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by

Louis A.G. Hissink M.Sc. MAIG, MIEEE

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THE EARTH IN AN ELECTRIC SOLAR SYSTEM

Louis A.G. Hissink M.Sc. MAIG, MIEEE

Consulting Exploration Geologist, Perth, WA, Australia

E-Mail:lhissink@fgservices.biz

ABSTRACT

Since Isaac Newton's time till the present, science has described the universe in terms of his laws of gravitation without explanation but since the development of the modern industrial age electrical engineers have also noted unexpected electromagnetic behaviour in the various engineered systems humanity uses whether on land, in the oceans and in space. The electromagnetic solar connection is best explained by theories of the electric plasma universe in which the Earth is thought to be electro-dynamically connected to the electric plasma of space. Laboratory plasma experiments and particle-in-cell computer simulations using the equations of Maxwell and Lorentz have accurately described galaxy morphology and motions, and from the scalability of plasma phenomena, it is possible to explain other similar rotary phenomena such as Earth based hurricanes. This paper is a brief summary of the more salient aspects of the Earth's electrical plasma environment.

1. INTRODUCTION

Some fifty years ago a small book, *Rival Theories of Cosmology*, was published by Oxford University Press which noted three prevailing theories of the universe:

- a) Relativistic theories (basically variants of the Big Bang),
- b) Steady State Theory and
- c) The Electric Universe Theory.

The Big Bang theory proposes that the universe appeared at some initial point in time and expanded to its present state. The Steady State Theory and the Electric Universe theories both assumed the universe always existed but the latter proposes that 99% of the visible universe is comprised of matter in the plasma state in which electromagnetic forces dominate, in addition to gravity. No major disagreement between the advocates of the latter two theories existed, but both were at odds with the proponents of the relativistic, or Big Bang, theories. Of interest is that the proponents of the Steady State and Electric Universe included gravity in their hypotheses while

adherents of the relativistic theories deny electricity plays any part at all in the universe, despite the fact that matter is comprised of electric charge.

Then on July 9, 1962, the United States detonated a nuclear device 400km above Johnston Island in the North Pacific Ocean which produced a plasma whose initial spherical shape striated within a few minutes to produce an artificial aurora. Associated with the detonation was a deterioration of radio communication over a wide area of the Pacific, lightning discharges, destruction of electronics in monitoring satellites and an electromagnetic pulse which affected some power circuitry as far away as Hawaii, some 1400 kilometres away. The event was noticed world wide as the plasma formed at least two intense equatorial tubes, artificial Van Allen Belts, around the Earth. These tubes, or plasma toroids, produced intense synchrotron radiation that lasted far longer than expected, some 100 days, (Peratt 2003). Humanity, unknowingly, has also viewed synchrotron radiation from the Crab Nebulae for centuries - the only known mechanism that produces this radiation are electrons spiralling about a magnetic field at nearly the speed of light, (Peratt, 2003). The nuclear experiment suggested that there was more to the Earth's electromagnetic environment than first thought.

At present gravity is thought to be the only force operating between the Sun and planets but there may well be electromagnetic effects that have powerful influences. In particular the behavior of the Sun is thought to drive the Earth dynamics. However there are signs that the gravitational cosmology of the Big Bang is in trouble. Dissident scientists form the Alternative Cosmology Group that culminated in the publication of an Open Letter on Cosmology published in *New Scientist*, May 22, 2004. This letter points to fundamental problems with Big Bang Theory in which recent observations contradict the theory's predictions, especially when the Cold Dark Matter model began to fail - only to worsen with the ad hoc addition of dark energy. A more detailed summary of the present situation can be read at the Alternative Cosmology Groups web site <http://www.cosmology.info>.

Is there an alternative to the Big Bang Theory? As Steady State theory has fallen by the wayside, with its no less miraculous continuous creation of matter, only the ideas of the Electric, or Plasma, Universe remain as a plausible alternative. This theory has a long history stretching back to the nineteenth century when Norwegian physicist Kristian Birkeland proposed from direct experimental evidence the polar auroras were produced by charged particles from the Sun. He designed a magnetised sphere suspended in a vacuum to experimentally model the electrical behaviour of the Earth and from these "Terrella", (little Earth) experiments discovered that the magnetic field guides the charged particles to the magnetic poles producing rings of light that appeared to mimic the Earth's auroras. Birkeland's ideas were dismissed at the time but confirmation of his hypothesis came from observations made of the ionosphere by satellites during the 1960's and 70's. We now know these electric currents, named Birkeland currents in his honour, flow in and out of the Earth's atmosphere at high altitudes and have total magnitudes of millions of amperes (Peratt 2003).

According to Peratt, author of the text "The Physics of the Plasma Universe", "Plasma is overwhelmingly the dominant constituent of the Universe. Yet most people are ignorant of plasmas. In daily life on the surface of planet Earth, perhaps the plasma

to which people are most commonly exposed is the one that produces the cool efficient glow from fluorescent lights or the now ubiquitous plasma TV screens. Neither solid, nor liquid, nor gas, plasma most closely resembles the latter, but unlike gases whose particles are electrically neutral, plasma is composed of the building blocks of all matter: electrically charged particles at high energy."

Plasma consists of a percentage of ions and electrons, together with neutral atoms and molecules. It is only when plasma is cooled that the atoms or molecules that are so predominant in forming gases, liquids, and solids that we are accustomed to on Earth, is possible. So, in space, plasma remains electrically conductive while quasi-neutral in bulk. Plasmas carry electric currents and are more influenced by electromagnetic forces than by gravitational forces. Outside the Earth's atmosphere, the dominant form of matter is plasma, and "empty" space has been found to be quite "alive" with a constant flow of plasma and electric currents - signified by the ubiquitous magnetic fields found in deep space.

2. SO WHAT IS PLASMA?

According to Scott, (2006), "When one or more of the outer (valence) electrons are stripped away from an atom we say the atom has become "ionized". It then exhibits a net positive electrical charge, and is called a "positive ion". On the other hand, if an extra electron is *added* onto a neutral atom, the combination then carries a net *negative* charge and is referred to as a "negative ion". The electrical forces between dissimilar ions are orders of magnitude stronger than any mechanical force such as that produced by gravity. Electrical "plasma" is a cloud of ions and electrons that, under the excitation of applied electrical and magnetic fields, can sometimes light up and behave in some unusual ways. The most familiar examples of electrical plasmas are the neon sign, lightning, and the electric arc welding machine. The ionosphere of Earth is an example of plasma that does not emit visible light. Plasma permeates the space that contains our solar system. The cloud of particles that constitutes the solar "wind" is plasma. Our entire "Milky Way" galaxy consists mainly of plasma. In fact 99% of the entire visible universe is matter in the plasma state.

The development of plasma, or electric universe, theory had its origin in the pioneering work of Kristian Birkeland, who discovered the twisted corkscrew shaped paths taken by electric currents in plasmas, which sometimes are visible and sometimes not - depending on the strength of the current density being carried by the plasma. The mysterious "sprites", "elves", and "blue jets" associated with electrical storms on Earth are examples of Birkeland currents in the plasma of our upper atmosphere, Figure 1.

In the early 20th century, Nobel laureate Irving Langmuir studied electric plasmas in his laboratory at General Electric where he further developed the body of knowledge Birkeland had initiated. It was Langmuir who first used the name "plasma" to describe the almost lifelike, self-organizing behaviour of these ionized gas clouds in the presence of electrical currents and magnetic fields.

Virtually all of modern plasma physics is indebted to Hannes Alfvén for his insights into the role of electric and magnetic fields in plasma. In 1970 Alfvén received the Nobel Prize for his discoveries in magnetohydrodynamics but used his acceptance

speech to beg scientists to ignore this earlier work, in which he proposed that magnetic fields could be frozen into plasma, which was shown to be wrong. His plea was ignored.

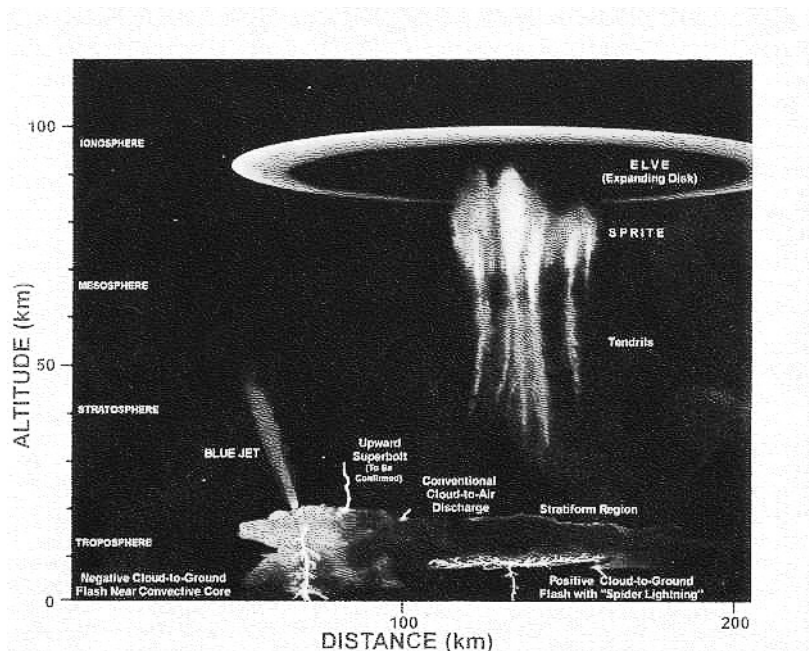


Figure 1. Atmospheric and ionospheric plasma phenomena

3. BASIC PROPERTIES OF ELECTRIC CURRENTS IN PLASMA

There are three distinctly different modes in which electric discharges in plasma can operate:

3.1 Dark Current Mode

The density (Amps per square meter) of the electrical current (flow of charged particles) within the plasma is very low. The plasma does not glow. It is essentially invisible. We would not know the discharge was there at all unless we measured its "wind" or magnetic field. A familiar example is an air ioniser where electrical discharges occur preferentially from sharp points so that fine needles are used as discharge points; hence a plasma discharge in air is detected as a breeze. The solar wind is another example of plasma operating in the dark current mode.

3.2 Glow Mode

The density of the electrical current (flow of charged particles) is significant. The entire plasma glows. The brightness of the glow depends on the intensity of the current in the plasma. Examples: Any neon sign, emission nebulae, the Sun's corona, plasma TVs.

3.3 Arc Mode

The density of the electrical current in the plasma is very high. The plasma radiates brilliantly over a wide electromagnetic spectrum. Current tends to form twisting filaments. Examples of this mode of operation are: An electric arc welding machine, lightning and the penumbral filaments seen in perspective in large Sunspots.

In all three modes of operation, plasmas emit measurable electromagnetic radiation (radio frequency noise) which at any given time the current density (Amps per square meter), existing in the plasma, determines which particular mode a plasma is operating in. The atomic structure of the gas that became ionized to form the plasma in the first place also is a factor in this.

3.4 Double Layers

One of the most important properties of any electrical plasma is its ability to “self-organize” - that is, to electrically isolate one section of itself from another. The isolating wall is called a double layer (DL). When plasma is studied in the lab, it is usually contained in a closed cylindrical glass (Geissler) tube. Electrodes are inserted into the ends of the tube - one electrode (called the anode) is maintained at a higher voltage than the electrode at the other end (the cathode). If sufficient voltage difference is applied, then ionization will be initiated and current will start to flow through the plasma. Positive ions (atoms with one or more electrons stripped off) will migrate away from the anode, and electrons will move toward the anode. The mathematical *sum* of these two oppositely directed flows constitutes the total current in the plasma.

If the voltage difference from one electrode to the other becomes large enough, a DL will form in a narrow cross-section somewhere above the cathode. Almost all the voltage drop that is applied across the electrodes will fall across this DL. The plasma on one side of the DL (the side toward the anode) will have approximately the same voltage as the anode. The plasma on the cathode side of the DL will have essentially the same voltage as the cathode. The bulk of the plasma (called the positive column) is electrically isolated from the cathode by the DL. The total electric current, however, is the same throughout the plasma (on both sides of the DL). Plasmas are excellent, but not perfect, conductors and, therefore, there will not be a significant voltage drop across the extensive positive column. The DL “takes” most of any externally applied voltage. In other words, the DL is where the strongest electric fields in the plasma will be found.

If a foreign object is inserted into plasma, a DL will form around it, shielding it electrically from the main plasma but this effect makes it difficult to insert voltage sensing probes into plasma in order to measure the electric potential at a specific location. This is a well known property of plasmas and various methods have been developed in the laboratory to overcome it.

In space, it is impossible to “send a spacecraft to measure the voltage of the solar plasma at some point”. Voltage is a relative measure (like velocity, for example) and must be measured *with respect* to some datum. A spacecraft will start out having the same voltage as the surface of Earth. As it penetrates the plasma-sphere and enters the solar plasma it will slowly alter its charge and thus alter its voltage. The planets

occupy the positive column of the solar discharge so that the electric field is very weak - only sufficient to cause a drift of electrons to the Sun and the acceleration of the solar wind away from the Sun.

3.5 The Z-Pinch

Electric current, passing through plasma, will take on the corkscrew (spiral) shape discovered by Birkeland and are comprised of a twisted pair of current filaments aligned with the local ambient magnetic field. There is a tendency for interacting Birkeland current pairs to compress between them any material (ionized or not) in the plasma. This is called the “z-pinch” effect. The ability of Birkeland currents to accrete and compress even *non*-ionized material is called “Marklund convection”.

3.6 Currents in Cosmic Sized Plasmas

Because plasmas are good (but not perfect) conductors, they are equivalent to metal wires in their ability to carry electrical current. Any relative motion between cosmic plasma cells of different densities, temperatures or magnetic field strength, will generate electric currents. These currents will, in turn, produce their own magnetic fields.

3.7 Scalability of Plasma Phenomena

Plasma phenomena are scalable. That is to say, their electrical and physical properties remain the same, independent of the size of the plasma. Of course dynamic phenomena take much less time to occur in small laboratory plasma than they do in plasma the size, say, of a galaxy. But the phenomena are identical in that they obey the same laws of physics. So we can make accurate models of cosmic sized plasmas in the lab - and generate effects exactly like those seen in space. In fact, electric currents, flowing in plasmas, have been shown to produce most of the observed astronomical phenomena that are inexplicable if we assume that the only forces at work in the cosmos are magnetism and gravity. According to Alfvén plasma phenomena can be scaled up in three jumps of 10^9 magnitudes, though it would probably be a combination of gravitational and electromagnetic forces which determine the large structures and nuclear forces as the power supply of stars.

4. THE FORMATION OF GALAXIES IN COSMIC SIZED PLASMA

Dr. Anthony Peratt is a former Scientific Advisor to the United States Department of Energy, Washington DC and a member of the Associate Laboratory Directorate of the Los Alamos National Laboratory. He was a graduate student of Nobel Prize winner Hannes Alfvén. He is a world renowned electrical engineer who first received notice among the general public through the publication of his work involving supercomputer simulation of galaxy formation in E. J. Lerner's 1991 book “The Big Bang Never Happened”. Peratt had worked on those simulations for several years prior to that time. By 1986 he had achieved sufficient professional stature to be asked to serve as Guest Editor of the Dec. 1986 IEEE Transactions on Plasma Science (Vol. PS-14 No. 6). In that issue he published two articles: “Evolution of the Plasma Universe: I. Double Radio Galaxies, Quasars, and Extragalactic Jets; II. The

Formation of Systems of Galaxies. He has served on the Administrative Committee of the Institute of Electrical and Electronic Engineers. In the issue of the IEEE Transactions that Peratt edited there were two articles by his mentor, Hannes Alfvén. There were other articles by the astronomer Halton Arp as well as many top plasma scientists and engineers. It is a seminal publication that sets out the fundamental basis of the Electrical/Plasma Universe. It is, for the most part, readable by any reasonably informed layperson interested in astronomy. It should be available in the library of any good college of engineering, (Scott 2006).

Peratt used a supercomputer to apply the Maxwell - Lorentz equations (the basic laws governing the forces produced by, and the interactions between, electric and magnetic fields) to each of a huge 3D ensemble of charged particles. He calls this Particle in Cell (PIC) simulation and his results are almost indistinguishable from astronomical images of actual galaxies.

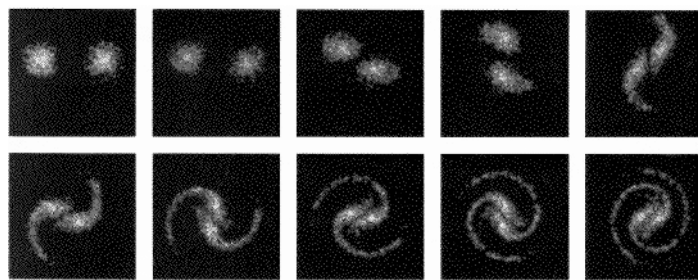


Figure 2. PIC Simulations of Spiral Galaxies (Plasma bulge at the core removed for clarity).

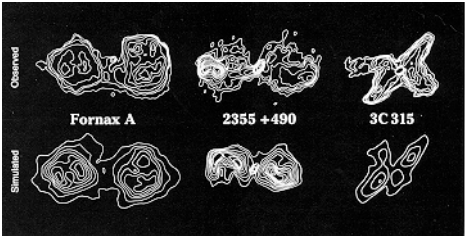


Figure 3. PIC simulated versus Observed Galaxy shapes

(It is pointed out that the PIC simulations shown above have had the large plasma bulge, which occurs at the elliptical core at the geometrical centre of the simulation, removed as it tends to obscure the coalesced region.)

Peratt went on to publish the text: “The Physics of the Plasma Universe” (Springer-Verlag, 1992). It is an up-to-date presentation of the mathematical laws of physics that govern the behaviour of plasmas and provides the fundamental argument for why electrical effects cannot be ignored in any modern study of the cosmos.



Figure 4 Typical Spiral Galaxy

4.1 The Peratt Instabilities

One of Peratt's latest and most important discovery's are plasma instabilities and named in his honour. These are observed dynamic effects that occur in intense Birkeland currents or arc discharges found in plasma torches, z-pinch plasma filaments, or in high energy density electrical discharges. The instability takes on the shape of a column of axially symmetric toroids or spheroids that remain in a semi-stable state until disruption. During this state the column may be a source of intense x-rays whose intensity is greatly enhanced if two current filaments are in interaction. The instability can also take on a sawtooth structure with a violent snaking motion as found between the anode and cathode of a high power plasma torch or in high energy density plasmas, Peratt et al, 1980.

There is an extensive website containing information for both the novice who wants to learn about the Plasma Universe and the experienced investigator who wants to download the seminal scientific papers that underpin all these ideas. It is a treasure trove of interesting information about the electrical nature of our Universe and can be accessed at the following web address: <http://public.lanl.gov/alp/plasma/universe.html>.

5. THE CONNECTION

5.1 The Sun

The Sun is an insignificant star in the Milky Way with its own solar system of which the planet we live on is part. Many years ago Kristian Birkeland averred that

"According to our view of looking at the matter, every star in the universe would be the seat and field of activity of electric forces of strength that no one could imagine". Birkeland thought that stars, and thus our Sun, were essentially electrical phenomena.

However the standard model of the Sun assumes that the energy source is internal in which the Sun's core is supposed to be a nuclear fusion reactor burning slowly out over time but proponents of plasma theory, noting that observations fail to substantiate this Standard Solar Model, think there might be a simpler explanation. However the

electric star hypothesis is by no means accepted and for the present all we can say about the Sun is that it is a complex body with a poorly understood structure. It is a body, according to current theory, held together by gravitational forces with a nuclear power source with complicated heat transfer mechanisms involving the flow of electrically charged particles, probably responsible for the observed magnetic fields, currents, Sunspots and corona.

The standard solar model cannot explain, nor should expect, Sunspots. And the measurement of the Sun's temperature profile away from the photosphere completely contradicts the nuclear fusion core assumption of a diminishing temperature with increasing distance from the core. This temperature profile or gradient starts from the insides of Sunspots which are at a lower temperature than the Sun's surface, or photosphere which is some 5,600 Kelvin; The solar temperature gradient then decreases to about 5000 Kelvin at 600km above the Sun's surface but strangely starts to then increase to 10,000 Kelvin some 2000km above where a transition region occurs in which the temperature suddenly rises to 2 million Kelvin at base of the corona and continues to rise with further distance from the Sun.

Just how a hot body like our Sun can have a temperature minimum just above its photosphere is not easy for the standard fusion model to explain - but straightforward for the electrical model. The solution to the problem is to realise that the Sun's energy source is external in the same way that the Earth's similar atmospheric temperature gradient is the result of an external energy source.

5.2 The Earth

The Earth can be considered an electrically charged sphere suspended in the plasma of space. It is electrically isolated from its space environment by complex plasma double layers, and the best electrical device which can serve as a model for this is a leaky capacitor. In the Earth's case the ionosphere is the positive electrode while the Earth itself the negative electrode and the leakage of electric current between the Earth and space appears as various forms of lightning and severe storms. There is also a strong electric field within this double layer of at minimum 100 volts per linear metre upwards. (This electric potential is maintained by the Earth and its immersion in the highly active electric plasma of the solar system).

There is a continuous flow of electric current between the Earth and the Sun, entering at the Polar Regions and then travelling over the ionosphere to return to the Sun at the other pole. Usually this plasma current is in dark mode and is not visible but when the solar electric currents do increase, spectacular visible aurora activity occurs at the poles. As Peratt notes in a recent paper, these aurora polar currents, once the subject of intense debate, are now recognised as Birkeland currents and are routinely measured by today's satellites having total magnitudes of millions of amperes (Peratt, op. Cit). It is an energy source that is completely ignored in climate studies.

Recently NASA has discovered via its THEMIS satellite that the Earth is connected to the Sun by magnetic flux lines or ropes. Now anyone who has understood a little about high school physics knows that only electric currents produce magnetic fields so these magnetic flux ropes are in all likelihood twisting Birkeland currents connecting

the Earth and the Sun. I here quote the beginning of the NASA release of October 30, 2008, entitled “Magnetic Portals Connect Sun and Earth”:

During the time it takes you to read this article, something will happen high overhead that until recently many scientists didn't believe in. A magnetic portal will open, linking Earth to the Sun 93 million miles away. Tons of high-energy particles may flow through the opening before it closes again, around the time you reach the end of the page. “It's called a flux transfer event or ‘FTE’,” says space physicist David Sibeck of the Goddard Space Flight Centre. “Ten years ago I was pretty sure they didn't exist, but now the evidence is incontrovertible.” Indeed, today Sibeck is telling an international assembly of space physicists at the 2008 Plasma Workshop in Huntsville, Alabama, that FTEs are not just common, but possibly twice as common as anyone had ever imagined.

They say it is good to have powerful friends!

6. EVIDENCE FOR A SUN - EARTH CONNECTION

Ever since the advent of the modern industrial age electrical engineers have noted unexpected behaviour in the various engineered systems humanity uses whether on land, in the oceans and in space. Satellite failure, cell-phone dropouts, and power utility failures are some of the more common examples identified. Electrical engineers have now established that these disruptions are due to Solar factors in which at least 10,000 have so far been identified some five AU (astronomical units) from the Earth by the Ulysses spacecraft. “These modes couple the magnetosphere, the ionosphere, the geomagnetic field and atmospheric pressure. Estimates of the power spectrum of data from solar radio telescopes and induced voltages on ocean cables show what appear to be solar modes at both lower and higher frequencies than the optically measured solar p-modes. Most surprisingly these modes are easily detected in seismic data, where they literally shake the Earth”, (Thomson et al. 2007).

6.1 Seismic Data

It is generally thought that the low frequency background signals, the well known seismic hum, in seismic data could be attributed to ocean waves but Thomson et al (op cit) point out that this hypothesis cannot explain the observed high Q-peaks and obvious solar modes. However the oceanic source hypothesis is supported by some good correlations between the amplitude of the seismic hum and wave height, possibly implying that space weather drives ordinary weather (Thomson et al, Op cit, pp.1122). Electric-plasma-universe theory regards Earth's weather as the physical behaviour of the interface between the Earth and its space environment via plasma interactions; and hence, it is not surprising that space weather could drive the Earth's weather.

6.2 Hurricanes, Cyclones and Dust Devils.

If we compare Peratt's simulations above with spiral galaxies on one scale, and hurricanes or cyclones on the smaller Earthly scale, then the similarities suggest a common mechanism. In the computer simulations Birkeland currents generate rotating spiral galaxies in the plasma of space. That is, it's the electrical currents which are