

# ARTICLES

## Why the ELECTRIC UNIVERSE® isn't the same as the Plasma Universe and why it matters

Robert J. Johnson

### Synopsis

This paper will examine the relationship between the ELECTRIC UNIVERSE® and the Plasma Universe (henceforth EU [1] and PU respectively). It will be shown that even though the EU agrees with the PU in recognising the need for incorporating plasma physics into astrophysics, the EU and the PU have very different fundamental principles, objectives and *modus operandi*. In particular, the EU promotes one model to the exclusion of all others but this may not be the right one. The future of Plasma Cosmology based on the principles of the PU may lie in a completely different direction.

### Introduction

The boundaries between the ELECTRIC UNIVERSE® and the Plasma Universe often seem to have been blurred to the point where it's sometimes hard to tell the difference. Critics of the EU certainly seem to think the EU and the PU are the same thing; they then dismiss them both in the same breath. But is the EU the same as the PU? And why does it matter whether it is or it isn't?

The first question can be answered very easily. Anthony Peratt, author of *Physics of the Plasma Universe (PPU)* [2], wrote in the introduction to the first edition that:

The purpose of this book is to address the growing recognition of the need for plasma physics in astrophysics.

Peratt went on to suggest that the PU is the unified discipline of the study of cosmic plasma and astrophysics together.

In contrast to this broad agenda, it has recently been stated in an EU video on YouTube [3] that the results of the SAFIRE experiment show "a desperate need for a new perspective in planetary science, one which recognises charge exchange between celestial bodies" [4].

Similarly, Wallace Thornhill, one of the key figures within the EU, has written that "[Velikovsky's] basic premise of planetary encounters has been confirmed and the details fleshed out to an extraordinary degree" and that there is a "crucial distinction between the planetary catastrophism of the ELECTRIC UNIVERSE® and that of neo-catastrophists who attempt to explain the evidence for planetary encounters in terms of cometary phenomena" [5]. That model of charge exchange between celestial bodies and Immanuel Velikovsky's near-collisions of the planets within the last few thousand years is particular to the EU; it is not found in Peratt's *PPU* or anywhere else in plasma physics or astrophysics.

There's another major difference too: the Thunderbolts Project™ Inc. which is "A voice for the ELECTRIC UNIVERSE®", seems to have been set up to sell a product: the ELECTRIC UNIVERSE® model. The Thunderbolts Project™ and the ELECTRIC UNIVERSE® are indeed registered trademarks [6]. In other words, the EU is a highly commercialised organisation. In contrast, Peratt's *PPU* is a plasma physics textbook.

So the EU certainly isn't the same as the PU; they're as different as chalk and cheese. We could perhaps stop there, but the second question of why it matters is going to take longer to answer and involves looking in more detail at the reasons why the EU isn't the same as the PU.

### The Relationship between the EU and the PU

If the EU isn't the same as the PU, then what is the relationship between them? Thornhill has stated on his 'Holoscience' website that the EU "is more interdisciplinary and inclusive of information than any prior cosmology" [7], which implies that there's more to the EU than you get with the PU. There's no obvious indication in the EU publicity that they are being selective about which parts of the PU they include, so let's assume to start off with that the EU includes the whole of the PU. This would be like a special offer along the lines of, 'Buy the EU theory and get the PU free'. But it would be sensible to check what's in the box before committing to a purchase [8].

A background sketch may be useful here. According to a brief article by Peratt [9], in the early twentieth century the Norwegian physicist Kristian Birkeland postulated the existence of charged particles in what was then supposed to be the ‘vacuum’ of space; unfortunately Birkeland died in 1917, leaving the proponents of the ‘space is a vacuum’ view led by Sydney Chapman largely free to dictate the course of astrophysics in the years that followed and it was not until 1974 that space probe measurements decided the controversy in Birkeland’s favour.

In 1950 Hannes Alfvén had published *Cosmical Electrodynamics*; the second edition of 1963 was co-authored with his colleague Carl-Gunne Fälthammar [10]. In this work, the authors argued for the need to consider electric currents and their complete circuits in the understanding of space plasmas. Alfvén continued to promote the role of electric currents in space until his death in 1989. In 1992 Anthony Peratt coined the term ‘Plasma Universe’ to describe the new discipline, also referred to as ‘Plasma Cosmology’; he later extended the scope of the PU by identifying the relation between petroglyphs and the types of plasma formations he’d seen in his work on high-energy plasma discharges at the Los Alamos research laboratory [11]. Inclusion of this aspect of the PU is the primary difference between the first (1992) and second (2015) editions of his book, *PPU*.

Meanwhile the foundations of the EU approach were being laid down. In 1944 Charles Bruce had proposed an Electric Discharge model of the universe based on his hypothesis that the Sun’s photosphere consists of electric arc discharges; following a number of other articles on the subject, in 1960 Bruce summarised his thesis in a short paper titled *An All-Electric Universe* [12]. During the same period, Immanuel Velikovsky published *Cosmos without Gravitation* in 1946 and *Worlds in Collision* in 1950 [13] which between them introduced the key concepts of the role of electromagnetic forces in the cosmos and the theory of encounters between charged planets, including Earth, within the last few thousand years. In the 1970s Ralph Juergens, inspired by Velikovsky’s ideas, proposed that the Sun was powered not by internal fusion but by external electric currents [14].

In 1980, David Talbott published *The Saturn Myth* [15.(1)] in which he proposed that ancient myths and tradition describe the planet Saturn as the dominant celestial body in the sky, appearing fixed at the north celestial pole. In 1997, Wallace Thornhill, who had previously met Velikovsky and discussed the latter’s *Cosmos without Gravitation*, presented a paper titled *The Electric Universe*. to the conference ‘Planetary Violence in Human History’ in Portland, Oregon [15.(2)]; in his paper Thornhill pointed out that electrostatic forces are many orders of magnitude more powerful than gravity and would operate in a plasma medium; therefore, he suggested, modern plasma physics may help to explain features of the Saturnian system proposed by Talbott.

Thus we can already see the different strands of the PU & EU thinking emerging; the modern EU movement founded by Talbott and Thornhill in the 1990s draws on both strands. In order to keep track of these two strands as they are developed throughout the remainder of this paper, we will summarise the key differences in the form of a simple table comparing the EU and PU (Table 1 below) and explain the entries on the table as we go along. The theory of charge exchange between celestial bodies effectively defines the EU strand; near-collisions of charged planets with Earth within the last few thousand years clearly belong in the EU as well, together with Talbott’s Saturn Theory, and Juergens’ Anode Sun model together with its later development, the Electric Sun (see below for more details). None of these are found in the PU strand.

Similarly, we can define the PU strand as ‘plasma physics in astrophysics’. The PU includes the whole of plasma cosmology, including Birkeland Currents, plasma filaments in space, double layers, parallel electric fields and many other aspects of plasma behaviour that anyone who follows the EU will be familiar with. Also in the PU is recognition of the value of Birkeland’s terrella experiments in helping to demonstrate that phenomena such as the auroras can be explained by considering charged particles in space, together with Peratt’s more recent hypothesis that petroglyphs could have been records of plasma events seen in the heavens within the last few thousand years. As noted above, this extension of PU theory represents the primary difference between the first and second editions of Peratt’s *PPU*.

So, are the EU theorists simply continuing to extend the range of the PU as Peratt did? At first sight this might appear so, but we’ve already had a strong hint that this is somewhat misleading – what you get in the EU is very different to the contents of the PU, and probably would not be seen as a *valid* extension of PU theory by the pioneers as Peratt himself has recently indicated [16].

In a nutshell, the PU is based on plasma physics theory backed up with laboratory research and detailed mathematical modelling, including both fluid analysis and kinetic Particle-in-Cell models requiring massive amounts of computer time on the largest machines available. In contrast, as will become apparent below, the EU is largely based on speculative proposals and visual analogies; these are backed up by claims that genuine examples of plasma behaviour in space are evidence for their own model of an electrically-driven Sun and recent close encounters between charged planets. This ‘sales technique’ of mixing of PU fact and EU theory is easy to miss if you’re not looking carefully.

## Examining the EU's claims that examples of plasma behaviour support the EU model

We can see this EU sales technique in action when we look at their recent YouTube video Series, 'Top 10 Reasons why the Universe is Electric' (T10R) in detail. Episode 2 is an especially good example.

Episode 2 – 'Filaments in space' does present a lot of genuine evidence for filamentary behaviour of plasma in space including lightning discharges and sprites in the Earth's upper atmosphere; electric currents between Jupiter and Saturn and their respective moons; and the filamentary nature of penumbral filaments on the Sun. But these genuine examples of plasma behaviour are intermixed with key claims of the EU's model such as, "in the EU, all stars are positively charged anodes", the (erroneous) claim that magnetic ropes have been found stretching from the Sun to Saturn (see below), and much more.

At ~8:05 it is claimed that these pieces of genuine evidence "All attest to the electric circuitry in the solar system". David Talbott, one of the principals of the EU, has stated the implications of this finding elsewhere:

I do not believe that anyone following the fact-based discussions in recent years, including five full-length documentaries, more than a hundred episodes of Space News, and 31 episodes of our Discourses on an Alien Sky, would want to suggest that evidence for an electrified heliosphere is lacking. **(Yes, an electrified heliosphere does mean an Electric Sun.)** [17]

What is not mentioned is that the existence of the Heliospheric Current Sheet (HCS), extending approximately in the Sun's equatorial plane throughout the heliosphere, has been recognised by astrophysicists for decades but they would not agree with Talbott that this means an Electric Sun. Alfvén's diagram of the complete circuit of the HCS shows it passing *above the photosphere* from low to high solar latitudes, then running along the rotational axis in both directions before returning back to the equatorial plane at some unspecified distance from the Sun, but even he did not take the fact that the heliosphere was obviously electrified to mean that the Sun itself is Electric. On the contrary: Juergens, to whom the original model of an electrically-powered Sun is due, complained bitterly that Alfvén wouldn't endorse it [18].

At ~3:20, T10R Episode 2 shows Donald Scott's diagram indicating how the EU theorists modify Alfvén's HCS electric circuit by routing the current *through the photosphere* so that it enters and leaves the body of the Sun. I've shown previously that Juergens' model with the current entering and leaving the photosphere is contradicted by the actual evidence; Alfvén's HCS circuit is correct. [19, 20].

The EU theorists have now abandoned Juergens' 10 billion Volt model in favour of a 'Hybrid' model in which the Sun is partially driven by an un-quantified amount of incoming current which in turn is supposed to catalyse fusion in the photosphere. This hybrid Electric Sun model retains Juergens' key concept of an Anode Sun with currents entering and leaving it; the granulation of the photosphere is still supposed to be indicative of the behaviour of an anode in an electrical circuit. However, I've shown elsewhere that this 'hybrid' concept is equally flawed; the electric discharge activity which Bruce identified in the solar spectra is coming mostly from coronal loops and chromospheric flares, not from the photosphere as he thought [21].

It's only in EU theory that one finds an Electric Sun. Scott has further postulated that the Sun is actually 'Electronic', i.e. that its behaviour is analogous to a PNP transistor [22]. These concepts aren't in the PU strand of proper plasma physics. So we need to extend our table to include the EU claim about the implications of an electrified heliosphere, but also to note that the HCS and Alfvén's circuit don't imply an Electric Sun.

T10R Episode 2 episode concludes with a discussion of the magnetic fields which have been identified "everywhere we look" in space but "we don't know how these vast fields are generated ..." [13:35]. Apparently, "astronomers **must recognize** the electric currents required to produce and sustain the magnetic fields" [14:05, emphasis added]; this harks back to the central claim of Episode 1 – 'Galactic Magnetic Fields', that "Currents generate magnetic fields"; it's followed by reference to Peratt's simulations of two BCs interacting to form a spiral-galaxy-like pattern and it ends with the statement that "Alfvén wrote that space is filled with currents" [~15:30] which appears to lend his authority to what you've just been told.

When you look carefully, you can see that T10R Episode 2 is a classic example of the 'smoke and mirrors' technique: genuine PU evidence for electric currents in space, together with valid statements such as "for several years astrophysicists have recognised the electrical currents connecting Saturn and Jupiter to their moons" [~8:00], are being used to persuade the audience to believe in the EU's 'Big Picture Illusion' that electric currents are the primary factor, magnetic fields are merely secondary [23], and therefore the EU model must be right.

Michael Armstrong of Mikamar Publishing, who have produced many of the EU's books, wrote elsewhere about a critical article on the EU in Vice.com, saying that it was "A masterful mix of some factual information, canted

innuendo, misinformation, and misrepresentation” [24]. The irony of the situation becomes apparent when we consider Episode 2 of T10R.

What the EU theorists don't explain in Episode 2 is where the Birkeland Currents are supposed to have come from. However, we know from Episode 3 at ~8:35 that:

.. in the EU, space has a vast substructure ... of electric potential, typically extremely subtle at any point but sufficient to affect cosmic directionality. Both stars and galaxies occur like pearls on a string revealing a filamentary or even cellular structure to the universe ...

In other words, the EU theorists simply assume that the source of the currents in space are regions of different electrical potential which are discharging via Birkeland Currents. Likewise, on a smaller scale, the Sun is stated to be an anode delivering power to the planets which are charged to a different potential. How these regions of Potential Difference arise in the first place is never explained.

Episode 4, 'Light Bulbs in Space', develops the EU's analogy between electrically-powered stars and household light bulbs, both being powered from a remote generating station. Unfortunately, this episode starts off with a fundamental error: it's acknowledged that electric currents in space are recognised by some mainstream astrophysicists but then it's claimed at ~ 1:00 & ff that they assume that they're produced by "mechanical and kinetic processes", obviously trying to equate the term 'kinetic' with simple Newtonian mechanics. More 'mechanical and kinetic' denigration occurs after ~7:40. (Perhaps not coincidentally, I'd written an article in favour of kinetic models of the Solar Wind [25] which was published shortly before this episode was released.)

What's very concerning is that the EU theorists are thereby demonstrating that they don't understand the term 'kinetic', despite continually trumpeting Peratt's computer modelling of plasma; these Particle-in-Cell computations are based on kinetic modelling! In fact the whole EU argument requires the kinetic approach to modelling plasma behaviour; this approach can replicate features such as currents and double layers which the alternative 'fluid' approach can't do. If the EU theorists don't even understand the terminology then how can we trust their interpretation of the plasma physics?

There's more unsupported speculation in the episode which follows. The draft of T10R Episode 5 posted on 14.11.17 looks at pulsars. This episode describes pulsars in terms of Scott's un-quantified hypothesis of a 'plasma bridge' between two closely-orbiting binaries, one of which is being charged by an external current. By analogy with lightning in the Earth's ionospheric cavity on Earth, Scott suggested that this might be the explanation of pulsar behaviour if the system was acting as an oscillating resistive-capacitive circuit discharging along the plasma bridge. Comments were invited privately on this draft of episode 5 but unfortunately for Scott's hypothesis, a keen supporter of the EU pointed out that radio engineers have shown that a plasma bridge between binaries couldn't produce the stable oscillations observed from pulsars [26].

There *are* many puzzling aspects of pulsar behaviour which appear to require a plasma-based explanation but Scott's speculations are apparently as impractical as his diagram of the HCS and Electric Sun which appeared in episode 2.

Episodes 6 & 7 concentrate on 'Charged Planets', once again using valid PU evidence of electrical activity to support various EU contentions: that electric charge exchange between the Sun and the planets is the best explanation for many phenomena unexplained in standard astronomy (Ep. 6, 7:40); that it's the electric current system connecting Earth and Sun which drives our weather (Ep. 6, 5:30); that it has always been EU's position that the planet's powerful auroras, polar storms and magnetic field etc. are induced [27] by powerful Birkeland Currents from the Sun focused at the planet's poles (Ep. 7, 5:00); and similar categorical statements of how the solar system works, according to the EU.

Episode 8 continues with the theme of charged planets, exploring Electrical Planetary Scarring. It begins:

Evidence for electric currents throughout space is now undeniable ... and is more and more routinely acknowledged by cosmologists & astrophysicists ..., but ramifications have been slow to effect any meaningful change in consensus scientific theory; ... a major obstacle is a lingering belief that science discovery has emphatically contradicted: that celestial objects cannot have any net charge separation ... (0:30 & ff).

As we've seen in previous examples, alternative explanations are never given a hearing: genuine evidence of currents in space is taken to verify the EU model based on charged celestial bodies being the source of electrical discharges between them, and astrophysicists need to catch up. The underlying philosophy is revealed in the interesting statement we saw before about the results of the SAFIRE experiment, which were claimed to show a "desperate need for a new perspective in planetary science, one which recognises charge exchange between celestial bodies" [28].

It seems that the 'desperate need' is the EU's own - to gain acceptance of their particular interpretation of the undoubted electrical activity in the Solar System and beyond.

## Misrepresentations, False Dichotomies and Denigration of Mainstream Science

Another feature of the EU publicity is its frequent misrepresentation or misinterpretation of the original sources. In many instances the writers may not be directly to blame for the misunderstanding because they tend to rely heavily on secondary sources such as popular science websites and similar media for their information, and it often happens that these sources have given a particular slant to the research which is not apparent in the original papers.

<p style="text-align: center;"><b><u>Electric Universe</u></b></p> <p style="text-align: center;"><i>Charge exchange between celestial bodies</i></p> <ul style="list-style-type: none"> <li>• Recent planetary collisions with Earth</li> <li>• Saturn Theory</li> <li>• Anode Sun model (Electric Sun, Electronic Sun)</li> </ul> <p style="text-align: center;"><b>= speculative proposals and visual analogies relying on PU evidence</b></p> <p style="text-align: center;"><b><u>EU claims and methods:</u></b></p> <ul style="list-style-type: none"> <li>• "Yes, an electrified heliosphere does mean an Electric Sun" [Talbot]</li> <li>• Magnetic fields mean the Universe is Electric</li> <li>• Currents in space are due to assumed Potential Differences</li> <li>• Flux ropes from the Sun to all planets</li> <li>• Constant denigration of mainstream scientists</li> <li>• Misrepresentations and false dichotomies</li> </ul>	<p style="text-align: center;"><b><u>Plasma Universe</u></b></p> <p style="text-align: center;"><i>Plasma physics in astrophysics</i></p> <ul style="list-style-type: none"> <li>• Plasma Cosmology (Birkeland, Alfvén, Peratt)</li> <li>• Birkeland Currents, plasma filaments in space, double layers, parallel electric fields, etc.</li> <li>• Birkeland's terrella experiments</li> <li>• Petroglyphs as records of plasma events</li> </ul> <p style="text-align: center;"><b>= plasma physics</b></p> <p style="text-align: center;"><b><u>PU science inconsistent with EU theory:</u></b></p> <ul style="list-style-type: none"> <li>• HCS &amp; Alfvén's circuit do <b>not</b> imply an Electric Sun</li> <li>• A role for magnetism as well as electricity</li> <li>• Faraday's Law of Induction generates currents from magnetic fields + motion of plasmas</li> <li>• Magnetic Energy storage in plasma</li> <li>• Modern Kinetic modelling</li> </ul> <p style="text-align: center;"><b><u>Interim Conclusion:</u></b></p> <p style="text-align: center;"><b>The EU is not the same as the PU, nor does it include the whole of the PU</b></p>
<p style="text-align: center;"><b><u>Common principle:</u></b></p> <p style="text-align: center;">Myths can illuminate plasma cosmology and <i>vice-versa</i></p>	
<p style="text-align: center;"><b><i>Examples of EU interpretation:</i></b></p> <ul style="list-style-type: none"> <li>• Birkeland Current runs directly from Sun to Earth and causes discharges</li> <li>• Venus was a comet and caused discharges during near collisions</li> </ul>	<p style="text-align: center;"><b><i>Examples of PU interpretation:</i></b></p> <ul style="list-style-type: none"> <li>• Inductive Solar Wind – Magnetosphere Coupling and discharges via the 'Gold scenario'</li> <li>• Venus only <i>looked like</i> a comet</li> </ul>

**Table 1: A Comparison between the Electric Universe and the Plasma Universe**

**Refer to the text for a full explanation of the entries.**

On the few occasions when the EU publicists do refer directly to a peer-reviewed source, they still manage to interpret it in a way which suits their model but one which isn't necessarily in line with the original paper. This failure to accurately represent the original sources can be traced back to Juergens himself where, as I showed in 2013 [29], of the four key sources he cited in support of his 10 billion Volt Anode Sun model, three actually contradicted his interpretation and the fourth showed that a mere 400 V potential drop near the Sun was sufficient to explain the relevant observations. A recent example will serve to demonstrate that the problem of misinterpretation continues.

In Episode 7 of the T10R series, reference is made at ~15:00 to a 2016 discovery by Jasinski *et al* of a magnetic flux rope apparently stretching between the Sun and Saturn. The commentary states that this flux rope is traversing the vast distance between the two bodies, a point reinforced at ~15:40 when it's stated that the flux rope extends "nearly 900 million miles from the Sun to Saturn".

However, at ~15:15 the commentary also refers to a UCL news report [30] in which Jasinski is quoted as saying in an interview that Saturn's magnetosphere behaves similarly to Earth's magnetosphere. Because the well-known Solar Wind – Magnetosphere Coupling mechanism (see my paper on Tectonic Uplift [31] for a detailed discussion) doesn't involve a flux rope stretching from the Sun, this immediately raises the question, what does the original paper by Jasinski *et al* [32] actually say about the Saturnian flux rope?

Key points from that paper include the following (emphasis added):

Conditions **at Saturn's magnetopause** are at times conducive to multiple X-line reconnection and flux rope generation. [p. 6713]

Discussion & Conclusions:

We have presented the first detection of an FTE-type flux rope **at Saturn's dayside magnetopause**. The Cassini spacecraft passed from the magnetosphere, where it observed five TCRs and then passed into an open flux region where energized magnetosheath plasma was observed as well as the FTE-type flux rope. ... Cassini then crossed into the magnetosheath, where the plasma increased in density, before finally traversing the bow shock and into the solar wind. [p. 6720]

Figure 2 of the paper confirms Cassini's trajectory from Saturn's magnetotail around to the dayside of the magnetopause and shows exactly where the flux rope was found. Similarly, the aforementioned UCL news report gives further details (emphasis added):

A twisted magnetic field structure, previously never seen before **at Saturn**, has now been detected for the first time, ...

**When the Sun's magnetic field interacts with the Earth's magnetic field (the magnetosphere)**, a complex process occurs called magnetic reconnection which can twist the field into a helical shape.

It's clear both from the original paper and from the full UCL news report that the flux rope is located on the dayside of the boundary of Saturn's magnetosphere, as indicated in the diagram from the UCL news report which the EU showed in Episode 7. There is no support whatsoever for the EU's claim that it stretched ~900 million miles from the Sun to Saturn.

What The EU publicists appear to have done, perhaps inadvertently, is to read what they want to read in the UCL news report which was titled: 'Magnetic Rope observed for the first time **between** Saturn and the Sun' (emphasis added), and interpreted the word "between" as meaning "stretching 900 million miles between the Sun and Saturn". However, the title of the original paper by Jasinski *et al* is 'Flux transfer event observation at Saturn's dayside magnetopause by the Cassini spacecraft'. If you read the original paper, or even the full UCL news report, then it's clear that the use of the word 'between' in the title of the news report must mean 'located between', not 'stretching between' as the EU publicists claim. To rely on a particular interpretation of just one word in the title of a popular news report is cherry-picking in the extreme.

We've spent some time on this one point because firstly, it's an important piece of claimed evidence for the EU's model of Birkeland Currents connecting the Sun and the planets which must now be discarded; and secondly, because it shows just how careful one must be not to simply believe everything the popular science media or the EU says, but instead to go back to the original sources and check what the researchers actually wrote. Time and again, one finds that the original research doesn't back up the EU's spin.

Another example of the EU advocates' misrepresentation of the facts is in their constant claims that the Standard Solar Model (SSM) suffers from various anomalies and so their alternative of an Electric Sun must be correct. Firstly, this is a false dichotomy: even if the claimed anomalies with the SSM were substantiated, this does not imply that there is only one alternative. Secondly, as I showed in a recent paper [33], the anomalies claimed in the EU book *The Electric Universe* [34] and referred to regularly in EU publicity do not stand up to close scrutiny. (I also described an alternative 'plasmoid' model in that paper but the details aren't relevant here.)

So far we've seen that what's in the EU isn't what you might expect from their sales pitch, and they aren't who they pretend to be. The EU model is not a scientific extension of PU theory: it's a particular model that's been erected on the foundations of PU theory and dressed up in plasma clothes, but if you look underneath the window-dressing you'll find that it's not what the EU want you to think it is.

Another thing you'll find in the EU is your free association is with a group which spends an inordinate amount of time denigrating all mainstream astrophysicists and cosmologists, not to mention most scientists in general. For example, Thornhill has written on his Holoscience website that:

The implications of electrical activity between planets will be profoundly disturbing for those who have built their cosmology around the weak force of gravity, acting in an electrically sterile universe. This strange, dogmatic oversight guarantees that nothing will remain in future of the fanciful Big Bang theory or the simplistic story of the formation of the solar system. [35]

This endless stream of criticism is apparently intended to distinguish the EU as the only group of people who know what is really going on, especially when it comes to the role of electricity in space.

The EU movement also incessantly misrepresents the state-of-the-art in mainstream astrophysics. As has been observed by others familiar with the EU's methods, the EU publicists generally deny that mainstream scientists have any recognition of electrical activity in comets and the rest of outer space, whereas in reality electrical processes are widely recognised [36]. On the few occasions when the EU theorists need to acknowledge that astrophysicists have referred to electrical activity, then, as we saw above, there is usually a caveat which suggests a lack of complete understanding of the process, i.e. that the scientists concerned don't fully appreciate the role that electricity is playing, or what is driving it.

On a similar theme, as I pointed out in my recent presentation to the SIS in 2017 [37], the EU publicists consistently fail to acknowledge that there is a significant minority of plasma scientists who are arguing for the kinetic/particle approach to analysing space plasmas but who, like the EU, are struggling to make their voice heard against the majority view that there can be no electric fields in space because of plasma's very high conductivity. The majority of 'consensus' scientists still seem to prefer the 'fluid analysis' approach championed by Eugene Parker [38] who usually prefer to analyse plasma behaviour in terms of the magnetic field; this approach is easier because it allows the equations to be solved directly. The alternative 'kinetic' approach has to rely on computers to carry out the number crunching to produce a solution of the complex equations for each particle separately. The benefit is that the kinetic approach can model currents, double layers and parallel electric fields which are needed to explain plasma behaviour in some situations.

However, as Alfvén pointed out [39], there are many situations in which the magnetic approach is perfectly adequate; this approach is not only easier but it also allows much more to be achieved than would be the case if every researcher was having to apply for a slot in the limited amount of hugely expensive supercomputer time. There is room for both approaches as long as the limits of applicability of the fluid analyses are recognised, as some plasma physicists such as Parks [40] have been arguing for many years.

But you wouldn't know that from listening to the EU's publicity. One has to wonder why the EU theorists refuse to acknowledge the one group of mainstream scientists they are in at least partial agreement with. Surely they're not trying to reserve the turf exclusively for themselves, so that the non-PU aspects of EU theory don't get swept away when the mainstream astrophysicists move in? That really would be a 'dog-in-the-manger' attitude to the progress of science. But as we've seen, you're buying into this whole pattern of behaviour when you subscribe to the EU; it's part of the EU strand along with the rest of their theories.

We must add all the above claims and negative aspects to the EU side of our table; we also need to add the kinetic modelling denigrated by the EU to the part of the PU side which is inconsistent with EU theory. Now we need to look at what else is missing from the PU side that really should be there, if our initial assumption that the EU includes the whole of the PU is correct.

## **Induction and the Role of the Magnetic Field**

Astute readers will have noticed that we've only barely mentioned Episode 1 of T10R so far. The title of that episode is 'Galactic magnetic fields' and it presents one of the EU's central claims that the fact that magnetic fields have been found throughout the solar system (and the galaxy) must be direct evidence of currents in space because it's well known that currents generate magnetic fields; hence evidence of magnetic fields must be support for their model based on Birkeland Currents running between the Sun and the planets including Earth. This claim is incorrect on two counts.

Firstly, the implication in Episode 1 is that magnetic fields arise *exclusively* from electric currents. Secondly, even when the fields are produced by currents this does not necessarily mean that the EU model is correct. Note also that a

corollary of the first point is that in EU theory the magnetic field is relegated to a supporting role; this is diametrically opposite to the majority mainstream view. However, whilst I agree that the mainstream analyses are often too skewed towards the role of magnetism at the expense of electric currents, I'm equally convinced that the EU's approach has gone too far the other way. The magnetic field plays an important role too, and not just as an indicator of the presence of currents as the EU would have us believe in T10R Episodes. In order to understand these points we need to investigate what other mechanisms can generate magnetic fields and electric currents.

It is undeniable (as the EU theorists like to say) that plasma obeys Maxwell's Equations, but Maxwell was well aware that electricity and magnetism are two sides of the same coin. In any non-static situation, a changing electric flux is associated with a non-zero magnetic field; likewise, a changing magnetic flux is associated with a non-zero electric field. However, the two situations aren't entirely symmetrical because, as the first of Maxwell's Equations shows, a magnetic field is also generated by an electric current. It's apparently this last point that the EU theorists base their claim on.

As we saw above, in Episode 3 the EU publicists insist that the electric currents arise because of "a vast substructure of electric potential", i.e. Potential Differences (PDs) between different regions of the cosmos. But where do those PDs come from? As far as the solar system is concerned, Episode 1, ~8:40 suggests that in the EU model the planets are electrically charged bodies that are part of the larger electric circuits connecting them to the Sun, which of course is held to be an Anode at a different potential. In the wider cosmos we apparently have to rely on the pre-existing 'vast substructure of electric potential'. Similarly, in Scott's *The Electric Sky* [41] Ch. 9 'Shake Hands with the Plasma', the subsection 'The Cause of Electric Currents in Plasma' simply makes the analogy between electric currents in a wire and water flow in a pipe and explains that "An electric current is caused by applying a higher voltage at one end of the wire than at the other." In a plasma, the ions (sic) "move in response to any applied  $E$ -field, ..." but Scott does not inform us where the applied  $E$ -field itself comes from.

So we still haven't really explained the ubiquitous magnetic fields; claiming they're due to equally unexplained electric currents is simply pushing the problem down the line. It seems to me that we have a situation analogous to the question: where does the ubiquitous matter in the Universe come from originally? The Big Bang model offers one possible solution, involving a massive 'free lunch' appearing out of nowhere; the EU theorists prefer not to say where the matter came from - perhaps the Universe has always been there. If that is so then there seems to be no *a priori* reason why the magnetic field could not have always been there as well.

A more deterministic model could be based on the fact that every electron and every proton has its own magnetic moment, i.e. it comes complete with a small magnetic field. Combining a proton and an electron into a hydrogen atom doesn't destroy their fields and so most particles in the Universe still have magnetic fields of their own, whether or not there was a Big Bang Beginning.

Simple random distributions of the particle density, their spin directions and their mutual effect on each other would seem to imply that there would inevitably be some regions with a bit more magnetic field and some with less; some regions where the average of all the particles' field directions was pointing one way and others where it was pointing another way, and so on. Compare the effect a bar magnet has on iron filings, for example, or of the way two bar magnets try to align with each other. Any small region with a net magnetic field will influence all the particles in its vicinity. Variations in thermal velocity of the charged particles add a further complication.

These principles have already been recognised when considering the problem of the origin of the first cosmic magnetic fields. For example, "in a 'Biermann battery' magnetic fields develop 'spontaneously', that is, from initially being zero, when there are non-parallel gradients in electron temperature and density" [42]. Similarly, the Weibel instability driven by the anisotropy of the particle velocity distribution, naturally generates nG magnetic fields [43]. However these mechanisms are generally thought to be insufficient to generate the observed present-day levels of magnetic fields in the cosmos without some further amplification mechanism. One possible mechanism is via turbulence generated by reflected particles downstream of an 'astrophysical shock' arising when incoming plasma interacts with an obstacle; the shock effect is greater if the obstacle is magnetised [44]. Laminar electrostatic shocks closely resemble Current-Free Double Layers [45]; they incorporate a PD across them and turbulent shocks are similar: the turbulence arises as particles reflected by the PD interact with the incoming neutral plasma. It appears that the motion of magnetised bodies through a background plasma is efficient at generating these PDs in the form of DLs or 'shocks', but they are confined to the DL itself.

Note that currents are not the primary factor in any of the processes discussed above. Whilst one could argue that an electron orbiting a proton in a hydrogen atom is itself a current and this process is what makes an iron bar into a magnet, the magnetic field was there first and there's no PD driving the electron round its orbit. In space as on Earth, there can't be an electric current without magnetism, but there can be magnetism without a current: an electron still has its magnetic moment even when it's stationary. More magnetism is generated when electrons are moved relative to an



ion background to create a current, but there has to be some force to move the electrons. That force may be a Potential Difference, which the EU theorists suggest in the T10R series is the only possibility.

However, the PU has another method of generating currents. It's called an electromotive force (EMF) and it comes about because of the Maxwell Equation which deals with time-changing magnetic fields. This equation is also known as Faraday's Law of Induction and it works like this:

If you change the magnetic flux over time then you generate a curl [46] of the electric field in space which causes an EMF which makes all the electrons in a conductor move. Suppose for example that you have a ring of conducting material through the centre of which there is some magnetic flux, say from a nearby bar magnet. Now change that flux by moving the bar magnet towards or away from the conducting ring. This immediately results in a change in the amount of curl of the electric field. This causes an EMF and so all the electrons in the conducting ring simultaneously start to move around the ring. The direction of motion of the electrons is such as to oppose the change in the magnetic flux by generating new magnetic flux to try to restore the original amount of the field; that's known as Lenz's Law. It's as though the magnetic field has some sort of inertia and resists being changed.

The moving electrons constitute a current around the ring. But notice that there's no PD based on a charge differential anywhere. There's only an EMF. That's induction at work. And of course plasma is a conductor so one can choose any number of conducting rings in a region of plasma. All the electrons will be affected if the magnetic flux changes, and currents could arise anywhere because of the change of flux. That change may come about if the region of plasma expands or contracts, so as to include more or less external flux through any selected conducting closed path.

But EMFs also arise because of the magnetic Lorentz Force  $\mathbf{F} = q(\mathbf{v} \times \mathbf{B})$  whenever plasma moves across a background magnetic field without necessarily expanding or contracting [47, 48]. For example, if there's a region of plasma in interstellar space which is moving across the background galactic field, then an EMF will be generated in the plasma and Birkeland Currents will appear without a charge-based PD. This is just Faraday's Law of Induction at work, generating currents in a plasma from nothing more than a magnetic field and relative motion. Of course, these induced currents generate more magnetic field and so presumably motion-generated EMFs should be considered as another possible mechanism for amplification of the original magnetic field.

And this brings us to another point: magnetic energy can be stored in plasmas by setting up a system of current loops within it [49]. This quality is known as 'inductance'. Once the current loops have been generated, and as we've just seen, it's easy to achieve this by generating EMFs from relative motion of the plasma and the magnetic field, then the stored magnetic energy related to the currents is proportional to the square of the field strength integrated over the volume concerned.

Peratt gives an example of the generation of magnetic energy storage in the solar corona where the current loops are in a force-free configuration, i.e.  $\mathbf{j} \parallel \mathbf{B}$  where  $\mathbf{j}$  is the current density and  $\mathbf{B}$  is the magnetic flux density. As he explains:

The storage of energy in the force-free magnetic field can be thought of as a slow process where the field evolves through a sequence of force-free configurations, each time ending up in a higher energy state. An example of this slow process is in the photosphere and lower chromosphere of the Sun, where the energy of the plasma motion dominates the magnetic energy and, therefore, the field is swept passively along with the plasma. This situation is characterized as a high- $\beta$  plasma; [ $\beta$  = gas pressure / magnetic pressure; high- $\beta$  is when  $\beta \gg 1$ ] Higher up in the corona where the density is so small that the magnetic pressure dominates, we have a low- $\beta$  plasma [ $\beta \ll 1$ ], and the magnetic field must take on a force-free character (Gold 1964) as it slowly evolves.

In the solar wind the magnetic field is no longer 'swept passively along with the plasma'; nevertheless, observations of magnetic substorms clearly indicate that the solar wind is magnetised when it reaches the Earth's own magnetosphere, and that the direction of the magnetic field in the solar wind is a vitally important factor in the generation of substorm activity [50]. Thus, whilst the field in the solar wind may evolve *en route* from the Sun to the Earth, perhaps in some form of turbulent interaction with the particle velocity distribution, magnetic field and magnetic energy are still in effect carried along with the plasma.

A good example of magnetic fields being carried by moving plasma is Coronal Mass Ejections, especially the 10% or so of them which form what are classified as 'magnetic clouds'. These are in fact huge plasmoids, i.e. self-contained and highly organised plasma structures with high magnetic energy densities existing in a force-free configuration. The term 'plasmoid' was coined by Bostick to describe similar plasma structures which he was able to create in a plasma gun and fire across the field lines of an external magnetic field carrying their own magnetic field with them.

Bostick also demonstrated that plasma has a natural ability to interchange magnetic and kinetic energy, seeming to tend towards equipartition of the two in any situation [51]. Plasmoids often form whenever the bulk plasma velocity is very high; this seems to be plasma's way of converting some of its kinetic energy into magnetic energy in order to reach a more stable state of equipartition of energies.

And so once again we see that the magnetic field often plays a much more important role than the EU allows it to do. It really is a chicken-and-egg situation in plasmas, where currents do generate magnetic fields but fields plus motion generate currents. But you won't find induction or any other significant role for magnetism inside the EU according to the various T10R episodes [52], presumably because that would undermine their claim that electric currents come from charged planets, Anode stars, and large-scale Potential Differences in the cosmos. Whatever the reason, we'll have to update our table again to show the different interpretation of the role of magnetic fields in the EU and PU approaches.

But we've now reached the point where there's so much of the PU that's inconsistent with the EU theory that we've disproved our starting assumption that the EU includes the whole of the PU. The EU only uses part of the PU in support of its own theories and ignores those parts of the PU which contradict them.

Thus at best the EU appears to be a development of the PU in one particular direction but we've already seen that this can't be considered to be a *valid* extension of the PU. Furthermore, the EU offers a very specific model which isn't open to development of its central theses in the way that proper plasma science should be [53].

## **Alternative Developments of the PU**

Recognising that the EU does not include the whole of the PU has another very important consequence: it means that there can be developments of PU theory which are in a completely different direction to the one promoted by the EU. And that brings us to another feature of the EU: their dogmatic insistence that their model is the only possible alternative to the mainstream consensus model.

We've already seen how the EU publicists misrepresent the mainstream position as an undivided one supporting a single consensus viewpoint, and deny that there are in fact a number of different views within mainstream science. But the problem goes further than that: the EU theorists also dismiss out of hand all alternative models based on the principles which they themselves adhere to, i.e. plasma phenomena in space which could be related to historical and mythological events.

A good example is what I [54] and van der Sluijs [55] have separately referred to as the 'Gold scenario', in which extreme solar eruptions have potentially catastrophic effects on Earth because of electromagnetic induction, not because of the EU's hypothesis of a Birkeland Current (BC) stretching between the Sun and the Earth, or because of near-collisions with other planets.

Peratt referred to Thomas Gold's work in his first paper on petroglyphs and the z-pinch [56]. Gold [57] had described how an extreme increase in the Solar Wind speed would compress the Earth's magnetosphere down to the point where the induced currents in the inner magnetopause would short out down to the surface of the Earth instead of closing through the upper atmosphere. This, Peratt argued, could have caused the plasma discharges seen by the Ancients.

The 'Gold scenario' is an extreme example of the well-known if not completely understood phenomenon of Solar Wind – Magnetosphere Coupling (SWMC) that I examined in detail in my paper on tectonic uplift [58]. In that paper, I showed that there is more than enough energy in a huge Coronal Mass Ejection to have caused the raising of the Andes even if only a very small fraction of that energy was delivered to the surface of the Earth by Gold's mechanism.

Unfortunately, in his later 'petroglyph' papers, Peratt moved away from his initial exploration of Gold's work and developed an EU-specific alternative explanation in the form of a massive plasma column of BC located above the Earth's south-pole; the inductive aspects of the SWMC mechanism were lost in the process. However, Van der Sluijs and I showed conclusively in 2013 [59] that Peratt's polar column cannot explain the worldwide evidence of petroglyphs as he had claimed, even with Peratt's postulated 'bend' in it; apparently, the value of Peratt's early insights had been compromised by his later attempt to force-fit the observations into the EU's model of BCs and the Saturn configuration.

Another example of alternative models is the question of whether Venus was ever a comet. This Velikovskian suggestion remains at the very heart of EU theory, along with the claim that Venus still carries a significant proportion of its supposedly original potential difference from the time that it was in a very different orbit. In *Worlds in Collision*, Velikovsky based his claim that Venus had been a comet on both the mythological evidence and also on his interpretation of the anomalous numerical data contained in the ancient Hindu astronomical text known as the Pañchasiddhântikâ.

Velikovsky claimed that these ancient records of observations of the synodic periods of the planets showed that both Venus and Mars must have been on very different orbits to those they occupy at present. However, as I showed in a presentation to the SIS in 2017 [60], the anomalous data in the Pañchasiddhântikâ is consistent for all five planets recorded, i.e. Mercury, Venus, Mars, Jupiter and Saturn, and it implies orbital periods for all five planets and Earth itself of only 98.5% of their present-day values. Whilst this does require an explanation [61], Velikovsky was incorrect

to claim this ancient data showed that *only* Venus and Mars must have had orbits *very* different to their present ones, and to use this as strong support for his theory of near collisions between Mars, Venus and Earth in the recent past.

Similarly, both Velikovsky and the EU after him take ancient reports of alterations to Venus' orbital motions, found in Varro as cited by Augustine, as direct evidence that Venus was originally a comet which was captured by the Sun and became a planet with a near-circular orbit. However, as van der Sluijs has pointed out [62], Augustine also stated that Venus soon resumed its original orbit, a fact which rules out Venus having previously been a comet. Moreover, van der Sluijs has shown in a number of articles [63] that the mythological data can be interpreted very differently: all the descriptions of Venus having had cometary characteristics, which the EU take to be evidence that Venus *was* a comet, may instead be seen simply as a description of Venus appearing comet-*like* whilst remaining in or close to its usual orbit. For example, Venus could have been seen with a tail similar to that which a true comet exhibits.

In fact modern observations have shown that Venus does have a comet-like tail, although it is not visible to the naked eye [64]. As the Solar Wind sweeps around Venus, it forms an elongated magnetotail which has been found to stretch as far as Earth's orbit, and also shows a remarkably 'comet-like' concentration of solar wind on both edges of the magnetotail.

As van der Sluijs has suggested in the above-referenced articles, it's possible that the Solar Wind flow past planet Venus increased during a period of extreme solar activity to the point where its normal magnetotail became visible to ancient peoples. Thus it is not a logical deduction to conclude, as the EU theorists do, that observations of Venus appearing *like* a comet must have meant that it *was* a comet on a different orbit.

The above examples are two of many possible ones which could have been chosen to illustrate the point that there are alternative explanations of historical and mythological records in terms of plasma phenomena; what's more, unlike the EU model, they don't require misrepresentation or omission of parts of the evidence. Nevertheless they aren't considered by the EU because they don't conform to their particular pre-conceived ideas. Our table must include these different interpretations branching from the common principle that myths can illuminate plasma cosmology and *vice-versa*.

A quick glance at the completed table will immediately reveal the great differences between the EU and the PU; most of these differences arise because of the EU's urgent promotion of their particular model and denigration of all the alternatives. It's a great pity that the EU principals have become so dogmatic; it seems as though they have invested so much time and effort into promoting one particular model that they cannot accept any significant changes to it at this point. The irony, of course, is that resistance to change is one of the things that the EU publicists regularly criticise mainstream scientists about.

Similarly, the EU publicists often try to claim the moral high ground by suggesting that the mainstream scientists aren't practicing science in the proper manner. Two recent examples will serve to represent many others. The Thunderbolts Project newsletter of 19 August 2018 states that, "Failure to see contradictory evidence is not elegant". Similarly, their *Space News* of 13 August states, "Openness and critical scientific judgment must be partners". Yet the EU theorists are themselves guilty of failure to see contradictory evidence, they are certainly not open to alternative ideas and they don't demonstrate critical scientific judgement, even though they openly imply that these are the scientific principles that should be adhered to.

## **Why it matters that the EU isn't the same as the PU**

So, why does all this matter? Surely the EU deserve credit, not criticism, for advancing astrophysics by bringing the electrical behaviour of plasma in space to everyone's attention?

Well, no – I disagree. The problem is, as we've seen, that the EU principals are not practising the scientific method; instead they're promoting their own particular theories for their own ends. In doing so, and by constantly denigrating all astrophysicists and cosmologists, I suggest that they are making it more difficult for anyone in the mainstream to incorporate PU science including kinetic modelling of currents, double layers and the like into astrophysics because of fear of ridicule on the grounds that they are siding with pseudo-scientists.

So, instead of "furthering the science of astrophysics" in a "New Enlightenment", as Adrian Gilbert recently suggested [65], it seems that the EU are actually holding back progress in the one area in which they say they would most like to see it being made. The long-term effect of the EU's constant publicity [66] for their highly idiosyncratic interpretation of plasma effects will *not* be to demonstrate that they are the inheritors of the plasma mantle of Birkeland, Alfvén, and Peratt but instead to compromise the legacy of those founders of the PU.

The EU are also stifling development of alternative catastrophic models of plasma behaviour linking myth to plasma cosmology. Researchers, including Velikovsky, Peratt and even the EU principals themselves, deserve credit for

exploring the link between myths and electrical or plasma events in space, but the EU theorists are wrong to claim that their model is the only possible explanation.

The principle of myths illuminating plasma cosmology and *vice versa* is one which is shared between the EU and PU, but the developments from that principle lead in very different directions. There are viable alternatives based on known plasma behaviour rather than on colliding charged planets, hand-waving speculations about what plasma might be capable of [67], and misinterpretations of the actual evidence. These alternatives, I suggest, are much more likely to lead to a real breakthrough in understanding, both of how the Universe really works, and of how plasma events in Earth's environment and beyond might have been witnessed by ancient humankind.

The EU approach is beginning to look very much like a dead end which is leading nowhere because it's strictly limited by their theorists' dogmatic insistence on one particular model which we know doesn't work.. But the good news is that when it's recognised that PU theory is not constrained by being contained entirely within the EU then Plasma Cosmology can continue to develop independently of the EU side track.

There are important ramifications in other areas of science too. For example, the present climate-change debate pits those who argue that the change is due to anthropological factors, especially CO<sub>2</sub> emissions, against those who argue that natural factors are the main driver. The former are, in effect, still close to assuming that space is a vacuum and radiation is the only thing that can cross it and affect the climate. Anyone familiar with the concept of 'Space Weather' will know that this is incorrect; the question is, just how much influence can the Sun have on Earth's climate via the ubiquitous plasma?

This question is hotly debated and I have written elsewhere [68] showing how the Solar Wind – Magnetosphere Coupling mechanism links the magnetosphere to the ionosphere and how the previously well-known, but now largely forgotten, Global Electric Circuit links the ionosphere to the surface via the climate regions of the Earth's atmosphere. This mechanism for direct solar influence on the climate relies on induction, not on some fanciful Birkeland Current connecting the Sun directly to the Earth as the EU claim, but scientifically-based proposals of plasma-based effects are unlikely to gain much traction if the PU is associated with the EU in the minds of the decision-makers and the scientists who advise them.

So, it *does* matter that we keep in mind the differences between the EU and the PU, and that we remember that there are alternative explanations for all the genuine evidence of currents in space and plasma behaviour which the EU publicists erroneously claim as evidence that their model must be correct.

## Notes and References

1. This paper uses the term 'EU' both for the model and for the movement which promotes it; the meaning will always be clear from the context.
2. A. L. Peratt, *Physics of the Plasma Universe*. Springer-Verlag, New York, 1992; 2nd. edn. Springer, New York, 2015. DOI 10.1007/978-1-4614-7819-5.
3. YouTube video series 'Top 10 Reasons why the Universe is Electric' (henceforth T10R); playlist at <https://www.youtube.com/playlist?list=PLwOAYhBuU3Uez8f1P6ZyYdi90Egln3rX5>. Retrieved 15.7.18. (There are only 8 episodes available at the time of writing.)
4. T10R, 6, 19:20 (Note: this and the following references to the T10R episodes adopt the format 'T10R, Episode, approx. time').
5. W. Thornhill's 'Holoscience' website, the ELECTRIC UNIVERSE® Synopsis 3, <http://www.holoscience.com/wp/synopsis/synopsis-3-a-little-history/> accessed 26.8.18.
6. Thunderbolts Project 'About' page <https://www.thunderbolts.info/wp/about/>, accessed 26.8.18; the ELECTRIC UNIVERSE® Synopsis 2 <http://www.holoscience.com/wp/synopsis/synopsis-02-the-electric-universe/>, accessed 26.8.18. This paper follows the usage on Thornhill's website of capitalisation and including the registered trademark symbol on every mention of the full phrase ELECTRIC UNIVERSE®
7. W. Thornhill's 'Holoscience' website, the ELECTRIC UNIVERSE® Synopsis 2, accessed 26.8.18.
8. This paper is not going to cover the wider claims of the EU's 'Big Picture' which fall under the definition of Cosmology as Natural History, such as Thornhill's Electric Gravity model, his Hollow Earth theory, and the role of electricity in EU geology etc.; instead this paper is limited to the narrower definition of plasma cosmology in space. I hope to cover the other matters in a subsequent paper.
9. A. L. Peratt. 'Birkeland and the Electromagnetic Cosmology', *Sky & Telescope*, May 1985.
10. H. Alfvén, *Cosmical Electrodynamics*. International Series of Monographs on Physics, Oxford: Clarendon Press, 1950. 2nd edition co-authored by C. G. Fälthammar, Oxford University Press, 1963.
11. (1) A. L. Peratt, 'Characteristics for the Occurrence of a High-Current, Z-Pinch Aurora as Recorded in Antiquity'. *IEEE Transactions on Plasma Science*, 31(6), 2003, pp. 1192-1214; (2) A. L. Peratt, J. McGovern, A. H. Qöyawayma, M. A. van der Sluijs & M. G. Peratt, 'Characteristics for the occurrence of a high-current Z-pinch Aurora as recorded in antiquity, Part II: Directionality and source.' *IEEE Transactions on Plasma Science*, 35(4), 2007, pp. 778-807; (3) A. L. Peratt & W. F. Yao, 'Evidence for an intense solar outburst in prehistory.' *Physica Scripta*, 131, 2008, pp. 1-13.
12. (1) C. E. R. Bruce, *A new approach in astrophysics and cosmogony*. London & Woking, 1944. (2) C. E. R. Bruce, 'An All-Electric Universe', *Electrical Review*, 23 Dec 1960, pp 1070 – 1075.
13. (1) I. Velikovsky, *Cosmos without gravitation*. Simon Velikovsky Foundation, 1946; (2) I. Velikovsky, *Worlds in Collision*. Macmillan, 1950.

14. (1) R. E. Juergens, 'Plasma in Interplanetary Space: Reconciling Celestial Mechanics and Velikovskian Catastrophism,' *Pensée IVR II* (Fall 1972), pp. 6-12. (2) *Velikovsky Reconsidered*, Doubleday, New York, 1976, pp. 137-155. (First presented at the Lewis & Clark Symposium, Portland, OR, August 15-17, 1972.) Note that Juergens' Anode Electric Sun model required a 10 billion Volt driving potential and a current of  $4 \times 10^{16}$  Amps to match the Sun's observed radiant output.
15. (1) D. Talbott, *The Saturn Myth* (1980) Doubleday, ISBN: 0-385-113376-5; (2) B. C. Liesching, 'A Personal Report on, and Irreverent Look at, the World Conference 'Planetary Violence in Human History' Portland, Oregon, January 3-5, 1997', *SIS Chronology & Catastrophism Review* 1996:2 (May 1997).
16. See e.g. the Preface to the 2<sup>nd</sup> edition of Peratt, 2015, *op. cit.*, [2]. "Countering the growth of faster computers, better diagnostics, and nuclear research facilities has been the encroachment of those not schooled in plasma science, computer science, physics, astrophysics, or high-power electrical, pulsed energy, and nuclear engineering. Without exception they rail at barriers placed to insure sound scientific technique and methodology. ... now the internet or World Wide Web allows anyone, even cults, to present their cacophony to the world, often citing unsuspecting researchers as 'colleagues' for false endorsement." Peratt's website seems to indicate that this comment would apply to the EU: it states "The Plasma Universe and Plasma Cosmology have no ties to the anti-science blogsites of the holoscience 'electric universe'." See <http://plasmauniverse.info/> accessed 8.11.18.
17. D. Talbott, Intersect email forum, 20.10.17, emphasis added.
18. "Hannes Alfvén has been a pioneer in seeking understanding of the cosmic roles of electricity and magnetism. Yet, by accepting the prevailing notions that the universe is inherently neutral and that the stars are powered internally, Alfvén has effectively sealed himself off from discovering many important electrical phenomena; thus he has uncovered little fundamental information about the universe from his electrical studies", R. E. Juergens (ed. E. R. Milton), 'Electric discharge as the source of solar radiant energy', *Kronos* Vol VIII (1), Fall 1982, p. 6.
19. R. J. Johnson, 'The Nature of the Sun Reconsidered'. Presentation at the Electric Universe Conference, Albuquerque, NM, January 2013. Video: <https://www.youtube.com/watch?v=JWpPetpI50U>
20. R. J. Johnson, 'The Nature of the Sun Reconsidered' Updated version: Presentation at the Society for Interdisciplinary Studies autumn meeting, October 2014. Video: [https://archive.org/details/BJ251014\\_201501](https://archive.org/details/BJ251014_201501)
21. R. J. Johnson, 'The source of the Sun's electrical activity'. Presentation at the Society for Interdisciplinary Studies autumn meeting, October 2017. Video: <https://www.youtube.com/watch?v=ehgJY06sbwU&feature=youtu.be>.
22. D. E. Scott, *The Electric Sky*. Mikamar Publishing, Portland, Oregon 2006.
23. Note that the EU's interpretation is a complete reversal of the common mainstream position in which currents in space are held to be impossible and magnetic fields are the primary factor. This will be discussed in more detail below.
24. M. Armstrong to Intersect email forum 17.9.17 commenting on an article on Vice.com titled 'The People Who Believe Electricity Rules the Universe', 18 Feb 2016; original article at [https://motherboard.vice.com/en\\_us/article/nz7neg/electric-universe-theory-thunderbolts-project-wallace-thornhill](https://motherboard.vice.com/en_us/article/nz7neg/electric-universe-theory-thunderbolts-project-wallace-thornhill)
25. R. J. Johnson, 'Acceleration of the Solar Wind - a New Model for the Generation of the Necessary Suprathermal Electrons in the Solar Transition Region'. *Chronology & Catastrophism Review* 2016:3, pp. 2-11.
26. "About five years ago I conversed with an expert level radio engineer in a deep discussion of Pulsars, when considering an electrical interpretation. The discussion included the Dr Scott view of the relaxation oscillation hypothesis of pulsar action, which can have appeal due to the ease of understanding and the ability to explain energetic outbursts. There was one failing in the view that we both agreed we were stuck on... it was with regard to a "bridged plasma due to close orbiting bodies". The problem was how this dimensionality [sic] (*transmission line dimensions*) variable (due to the nature of plasma and orbital bodies) electrical discharge path could display the most exceptional frequency stability, matching that of our most accurate clocks. Unfortunately I think the *bridged - relaxation oscillator*, on it's own, finds too greater difficulty as an explanation. .... The trapped ion in the atmosphere of a single body, to me, via Peratt's work, seems to be the only science that can explain the pulses. I just can't see it coming from a bridge, even though such bridge might be involved in the *>instabilities<* of the pulse signals." Alex Jarvie to Intersect private email forum, 14 Nov 2017.
27. See note [52] below.
28. T10R, 6, 19:20.
29. R. J. Johnson, 2013, *op. cit.* [19, 20].
30. 'Magnetic Rope observed for the first time between Saturn and the Sun.' *UCL Mathematical & Physical Sciences News Report*, 6 July 2016. <https://www.ucl.ac.uk/mathematical-physicalsciences/news/2016/jul/magnetic-rope-observed-first-time-between-saturn-and-sun> Retrieved 18.7.18.
31. R. J. Johnson, 'Massive Solar Eruptions and their Contribution to the Causes of Tectonic Uplift', *New Concepts in Global Tectonics Journal* 2(1), March 2014, pp. 16-36.
32. J. M. Jasinski *et al.*, 'Flux transfer event observation at Saturn's dayside magnetopause by the Cassini spacecraft', *Geophysical Research Letters*, 43(13), 2016, pp. 6713-6723.
33. R. J. Johnson, 'The Electric Sun and Claimed Anomalies of the Standard Solar Model Reviewed; the Plasmod Sun Model Revisited', *Chronology & Catastrophism Review* 2018:1, pp. 3-19.
34. Thornhill & Talbott, *The Electric Universe*, Mikamar Publishing, Portland, Oregon 2002, 2007,
35. W. Thornhill, *op. cit.*, [5]. See also the presentations Thornhill has given at various EU conferences, viewable via the Thunderbolts YouTube channel <https://www.youtube.com/user/ThunderboltsProject/featured>
36. M. A. van der Sluijs, personal communication, 13.7.18.
37. R. J. Johnson, 2017, *op. cit.*, [21].
38. However, Parker himself has occasionally referred to electric currents and even Double Layers. See e.g. E. N. Parker, 'Space Plasma and its Origin at the Sun', *Physics of Fluids B: Plasma Physics* 3, 1991, 2367; doi: 10.1063/1.859605.
39. "Since the beginning of the century physics has been dualistic in the sense that some phenomena are described by a field concept, others by a particle concept. This dualism is essential also in the physics of cosmic plasmas: some phenomena should be described by a magnetic field formalism, others by an electric current formalism", H. Alfvén, 'Electric Currents in Cosmic Plasmas', *Reviews of Geophysics*, 15(3), 1977, pp. 271-284.
40. G. K. Parks, 'Why Space Physics Needs to Go Beyond the MHD Box', *Space Science Reviews*, 113(1-2), 2004, pp. 97-121.

41. Scott, 2006 *op. cit.* [22]. However, compare p.77 of that work (TES): “Alfvén pointed out that this idea of “frozen-in” magnetic fields, which he had earlier endorsed, was false. In reality, moving magnetic fields within a plasma create currents. This fact is one of the basic concepts embedded in the Electric Sky.” Why this inductive means of generating currents wasn’t mentioned either in the TES subsection on ‘The Cause of Electric Currents in Plasma’, or in the index to that book, or in the recent T10R series is puzzling. It seems that induction does not represent a very important part of EU thinking despite Scott’s statement. See also note [52] below.
42. R. Beck, 2007, *Scholarpedia*, 2(8):2411. doi:10.4249/scholarpedia.2411 revision #183531. Note that similar arguments can’t be used to justify the EU’s presumption of initial weak Potential Differences throughout the cosmos: the EU’s all-important Coulomb Force prevents charge separation on any significant scale.
43. See e.g. C. M. Huntington *et al.*, ‘Observation of magnetic field generation via the Weibel instability in interpenetrating plasma flows’, *Nature Physics*, 11(2), 2015, p.173.
44. See e.g. A. Rigby *et al.*, ‘Electron acceleration by wave turbulence in a magnetized plasma’, *Nature Physics*, 14, 2018, pp. 475–479
45. D. Montgomery and G. Joyce, ‘Shock-like solutions of the electrostatic Vlasov equation’, *J. Plasma Phys.*, 3(1), 1969, pp. 1- 11 “Here, we shall be concerned with a different limit, the purely electrostatic one, which involves no magnetic field or net electrical currents at all.” [p1].
46. ‘Curl’ is a measure of the amount and direction of rotation in a vector field such as the electric field or the magnetic field. It may be helpful to think of the effect of changing the magnetic flux as creating a vortex of electric field.
47. A. L. Peratt, ‘The Evidence for Electrical Currents in Cosmic Plasma’, *IEEE Transactions on Plasma Science*, 18(1), 1990, pp. 26-32.
48. H. Alfvén, *Cosmic Plasma*, Ch. 3, p. 45, fig. III.1 (a, b) and accompanying text. *Astrophysics and Space Science Library*, v. 42, D. Riedel, Dordrecht, 1981, ISBN 90-277-1151-8.
49. See e.g. A. L. Peratt, 2015, *op. cit.*, [2] §3.7 Storage of Magnetic Energy.
50. See e.g. the discussion in *op. cit.* [31]
51. See e.g. R. J. Johnson & M. A. van der Sluijs, ‘A Note on Plasmoids on the 100th Anniversary of the Birth of Winston H. Bostick’, *Chronology & Catastrophism Review* 2016:2, pp. 43-46, for an introduction to Bostick’s plasmoids.
52. The brief mention in T10R episode 7 cited above of auroral and similar phenomena being ‘induced’ by Birkeland Currents is misleading. The EU maintain that it’s the supposed Birkeland Current from the Sun which is directly driving the aurora; Scott’s papers on his BC model make this very clear. According to the T10R YouTube series, currents in the EU model are driven by PDs between the Sun and Earth, not induction. Likewise, the EU’s Birkeland Currents in space are driven by unspecified PDs, not induction.
53. Admittedly, some areas of consensus-driven mainstream science aren’t either, a point the EU activists make loudly and often, but, when you look carefully, the EU activists are just as bad if not worse in this respect.
54. R Johnson, 2014 *op. cit.* [31]
55. M. A. van der Sluijs, ‘A Geomagnetic Approach to Traditions of *Axes Mundi*’, Parts I – III, *Chronology & Catastrophism Review*, 2016:2, 2016:3 & 2017:1.
56. A. L. Peratt, 2003, *op. cit.* [11.1].
57. T. Gold, ‘Large solar outbursts in the past’. *Pontificiae Academiae Scientiarum Scripta Varia* 25, 1962.
58. R. J. Johnson, 2014, *op. cit.* [31].
59. M. A. van der Sluijs & R. J. Johnson, ‘Geometry of an Intense Auroral Column as Recorded in Rock Art’, *Journal of Scientific Exploration* 27.2, 2013, pp. 227-246. Available online: <https://www.scientificexploration.org/journal/volume-27-number-2-2013>
60. R. J. Johnson, ‘The anomalous planetary periods in the Pañchāsiddhāntikā revisited.’ Presentation at the Society for Interdisciplinary Studies spring meeting, April 2017. Video: <https://www.youtube.com/watch?v=0hw109OsKtk>
61. As I explained in my presentation, the options are either that the data is incorrect or the Earth’s spin rate was different or the solar system was ~1% smaller; this last option opens up intriguing possibilities relating to the origin of the Titius-Bode Law.
62. M. A. van der Sluijs, ‘Thereby Hangs a Tail’, *Thunderbolts Project TPOD* 17.12.14, <https://www.thunderbolts.info/wp/2014/12/17/thereby-hangs-a-tail/> MAS wrote (emphasis added):  
 “Presumably, such an event would have been the result of a solar superstorm, the like of which has not been seen in millennia. A magnetic storm of such intensity would likely affect the earth as well and it may not be coincidental that, according to the otherwise unknown mathematicians Adrastus of Cyzicus and Dio of Naples, cited by Augustine in the same context, the portent “happened in the reign of Ogygus”, that is to say, concomitantly with the legendary flood of Ogyges. **Although the physical relationship between a solar superstorm and a terrestrial flood is not easily explained** and the date of the legendary Ogyges is a vexing subject in its own right, the correlation is bound to be relevant. This was pointed out as early as 1684, by the English theologian and royal chaplain Thomas Burnet (c. 1635? – 1715):  
 “This is a great presumption that she suffer’d her dissolution about the same time that our Earth did ...”

As an aside to the present paper, I suggest that it may be possible to explain the physical relationship between a solar superstorm and a terrestrial flood as follows:

<sup>14</sup>C is known to be produced in Earth’s upper atmosphere when thermal neutrons derived from cosmic rays are absorbed by Nitrogen atoms in the reaction  $n + {}^{14}_7\text{N} \rightarrow {}^{14}_6\text{C} + p$ . However, most Nitrogen is in the molecular form N<sub>2</sub> which suggests that there may be another mechanism involved.

Louis Kervran found that CO poisoning in French welders was due to the highly excited Nitrogen molecules in the air above the ferrous work piece being converted into CO in their lungs when they breathed it in; the hot ferrous metal apparently acted as a catalyst to raise the excitation level of the Nitrogen nuclei, whereafter an endogenous reaction in the lungs triggered the conversion to CO. When the welders were given helmets with an air supply drawn from behind their backs the problem of CO poisoning was almost eliminated.

Kervran suggested that the endogenous reaction was  $2. {}^{14}_7\text{N} \rightarrow {}^{12}_6\text{C}. {}^{16}_8\text{O}$  due to the exchange of a p-n group between the nuclei. However, applying the principle of Kervran’s finding of conversion of N<sub>2</sub> to CO to the effect of incoming particles in the upper atmosphere then another mechanism seem possible. Noting that the usual method of <sup>14</sup>C production is equivalent to moving a valence electron into the <sup>14</sup><sub>7</sub>N nucleus thereby converting a proton to a neutron, the simplest conversion of N<sub>2</sub> to CO might be  $2. {}^{14}_7\text{N} \rightarrow {}^{14}_6\text{C}. {}^{14}_8\text{O}$  by transfer of an electron from one N<sub>2</sub> nucleus to the other via  $(p + e) \rightarrow n$  and  $(n - e) \rightarrow p$  in the

two nuclei respectively. Note also that  $^{14}\text{O}$  decays naturally to  $^{14}\text{N}$  by  $\beta^+$  decay with a half-life of ~70 seconds; the reverse process seems possible or even likely to occur under the extreme conditions under consideration. What's more, the 70 second half-life of  $^{14}\text{O}$  would give sufficient time for other reactions to occur before decay back to  $^{14}\text{N}$  occurred.

The energy for the conversion of  $\text{N}_2$  to CO could come either from cosmic rays or from proton or high-speed electron impact under the extreme solar wind conditions causing Venus' tail to become visible. It could also have come directly from atmospheric electrical discharges caused by the 'Gold scenario' and enhanced SWMC processes which would inevitably be associated with the extreme solar event.

Whether by this reaction or a similar one involving proton and/or neutron impact with  $\text{N}_2$  molecules in the upper atmosphere, the net result would be a dramatic increase in CO whilst at the same time one would expect an increase in the availability of free protons, either from the solar wind itself or from an associated Solar Proton Event.

Thus all the necessary ingredients for the production of large quantities of water (and hydrocarbons) in the Earth's upper atmosphere would have been in place during the extreme solar event causing Venus' tail to become visible, but establishing the precise details of the reactions would require the attention of a specialist atmospheric chemist. It's also possible that electrical discharges played some role in the process; in this context it may be worth pointing out that apparently an unexpected consequence of Peratt's high-energy z-pinch experiments was the need to mop up quantities of water in the lab after every discharge. As far as the present author is aware, this anomaly was never fully investigated.

This process of conversion of  $\text{N}_2$  to CO could possibly help to explain the origin of water on Earth which still requires a satisfactory explanation because comets and meteorites have been shown to be a completely inadequate source for the oceanic quantities of water present today. This process could also help to explain the sudden appearance of huge quantities of Oxygen in the atmosphere ca. 2,450 MYa ago during the 'Great Oxidation Event' or 'Oxygen Catastrophe'.

63. M. A. van der Sluijs, (1) *op. cit.*, [62]; (2) 'Venus' Tail of the Unexpected', *TPOD* 20.02.08, <http://www.thunderbolts.info/tpod/2008/arch08/080220venustail.htm> ; (3) 'Velikovskian Chaff and Wheat: Venus', *TPOD* 27.3.09, <http://thunderbolts.info/tpod/2009/arch09/090327chaff.htm> (4) 'Multiple Morning Stars in Oral Cosmological Traditions', *Numen; International Review for the History of Religions*, 56, 2009, pp. 459-476, note 21 on pp. 473-474.
64. See e.g. the 2007 ESA image 'Interaction between Venus and the solar wind.jpg' [http://www.esa.int/spaceinimages/Images/2007/11/Interaction\\_between\\_Venus\\_and\\_the\\_solar\\_wind2](http://www.esa.int/spaceinimages/Images/2007/11/Interaction_between_Venus_and_the_solar_wind2)
65. A. Gilbert, facebook page announcement 23 Dec 2017 of his forthcoming EU-UK 2018 conference.
66. See the remarks by Talbot quoted in the discussion of T10R episode 2 above for an indication of how relentless this publicity has become. However, as the TBP video 'Comets: Discovery vs. Belief' available at [https://www.youtube.com/watch?v=i\\_pNpGSgMgl&t=25s](https://www.youtube.com/watch?v=i_pNpGSgMgl&t=25s) rightly pointed out at ~15:20, "repetition does not make conjectures true."
67. E.g. Thornhill's response to queries I raised in 'The Nature of the Sun Reconsidered', *op. cit.* [19], regarding the EU's claimed constant electric field in the 3-dimensional heliosphere, was that "plasma could behave in ways we don't yet understand and generate a constant electric field in other ways", Thornhill, personal communication, 27 July 2014, Toronto, noted previously in *op. cit.*, [20].
68. R. J. Johnson, 'The variability of the Sun and the effects on Earth'. Presentation at the Society for Interdisciplinary Studies spring meeting, April 2015. Video <https://www.youtube.com/watch?v=XdrDg-Nuxdg&feature=youtu.be> Retitled as 'How plasma connects the Sun to the climate' for *WUWT*, 30 April 2015: <https://wattsupwiththat.com/2015/04/30/how-plasma-connects-the-sun-to-the-climate/>

## The 5th Century Invasions According to Tóth Gyula

Patrick S. Giles

Mr Phillip Clapham, a long-time member of the Society for Interdisciplinary Studies, has in his "Saint Alban and St Albans" (*C&CR* 2017:2) used the history of the monastery and religious sect of St Alban as a lens into issues in British historiography and chronology. St Alban is said to have been the first British martyr, and the monastery dedicated to him is suspected of having been sacked at least twice in history (first by Saxons, then by Vikings), though there is poor evidence of such events, and mainly only disruptions in the written records which are still not satisfactorily explained. Some of the other problems addressed in Clapham's piece touched upon wider problems in European chronology, such as properly documenting sequences of events at the end of the Roman Empire into the era of Charlemagne and the Viking invasions, an era which has attracted the attention of several other well-known revisionists. The Society has perhaps not heard much from the Hungarian-speaking researcher Tóth Gyula (or if it has, it was before I began reading), whose work I wish to relate in part in this short article. The work of Mr Gyula proposes an alternative arrangement of events near the end of the Roman Empire which may ultimately aid in a better understanding of the problems discussed by Mr Clapham, proposing that a mishandling of the Julian and Gregorian calendars created an approximately 45-year discrepancy and duplication of historical events at the end of the Roman Empire.

### The *Chronicon Pictum* and Late Roman Revisionism

In relating Gyula's main ideas, I do not claim to be an expert on all of his work, having discovered it relatively recently, and the majority of it being in the Hungarian language only. Having said that, his thesis is hopefully well enough understood, and warranting enough of additional attention, that it still serves its purpose in causing us to reconsider our