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

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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.