

## D. E. Scott Rebutts T. Bridgman

(Revised 3/20/09)

When I first heard about Dr. Tom Bridgman's 48-page onslaught against me and the material I present in my book, *The Electric Sky* (TES), I thought I would simply ignore him. But friends I admire and trust have repeatedly implored me to take up my pen so that the casual reader of his criticisms will not assume I accept them. These following paragraphs are not a comprehensive dissection of each and every allegation he made. They are simply my reaction to what stood out as being most outrageously inaccurate, and uninformed.

Bridgman's 'critique' can be found here:

[http://homepage.mac.com/cygnusx1/anomalies/ElectricSky\\_20080322.pdf](http://homepage.mac.com/cygnusx1/anomalies/ElectricSky_20080322.pdf)

The following is my response to Bridgman (TB) roughly in the order in which he states his objections.

**PULSARS** [On the top of his page 2] TB implies that I have proposed a "radically different model of pulsars". The notion that pulsar repetition rates are most probably due to an electrical oscillation rather than light-house-like massive stars rotating at 60,000 rpm or more is due, not to me, but to other investigators such as Healy & Peratt (see:

<http://public.lanl.gov/alp/plasma/downloads/HealyPeratt1995.pdf>.

Those authors begin their (peer reviewed) paper with a review of the history of the discovery of pulsars and the classical theoretical descriptions of their behavior. They (H&P) performed a plasma supported transmission line experiment that duplicated some 17 detailed properties of those observed emissions. I have read their paper, discussed this with Peratt personally, and find much merit in what they say. Postulating this electrical mechanism as an explanation for observed pulsar emissions is far less of a stretch of one's sense of reality than proposing that an incredibly massive star rotates with the speed of a dentist's drill. But H&P's proposed model is, regrettably, not mine to take credit for.

**MISREPRESENTATIONS OF WHAT I SAY** On his page 4 Bridgman states: "Dr. Scott states that astronomers assume that the physical laws in the distant cosmos are different from those known on Earth (page 7)." What I did say in part was this:

"The hypotheses of these plasma scientists on the subjects of solar, stellar, and galactic behavior are careful extrapolations of their demonstrated experimental results and physical principles. They do **not** involve invisible matter or unseen forces or "new science" – claims that the laws of physics must be different out there in deep space (where we cannot falsify them) from what they are here on Earth."

I have indeed heard arguments that: "Just because something is falsified here on Earth doesn't mean it can't happen out in space." For example see the section of this rebuttal on the impossibility of neutron stars (below). His (TB's) claim that matter made up solely of neutrons can and does exist out in space despite the fact it cannot here on Earth is a case in point. He also mentions "There are some searches for Dark Matter and Dark energy candidates that are being conducted in Earth laboratories." I hope I live long enough to see positive results of these searches announced. I doubt I will.

**THE (NON)USEFUL PRODUCTS OF ASTROPHYSICS** Also on his page 4, TB claims that the Global Positioning System *requires* general relativity for precise computation of transmission delay times of the GPS signals in the gravitational field of Earth. This, he claims, is a useful contribution of astrophysics. However, as with so many of the pronouncements of the astrophysics power structure, there is an alternative explanation. H.F. Fliegel and R. S. DiEsposti of the GPS Joint Program Office of the Aerospace Corporation conclude<sup>1</sup> "Except for the leading  $\gamma$  [gamma] factor [in their final equation], it is the same formula derived in classical physics for the signal travel time from the GPS satellite to the ground station. As we have shown, introducing the

y factor makes a change of only 2 or 3 millimeters to the classical result. In short there are no 'missing relativity terms.' They cancel out." General Relativity Theory is not needed.

On this same topic, TB references his 37 page paper<sup>2</sup> subtitled *How Cosmological Science Became Earth Technology* wherein he discusses topics such as: spectroscopy, Doppler shifts, radio-activity, models of the atom, the periodic table of the elements, the discovery of the electron, nuclear energy, quantum mechanics, the electron tube, the Esaki diode, and very large scale integrated circuits (VLSI) – interpreting them all as somehow being products of astrophysical theory. In the concluding paragraph he states, "To be fair, some of these discoveries probably would have been made without the **intervention** of astrophysics. Many were on the verge of being technically possible and the astrophysical observations provided an additional incentive to examine them more closely." [*Emphasis added*]

What **intervention** did astrophysics make in developing VLSI? J.J. Thomson discovered the electron in 1897. Twenty-three years later astrophysicists were still debating<sup>3</sup> if there was anything outside the Milky Way galaxy. What **intervention** could such a primitive astrophysics have possibly made twenty-three years earlier in Thomson's work in 1897? At that time astrophysicists were denying the possibility of charge separation in space. Some (Bridgman apparently is one of them) still do.

At any rate, in one swoop, TB attempts to subsume all of the practical achievements of modern chemistry, solid-state physics, and electronics into owing their origins to astrophysics. This is absurd on its face. If he thinks that Leo Esaki, working for (what is now) Sony Corporation in 1957, had any thoughts about astrophysics in his mind while developing his tunnel diode, I submit he is delusional. What about Brattain, Bardeen, and Shockley while working at Bell Laboratories on their bipolar junction transistor – or the field-effect transistor? Were they thinking about astrophysics too? I very much doubt it.

The fact remains indisputable – astrophysics is a *consumer* of technology, not a *producer* of it. Astronomers say they want some new tool – engineers try to give it to them. It is just that simple. Bridgman's attempt to credit theoretical astrophysics with the technological fruits of almost all of science and engineering is brazen self-aggrandizement. It also shows his willingness to rewrite history.

He ends his discussion of this topic [his p.5] by pointing out that Newton's  $1/r^2$  force was not tested until the 1970's and that there are many cases where inventions have been developed theoretically prior to testing them in the lab. Of course! There is always some thought, some design, some theoretical work done in developing a product. People don't just go into the lab and start mixing chemicals.

The point I was making (or trying to) in that section of my book, is that there is no hope of falsifying cosmological hypotheses. There is almost no way to judge the validity of theoretical proposals that deal exclusively with phenomena that happened long, long ago and far, far away – with things that we cannot directly get our hands on. Falsifying experiments are not possible in deep space. This is not the fault of the investigators in those areas of science; it is simply an inherent problem for them. How do they cope with it? In my opinion – not well. They (astrophysicists in particular) should exhibit more professional openness to alternative hypotheses (especially ones that are based on successful laboratory testing) and a reasonable professional humility.

Mysterious immeasurable entities should not be capriciously invented and then presented as accepted truths. A pompous attitude of omnipotence and adherence to a single hypothesis (that requires these hypothetical entities), when other hypotheses exist that do **not** require these fictions, is both inappropriate and counter-productive to scientific progress.

TB's point that someone, somewhere, is trying to synthesize Dark Matter is irrelevant.

**THE IMPORTANCE OF IN SITU MEASUREMENTS** TB states [p. 5] that I say, "All kinds of claims should be admitted on equal footing." No, I do not say that at all. There is a big difference between giving a novel proposal due scientific examination (giving it its day in court, so

to speak) and blindly elevating it to equal status without examining it. I am not recommending the latter course of action. TB seems unaware of the difference between being open-minded and being empty-headed.

It is ironic that TB uses Galileo's discoveries as an example of how the requirement of experimental testing might have been used against a hypothesis wrongly. Actually it was Galileo who was **challenging the prevailing** Ptolemaic Earth-centered model of his time. His discovery of four moons of Jupiter and the phases of Venus was experimental evidence that falsified the accepted model. The Church held up this philosophical, **theoretical**, earlier model as being God-given and thus unassailable – it was a sacrilege to try to falsify it or replace it (quite similar to NASA's – and Bridgman's – attitude regarding the Big Bang).

It is also ironic that Bridgman should object so strongly to my suggestion that, in so many cases in his field, totally erroneous early pronouncements have been corrected **only after** we have gone there and made close (*in situ*) observations: e.g., Birkeland being correct and Chapman wrong; Venus being hotter than the melting point of lead; Earth's emitting radio signals that can only be detected above the ionosphere; plasma (charge separation) in space; etc....

**TRUSTING MATHEMATICAL MODELS** TB [his p.6] says that I complain about trusting mathematical models. He completely misses my point. I spent almost my entire professional career as an electrical engineer working with mathematical models. I **do** trust them – up to a point. My warning about them was this: If every time new data comes along we have to add complexity to our model in order to accommodate it, this should be a hint that the model is not robust. It is fundamentally a failure. It is a blob of 'silly putty' that is malleable enough to fit any new data. This sort of model is not a proper basis for a hypothesis; it is merely a blank check to claim we understand something when we really do not. I stand by that statement.

**IT LOOKS LIKE 'X' SO IT MUST BE 'X'** TB condemns my pointing out that a similarity in appearance of certain objects might indicate they have a common cause, e.g., the Grand Canyon and Lichtenberg patterns formed in grass by lightning strokes. He then goes on to say that Mark Twain "noted how the [Mississippi] river course would change, with no reports of giant electric arcs."

There are many morphological characteristics of the Grand Canyon that are enigmatic for 'standard' geologists. Different from the Mississippi (and similar to Lichtenberg patterns), it has no delta, it is narrow at both ends, and its tributaries are as deep at their beginning points as they are when they join the main stream; many such tributaries join at right angles to the central valley. And, of course, it is a mile deep.

Also, there is the old saying: "If it walks like a duck, and quacks like a duck....."



Figure 1. A Lichtenberg pattern etched in grass by lightning – not to be confused with the Mississippi River Valley

Now compare this pattern with a Google Terrain map of the Grand Canyon:  
[http://maps.google.com/maps?f=q&source=s\\_q&hl=en&geocode=&q=Grand+Canyon,+AZ&ll=37.0625,-95.677068&sspn=62.226996,106.875&ie=UTF8&ll=36.228766,-112.719727&spn=2.018306,3.339844&t=p&z=9](http://maps.google.com/maps?f=q&source=s_q&hl=en&geocode=&q=Grand+Canyon,+AZ&ll=37.0625,-95.677068&sspn=62.226996,106.875&ie=UTF8&ll=36.228766,-112.719727&spn=2.018306,3.339844&t=p&z=9)

**AD HOMINEM ATTACKS** The definition of an ‘*ad hominem*’ attack is that it is a reply to a claim or argument that attacks the person making the claim or argument, instead of by addressing the substance of the argument or producing evidence against it. *Ad hominem* attack often works to change the subject. Bridgman uses this technique several times throughout his rant. It is really uncalled for. For example on his page 8:

“Dr. Scott, an electrical engineer, is clearly a victim of this professional isolation himself. I found little mention of quantum mechanics or its impact in astronomical observations and astrophysical understanding and the feedback astrophysics provided to Earth laboratories. Considering that the quantum mechanics that explains the spectra and energy source of the stars is the same quantum mechanics that has made modern microelectronics possible, I suspect Dr. Scott has some interesting misconceptions about this subspecialty of his own field.”

A discussion of quantum mechanics has no place in my book. I intentionally do not discuss the very many subspecialties of electrical engineering. That was not the thrust of my book and I submit comments such as the one above are simply ‘red-herrings’ dragged across the path of that thrust.

**GRAVITATIONAL LENSING** TB says I “describe gravitational lensing (GL) as untested.” This is a total fabrication. I resent it. A complete reading of that section of TES will reveal that, in my opinion, it is not that GL is *untested* but rather that it has been *misapplied* in ways that Einstein never intended. He described it as being an effect between two stellar (point) sources. In order to interpret it as being an effect observable between a galaxy and a distant QSO, the galaxy would have to behave in a way such that all its mass is acting at a point, a so-called ‘point-mass singularity’. There is no astronomical (or laboratory) evidence of infinitely dense point-masses. When relativists discuss ‘point-masses’ what they mean is a mathematical abstraction – the center of mass – which is not a physical object.

So my opinion is that the original Einstein prediction has been hijacked for purposes of explaining away enigmatic observations to which its application is inappropriate.

**GENERAL RELATIVITY DOES INCLUDE ELECTROMAGNETISM** TB states: “Scott claims there is no electromagnetism effects in general relativity (page 218).” A careful reading of that page will reveal that, after I presented the famous  $G = T$  postulate, what I said was: “Note carefully that this postulated relationship does not **explicitly** include any electrical or magnetic phenomena.” And indeed it does not. General relativity was originally based on purely mass / gravitational / space / time considerations. The loudest objections made against the ideas of Plasma Cosmology usually come from strong defenders of General Relativity Theory. Bridgman told me that he is aware of challenges that are presently being made<sup>4</sup> against the validity of General Relativity Theory.

**NAKED SINGULARITIES ARE NOT BLACK HOLES** TB takes me to task for neglecting to point out that: “A black hole is a singularity ‘clothed’ in an event horizon.”, whereas I just made reference to a ‘singularity’ as being a black hole and did not explicitly state the requirement that it must be ‘clothed in an event horizon’. Mea culpa. A black hole is not just a singularity – it is a singularity ‘clothed’ in an event horizon. (Which is also imaginary.) I hope I am forgiven for that oversight. I *do* wonder, however, if the distinction is significantly important to the casual reader for whom my book is intended.

I did not bring up the ‘event horizon’ which is also called the ‘Schwarzschild radius”, but since Bridgman has raised the issue – it too is a false notion. Stephen Crothers<sup>5</sup> points out that:

Finally, although the fundamental solution to  $Ric = 0$  is usually called the “Schwarzschild solution”, despite its name, it is not in fact Schwarzschild’s solution. Schwarzschild’s actual solution forbids black holes. The frequent claim that Schwarzschild found and advocated a black hole solution is patently false, as a reading of Schwarzschild’s papers on the subject irrefutably testify. False too are the claims that he predicted an event horizon and that he determined the “Schwarzschild radius” (i.e. the alleged “radius” of the

black hole event horizon). Schwarzschild actually had nothing to do with the black hole, but attaching his name to it lends the notion an additional façade of scientific legitimacy.

In this section TB refers to 'numerical modeling of a **gravitational collapse**.' I would point out that 'gravitational collapse' remains one of those postulated fictions that astrophysicists have quietly elevated from the level of 'hypothetical proposal' to 'accepted reality' and for which no direct observational evidence has ever surfaced.

### **OUTFLOWS FROM ACCRETING BLACK HOLES ARE NOT HAWKING**

**RADIATION** On his page 10, TB accuses me of making an error by stating (in a footnote) that astrophysicists say that some black holes can radiate energy via a mechanism known as Hawking Radiation. TB says I thereby demonstrate my ignorance of the fact that Hawking Radiation comes, instead, from **accretion disks** not black holes.

TB ought to look at the Wikipedia definition of Hawking Radiation, the first sentences of which are:

**Hawking radiation** (also known as **Bekenstein-Hawking radiation**) is a thermal radiation with a black body spectrum predicted to be emitted by **black holes** due to quantum effects. It is named after the physicist Stephen Hawking who provided the theoretical argument for its existence in 1974, and sometimes also after the physicist Jacob Bekenstein who predicted that **black holes** should have a finite, non-zero temperature and entropy. Hawking's work followed his visit to Moscow in 1973 where Soviet scientists Yakov Zeldovich and Alexander Starobinsky showed him that according to the quantum mechanical uncertainty principle, rotating **black holes** should create and emit particles. The Hawking radiation process reduces the mass of the black hole and is therefore also known as **black hole** evaporation.

**GRAVITY VS ELECTRICITY** On his page 10 TB says I "make a very strange point about how Newton's law of gravity works... Is he [Scott] claiming that there could be significant electrostatic forces operating between... other objects in the solar system?" No I am not (at least not under the prevailing conditions in our solar system). What I am saying is that 1. Anomalous actions have been observed that are not easily explained by Newtonian gravity and 2. It is entirely possible that certain distant inter-planetary probes are beginning to feel an electrical effect due to the double layers that define the extent of the solar plasma (heliosphere) and also planetary magnetospheres. Consider the following news release:

Jet Propulsion Laboratory scientist John Anderson and his colleagues<sup>6</sup> have been searching for an explanation since 1980. But as of yet, they have found nothing conclusive; no spacecraft behavior or previously unknown property of the outer solar system can explain the deceleration of the Pioneer spacecraft. Scientists are being forced to consider the unthinkable: something may be wrong with our understanding of the laws of physics.

I submit there is nothing wrong with our understanding of the laws of physics provided we consider them all (such as our experimentally gleaned knowledge of plasma behavior). Also there is this news release<sup>7</sup>:

Now Jet Propulsion Laboratory astronomer John Anderson and his colleagues — who originally helped uncover the Pioneer anomaly — have discovered that four spacecraft each raced either a tiny bit faster or slower than expected when they flew past the Earth en route to other parts of the solar system.

The researchers looked at five deep-space probes — Galileo to Jupiter, the NEAR mission to the asteroid Eros, the Rosetta probe to a comet, Cassini to Saturn, and the MESSENGER craft to Mercury. Each spacecraft flew past our planet to either gain or lose orbital energy in their quests to reach their eventual targets. (Galileo made two flybys.) In five of the six flybys, the scientists have confirmed anomalies.

“I am feeling both humble and perplexed by this,” said Anderson, who is now working as a retiree. “There is something very strange going on with spacecraft motions. **We have no convincing explanation for either the Pioneer anomaly or the flyby anomaly.**” [Emphasis added]

**SOLAR AND NUCLEAR ENERGY ERRORS** Starting on his page 11 and continuing for several more pages, TB misinterprets what I say in several instances.

- I do not *deny* that nuclear fusion can be the energy source for the Sun and other stars. I *do* point out that there are several errors in the experimental process used by the Sudbury Neutrino Observatory in their attempt to explain the makeup of the solar neutrino flux. This does raise problems for the proponents of solar fusion energy, but Bridgman chooses to ignore these questions and, instead, mock me for asking them. See the next section on Missing Neutrinos.
- Eddington may not have *intimidated* subsequent investigators, but no alternative mechanisms were ever seriously examined after his pronouncement that nuclear fusion was the source of all stellar outputs.
- I have heard a rather well known astronomer say, on stage at a meeting I moderated, that “all the steps in the hydrogen – helium fusion process have been tested in various laboratories.” I suspect the Tokamak investigators trying to develop a sustained fusion reaction would be surprised to hear they had been beaten to the finish line. Which lab is it that has done that? TB does admit that the first step in the process,  $p+p \rightarrow d+e^++\nu_e$ , has not been accomplished in any laboratory. This does not mean it cannot be done eventually, but after 60 years of spectacular failure to obtain a viable continuous fusion reaction, the hubris of the Tokamak community (and their astrophysical colleagues) does, to me, seem misplaced.
- On his page 15 TB asks, “So which of these [assumed solar] processes does Dr. Scott deny functions at the center of the Sun?” I don’t deny anything of the sort. I simply say that the complicated process you describe is based on assumption. There are alternative models. One (which I do not particularly support), that has some degree of support is the Iron Sun model of Oliver Manuel<sup>8</sup> and his colleagues. Juergens’ Electric Sun is another.
- “What is his [Scott’s] laboratory justification?” What is TB’s? No continuous fusion reaction has been obtained. The chain is only a chain when all links work at the same time. And so far this hasn’t occurred. If you ask us to accept the *possibility* as a matter of faith, that would be one thing. But to promulgate this assumption (‘clothed’, of course, in a fog of mathematics) as being a *certainty* at the unseen center of the Sun is not justified at this time.
- At the conclusion of this section of his critique, TB states that, “...Irving Langmuir would conduct a similar analysis of separating charges in a plasma and derive an oscillatory time scale, today called the plasma frequency.” In addition to the fact that an ‘oscillatory time scale’ is a meaningless phrase, I would like to point out that I discuss the plasma frequency on pages 75 and 76 of TES in terms that even a layman can understand. Why TB found it necessary to include this comment in his critique is not clear.

**MISSING NEUTRINOS** TB states that I start my critique of the Sudbury Neutrino Observatory report by ‘parsing a sentence’ from that report. He agrees with my conclusion that the sentence makes no logical sense, but weasles that it was for *only this experiment*<sup>9</sup>. But this was the experiment that has been ballyhooed as constituting the definitive ‘proof’ that neutrinos ‘have mass and can change flavor.’ This one was the ‘big one’. What TB ignores is that I do start by stating a simple obvious fact, “**There is no way that a measurement taken at only one end of a transmission channel can reveal changes that have occurred farther up the channel.**” That is what the SNO researchers did and it is a blatant logical error in their experimental procedure. TB’s refusal to attempt to refute this singularly important

point and, instead talk about my parsing of a sentence, exposes his 'critique' as being nothing more than a defensive smoke screen.

**NUCLEAR REACTIONS IN SOLAR FLARES** The first statement Bridgman makes on this [p.15] is totally false. He claims I try to explain the presence of *helium* on the Sun by invoking H→He fusion in places like *solar flares*. A careful reader will see that what I was trying to do was to explain the observed traces of some **68 different elements** in solar spectra. How can this happen if the **only** elements in and on the Sun are hydrogen and helium? I suggested that fusion reactions *might* be occurring in the z-pinch regions of the double layer that is probably present above the photospheric surface. As a matter of fact, the plasma z-pinch mechanism<sup>10,11</sup> is one that **does** hold out some hope of future success in developing a steady-state fusion reaction.

**POWERING THE SUN FROM THE OUTSIDE** Starting on his page 17 Bridgman launches into a long discussion peppered with equations, tables of numbers, and diagrams, all designed to disprove the possibility of powering the Sun electrically from the outside. My reaction to it can be summarized as follows:

Whether or not Juergens was completely correct in his assertion that the Sun is totally or partially powered by external electrical excitation is really **not the most important aspect** of the Electric Star (ES) hypothesis. This question is one of the most controversial and speculative aspects of plasma cosmology. So it is an easy one to pick on.

What *is* important is that most of the phenomena we observe on and above the photospheric surface of the Sun (a partially ionized plasma) are explainable in terms of well-known properties of plasma. This is true no matter how the Sun gets its power.

Establishment astronomers appear certain about how the Sun generates its power and what is occurring deep down within it. They claim that the core of the Sun is a continuous nuclear fusion reactor. This core occupies 20% of the Sun's radius. Surrounding the core is a radiative zone wherein heat energy is transported away from the core by photons. This zone occupies some 50% of the Sun's radius. Sitting on top of this structure (and occupying the remaining 30% of the radius) is another zone in which heat is carried to the surface by convection columns - very much like hot air rising from the top of a hot stove. The entire journey from the core to the surface takes between 100,000 and 200,000 years. The granulations we see on the surface of the photosphere are supposedly the tops of 150,000-mile-long "convection columns" - stable tubes of rising matter that transport heat energy up from the Sun's core toward the surface. Presumably that matter sinks back down toward the bottom of the convection zone along the edges of the tubes.

But if this complete process actually takes many thousands of years, then **why do the "granules" change shape and even disappear in a period of hours?**

Next, above the photosphere, is the chromosphere, a relatively thin layer approximately 2000-3000 km in height. In comparison to the much brighter photosphere, it glows faintly in red. The standard model does not predict its existence or explain it very well.

**A temperature minimum** occurs just above the chromosphere. The lower regions of the Sun's corona, quite high above the visible surface, are millions of degrees hotter than the surface of the Sun itself. Although astrophysicists like TB scoff at the idea these observations might present serious problems for their model, others<sup>12</sup> are not quite as confident. The region of the temperature minimum is called the transition zone.

Above the transition zone an extended glowing plasma structure that we can see during solar eclipses exists - the corona - it is a fully ionized plasma. Beyond the corona, an

invisible plasmasphere (heliosphere) extends out, many times the distance of the planet Pluto. The corona and the plasmasphere carry streams of ions and electrons that have been named the 'solar wind.' The standard fusion model provides no fundamental reason for the existence of the chromosphere, the corona, the plasmasphere, or the solar wind. The adherents of this model do recognize these entities exist of course and have *ad hoc* explanations ready for them. But, if the standard (non-electrical) model were correct, heat and light ought to simply radiate away from the photosphere as from a hot stove.

The flux of ions that the Sun emits in the solar wind varies in intensity. The ion stream sometimes stops completely. How? Why? And the ions in the solar wind accelerate - their velocity increases the farther away from the Sun they get. How? Why? Again the standard model has only *ad hoc* explanations for these observations.

***The Sun rotates more rapidly at its equator than near its poles.*** Why? If it does operate as a Faraday (homopolar) motor as the ES model suggests, this phenomenon is completely expected.

***The magnetic fields near sunspots reverse polarity from one eleven-year sunspot cycle to the next.*** These and many other observed phenomena associated with the Sun give strong indication that a high level of electrical activity is at work on and above the surface of our local star. Magnetic fields do not reverse unless their associated electric currents do too.

It should be clear that the standard model is deficient in its description of the Sun's structure.

"In so many fields of astrophysics the textbooks and the ordinary review articles have a tendency to present only the 'generally accepted' point of view, often not mentioning alternative theories, and even ***sweeping under the rug those observational facts which are adverse to the dominant view.***"<sup>13</sup> [Emphasis added] The ES model predicts and explains these phenomena in quite simple ways. The standard model does not even predict their existence and offers no natural explanations for why they occur. It invokes the existence of an unseen Solar Dynamo to explain magnetic phenomena that, for them, 'are yet not fully understood'. TB dismisses such phenomena as being of secondary importance - temporary minor anomalies for which *ad hoc* explanations will eventually be developed. In reality they are loose threads, which when pulled, unravel the entire fabric of the standard model.

***SUN'S MAGNETIC FIELD*** On his page 18 Bridgman calculates what he says is the magnetic field strength that ought to result from Juergen's electric star model. He uses a long straight wire to make his calculation. Where he got the idea ***that*** is a valid geometry, only he knows. The Sun's magnetic field (and its associated current) exists in a ***spherical*** geometric frame and may well be due to internal current circulation in the Sun.

***CURRENTS IN SPACE*** [pp. 19 & 20] Bridgman reveals his ignorance of the behavior of Birkeland currents in plasma discharges by saying: "Virtually every graduate-level textbook on plasma physics talks about the stability problems of currents moving in space without the guidance of a conducting wire. These instabilities, driven by the fact that electromagnetism can be attractive and repulsive, are the primary technical problem in electromagnetic confinement methods for controlled fusion. When confined by a purely attractive force, like gravity, these instabilities become insignificant."

1. If Bridgman is saying there are no cosmic plasmas containing electric currents, he is wrong.
2. Bridgman says the instabilities that "are the primary technical problem in electromagnetic confinement methods for controlled fusion... when confined by a purely attractive force, like gravity, ...become insignificant", then why do we not have controlled fusion on Earth? We have gravity here too.

Had TB said that, “Virtually every graduate-level textbook *in astrophysics* talks about the stability problems of currents moving in space without the guidance of a conducting wire...”, I would not disagree. But they are wrong if they do say that.

Birkeland currents themselves form a natural ‘twisted pair’ power transmission line in plasma - entirely analogous to a twisted pair of wires. The important factor in the stability of cosmic sized Birkeland currents is that the current density in them is very low. In unconfined space plasma, radio telescopes are able to trace Birkeland currents by their radio signatures. Peratt notes in his book that within the radio bright lobes of double radio galaxies, [Birkeland] filaments may exceed  $6 \times 10^{20}$  meters in length (p. 48), that is 40 million times larger than the distance estimated from the Sun to the heliosphere ( $1.48 \times 10^{13}$  meters). And there is compelling evidence from radio telescopes for supercluster-sized Birkeland currents<sup>14</sup>. Plasma instabilities *do* show up in the unstable behavior of some stars, and the outbursts of our own Sun, where the current density increases, or ‘pinches,’ at the star. Bridgman’s last sentence (where he mentions gravity as a stabilizing force in plasmas) is absurd, remembering that the force of gravity can be neglected in the presence of strong electromagnetic forces. [See p. 81 in TES]: “The electrons that flow inside a copper wire also constitute a plasma. Those electrons respond to electrical forces, not gravitational ones. We do not have to place our coffee maker at a lower level than the power outlet in the wall so that gravity can enable the electrons to run downhill like water in a river. Charges moving within (cosmic or terrestrial) plasmas are just like an electric current in a wire – moving charges driven by electrical forces that **completely ignore gravity.**”

**SOLAR ELECTRON VELOCITIES** All of Bridgman’s arguments on pp. 20 & 21 involving the velocity of electrons are specious. The fast solar wind from the ‘cooler’ coronal holes is easily explained by the Electric Sun model but has no conventional explanation. The ‘temperature’ is low where the electric field is strong.

**MISCELLANEOUS SOLAR SILLINESS** TB states [p. 22] I claim that coronal holes almost cover the Sun during solar minimum. What I did say is that during solar minima, coronal holes spread over most of the corona and (in x-ray) it “switches off”. For example, the Feb 7, 2002 APOD<sup>15</sup> states, “But this coronal hole, one of the largest seen so far in the current solar activity cycle, extends from the south pole (bottom) well into northern hemisphere.”

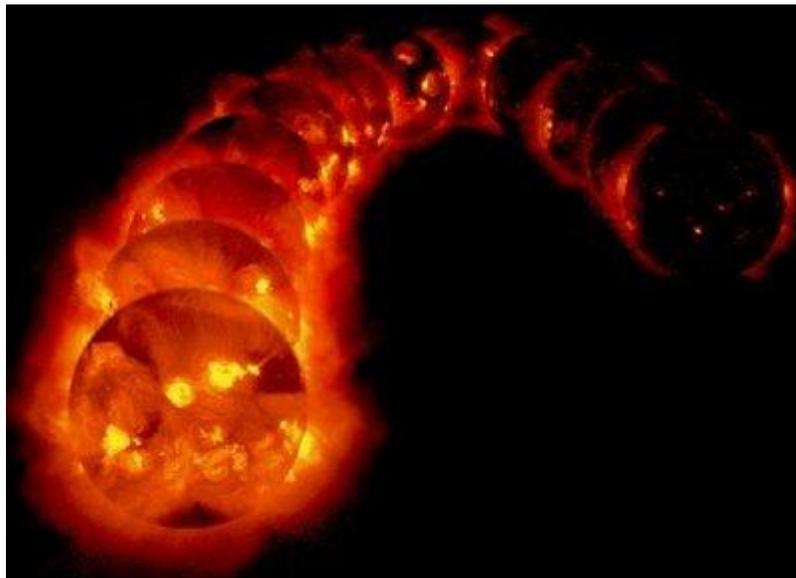


Figure 2: Soft X-ray solar cycle, showing *Yohkoh* observations ranging from 1991 (leftmost image; sunspot maximum) to 1996 (sunspot minimum).

NASA’s ‘Cosmocopia’ web site<sup>16</sup> shows an x-ray image of a giant solar hole and describes it by calling it: “A large coronal hole, extending from the northern into the southern solar hemisphere, is

near the Sun's center." But most importantly, see in figure 2 the Yohkoh soft x-ray image<sup>17</sup> that indisputably makes my point.

**CRATER FORMATION** On his page 24 Bridgman states, "Scott claims that craters on the Moon, Mars and other celestial objects are not formed by impacts, but by giant electric arcs. Part of his evidence is that if they were formed by impacts, we should find more remnants and more elliptical craters (page 138). Yet on the next few pages (page 140, figure 33), he has a picture with elliptical craters!"

My figure 33 shows a NASA image of a sinuous rille, not a crater. In discussing how electric discharge machining is known to be able to create this sort of formation I stated, "This produces a line of **elongated** or over-lapping craters. The continuous blast effect erodes a wider uniform channel along the path." [Emphasis added] This is exactly what the figure shows.

The standard explanations for these formations include such things as lava channels, collapsed lava tubes, near-surface dike intrusion, subsidence of lava-covered basin and crater floors, tectonic extension, and that they are 'grabens', sections of the crust that have sunk between two parallel faults. How anyone can look at figure 33 and suggest these explanations is beyond me.

**DARK MATTER** On page 29 Bridgman claims, "Dark matter... is simply matter below our ability to directly detect it<sup>18</sup>". He is implying that, of course, the matter is there – it has to be – or the gravity-only theory fails. He ridicules Halton Arp's statement that "we cannot see through Seyfert galaxies" and presents a hand-waving argument (into which he drags the imaginary stuff called "dark matter") to 'show' that we can indeed see through galactic disks. Really? Well, take a look at this image that I took [from my observatory]:

<http://www.members.cox.net/dascott2/M31.html>

and tell me you would be able to see a star (QSO) far beyond this galaxy, directly behind it. And this galaxy, M31, isn't even a Seyfert. He also states (using all upper case letters) that, "We see through the disk of our own galaxy." This is simply a false proclamation thrown down from authority. There are many completely opaque dark nebular regions within our galaxy. But a galactic core can also be opaque because it is **too bright** to see through.

**THE WMAP MAP** In this section Bridgman asks, "WHERE ARE THE CURRENT STREAMS<sup>19</sup>" in the WMAP plot? This question cuts both ways. That is, since NASA knows that galaxies form in gigantic strings<sup>20</sup>, there must be a filamentary structure to the cosmos (intergalactic space). If WMAP does not show any such filamentation, this calls the cosmological interpretation of that data into question. As it happens, recent radiotelescopic data reported<sup>21</sup> by Gerrit Verschuur of the University of Memphis indicates filaments are present in HI observations. These HI clouds are almost certainly interstellar (inside our galaxy). Verschuur states:

"The high-frequency continuum emission data were obtained by the WMAP whose purpose was to study structure in the early universe. If the continuum emission peaks are in fact cosmological in origin, there should be absolutely no relationship between those signals and the galactic HI structure. Instead, in the examples shown above, close associations between the two classes of structure are found.

If confirmed, this argues that the WMAP observations have a strong if not dominant component as a result of processes occurring in interstellar space."

So, is WMAP data just galactic noise generated within (or near to) the Milky Way? There is evidence that this is the case.

We know of the existence of huge galaxy clusters. If the WMAP data actually comes from the farthest points in the universe why do we not see those huge strings of galaxy groupings silhouetted (back lighted) by that distant light continuum? I repeat TB's question back at him: "Where are the current streams?" that NASA knows must be there?

**DOUBLE LAYERS** On (his) page 32 Bridgman contends that double layers (DL) cannot exist in the steady state by saying they are just like charged capacitor plates that would immediately slam together if not restrained physically from doing so. He also contends that DLs "invariably must include the motions of electrons and ions between fixed anodes and cathodes." Of course

this demonstrates his ignorance of what plasma is and how it functions in space. Irving Langmuir investigated exactly this question. It is NOT a simple electrostatic problem – it is a dynamic one that requires more than the electrostatics section of a second year physics course to understand.

DLs have been observed and worked with in plasma labs for decades. They DO exist. It sounds as if Bridgman doesn't think they do or can – he thinks they would all collapse “like charged capacitor plates that would immediately slam together if not restrained physically from doing so.” Sorry, Dr. Bridgman – stable double layers have been observed and worked with for years.

Bridgman also claims I propose that DLs serve as the “driver of plasma oscillation frequencies described by Langmuir”. No, I did not say or imply that DLs **drive** plasma oscillations. DLs **can** explode for various reasons and by doing so interrupt current streams. That, in turn, will explosively release previously stored magnetic energy.

**MAGNETIC FIELDS EASIER TO MEASURE** On his p. 35 he accuses me of ignoring the fact “that magnetic fields are much easier to measure than electric fields in distant locations.” I do not ignore that fact – I agree completely. Hannes Alfvén said it first (in *Double Layers and Circuits in Astrophysics – IEEE TPS 1986*) However, it does not justify TB's ignoring the fact that those measured magnetic fields must be accompanied by electric currents. His use of the phrase ‘electric fields’ instead of ‘electric currents’ reveals his confusion in this regard.

**OPEN MAGNETIC FIELD LINES** On pages 35 and 36 he sets up a straw-man by saying that when we sketch magnetic fields by using the concept of ‘field lines’, we often show some of them going off the edge of the diagram. Of course. Then he asks if I am claiming such lines don't exist. Of course not. But there is a big difference between showing the beginnings and endings of such lines (that extend beyond the edge of our diagram) and the claim that they go out an unlimited distance **and never return**. When engineers sketch magnetic field diagrams of a permanent magnet (via a conceptual tool – magnetic lines), we are always careful to show exactly the same number of lines leaving one pole as we show returning to the other pole. If fifteen lines go off the page from the North Pole, fifteen lines will be shown coming in from the edge of the paper into the South Pole. That's what Maxwell's equation  $\text{Div B} = 0$  implies and requires. There is no such thing as a magnetic monopole.

Equivalently, there is no such thing as open contour lines on a topographical map.

There is no such thing as open isobars on a weather map.

It's just that simple. Helioseismologists and astrophysicists ought to stop using this erroneous concept<sup>22</sup>. ‘Open magnetic field lines’ do not exist in real space – nor even on paper (if our paper is large enough).

**RECONNECTION** On page 36 he claims I only discuss Magnetic Reconnection in *FREE SPACE* [upper case is Bridgman's]. This is untrue. I never use the words ‘free space’ in the entire book. (I have an electronic version and have scanned it.) This is Bridgman's attempt at obfuscation.

TB is visualizing a pure magnetic field (“in free-space”), not realizing there has to be an electric current in the nearby vicinity to create that field. Such currents require conducting paths – in space this is provided by plasma.

The major point, that Bridgman and most other astrophysicists ignore, is that in order to have a magnetic field, there has to be an associated electric current. If that current is abruptly interrupted, the magnetic field quickly collapses, resulting in an explosive ejection of whatever matter constituted the plasma. There is no such mechanism as ‘reconnection’ – neither in free space, in magnetized plasma, nor anywhere else.

**NEUTRON STARS** In defending the notion of the Neutron Star TB blithely states [p. 37], “Neutron stars are not completely neutronium. Their outer layers are composed of heavy nuclei, free protons, and free electrons where the pressure is not high enough for **neutronization**<sup>23</sup> to proceed.” It sounds as if he has actually gotten hold of one of these ‘stars’ and dissected it - he

actually has the chutzpah to talk not only about what this fabricated entity is made of internally, but what its 'outer layer' is composed of. Having gone that far, why doesn't he reveal to us what the color and texture of that outer surface is? Is it bumpy or smooth? How hot is it?

But seriously – How did the neutron star form in the first place? Was it born, fully formed, in the Big Bang. If not, then how did the first two or three neutrons stick together to form the nucleus of what later became the center of the neutron star? For those first few neutrons “the pressure is not high enough for *neutronization*<sup>24</sup> to proceed.” either. The standard explanation of neutron star formation is 'gravitational collapse' of a 'dying star'. As I said above, that is another fictional mechanism for which no real evidence has ever been found.

If Bridgman or anyone else wants to believe that an object having the mass of a star can rotate at 63,000 rpm, fine. Just do not expect reasonable people to accept it as being plausible.

**LACK OF MATHEMATICS** On his pages 40 and 44 Bridgman derides the use of 'back-of-the-envelope' calculations by electric cosmologists. This is a correct observation – at least in part<sup>25</sup>. But it is for a reason. The detailed dynamic behavior of every plasma cloud in outer space is not yet fully describable by tensor algebra. Isn't it premature in the extreme to leap into mathematical complexity when one is still just developing a model and attempting to identify and isolate the cause and effect variables and mechanisms?

John von Neumann said, “There's no sense in being precise when you don't even know what you're talking about.”

I do recognize that clothing your assumptions thickly with mathematics can be an effective propaganda tool. We are just honest enough not to do it.

**NON-NUMERICAL AXES** On page 41 he takes me to task for not having detailed quantitative values on my graphs for such quantities as voltage, altitude, temperature, and current density at a star's surface. ***We don't know those numbers yet – we haven't gone there to measure them.*** These are only qualitative not quantitative descriptions (but are preferable to quantitative but erroneous descriptions).

**LUMPED CIRCUIT ELEMENTS** On page 42 Bridgman attacks Alfvén's (and my) use of lumped linear circuit elements such as resistors and inductors to describe phenomena in space. It is a well-accepted technique in electrical engineering to use ***lumped, linear,*** elements in first-order approximations of more complex systems (such as transmission lines) in order to get a conceptual model started. When necessary, we then go on to ***distributed*** models that require partial differential equations for their solution – eventually any necessary ***non-linearities*** are incorporated. After that, perhaps the problem becomes complicated enough that it will only yield to iterative computer simulation rather than closed-form solutions. There is nothing wrong with this approach. In fact I would venture to say it is highly preferable to leaping directly into a morass of matrix equations that (as Alfvén so accurately pointed out) the plasma either doesn't understand or is clever enough to disobey.

**WHERE DOES THE ENERGY COME FROM?** His question on pg 42, “Where does the energy come from to form these accumulations [of separated charge in space]?” comes full circle back to the argument raised against Birkeland's idea that the auroras are powered by currents from the Sun. On page 21 of *The Electric Sky* I said:

“For decades, students in astronomy classes have been told by their professors, ‘There cannot be charge separation in space. Therefore, all proposals of cosmic electrical effects can be safely ignored.’ Many astronomy graduate students have heard their professors give the ‘teaspoon of salt’ lecture. The lecturer takes a teaspoon of salt, holds it up in front of the class, and then asks the students to calculate how much energy it would take to separate one electron from each of the molecules of sodium chloride in the spoon. The answer is horrendously large. ‘See,’ cries the professor, ‘There cannot be charge separation in space. There just isn't enough energy out there to do it.’ “

But separated charge ***IS*** out there; we have measured it.

Bridgman will no doubt chastise me for not giving the name, place, and date of the 'Teaspoon of Salt Lecture.' In return I ask Bridgman: Where did all the rotational spin energy (angular momentum) in the universe come from if the Big Bang just blew things radially outward? Everything in the cosmos seems to be spinning, rotating, and revolving. How? Why? Where does the shockingly high energy of cosmic rays come from? (Plasma cosmology has reasonable explanations for these phenomena.) These ought to be easier questions for him to answer than: "Where did the energy to power the Big Bang come from?"

**MORE LIKE CREATIONISM THAN I EXPECTED** [p. 44] TB seems to take offense at the degree to which I talk about plasma when it is in the dark current mode of operation (Earth's ionosphere for example, or the outer interplanetary plasma, etc.). He states, "...much of Scott's model hides connections behind 'invisible' dark currents. These 'Dark Currents' seem to fulfill in Scott's 'theology' the role of God in creationist claims as a form of invisible agent."

I submit this comment, coming from a staunch supporter of Fairie Dust<sup>26</sup> entities such as Black Holes, Dark Energy, Dark Matter, and Neutron Stars, is the epitome of hypocrisy. In his zeal to play Citizen Robespierre to anything that challenges his belief structure, he seems to see the Ghost of Creationism lurking everywhere – even when it is clearly not.

Does he feel no unease that it was Georges Lemaître, a Roman Catholic priest, who was one of the inventors of his beloved Big Bang Myth? It is well known that one of the early general appeals of the BB was that it bridged the gap between 'science' and 'faith'. When the big bang theory was first heralded, Pope Pius XII wrote, "Scientists are beginning to find the finger of God in the creation of the universe<sup>27</sup>".

On p 28 of TES I said:

Alfvén commented on Lemaître's proposal: "The appeal of the Big Bang has been more ideological than scientific. When men think about the universe, there is always a conflict between the mythical approach and the empirical scientific approach. In myth, one tries to deduce how the gods must have created the world – what perfect principles must have been used."

It is not the purpose of this book to denigrate the Almighty. We simply contend that we do not need a spiritual argument to explain the sky. It's not that supernatural. The real cosmos is not invisible, immeasurable, or unknowable. We simply must use our eyes, our brains, and the work product of the last hundred years of serious electrical science. If we do so, we shall see through the mystifying fog.

After reading those paragraphs, TB's describing my work, as being a 'theology', is a low-blow. Gratuitous comments such as this are an indication that his urge to attack me has overcome his reason. It is modern astrophysics that demands its followers 'believe' in unseen, immeasurable entities such as WIMPS, MACHOs, Dark Matter, and Inflatons as a matter of 'faith' without proof. The reification of abstractions such as point-masses, magnetic field lines, and mathematical singularities into real entities that can have an effect on matter in real space are classic theological transmogrifications – miracles. If TB wants to see a supporter of this species of Creationism, he can simply look in a mirror.

**BINARY POWERED PULSARS** As his final "Homework Problem" [p 48] he challenges me to calculate the density of a binary pair of stars that orbit a common center in a period of one millisecond. Why? What has this got to do with anything I have said? Please read pages 173 to 188 in *The Electric Sky*. In there, one of the things I *do* say is, "The rate of this [pulsar] charge/discharge phenomenon depends on the strength of the input (Birkeland) current, the capacitances (surface areas of the stars) and the breakdown voltage of the (plasma) connection. It in **no way** depends on the mass or density of the stars." It is also independent of the orbital periodicity of any binary pair.

## **OBSERVATIONS**

As I went through Bridgman's critique and examined his accusations against my work, I checked the actual statements I had made in *The Electric Sky*. I actively sought out evidence of whether I had been correct or had erred. In just about every case, I found new (at least to me) confirmation of my original statements. In instance after instance Bridgman has said or implied that I have said or implied things that I have not.

## **CONCLUSION**

Astrophysics pseudo-skeptics like Bridgman have certain recognizable characteristics in common.

1. They speak down to their audience using 'arguments from authority'.
2. They refuse to consider any electrical causation for anything in space.
3. When confronted with 'in your face evidence' such as the image of a high redshifted QSO in front of a more distant, low redshifted galaxy, they resort to arguments (usually involving math or statistics) to disprove – or at least make you doubt – what your eyes are telling you. The old Groucho Marx line comes to mind: "Who you gonna believe? Me? Or your lying eyes?"
4. They put forward their **assumptions** as if they were universal truths. The fact that they have been voted upon and accepted by a self-involved, insular group of 'experts' does not make them true. Winning a hand vote is not the same thing as scientific validation.
5. It is clear that they have never been exposed to the basic properties of plasma nor the fundamental inter-relationships between magnetic fields and electric currents. But they feel free to lecture those who have.
6. If the pseudo-skeptic has a monetary interest (such as maintaining a funding stream or a salary) his criticisms often become vituperative.

When I met Bridgman at his place of employment - NASA's Goddard Space Flight Center in Greenbelt, MD on March 16, 2009, he appeared more personable than his rant (and the addendum he has since issued) would indicate. I got the feeling at that meeting that if we could just sit down and talk about things, some area of agreement and mutual respect might be found. Apparently, from reading what he has written subsequent to this meeting, there is little hope of that.

It should be understood that if there are criticisms made by him that I have apparently neglected to address in detail in my comments here, it should **not** be assumed I have no response to them. At this point, I'm tired of wading through his half-truths, misunderstandings, *ad hominem* cuts, pseudo-intellectual swagger, and ignorance of most things electromagnetic.

Because I see no willingness on Bridgman's part to discuss things calmly, with mutual respect, he remains, in my view, simply one more pseudo-skeptic who claims to know-it-all – not an open minded scientist.

***Nemo me impune lacessit.***

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## **References**

<sup>1</sup> Fliegel, H.F. & DiEsposti, R.S., *GPS and Relativity: An Engineering Overview* GPS Joint Program Office The Aerospace Corporation, El Segundo, CA 09245. Available:

[http://tycho.usno.navy.mil/ptti/1996/Vol%2028\\_16.pdf](http://tycho.usno.navy.mil/ptti/1996/Vol%2028_16.pdf)

<sup>2</sup> Bridgman, W.T. *The Cosmos in Your Pocket: How Cosmological Science Became Earth Technology I*, 2007. Available: [http://arxiv.org/PS\\_cache/arxiv/pdf/0710/0710.0671v1.pdf](http://arxiv.org/PS_cache/arxiv/pdf/0710/0710.0671v1.pdf)

<sup>3</sup> [http://antwrp.gsfc.nasa.gov/diamond\\_jubilee/debate\\_1920.html](http://antwrp.gsfc.nasa.gov/diamond_jubilee/debate_1920.html)

<sup>4</sup> <http://www.sjcrothers.plasmaresources.com/papers.html>

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- <sup>5</sup> See: <http://www.sjcrothers.plasmaresources.com/Waves-1.pdf> Also see: <http://www.sjcrothers.plasmaresources.com/index.html>
- <sup>6</sup> See: [http://www.planetary.org/programs/projects/pioneer\\_anomaly/](http://www.planetary.org/programs/projects/pioneer_anomaly/)
- <sup>7</sup> See: <http://www.space.com/scienceastronomy/080229-spacecraft-anomaly.html>
- <sup>8</sup> <http://www.omatumr.com/PapersArxiv.html>
- <sup>9</sup> Italics are Bridgman's.
- <sup>10</sup> See: <http://zpinch.sandia.gov/> and [http://fire.pppl.gov/fpa05\\_olson.pdf](http://fire.pppl.gov/fpa05_olson.pdf)
- <sup>11</sup> See: <http://www.focusfusion.org/>
- <sup>12</sup> See: [http://en.wikipedia.org/wiki/Unsolved\\_problems\\_in\\_physics](http://en.wikipedia.org/wiki/Unsolved_problems_in_physics)
- <sup>13</sup> Alfvén, H. and Asoka Mendis, Nature and Origin of Comets, Nature Vol. 246, December 14, 1973
- <sup>14</sup> Available: <http://www.nasa.gov/centers/goddard/news/topstory/2004/0107filament.html>
- <sup>15</sup> <http://apod.nasa.gov/apod/ap020207.html>
- <sup>16</sup> <http://helios.gsfc.nasa.gov/chole.html>
- <sup>17</sup> [http://www.scholarpedia.org/article/Solar\\_activity](http://www.scholarpedia.org/article/Solar_activity)
- <sup>18</sup> So are ghosts and ectoplasm.
- <sup>19</sup> Upper case is in TB's critique.
- <sup>20</sup> <http://www.nasa.gov/centers/goddard/news/topstory/2004/0107filament.html>
- <sup>21</sup> Verschuur, G.L. *Interstellar Space and Possible Detection of Related Continuum Emission* IEEE Trans on Plasma Sci. Vol 35, No. 4. Aug 2007, pp 759-766.
- <sup>22</sup> See, for example <http://pluto.space.swri.edu/image/glossary/IMF.html>
- <sup>23</sup> No such word as 'neutronization' exists.
- <sup>24</sup> No such word as 'neutronization' exists.
- <sup>25</sup> I submit that Peratt's *Physics of the Plasma Universe* Springer-Verlag, 1992 contains enough mathematics, I should think, to satisfy even him for a while – he claims to have read it.
- <sup>26</sup> **Fabricated Ad hoc Inventions Repeatedly Invoked in Efforts to Defend Untenable Scientific Theories**
- <sup>27</sup> <http://www.christiancourier.com/articles/133-the-big-bang-theory-vs-gods-word>