

The Electric Universe Illuminates Recent Discoveries

Wallace W. Thornhill

Vemasat, 26 Maplestone Place, Chapman, ACT, 2611, AUSTRALIA

e-mail: walt@holoscience.com

The Electric Universe is a cosmology that argues the powerful electromagnetic force plays a dominant role in the birth and life of stars. This new paradigm is an extension of well-established plasma cosmology. The Electric Universe has unequalled success in predicting and simply explaining many new discoveries in the space age without requiring ad hoc modifications and the introduction of unobservable entities and non-physical concepts. In this paper a new concept is introduced to explain enigmatic features of planetary nebulae.

1. Introduction

A good theory is distinguished by its explanatory and predictive power, particularly when the predictions are counter to usual expectations [1]. In this paper I present two recent discoveries that have surprised researchers but were predicted by, or fit seamlessly, the Electric Universe (EU) paradigm.

In recent decades it has been possible to simulate and experimentally verify high-energy plasma discharge behavior in the lab that can also be observed on stellar and galactic scales [2]. It introduces a conceptual hurdle for the orthodox view that the charge separation required to generate electric currents on a cosmic scale is not possible. However there are two important aspects of space plasma that are generally overlooked. The first is the phenomenon of ‘critical ionization velocity’ (CIV) in the near vacuum of space, which ionizes neutral atoms when their kinetic energy with respect to the local plasma is equal to the atom’s ionization energy. Although confirmed empirically there seems a reluctance to accept CIV because there is no full understanding of it [3].

The second aspect is, “Regardless of scale, the motion of charged particles produces a self-magnetic field that can act on other collections of particles or plasmas, internally or externally. *Plasmas in relative motion are coupled by currents that they drive through each other.*” [4] [Italics in original] These concepts are the basis of plasma cosmology, which has the advantage of scalability from the lab to cosmic scales and is therefore subject to empirical tests. Also, the electromagnetic force being 10^{39} times stronger than gravity allows normal physical concepts to account for phenomena that in gravitational models require unreal objects, particles and energies.

The EU cosmology builds on plasma cosmology while taking conceptual leaps beyond. A most important aspect of the EU paradigm is the plasma discharge model of *all* stars [5]. Two recent discoveries highlight the failure of accepted models to expect or account for observations and show the predictive and explanatory power of the EU model.

2. Star Birth

“There is a general belief that stars are forming by gravitational collapse; in spite of vigorous efforts no one has yet found any observational indication of confirmation. Thus the ‘generally accepted’ theory of stellar formation may be one of a hundred unsupported dogmas which constitute a large part of present-day astrophysics.” [6]

The EU has stars accreted, born and lit electrically [7]. In 1986 Hannes Alfvén predicted that stars would form along Birkeland current filaments in the dusty plasma of a molecular cloud [8]. Yet researchers were astonished when the Herschel infrared telescope showed stars being born inside molecular clouds, strung along glowing filaments. The ESA report describes, “an incredible network of filamentary structures, and features indicating a chain of near-simultaneous star-formation events, glittering like strings of pearls deep in our Galaxy.” [9] Like tortured earthly intra-cloud lightning-bolts Fig. 1 shows, “the filaments are huge, stretching for tens of light years... regardless of the length or density of a filament, the width is always roughly the same.” [10]

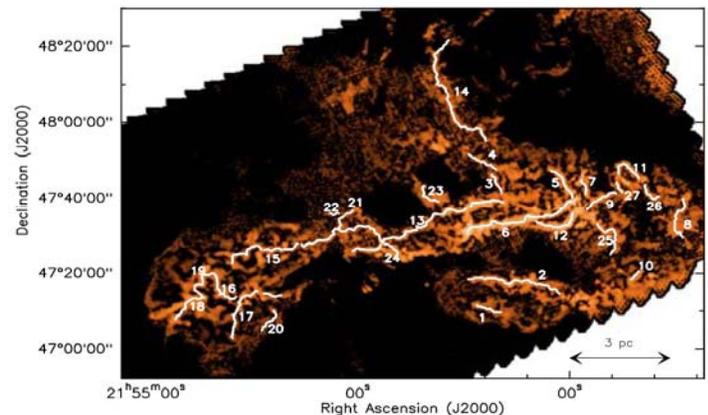


Fig. 1. A network of 27 star forming filaments derived from Herschel observations of the IC 5146 molecular cloud. Credit: D. Arzoumanian et al.

The interstellar Birkeland current filaments align in a ‘force free’ manner with the ambient magnetic field [11], which fulfills Alfvén’s star birth model prediction. Scavenging of matter from the weakly-ionized molecular cloud takes place strongly toward the filament axis. The electromagnetic attraction of the filament is powerful and long-range since it declines linearly with radial distance from the filament. The weak force of gravity plays little role until the accreting matter reaches the filament axis, whereupon the matter tends to coalesce along the filament into spherical bodies. The accretion process is known as Marklund convection [12], which accretes matter differentially to the filament axis according to ionization potential. The result is a concentration of heavy elements with low ionization potentials closest to the axis and hydrogen and helium outermost. The matter nearest the filament axis is cool. Thermonuclear hydrogen reactions do not

light stars [13]. This has significance for the following recent discovery.

Astronomers have noticed that several of the young stars in their natal filament varied in their brightness by more than 20 percent over just a few weeks.

"Astronomers using ESA's Herschel and NASA's Spitzer space telescopes have detected surprisingly rapid changes in the brightness of embryonic stars within the well-known Orion Nebula... Astronomers were surprised to see the brightness of the young objects varying by more than 20% over just these few weeks, since the accretion process should take years or even centuries... Yet again, Herschel observations surprise us." [14]

Such variability is expected in the electrical model of stars because the embryonic stars are loads in an interstellar circuit that has natural oscillatory characteristics. Our Sun shows an electrically driven variability in the sunspot cycle, where the oscillation is most noticeable in X-ray energies. At the high-frequency end of the oscillatory scale we find pulsars, which are normally constituted stars with a magnetospheric disk-field-aligned-current transmission line system, *"...where the extent of the magnetosphere, not emission points on a rotating surface, determines the pulsar emission."* [15]

Further observations of nascent stars may help eliminate the gravitational accretion model since periodicities in behavior of the group of stars along a single filament would not be expected in the gravitational model.

3. The Sun's Environment

The EU model of stars has them continuing to be powered throughout their lifetimes by the Birkeland current filaments, which operate in 'dark mode' when the current and/or matter density in the filament is low. With this in mind, I predicted that the Sun's interface with its environment would not conform to the mechanical shock model. Evidence for this began to arrive from Voyager 1 in 2005, where I wrote in relation to the generation of anomalous cosmic rays (ACRs) by a shock mechanism, *"[ACR generation] does not require a mechanical shock."* [16] It is now official that there is no heliospheric shock [17].

In the same article, based on the physics of a low-pressure gas discharge, I predicted the presence at the heliospheric boundary of a strong electric field in the 'virtual cathode' region of the solar discharge that would tend to accelerate electrons toward the Sun. NASA recently reported, *"...Voyager has detected a 100-fold increase in the intensity of high-energy electrons from elsewhere in the galaxy diffusing into our solar system from outside."* [18] The solar 'wind' protons are yet to be detected accelerating away from the Sun as Voyager coasts deeper into the virtual cathode region.

Discoveries about the Sun's interface with the interstellar environment do not support any models based on the Sun mechanically plowing through the interstellar medium: *"...the shape of the heliosphere is not consistent with that of a comet aligned in the direction of the Sun's travel through the galaxy as was previously thought."* [19] Since early 2009, the Interstellar Boundary Explorer (IBEX) mission has been building all-sky maps of the emissions of energetic neutral atoms produced at the boundary between the heliosphere and the interstellar medium. These maps have un-

expectedly revealed a narrow band of emission circling the heliosphere.

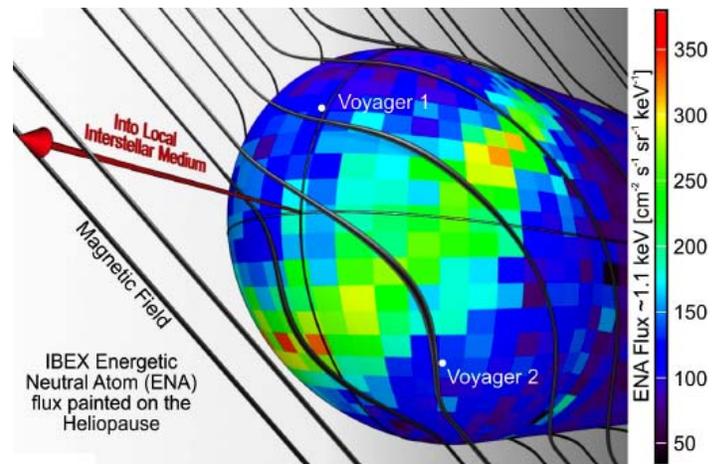


Fig 2. Model of heliospheric interaction where the external magnetic and dynamic forces are comparable. The band of ENA emission and hot spots are clear. Credit: D. J. McComas et al, Southwest Research Institute.

The band of emission has a string of 'hot spots' that change over months. Researchers acknowledge, *"a completely new paradigm is needed for understanding the interaction between our heliosphere and the galactic environment."* [20]

In April 2007 I published the following:

"Alfoén pioneered the stellar circuit concept and it seems his 'wiring diagram' is essentially correct but incomplete because it does not show the star's connection to the larger galactic circuit. Alfóén remarked, 'The current closes at large distances, but we do not know where.' Plasma cosmologists have supplied the answer by mapping the currents flowing along the arms of spiral galaxies. It is but a small step from there to see that all stars are the focus of Z-pinchs [Fig. 3] within a galactic discharge. Normally the current flows in 'dark mode' so we don't see the spectacular bipolar 'wiring harnesses'..."

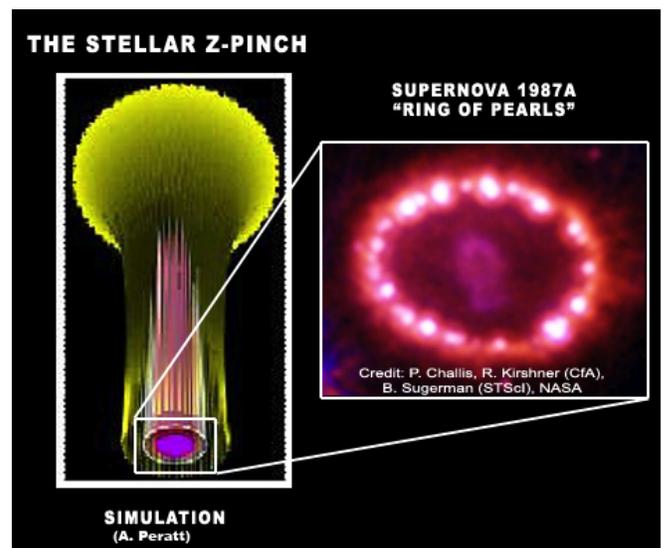


Fig. 3. Every star sits axially within a magnetically pinched bundle of current filaments that takes the general form shown (left), aligned with the local interstellar magnetic field. Where the con-

centric cylinders of Birkeland current filaments encounter an equatorial disk of dust from a star they produce a ring of enhanced emission 'hot spots' seen to advantage in SN1987A.

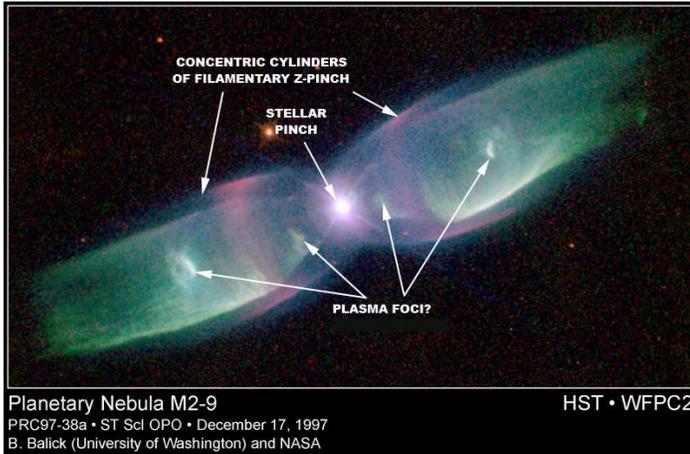


Fig. 4. Planetary nebulae reveal the concentric filamentary Birkeland current cylinders and probable plasma foci in glow mode. Annotation: W. Thornhill.

The planetary nebula in Fig. 4 shows the concentric filamentary cylinders of a stellar circuit with the star the focus of the most intense magnetic pinch effect. For most stars the circuit is invisible due to the low current density and lack of dust in the plasma. Electromagnetic forces shape the nebula so the discovery of a stronger than expected magnetic field beyond our Sun's heliosphere is significant. "We've seen one after another signature of a very strong magnetic field in the galactic environment... That leads to a whole new paradigm." [21]

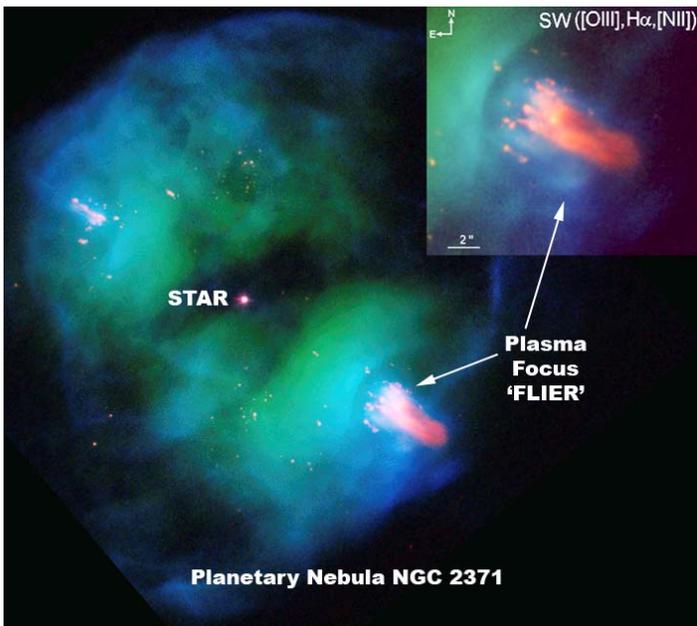


Fig. 5. Planetary nebula NGC2371. Credit: NASA, ESA. The inset shows a feature commonly designated a "fast, low ionization emission region, or FLIER." [22] A second opposing FLIER can be seen toward the top left. FLIERS have much lower ionization as well as equal and opposite supersonic Doppler shifts relative to their environment.

The planetary nebula NGC 2371 supports the argument elsewhere in these proceedings [23] that the stellar Z-pinch produces opposing plasma focus effects [24] centered axially on the star. In Fig. 5 we see incomplete rings of bright spots, which in the close-up inset show linear sections of the Birkeland filaments glowing like parallel comets. The penumbra of the plasma focus sweeps away from the star, forming the axial ion jets. The low ionization of atoms in the FLIER and sharply defined circular collar may be explained by Marklund convection of low-ionization species toward the axis of the Birkeland filament bundle. Seen edge-on many FLIERS show the characteristic shape of the plasma focus penumbra, concave toward the star.

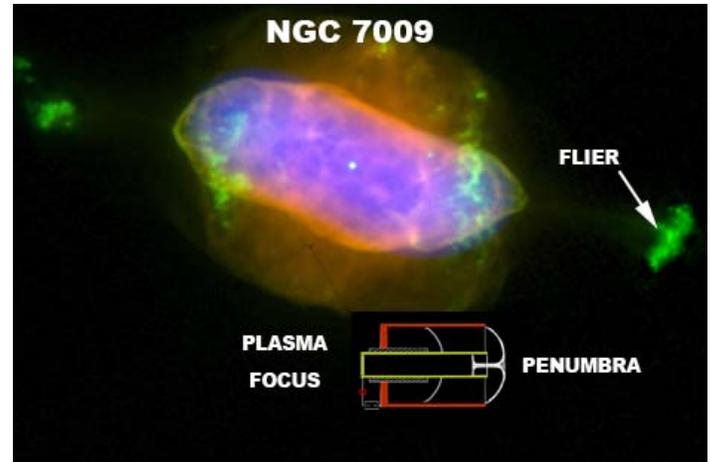


Fig. 6. Planetary nebula NGC 7009 shows a FLIER with the distinctive plasma focus penumbra morphology. NGC7009 image courtesy of NASA.

A high-speed version of a FLIER, like that seen in Fig. 6, can also be seen on-axis in movies of the activity at the dynamic electrical heart of the Crab Nebula [25]. Such repetitive electrical discharge behavior of plasma may account for the extraordinary complexity of many planetary nebulae. Returning to Supernova 1987a, a "mystery spot" of enormous energy was observed moving at a good fraction of the speed of light along the axis of symmetry [26]. I suggest that it was the moving penumbra of a plasma focus, its central plasmoid being the most powerful, compact source of radiation known.

These examples of electrical activity centered on stars show that locally the solar ENAs are produced where positive ions from the 'Local Cloud' and solar 'wind' current sheet intercept and are neutralized by electrons from the Sun's innermost Birkeland current cylinder. Since that cylinder is comprised of filamentary particle beams the ENAs will exhibit fine structure and appear to come from 'hot spots,' which vary in intensity depending upon the dynamics of the filament pairs and the variable solar 'wind' source.

It should also be noted that the plasma focus is an efficient particle accelerator and source of radiation. This, perhaps together with particle acceleration in double layers in the Sun's polar Birkeland filaments may explain the recent discovery of mysterious polar cosmic ray 'hotspots.' The sources are invisible and must lie within 0.03 light-years of Earth otherwise galactic magnetic fields would have deflected them and smeared the signal across the sky [27].

4. Conclusion

Discoveries that have been reported recently have served to support and enhance the EU model of star birth and subsequent power source. Applying these new EU concepts may solve the many mysteries of the Sun, its environment and complex planetary nebulae.

References

- [1] Thunderbolts, "Predictions Confirmed", <http://www.thunderbolts.info/predictions.htm>.
- [2] A. L. Peratt, **Physics of the Plasma Universe** (Springer-Verlag, 1991).
- [3] G. L. Verschuur, "On the Critical Ionization Velocity Effect in Interstellar Space and Possible Detection of Related Continuum Emission", *IEEE Transactions on Plasma Science* **35** (4): 759-766 (Aug 2007).
- [4] Op. cit. [2], p. 48.
- [5] W. Thornhill, "The Z-Pinch Morphology of Supernova 1987a and Electric Stars", *IEEE Transactions on Plasma Science* **35** (4): 832-844 (Aug 2007).
- [6] H. Alfvén, G. Arrhenius, **Evolution of the Solar System**, NASA SP-345, p. 480 (1976).
- [7] W. Thornhill, "Stars in an Electric Universe", *Proceedings of the NPA* **8**: 630-637 (2011).
- [8] H. Alfvén, "Model of the Plasma Universe", *IEEE Transactions on Plasma Science* **PS-14** (6): 629-638 (Dec 1986).
- [9] ESA News, "Herschel Views Deep-Space Pearls on a Cosmic String" (2 Oct 2009), <http://www.esa.int/esaMI/Herschel/SEMUA0G0.html>.
- [10] D. Arzoumanian et al, "Characterizing interstellar filaments with Herschel in IC 5146", *Astronomy & Astrophysics* **529**: L6 (2011), <http://dx.doi.org/10.1051/0004-6361/201116596>.
- [11] MPA Science Release, "Magnetic Fields Set the Stage for the Birth of New Stars", (16 Nov 2011), http://www.mpia.de/PR/2011/PR111116/PR_111116_en.html.
- [12] G. T. Marklund, "Plasma convection in force-free magnetic fields as a mechanism for chemical separation in cosmical plasmas", *Nature* **277**: 370-371 (1 Feb 1979).
- [13] Op. cit. [5].
- [14] ESA News, "Young Stars Flicker Amidst Clouds of Gas and Dust" (29 Feb 2012), http://www.esa.int/esaSC/SEMXXRL4Y1ZG_index_2.html.
- [15] K. R. Healy, A. L. Peratt, "Radiation Properties of Pulsar Magnetospheres: Observation, Theory, And Experiment", *Astrophysics and Space Science* **227**: 229-253 (1995).
- [16] W. Thornhill, "Voyager 1 at the Edge - of what?" (Nov 2005), <http://www.holoscience.com/wp/voyager-1-at-the-edge-of-what/>.
- [17] NASA IBEX News, "IBEX Reveals a Missing Boundary at the Edge of the Solar System" (10 May 2012), http://www.nasa.gov/mision_pages/ibex/news/nobowshock.html.
- [18] NASA News, "NASA's Voyager Hits New Region at Solar System Edge" (5 Dec 2011). <http://www.jpl.nasa.gov/news/news.cfm?release=2011-372>.
- [19] Editor, "What's Happening in the Heliosphere", *Science* **326** (5955): 915 (13 Nov 2009).
- [20] D. J. McComas et al, "Global Observations of the Interstellar Interaction from the Interstellar Boundary Explorer (IBEX)" (Oct 2009), www.sciencexpress.org/15.10.1126/science.1180906.
- [21] N. Schwadron, NASA IBEX News "IBEX Reveals a Missing Boundary at the Edge of the Solar System" (5 May 2012), http://www.nasa.gov/mission_pages/ibex/news/nobowshock.html.
- [22] B. Balick, "Fliers in Planetary Nebulae: What Are They?", *Stellar and Circumstellar Astrophysics, ASP Conference Series* **57** (1994) <http://adsabs.harvard.edu/full/1994ASPC...57..172B>.
- [23] D. E. Scott, "An Electric Universe View of Stellar and Galactic Formation", *Proceedings of the NPA* **9**: this volume (2012).
- [24] A. L. Peratt & A. J. Dessler, "Filamentation of Volcanic Plumes on Io", *Astrophysics and Space Science* **144**: 451-456 (1988). <http://chandra.harvard.edu/photo/2002/0052/animations.html>
- [25] <http://chandra.harvard.edu/photo/2002/0052/animations.html>
- [26] L. Wang et al, "The Axisymmetric Ejecta of Supernova 1987a", *The Astrophysical Journal* **579**: 671-677 (10 Nov 2002).
- [27] A. Ananthaswamy, "Strange Cosmic Ray Hotspots Stalk Southern Skies", *New Scientist* (3 May 2011), <http://www.newscientist.com/article/dn20436-strange-cosmic-ray-hotspots-stalk-southern-skies.html>.