles. The force lines, anchored in the sluggish, densely packed cor turn with that mass in a period of twenty-seven days.

If the sun were a solid ball—or only partially liquid, like the inner planets with their molten cor —then the field lines would be trapped immovably in the matrix of iron and stone. But the sun is n solid; its plasma is more liquid than water, more volatile than burning oil or methane.

Rotation in a solid ball, like the little green world, imparts a wrenching differential velocity th the surface structure must endure. The poles will seem not to turn at all, while the equator spins at thousand miles an hour. In between, the basaltic land masses of the crust must shift and bend accommodate the resulting stresses.

But in a globe of gas or plasma, where nothing is more solid than two charged particles rubbin past each other in the suspension of magnetic repulsion, those stresses wrench upon nothing. Eac square kilometer of surface finds its own speed, and the atmosphere flows into banded patterns, lik the faces of Jupiter and Saturn. Even on the little green world, the mantling shell of gas lapses in wide belts of alternately moving and stagnant air called "trade winds" and the "horse latitudes."

The sun's visible surface might also settle itself into such a stationary display, were it not for th fusion fires burning deep in the core, and for the intervening layers of opaque plasma that bubble an rush to carry the heat outward to the surface. The convective zone's rising columns of heated g creates dense clots of material. Up near the poles, the ions in these rising heat cells can becom aligned to the prevailing magnetic flux, trapped in the cells' electrically charged material, frozen place inside a columnar granule of upwelling gas.

So, instead of passing through the slippery plasma like a navigational buoy anchored against th flooding tide, the field line is bent at the core and dragged off with the sphere's differential rotatio heading out into the fester-moving currents like that same buoy when its anchor chain has been cut.

Drift

Spin

Drift

Spin

When the field lines become strongly trapped in a convection cell and are ripped away from th great parent loops up near the poles, moving down into quadrants that are spinning more quickly, the the orphans tend to spin around each other, acquiring perturbations that stretch and twist the magnetic domains and break up their uniform polarity. In retaliation, seeking a new equilibrium, th broken lines curve over and plunge back into the photosphere. They create a new north or south pol charge to complement the distant place they can no longer reach, half a globe and more away.

So a trapped field line becomes a tiny loop, a horseshoe of potential, rising out of one convectio cell and plunging back into another nearby. The opposing charges at the exit and entry points attra each other, and so the pair of anchor points stays together in the roiling convective layer.

Now, pulling a field line away from the pole is the usual, or probabilistic, way that a magnet anomaly can form on the sun's surface and start to grow. There are, however, alternate methods c generation.

For example, when that thermal bloom collapsed a broad, twenty-two-degree area of convectic cells near the equator, the resulting weakness in the outer layers offered a temporary shortcut to th solar magnetic field. The force lines bent and redirected themselves out through the electrically qui patch, truncating one or more of the great loops that stretch from pole to pole.

A suddenly active region like this does not form smoothly, nor does it create a uniform magnet charge. So close to the equator, equidistant from the two poles, the sun's magnetic domains enter a w for dominance there. Alternating divots of north and south field strength attract and link to each othe Parallel turfs with similar charges repel and isolate each other. So, once again, separate loops ar horseshoes of potential form and dance around each other in the sun's outer layers.

Twist

Twine

Twist

Twine

As the short, horseshoe-curved field lines twist and stretch, buffeted by their movement throug areas of more stable plasma, they gain new energy from their kinetic motion. They twist and cu around opposing columns of charged particles. The violent winding-up of these ion tubes works lil an electric dynamo, inducing a strong current and strengthening the magnetic flux. The fiel associated with a naturally occurring anomaly can reach 2,000 to 3,000 gauss, or a thousand times th Earth's own field. The fields over a major blowout patch can exceed ten or twenty times that strength

A mammoth potential current flows through the horseshoe loop, induced by the furiously curlin gases. The already strong and strengthening magnetic field trapped in these anchoring tubules repe the surrounding solar material; so they rise toward the sun's surface, the photosphere. And where the trapped fields touch the surface, they create quiet, dense, cool pools of matter, isolated by their hig field strength from the heated gas that is continually rising around them.

These pools develop and darken long after that initial bubble of core-overload energy has escape through the photosphere and poured itself upward into the corona. The depleted column, with nothin but magnetic charge to sustain and shape it, lies passively on the sun's face and moves with the star rotation around the equator.

To see these pools from the outside, against the background of the photosphere, they are so cold a to appear black. The surrounding material, repelled by their charges, is slightly warmer but still not hot as the rest of the photosphere. So this apron appears as a shadowed gray.

For half a millennium, Earthly astronomers with the means to look beyond and through the sun glare called such dense shadows "umbra," and the gray shadings "penumbra." Darkness and nea darkness. Sunspots and their surrounding blush of cool death.

The spots, whether drifting down from the poles or arising out of the equator, appeared irregular on the face of the sun. They came in staggered cycles, like an outbreak of plague, like rashes ar buboes on the face of the daystar. So early astronomers thought of them as a sickness, as signals c catastrophe. The blemishes were considered portents of dissolution and disruption. For, after all, th ~~things of heaven—and was not the sun the brightest and most necessary of the objects sighted beyon~~ Earth?—were all known to be pure and unchanging. Spots on the sun could bode no good to anyone.

Reinforcing this provincial and time-limited viewpoint was the uncertainty of the solar outbrea For reasons not clearly understood then, the black spots arose, grew in number, peaked, and fell awa in cycles of eleven Earthly years. In between these cycles the sun, as humans could observe it, wore blank, white face of perfect health. Then the sickness spots would pop out again or drift down from th sun's clear brow.

But sometimes the spots did not come at all. For year after year, decade after decade, the su showed its clear face. And then people breathed more easily, hoping that the daystar had finally settle down to a regular, healthy life. That the plague had passed at last.

Strangely, although the sunspots themselves seemed to be dark pores and cooler pools on th burning face, they appeared to make the star burn more brightly, like fever in a plague victim. An when the spots went away, the sun's thermal output declined. On Earth, the rivers froze where befo they had run all winter long. Glaciers oozed down from the snows of the mountaintops.

These effects spanned periods longer than most single human lifetimes. So, only when one ma wrote down what he observed one morning and one winter, and when another man years later rea those notes and compared them with *this* morning and *this* winter, could any person on the gree world appreciate that a greater cycle was afoot.

But when the sunspots went away for so long, then most people stopped caring. They took n notice of what was not there. All but the astronomers themselves would grow forgetful, bein preoccupied with other wonders, other problems. The world slumbered, shivered in its bed, b slumbered on.

Chapter 5

Prophet Without Honor

Tick!

Creak!

Groan!

Click!

Aboard the Solar Research Vessel *Hyperion*,

March 7, 2081

The ship's thermal management systems hummed and whirred while her silvered metal sk alternately crept and shrank, passing through and settling into fleeting new configurations as sh transited the solar disk.

With each kilometer of advance in *Hyperion's* orbit, the superstructure's blunt end expos micrometrically now more, now less of its face to the white blaze of energy. The circulating systen pumped their freon gel now faster, now slower to carry the excess heat backward and outward to t radiating tendrils of the heat exchangers. And there, in the tenuous shadow of the ship's mushroo cap, they conducted an unbalanced trade of warmth for warmth and so maintained the margin coolness that supported two human lives.

Dr. Hannibal Freede barely noticed these tiny sounds, in part because he had lived with them f more than one hundred and eighty days. That was just over two solar years at approximately the san distance from the sun as the planet Mercury—except, of course, t*hat Hyperion's* orbit was pol instead of equatorial. And in part Freede ignored the stressful workings of his ship because his fu attention was now glued to the monitor screen in front of him.

There the sun's image, filtered by his equipment to the narrow spectrum of hydrogen-alpl radiation, resembled the fiery mask that the Wizard of Oz had shown Dorothy and her friends on the first audience in the Emerald City. In the classic film of that story, Freede remembered, the wizard head had been a great ball of cotton saturated with naphtha—or was it plain kerosene?—and set afi The face had burned with little jets and gobbets of yellow flame licking upward in a smooth cur around the ball, darkening at the edges where the smoke gathered and rushed toward the ceiling. Tho flames were not unlike the spicules of false fire which Freede could see on the disk that hung abo *Hyperion*.

His eyes traveled up the screen, toward the blurred edge that was continuously passing beyo *Hyperion's* singular point of view. This edge was similarly darkened—but not by smoke. His straigh on view of the surface area immediately below the ship had probed more deeply into the sol atmosphere than this slantwise line of sight toward the globe's limb. The deeper one looked into t thermally stratified layers of that atmosphere, the brighter the observing field appeared. Now the ar he was trying to inspect at the far edge of the sun was limited to the higher, cooler, and therefore mu darker regions of the photosphere. Too dark to show clearly what he wanted to see.

Still, Freede searched in this area for any last signs of the anomaly he had faintly detect yesterday and had been tracking continuously since then. In the altered, hydrogen-alpha image, h eyes strained to see between the tips of those dancing spicules which further fuzzed up the darkeni limb.

For an instant Freede could almost believe he discerned there a pattern of black scoops crevasses. That high up on the solar disk, the clefts would certainly be foreshortened and flattened the Wilson Effect, a trick of perspective described more than three hundred years earlier by t Scottish astronomer Alexander Wilson. The man had thereby demonstrated how the recurring da marks on the sun's surface actually had depth and might indeed be holes in the photosphere. Viewe practically edge-on, they would probably look like the curving smear of thin, gray-edged strea Freede had seen yesterday. He strained now to find those same, broad smudges of cool shadow.

The anomaly had certainly been strange: a horizontal clouding-up of the disk's edge, deeper a blacker than normal limb darkening, and wider by far than any penumbra he'd ever seen in the reco tapes. Twenty-two degrees wide it was, according to yesterday's measurements. And then toda nothing....Or maybe the smudges were never there to begin with.

But wait a minute now! How far, after all, had *Hyperion* traveled down the sun's face in the la