I. What is A Galactic Science Driver?

by Benjamin Deniston

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In the spring of 2015 the LaRouche PAC science team defined a perspective for addressing the water crisis in California and other locations based on recently developing insights into the role of our Galactic System in shaping climate, weather, and the behavior of the water cycle on Earth.[1] However, this is just one aspect of understanding our Galactic System, and how it relates to processes in our Solar System and on Earth. In this report we will recognize that galactic water perspective as just one expression of a deeper relation to our Galactic System. In what follows we will examine a broader perspective for understanding the higher-order system which is our Galaxy, in pursuit of a universal physical principle of the Galactic System.

Over the recent months Lyndon LaRouche has increasingly emphasized the need for a science driver program focused on understanding the Galaxy.

Here we will present various paths of investigation into scientific frontiers associated with the Galaxy, but before getting to that, we must emphasize a clarification on the meaning of a science driver program.

This is different than a technology driver, or an engineering driver, or a physical economic driver. That is not to say those are not important—they are needed elements of general human progress. However, none of them are designed to achieve the same thing as a science driver (although there can be inherent overlap).

The former drivers focus on increasing the useful applications of known scientific principles, to improve the ability to utilize known principles, and to expand the scale of national utilization of those potentials. A science driver focuses on pursuing new fundamental principles, principles existing outside the entire domain of operation of these other drivers.

This is the same distinction underlying many people's miSunderstanding of LaRouche's emphasis that "there has been no progress in science, no practiced progress in science since the beginning of the Twentieth Century."

Einstein and Planck changed our fundamental understanding of the Universe. The age of space travel, smart phones, satellites, and silicon has been built upon that new understanding of the Universe. While our ability to pursue certain tracks of engineering and technological development has greatly improved, there have been no new fundamental scientific revolutions—no new Einsteins, no new Leibnizs, no new Keplers. Even worse, the understanding of true science has not merely stagnated, it has collapsed.

As Jason Ross has been developing, the understanding of how it is that the human mind comes to create and develop true science has profoundly degenerated—with a cult belief in mathematics, logic, and formal systems increasingly overtaking any true insight into human creativity.[2] The Twentieth Century has seen a profound degeneration in the very understanding of our

1. "New Perspectives on the Western Water Crisis,", April 3, 2015; "Atmospheric Moisture Control," *EIR*, April 17, 2015.

2. "Man's True Nature," by Jason Ross, *EIR*, May 1, 2015.

own nature as mankind, as expressed most clearly in modern cultural and artistic expressions.[3]

This is not merely unfortunate, it is existential. This is a rejection of the very essential capability which defines mankind as distinct from the animals—predefining a path into a new dark age.

So Why the Galaxy?

Start with Nicholas of Cusa's conception of the ordering of the Universe.[4] Truth (knowledge) is not developed through the accumulation of self-defined and self-contained facts—it is developed by a unique power of the human mind to create increasingly less-imperfect conceptions of the wholes which create the facts (sometimes even seemingly contradictory or inconsistent facts). This is developed by the unique human creative capability to create valid higher-order conceptions of the unsensed causes (rather than simply recording sensed effects). Scientific understanding of causality in the Universe does not come from a Newton-Laplace style accumulation of measurements of an increasing number of individual parts; it comes from the discovery of successive higher-order unifications which determine the lower-order multiplications.

Nicholas of Cusa (1401–1464), founder of modern science and leading organizer of the Renaissance, whom Vernadsky describes elsewhere as "one of the most original and prodigious minds of his time."

Here we will work from a developing thesis, first published in the article, "Science For A New Paradigm: Time for a Solar Noösphere."[5] By that thesis, the present scientific knowledge level of mankind could be broadly classified as a "stellar system level." For example, the revolutionary understanding of the equivalence of matter and energy underlines the energetic activity of our star, the Sun; an adequate understanding of the physics of these processes requires the understanding of the quantization of activity in the very small; the relativistic understanding of gravitation underlies the orbital organization of the Solar System's bodies.

But, what subsumes the Solar System? From what was the Solar System created, and what is the physics associated with that higher-order process?

Consistent with the destructive intervention by David Hilbert and Bertrand Russell (to call for the axiomatization of mathematical and scientific thought), the current narrative taught in schools is that everything from the Galaxy to the entire Universe will be explained in the mechanisms and capabilities associated with this stellar-level science.

Here that assumption will be rejected—both on the basis of its dubious, unnatural origins, and on the basis of the evidence and anomalies provided by the studies of our Galaxy, pointing to the potentialities of new levels of science beyond our current stellar-level conception.

Leaving the treatment of the inherently dubious nature of this rejected assumption to other locations,[6] in this report we will review two categorical tracks of evidence which could converge upon a new galactic-level of science.

Since our Solar System is a subsumed component of the higher-order Galactic System one area of study is the history of the Earth and the Solar System, seeking indications of how they have responded to and been influenced by the higher-order Galactic System. The other track focuses on properties of the large-scale structure of the Galaxy itself.

The remainder of this introductory article will briefly review examples of possible studies in each category. This will be followed by additional articles addressing some of these studies in more depth.

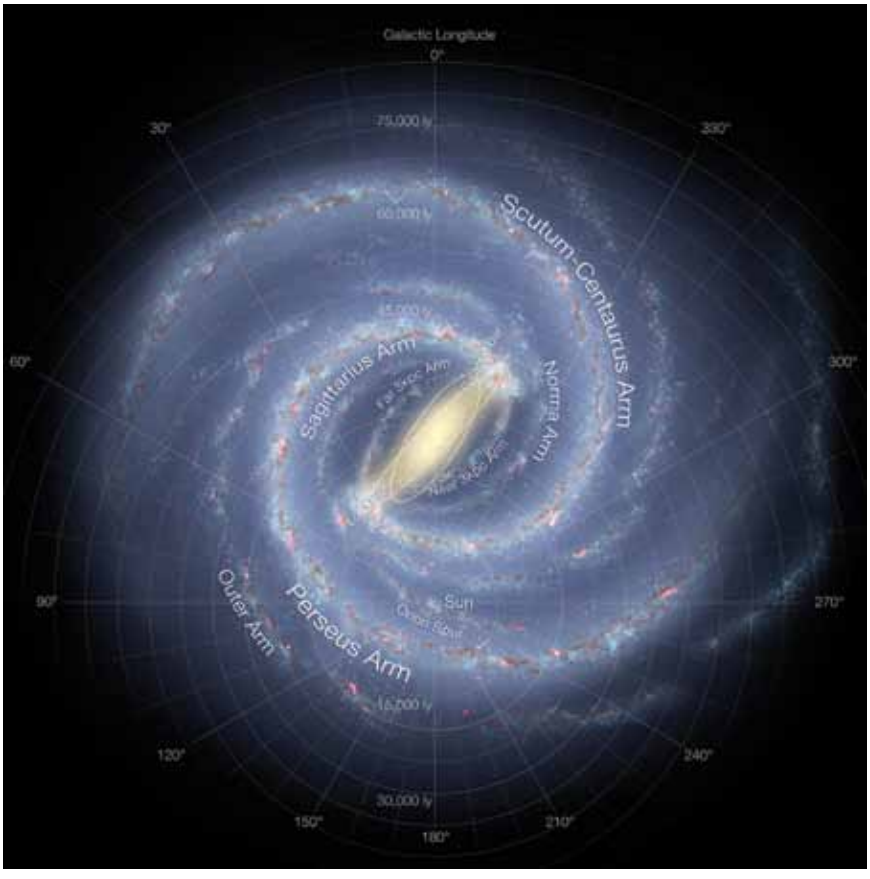
Response of Stellar Systems to Changing Galactic Environments

Improving records of climatic, biospheric, and geophysical activity on Earth (and in some limited cases on other planetary bodies as well) provide long histories of variations and changes of these systems. In a number of

3. See the May 20, 2015 LaRouche PAC A New Paradigm for Mankind show, "Mankind Is Not An Animal."
4. *De Docta Ignorantia*, Nicholas of Cusa, 1440.
5. November 28, 2014 issue of **Executive Intelligence Review**.
6. See, "Man's True Nature," Jason Ross (*EIR*, May 1, 2015) and upcoming work by Ross.

cases the changes of these systems correspond quite well with what is presently known about the travels of our Solar System through our Galaxy, and with the associated changes in the galactic environment. In some cases there are hypotheses for the mechanisms by which a changing galactic environment can affect these planetary systems; in other cases the current scientific paradigm fails to provide adequate hypotheses.

Evidence for such responses can be seen in three types of systems (climate systems, biospheric systems, and geophysical systems), though they are not mutually exclusive, and clearly interact. In certain cases, perhaps some of the most provocative evidence could come from indications of separate planetary bodies responding and reacting simultaneously—indicating that each planetary body would be responding independently to the same external, cosmic influence.



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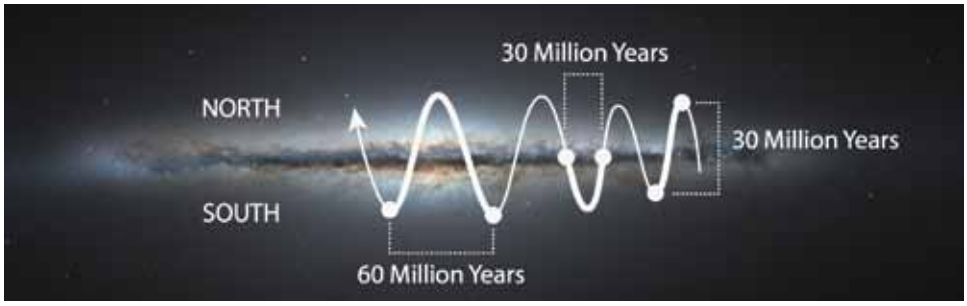
Artist's rendering of our Milky Way Galaxy, with the galactic coordinate system, Solar System location, and spiral arms labeled.



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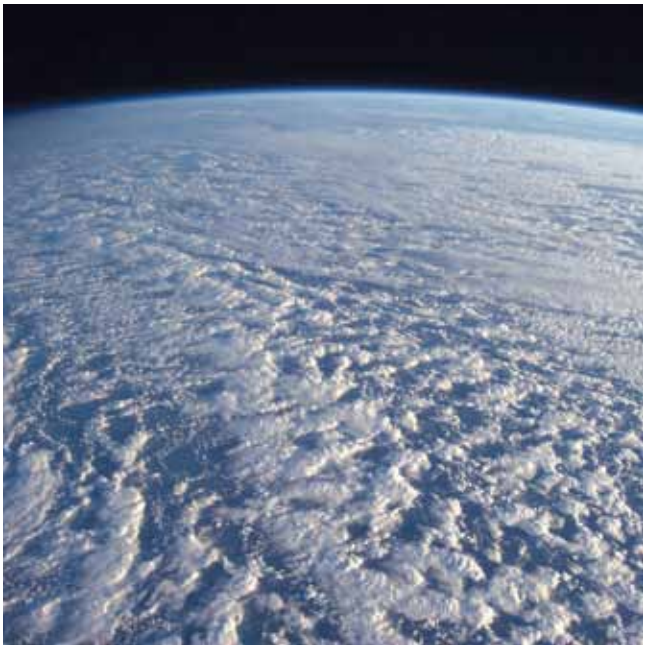
Side view of a spiral galaxy, with an exaggerated illustration of the motion of the Solar System above and below the galactic disk.

Climate and Weather

The collaborative work of scientists Henrik Svensmark, Nir Shaviv, and their associates has provided a growing body of evidence showing that the different galactic environments experienced by the Earth have a profound effect on the Earth's climate system. First, it was shown that periods of major ice ages (spanning tens of millions of years) corresponded with the passages of the Solar System through our Galaxy's spiral arms.[7] More recently it has also been shown that the cyclical motion of our Solar System above and the galactic plane also corresponds with temperature variations (on a cycle of about 30 million years).[8] They have developed a solid theory that this galactically-induced climate change is mediated through variations in the galactic cosmic radiation environment of our Solar System, our Earth, and our Earth's thin atmosphere—controlling the behavior of

7. See "Celestial driver of Phanerozoic climate?" Nir Shaviv and Ján Veizer, GSA Today, July 2003.

8. "Is the Solar System's Galactic Motion Imprinted in the Phanerozoic Climate?" Nir J. Shaviv, Andreas Prokoph, & Jan Veizer, Nature Science Reports, August 21, 2014.



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Stratocumulus Clouds Over Pacific, January 2013. Evidence now shows that high energy galactic cosmic rays play a significant role in cloud formation.

2005 David Monniaux

Tyrannosaurus rex at the Palais de la Découverte, Paris. Tyrannosaurus rex was just one of billions of animal species which have gone extinct.

atmospheric water vapor, cloud formation, and, thereby, the climate.

This overall framework provides the basis for an understanding of how mankind can manage these conditions himself—controlling aspects of the weather, rainfall, and climate.[9]

Additional insights could be provided by an examination of changes in the climate and weather systems of different planetary bodies, in an attempt to define indications of external factors influencing and controlling certain aspects of entire planetary systems (see "Solar System Weather Changes Challenge Conventional Theories," by Meghan Rouillard).

Evolution of Living Matter on Earth

A 2005 study showed very strong cycles of rise and fall in the number of distinct fossilized species over the past 540 million years—a stronger cycle of 62 million years and a weaker but still significant cycle of 140 million years.[10] Both of these cycles of rise and fall in biodiversity correspond (in period and phase) with these same two cyclical aspects of our Solar System's motion through the Galaxy (mentioned just above)—the motion above and below the galactic plane and the passage through the spiral arms. While this correspondence has been noted, the cause for such a relation is more ambiguous. Additional studies have also shown evidence for a relation between the galactic environment and the evolutionary development of living matter, proposing a few possible mechanisms. Svensmark has shown a relation between changing galactic environments (characterized by the expected changing rate of nearby supernovae) and the overall productivity of the biosphere—hypothesizing that the relation is mediated through climate change.[11] Another scientist has examined a possible periodicity in mass extinction events which might correspond with the periodic passage of our Solar System through the Galaxy's central disk—hypothesizing that this could perturb and provoke periodic comet impacts.[12]

Even with these proposed mechanisms, there is much ambiguity for how and why such a galactic relation to evolution would exist, perhaps reflecting a profound lack of understanding about the fundamental nature of living processes and/or of our Galactic System. The work of Vladimir Vernadsky provides an

9. See the LaRouche PAC show, A New Paradigm for Mankind, for May 6, 2015 and for May 13, 2015; also published in *EIR*, May 15, 2015 ("Galactic Man: Shadow versus Principle"), and May 22, 2015 ("Bringing the Rain").

10. "Cycles in fossil diversity," Rohde and Muller, March 10, 2005, Nature, Vol. 434.

11. "Evidence of nearby supernovae affecting life on Earth," Henrik Svensmark, Monthly Notices of the Royal Astronomical Society, Volume 423, Issue 2, pages 1234-1253, June 2012.

12. "Disc dark matter in the Galaxy and potential cycles of extraterrestrial impacts, mass extinctions and geological events," Michael R. Rampino, February 18, 2015, Monthly Notices of the Royal Astronomical Society, Vol. 448, Issue 2.

epistemologically better framework for approaching this question (see "A Vernadskian Reconsideration of Galactic Cycles and Evolution," republished as a contribution to this present report[13]).

Geophysical Activity

Studies have also shown a provocative correlation between records of periodic geophysical activity on Earth, the evolutionary development of living matter, and the motion of the Solar System above and below the galactic plane—all approximating the same ~60 million year periodicity.[14] Because the current stellar-level scientific paradigm lacks adequate hypotheses for how the influence of the Galactic System could affect the internal dynamics of planetary bodies, most authors touching upon this subject tend to put little (if any) emphasis on the galactic correlation to geophysical activity. However, at least one study has cited a theoretical mechanism by which the varying galactic environments experienced by the Earth could induce a type of geophysical activity (in this case volcanism).[15]

Returning to the method of comparing different planetary bodies for indications of correlated activity provides some preliminary but provocative indications that recent (in geological time) periods of large-scale volcanism on Earth correspond quite well with the most recent periods of volcanism on the moon—indicating a coordinated response of seemingly independent planetary bodies, pointing to external cosmic influences on timescales corresponding to galactic variations (see "Earth-Moon Comparative Planetology," in this report).

Taken together we see indications that the long-term changes and development of various processes on Earth (and perhaps on other planetary bodies)—from geophysical activity, to climate and weather, to the evolutionary development of living matter on Earth—correspond with the changing galactic environment experienced by the Solar System.

As stated above, in some of these cases there are hypotheses for how this interaction may occur; in other cases the current scientific paradigm fails to produce adequate hypotheses. The point is not to expect a resolution from within the existing framework, but to seek the clues indicating a higher level galactic principle, subsuming the present scientific level. The response of Earth systems (and potentially other planetary bodies) to changing galactic environments is only one path of

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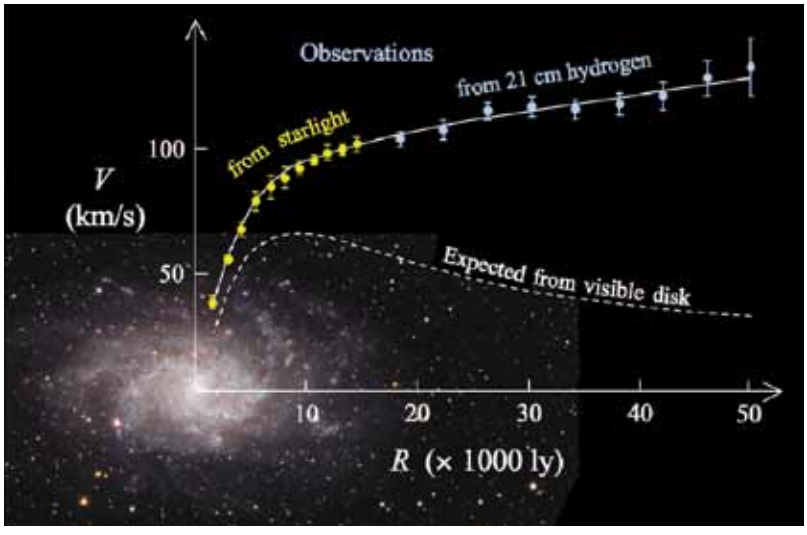
Three Devil's grade in Moses Coulee, Washington is part of the Columbia River Large Igneous Province (LIP). Lips are produced when massive amounts of hot magma extrudes from inside the Earth and flows over the surface.



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The orbital speed measured at different distances compared with what would be expected for the galaxy M33.

13. Originally published in *EIR*, May 22, 2015

14. "An ~60-Million-Year Periodicity Is Common to Marine 87Sr/86Sr, Fossil Biodiversity, and Large-Scale Sedimentation: What Does the Periodicity Reflect?" Melott, Bambach, et al, Journal of Geology, Vol. 120, No. 2 (March 2012),

15. "Disc dark matter in the Galaxy and potential cycles of extraterrestrial impacts, mass extinctions and geological events," Michael R. Rampino, February 18, 2015, Monthly Notices of the Royal Astronomical Society, Vol. 448, Issue 2.

pursuit of this galactic principle—we can also examine the large-scale, global dynamics and features of Galactic Systems as a whole.

Global Galactic Structure, Dynamics, and Singularities

Certain characteristics of galaxies, when studied as single systems, remain outside the scope of explanation within the current stellar-level science. Many characteristics could possibly be included, but here we will review just a few: evidence for an effect associated with the investigations into so-called dark matter; evidence for a large-scale coherence in the global organization of galactic systems; and the association of this coherence with a physical singularity (often referred to as a supermassive black hole).

These phenomena challenge our current conceptions of causality (expressed across space and time on these scales), and the energy flux density limits of reactions.

So-Called 'Dark Matter'

For decades it has been known that the orbital periods of stars in the outer regions of galaxies are much faster than can be explained by the amount of mass which can presently be detected in the respective galaxies. This has given rise to speculations and investigations into hypothetical types of matter which haven't been able to be detected, but which exert gravitational effects—so-called dark matter. Others view this as evidence that our understanding of gravity is not complete, and needs to be modified when expressed on galactic scales.

From the standpoint of the thesis of this report, we should start with the original discovery of universal gravitation, as done by Kepler in his discovery of the harmonic organization of the Solar System as a single system. To assert that we can take the mathematical interpretation of that discovery, and apply it to the organization of the higher order system of a galaxy, is an assumption—one which could very well be invalid. The so-called dark matter paradox might only be resolved with a discovery of a higher-order principle governing the harmonic organization for the Galactic System as a whole.

M-Sigma Relation

Another indication of a higher-order principle governing the structure of a single galactic system is referred to as the "M-sigma" relation (or the black hole-bulge relation). This is an indication that the mass of a supermassive object found at the center of most galaxies (thought to be a supermassive black hole) is always in a very direct proportion with the mass of the spherical bulge structure of the host galaxy. A larger galaxy, with a larger bulge, will have a larger supermassive central object, and a smaller galaxy, with a smaller bulge, will have a smaller supermassive central object.

At first this would intuitively seem to make sense. However, because the scales are so different, it is not understood how either the supermassive central object could exert control over the bulge, or how the bulge could exert control over the supermassive central object (or how they could both be subject to the same external control). Moreover, this is not a broad relation; it is a very tight proportion, holding across many orders of magnitude of size of different galaxies.

Within the existing mechanisms available to the current level of stellar science, it is not yet clear how to explain this relationship—nor is it clear that it could be explained within the current framework. Perhaps a new level of science is required (see "Singularities and Supermassive Black Holes," in this report).

A Physical Singularity?

This takes us to another particularly interesting area of investigation: the phenomena referred to as supermassive black holes. The very idea of a black hole is inherently an anomalous phenomenon.

According to the mathematical interpretation in general relativity, a black hole is a location where the equations explaining space and time go to infinity (a singularity), and attempts to understand the physics break down. This is an unambiguous boundary marking the limits of present knowledge—what happens here (and beyond here) is not only unknown; it is unknowable in the present stellar-level scientific framework, and will require a new revolution in science to discover (see "Singularities and Supermassive Black Holes," in this report).

Active Galactic Nuclei

What makes this even more interesting is the association of supermassive central objects (physical singularities) with a phenomenon known as active galactic nuclei.

In a small percentage of observable galaxies, the very central region of the core is incredibly active and

NASA

Galaxy NGC 4414.

energetic, shining more brightly than the entire rest of the galaxy (i.e. producing more energetic output than billions of stars combined). Moreover, evidence indicates this immense activity is coming from an incredibly small region of the galaxy. There are attempts to explain this energetic output from within the current paradigm, but they are very sketchy and contradict observational evidence.

Is it a coincidence that the most energetic phenomenon presently observed in the known Universe is associated with a phenomenon for which our current mathematical framework literally breaks down? Perhaps the energetic output of this mysterious phenomenon is an expression of a new type of reaction, associated with a galactic-level of science (see "Singularities and Supermassive Black Holes," in this report).

In Search of Principle

This is a brief overview of some important lines of investigation into the science of our Galaxy. On the one side, we can study the history of changes on the Earth (and on other bodies in the Solar System) as possible records indicating what the Galaxy is by what it does to lower-order stellar systems. On the other side, we have anomalous features of the large-scale structure and dynamics of a galactic system as a whole, which might only be explained by an as-yet-unknown organizing principle.

Most important will be unexpected convergence of multiple tracks which were thought to be independent.

The goal is to discover a new principle which subsumes current notions—by this very nature (with respect to current knowledge) its character, and how and why it subsumes what notions, is not deducible before its discovery.

We can be guided by certain general epistemological insights (following the principles of the foundations of modern science developed by Cusa), but there is no formula, and we must seek the anomalies and clues which can provoke the unique power of human creativity to generate new hypotheses (existing outside the current framework) in pursuit of a new discovery of principle.

What follows are a series of articles elaborating various aspects of this investigation, brought together in pursuit of convergence on a new principle.

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A Hubble Space Telescope photograph shows a massive jet of plasma being ejected from the massive galaxy M87.