



Electro-Fractal Universe

C o l i n H i l l

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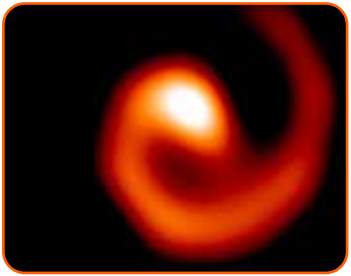
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This book is dedicated to Antony who died, aged 5, of Neuroblastoma, a childhood cancer.

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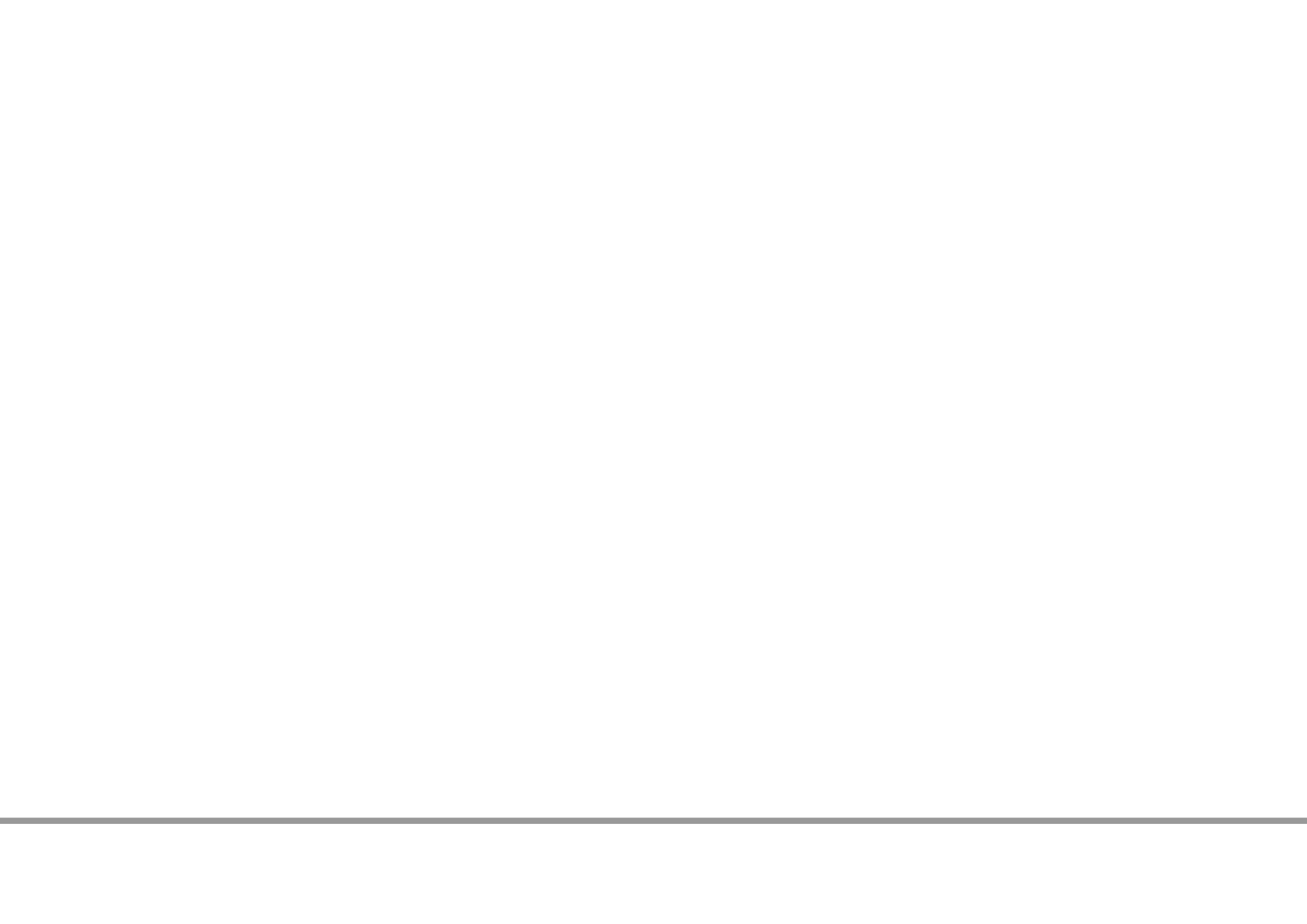
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Electro-Fractal Universe

Introduction

The primary purpose of this book is to present the hypothesis that the universe is electrical and that it works through a fractal mechanism.

In doing so I hope to further the work of remarkable men who saw, from early days, that contrary to popular belief, electricity is an important component of the universe. Prominent was Dr Charles Bruce whose giant insights were too much for his contemporaries even to contemplate.

Almost all of my "observations" use professional images; a few use amateur pictures. In some cases digital processing has been used to expose detail which otherwise would have remained hidden. All results have been double-checked and those of a dubious nature were scrapped. The fact that the same shapes crop up again and again across the range of sizes is reassuring.

That the electrical route is the right way to go I have no doubt. The theory answers too many questions for it to be otherwise, but I am under no illusion that there is little more to discover or that I have made no errors.

Do I ever panic and doubt my findings? Of course, from time to time, but being a retired industrial scientist I am used to coping with that.

Thus I hope also to whet the appetite of those readers with enough curiosity to dig deeper, and to improve on and correct my amateur efforts.

Electricity is at work everywhere in space. Plasma extends out to at least

13.3 billion light-years, if we are to accept WMAP observations.

www.hep.upenn.edu/~max/wmap3.html

Since the electromagnetic force is enormously more powerful than gravity, we should conclude that the universe is dominated by it. Certainly the huge currents of electricity measured by radio telescope bear this out.

Chapter 1

Light Dawns

Deciding that the sun is flat isn't likely to improve my scientific standing; that much is clear. Still, there are more incredible ideas, like "dark matter" or the magical "anti-gravity force", and at least mine is based on observation. Nonetheless, at times I have to pinch myself. I can well understand the doubters, even the hysterical ones.

My interest in cosmology began with a bang (pun intended and very typical) over a pint one night in the pub, after an astronomical society meeting. I speculated that each spiral galaxy might perhaps have a miniature spiral at its centre, that is, if Benoit Mandelbrot got it right in 1977. He spotted that galaxy maps are fractal patterns, which means that the whole universe must be fractal.

A more knowledgeable member already knew that such galaxies do exist. She gave me a list: NGC 1097, 1365 and so on [Figure 1]. I was shocked; it was too easy. This effortless prediction of a fractal feature in galaxies looked too good to be true. Discoveries, in my experience, don't usually come so easily. What I had in mind would signal the presence of universal organisation, with both a process to make it, and the fuel to power it. If one bit is fractal, the rest must be also: a notion totally at odds with the standard model/big bang theory.

If I could confirm those inner spirals, it would mean that I had happened on something big.

All it needed was a few minutes with Google. They were there, just as my friend had said: in Hubble and ESO images and others. Anybody can check; no “rocket science”; no mathematical analysis.

The stacked spirals are important simply because they are there, and they mean that mainstream cosmology is on the wrong track and always has been.

The next step was obvious: to find out what put them there. What had started so simply became a long-term, probably a permanent obsession. I gradually came up with something like a full-blown cosmology: the theory that the universe is fractal, that it is electrically made and driven, and that all objects in the universe are close spiral relatives, perhaps even down to atoms.

Separately most of the ideas are not new, but the combination probably is, and I have thought of a few of my own. The result is a great departure from orthodoxy. I realise that it is hard to take for a good many people, as it was for me when it sank in what my theory predicts about the sun.

For several weeks I was in denial, using the avoiding tactic of trying to devise a spherical solar model. But no escape; only a flat spiral generator has the necessary electrical properties.

That each and every celestial object is made by a simple, fast, electrical process, repeated thousands or maybe millions of times in each case is an idea which will be unfamiliar to most and uncomfortable for some. People are conservative. Most will not abandon a theory unless there is at least the prospect of a better one. So be it.

Common origins mean shared characteristics so the reader will be asked, along the way, to consider some strange ideas: that the shape of the tiny Halley’s Comet has a close resemblance to that of a massive barred spiral galaxy, that the sun is effectively flat, and that the Earth spews out sporadic plasma jets like the planetary satellite, Io.

For those who aren’t sure what plasma is, have a look at your nearest fluorescent tube, nebula, neon sign, or aurora [*Figure 2*]. It’s ionised gas and it’s all over the place. Because of its unusual behaviour it has been called the “fourth state of matter”. It is fascinating to study.

The process of fractal-making accounts for much of what is beautiful on earth. So what I ask of you is to open your mind to the notion that the same applies to those glorious sights in the night sky. What have you got to lose? A the-



Figure 1. Barred spiral galaxy.



Figure 2. Aurora.

ory that has predicted about as much as Mystic Meg!

Fractals are about “complexity out of simplicity”. Intricate patterns are made, not by fiendishly complicated processes but by simple ones with many repeats. In this sense the “Grand Unified Theory” already exists. Nor does it need a mathematician to fathom it. Every one of us has the delightful, built-in skill to enjoy intricate patterns. Pattern recognition is at the very heart of being human. No computer or equation can match it.

A sizeable minority of scientists now accept that galaxies are fractal but few seem to grasp that if this is true, then all other celestial bodies must be the same; the entire universe must be fractal. Others, especially those with an electrical background, are content with the idea that electricity drives the universe, but unfortunately there are few fractaleers amongst them. Being a member of both schools provides me with the excuse to write the book, but remembering what Richard Feynman said:

“Scientific knowledge is a body of statements of varying degrees of certainty. Some most unsure, some nearly sure, none absolutely sure.”

Chapter 2

The Neglect of Spatial Electricity

From the early twentieth century, electricity has been assumed to be impotent in space. Since it consists of negative and positive charges it is assumed that these cancel out at large scale, but an abundance of contrary evidence has been there all the time and only prejudice has suppressed its importance. From Michael Faraday's practical work, James Clerk Maxwell in 1864 concluded that electricity and magnetism are two sides of the same coin, yet the sun is not acknowledged as being an electrical body, in spite of the generally accepted concept of its "magnetic" plasma loops.

In the late 1890s Kristian Birkeland, a Norwegian electrical engineer surveyed the pattern of geo-magnetism in the far north of his country in an attempt to explain the Aurora Borealis. His observations showed that electricity is flowing in almost vertically from high altitude. His calculations indicated that a prodigious quantity of energy is gushing in continuously. He speculated that it could only have come from the sun and his comparison of the fluctuations in the brightness of the aurora with those of sunspot activity clinched it. He brilliantly projected well beyond the terrestrial:

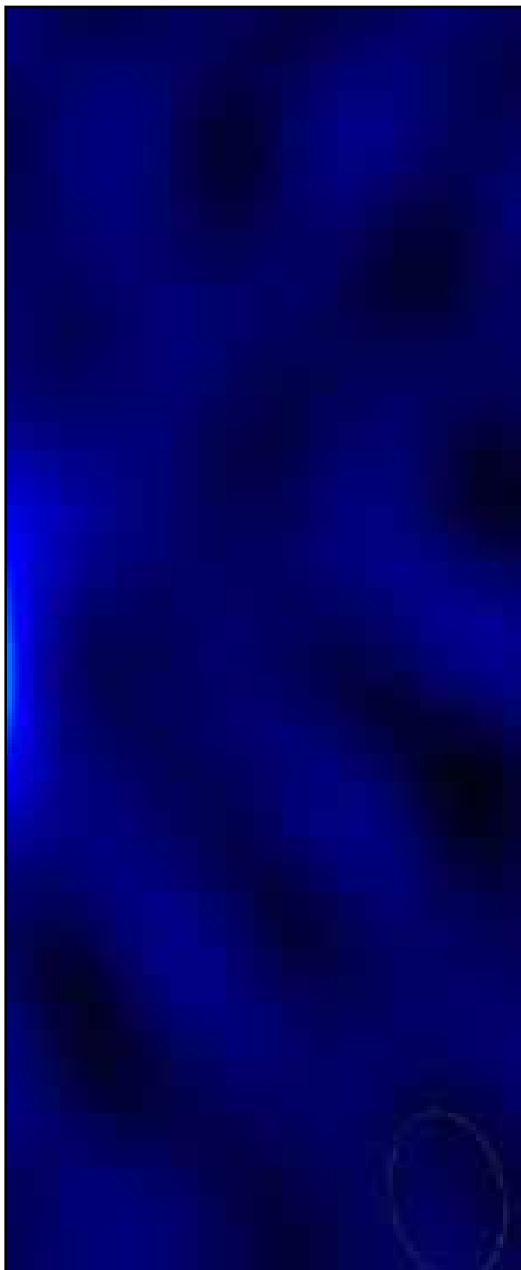


Figure 3. Plasma mesh.

"...every star in the universe would be the seat and field of activity of electric forces of a strength that no one could imagine [Figure 3]. We have no certain opinion as to how the assumed enormous electric currents with enormous tension are produced, but it is certainly not in accordance with the principles we employ in technology on the earth at the present time... It seems to be a natural consequence... to assume that the whole of space is filled with electrons and flying electric ions of all kinds. We have assumed that each stellar system in evolutions throws off electric corpuscles into space. It does not seem unreasonable therefore to think that the greater part of the material masses in the universe is found, not in the solar systems or nebulae, but in 'empty' space".

Birkeland's astounding work counted for little among professionals; it clashed with accepted scientific notions and it was largely ignored. That the identification of this huge source of solar energy, in the form of electrified gas, and travelling across millions of kilometres of space, should so little influence scientists' thinking, now seems incredible. And how they came to adopt gravity and the big bang concept, at the expense of electricity, is not merely incompetent, it is tragic. Mathematical theorising was and is preferred to experiment and observation. We are still bamboozled with the myth of mathematical rigour, when in fact maths is just as prone to subjectivity as any other discipline. Unguided by observation it has been disastrous.

Thus Birkeland's work pointed the way to explore the universe. Cosmologists should have raced to investigate, but they chose, nearly a century ago, not to. The ignorance and arrogance of theoreticians crippled cosmology for the whole of the twentieth century.

Albert Einstein arrogantly expressed the opinion early on, that the mathematical description of the natural world was so nearly complete, that scientists would soon have no need for experimental work at all. The conjectured 'Grand Unified Theory' would wrap up everything. He produced little of substance thereafter. Gravity has resisted his and all other attempts to unify it with the other forces.

Alexander Friedmann compounded Einstein's pseudo-science in 1922. His "rigorous mathematics" started with the assumption that the universe can be modelled on dust, not unreasonable then, but by opting to exclude the tensor for electromagnetic radiation from his equations for the evolution of the uni-

verse, he sowed catastrophic seeds. Like Einstein, he made the wrong assumptions that the universe is homogeneous and isotropic, identical and smooth everywhere and that it is expanding.

Grandly-named it might have been, but this “cosmological principle” was soon under fire and still is. It was ill-founded, but its proponents are powerful and chauvinistic and it remains the foundation of mainstream cosmology even today. Theory was to triumph over observation again and again for another eighty years.

The accidental discovery in the Thirties of microwave background radiation and its near perfect homogeneity was sound corroboration of Birkeland’s researches. It should have roused suspicions about the validity of Alexander Friedmann’s equations and his failure to include electromagnetic radiation in them. Instead it was perversely trumpeted as corroboration of traditional dogma; as evidence for the imagined smooth distribution of matter in space. Even after the COBE fiasco this idea was not dislodged (see chapter 8).

Today none of these holds up; observation (especially radio) shows a universe far from uniform, mostly of ionised hydrogen and helium, very little dust, and dominated by electricity. Friedmann’s justification was the usual one of mathematical theorists: to simplify the horrendously difficult maths. Mathematicians now understand that any attempt to meddle with a fractal process in this way is to invite error. But he would not have been aware of it.

No correction has been made since. It is not generally accepted that fractal geometry plays any part in the structuring of the universe; nor is the key role of electricity recognised.

By 1938 British Admiralty scientists had found radio-reflective plasma layers up to three million miles into space and, two years later, electromagnetic interference to radar signals was traced by a British Army research team, to radio emissions from the sun. This led to the detection of radio emissions from the constellation Cygnus. Thousands more sources, including galaxies, quasars and supernovae, were identified from then on and bells were ringing. Cosmologists though remained deaf; electricity remained surplus to their requirements.

At about the same time, Dr Martin Ryle reported a solar emission which reached over a million miles an hour. Dr Charles Bruce, a Scottish electrical engineer, saw similarities between its behaviour and that of lightning. He was an expert on the subject, but just as important, he was an amateur astronomer!

Jodrell Bank in July 1946, was the scene of the accidental observation, by Bernard Lovell, of a radio ‘outburst’, associated with a solar flare whose intensi-



ty peaked at 'over one hundred million times greater than would be expected from a body at the temperature of the solar disc'

[page 167 of his 'Astronomer by Chance'] and [Figure 4]

By 1963, he and his Russian astrophysicist associate, Iosip Shklovsky, agreed that an "entirely unknown process of energy production must be operating in the universe". Even after this massive hint, they were not able to step beyond the limits of orthodox thinking. Both had a background in astrophysics and in Lovell's case, in radar and electronics. Yet neither had the insight to spot the admirable credentials of electricity, with its unique power, to fill the role. Or if they did, they kept it quiet, regardless of the mounting evidence.

The same depressing mind-set pervaded scientific thinking in the States; three successive 'Explorer' probes were sent up, with sensitive equipment to measure what the physicists there imagined would be tiny flows of electricity in space. The satellites returned with burned out instruments! When the light began to trickle through: that freak occurrences were not to blame, a beefed-up fourth probe was launched. It found the powerful current later named the Van Allen belt but even then it occurred to nobody to question the position of gravity as the premier force in space. Electricity was not promoted.

In 1968 events took a dramatic turn. A report (No. 5275) was submitted to the Electrical Research Association entitled "Successful Predictions of the Electrical Discharge of Cosmic Atmospheric Phenomena and Universal Evolution". Dr Bruce had progressed apace. His choice of such a prosaic and convoluted title for his paper was probably an attempt to blunt its startling findings: it completely contradicted orthodox cosmology and it postulated an electrical formative process pertaining to the whole of creation. As his summary said:

"The object is to show that all cosmic atmospheric phenomena can be explained as deriving from electrical discharges, resulting from the breakdown of electric fields..."

The man had courage! He did not claim that his explanation applied to one, or even to a few of the objects in space. He confidently stated that it covered all of them! He was a respected research physicist, a former officer of a respected scientific body, and a careful researcher, so why not?

Today there is a growing body of evidence, mainly from radio telescopes, that he was right, but his was a set of ideas at odds with every cosmo-

Figure 4. Solar plasma loops.

logical convention. He did his best. His presentation was terse and he made no attempt to dramatise. Indeed he stressed the familiar nature of these spatial lightning discharges. Even galaxy arms, he said, are merely electric arcs on a large-scale [Figure 5]. Today these loops are visible at radio and X-ray frequencies. The portrayal of his whole remarkable picture was simple and couched in everyday terms. He and most of his audience were electrical engineers, who would have found little, if anything, of an unfamiliar nature, but to outsiders the report was alarming, not just for its total departure from orthodoxy, but because it attempted to promote electricity to the prime role. There was and still is great opposition to his inspired work.

Hermann Bondi read the signs in 1977 and warned against the "lure of completeness": that obsession which had gripped Einstein, Eddington, Schrödinger, Heisenberg and others who imagined that the whole of Nature could be condensed into a few equations. He advised them to recognise its great complexity; "to expect the unexpected". He pointed out that every new piece of technology had led to totally unexpected discoveries. He was timely. That same year Benoit Mandelbrot announced that a newly-plotted map of galaxy distribution showed, not a random spread, but a beautiful, fractal pattern, implying that the universe is the product of a single process, operating everywhere. Old die-hard cosmologists had yet another challenge to contend with.

Resort was made to some desperate defensive tactics in the eighties and nineties, but the situation went steadily down hill. COBE was probably a fraud and WMAP was extremely expensive, but it bought a little time. The Hubble space telescope meanwhile was a major asset, diverting attention from the troubles, in spite of its incompetent start.

Unfortunately though, questions were now being asked in high places and a number of Senate committees looked into where all the money was going. ESA and ESO were doing well and for far less.

Awareness of the importance of spatial electricity is slowly taking hold and more countries are building radio telescopes. Many countries are bolstering their efforts through collaboration. Australia, Canada, Norway, Sweden, France, Germany, the UK, Russia and Poland are all pooling resources with others and even the US is getting involved in joint ventures.

Many scientific workers are uncovering evidence of electrical activity, some of them unintentionally and unknowingly. Ironically, even some of those seeking to further the big bang concept, have contributed valuable insights.

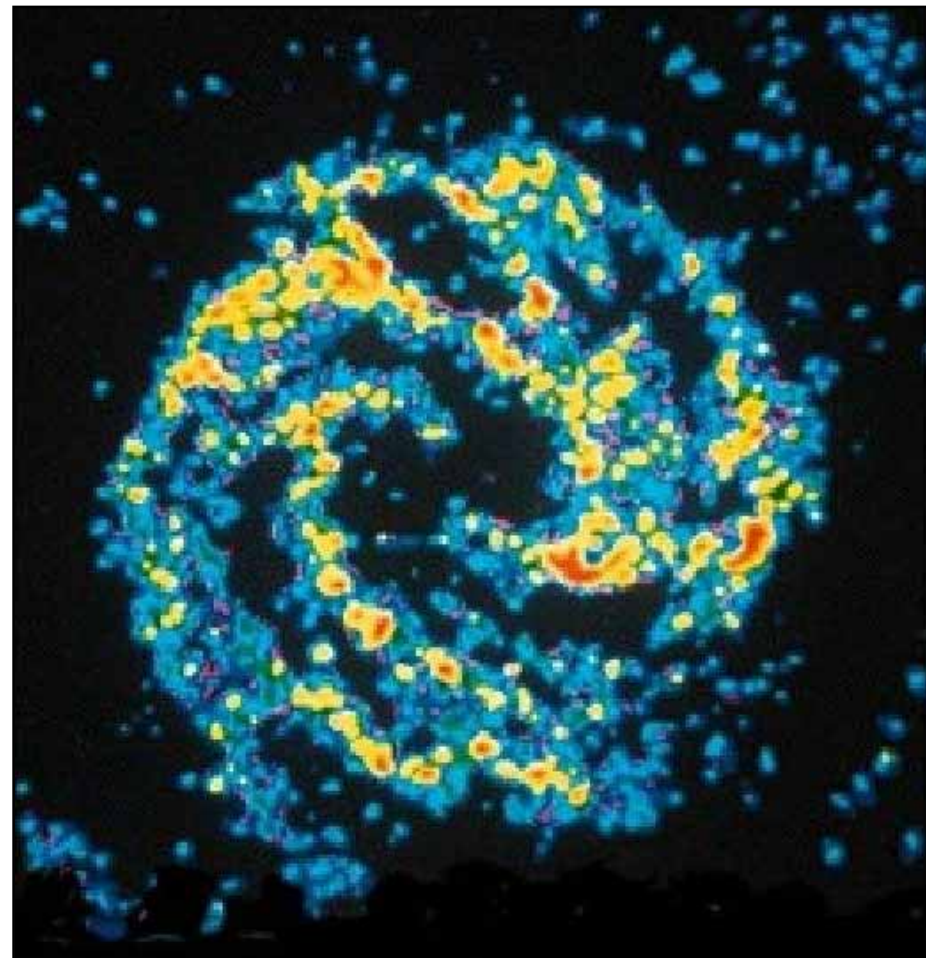


Figure 5. Galactic arms/loops.

Chandra publicists for instance, have recently begun to back-pedal on “dark matter”, having first replaced the term with the more vague “missing matter”. They now tell us that it consists of “hot plasma” and that it accounts for sixty percent of the mass required to prevent galaxies from flying apart. Quite how they arrived at this figure is hard to fathom and they have given no hint as to the nature of the remaining forty percent. However, their partial u-turn should not be underestimated, even though they are not able to see the implication of their own observations, which is that electricity is the major force, at least in galaxies.

Unlike their optical counterparts radio telescopes can ‘see’ electricity at work in space, and better still, very large arrays of them can be deployed and coupled together as one interferometer with undreamt of aperture and resolution. It will take some time before mainstream cosmologists are forced to allow electricity its proper role as the prime force in the universe, but not that long.

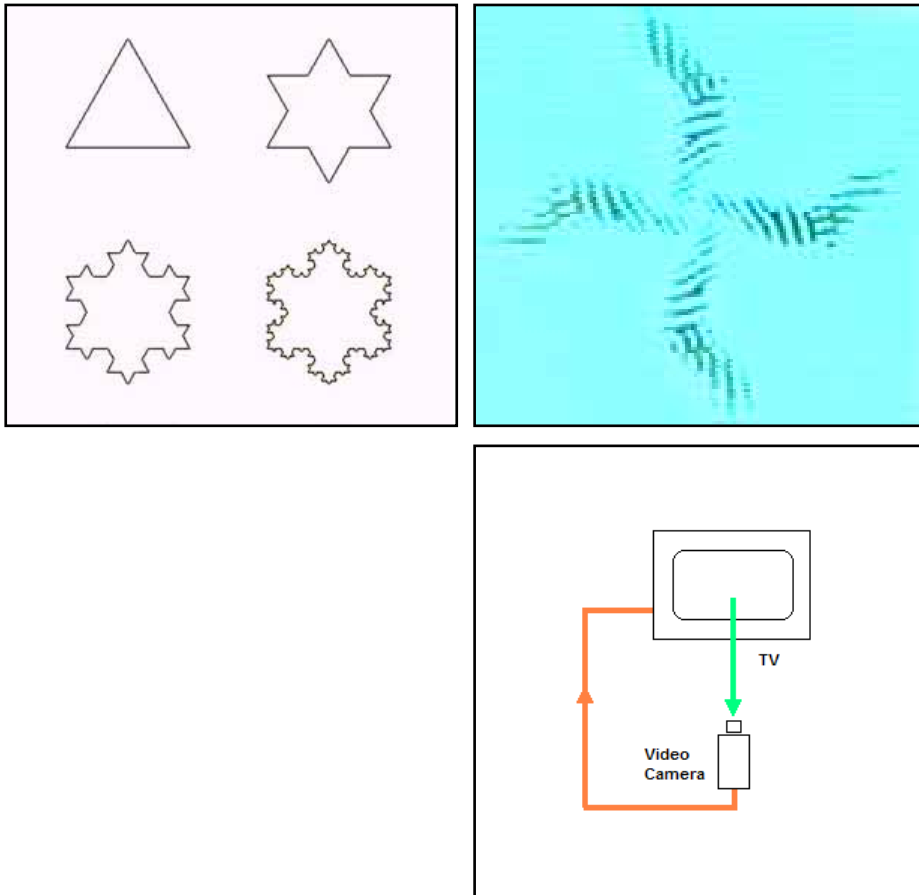
Chapter 3

Fractals in General

Over the following weeks, after the pub episode, I enthusiastically put together my knowledge of fractals and my entire knowledge of astronomy. There wasn't much. Obviously, I would have to work and the internet was going to be a major tool in my self-education.

Soon I found that that certain shapes (and not only spirals) keep cropping up everywhere, and in many sizes. Fractal shapes like clouds, sand dunes and mountains are so commonplace on earth that they are hardly mentioned. They are very easy to recognise but far more difficult is to find how they are made. That such complex forms can be brought about by the repetition of some simple process is not easily grasped, but a simple example, the Koch curve, may help.

This fractal starts with an equilateral triangle. Each of its sides is given a triangular kink. All the sides of the kinks are then given the same treatment; they are kinked. Kinking of the straight bits continues ad infinitum and the outcome is a lacy snowflake pattern which is as subtle as the original triangle was boring. It has surprising properties. The perimeter length, for instance, is infinite, but it



encloses a finite area. Zooming in shows the same detail everywhere: the one subtle clue to its origins [Figure 6].

This very basic example is instructive in that it embodies some, though not all, of the fundamentals. It illustrates that many repeats of the kinking action are needed to achieve results and thereby hints at the infinite. There is too, the clear message that the simple can give rise to the complex and that the outcome is one of profound change, as seen in the experiment shown at below left. Adjustment of the camcorder gives strange rotating shapes from blobs to swastikas.

Not so obvious is that, in the real universe (as opposed to the mathematical one), some fuel or other would be required to power the changes, which in turn raises the question of how long such complex operations might take.

Not long to judge by observation: in supernovae and like bodies, structuring is tumultuous and massive, and in stars and pulsars some powerful bursts last only seconds.

These characteristics are part and parcel of the everyday activities in space and there is abundant evidence, not merely that change happens very quickly, but that it involves continuous, creative activity and destruction, implying cyclic timelessness.

Nothing backs up the conventional idea of a limited time span for the universe. Recycling rules, not entropy, OK?

The Koch example is valuable too in pointing to the property of fractals' repeating patterns. Several barred spiral galaxies have not one, but several replicas of themselves both within and without. Inside are stacked smaller and smaller spirals, while outside, across the whole cosmos, there are both smaller and larger spiral relatives. In ascending order they include: comets, stars, nebulae, galaxies, clusters and superclusters. Some of these do not look spiral, but looks are deceptive as will be shown later.

Nature is not frivolous in using fractals; they are not merely decorative. Wherever a fractal is found, you may be sure that whatever process is going on, it is efficient. James Gleick illustrates with reference to systems in our bodies:

"This exquisite structure- actually two intertwining trees of veins and arteries- is far from exceptional. The whole body is filled with such complexity. In the digestive tract tissue reveals undulations within undulations. The lungs too need to pack the greatest possible surface

Figure 6. Koch Curve (left), video feedback (right).

into the smallest space. Our ability to absorb oxygen is proportional to the surface area of the lungs. Human lungs pack in a surface bigger than a tennis court.” [‘Chaos’, p108, Sphere Books Ltd, 1987, ISBN 0 7474 0413 5]

Nature’s employment of a branching fractal system in space does not of course stem from a shortage of room, but in order to collect energy from a large volume of space , and this it does very effectively. More on this later.

Any repeat process which is the basis of fractal-making, employs a system of “positive feedback”. The output is fed back to the input as in the camcorder experiment. Another example is the weather: yesterday’s finishing condition is today’s start: today’s finish will be tomorrow’s start, and so on, round and round. The energy input is sunlight which varies in intensity; the result: unpredictable [*Figure 7*]. All depends on the starting point. As James Gleick expressed it:

“In weather for example it translates into... what is only half jokingly called the Butterfly Effect- the notion that a butterfly stirring the air today in Peking can transform storm systems next month in New York.”

Low energy feedback makes for sedate change, but the high energy version is often violent and awe-inspiring. Meteorologists in the first instance can make long-term predictions, but otherwise they have a hard time of it. About three days is about all they can manage even with the largest computers at their disposal. After that, matters are less certain. The seasons follow a pattern which is familiar to everyone but who would attempt to say whether next summer is to be wet or not?

It looks as if all Nature is made of fractals. Their unique and critical characteristic is one of precarious stability. They teeter on the edge of chaos. Such systems, sitting as they do on the edge of anarchy, can change very quickly and tumultuously. We are used to the idea of a stately, timeless universe. The thought of celestial bodies evolving very quickly is new and uncomfortable, but alteration and construction, brought about with literally lightning speed, producing large structures in perhaps a few thousand years, look highly likely. The evidence, especially in supernovae is plentiful, as will be shown.

In his book “Chaos”, James Gleick, in describing the uneasy evolution of the vocabulary of fractalism also describes its essence and its utility:

“In the end the word fractal came to stand for a way of describing,

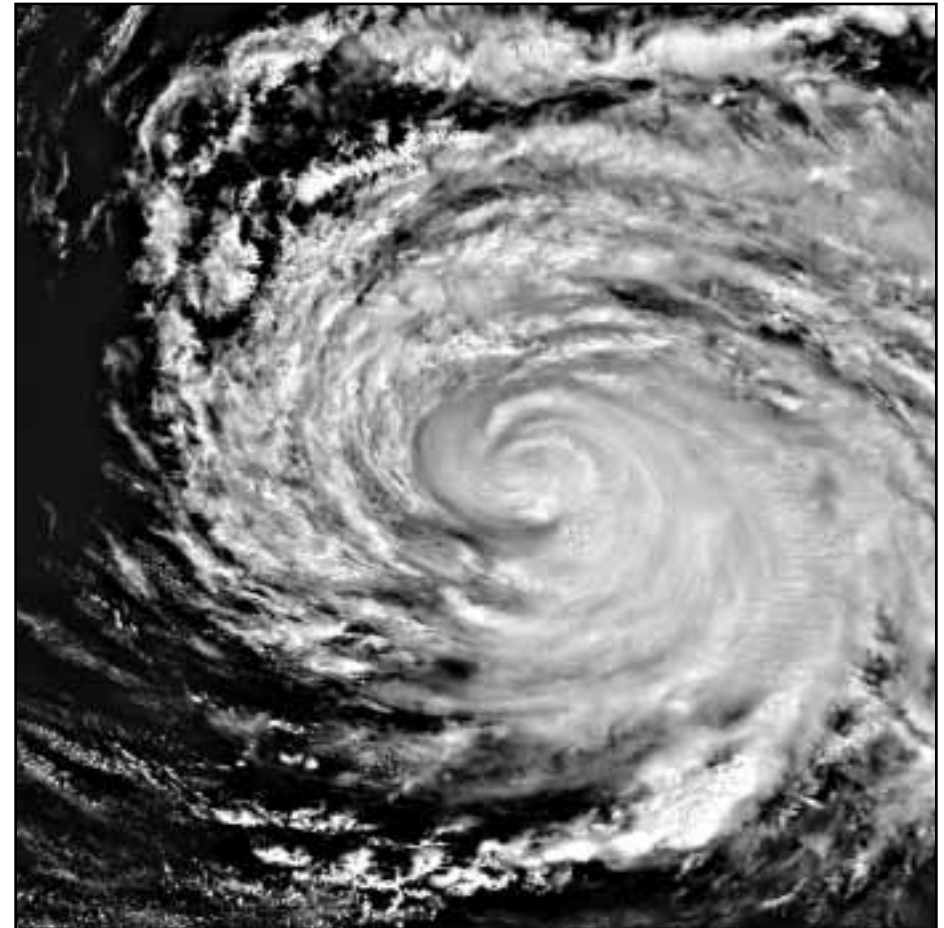


Figure 7. Tornado.

calculating and thinking about shapes that are irregular and fragmented and broken up- shapes from the crystalline curves of snowflakes to the discontinuous dusts of galaxies... A fractal curve implies an organising structure that lies hidden among the hideous complication of such shapes... (there are) unsuspected regularities that could only be described in terms of the relation of large bodies to small. The structures that provided the key to non-linear dynamics proved to be fractal. And on the most immediate practical level, fractal geometry provided a set of tools that were taken up by physicists, chemists, seismologists, metallurgists, probability theorists and physiologists."

But evidently not by cosmologists, in spite of the evidence. Their sticking point seems to be Gleick's "organising structure" which clashes with tradition, and it does not help that it has to have the seemingly contradictory capabilities of exerting its great power with great delicacy. Electricity in concert with plasma is the one fuel which is up to the job, but that is jumping ahead.

As Gleick makes clear, the key is to look for the regularities of shapes whilst ignoring the distraction of size. Celestial building is in progress and it will need a drastically altered approach to fathom it. The patterns, neglected and misconstrued so far, need explanation, not with meretricious inventions of the NASA brand, but those deriving from the laws of science and observation.

Chapter 4

Fractals in Space

Poodles, bulldogs, Irish hounds and dachshunds are all called "dog"; we choose to ignore the clear differences of size shape and colour. Yet we give dogs and cats separate labels, on the grounds of differences which are no greater than those between some breeds of dogs.

The same arbitrary thinking applies to our categorisation of objects in space: a system which arises from our ingrained habit of analysis. Differences are sought and inevitably found and, at times, they are given precedence over equally compelling correspondences. Discrimination of this sort can be useful in science but when applied to fractal systems, the likely outcome is inaccuracy and confusion. Where, for instance, do planets end and asteroids start? Where is the dividing line between galaxies and dwarf galaxies? What distinguishes between a dwarf galaxy and a spiral nebula? And what is the size difference between clusters and superclusters?

Observation shows that spirality is to be found in all of these objects. They are a continuum, but we have no collective term for this spiral hierarchy corresponding to "dogs". Instead we opt for division into "breeds": stars are seen as separate from quasars; spiral galaxies and elliptical galaxies are quite different,

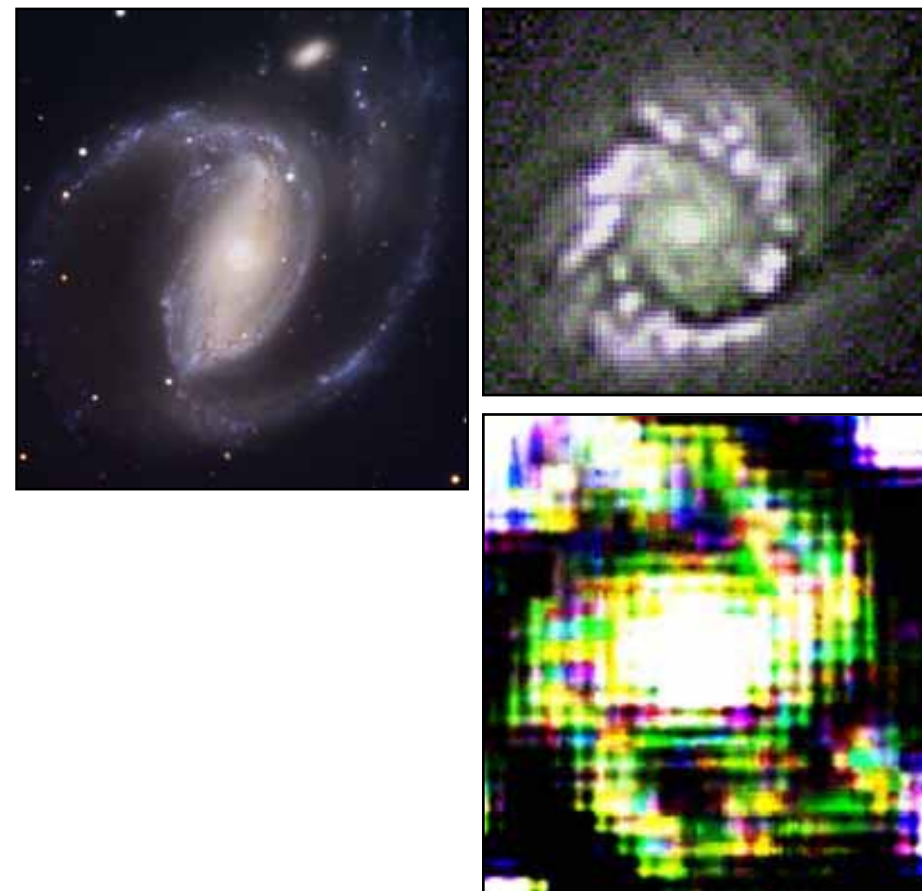


Figure 8. Internal similarity.

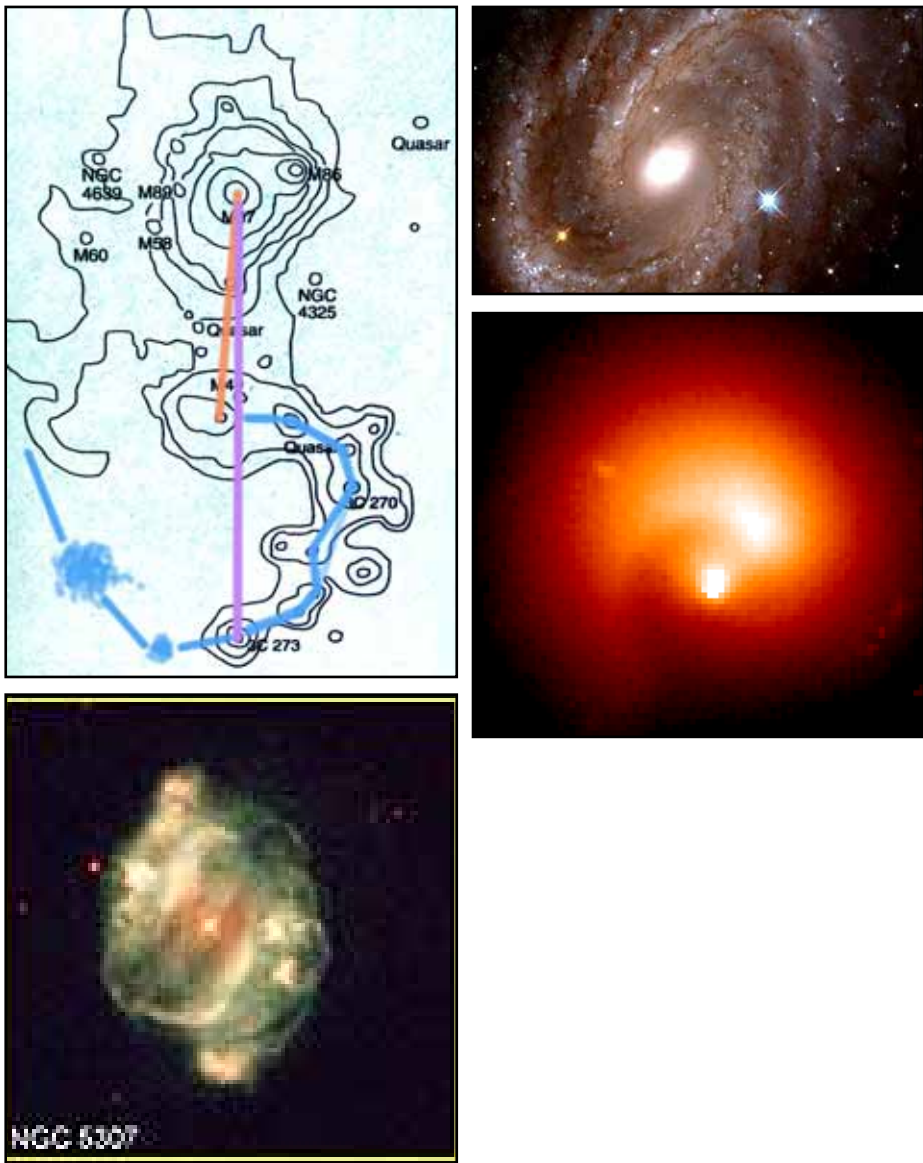


Figure 9. Cluster (top-left), galaxy (top-right), nebula (bottom-left), Comet Hale-Bopp (bottom-right).

and novae are distinct from nebulae. Examination in radio, X-ray, visible and infra-red frequencies shows marked behavioural resemblances across the range but we choose to cloud our perception of the universe by trying to put them into separate slots.

Evidence is now extensive and cogent: the universe is a dynamic, interactive whole. Yet professional defenders of conventional cosmology, who might be expected to welcome the uncovering of fractal organisation, are the very ones who oppose it. When it comes to the crunch they prefer the idea of a chaotic cosmos, destined for entropic nothingness.

Happily it looks as if these supposed servants of society are very wrong; bigger and bigger structures are turning up, well beyond their most ingenious explanations.

There is no theoretical limit to the size of fractals in space, but only the middle-sized members have hitherto been visible to us. Small ones are beyond the reach of telescopes and the very big ones have to be laboriously surveyed. Yet even old conveniently-sized friends like NGC 1365 and 1097 have been underestimated in spite of their visibility. These are not just barred spiral galaxies. They are arrays of stacked spirals. Each one encircles successively smaller spirals, co-centric and co-planar [Figure 8]. So astonishing an arrangement should have raised profound questions. Instead it has been relegated to ordinariness, and its strange form explained away with specious assumptions (see chapter 6).

Just as striking as these internally stacked clones is the fractal hierarchy of spiral bodies extending from galaxy clusters down to comets; what might be termed "external similarity" [Figure 9]. Comets are not customarily thought of as spiral bodies but reference to the superb pictures from the Harpoint observatory in Austria and elsewhere will confirm that they are. They show multiple plasma jets and coupled with their exotic spectra including X-rays, it is obvious that to portray them as passive snowballs is wrong. Electricity is unarguably involved again. There is clearly a built-in tendency in celestial bodies to reproduce a particular shape, as in barred spirals, which as already mentioned, have replicas of themselves at their centres but the Hoag object, which is galaxy-sized, is so-called because it is only remotely galaxy-shaped. Nobody disputes that it is a galaxy but where does it fit into the spiral hierarchy, if at all?

Magnification of its rim reveals miniature clones similar in shape to the parent, but with further magnification, the resemblance of each begins to fade giving way to the familiar lattice of plasma circuits. Each looks more like a small spiral galaxy and less like a donut, the rims being distinguishable only by faint var-

legations in colour [Figure 10].

The Hoag object's different appearance is superficial. It was made by the same process, its power plant is the same, and its fabric of plasma loops is the same as any other galaxy's. It is merely a fractal variation.

We take for granted the flat and spiral nature of galaxies and certain nebulae, but, as is to be expected in a fractal set up, there are much bigger examples. The Virgo supercluster has similar characteristics. It is flat and it is spiral; an observation with great significance for both cosmogony and cosmology.

"Although less well defined than the galactic plane, the supergalactic plane's presence indicates that the local supercluster, like the Milky Way, is a flattened structure".

[<http://astrosun2.astro.cornell.edu/academics/courses/astro201/lsc.htm>]

The properties of flatness and loop/spirality are seen even more clearly in the beautiful Chandra image of the Perseus cluster. Its galaxy-like shape is very striking.

Both flatness and spirality are crucial characteristics, the first resulting from the Fleming effect which will be explained later, the second from magnetohydrodynamics.

Since even larger flat structures, consisting of interconnected superclusters, have been mapped, stretching across huge expanses of sky, it is not unreasonable to expect them to be spiral as well. Indeed we may speculate as to whether the universe itself is the biggest of the flat spirals or not.

The flatness of the nearby Virgo Cluster is not the only feature which poses problems for orthodox theory. X-ray mapping has revealed topographical evidence that places a number of X-ray-emitting quasars well and truly within its bounds, deployed in a spiral/loop shape, which resembles half of a barred spiral galaxy. The bar, including a quasar, extends from galaxy M87 to galaxy M49, but connects there with an arc of quasars and other bodies, mimicking a spiral arm. According to the ROSAT map's contours it finishes at, but includes quasar 3C273

[Figure 11].

But there is a problem; the nearest quasars, according to Hubble's law, should be millions of light years away. Either Hubble, who to be fair, was very sceptical about his own idea, or the ROSAT team got it wrong! Evidence has piled up that Hubble's doubts were well-founded; something is wrong with red shift theory.

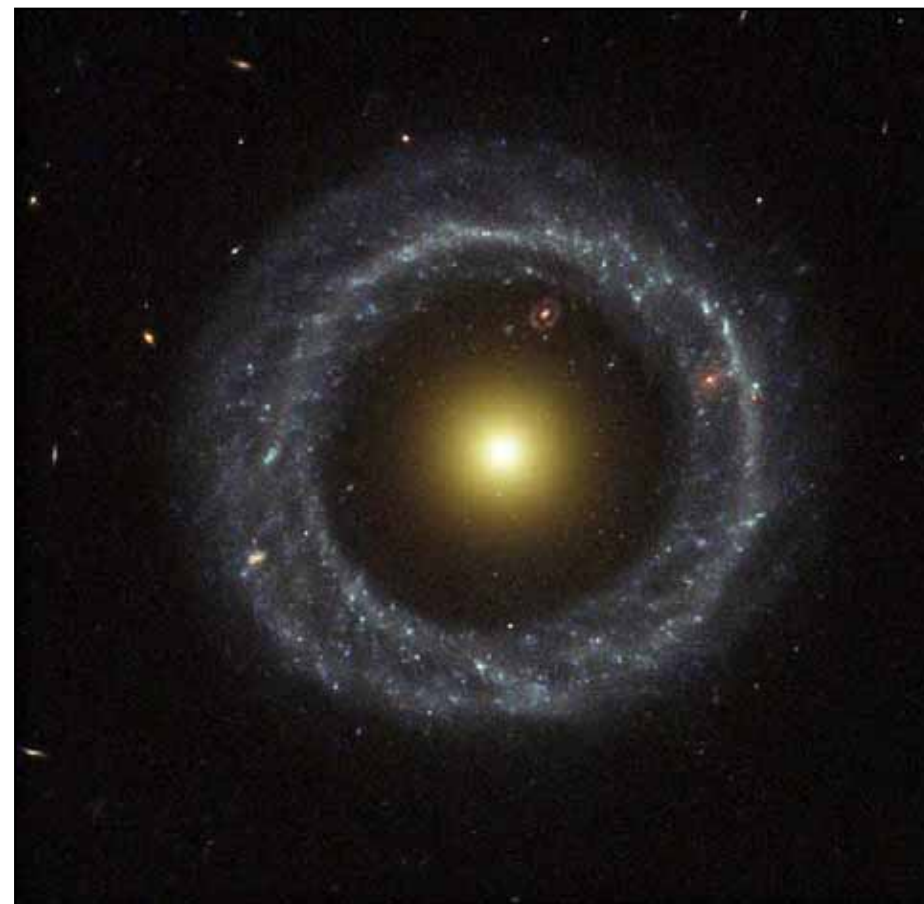


Figure 10. Hoag Object.

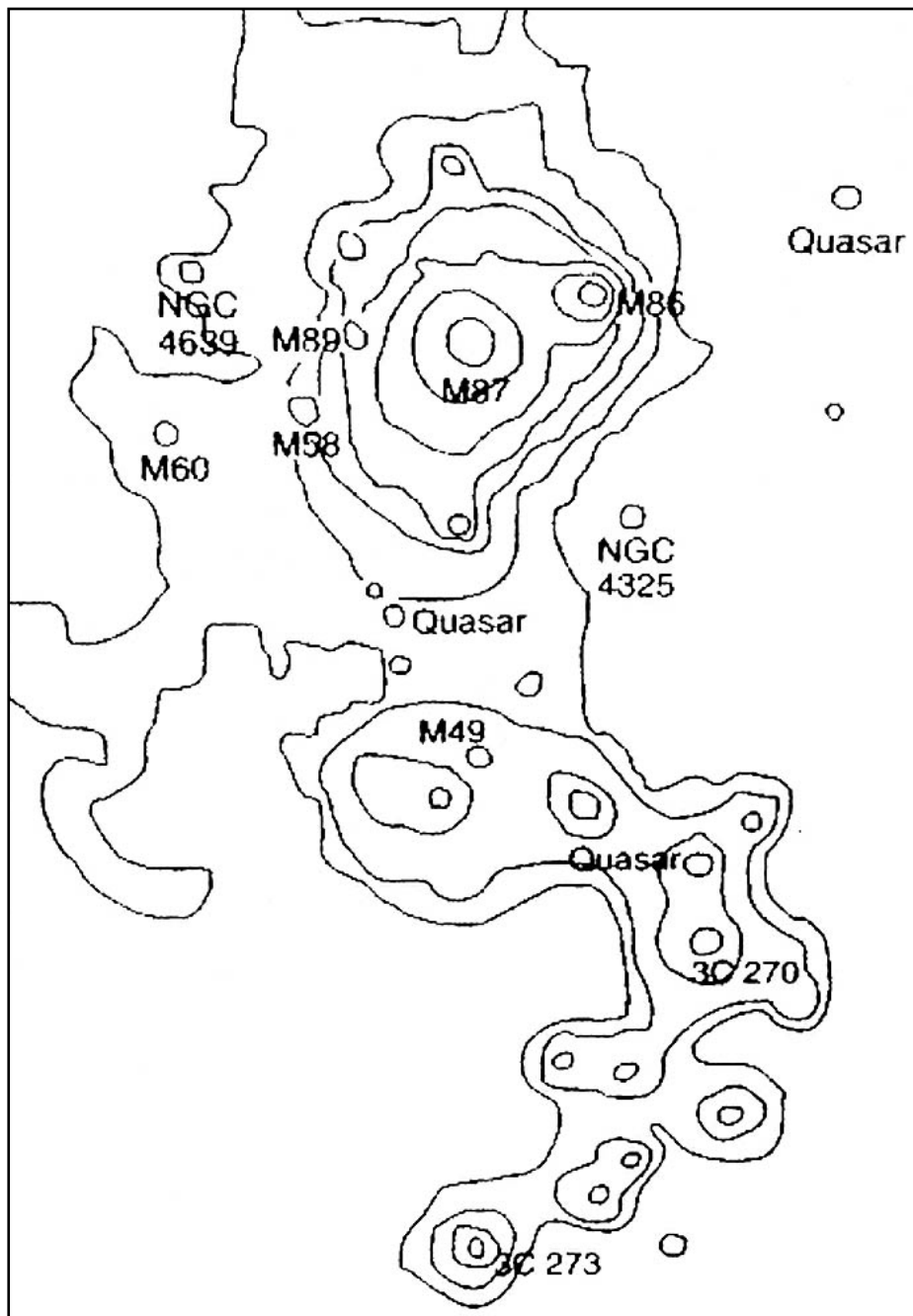


Figure 11. Virgo Cluster

NASA sources cannot agree on the degree of proximity of 3C273. One refers to a “relatively close quasar”, whilst the Hubble News Center makes reference to a “nearby quasar”. It has shied away from anything more definite. Certainly no measurement is given; nor do they even mention the dread implications. Gradualism at NASA is now a fine art. See <http://hubblesite.org/news-center/newsdesk/archive/releases/2003/03/image/b>. Regarding quasar 3C273, it says, in part:

“The ACS (Advanced Camera for Surveys) reveals a spiral plume wound around the quasar, a red dust lane and a blue arc and clump in the path of the jet blasted from the quasar”.

All typically vague, but still very revealing to the fractalist.

There is an alternative explanation of the extraordinary redshifts of quasars and other very high energy bodies which makes good sense of them, and a lot else besides. In the abstract of his paper published in *Astrophysics*, Ari Brynjolfsson takes a dissident view. He wrote about the redshifting of photons penetrating hot plasma as follows:

“A new interaction is derived... when the plasma is very hot and has low density, such as in the solar corona, the photons lose energy... (by) interaction with the electron plasma... This energy loss (‘plasma redshift’ of the photons) consists of very small quanta, which are absorbed by the plasma and cause significant heating. In quiescent solar corona, this heating starts in the transition zone to the solar corona and is a major fraction of the coronal heating. Plasma redshift also contributes to the heating of interstellar plasma and to the galactic corona. It explains the solar redshift, the galactic corona, the cosmological redshift, and the cosmic microwave background. Plasma redshift also leads to repulsion of photons in a gravitational field and, thereby, causes fundamental changes in the theory of general relativity”.

[astro-ph/0401420, Wednesday 21 January 2004]

This is tantamount to a wholesale rebuttal of both conventional cosmology and of much of twentieth century physics. Its great strength is that it allows quasars to occupy positions anywhere in space; no artificial relegation into the

outer reaches and no clashes with accepted physics.

The placing of quasars in remote space was never a viable idea; it even contradicts the big-bang assumption of a homogenous universe. Furthermore it poses the question of how and why they should have formed only in the past and not now.

Novae have caused difficulty too. Most cosmologists are presently celebrating the contrivance of a mechanism, supposedly explaining high intensity gamma ray sources, by the UK's Astronomer Royal. The most intense of these "Hypernovae" (yet another category of spatial object) were deemed to be both very distant, according to Hubble's law, and very powerful. So powerful, in fact, as to defy the laws of physics. But the eminent astronomer had a solution: he assumed that the radiation is focussed by a black hole, thus greatly reducing the energy requirement and staving off the fatal hour. He appears content to collaborate in the presentation of his speculation and to contradict big bang homogeneity.

Radical and unfamiliar concepts do not readily penetrate into scientific thinking, some never. Copernicus' ideas took fifty years or more before they were taught in the universities.

The new fractal picture could not be less like the old theory: a universe which is alive and organised from top to bottom.

Chapter 5

Electricity in Space

Making spatial fractals takes energy. The fuel has to have certain very special attributes. It must be able to drive a fast and supremely powerful machine in order to make the huge shapes such as galaxies and clusters. It has to have the ability to provide a feedback system capable of the crafting of the intricate patterns seen in all celestial bodies, and not least it must be able to bring about nuclear fusion.

One fuel to energise one supremely potent but delicate mechanism is the requirement, and it has to be available everywhere in space. The only qualifier, according to this already very tight specification, is electricity, but it has yet another talent: the unique ability to act at right-angles. Professor Richard Fitzpatrick at the University of Texas has this to say about the electromagnetic force:

"(It) is generally observed to create structure: e.g. stable atoms, molecules and crystalline solids. In fact, the most studied consequences of the electromagnetic force form the subject matter of Chemistry and Solid State Physics, both disciplines developed to understand

essentially static structures... Structured systems have binding energies larger than the ambient thermal energy... At temperatures near or exceeding atomic ionisation energies, atoms... decompose into negatively charged electrons and positively charged ions. These... are by no means free, they are strongly affected by each other's electromagnetic fields. Nevertheless because the charges are no longer bound, their assemblage becomes capable of collective motions of great vigour and complexity. Such an assemblage is termed a plasma."

[From his website notes to students]

Magnetic fields exert a sideways push or pull, the Lorentz force, on any current-carrying circuit. This trivial-looking snippet is summed up in Fleming's Rule which was devised to help electrical engineers to predict the direction of rotation of motors, but I posit that it applies equally to spatial plasma circuits, including galactic. In this one property lies the key to the fractal pattern of the universe, Mandelbrot's discovery.

In plasma, electricity operates at any of three distinct energy levels. The lowest fails to produce even a glow. The middle level causes emission in the visible portion of the electromagnetic spectrum, very useful in fluorescent and neon lights, and for illuminating nebulae and the aurorae. The highest energy state is most commonly seen in lightning and welding arcs, but it appears in such violent, spectacular shows as supernovae, active galactic nuclei, and solar flares. At a high enough current it fuses gas atoms, which in space usually causes plasma ejection [Figure 12].

All three modes cause electromagnetic radiation, detectable by radio telescopes. Not surprisingly, the third mode emits a very wide band of frequencies at high intensity, extending up to X-rays and gamma rays in quasars, stars, supernovae and AGNs.

The ions of the various elements travel in plasma filaments at speeds depending on their masses, the heavier being slower, the fastest being hydrogen. Separation of the elements with their different spectra so adds colour to the already beautiful shapes we see. This effect appears also to distinguish miniature Hoags from their surroundings in that galaxy (see chapter 11).

No wonder then that big bang dogma insists that hydrogen gas in space is neutral and impotent, and that electricity has no role. It is a dire threat. But there are still a few objective scientists. Dr Max Tegmark of WMAP fame and a

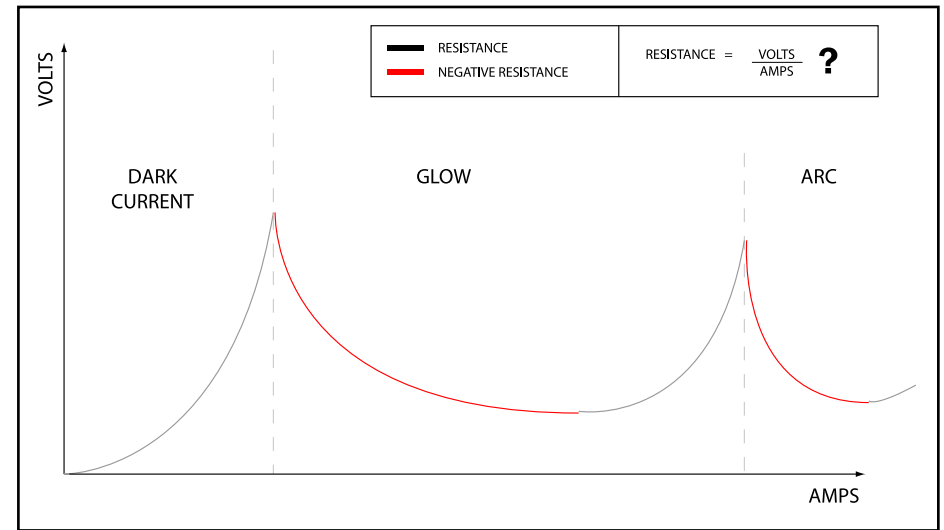


Figure 12. Negative resistance in plasma.

big bang supporter, told-it-like-it-is. His website says:

“Our entire observable universe is inside this sphere of radius 13.3 billion light-years, with us at the centre. Space continues outside the sphere, but this opaque glowing wall of hydrogen plasma hides it from our view”.

But he didn't seem to realise that this means 13.3 billion light-years dominated by electricity. See www.hep.upenn.edu/~max/wmap3.html

Measurements of the strengths of electric currents in spatial plasma range from tiny to trillions of amperes. The universe consists of little other than conducting hydrogen and helium; the heavier elements are scarce. The evidence is that electricity is the universal fuel, and plasma is the engine. This dynamic duo is uniquely qualified to shape the whole of creation. Nothing else gets anywhere near, least of all gravity.

Electricity, unlike fluids, can only move in circuits; any break and the flow stops. The gaseous plasma circuits in space, being no exception, take the form of loops. They come in all sizes; from the smaller looped/spiral arms of galaxies, to the giant conductors of superclusters, but they all obey the same earthly rules of electrical engineering and nuclear physics. Scale invariability applies, which is very handy since plasma physics has been a mathematically rigorous discipline since the 1950s.

Observation shows that the electrical loop/spiral is a talented builder of structures. They are all so made: the stars, quasars, supernovae, galaxies and the rest; they all are mere variations on a theme, with differences only in size and level of electrical energy.

But there remains a question, an important one. Why are there any differences at all? Why are all bodies not identical if they have been made by the same agency? The reply is that such behaviour is typically fractal. More on this later.

Gravity when considered objectively as a candidate for the role of cosmic driving force is hopelessly inadequate; it is simply too slow, too clumsy, and too weak. It plays a secondary role, such as in the gathering of the heavier products of fusion into planets.

When an electric circuit, including the plasma type, is broken the associated magnetic energy is released in an explosive burst, familiar in electronic and computer technology as a “spike”, but confusingly, astronomers and cosmolo-

gists refer to this interruption as “magnetic reconnection” [Figure 13]. Professor Richard Fitzpatrick comments thus:

“Magnetic reconnection is a process by which magnetic field lines suddenly change their topology; it can give rise to the sudden conversion of magnetic energy into thermal energy as well as the acceleration of some charged particles to extremely high energies, and is thought to be the basic mechanism behind solar flares.”

The behaviour of ionised gases in space is not governed solely by the rules of fluid dynamics. It is complicated by the presence of magnetic fields. This combination of influences, termed “magnetohydrodynamics” by Hannes Alfvén back in the middle of the last century, is receiving more attention, but not as much as it deserves.

Electricity’s very familiarity deceives us into believing that we understand it. But, like gravity, we know it only by what it does, much less by what it is. It is not matter: it is not merely energy. It is also a means of transporting energy across vast distances and at great speed. As radiation it is even faster; light fast.

It has unique properties, some reversible. So a generator may function as a motor, which is possible because a conductor of electricity makes a magnetic field, and conversely, a magnetic field moving past a conductor generates a current in it.

Studies of plasma have established that electrical conduction begins at less than 0.001% ionisation. Professor Fitzpatrick, quoted above, puts it so:

“Note that plasma-like behaviour ensues after a remarkably small fraction of the gas has undergone ionisation. Thus, fractionally ionised gases exhibit most of the exotic phenomena characteristic of fully ionised gases.”

Once established spatial plasma tends to pinch itself into filaments, and to gather up adjacent ions, which increases the pull. The ‘vacuum cleaner’ effect builds up, as long as additional, adjacent matter remains. It is a feedback mechanism and cogently explains galaxy walls and perhaps contributes towards the formation of voids.

For sheer size the sheet-like hydrogen fields announced by NASA’s News Centre in January 1995 takes some beating. What were formerly thought to be

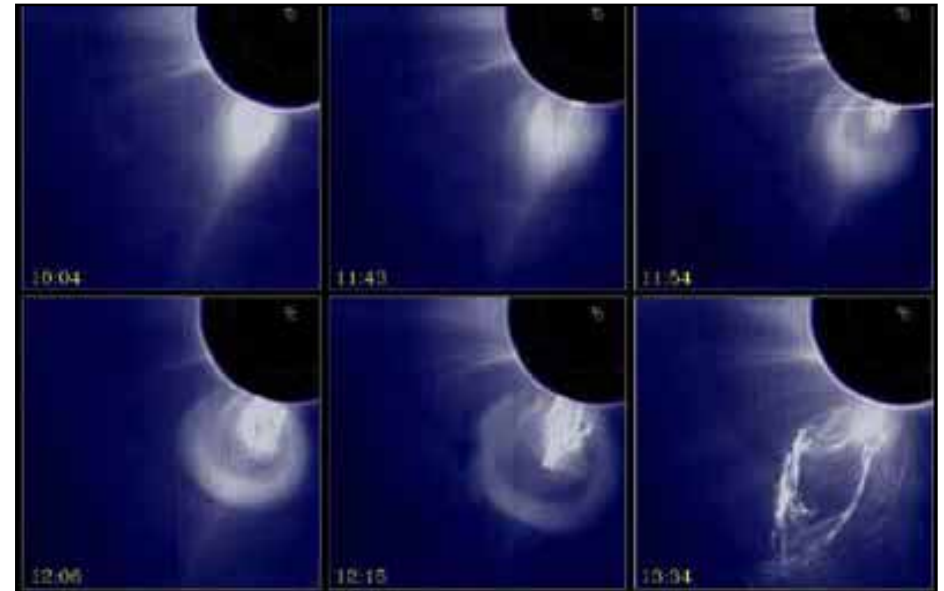
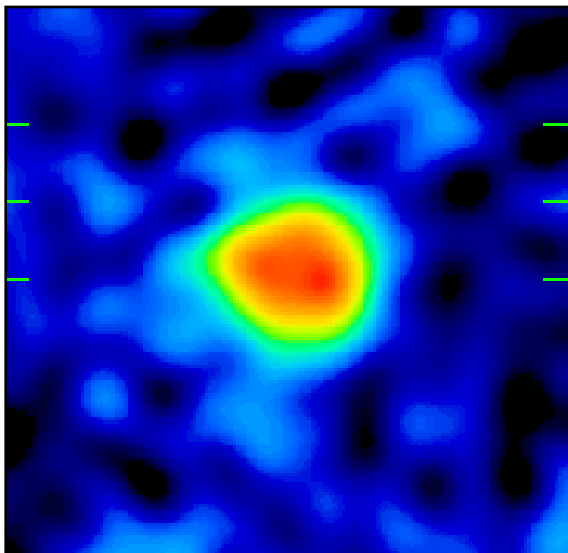


Figure 13. Solar flare.

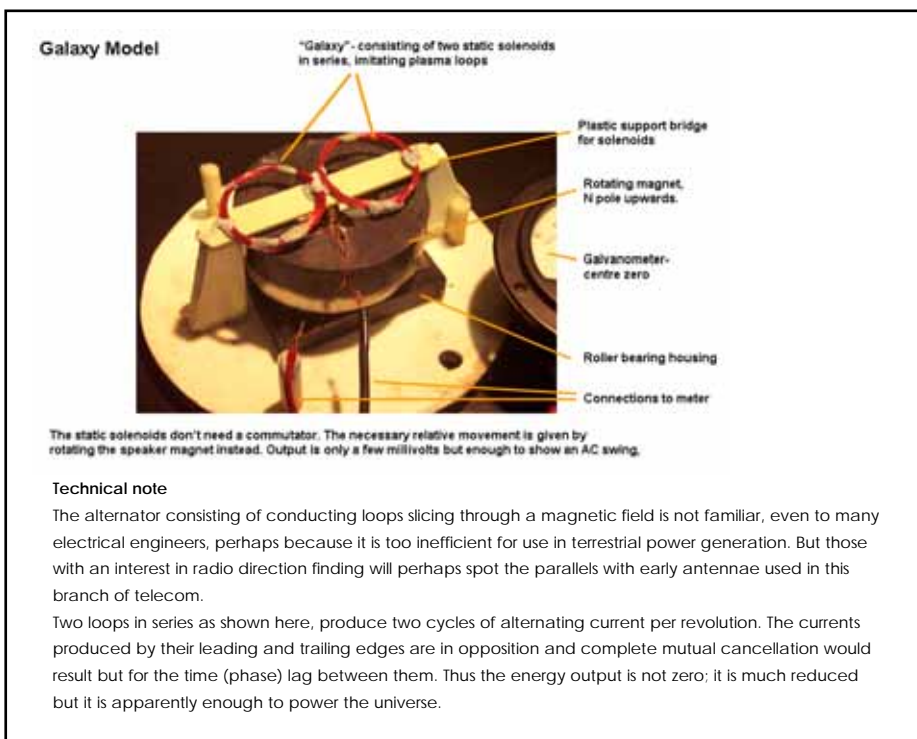


bulky clouds were reported to be nets of plasma filaments. One of the layers was reported as having been traced across a million light years of space. Such a huge ordered structure does not happen by chance and there is no known means for it to have been made by gravity (see chapter 8).

Lattices of filamentary conductors are so pervasive that space has been described by one scientist as “a plasma spaghetti bowl” [Figure 14]. The strands connect every known celestial object in an invisible electrical grid system. Before the advent of radio telescopes this was undreamt of. No exceptions have been found. Even the sun and planets are ‘plugged in’.

But what is the power source? Where are the ‘generators’ which drive the current round the circuits? The answer was provided decades ago by Hannes Alfvén. He observed that galaxies resemble Michael Faraday’s first primitive dynamo, albeit on a very different scale. It is simple to the point of crudity: a metal disc, making electricity by being rotated in a magnetic field. In a galaxy, the disc is replaced by a network of spiral/loop plasma arms but the effect is the same. Electricity flows into the centre where those sizzling Active Galactic Nuclei are to be found. No black holes needed, just a huge electric arc.

The electrical model explains, in one go, where all that energy comes from, why there are ejections of plasma, what makes AGNs and why the whole of creation, and the things in it, are the shape they are.



Figures 14, 14a. SN1987 (top), Galaxy Model (bottom).

Chapter 6

The Spiral Hierarchy

Long ago William Herschel saw evidence of organisation in space. Far more is now apparent to those prepared to look and to see. The elements of the cosmos are so interconnected and interactive that to try to separate them, even for the purpose of writing the chapters of a book, is confusing and artificial. Analytical methods in the examination of the fractal universe don't work. To consider any one feature in isolation is more likely than not to lead to error. Habit makes this far from easy to avoid but there is no other way.

The hierarchy of diminishing spirals stems from the shared formative process, which relies on repetition and which evolves variations, within limits. Nonetheless it is a continuum. Although similarity does not mean identity, the members are sufficiently alike to be recognisable as such. For instance, the Cartwheel, in spite of considerable differences, is classed with the galaxies, an ill assorted lot, which comprises dwarfs and giants, ellipticals (so-called), and spirals, and which overlap the nebulae.

So size difference is not a barrier to similarity. Indeed it is an intrinsic property of the universe as a whole if we are to call it "fractal". Just as adult humans beget infants, so our counterparts in space "breed" miniatures of

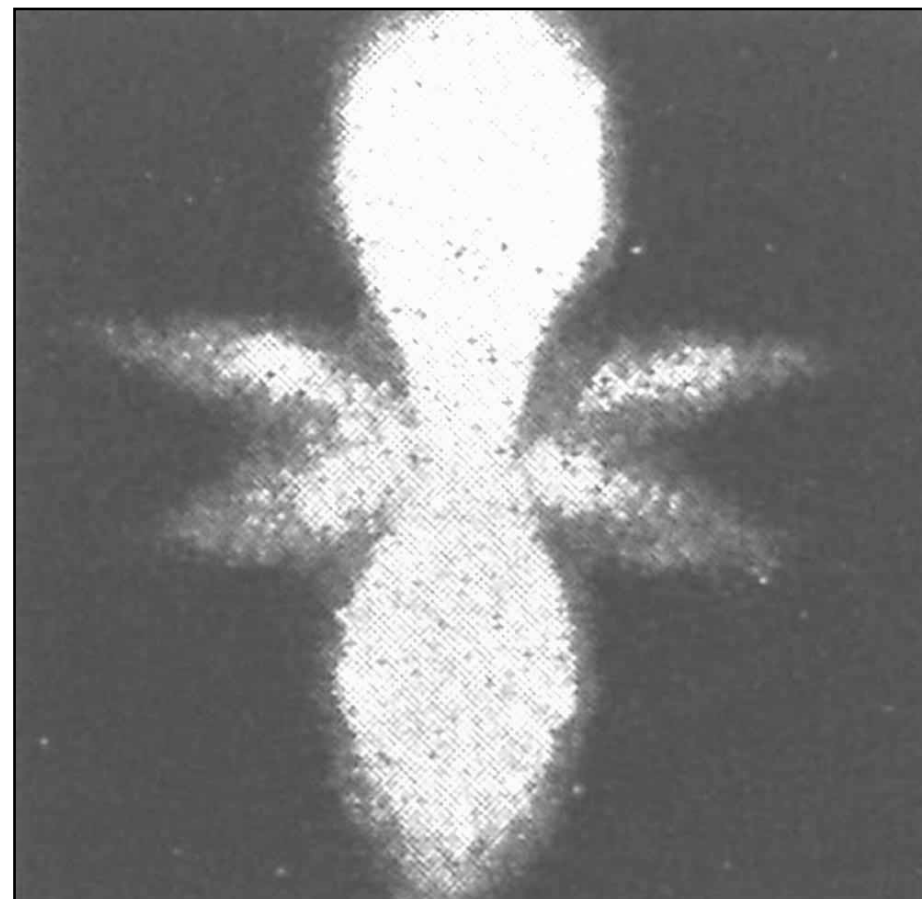


Figure 15. Schrödinger atoms.

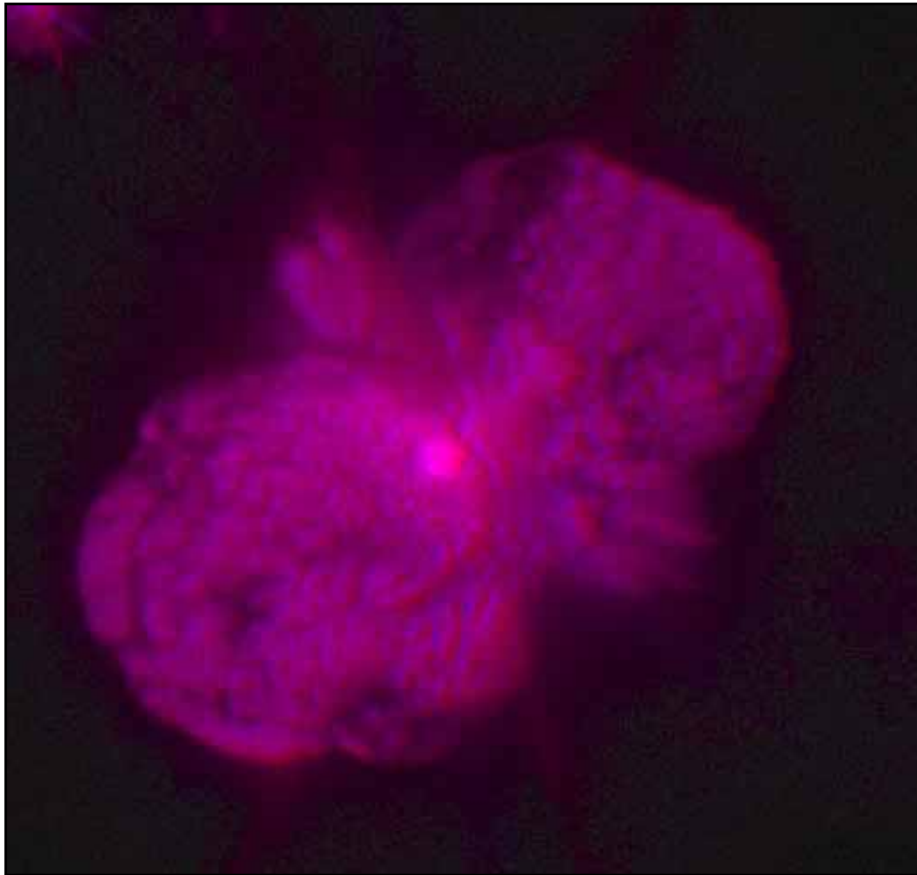


Figure 16. Eta Carinae.

themselves. Elliptical galaxies differ from spirals only in having a bright halo, resulting from higher electrical activity.

As Dr Anup Rej at Trondheim University says:

"...we need to abandon the concept of homogeneity that has so far been assumed in the making of cosmological models...Instead the matter distribution in the universe is believed to be a fractal characterised by a fractal dimension, (and in which) time has a different meaning to that believed in the context of the big bang model".

The question then remains of how far down the hierarchy reaches. Are atoms tiny flat spirals? Are they fractal?

Heisenberg showed that trying to probe inside an atom is a dicey business. His "Uncertainty Principle" brought an end to the notion that the universe is deterministic, prompting the adoption of quantum mechanics as a new, more subtle means of grappling with it. It recognises that "uncertainty" is a characteristic of the whole, and that the slightest intrusion can upset the works, including those of an atom. This describes the famous "butterfly effect". It was another broad hint that the universe is fractal.

Illogically, therefore, particle physicists use, not subtle and indirect investigation or ingeniously delicate tools, but powerful colliders, aka "atom smashers", to knock chunks off the target atom. Unsurprisingly, little more is understood now than fifty years ago.

So how can atoms be investigated without their disruption? James Gleick was clear, "look for the patterns", and chemists such as Dmitri Mendeleev did just that in the late 1860s with tremendous success. His periodic table showed periodic similarities between elements.

When arranged in order of atomic weight, similarities show up every eighth one. Others had had similar ideas, but Mendeleev's genius, the innovation which set him apart, was to recognise that gaps should be left for hitherto undiscovered elements; to have the courage to trust in the pattern. The gaps prompted the search for the missing elements. They were soon found because his table predicted their properties.

Chemistry progressed by leaps and bounds, but particle physics floundered and still does. Cosmology too will continue to stagnate until the patterns are sought; till professional cosmologists recognise that the universe is not amenable to simplistic analysis. It is not linear or deterministic; it is wonderfully

and gloriously unpredictable: it is gloriously fractal.

Lord Kelvin theorised that the stability of the atom is best explained by portraying it as a vortex and the organisation of matter into flat structures at all known sizes, their regular lamination and the latticed (bifurcated) pattern of hydrogen plasma sheets is typically fractal. So exploration of the idea of atoms as flat spirals, even though it is not a new idea, looked worthwhile. Furthermore the range of flat looped/spiral structures must continue all the way down in size if it is to define the universe. It must include atoms and even sub-atomic particles.

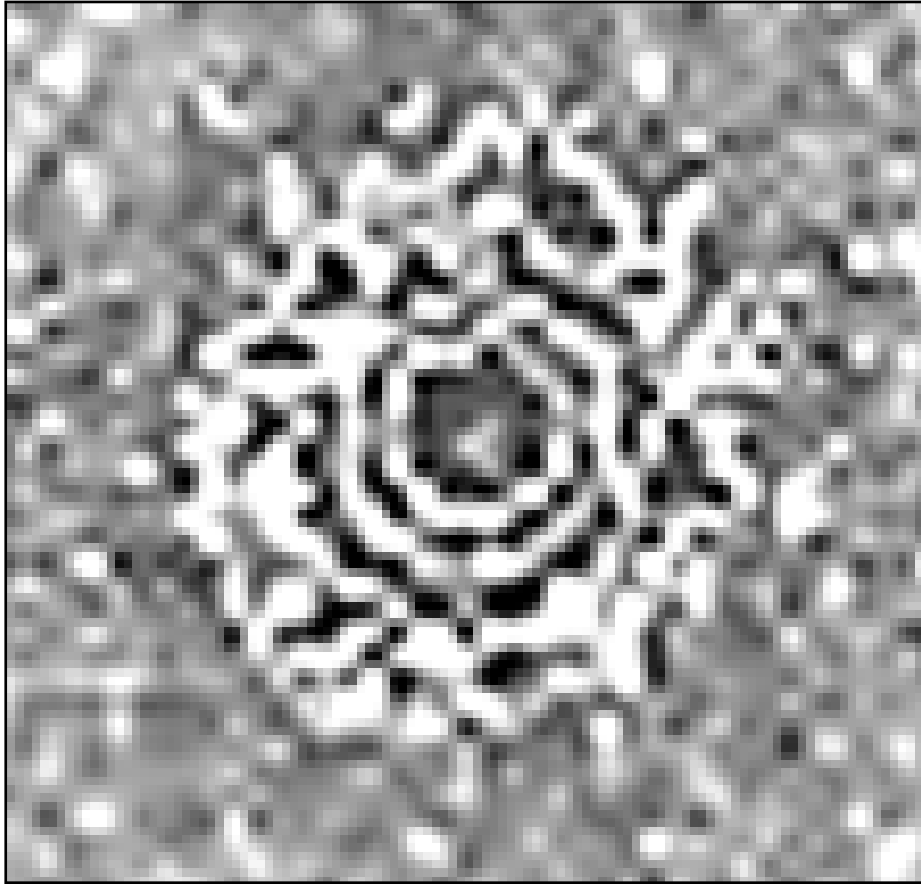
But Schrödinger's atomic models are represented as three dimensional, the exceptions being those of the lightest elements. See figures 15 and 16. The clash though is superficial, in spite of undeniable similarities between certain of his 3D atomic shapes and those of certain planetary nebulae. See www.amherst.edu/~rlolders/menu.html. On closer inspection there is room for both representations: the flat and the solid.

Schrödinger's calculations were necessarily based on the spectra of atoms in the ionised state (plasma), the only data available to him. This accounts for the similarities in shape between his atomic models and those of planetary nebulae but they only describe atoms in a temporary state of excitation: ions. About the undisturbed ground states they can tell us little or nothing.

Today we have the extra perspective of fractal geometry. Similarity in hierarchies allows us to draw comparisons not previously apparent. Consequently it is here suggested that the universe consists of a fractal hierarchy of two dimensional structures. Further it is posited that atoms and electrons, like galaxies and the other hierarchs, are habitually flat until energised.

This theory tallies with astronomical observation and with the theory of chemical valency. Excitation in celestial bodies makes temporarily turbulent bodies such as Seyfert galaxies, planetary nebulae and supernovae, whilst at the atomic level, comparably short-lived ions capable of chemical reaction are the result. Also it satisfactorily accounts for magnetism, including electron spin, whereas Schrödinger's three dimensional models do not. The overall message then is that the universe, both micro and macrocosmic, is not random; it is structured; all the way down.

So far so good but is there a galactic equivalent of the atomic nucleus? Do they have proton-like objects? At present there is no way of knowing. The best pictures of the nearest galaxy centre, our own Milky Way, shed no light. They show a tantalizingly familiar spiral structure, Sagittarius A, but seeing



to the very centre must wait for more refinement in radio telescopes.

Figure 17. Quasar.

Chapter 7

Large Structures and Morphology

As already noted, one of William Herschel's least heeded discoveries was that the galaxies visible to him, and known then in 1798 as nebulae, were not randomly distributed, but appeared to be deployed in a broad stratum, or strip, extending away from our own galaxy. The modern picture is not quite as simple as that, but he had revealed a stunning feature with vast implications. No mean feat, but he might have saved himself the effort.

The potent implication of Herschel's stratum, then and now, is that some huge and super-powerful mechanism must have been at work, an observation denied by orthodox cosmologists. Gravity, their strongest force, is simply not up to the job. Similar criticism can be applied to the traditional explanation of the clones within barred spiral galaxies. They are accurately concentric and co-planar, yet we are expected to believe that they result from collisions. Precision collisions indeed.

In the absence of an organising agency only random shapes can be expected to form. Repeating shapes, including flat sheets, cannot happen accidentally; nor can the mighty structure, extending across a huge expanse of sky, described by Dr. C.E.R. Bruce.

As early as 1968, knowledge of spatial structures was sufficiently detailed for him to be able to describe the nature of one of them in his report to the Electrical Research Association. He described the Virgo cluster thus:

"A vast super-galactic organisation of several hundred nebulae, in a system whose shape is visibly flattened".

In 1977, Benoit Mandelbrot alerted scientists to the fact that the then new maps of galaxy distribution showed typical fractal features and we are privileged that the computer age has given us the tools to explore fractal geometry as never before. Technology as usual spawns new ideas and stretches the intellect, but as in Galileo's time not everyone is willing to take up the challenge.

More recently, Brent Tully diplomatically pointed out that:

"Three remarkable properties of the large-scale distribution of galaxies appear to have escaped attention.....The structure in the vicinity of the Virgo Cluster that has traditionally been called the Local Supercluster, seems to be appended to a very large agglomeration. This very large structure is flattened with axial ratios of 4:2:1...there is a suggestion that the distribution of galaxies is stratified into four layers."

[Astronomical Journal, volume 303, 1 April 1986]

So Bruce's "supergalactic structure" is even vaster than he knew. The formation has been traced from Cetus, through Pisces Perseus, Coma and Hydra, to Centaurus and is in part a four-layer structure! But Dr Timothy Ferris wrote later, in 1992, with regard to large scale structures of the universe:

"Some superclusters evidently are flat in shape, as spiral galaxies are, but what this means is unclear... If the universe turns out to be built on fractal geometry or if... it consists of ever larger structures... then the assumption of homogeneity is false and the large-scale structure problem is probably going to be very difficult to solve. ...astronomers have probed six billion light years of cosmic space, turning up dozens of concentrations of galaxies... The regularities indicate concentrations of galaxies spaced at intervals of about 300 million light years... So it may be that they have finally found the limits to cosmic structure."

Here Dr Ferris clearly shows that he is familiar with fractal geometry, yet he ignores it. In implying that there are size limits to what counts as structured, he ignores fractal hierarchies, and his dismissal of the flatness of galaxies and superclusters, looks similarly suspect.

He might have commented that this pattern of flat structures, regularly spaced, and six billion light years deep is ordered and a tell-tale fractal, and that it contradicts the very basis of the big bang theory, but he did not.

Dr Ferris is tolerant of the failure of the big bang theory to make any predictions:

"We (big bang cosmologists) do not so much predict the future as account for the past".

Yet he allows no such excuses for rival theories:

"The Plasma model... has not yet made a prediction."

He was wrong. A team at Rome University, headed by Lucian Pietroniero is far more open-minded. Not only do they propose that there are fractal features in space, they have gone so far as to calculate the fractal dimension of the universe at 2.1; higher than Benoit Mandelbrot's figure of 1.23 but galaxy maps have improved dramatically since then. The report states that: "the universe is fractal on scales up to 300 million light years" [Figure 18].

Benoit Mandelbrot invented the idea of fractional dimensions to describe shapes which are between whole number dimensions. A straight line for instance is one dimensional, but a V shape is nearer to two dimensional, although not quite. He suggested that a useful description for such in-between shapes would be in-between numbers, and he gave guidelines on how to calculate them. Thus the lacy distribution of galaxies in so-called walls is broadly two dimensional. Being essentially flat meshes they are as much hole as substance. Thus the Rome team's figure. Flat clustering according to their researches extends all the way up to the largest scales. See <http://pil.phys.uniroma1.it/debate.html>

Plainly the organisation of galaxies on the supercluster scale does not reflect a three dimensional fractal geometry.

Radio telescopes are the up-and -coming tools. With each improvement in the technology, ever bigger structures have been found. Where this will stop is anybody's guess. Theoretically there is no limit.

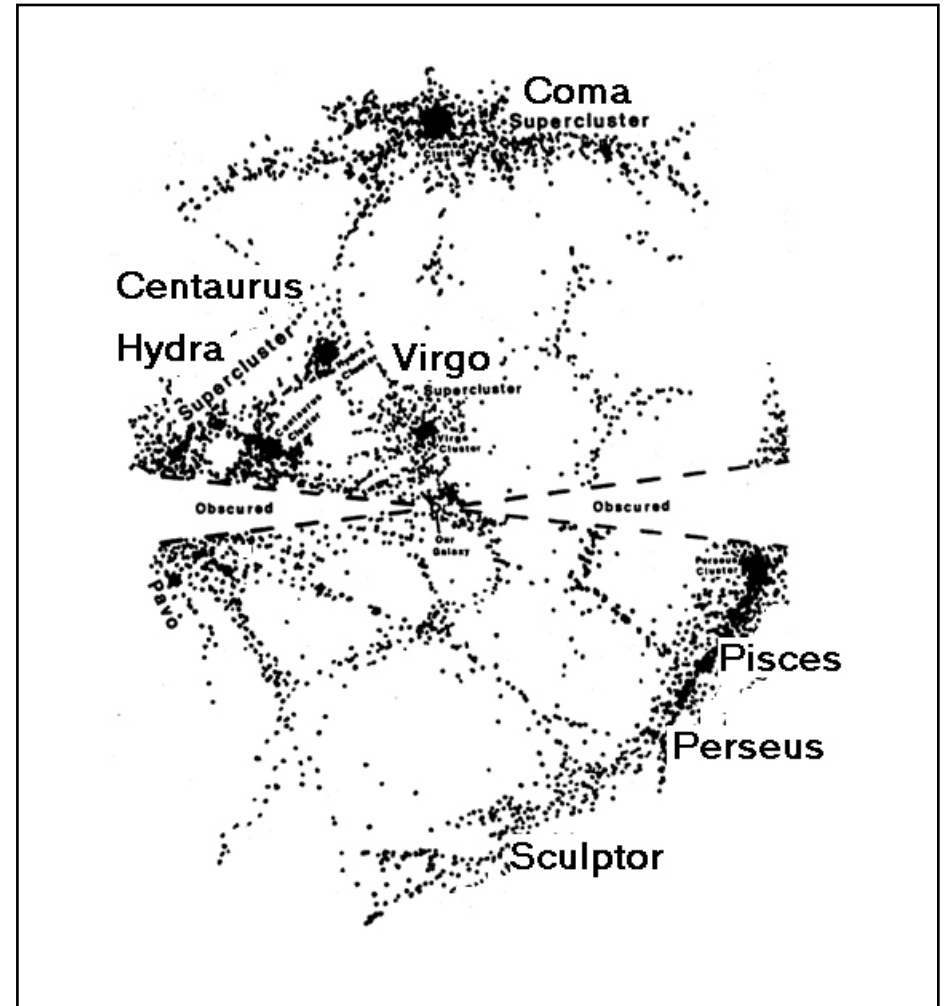


Figure 18. Fractal galaxy distribution.

The fractal features of spatial structures, including flatness, point to new lines of inquiry, not just in cosmology but in cosmogony also. The indications are that progress will be made only through the wholehearted adoption of the tools of electrical engineering and fractal geometry. Plenty is known about both.

Fractal theory did not come into its own until the computer age so it is not surprising that Dr. Charles Bruce made no use of its vocabulary in any of his papers. Nonetheless he clearly showed his grasp of its main points as they pertain to spatial geometry. With sound empirical work, he showed yet again the fundamental economy of 'Mother Nature'.

The simplistic assumptions and misguided strategies which are the basis for traditional cosmology have failed to reveal this, as Franscesco Sylos Labini, one of the Rome team notes. He pinpoints the weakness as:

"...the inappropriate application of analysis to the investigation of the fractal distribution of galaxies".

He maintains that orthodox cosmologists are mistaken:

"What they are seeing is an artefact of the way they analyse galaxy surveys. If the universe is fractal there is no characteristic scale. Everything, including average density, changes with scale, so the concept is meaningless. It's not surprising that people find the universe is homogeneous when homogeneity is one of their basic assumptions".

The ability of Bruce's theory to explain so many puzzles is a sure indication that he was on the right lines. There is the further advantage that it is easily checked out. The clarification of the making and functioning of every feature in space, from the bars of barred spirals to solar prominences, was just such an epoch-making revelation. In the light of his findings, even the most conservative critic should have paused for thought, but the majority has ignored his wisdom undeterred and unrepentant.

Chapter 8

Form, Flatness and Failure

The knotty problem of structure in space has been a constant and worsening headache for mainstream cosmologists. It stems from the hijacking back in the sixties of 'microwave background radiation' in support of the big bang theory. The payoff is that it spawned most of the major problems, then and since, and they will not go away.

The fractal geometry of space appears the same at any scale, and for this reason size has no real meaning. Pragmatism though requires that we make size comparisons in our own locality. Radio mapping shows a network of plasma filaments, with eddies at irregular intervals. At one level this pattern describes intergalactic strands dotted with spiralling galaxies, but the galaxies are made of lesser plasma strands, punctuated with spiralling stars. The picture is the same, up and down; lively, creative, purposeful, intricate [Figure 19].

Fred Hoyle put it like this:

"Instead of matter all the time becoming colder and more spread out, we often see it clustering together to produce swirling galaxies and exploding stars. Where is all the drive for this sustained activity

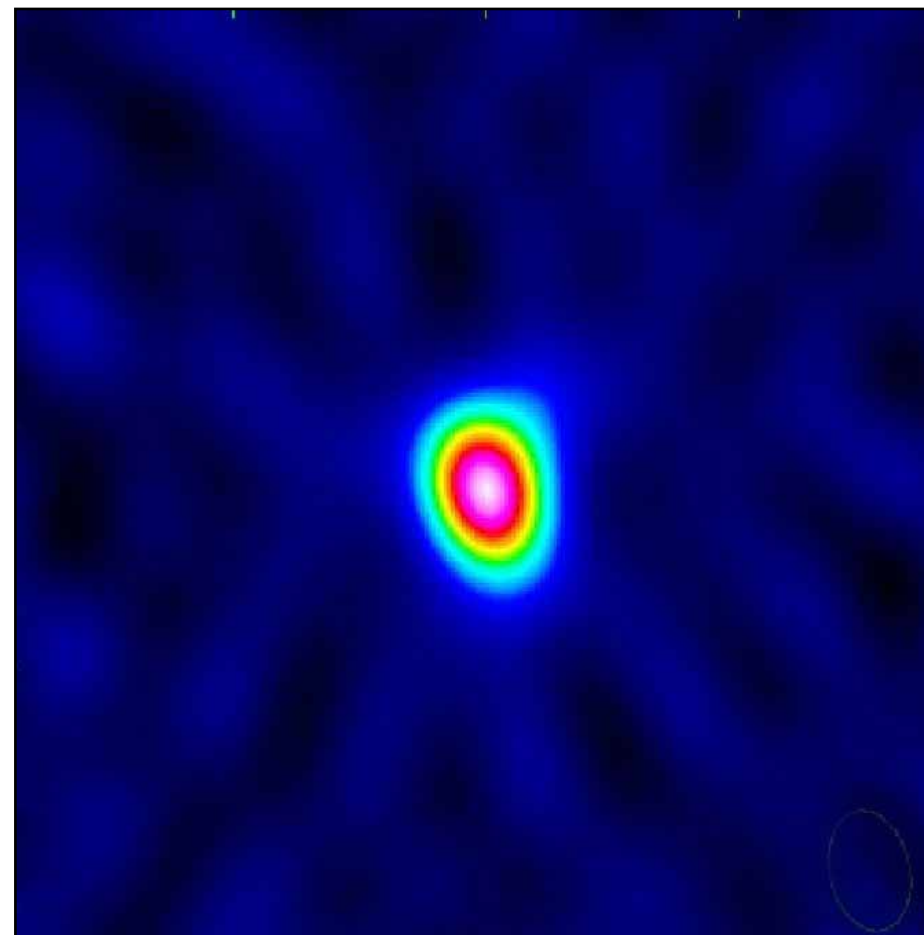


Figure 19. Betelgeuse in plasma mesh.

coming from?"

It is of little use to look to mainstream cosmology for the answer; its assumptions were faulty from early days. For instance hydrogen's smooth microwave radiation merely tells us that, because its atoms can both transmit and receive radio waves, it is self-smoothing. It is a pretence that it can tell us anything about the origins of the universe. So is the denial that clustering into large scale structures does not happen. As ever larger ones have been discovered, so the big bangers have ratcheted up the specification. It started with the denial of the existence of any structures at all up to the 1970s but by 2004, even a size of several million light years fails to qualify, in their eyes, as "large scale"

Size alone is, however, not their major headache; the combination of size and shape is. Structures in the form of flat sheets are being found in all sizes, as stated in chapter 7. Some are multi-stacked; a feature which is very difficult to deny or discount, even with their expensive propaganda machines.

Even the conservative Hubble News Center has been forced to give ground, albeit very carefully:

"Astronomers using NASA's Hubble Space Telescope have discovered evidence that clouds of hydrogen found between galaxies at distances of billions of years from Earth are at least ten times larger than previously thought - at least one million light years in diameter - and may have a remarkable sheet-like structure".

[Hubble News Center, January 19 1995]

No comment was made as to the significance of the shape.

Thus the decision to lay claim to background radiation was not only hasty, it became extremely expensive. From go, the discrepancies increased and even respected scientific journals began to smell-a-rat. By 1989 the prestigious science journal 'Nature' joined in the clamour. It was obvious that something very drastic had to be done at NASA to try to maintain credibility.

A microwave probe, COBE, costing millions was sent up to try to wrest something positive from the mess. The probe did not oblige. No substantial irregularities were found. The radiation looked exactly the same as it had back in the days of Penzias and Wilson, its discoverers. It remained embarrassingly smooth. www.pbs.org/wgbh/aso/databank/entries/dp65co.html

The propaganda claimed that this was just as expected. The project was

hailed as a triumph of scientific and technical endeavour, but it wasn't, and they knew it.

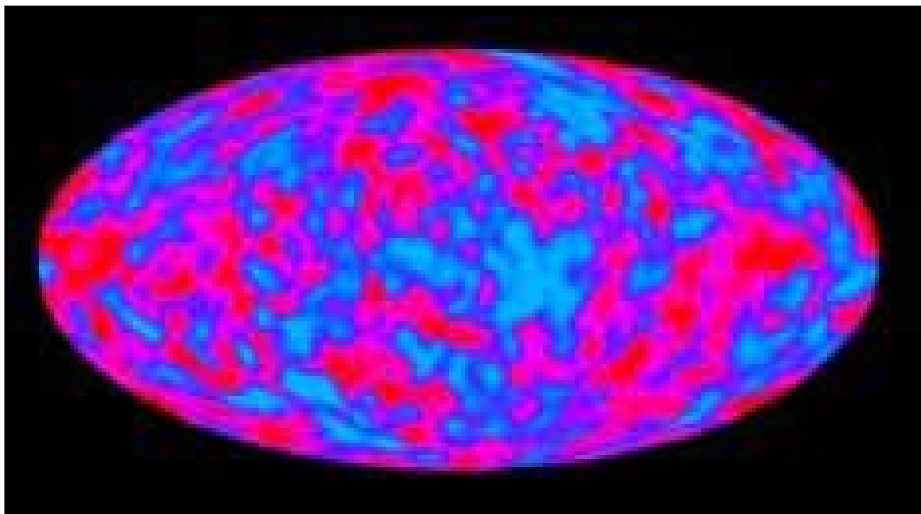
The reality is that NASA and the big bangers can't win in the long run, although they tried hard, some by foul means rather than fair.

George Smoot in his book "Wrinkles in Time" attempted to convey a picture of a brave scientific endeavour, but there are many gaps left for the alert critic to pounce on. The most glaring of these pertains to the COBE team's strange choice of equipment. They opted for a wide angle probe which raised questions as to how it had managed to resolve the fine structure shown in their map. Eventually it was rejected as bogus but the rest of their findings went mostly unchallenged. The critics were temporarily thwarted but NASA quickly and quietly began almost immediately to plan a bigger better probe. They knew the dire weaknesses of COBE. The choice of its unsuitable format was forced on them by the poor sensitivity of their electronic detectors: all the signal strength that could be squeezed out was needed.

Even this set-up was well short of satisfactory. The weak signals they sought to measure were lost; obscured by the internally generated hiss of the probes electronics. The signal-to-noise ratio was undeniably abysmal, but Smoot and his colleagues claimed that they could root out the signals from the mush; that is, that they had devised a method of retrieving the desired detail by means of computer wizardry of their own devising. But no details of this process were mentioned in the book. We are left to guess whether they used artificial intelligence techniques which are less prone to the hazards of subjectivity or whether they settled for the far less rigorous linear digital method, with its built-in susceptibility to bias and manipulation. Nobody outside knows for sure, but what we do know is that some very questionable claims were made judging by subsequent reports resulting from the later WMAP survey.

This second very expensive probe was sent up after an indecently short time, giving the lie to the claimed success of COBE. It is hard to avoid the conclusion, given the sequence of a NASA's actions, that it had been anything other than a wilful and misguided attempt to prop up the tottering big bang theory. WMAP would not otherwise have been necessary.

The new probe's data were portrayed as substantially the same as the old, and like COBE's, were given massive and triumphal publicity. In spite of their claimed agreement with COBE and tradition, two momentous departures had been casually included. The two additions portend no less than the eventual downfall of mainstream cosmology: Dr Max Tegmark, who did much to publicise



the findings, stated that the universe is not random and that the visible universe is bathed in plasma! This is heretical and tantamount to saying that large scale structures do indeed exist and that gravity does not dominate, but amazingly his show-stopper has not been picked up by the progressives, and disaster for the conservatives has been averted.

The meaningless COBE map [*Figure 20*], without coordinates, and without labels, drew heavy fire; the WMAP version was similarly vague, but most media including the BBC swallowed it, as always:

<http://news.bbc.co.uk/2/hi/science/nature/3753115.stm>

More recently other scientists have analysed the WMAP data with totally different conclusions [*Astrophysics abstract astro-ph/030746*]. See also <http://arxiv.org/abs/astro-ph/030746> which reports the detection of asymmetries, using wave analysis, and which contradict NASA's, conclusions.

NASA's rejoinder (2004) is that their findings have not been corroborated. Either way NASA and other big-bang supporters are in big trouble. If they insist that background radiation is nearly smooth it beggars the argument that it gave rise to spatial structures, now known to be very big. On the other hand if they concede that it is not smooth it contradicts fifty years of big-bang dogma.

Electricity, doing fractal things, can be observed by both radio and optical telescopes, everywhere in space. The application of its scale invariable rules is producing reassuring results and predictions. Induction-from-observation, the respected tool of science works well, as will be seen in the next chapter.

Contrivances and fabrications on the lines of dark matter, black holes, and anti-gravity are not needed to explain our superb, beautiful universe.

Figure 20. COBE map.

Chapter 9

The Mechanism: Plasma Ejection and its Products

The broad picture presented in this hypothesis is that the universe is permeated by a latticework of electrically-conducting plasma, and that the electromagnetic force rules the roost, but would-be researchers find that professionally published material about the role of electricity in space often betrays great ignorance of electrical technology. Solar plasma loops are misleadingly described as “magnetic”, when in fact they are electrical circuits [*Figure 21*]. The experts cannot even agree on the electrical workings of this, our own planet. See www.agu.org/history/mf/articles/Geomag20.html

Plasma in rivers is seen flowing everywhere in space, breaking up into whirlpools here and there and happily for science, its properties are scalable. There is every incentive for greater investigation and the foundations are good.

Maxwell showed that electricity and magnetism are inseparable, and the superior strength of the electromagnetic force, compared to gravity's, was established early on.

Hannes Alfvén's “magneto-hydrodynamics” described the combined properties of plasma and electricity and Dr. Per Carlqvist at the Royal Institute of Technology at Stockholm estimated the energy carried in galactic circuits at up



Figure 21. Solar plasma loops.

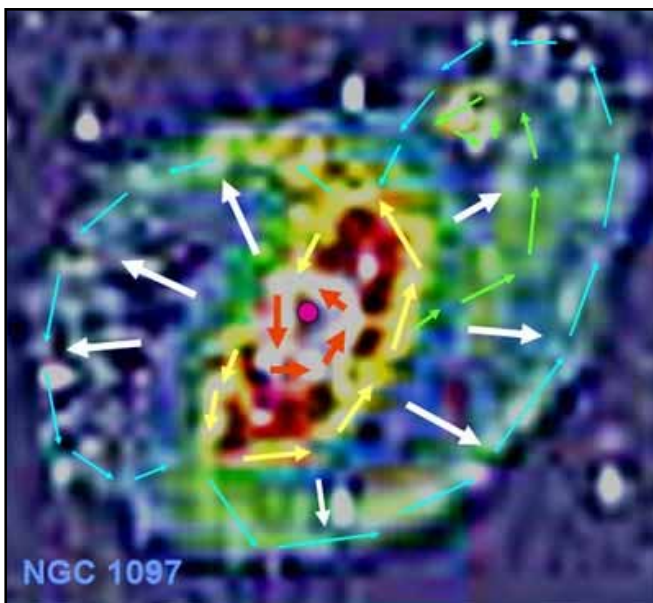
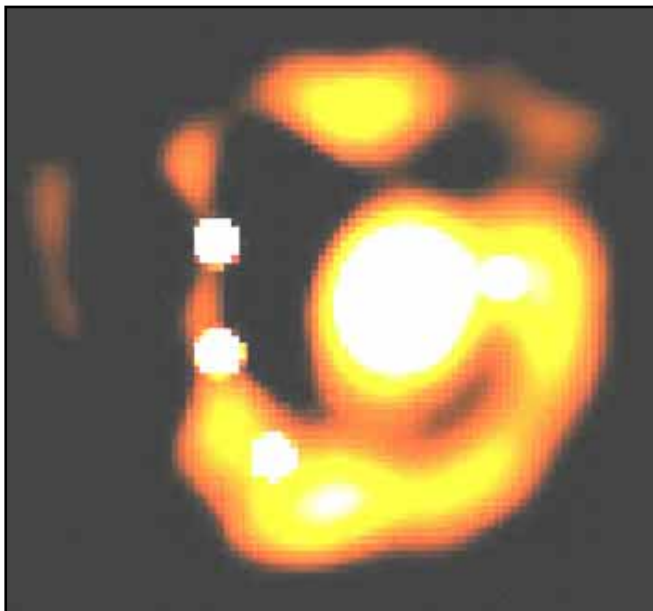


Figure 22. Protostellar object (top), ngc1097 growth (bottom).

to ten thousand billion amperes.

Fluids in motion form eddies, for no obvious reason. These pockets of stability survive amidst turbulence for long periods in spite of being buffeted about. Jupiter's 'Red Eye' is a good example.

A conductor rotating in a magnetic field generates electricity and a whirlpool of conductive plasma is no exception. This is the likely start of galaxies and the other celestial bodies (see chapter 12). Images of newly-formed spirals, such as "proto-stellar objects", show clearly how the process works.

The generation of electricity by rotation in the ambient magnetic fields gradually builds up a charge causing electrical stress and ultimate breakdowns. Each one of these "lightning" strikes is pushed outwards into a loop by the Lorentz force (Fleming effect), in a growing net or mesh, and Z pinch contributes by gathering in adjacent plasma.

This process which, it is proposed here, engenders all spatial structures is characteristic of Nature's frugality; it has striking similarities to the building of animal tissue, by cell generation. Electrical loops appear to be the cells of the sky. As with plant and animal growth it requires only a sufficient intake of fuel/food to ensure growth and birth. Even mutants and freaks, have a place. See Halton Arp's catalogue of strange galaxies www.bisque.com/thesky/tom/arp.asp

In the process the circuits pour energy into their cores, be they quasars, supernovae or active galactic nuclei; one model suits all sizes. If a sufficiently high current is reached, thermonuclear fusion will occur. More than one active site is common, as in the Einstein Cross which has five.

Galactic loops form relatively quickly but ultimately are subject to the Fleming force trying to fling them clear. Thus I suggest that contrary to traditional thinking, galaxies and the rest are not stable, explaining the formation of galaxy chains, and obviating the need for dark matter to supposedly hold them together. This propagation by seeding appears to be as essential in space as it is on earth for the continuation of the species [Figure 22].

The few and necessarily limited observations of the large scale organisation of matter in space tell us, albeit tentatively, that the cosmos is multilayered (see chapter 7). Putting it mildly this is a bombshell for mainstream cosmology. The verification of this highly organised deployment of galaxies is at a very early stage but the various reports tally very well, and no observer has so far denied it.

As reported in chapter 7, Brent Tully at Honolulu University found in 1986 that the distribution of galaxies within 75 Mpc of the earth is "stratified into four

layers”, and Alexander Szalay at Johns Hopkins has reported regularly-spaced layers out to 3 billion light years. Thus there is good reason to take the idea seriously and to look for a possible formative mechanism. The plotting of one such cluster can be found at:

http://arxiv.org/PS_cache/astro-ph/pdf/9610/9610047.pdf

The Fleming effect adequately covers the sideways seeding by galaxies and their resulting strata but it does not explain the vertical replication into the observed multi-laminations. What is needed in this case is a very specific process with a considerable degree of precision. It has to be able to spit out a portion of plasma at right angles to the plane of the parent galaxy clusters and to a distance very close to 300 million light years, the observed separation of galactic layers. Then the Fleming force can take over and the seedling plasmoids can grow and multiply to build the new layers.

Finding a mechanism with this specification at first sight looks impossibly difficult, but the contrary is the case. Such powerhouse galaxies as M87 and Cygnus A look very promising since they eject long thin plumes of gas. The latter is an immensely hot radio source which has long been spitting out twin, axial jets. With helical tracks, owing to the Lorentz effect, these have bulleted out to an enormous distance with a hint of spiral formation, revealed by digitally processing, in the ostensible turbulence,. Thus it is has good credentials as a long-distance disseminator, literally [Figure 23].

Our view from within this layer-cake of a cosmos is, unsurprisingly, panoramic: it stretches around 360 degrees of sky. Hence, zooming in should show, if my theory is correct, occasional plasma filaments, bridging the space between any two layers. More precisely, the filaments should link up pairs of large powerful bodies at their poles.

My predictions are based on professional mappings which at this early stage are inevitably far from complete. Thus it has to be admitted that my portrayal of the origins of this strange geometry is speculative, although it stays within the rules of science in that it is testable. The first test has shown some positive indications, including a possibility that a connecting filament such as mentioned above has already been detected. A galaxy map of the Southern Void on Brent Tully’s website, www.ifa.hawaii.edu/~tully/outreach/spv_ymxLBLD.gif, states:

“Adjacent, the major structures there are big voids... The South Pole Void... occupies much of the sky directly above the southern pole of the Milky Way Galaxy... The nearest wall comes within 40-50 million

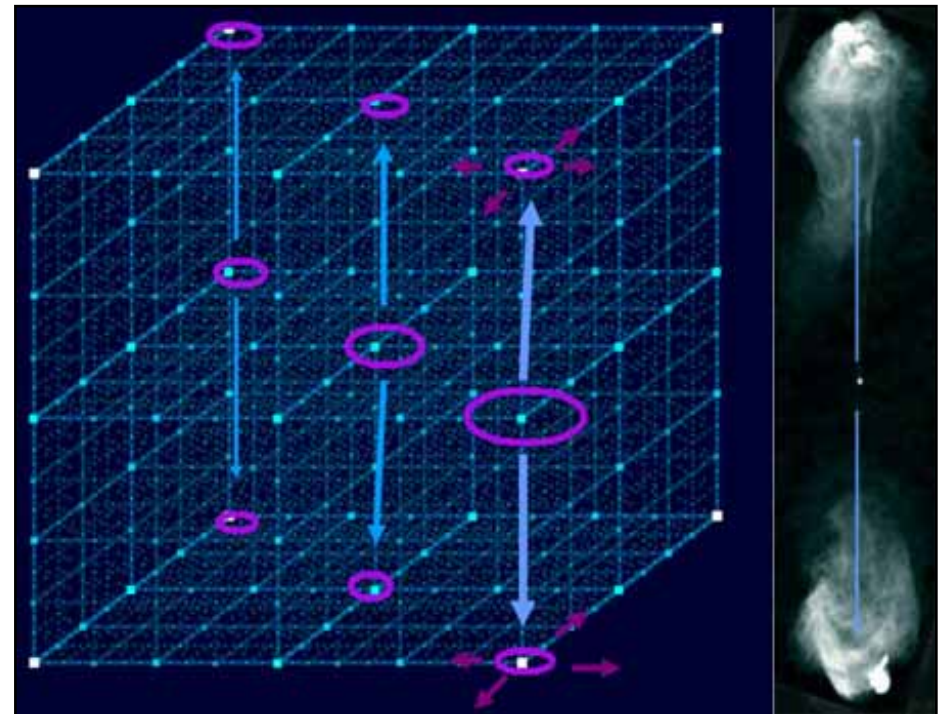
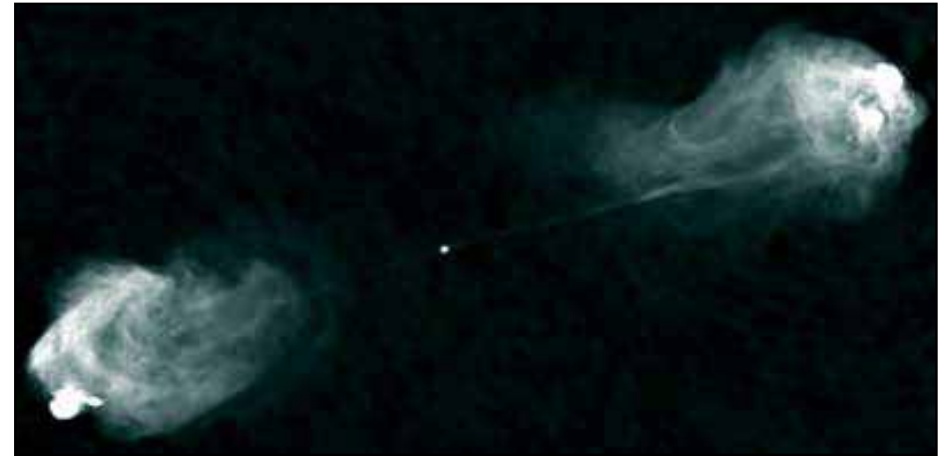


Figure 23 . Cygnus A (top), galaxy stack (bottom).

light years of us. This part of the structure has been called the Southern Supercluster. The far side roughly 300 million light years away is the Southern Galaxy Wall. In fact the 'void' is not entirely empty. There is a lacy filament that intersects it."

If this filament is found to span the gap between two layers, running from the pole of a big galaxy in the one to a corresponding galactic pole in the other, then the proposition will be vindicated.

I propose that, on the evidence, electrical cosmology has good explanations of many celestial phenomena: of the formation and inherent flatness of all structures, of the formation and irregular spacing between galaxies and of the formation and regular spacing of galactic layers.

Electrical activity in plasma is the essence of the universe. It makes the spiral building block, and it fuels the building process but above all it embodies the blueprint. No other agency could do it. No other force acts at right angles.

Chapter 10

Plasma Ejections and Supposed Ancient Origins

Plasma ejection then is not just a manifestation of galaxies, it is the universal, fundamental process shared by all celestial objects. The sun for instance, ejects plasma on a daily basis, which reaches a velocity of a million miles an hour by the time it gets to us. Even tiny Io was photographed sending a gaseous plume, with sufficient energy to reach miles into space. Comets Hale-Bop and Hyakutake, on occasion, go into ejection mode too, and spew multiple jets. We even have plasma ejections right here on home territory, very different to those of volcanoes [*Figure 24 and www.astrosurf.com/lombry/qsl-perturbation.htm].*

Witnesses of the catastrophic Tunguska (Siberia) event in 1908 reported hearing a quadruple explosion: an initial subterranean rumble followed by three explosions, higher up in the atmosphere. A storekeeper told of being knocked down unconscious twice. Destruction of terrifying proportions has clearly happened before in Siberia. Glass-like basalt surrounded by a wide skirt of tuff (like pumice) occupies an area stretching from the edge of the Russian Arctic Sea to just short of the Mongolian border.

Andrei Ol'khovatorov's website on the subject states:



Figure 24. Terrestrial ejection 'sprite'.

"From the geological aspect, the Tunguska event occurred in a rather remarkable place in the southern part of the Siberian platform. It was the place of one of the most powerful volcanic activity in Earth's history 250 millions years ago, a former 'hotspot'. The area is rich in various gas/oil and ore deposits, including rare earth elements, and platinoids. There are (diamond bearing) kimberlites in the region too. The upper mantle in this region has anomalous speeds of seismic waves."

One might object to the use of the word "volcanic" in this context since no significant crater has been found but he gathers in some very pertinent facts which are conveniently ignored by many theorists:

"Moreover there are peculiarities of the Tunguska forest fall, which can not be produced by any known type of a space body fall: an effect of rotation of fallen trees in the epicentral area. The rotation achieved 5 degrees clockwise in the epicentre, decreasing to negligibly small values at about 16 km from the epicentre. So the field of the mean directions of the tree-fall is the vortex one. In other words, the hypothetical Tunguska space body explosion's shock wave was to transfer a very large angular momentum. But such explosion couldn't produce it due to a law of conservation of angular momentum. One more puzzle for the space body interpretation is the area of the forest fall on the ridge Chuvar, which is about 23 km from the epicentre, and according to the local Events had formed the same morning as the general one. The peculiarity of this forest fall is that trees were uprooted with their tops in the opposite way to what was expected from the meteorite fall direction.

The tree burn in the epicentre is a remarkable and important aspect of the Tunguska event. Indeed some cases of the ignition of wood bedding were reported up to 34 km from the epicenter. So the burn should have been many times stronger right in the epicenter, and everything alive would completely burn into ashes at the epicenter.

In reality many groups of trees survived at the epicenter. Moreover, some single standing trees in open places of the epicenter had no visible traces of the burn!"

[Please note that I have made a few minor changes to the text to make the authors

Ol'khovатов goes on to say:

"Simultaneous realization of all these geophysical phenomena together with Tunguska as just pure accidental coincidence is very unlikely. Remarkably, on small scales similar geophysical micro-Tunguskas occur rather often. The exact physical mechanism of Tunguska event is still disputable. In my opinion electromagnetic phenomena play large role in it. You can read my detailed Tunguska story at <http://olkhov.narod.ru/tunguska.htm>."

The thrust of this scientist's theory is that the Tunguska event is mainly electromagnetic in nature and not an isolated case. He also states that it was an internally made explosion with spiral manifestations. In spite of his rather fractured English his website is well worth a visit.

As he says, there are instances of possibly related phenomena. One such took place at Pusalu (Beijing) in 1999. Many onlookers saw a brilliant gold light which they variously reported as "like a person (or Buddha) rising to heaven". It is likely that an ejection to a great height took place involving destruction to surrounding trees and plants for miles.

In Spain in early January 2004, several thirty centimetre holes, belching vapour, appeared in the ground. At the same time "lights in the sky" were seen, but scientists pronounced that the two were not related. How could they be so certain?

There are enough websites about these phenomena to make any detailed treatment unnecessary here. Suffice it to note the basics; that they do not resemble impacts, the conventional explanation, and none left a crater.

The Dumbbell nebula is traditionally represented as the wreckage from an explosion: a popular get-out with mainstream cosmologists for explaining away those things which gravity fails to deal with. The object is said to have died explosively, followed by inactivity which allowed gravitational settlement and compression into a perfectly smooth sphere, supposedly a super-heavy "white dwarf" star.

But none of this agrees with observation and logic. Why should an explosion leave a central star if that is what it is? If the nebula were in fact composed



Figure 25. Central star in M27 'Dumbbell Nebula' (top), Einstein Cross time-lapse (bottom).

of dust and debris, we should surely expect a dismal scene, an amorphous and chaotic graveyard. Not so. The overall shape has symmetry and is dominated by twin opposite ejections, with twin electric arcs akin to galactic arms. Zooming in on the high resolution image from ESO shows a busy scene, with electricity doing its familiar, organising job. Across the whole nebula there is a lacy pattern of plasma filaments, connecting its numerous stars. They all have plasma loops like the sun, which everybody agrees is alive and well. It could hardly look more frenetically and electrically alive [Figure 25].

The same applies to the Crab Nebula which purportedly has a "neutron star" or pulsar in the middle. Examination of the composite image from the Chandra photo album shows in great detail a spiral object with a highly active core. Its pulsation is typical of electronic oscillators (see chapter 12).

Detailed examination of high resolution images of the Rectangular Nebula leads to the same conclusion: that it is the site of creation rather than of destruction. Its central region shows evidence of several ejections at right-angles.

The Einstein Cross has been hyped by those over-anxious to promote the idea of "gravity lensing". Adjustment of the brightness of the Hubble image reveals it to be what one might expect in the middle of a galaxy, an AGN. Five ejecting cores are seen with a halo of plasma latticework. Pretty standard in an electrical universe, but not in the old one.

The Einstein Cross movie from NASA would show ejections and fluctuations of its electrical fields if its makers had not made it so very dark. A few moments of computer work, increasing the brightness, is all that is needed to reveal detail not even mentioned by the 'professionals'. The NASA analysis has it that the four outer cores are four images of the same distant object, focussed by the closer central 'lens', but this is impossible. Their own time-lapse movie (left) shows a plasma bridge between the central core and core C and the rest are seen to be taking turns to glow brightly: obviously they are five independent bodies.

The chances of a gravity lens focussing the image of any distant object exactly at the earth's surface where astronomers can see it is very small. Simple probability tells us to expect very few, but thousands have been claimed by big-bangers. Very few hold up under close scrutiny.

Flares, in whatever type of object, are short-lived as the name suggests. More likely is that they signal fusion and ejection, axial or lateral, and the onset of birth and building. Ejection is apparent all over the cosmos.

Transient phenomena on the Moon hint that even this barren looking place is not yet dead. It may not erupt in flamboyant style like Io, but its frequently observed, luminous patches tell the real story. Being connected electrically to the rest of the solar system it could hardly be otherwise. Evidence of lunar plasma discharges is to be found at www.electric-universe.org/

Surveying all the evidence it appears that plasma ejection is part of a positive process. We should not allow ourselves to be deceived by the showy flare-ups; they look more like birth pangs, than death throws. It is the start of a process which shapes everything in the universe, no less!

Supernova 1987 has built its two outer loops and the impressive centre loopy structure in less than twenty years [Figure 26]. The middle even resembles the Cartwheel Galaxy in shape (but of course not in size). This spoked-wheel shape crops up everywhere in every size.

Large-scale and complex organisation, has taken place in a very short a time, indeed in less time than it takes to grow most trees. On its own this conclusion is revolutionary enough but there is no good reason to think that it does not occur universally and routinely! But if you would prefer the explanation of an "expert" at NASA:

"...HST has ...imaged a pair of rings of glowing gas (in)...Supernova 1987. One possibility is that the two rings might be 'painted' by a high energy beam of radiation or particles, like a spinning light-show laser beam, tracing circles on a screen."

Take your pick.

Equally swift events are going on in quasars. Dr Halton Arp, in the epilogue to his book 'Seeing Red', comments on swift, violent behaviour spotted by an Australian team:

"...large variations in radio wavelengths, in less than an hour in a quasar. This marked the size of the energy emitting region as less than a light hour in diameter. At its red shift distance the luminosity of the quasar was so enormous that it made the surface brightness incomprehensibly large".

Much traditional dogma makes no sense in the light of not just recent



Figure 26 . SN1987.

findings, but of older knowledge too. Instead of an aeons old, unchanging universe we are starting to glimpse a dynamic fractal cosmos, with constant and continual modifications, additions and deletions. If the complex internal structure of a supernova can be laid down in sixteen years then we have reason to ponder just how short a time it takes to make a galaxy, or a cluster, or a supercluster, or the universe.

Chapter 11

The Sun, Other Stars and Planets

Scientists and public alike were overawed, in the early days of its discovery, by the barely imagined power of atomic energy. It was all too tempting to see in it the complete explanation of the sun's activity. It looked potent enough to be the only source of its energy.

But the evidence was and still is to the contrary. Many discoveries over decades have shown that the assumptions are very flawed, and there are now more anomalies than explanations.

The sun, we are told, is a typical star, lying as it does in an arm of the Milky Way Galaxy. It resembles those in other galaxies and therein lies the tremendous potential for scientific investigation; we have two perspectives, the local and the distant. But there is a further, much more powerful tool available to us. If the universe is indeed fractal, the sun gives us a golden opportunity to study at first hand a paradigm of even the most distant galaxies and all the other celestial bodies.

The sun, being so close a stellar specimen has allowed detailed scrutiny, but perversely much observation has been ignored or dismissed because it failed to fit in with convention. Again no role was assigned to electricity, and the comfortable assumption had been made by mid- 20th century: that the sun was



pretty well understood, along with the other stars, and that barring a few unimportant and temporary difficulties, its technology had been cracked.

It began with Sir Arthur Eddington's model, which became the foundation, almost unchanged, of the current one. He assumed that the sun is a product of gravitation alone, that it generates its own atomic energy, and that it receives no energy from outside. Much of the evidence then and later says that all these assumptions are wrong.

For example NASA's APOD (Astronomical Picture of the Day) for 29th November 2001 shows a plasma flow into the sun, close to the pole, much like the auroral inflow to the earth. The sun is patently not a self-contained powerhouse but no reappraisal has been made since.

Even massive long-term swings in its energy output seem not to have provoked any anxiety among the professionals as to the validity of the traditional model. The Maunder Minimum, for example, was the time between 1645 and 1715 when the sun made no sunspots and its output was so reduced as to cause the "little ice age". By contrast the 12th century saw a long term temperature rise, involving gross terrestrial climate changes. Professional opinion differs widely as to the explanation.

The relative coolness of the sun's photosphere is an equally intractable puzzle. It is sandwiched between the sun and its corona. Both are very hot. According to mainstream theory, thermo-nuclear heat travels outwards, from the one to the other, without unduly heating the photosphere in between! Explanations of how this happens range from the inadequate to bizarre.

SOHO movies of the sun have a graphic message which is mostly ignored. They show with great clarity plasma loops visibly generating heat at their tips and at their roots, that is, at low and high altitude, but less in between. Iosip Shklovsky's demonstration in the 1940's that radio waves emanate from the ionized layers of its corona carries the same graphic message [Figure 27].

The sun's episodic variation, including switch-off, is typical fractal behaviour. It is the key to understanding the sun. Once it is taken into account the sun begins to look a lot less of a mystery. There is much more to be learned; once the pattern-spotting approach is adopted and similarities are sought out.

The Sun's Main Properties:

1. It appears spherical.
2. It is hot and very bright.
3. It is central to the flat solar system.

Figure 27. Solar loops.

4. It rotates a lot slower than expected.
5. Its corona is much hotter than its photosphere.
7. Activity is seen mostly at the middle latitudes.
8. Its e.m. radiation is wide-band.
9. It receives a plasma inflow towards the pole.
10. It emits fewer neutrinos than expected of a nuclear furnace.
11. The solar wind is flat and is ejected equatorially.

And most importantly

- 12 It is clock-like (periodic) and is oblate (flattened) in shape.

The first three of these cause no headaches for traditional science, but the rest are bothersome. By contrast all except the first support the electrical model. The sun has all the attributes of a flat spiral generator except one: it looks round not flat. Could it perhaps be a disguised member of the flat spiral hierarchy? There is now good reason to think so. Its apparently perfect sphericity is deceptive; recent measurements show that the sun is flattened, not by much, but enough to provoke comparisons with other stars:

1. Alpha Eridani is an oblate supergiant star. Like the sun, it is not spherical, having a diameter of one and a half times its height, a large degree of flattening according to its investigators at ESO. (See *Astron. Astrophys.* 359.695-706(2000)). The authors expect this ovoid shape to apply to all B[e] supergiants.
2. It resembles elliptical galaxies, even down to the dust rings, which have been shown to be spirals. (See below.)
3. As well as having circumstellar discs, supergiant stars emit strong plasma winds, like the sun.
4. Another massive star, in the Small Magellanic Cloud, ejects plumes of plasma at its poles like some elliptical galaxy! (See *astroph/9912017*.)

Another piece of the puzzle is that elliptical galaxies which can be digitally inspected (being face-on) are in fact spiral. The true shape is obscured by the glare of central fusion. A first class example appeared as "Astronomical

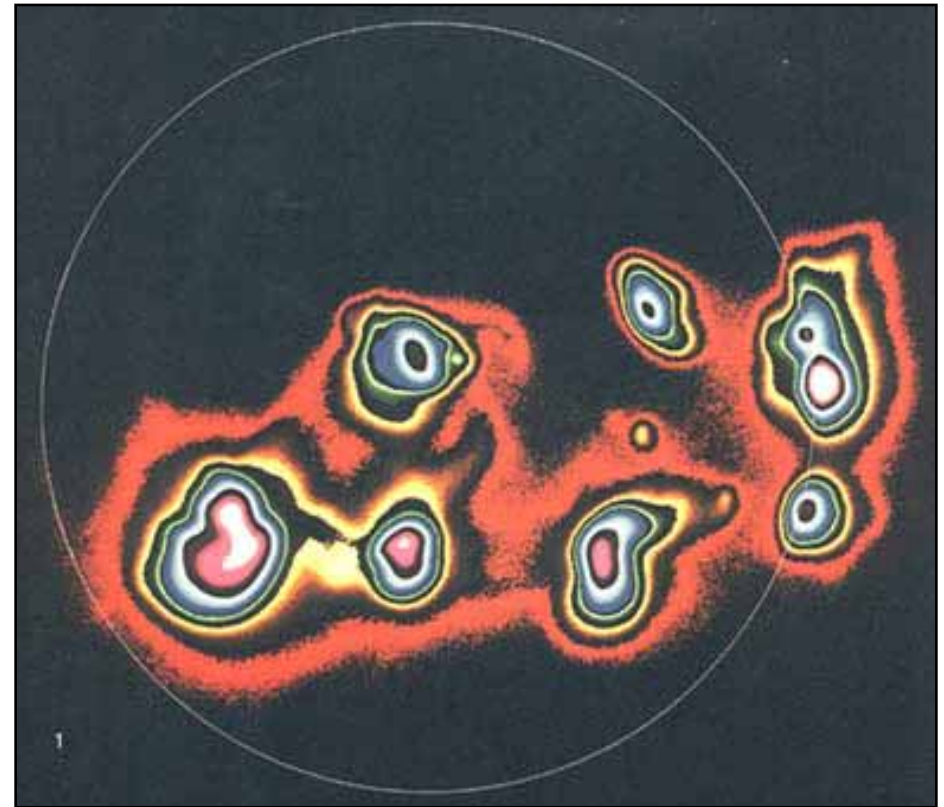
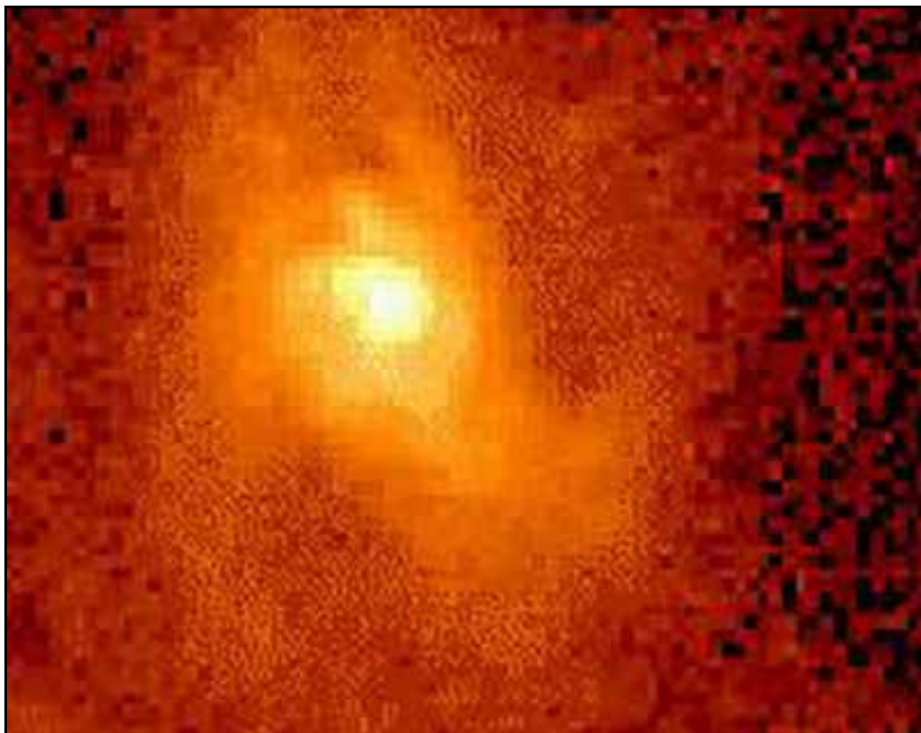


Figure 28 . Solar x-ray.



Picture of the Day", courtesy of the European Southern Observatory, on 2nd June 2000. The NASA authors of its caption expressed their surprise at the finding of a spiral structure in an elliptical galaxy, IC 3328, which didn't do them much credit since Cambridge (UK) University's Institute of Astronomy 1996 website had carried the Headline and caption:

"HUBBLE OBSERVES SPIRAL GAS DISK IN ACTIVE GALAXY.

A NASA Hubble Space Telescope image of a spiral-shaped disk of hot gas in the core of active galaxy M87" [Figure 29].

Significantly they did not ask the question: "How many more are there?"

Further evidence supporting the idea of a flat, spiral/looped sun is the localised distribution of its sunspots in the lower latitudes. The higher the electrical energy, the greater the Lorentz effect, and their confinement towards the equator (left bottom). Cooling towards the poles and its flat solar wind are both cogently explained too.

The most telling evidence, however, is its slow rotation. Its low angular momentum, only about two percent of the rest of the solar system's, is perhaps the biggest problem for the traditional model. We are led to believe that it is a purely gravitational body but if this were so it would go a lot faster. The anomaly remains.

The electrical model has no such difficulty. Any electrical alternator, or generator, experiences magnetic braking, the electrical version of friction. The energy of momentum is lost by conversion into electric current. Electric trains use exactly this principle for added safety. Switching the drive motors, to act as generators causes extra braking.

The sun shows periodic behaviour, as do Cepheid variables, RR Lyraes, and pulsars. They all show fairly accurate clock-like behaviour which defies explanation within the confines of the gravity-ruled cosmic theory. Attempts have produced some of the most outrageous speculation of all.

The favoured explanation for pulsars for instance has it that they behave like lighthouses. They are assumed to emit a highly focused pencil beam of light which, by means of an assumed wobble of precession, sweeps the sky at regular intervals. The means to this focussing is left in obscurity.

The electrical model proposed here suffers no such constraints. Suggested is an electrical clock whose mechanism works in all sizes. Small ones tick fast, big ones tick slow.

Figure 29. M87.

But there is a startling corollary. As the sun's magnetic poles change places every eleven years it looks like an alternator, not a DC generator. Direct current cannot explain the numerous clocks observed in space. Their time intervals last from a fraction of a second for pulsars, through a few hours or days for Cepheids and RR Lyrae stars, to twenty-two years in the case of the sun [Figure 30].

Larger structures like galaxies and clusters give no clues. Their massive size implies vastly longer clock cycles: much longer than our lifetimes. Even years-long observation will give the false impression that they make direct current.

Planets are the fractal offspring of stars, the sun in our case, and they look like the parent: roundish, not flat. Saturn admittedly has rings, one of the rare hints at flatness, but on the face of it their credentials as members of the hierarchy of flat spiral generators look pretty thin. They don't even look much like each other, being split into two groups: the rocky inner tiddlers and outer gas giants. So where is the similarity and the pattern here?

As in the case of the sun the evidence is not obvious, but it is there, nonetheless. The earth for instance has a similar electromagnetic set-up to the spiral galaxies: a toroidal magnetic field. Flowing equatorially, east to west and just a couple of hundred kilometres up, is the main current of plasma, the so-called "equatorial electro-jet". Two plasma inputs squeeze into the two polar holes in the magnetic field, exactly like the one found in 2001 by SOHO at high latitude in the sun. They are visible as the two auroral displays.

Plasma ejections are required of flat spiral alternators, from time to time, and the earth obliges, judging by recent satellite observations.

Nothing known about the earth and the other planets conflicts with the electrical model. On the contrary, it elucidates the solar system's doings as no other can. Seen as a galaxy-like structure, the solar system loses its mystery. The sun's erratic behaviour mimics AGNs; its periodicities are familiarly electrical/fractal in origin and the solar wind is just one in a huge network of plasma connections, more easily seen in distant objects than here under our noses.

Very striking is the theory's ability to explain the chemical nature of the planets. Charged particles in plasma filaments travel at different speeds, depending on their masses, as mentioned in chapter 5. Unsurprisingly the lighter ones go faster. Separation, though sometimes only partial, shows in the glorious spectral colours of nebulae etc.

It looks as if this is the process which made us a home. The material of the earth and the other rocky planets is presumably the lumbering tail-end in one of the solar loops, whilst the lighter and faster elements sped further out to form the

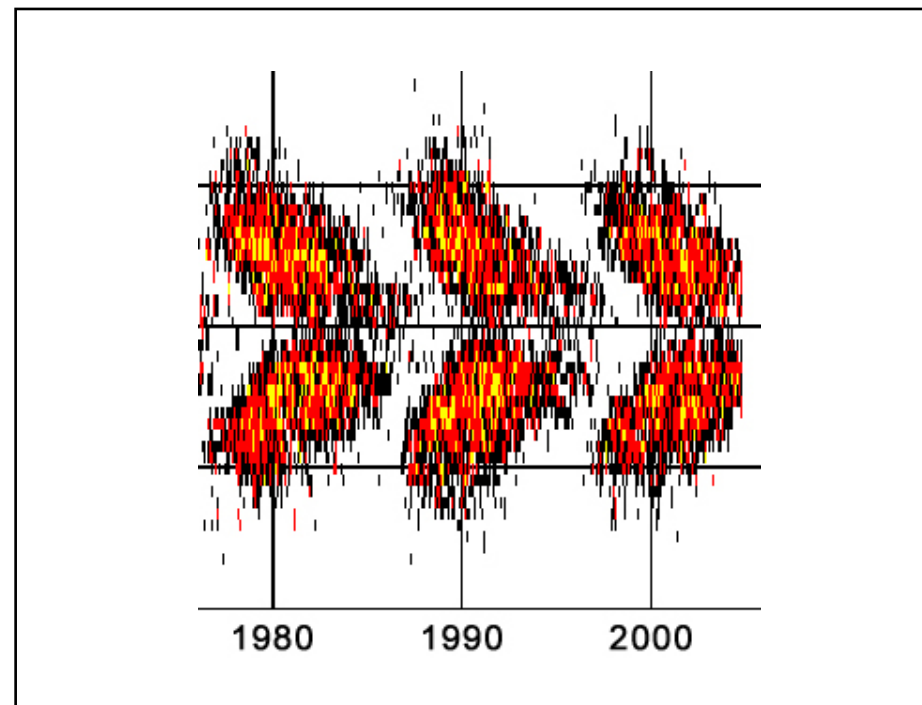


Figure 30. Sunspot cycle.

gas giants. Much of the earth is non-conducting or poorly so, and the electromagnetic force would lose its grip after cooling had allowed the formation of its solid compounds. Gravity would then get a chance. The globe shape is thus of gravitational, not electrical manufacture. Hence since most of the universe consists of hydrogen and helium, gravitation must prevail only in small isolated pockets, but even then fractal behaviour is apparent. The New Scientist Guide to Chaos, in examination of the inadequacy of Newton's treatment of the solar system as a two body problem, puts it like this on page 96:

"People tend to think of the solar system as a paradigm of order and regularity... But the solar system is not composed of just two bodies... The planets also influence each other's motion... all according to the inverse square law. For example, the basic ellipse of the Earth's orbit is not fixed in space; it gradually rotates or precesses... due to perturbations by other planets, most notably Jupiter."

Even so the earth manages to be a relatively safe haven for us amidst the hurly-burly of a vast building site. It is known that we are sheltered from the sun's ionic blast by the strength of the earth's magnetic field, but this makes difficult the explanation of the infrequent and sporadic pole reversals of our planet. Perhaps interaction with the sun's field is implicated. The planets have magnetic field strengths commensurate with their size and less so with their speed of rotation.

A reasonable conclusion from all this is that the sun and the other stars, despite appearances, are predominantly flat, spiral and electrical, fitting neatly into the cosmos, whose calculated fractal dimension of just over two, equates to widespread flatness as well as fractality. Gravity apparently assumes a greater role at local level according to the evidence of the solar system, but it is a fractal one, which is compatible with the electrical set-up outside.

Chapter 12

Cosmic Clocks

The ideas leading to my conclusions about the sun's real nature had been most upsetting, having been forced on me by my own argument that, like galaxies, it had to be a flat generator of electricity (albeit in the agitated state such as is depicted in certain of Schrödinger's atomic models [*Figure 15*].

Furthermore since the sun's magnetic poles are known to swap places every half sunspot cycle, every eleven years, it must be producing an alternating current (AC) whose frequency is not determined by the sun's twenty eight day period of rotation but by some other mechanism. Thus there must be two: one with a period of twenty eight days and the other of twenty two years, and necessarily by means of two very different processes.

The first, is most likely the primary energy source: the familiar product of rotation (see page 33), but the second, being of much lower frequency requires a more esoteric mechanism. The presence of hot plasma gives the clue. Marconi's primitive oscillator/transmitters depended on the negative resistance of high voltage sparks to induce alternating voltages in tuned circuits, which radiated electromagnetic energy through an antenna. Crude maybe, but powerful: his signals bridged the Atlantic.

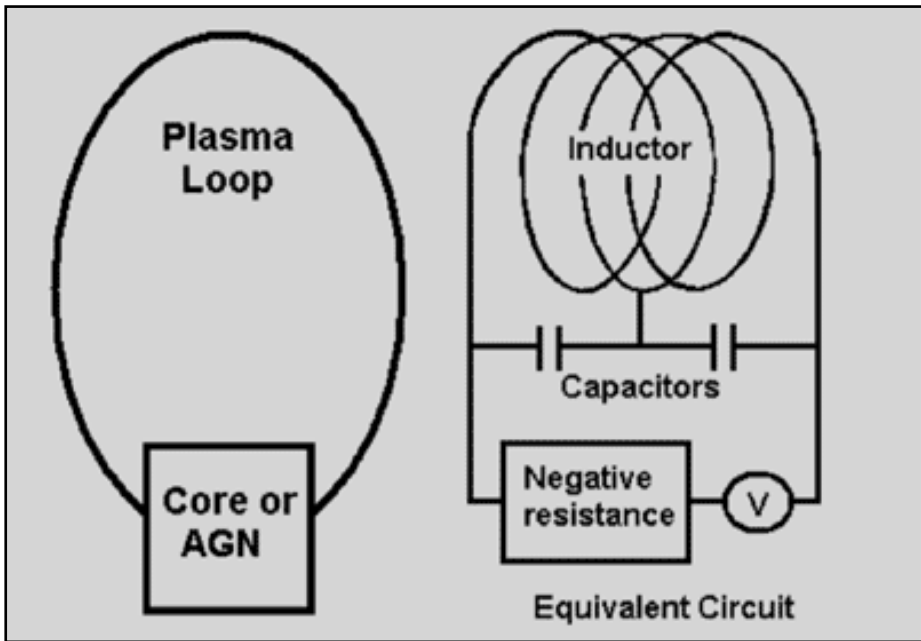
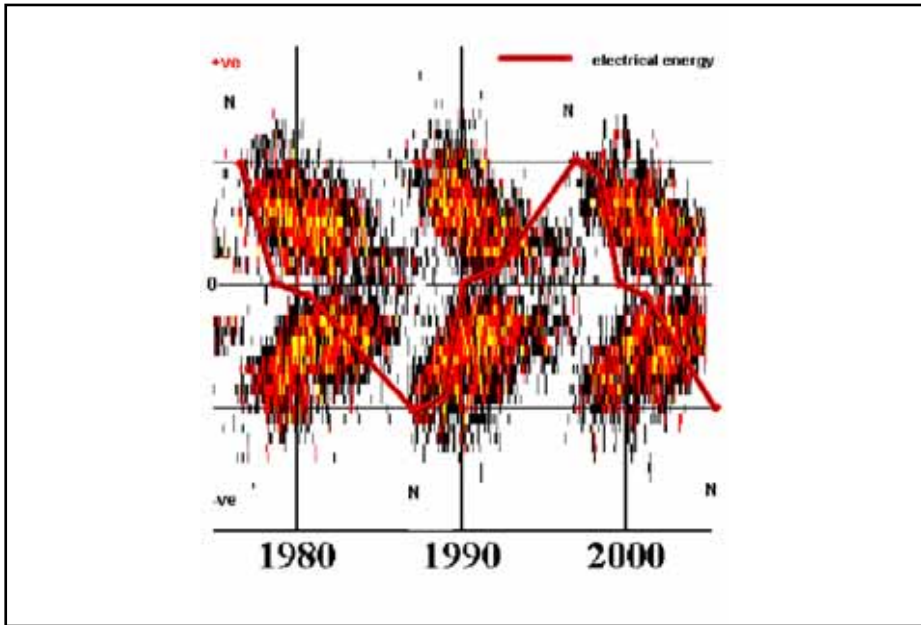


Figure 31. Sunspot energy and pole variation (top), oscillator (bottom).

When conductors are mentioned we tend to think of metals, but some liquids and gases qualify. Conduction in metals usually conforms to Ohm's law: increasing the voltage increases the amperage, but fluids are less straight forward. Liquids may be electrolysed and gases can be even more exotic. Under certain conditions an increase in voltage can produce a fluorescent glow with reduced, not increased amperage. This non-linearity, known as negative resistance, is an exception to Ohm's law. A tuned circuit having both inductance and capacitance, needs only to be coupled to a negative resistance and a power source to generate oscillations. The plasma loops originating in celestial bodies appear to have just these same components. So clocks in space appear possible and likely, courtesy of plasma and negative resistance [Figure 31].

The next move was to simulate a scaled-down solar oscillator in the laboratory and to measure the frequencies of its oscillations with different lengths of wire loop. Extrapolation to find the length of a solar loop corresponding to its periodic time of twenty two years was not on, but graphing the data revealed two interesting insights. First, frequency stability improves with greater loop length (greater inductance) and that the sun's slow tick implies a very long loop indeed; rather unremarkable perhaps, but reassuring.

The exploitation of oscillations from variable stars in the measurement of distance is now familiar but an unexpected variant is under development at the Max Planck Institute. Some radio emissions from the centre of the Milky Way are polarised. Plotting them has revealed structures which are not otherwise discernable www.mpifr-bonn.mpg.de/div/konti/antalya/Session-III.pdf. The work is at an early stage and it appears likely that other tools based on polarised radio waves will be devised.

Identifying the sun as an oscillator/alternator opened many doors. Variable stars, including Cepheids and RR Lyraes and pulsars lost their mystery, and the explanation of other sources of radiation, over a great range of frequencies became available at a stroke. Most importantly though, it identified the universe's feedback process: the fractal process inherent in plasma. Electricity with hydrogen and helium together rule the universe. The combined talents of these three giants are awesome to the point of exotic. In comparison gravity looks bland and puny. Low levels of electronic feedback make for predictable, well-behaved electronic oscillators but raising the energy invites erratic outbursts. Once a certain threshold is crossed anything goes. There may be intervals of quiet, even long intervals, but they will be interspersed with wild excesses and there is no knowing exactly when, or just how wild. Solar electron-

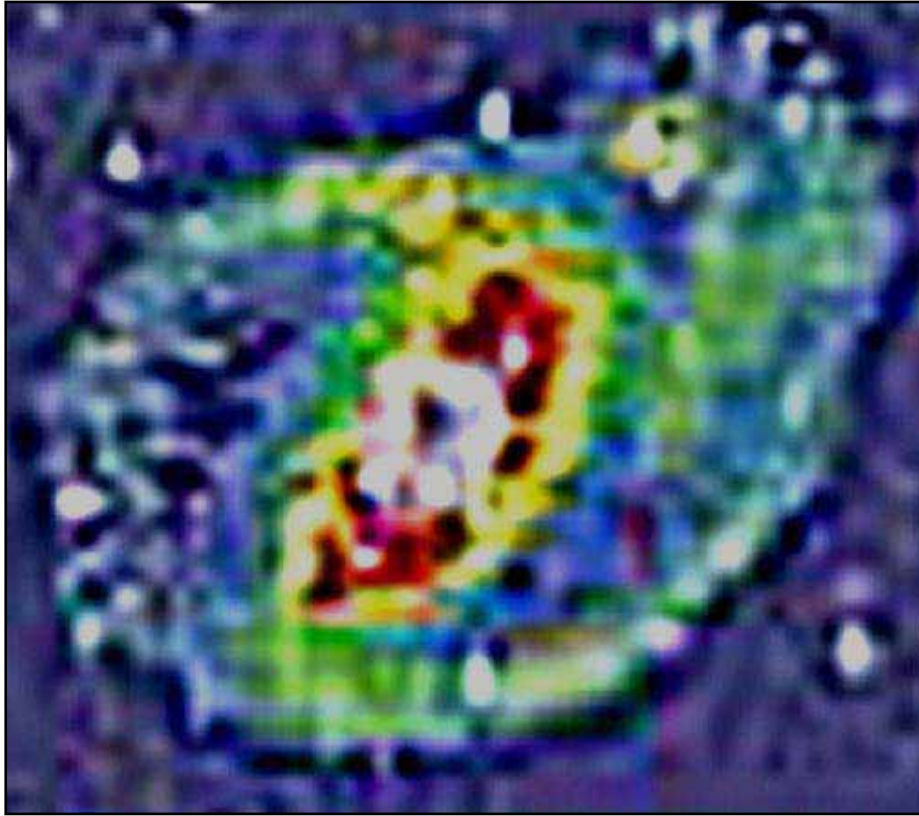
ic blasts of sufficient strength to knock out our communications are common. Even electric power grids are disabled from time to time.

Even at moderate levels of feedback, unpredictable performance is common.

"...the (fractal) system may not settle to any regular oscillation but may continue to vibrate erratically, never quite repeating any previous manoeuvre and yet never escaping from the well. This is a chaotic solution, otherwise called a strange attractor. It can be represented graphically, so as to reveal its detailed form and inner structure, in a way which distinguishes chaos from the fuzziness arising from 'noisy' external forces." [New Scientist Guide to Chaos, page 153 and chapter14]

This means that oscillators like the sun can tick continuously but not necessarily accurately. They display quasi-stability: neither totally stable nor completely random. Over the last seventy centuries the sun's output has shown this "normal variation" in only fifty two of them. During ten it performed below par and in eight it exceeded its quota; predictable unpredictability. Even the so-called "greenhouse effect" may in fact be a solar fractal feature.

In the proposed fractal hierarchy of flat spirals/loops the same is to be expected of all members. From supernovae to comets, from active galactic nuclei to quasars. Stability is temporary. This is not to say that these proposed oscillators are always destructive or self-destructive. Undoubtedly there are destructive episodes but they appear to be brief pauses between bouts of reconstruction and recycling.



Chapter 13

Galaxies and Morphology

Galaxies are members of the family (hierarchy) of spirals. They outrank nebulae, quasars and comets etc in our view of the heavens because of their size: just right for telescope viewing. Charles Bruce chose them to explain his electrical model of the cosmos.

By 1968 he had concluded that galaxies, and indeed all objects in space, derive from an electrical process. He postulated that spiral arms start as huge lightning strikes forming only partially-visible looped circuits. Radio telescope images later proved him right. To take the case of barred spirals, he reasoned that what he saw pointed to a two-stage business; first two simultaneous and diametrically opposite ejections to make the plasma bar. This process was apparent even then, albeit in the rather low quality astrophotographs of certain nebulae. Today's far better images altogether back his judgement. Twin lightning strikes (arcing) between the tips then form the spiral arms, followed by the filling in of fine detail [*Figure 32*].

Overall he was correct but what he saw was only the biggest of many such events. It was the last in a long repetitive growth process: a loop-making sequence making increasingly larger spirals by bar and loop formation.

Figure 32. Galactic bar and 'spiral' arms.

Throughout, correspondingly greater quantities of electrical energy have to be generated through rotation. The formation of intricate patterns of convoluted loops is perhaps aided by leakage currents. They are of surpassing beauty and no two are exactly the same.

The plasma framework is more than just the fabric of a galaxy. As stated in chapter 9, it is its means to growth and reproduction. The Milky Way galaxy is so equipped. In generating electricity, it forces its own sideways expansion by the Fleming effect, refuelled in part with new plasma sucked in by Z pinch. Ordinary spiral galaxies appear to omit the initial twin ejection, going straight to the loop formation stage.

The complicated story does not finish there. Images from many sources with enough resolution to allow digital processing have shown that plasma loops are to be found in every type of celestial body and in every size. Being the means to nuclear fusion, it is not surprising to find them at the heart even of quasars. [*Figure 17*].

A fractal universe can have only one organising process. Two would clash, making only chaos. But “organised” does not mean “uniform”. Our present separation of the celestial bodies into different sizes and categories is arbitrary and misleading. It obscures the most important property: their similarity. Hence the unconscious lapse into blurring terms like “dwarf or miniature galaxy” “spiral nebula” and “giant nebula”.

Overall similarity with fractal variation is the norm. The outcome is a fascinating continuum. Each family member has the common stamp but each is unique and individual.

Nebulae, for example, whilst remaining recognisable as such, come in a bewildering variety of shapes and sizes. Some look amorphous, not yet formed, whilst others have enough spiral organisation to resemble small galaxies. In turn some galaxies are only vaguely spiral-looking at best, with shapes defying description. Halton Arp’s catalogue of peculiar specimens testifies to this (see chapter 9).

The turbulent flow in spatial plasma filaments includes pockets of whirling semi-stability. Not surprisingly no two are exactly the same.

One process producing all shapes! It’s a tall order, but Nature does it with electricity, the immensely strong, subtle and versatile force.

Observation shows that loop ejection is the unlikely-looking building process of the universe.

Even the doughnut-like Hoag and the Cartwheel galaxy, on close exam-



Figure 33. M27 Dumbell.

ination, are seen to be mere variations and multiplications of the above process. Neither appears to have the characteristic galactic loop/spiral shape until much magnified. Hoag is seen to be studded with miniature Hoags, set in a filigree of more plasma loops. A better image would undoubtedly show yet more and the central object could well be a clone, but image quality is inadequate at present to confirm it. The Cartwheel galaxy's centre is clear enough to identify it as a dwarf Cartwheel.

There are no simple, straightforward products in the fractal universe. The stacking of ever smaller galaxy-like spirals within galaxies according to fractal theory is limitless. Winkling out the tiny shapes needs some digital processing skill. Once exposed, they are all-too familiar. Instead of being the answer, these miniature galaxies pose the same question: how deep does this probing have to go? Answer: atom-deep; maybe even further.

Images available on the net vary in their suitability for manipulation. ESO pictures of the Dumbell Nebula, a relatively close neighbour, are of such quality that they will withstand very high magnification before blurring [Figure 33].

Zooming in on its centre first shows not a white dwarf, but objects with elegant plasma loops. With further enlargement, the picture begins to deteriorate into square pixels, but not before exposing (you guessed it) yet another miniature; this time a diminutive Supernova 1987 look-alike. Or is it a tiny "Cartwheel Galaxy?"

Either way it is very small on the astronomical scale, being less than a hundredth of the diameter of the nebula around it, which itself measures a mere one and a quarter light years or so across. At a diameter of about 18 billion km the object is still considerably bigger than even the biggest stars but the picture will not stand any more magnification. When it can be seen it will probably look and behave like a small galaxy.

Investigating a hierarchy always ends like that; some detail beyond reach, but as knowledge increases new evidence of the fractal nature of the cosmos crops up regularly. Recently for instance, the Sloan Digital Sky Survey found an eleventh companion galaxy to our own. This nicely corroborates the theory postulated here: that all celestial bodies resemble each other, for if the sun has nine satellites, the Milky Way should have a similar number. Professional astrophysicists are perplexed: they expected far more; they are not happy:

"The prevailing 'Cold Dark Matter' model predicts that our own Milky Way galaxy is surrounded by hundreds of dark matter clumps, each a

few hundred light years in size and possibly populated by a dwarf galaxy. However, only 11 dwarf galaxies have been discovered orbiting the Milky Way. Perhaps some of these clumps have very few embedded stars, making the galaxies particularly difficult to find."

Being tied to the simplistic gravitational view of the universe denies them the means to fathom the universe.

See www.sdss.org/news/releases/20041020.companion.html

Chapter 14

Overview, Forecast and Some Conclusions

The big bang theory is just not adequate. Cosmologists have failed so far to see the picture which has been at least partly visible to us, through telescopes, for at least a hundred years. If they had, space shuttles might now be electrically driven. With the universal grid system, the sky's the limit!!

Instead of miserable decline we have a universe where energy is being gathered in every corner; where the whole business appears to be the recycling of matter and the fostering of life, not necessarily human. As plants gather in sunlight, so the heavenly bodies mop up the energy of spatial magnetic fields. Both systems seek to maximise the harvest, using branches and twigs in the one case, and a meshwork of plasma filaments in the other. Both are examples of fractal bifurcation: multiple splitting to cover a large area cost-effectively. Depiction, by Fred Hoyle of the cosmos as "a place with purpose" is hard to refute.

Ptolemy's misconceived epicycles misled men of science for over twelve hundred years, but our present debacle is showing signs of ending much quicker than that, principally because of information, both textual and pictorial, broadcast over the net.

There is too the comforting knowledge that although scientific data has

been misappropriated in the past, much of it still survives for reinterpretation.

Adjustment is happening, albeit reluctantly. There are signs of moves to abandon old ideas and to broach fractal geometry, electronic, and electrical engineering. Human nature being what it is, we are seeing sly adjustment and face-saving strategies. Change is happening because it is unavoidable. Hence the Chandra publicity machine's retraction on dark matter (see chapter 2).

A second opportunity to take up the creative cosmos idea is on offer. This time it comes packaged with a powerful new ally, electricity. It's a bargain at any price.

We may ponder too on the implications of fractality. Is the universe infinite in extent, and is there any limit to the size of objects in it? Do the stacked layers of galaxies perhaps extend infinitely upwards and downwards as theory dictates? Does the hierarchy of flat spirals include atoms? Lord Kelvin attributed their stability to vortex form:

www.phys.virginia.edu/classes/252/more_atoms.html.

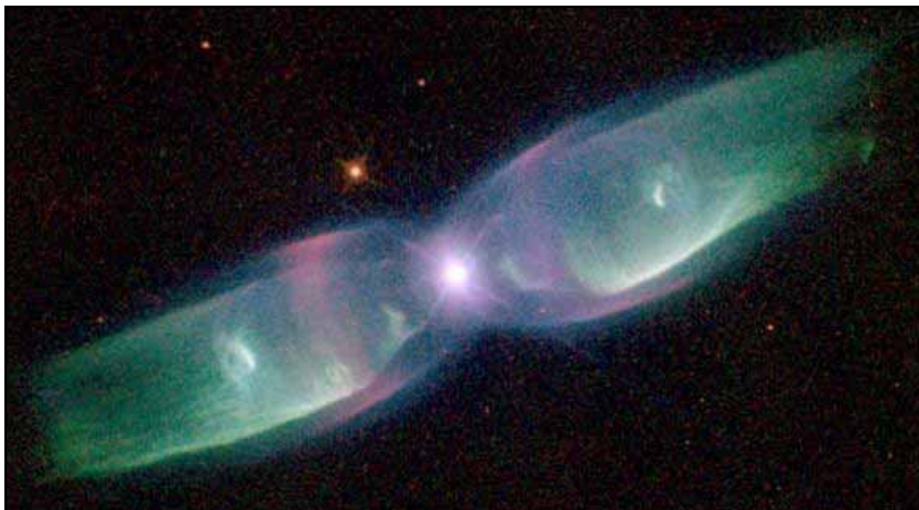
So now is a good time to take up an interest in cosmology, whether or not the hypothesis set out in this book has any validity. That spatial electricity and plasma are major players in space is past denial, and the mere presence of fractal shapes is already forcing a radical change in our conception of the universe, of ourselves and of scientific method.

An indicator of how things are likely to go, when more scientists are persuaded that the cosmos is indeed fractal, is to be found in chapter 10 of the *New Scientist Guide to Chaos* (Penguin ISBN 0-14-014571-0) which is by Benoit Mandelbrot himself. He begins with:

"Fractal geometry plays two roles. It is the geometry of deterministic chaos and it can also describe the geometry of mountains, clouds and galaxies".

He continues with a comment about his famous fractal set, but it applies also to other pictures of fractal objects:

"The Mandelbrot set does not just produce beautiful pictures. If we examine many pictures with great care, we find innumerable empirical observations that can be restated in the form of mathematical conjectures. Many of these have already led to brilliant theorems and



proofs. It has inspired a new approach to mathematics using a computer screen... In recent decades, there has been no input at all from physics or from graphics, which means that some areas of pure mathematics, such as the theory of iteration... ran out of steam. Fractal pictures done on the computer have revived it. Being able to play with pictures interactively has provided a deep well for mathematical discoveries."

This echoes James Gleick's advice, quoted in chapter 3, to seek out the patterns, which, delightfully, is well within the capabilities and resources of non-professionals. Perhaps we may not be able to penetrate the utmost depths but we can surely contribute, as I hope my theory has done.

The world's increasing fuel problem has, as forecast, already brought about at least one war. We are running short of crude oil, but there is still no sign that nuclear fusion will be harnessed. Kristian Birkeland's message that the technology of stars could be worth study is perhaps beginning to be heeded. New plasma laboratories are springing up worldwide and since fusion is the norm in space, some scientists are looking there for guidance. Funding priorities of governments appear to be changing too.

Electricity's unique right-angled force confers on the universe a pattern which would be impossible otherwise. The fractal universe is a single entity and its configuration suits our needs neatly. Whether or not the blueprint is a manifestation of some supreme intelligence is another matter: electricity and plasma in combination go a long way towards explaining the "how", but not the "why".

The word 'plasma', meaning 'creature' in Greek, describes to a "T" the lively and capricious nature (it is tempting to write "personality") of ionised gas. Like magnetism it shows strange, almost animated behaviour. Both are due for promotion [Figure 34].

To try to separate out and probe each object in space gives a very narrow view which obscures the essential interconnectedness of the whole universe. It happened in the compiling of the big bang/standard model theory. Fractals are not susceptible to such analysis. The heavenly bodies, viewed for what they are, the products of a common iterative process, make sense. Even Halton Arp's so-called "strange galaxies", which are presently branded as miss-shapen deviations from the norm, then become unremarkable and predictable variations. They are part and parcel, not mysterious and alien.

But breaking my own rule by studying the differences has not always

Figure 34. Ant Nebula.

been a waste of time. An elliptical galaxy, when examined by means of digital processing in order to discover the nature of its assumed difference, turned up a totally unlooked-for spiral, little different to many a barred spiral. Once revealed the truth is obvious: all galaxies and all other bodies, being made by the same mechanism, have the similar, though not the same, basic shape. It may be less obvious in some than in others. It may be present in variegated form as in the Hoag object or it may be hidden by glare such as in ellipticals and the sun, but it is surely there.

Having been alerted, I looked for and found professional confirmation of "spiral ellipticals" on the net. So the lesson is clear and Charles Bruce was right all along. What is found here should be expected there; the universe should be viewed 'in the round'.

Nonetheless there is still a long way to go.

Many people will choose to stay with the forlorn quest for dark matter, black holes, dark energy, and for unification. They are a long time coming and gravity shows no hint of any willingness to be unified. Catastrophic collisions, devourings and explosions, the stock explanations, in traditional theory for anything unusual, are not needed. Expiry after aging and decline appears to be the norm both here and in space. Violent death appears to be the exception.

Chapter 15

Digital Image Processing

This book shows that cosmological research is possible using nothing more than a home computer with preferably (but not essentially) a wide-band connection to the net and digital processing software such as 'Photoshop'. The ability to dig out the fine detail, hidden in digitised astro-images is a powerful tool. It is no longer necessary to tamely accept professional opinion (or mine) about what is happening in space.

Looking for those similarities, including where none is immediately apparent, has been my main, almost my only, line of research. Once found and subjected to common sense methods of scrutiny, including in some cases some simple image processing, these have produced some very gratifying, and often beautiful discoveries. Others have shocked me to the core, so I was not excessively put out by the laughter and ridicule of one or two critics, at my declaration that the sun is a flat spiral. Indeed I am amazed that there has not been more adverse reaction to my website. None of the tens of thousands or so visitors has chosen to question this particular bombshell although some, I have little doubt, have simply shrugged off my ramblings. The source of my confidence is the visual skill which is given little academic standing, but which many people

have, even those with quite modest levels of education. In this computer age there is an overabundance of textual information which would need several lifetimes to sift, but images are readily available and a picture is worth a thousand words.

At an early stage in my image processing career I discovered, more or less by accident, that the centre of the Dumbbell Nebula is far from dead. According to the 'experts' a nebula consists of the debris of an explosion. M27 and other nebulae, we are told, have partially condensed under gravity into dead 'white dwarfs': super-heavy, perfectly spherical stars [Figure 35]. On zooming in, the 'debris' turns out to be highly organised. Far from being dead, all nebulae look electrically active; they have networks of plasma filaments and, at centre, a body with loops like a quasar or the sun. In each, a network of conductors connects all the stars in one circuit.

No great skill; just three tools were used to probe the objects: zoom, brightness/contrast and curve. Check for yourself.

Since then I've achieved a lot more but using no more than six: crop, image size, colour balance, curve, brightness-contrast, and un-sharp mask. 'Image size' works on the pixels and is superior to the zoom facility for the present purposes. Computers have the tremendous advantage that stored images are quickly and easily compared using the "browse" facility in, say, Paint Shop.

Artificially introduced effects such as "edge effect", have to be guarded against, especially at high magnification. It appears as a scalloped effect at borders of high contrast. Also I have encountered pie or wedge-shaped areas, in certain HST images which at first I interpreted as members of a fractal series because of the large range of sizes and similar shape, but as the investigation progressed, they looked more questionable. No definite conclusion was reached. Whether they were products of an optical aberration in the Hubble Telescope's patched up optics or some characteristic of compressed jpeg images? I decided it was best to exclude them as evidence.

It is no bad idea to consult an expert in digital image processing early in your career. They can advise on 'rule-of-thumb' precautions.

Some hours of diligent work is needed to achieve competence and confidence but meanwhile the hunt is often fascinating and the rewards begin early and increase as greater proficiency is achieved. It is not always easy to decide in advance which pictures are likely to yield good results. Generally the very large images (megabytes) are good bets but not always. Trial and error with lots of patience is the only way to be sure. Even then a lot depends on chance, skill

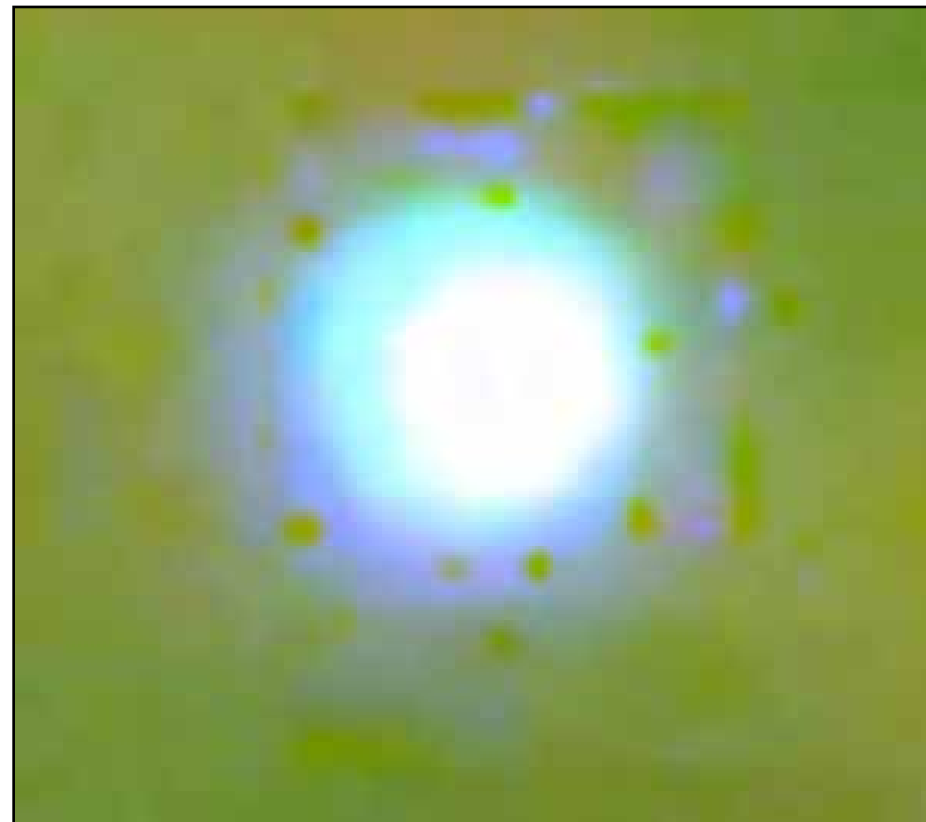


Figure 35. Star in M27.

and intuition.

The images made available by ESO are usually far superior to the space telescope's, but there are not many yet. For people without a broad band connection, ESO sells a set of very hi-res pictures on CD, advertised on their website. There is still much to discover, Good hunting.

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