New findings show magnetic organization of the Sun

Recent discoveries in astrophysics prove that Kepler was right and Newton was wrong, about the way the universe is organized. Charles B. Stevens reports.

The recently reported findings from the orbiting Solar and Heliospheric Observatory (SOHO) of the high degree of magnetic organization of the Sun's interior, confirm the initial 1995 findings of the Lanzerotti group at Bell Labs, that the solar magnetic field is coherently organized from the densest regions of its core out to the most diffuse portions of the solar wind. These observations blow away most of the contemporary theory and models of star structure and star formation. But the results also have even deeper implications, beyond that of sorting which particular physical theory is best fitted to what we know about the universe; they demonstrate that we must abandon the Aristotelian, reductionist method of Isaac Newton, which currently pollutes our scientific and educational institutions and has proven to be so sterile and misleading, and instead resurrect the Platonic method of *hypothesis,* as practiced by Johannes Kepler, and most recently elaborated on by Lyndon LaRouche. Ironically, while this article was being written, the Hubble Space Telescope was reported to have identified the largest star yet seen in the universe, the Pistol star, whose very existence is contrary to astrophysical models based on Newton's idea of universal gravitation.

It is not required for our purposes here, to once more prove that Newton was a fraud and hoaxster, whose work was shaped and in part concocted by Venetian political-cultural operative Abbot Antonio Conti and his associates, in the footsteps of Paolo Sarpi, in order to derail the progress of science and technology deriving from the Golden Renaissance and the work of Nicolaus of Cusa[1]. It is, however, germane to the specific issues raised here, to review some illustrative highlights, especially since Newton is far more frank and honest than his progeny in 21st-century astrophysics.

Reason versus witchcraft

The usual story fed to naive students from grade school to graduate school is as follows:

Kepler may have been the first to practice elements of the modern scientific method, but Sir Isaac Newton was the first real scientist. Along this line, it is falsely stated that Kepler simply took the observational data of Tycho Brahe and saw that the planetary orbits fit more closely to an ellipse than did the circular orbits of Copernicus. It is then reported that Newton, without preconceptions or intervening *hypotheses,* went much further than Kepler, by giving the *reason* for these elliptical orbits, as deriving from his inverse square law of universal gravitation. It is further reported that Kepler is somewhat kookish in his work, as seen, for example, in his nested polyhedral model for the placement of the orbits of the six planets that were known at that time.

The truth is quite otherwise. As John Maynard Keynes was forced to confess in his Newton Tercentenary Celebration address, due to the circulation of Newton's actual early scientific papers at that time:

> In the eighteenth century and since, Newton came to be thought of as the first and greatest of the modern age of scientists, a rationalist, one who taught us to think on the lines of cold and untinctured reason.
>
> I do not see him in this light. I do not think that anyone who has pored over the contents of that box which he packed up when he finally left Cambridge in

1. See, for example, Webster G. Tarpley, "How the Dead Souls of Venice Corrupted Science," *EIR,* Sept. 23, 1994.

1696 and which, though partly dispersed, have come down to us, can see him like that. Newton was not the first of the age of reason. He was the last of the magicians, the last of the Babylonians and Sumerians. . . .[2]

Or, to put the matter more succinctly, Newton was a witch, who primarily practiced alchemy during his creative "scientific" period before 1696. Around this time, he suffered a nervous breakdown, apparently due to the death of his mother.

Newton's general formulation of gravity is simply a mathematical formula generated by an inversion of Kepler's Third Law. On the other hand, Kepler had begun his investigations through discovering a *hypothesis* which corresponded to particular orderings for possible physical geometries for both the formation of the solar system and its current organization. For example, Kepler constructs a physical geometry in which there exists a unique harmonic ordering for the entire array of planetary orbits. That is, Kepler does not begin by assuming that the planets are self-evident singularities which need only be examined in terms of "pair-wise" interaction. Newton, on the other hand, honestly admits that his work is quite oblivious to questions of the creation of the solar system. According to Newton, this process of generation was "God's concern alone, not man's." Thus did Newton, a good Aristotelian, insist on the primacy of sense perception, as opposed to reason and the Platonic method.

In his *Principia Mathematica*[3], Newton states his famous dictum, *"hypotheses non fingo"* (I make no hypotheses) in the concluding General Scholium. Newton explains his reasons for choosing *induction,* in preference to hypothesis, as follows:

> In the preceding books I have laid down the principles of philosophy; principles not philosophical, but mathematical. . . . It remains that, from the same principles, I now demonstrate the frame of the system of the World. . . . For since the qualities of bodies are only known to us by experiments, we are to hold for universal all such as are not liable to diminution, can never be quite taken away. We are certainly not to relinquish the evidence for the sake of dreams and vain fictions of our own devising; nor are we to recede from the analogy of Nature, which uses to be simple, and always consonant to itself. We have no other way to know the extension of bodies than by our senses, nor do these reach it in all bodies; but because we perceive extension in all that are sensible, therefore we ascribe it universally to all others also. That abundance of bodies are hard, we learn by experience; and because the hardness of the whole arises from the hardness of the parts, we therefore justly infer the hardness of the undivided particles not only of the bodies we feel but of all others. That all bodies are impenetrable, we gather not from reason, but from sensation.

As Leibniz and Huygens noted at the time that Newton's *Principia* was published, Newton's concept of universal gravity was deficient in the following respects:

1. It could not account for the stability of the solar system;

2. It said nothing about the placement of the planetary orbits, or, in other words, the "quantization" of the solar system and its planetary orbits;

3. It said nothing about why the planets all orbit the Sun in the same direction.

In fact, recent work on the "many-body" problem, which uniquely derives from Newton's formulation, and not Kepler's, indicates that Newton's inverse square law leads to a relatively rapid instability and a blowing apart of the solar system.[4]

Plasma electrodynamics refutes Newton

Kepler was quite familiar with gravity and its effects. This is demonstrated in his work on correctly determining tides due to the motions of the Sun and Moon, as compared to the incorrect approach of Galileo. But Kepler insisted that gravity was not primary with respect to his physical geometry for the ordering of the solar system. Instead, Kepler pointed to the experimental work of William Gilbert on magnets, and suggested that the solar magnetic field is more significant with respect to the ordering and physical geometry of the planetary orbits.

It must be remembered that electrodynamics would not emerge as a major scientific focus for more than two centuries. From the time of Kepler up until the early 19th century, electricity and magnetism were considered to be relatively marginal phenomena, in terms of the organization of the physical universe. But it is very likely that Kepler's magnetic hypothesis led, either directly or indirectly, to inspiring the groundbreaking work of Benjamin Franklin, who revived experimental science in the mid-18th century, with his work on electricity. Kepler's work did centrally influence the actual founders of modern electrodynamics and electromagnetic technology, beginning with André-Marie Ampère and continuing through to Carl Friedrich Gauss and his collaborators, Wilhelm Eduard Weber and Bernhard Riemann.

It is by no means coincidental that Ampère's electrodynamic experiments provide the first laboratory refutation of Newton's inverse square law, which Gauss takes note of in his seminal work on potential theory. And in the second half

2. John Maynard Keynes, "Newton the Man," in *Newton Tercentenary Celebration* (Cambridge: Cambridge University Press 1974).

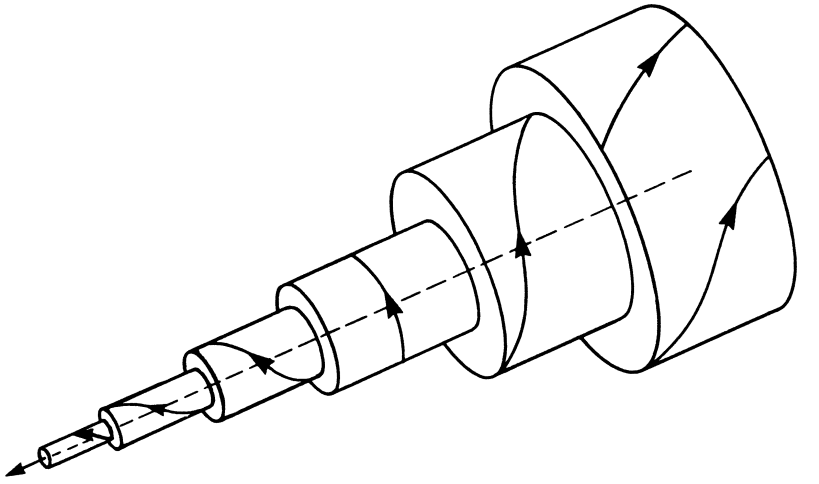
3. Isaac Newton, *Principia Mathematica* (*The Mathematical Principles of Natural Philosophy*) (New York: The New York Philosophical Society, 1964).

4. Based on a private communication from Prof. Simon Kochen, former chairman of the Department of Mathematics, Princeton University.

FIGURE 1

Beltrami force-free flow patterns

The directed flow pattern of Beltrami, Magnus-force-free flow, where the direction of the arrows represents not only the velocity flow of the fluid, but also the fluid vorticity direction. In a Lorentz force-free configuration, the arrows shown in the figure also represent the direction of the magnetic field and electric current. In Beltrami flow, the velocity and vorticity are everywhere locally parallel to each other. In the plasma version of Beltrami flow, the magnetic field and electric current are everywhere locally parallel, or alternatively, anti-parallel in the case where the magnetic field reverses direction, as in the reversed field magnetic Z pinch.



Source: *International Journal of Fusion Energy,* January 1985, p. 38.

of the 19th century, Weber launched an effort to account for the anomalous advance of the perihelion of Mercury, by applying the Ampère correction to Newton's inverse square law. As is well known, this advance of Mercury's perihelion has become the experimental cornerstone of Einstein's Theory of General Relativity, for which the formal mathematics is situated in Riemannian geometry.

As Riemann emphasizes in his philosophical writings, Newton *does* make hypotheses, such as the assumption that inertial mass is equivalent to gravitational mass. This linearization assumption concerning the gravitational field and the dynamics of the solar system is a major error carried over to Einstein's General Relativity. As we shall see, the specifics of the recent observations of the organization of the solar magnetic field tend to expose this error of assumption.

In responding to Riemann's plea to refute Maxwell's electromagnetism, the great Italian scientist and educator Eugenio Beltrami proceeded to develop a more advanced hydrodynamic science, which is generally referred to under the name of "force-free" flow, or Beltrami force-free vortices (see **Figure 1**). In the 20th century, Beltrami's students and Beltrami's nonlinear hydrodynamics became the cornerstone for advances in aerodynamics and advanced aircraft design, and have continued in that role down to the present day.

In developing the science for prospective hypersonic aircraft, the great German aerodynamicist Adolf Busemann applied Beltrami force-free hydrodynamics to the science of ionized gas, or plasma. Busemann had already generated the essential foundation of supersonic technology in the 1930s with his development of the concept of isentropic flow and "force-free" supersonic designs, such as his zero-lift, zero-drag supersonic biplane. This provided the essential conceptual framework for the development of advanced thermonuclear fusion designs for inertial confinement pellet fusion and hydrogen bombs. Busemann had grounded all of his work on Riemann's shockwave concept, presented in Riemann's 1859 "On the Propagation of Plane Air Waves of Finite Amplitude," which includes the essential concept of isentropic compression. This paper was also a crucial influence on the hydrodynamics of Beltrami.

During the 1950s, Busemann's work in the United States came to the attention of plasma scientists working on magnetic fusion confinement, especially Prof. Winston Bostick of the Stevens Institute of Technology in New Jersey and his students. By the late 1960s, one of these students, Daniel Wells, now a professor at the University of Miami (Coral Gables), had applied Busemann's work to the development of a more general theory of magnetic plasma confinement, based on Beltrami force-free flows. This minimum energy theory proved to be quite efficient, and gave a reasonable description of the stability, distribution of physical parameters, and dynamics of magnetic plasmas, ranging from very diffuse astrophysical plasmas like those seen in the solar wind, to the densest variety of plasma pinches.

In 1985, Professor Wells presented an overview of his theory at a seminar of the Fusion Energy Foundation in Leesburg, Virginia, chaired by Lyndon H. LaRouche, Jr. LaRouche suggested that Wells apply his theory of plasma Beltrami vortices to the formation of the solar system. After several months of research, Wells returned to present his stunning results to the Fusion Energy Foundation.[5]

In the first approximation, Wells's theory views the formation of the solar system as a concentric series of rings of infinitely long cylindrical plasma Beltrami force-free vortices. Each outer ring contains all of the interior cylindrical

5. Daniel R. Wells, "How the Solar System Was Formed," *21st Century Science & Technology,* July-August 1988.

rings, like a series tree rings. Each ring is a separate Beltrami force-free plasma vortex.

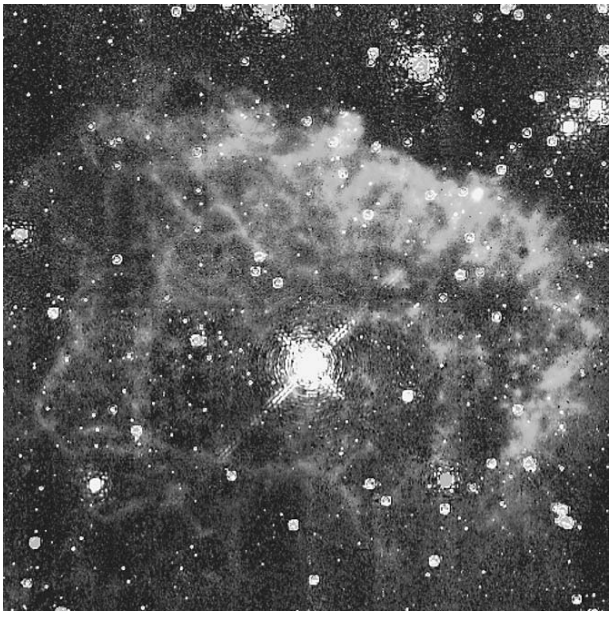
Within the first vortex, which alone has no ring within it, the fluid flow, or in this case, plasma flow, begins parallel to the axis of the cylinder. At a greater cylindrical radius, the flow begins to spiral. The pitch angle of this spiral increases with the radius of the cylindrical layer that one is observing until it reaches 90 □. At that point, the flow is a simple circle, always at right angles to the axis of the cylinder.

For ordinary fluid Beltrami flows, a second vortex forms outside of this last flow layer of the first vortex. And in this case, the pitch angle of the flow decreases for each cylindrical layer at a greater radius, with an overall direction opposite to that of the first vortex. That is, the second vortex's flow is opposite to the first, for ordinary fluids. This can continue until a flow layer forms which has a zero pitch angle and a flow which is parallel once again to the axis of the cylinder. A third vortex can form and follow the pattern of the first vortex in flow configuration, and so on.

In the case of a magnetic plasma, the magnetic and electric fields are directed along the same directions as the fluid flow. Furthermore, the fluid flow does not change its overall direction as one proceeds from an interior to an exterior ring. Instead, only the direction of the magnetic field changes. This is the reason why the planets orbit the Sun in the same direction. The relative placement of these plasma vortex rings from the central cylindrical axis gives the same values as the relative orbits of the planets. The relative average fluid flow in each vortex around the cylindrical axis gives approximately the same relative value as that found for each of the average velocities of the planets orbiting around the Sun. Furthermore, the change of the direction of the magnetic field, relative to the fluid flow, for each successive vortex ring, gives a physical basis for the variation in the magnetic field strengths observed by satellites for each of the planets.

The overall stability of the solar system follows from the plasma theory, since each of the plasma vortices is in its most stable state, according to the Wells minimum energy theory.

Pistol Star: the biggest and the brightest



NASA announced on Oct. 8, 1997 that the Hubble Space Telescope had found that one of the intrinsically brightest stars in our galaxy appears as the bright white dot in the center of the image shown here. Hubble's Near Infrared Camera and Multi-Object Spectrometer (NICMOS) was needed to take the picture, because the star is hidden at the galactic center, behind obscuring dust. NICMOS's infrared vision penetrated the dust to reveal the star, which is glowing with the radiance of 10 million suns.

The image also shows one of the most massive stellar eruptions ever seen in space. The radiant star has enough raw power to blow off two expanding shells of gas equal to the mass of several of our suns. The largest shell is so big—four light years across—that it would stretch nearly all the way from our Sun to the next nearest star, Alpha Centauri. The outbursts seen by Hubble are estimated to be only 4,000 and 6,000 years old, respectively.

Despite such a regular and large rate of mass loss, astronomers estimate that the extraordinary star may presently be 100 times more massive than our Sun, and may have started with as much as 200 solar masses of material, but it is violently shedding much of its mass.

In an Oct. 8 *New York Times* article, Drs. Don Figer and Mark Morris of the University of California at Los Angeles, the scientists who directed this Hubble discovery, report that the Pistol Star is so massive that it brings into question current thinking about how stars are formed. The standard model says that stars take shape within huge dust clouds when interstellar gases contract under their own gravity, eventually condensing into hot clumps that ignite the hydrogen fusion reaction. This standard theory precludes the existence of stars with a mass as large as that of Pistol, since the fusion reaction rates would produce a pressure far greater than that of the self-gravitational condensation, causing the star to explode.

Assuming that each plasma vortex ring eventually breaks and forms a planetary ball (there is some experimental evidence for this behavior of plasma rings), the relative quantized parameters and configuration of the solar system are accounted for, without taking gravitational effects into account. And thus, the Wells theory confirms the efficacy and efficiency of the original Kepler hypotheses concerning the ordering of the physical geometry of the solar system.

The Bell Labs results

While searching for the cause of a series of communications satellite failures in 1994, a team from AT&T Bell Laboratories inadvertently discovered a wide range of coherent waves in the motion of plasma electrons and ions in the solar wind, by examining data from the Ulysses satellite. The discovery was reported in a paper by David Thomson, Carol Maclennan, and Louis Lanzerotti in the July 13, 1995 issue of *Nature*.

This finding was totally contrary to all prevailing models of the solar wind. According to the standard view, as the magazine of the American Physical Society and American Institute of Physics, *Physics Today,* pointed out in a September 1995 report on this Bell Labs paper, "The solar wind is turbulent and possesses no long-lived structures, other than those associated with solar rotation and structure."

The Bell scientists did not set out to create a revolution in astrophysics; they discovered these coherent modes in the solar wind almost by accident. They were originally looking for the cause of intermittent fluxes of high-energy particle beams that were responsible for the satellite failures. They sought to correlate the bombardment of the Earth and its satellites by these intermittent particle beams, with the appearance

SOHO's recent discoveries

This report is based on a NASA press release.

The SOHO (Solar and Heliospheric Observatory) Satellite was launched Dec. 2, 1995 as a joint program of NASA and the European Space Agency. It gives scientists the ability to study the Sun continuously, 24 hours a day, 365 days a year, with telescopes and a dozen other diagnostic instruments.

Combined with the Global Oscillation Network Group (GONG), a worldwide, ground-based system of solar telescopes to record the Sun's oscillations, also established in 1995, SOHO is revolutionizing our understanding of the physics of the Sun, and thereby, of the universe.

These closer, continuous observations of the Sun's oscillations have already revolutionized our understanding of the solar wind and provided new evidence against currently held assumptions about how the Sun is organized and how it works. For example, the standard star model assumes that it is an isolated thermal system and a thermal gas system in equilibrium for the most part. But the measured mass solar wind outflow has shown this to be incorrect. (See box on Eddington's folly.)

Rivers on the Sun

The latest data from SOHO show that there are "jet streams" or "rivers" of plasma flowing deep beneath the surface of the Sun that are coupled to the structure of the solar magnetic field. "We have detected motion similar to the weather patterns in the Earth's atmosphere," says Dr. Jesper Schou of Stanford. "Moreover, in what is a completely new discovery, we have found a jet-like flow near the poles. This flow is totally inside the Sun. It is completely unexpected, and cannot be seen at the surface."

Ringing the Sun at about 75° latitude, these jet-like flows consist of flattened oval regions about 17,000 miles across where material moves about 10% (about 80 mph) faster than its surroundings. Although these are the smallest structures yet observed deep inside the Sun, each is still large enough to engulf two Earths.

Features similar to the Earth's trade winds have also been found on the surface of the Sun. While the Sun rotates much faster at the equator than at the poles, there are also belts in the northern and southern hemispheres in which currents flow at different speeds relative to each other. Six of these gaseous bands move slightly faster than the material surrounding them. The solar belts are more than 40,000 miles across, and they contain "winds" that move about 10 mph relative to their surroundings.

The first indication of these belts was found more than a decade ago by Dr. Robert Howard of the Mount Wilson Observatory. The Stanford researchers have now shown that, rather than being superficial surface motion, the belts extend down to a depth of at least 12,000 miles below the Sun's surface.

"In one way, the Sun's zonal belts behave more like the colorful banding found on Jupiter than the region of trade winds on the Earth," says Stanford's Dr. Craig DeForest. "Somewhat like stripes on a barber pole, they start in the mid-latitudes and gradually move toward the equator during the 11-year solar cycle. They also appear to have a relationship to sunspot formation, as sunspots tend to form at the edges of these zones."

The SOHO scientists have already speculated that the

of a hole in the solar corona, and thereby to show that the particle beams were being generated in association with the coronal hole. This connection could be established if the particle beam eruption correlated with the 27-day rotation period of the Sun, since the coronal hole makes its appearance opposite the Earth at that same frequency. Using hourly averages of ion flux measurements from the HISCALE detector on the Ulysses satellite for the 27-day period in question, the Bell Labs group found the expected correlation. But they also found a large number of other coherent oscillations in the ion flux, with periods ranging from hours to several days.

The Bell group was the first to take data from solar wind oscillations over extended periods of time. It was also the first to apply the most recently developed, advanced computer correlation test and associated spectral analyses to astrophysical data, that is, analytical methods which had been originally developed by the telephone companies for communications applications.

When they checked to see if these waves correlated with previous measurements of oscillations in the motion of the solar surface—what are called acoustic or p-waves—they found matches in 90 of 118 frequencies examined. They then checked data from the Voyager II satellite, taken seven years earlier, to make sure that these signals were not an artifact of the particular instruments or satellite trajectory. They also checked the data from IMP-8 and ISEE-3 science satellites.

Besides finding a correlation with these surface acoustic waves, they also saw waves in the solar wind which would correlate with longer-period solar oscillations that have been hypothesized to exist, but have not so far been measured with much certainty. These longer-period oscillations would come from seismic motions of the deep interior regions of the Sun.

differences in speed of the plasma at the edge of these bands may be connected with the generation of the solar magnetic cycle, which, in turn, generates periodic increases in solar activity. "But we'll need more observations to see if this is correct," DeForest reports.

SOHO data also show that the entire outer layer of the Sun, to a depth of at least 15,000 miles, is steadily flowing from the equator to the poles. The polar flow rate is relatively slow, about 50 mph, compared to its rotation speed, about 4,000 miles per hour; however, this is fast enough to transport an object from the equator to the pole in a bit more than a year (see **Figure 2**).

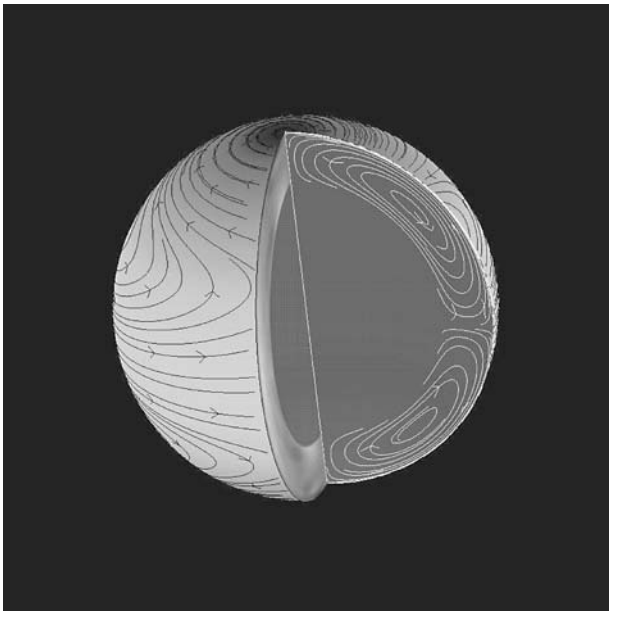
"Oddly enough, the polar flow moves in the opposite direction from that of the sunspots and the zonal belts, which are moving from higher to lower latitudes," according to DeForest.

The polar flow had previously been observed at the Sun's surface, but scientists did not know how deep the motion extended. With a volume equal to about 4% of the total Sun, this feature probably has an important impact on the Sun's activity, argue Stanford researchers Scherrer, Dr. Thomas L. Duvall, Jr., Dr. Richard S. Bogart, and graduate student Peter M. Giles.

Over the last year, SOHO has been aiming its scientific instruments at the Sun from a position 930,000 miles sunward from the Earth. The Stanford research team has been viewing the Sun's surface with one of these instruments, a Michelson Doppler Imager, that can measure the vertical motion of the Sun's surface at one million different points once a minute. The measurements show the effects of sound waves that permeate the interior. The researchers then apply techniques similar to Earth-based seismology and computer-aided tomography to infer and map the flow patterns and temperatures beneath the Sun's roiling surface.

FIGURE 2

Flow of plasma toward the poles of the Sun



Streamlines of plasma on the Sun, as detected by the SOHO satellite. The combination of differential rotation and poleward flow has been previously linked to the measured contorted shapes of the solar magnetic field regions, when those regions migrate to the poles and get stretched to the left. These new observations demonstrate for the first time that the poleward flow is not just a surface phenomenon, but extends deep below the Sun's surface and protrudes through at least 12% of the convection zone of the Sun.

Source: NASA and Solar Oscillations Investigation group at Stanford University.

Observations of these so-called g-wave seismic motions (waves for which gravity is the restoring force) would provide a major new tool for looking into the interior of the Sun and its workings, in the same way that geological seismic motions provide a window on the interior of the Earth.

The implication is—as it is with the acoustic waves—that these oscillations are being faithfully transmitted through the Sun and the heliosphere, through a change in material density of 26 orders of magnitude. (That is, the Sun's interior is 10^{26} times more dense than the diffuse solar wind that passes by the Earth.)

What could be faithfully transmitting such a signal over such a huge range of conditions? The Bell group conceived that it must be the solar magnetic field. That was when they examined previous measurements of oscillations in the solar magnetic field over the past several decades, and found strong correlations with their data.

Now, the usual argument employed to dismiss the effects of magnetic fields on astronomical processes, compared to that of Newton's beloved gravity, is the observation that the apparent, observable "force of the prevailing magnetic fields is quite weak compared to that of the observed gravitational fields." But if the magnetic field of the solar system is coherently organized, as the Bell group's observations indicate, and if that magnetic field is also organizing the structure and dynamics of the Sun down into its densest core, then this assertion of the relative weakness of the magnetic compared to the gravitational field cannot be maintained, at the very least for all time scales. As the Pistol Star's very existence indicates, there is something other than simple gravitational condensation driving the formation of stars (see box).

Magnetic fields, angular momentum shedding, and star formation

Before proceeding to examine some of the deeper implications of the Bell Labs measurements and their general confirmation by the recent SOHO findings, it is essential to point out problems existing in the standard model of star formation. The current model says that stars form in interstellar gas clouds due to condensation driven by the self gravity of the cloud mass. But the simple fact is that the self gravity that can be calculated for observed interstellar gas clouds is not sufficient to produce such condensation. All observed clouds have a rotational motion. From this observed rotation, we can calculate the centrifugal force on each of the cloud particles, which tends to disperse the cloud. Against this centrifugal force, the calculated total self gravity found for the size of gas clouds that we observe is far too small to account even for the clouds maintaining themselves, let alone contracting.

One possibility is that the prevailing magnetic fields hold the particles of the cloud together. Furthermore, as the Wells theory indicates, a magnetic field, such as that seen in the plasma pinch process, could provide the means, not only for compressing the clouds to greater densities, but also for transferring rotational motion from one part of the cloud to another. The part which loses its rotational motion could then be acted upon by gravity to undergo gravitational condensation. Another name for this process of transferring rotational motion from one part of the gas cloud to another, is angular momentum shedding.

In the Solar System, we find that most of the angular momentum is in the planets, rather than in the Sun. When we observe the different rates of star formation in a galaxy, we find that the process of angular momentum shedding is its chief marker, and the distribution of the regions of star forma-

LaRouche on curvature

The following is an excerpt from an Aug. 27, 1997 memorandum by Lyndon H. LaRouche, Jr., titled "Why U.S. 'Baby Boomers' Can't Read Poems: How to Read a Page."

Gottfried Leibniz was the first to develop the calculus, but it had been Johannes Kepler who had bequeathed the development of such a calculus to those who might come after him. The root of Kepler's idea is traced to the founder of modern experimental physics, Nicolaus of Cusa, who introduced the central problem of the calculus as a crucial feature of his own *De docta ignorantia* (1440). Luca Pacioli and Leonardo da Vinci developed their contributions to modern science under the influence of their study of Cusa's writings on experimental physical science. Kepler based himself largely on the programs of Cusa and the furtherance of Cusa's program by Pacioli and Leonardo. In this way, the aspect of Cusa's contribution which bears most directly upon Kepler's formulation of the need for a calculus, is indispensable for understanding the fraudulent intent of Cauchy's "limit theorem"; the same issue permeates the underlying developments of modern mathematics and its applications, from Cusa through Gauss, Riemann, and beyond. So, we have chosen an illustrative topic which is elementary, but also of extraordinary importance in modern science.

Archimedes' famous theorem on the quadrature of the circle, estimated π as an incommensurable magnitude, in the sense of "incommensurable" as attributed by Plato and his Academy to the school of Pythagoras. Cusa, reworking this theorem, detected a fallacy in Archimedes' treatment of π as incommensurable. Cusa showed, by an elegant, elementary geometric insight, that π does not meet the requirements of the kinds of incommensurables defined as

tion follows Kepler's laws for the orbits of the planets!

According to the Wells theory, it is the differentiation of the physical geometry of the plasma pinch magnetic field that is the means for accomplishing this transfer of angular momentum. What is it, then, that is producing this change in the magnetic field geometry? Harold Grad of the Courant Institute of Mathematics at New York University showed in the mid-1970s, that most theories for differentiation of magnetic fields were wrong. In particular, the generalization of the Helmholtz theorem for the conservation of vorticity to magnetic plasmas was wrong. According to Helmholtz, it is some local resistance, or viscosity, which generates the "breaking" of fluid flow lines to generate the singularity of a closed flow system, such as a vortex. In the case of plasmas, this is taken to be a local electric resistivity. But Grad showed that magnetic field line "reconnection"—for example, going from a simple circle to a figure 8—can take place even when resistivity goes to zero. According to Grad's investigations, it was the general boundary conditions which generate the differentiation in the magnetic field geometry. In fact, the magnetic field differentiation process, driven by these global boundary conditions, would tend to generate whatever local electrical resistivity that would be observed.

This, of course, leads to the questions: What is a magnetic

such by the Classical Greek construction; □ is of a different order, later identified by Leibniz et al. as a "non-algebraic," or "transcendental" cardinality. I reconstructed this argument in my 1992 "On the Subject of Metaphor."

This notion of higher, transcendental cardinalities became a central feature of Kepler's address to the subject of non-circular solar orbits. The contrast between Gauss's and other contemporary treatment of the asteroid orbits, was to emphasize, dramatically, how important Kepler's insight into the problem of developing a calculus had been. The problem had a highly practical form. Kepler, like the astronomers of Gauss's time, had limited access to observations of the actual and apparent motions of solar and other celestial bodies. How might one distinguish the actual orbit of such bodies from measurements of relatively small, even very small intervals of a circular, elliptical, or other curved orbits? How might we adduce, variously, constant or non-constant curvatures from a relatively few such small intervals of observation?

The comparison of the work of Gauss and his ostensible rivals on the subject of the asteroid orbits, points to the practical issue. Shall we rely upon a statistical average of numerous separate observations, or must we consider the fact that the curvature of the entire orbit is reflected in some way in the very small arc observed? Rather than attempting to construct an orbit through a curve-fitting to many observed points, we must find agreement in curvature within several very small arcs—otherwise, we might be describing a trajectory of some kind, but not an orbital trajectory. For Kepler, as for Gauss two centuries later, the curvature of a planetary orbit is the result of a specific rate of change of curvature, expressed within each smallest interval to be observed. It is the determination of that rate of change of curvature which is, using Leibniz's terminology, the universal characteristic of that specific planetary orbit.

Consider, as Jonathan Tennenbaum recently posed this in a pedagogical lecture delivered at the recent Oberwesel conference. The fact that the Sun appears to orbit the Earth in a circular mode, while the Earth follows an elliptical orbit about the Sun: presenting us with the product of a cycloid and an ellipsis. Look at these orbits from the standpoint of a fixed position on the Moon: more complications impacting observations in the smallest observable, or calculable interval of action of the process. Must we not rely upon the notion that a very small rate of change from an apparent constant, or non-constant curvature of a specific type, is occurring within the very small intervals of the arc? This was Cusa's approach to Archimedes' quadrature theorem, exactly.

Leibniz's work on "non-algebraic," or "transcendental" curvatures, complements such considerations. One could not assume, except for relatively crude sorts of calculations, that processes are necessarily reducible to straight-line motions in the extremely small. In other words, sometimes, as in dealing with a well-established sort of engineering problem, linear analysis is tolerable for making useful calculations. The same assumption, carried over from such engineering practice, into physics as such, is incompetence.

This issue was the included feature of the work of Leibniz et al., which was attacked with special violence by the Seventeenth and Eighteenth Centuries Cartesians and empiricists. These attacks involved, then, issues of transcendental curves in nature and in connection with implications of the retarded propagation and refraction of light. From the violent defense of linearization in the very small, as by Leonhard Euler et al. at Frederick the Great's Berlin Academy, on to the present day, the hoax of linearization in the very small (e.g., the "infinitesimal") persists as a leading practical issue within Nineteenth and Twentieth centuries physical science and mathematical formalism. The fallacy of Cauchy's "limit theorem" must be seen, and understood in light of the historical situation in which the issues of non-constant curvature in the very small have arisen, and persist.

field? What generates it? And, as we shall now explore, this also leads to unearthing the deeper implications of the Bell Labs observations.

Ampère's magnetic field

One problem we immediately confront, is that almost all current textbooks present nothing but lies about Ampère's law—the standard definition of a magnetic field. What is presented as Ampère's law, is actually Grassmann's law, which has no physical basis. Grassmann modified Ampère's experimentally derived law, because, as he reported, Ampère's law does not fit Grassmann's mathematics. And the "mathematical" complications that Grassmann found in Ampère's original law for how electrical currents generate a magnetic field do indeed lead to a correction in the inverse square law of Newton—another reason which Grassmann cites for altering Ampère's Law. Gauss and Weber, on the other hand, expanded upon this aspect of Ampère's law, as Laurence Hecht has shown.[6] Hecht explained that this work of Gauss and Weber led them to discover the sub-atomic and sub-nuclear domains, 50 years before their empirical confirmation. Weber was already exploring the possibilities of nuclear fusion of hydrogen in publications presented in 1870!

The point is not that Gauss and Weber were ahead of

6. Laurence Hecht, "The Atomic Science Textbooks Don't Teach: The Significance of the 1845 Gauss-Weber Correspondence." *21st Century Science & Technology*, Fall 1996.

Eddington's folly

Down to the present day, Sir Arthur Eddington's theory of stellar thermodynamics has been the dominant influence on the theory of the solar interior and stellar interiors in general. According to this theory, the kinds of structures now being discovered would have no reason to exist. The late solar astronomer Richard N. Thomas went beyond the Eddington approach, however. The following is a pungent excerpt from his draft preface to a planned book on stellar structure and stellar mass loss. The book was to be a collaboration with an astronomer trained in the school of Victor Ambartsumian at Byurakan Observatory in Armenia. It was not well advanced at the time of Thomas's death in 1996, however. Thomas was the senior organizer of the NASA-CNRS series of volumes, Nonthermal Phenomena in Stellar Atmospheres *and the author with Grant Athay of the 1961 classic,* Physics of the Solar Chromosphere.

While the preface excerpted below is vectored primarily toward the question of what causes stars to shed matter to the interstellar medium, this excerpt gives a good indication of the "fog-bound" character of most thinking about stellar and solar structure, right into the era of helioseismology.—David Cherry

Beginning with Eddington (1920s), models of stellar-interiors producing energy/mass fluxes have been almost exclusively the province of "speculative" theoreticians: those who proceed by hypotheses largely unrelated to detailed stellar observations. Their stellar data are essentially mass, wavelength-integrated visual flux, and "color"—translated into (incomplete) stellar characteristics by inapplicable thermodynamics. The approach reflects Eddington's speculative-belief that an astronomer living on a fog-bound planet, knowing all the "laws" of terrestrial laboratory and theoretical physics, could eventually predict the existence and details of all observable stellar phenomena free from observational guidance. This outlook was encouraged by his seeming success in constructing a thermodynamically universal stellar-structural model/pattern, the same for all varieties of Eddington-defined "normal stars" across the Hertzsprung-Russell plane. Such universal structural model required the same thermodynamic-universality for the origin of the radiative-energy flux that "stars" *must* (and were so observed to) produce. . . .

If there are any real-world stars satisfying: 1) Eddington's hypothetical-definition of a "normal" star as thermally-quiet and producing *only* a radiative-energy flux from the star; and 2) modeled by Eddington-type closed-system, quasi-Equilibrium thermodynamics [as written]. But predating Eddington's modeling, there were extensive observations of bright stars (including the Sun, because of its proximity) not satisfying the characteristics of Eddington-normal ones: they exhibited mass-loss by outflow, so were not "thermally-quiet," but were aerodynamically-"open" systems. Moreover, they exhibited a variety of non-Equilibrium spectroscopic features. . . . If one . . . could not avoid the observationally-established existence of "peculiar"-stars (including the Sun), at least some of which are thermodynamically-open systems because of observed mass-outflow/flux . . . then Eddington could not avoid observing the contradiction of his basic principle—the thermodynamic-universality of stellar structure—even while he constructed his "standard-modeling," and his successors elaborated it. . . . That one could not find an alternative "theoretical"/Universal model to represent "peculiar" stars is not so serious; it is serious, for Eddington's outlook, that two such [alternative models] could exist without the fog-bound astronomer being aware of it. . . .

their own time: The conception that Gauss and Weber—and Riemann, their prized student assistant—had of the microphysical domain, is still far superior, and far more potentially fruitful, than the poor degeneration which masquerades as the "modern" standpoint. Nevertheless, there is a distorted, and deficient reflection of this Gauss-Weber-Riemann standpoint which did prominently emerge in the 20th century around the question of the "rest mass of the photon."

Heisenberg, de Broglie, and Schrödinger all focussed their later work on this issue. And they all suggested that it was the cornerstone for a "unified field theory." Ironically, Gauss's *conception* of the question is not only superior: Gauss pioneered the development of precisely the best means of measuring the photon rest mass.

If the inverse square law is deficient for electrodynamics, then one could set up an electrostatic experiment to demonstrate the deficiency. The first experimental determination of the inverse square law, however, was actually carried out by Nicolaus of Cusa, with magnets. Benjamin Franklin carried out the first experiment, which demonstrated the inverse square law as a good approximation for electrostatics. To find the error in the inverse square law, it can be estimated from the electrodynamics of Ampère-Gauss-Weber that the experiment would have to be on an astronomical scale—utilizing electrostatic spheres about the size of Jupiter. Not having access to such scales, Gauss proceeded to test the law for a large-scale magnetic field, that is, the Earth's magnetic dipole field.

Gauss set up the first international collaboration in science, called the Magnetic Union. Despite the fact that the British royal family shut down his experimental facilities in 1836, the Magnetic Union went forward with the help of the United States, through the efforts of former President John Quincy Adams. In this case, one measures anomalies in the magnetic dipole field of the Earth. If those magnetic anomalies can not be accounted for by any local effects, such as geological magnetic fields, for example, then the anomaly corresponds to the deficiency in the inverse square law. The "modern" interpretation is to assume that this deficiency gives the measure of the rest mass of the photon. But for Gauss, the question is posed from a far more advanced, and truthful standpoint. The magnetic anomaly gives instead a measure of the curvature of space-time. But, as Lyndon LaRouche develops most profoundly, the Gaussian conception of curvature cannot be represented from the standpoint of any formal or mathematical representation. And in fact, as Riemann develops this question, it is the physics which determines the mathematics, not the other way around. The genius of Gauss is that he not only conceptually and experimentally unlocked the microphysical realm, but also initiated the precise path to most efficiently unlock its physical geometry. And in this case, most interestingly, with an astrophysical-scale experiment.

In other words, for Gauss, Ampère, Weber, and Riemann, the astronomical-scale magnetic fields are not locally produced, especially in terms of their essential differentiation and geometry, but rather are more directly reflective of the curvature of space-time, which otherwise provides a sort of Rosetta Stone for better understanding the organization and ordering of the physical universe. Or, to put the matter more succinctly, getting a better reading on God's clock, as opposed to man's clock. (See box, "LaRouche on Curvature.")

An anomaly in the Bell Labs observations

One anomaly that the Lanzerotti group at Bell Labs saw, in correlating the electron and ion beam signals they found in the solar wind with the p-mode oscillations previously observed in the Sun, was that the electron beam signal data had all of their frequencies upshifted by a factor of 1.00078. As B.A. Soldano, retired professor of Furman University, first pointed out in this regard, this upshift corresponds to precisely what Gauss was looking for in the experimental determination of the deficiency of the inverse square law, in his observations to determine the anomaly in the Earth's magnetic field. This anomaly in the Bell Labs measurements therefore indicates that Gauss's projections were correct, and are analogous to Kepler's prediction of the existence of the asteroid belt, whose existence Gauss experimentally confirmed 200 years later.

Soldano presents his detailed findings in his book, *Non-Equivalence, A Key To Unity*.[7] We excerpt from his introduction:

> The central premise of this work is the thesis that violations of both the strong and weak equivalence principle provide a unifying link between classical, continuum physics, whose crown jewel is general relativity (G.R.), with the latter exemplified by the utility of the Schwarzschild singularity, and the atomic discreteness represented by the quantum h. This unifying concept is examined over a wide array of experiments involving comparing the most stringent experimental validity limits (of both special and general relativity as well as those involving charge conservation and a related Pauli principle limit. . .) with those set by non-equivalence.
>
> Operationally, one finds that the effects of non-equivalence can be embedded in the behavior of a purely local, terrestrial, photon rest mass m= 2.385×10^{-17} electron volts, with $m \neq 0$ at astronomical distances relative to our terrestrial rest frame. This local photon rest mass originates in the local decay of the electron, whose terrestrial half-life t is equal to 2.56×10^{30} years; with the stability of the electron becoming infinite $t \to$ infinity at astronomical distances

7. Benedetto Soldano, *Non-Equivalence, a Key to Unity* (Oak Ridge, Tenn.: Grenridge, 1997).

relative to the Earth. The proposed positional dependency of the rest mass of the photon . . . is consistent with a cosmological anisotropy of light; one that can be linked . . . to an invariant rest mass of the graviton . . . through the latter's *indirect* decay into photons when mediated by . . . the strong nucleonic charge and that of the electron . . . via their local decay into photons. . . .

When the rotational anisotropic angle . . . is set equal to the 2□ of the spin one photon . . . a magnitude precisely equal to the . . . mass scale estimate of the Nodland-Ralston's cosmological light anisotropy model [is required]. (See "Cosmologists Attack LaRouche" article in this issue for a description of the Nodland-Ralston work.)

Gravitational anisotropy of light, when applied to the *interior* of the Earth, accounts for the key spectral factor (1.00078) required by Lanzerotti et al. to quantitatively establish a p and g wave helioseismological link between the Earth and Sun; one involving the coherence of the near vacuum of the solar wind.

A general non-locality between the Sun acting as an inertial center of mass and the orbiting Earth acting as a local gravitational center of mass, one consistent with Bell, is found to be an experimental prerequisite of non-equivalence. . . .

Soldano goes on to show that a unification of quantum physics, quantum electrodynamics, the nuclear strong force and the weak force were already implicit in Ampère's law:

> The significance of these analogues lies in the observation that extensions of Ampère's law, particularly those of Gauss and Weber, have reaffirmed the existence of a highly controversial longitudinal force [of Ampère]. . . . The latter suggests that Ampère's law possesses implications beyond the usual space-time considerations. . . . [This represents] the consequence of a "local" charge non-conservation; the latter ultimately attributable to mass non-equivalence. Not only does [this] . . . involve both the strong and electromagnetic coupling constants, but it characterizes the local photon rest mass as well. These quantities define the nature of the longitudinal force.

As the late Dr. Robert Moon, chief scientist of the Fusion Energy Foundation, so often emphasized, scientific research must be a moral discipline; the search for truth must be primary. By ignoring the physics of Ampère, Gauss, Weber, and Riemann, 20th-century science has unnecessarily buried itself in spurious parodox and obfuscation. Hopefully, we can now begin to change that.

Cosmologist attacks LaRouche on 'cosmological birefringence'

by Charles B. Stevens

Last spring, Dr. Borge Nodland, from the University of Rochester, and Dr. John P. Ralston, from the University of Kansas, published in *Physical Review Letters,* the stunning discovery that observations on the degree of polarization of radio waves from distant galaxies indicate that the speed of light varies, and that there exists a preferred axis for light travel through the universe, along which the speed of light is greatest, and this physical geometry is handed, or chiral, acting like a giant corkscrew. (In other words, the vacuum of universal space-time is organized like a crystal, and exhibits a "cosmological birefringence" for the propagation of electromagnetic waves.)

This finding has come under strong attack from the physics establishment, but Nodland and Ralston have refused to recant. The largest website on the Internet devoted to attacks on Nodland and Ralston, is the home page of Dr. Sean M. Carroll of the Institute for Theoretical Physics of the University of California, Santa Barbara, under the title: "Is there evidence for cosmic anisotropy in the polarization of distant radio sources?"

Among the material contained there, is an attack on Lyndon LaRouche. After discussing the technical papers on the Nodland-Ralston effect, Dr. Carroll reports: "Diffusion into the culture continues apace. The preferred direction has made the funny pages, courtesy of Hilary Price's *Rhymes With Orange*. Equally amusingly, it turns out that *Lyndon LaRouche* knew it all along. . . ." Carroll then quotes from an "EIR Talks" radio interview with LaRouche on May 7, 1997.

LaRouche was asked: "Let me ask you a question from physics and astronomy. Various scientists who have worked