IV. The Paradox at the Root of Science

Notes on the Legacy of Lyndon LaRouche and the Future of Science

by Bruce Director

These notes were prepared by the author as background for his August 6 video discussion with Megan Beets in this issue (see p. 45), and are cited by her in the discussion.

Lyndon LaRouche addressing a variety of audiences, spanning the period from 1985 to 2006, in locations from New York City to Moscow.

July 28—Over a long and productive life, Lyndon LaRouche, Jr. provided a myriad of inter-related original contributions to science, art, and philosophy, all flowing from his central discovery in what he emphasized, was the overarching field of the science of physical economy.[1] Current and future specialists in these fields, as well the rarer renaissance polymath, will, undoubtedly, bring forth new and unexpected discoveries from the implications of these contributions, especially as mankind extends his economic reach beyond the Earth. These notes are designed to take some of the first general steps, in the domains of physical, biologic and cognitive sciences.[2]

The central starting point, for thinking about the implications of LaRouche's concept of physical economy for the future of science, is LaRouche's rigorous placement of human creativity at the center of economics, or, perhaps more pointedly, his re-definition of the science of physical economy as the science of human creativity. In his work, LaRouche showed that human creativity, as manifest in economic relationships, within and among the generations, plays a central organizing role in the development of all processes on the Earth and nearby space, and by implication, the universe as a whole.

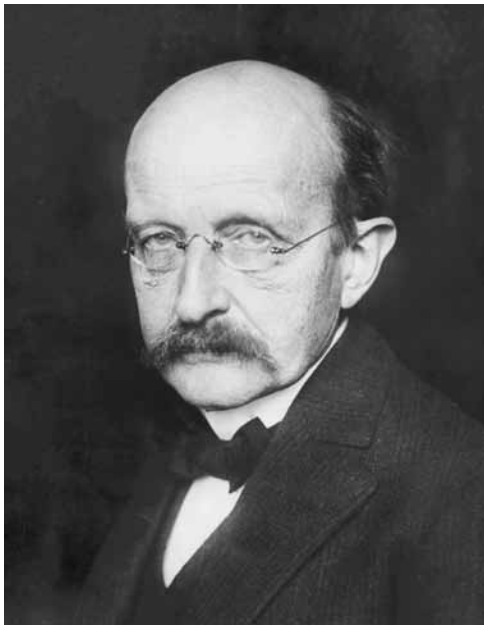
This expresses itself in the increased power of human

1. LaRouche, paraphrasing Carl Gauss, called his science of physical economy the "king of the sciences."

2. This writer had the good fortune to enjoy a more than 45-year relationship with LaRouche, the last 25 included many personal discussions on these subjects. The fruit of those discussions is reflected in these notes. However, unless directly attributed to LaRouche, the ideas contained in these notes are the impact of LaRouche's discovery on my own thoughts.

creativity to control and develop living and non-living processes, but also in the power of human creativity to increase the power of human creativity itself.[3] The former is associated with the general notions of science, while the latter with art. However, LaRouche insisted that neither can be separated from the other, and thus, there is only one science of human creativity, what LaRouche often referred to as the study of *"creativity per se."*

The general implication of LaRouche's concept, is that human creativity as manifest in physical economy is fundamentally *"anti-entropic"*[4] as expressed in the demonstrable increase in LaRouche's *potential relative population density*, energy flux density, and mankind's general increased power over nature. In other words, the action of human creativity produces secular increases in the state of organization of mankind and nature, i.e. an increase in *anti-entropy*. The question implied thereby is, "is this merely a characteristic of human nature, or is this a characteristic of the universe as a whole?" LaRouche insisted on the latter, and provided substantial proof, both original to him, and in the discoveries of many great thinkers who came before,[5] that this was the case. Future breakthroughs in science will be based on the recognition that LaRouche and his predecessors were correct in that assessment.



Max Planck

Where Was Science Going?

To begin to sort out the implication of the foregoing, a foundation must be laid. An appropriate starting point is the perspective developed by Max Planck in his 1931 essay, *"Where is Science Going?"*[6] which was written to take stock of the revolutionary changes brought about from around 1880 until that writing, with the advent of atomic science and what has become known as quantum phenomena. As Planck noted there, by 1880, "the common concept [of science] rested on a two-fold foundation. One part of the foundation consisted of [William Rowan] Hamilton's Principle of Least-Action, which includes the Principle of the Conservation of Energy. The second part of the foundation was the Second Law of Thermodynamics."

Since the present writing is only intended as notes, a full explanation of these two "foundations" will be dispensed with. Yet, Planck's identification of these two principles as "foundations" is an appropriate starting point for the intended purpose of these notes. Contrary to the vast amount of general misunderstanding of these principles, both were ultimately justified by a requirement that science may only adopt as principles, concepts that accept a coherence between the power of the human mind and the behavior of the universe as a whole. Leibniz originally formulated the first foundation as a consequence of the principle of sufficient reason, and thus, mechanical perpetual motion must be excluded. Planck formulated the second foundation on similar grounds, that perpetual motion of the second kind, i.e. perpetual motion with respect to a heat-engine, is also impossible.

While a more elaborated explanation of the immediate foregoing is absolutely indispensable for general comprehension of science, it is not necessary, to proceed here. Suffice it to say, that, as Planck himself developed, these two "foundations" specify two distinct types of physical processes which can be summarized as follows:

3. "Power" here is used in the sense of Pythagoras' and Plato's *dynamis*, and Cusa's Latin equivalent, *potentia,* which in English is often referred to as "potential."

4. "Anti-entropic" here does not signify the reversal of the increase in entropy, nor the decrease in entropy, but an entirely different process. For reasons stated below and elsewhere, this author has proposed the use of the term, *dynatropic*, comprising the Greek roots, *dynamis* (power) and *tropei* (change), or change in power (potential).

5. These thinkers included, but are not limited to, Pythagoras, Archytas, Plato, Augustine, Cusa, Kepler, Leibniz, Gauss, Riemann, Planck, and Einstein.

6. First published in English in 1933. The 1981 reprint was published by Ox Bow Press, P.O. Box 4045, Woodbridge, CT 06525.

1. Planck designated processes characterized by the principle of least-action as reversible and dynamical. That is, a potential of action is established by the physical principles under which action is determined, according to the applicable characteristics of these principles.

2. Processes characterized by the second law of thermodynamics were described by Planck as irreversible and statistical. No deterministic characteristic could be specified, only statistically more probable states.

Both types can be restated in terms of the concept of entropy, if that concept is understood in its most general form as designating "potential for change."[7] In processes of the first kind (least-action), there is no change in the potential, thus no decrease or increase in entropy. For processes of the second kind (thermodynamic), there is always an increase in entropy, that is, a *decrease* in the potential for change.

Herein lies the tale. As LaRouche demonstrated, the effect of human creativity defies both foundations. The effect of man's discovery and application of principles of science and art creates an increase in potential for change, as each new discovery lays the foundation, and the potential, for new discoveries. Such a characteristic can only be described as *"irreversible anti-entropy,"* a type of action not considered under the foregoing two foundations, but demonstrably existing.

Nicholas of Cusa

Where Is Science Now Going?

As it turned out, and as Planck elaborated in his essay cited above, neither physical processes, nor living ones, are characterized by the two foundations on which science was based in 1880. The rise of atomic physics, the interactions of light and matter, the generalizations of relativity and quantum phenomena, all indicated that a new foundation must be sought.[8] The discoveries of Pasteur and Vernadsky with respect to living processes and their interaction with the abiotic domain, clearly showed that life can only be characterized as *irreversibly anti-entropic.*

And, as cited above, LaRouche's unique treatment of the science of physical economy establishes *irreversible anti-entropy* as the unyielding characteristic of mankind. Thus, for science to progress, a new foundation must be laid. The initial principles have been set down by LaRouche.

This involves two aspects, both of which were emphasized by LaRouche. One, is a careful study of the characteristics of irreversible anti-entropy. The starting point for this is the study of the activity of human creativity as expressed in the physical economy.

The second, is the recognition that anti-entropy cannot be represented by any formal, logically deductive mathematical system, yet it nevertheless can be fairly precisely represented by the types of expression associated with classical art.

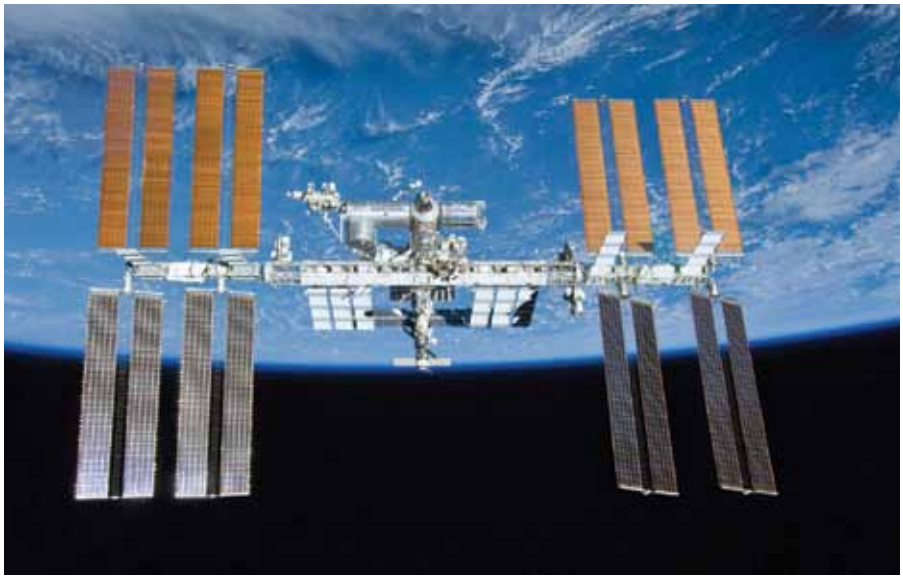
On the first aspect, both the deterministic and the statistical approach to investigating what nature appears to do, must be rejected. Instead, science must turn its primary attention to the investigation of the priority existence of potential. Such an approach is not new. In the 15th century, Cusa identified the study of potential as the most fundamental subject for scientific

7. Rudolf Clausius coined the term "entropy" in regard to heat-powered machines, from the Greek prefix *en* for internal and *tropei* for change, and he gave it an inverse measurement. That is, an increase in entropy signifies a decrease in the potential for change. Clausius made the blunder of extrapolating from the thermodynamics of a closed system to the universe as a whole, with the proclamation, "the entropy of the universe is always increasing." That blunder has bedeviled science ever since. Ludwig Boltzmann, but most importantly Planck, subsequently demystified Clausius's notion by showing that entropy implied statistical non-determinism. Thus, even Clausius's foolish statement had to be rephrased as, an increase in entropy is more probable than a decrease in entropy, in a closed system.

8. Such phenomena as the wave-particle duality, non-locality, etc. for example.

investigation.[9] For Cusa, what things are and do, is merely a consequence of the potential that enables them to behave as they are measured and observed. Though the behavior is apparent to the senses, the potential lies beyond the senses, and is accessible to the mind, via the anomalies that poke through into the sensible domain.

Thus, it is the nature of the potential that must be grasped and made intelligible. That is the actual subject matter of science. Cusa's approach was adopted by Kepler, Leibniz, Gauss, Riemann, et al., and formed the basis for all the fundamental breakthroughs in physical science from that time on. Gauss incorporated the term "potential" into physics, and formally ended the Newtonian-Cartesian construct once and for all. Yet, the dependence of science on sense perception persisted in the form of positivism, which continues to permeate mathematical physics and reductionist biology today, as well as the use of statistical methods in physics, biology and economics.



NASA

International Space Station, May 23, 2010.

The Potential to Create Potential

Cusa turned his attention to an even higher investigation, which is the true foundation of the future of modern science: *the potential to create potential.* While this may seem to be merely a philosophical investigation, it becomes very concrete, as LaRouche developed, in the domain of physical economy.

As LaRouche emphasized, economic progress proceeds via the active creative power of the human mind, which makes, and applies, discoveries of principles of man and nature. The potential for these discoveries is based on the level of material and social inputs available to the individual and society as a whole. But the true output of the economy is not the material or social benefits on which these discoveries are based, nor which they produce, nor the discoveries per se, but the potential to *make* those discoveries themselves. Or, even more fundamental, the potential to create the potential to make the discoveries.

Following Cusa and LaRouche, there is a still higher form of potential that must become the object of scientific investigation: *the potential to create a higher potential.* In the domain of physical economy this is exemplified by large-scale investments in space exploration, both directly by humans, but also by extension of human capabilities through advanced observational and robotic devices. Such investments provide not only an up-shift in the existing potential of the economy (through spin-off technologies and similar developments), but the organization of society in such an endeavor has the spiritual effect of increasing the creative potential of the individuals in society and society as a whole.

The above affords us an example upon which to outline a new foundation for science that replaces and supersedes the foundations identified by Planck. This is the higher foundation of the principle of irreversible anti-entropy. It is neither deterministic, since it depends on the creative generation of new, previously undiscovered, ideas, nor is it statistical, as these discoveries must not be merely *probable*, they are *necessary* for economic progress. And, further, economic progress is irreversible. Additionally, it implies a new form of least-action; a principle of least-action that maximizes the increase of anti-entropy, as exemplified by large-scale investments in human development beyond the Earth.

9. See, "Summit of Vision," Wertz translation, in *Toward a New Council of Florence: 'On the peace of faith' and Other Works by Nicolaus of Cusa*, translated and with an introduction by William F. Wertz, Jr.

Thus, the formulation and expression of a concept of irreversible anti-entropy is not only an essential subject for investigation, but its development itself is an embodiment of irreversible anti-entropy.

As LaRouche insisted, any attempt to formulate such a concept in conventional, or even non-conventional mathematical terms, is futile. But fortunately, that is not necessary. Great classical art is replete with inspirations that provide us the means to generate such concepts. In fact, the very characteristic that separates classical art from mere entertainment is precisely its congruence with irreversible anti-entropy.[10]

This points to the most crucial feature, that irreversible anti-entropy is not a formal construct. As cited above, the term, *potential*, expresses the active capacity of power (*dynamis*). In art, this is expressed by the emotions evoked by the artist that compel the mind, non-deterministically, to generate a creative discovery in the context of experiencing the artistic work. Such emotional power is an essential characteristic of economic development, as expressed in the recent celebrations of the 50th landing of a man on the Moon, which, in turn, is an expression of the power to dedicate one's life to contributing to an endeavor whose physical accomplishment is beyond the individual's mortal capacity to achieve.[11]

wikipedia

The Diskobolos (Discus Thrower) of Myron, an ancient Greek sculptor, 5th century B.C.

The Universe is Ontologically, Irreversibly Anti-Entropic (*Dynatropic*)

As the above sketch makes clear, the creative power of the human mind, in its inseparable and interrelated expression in the individual and in society within and among the generations, is irreversibly anti-entropic. However, science has been hampered by the false belief, which, at best, treats this characteristic as limited to humanity, while the universe as a whole, is characterized by irreversible increase in entropy, or, at worst, denies the existence of human creativity altogether. While this is emphatically the prevailing assumption in scientific circles, there is actually very little evidence to support the existence of universal increase in entropy.[12]

In fact, the scientific evidence is exactly the opposite. Exemplary are Vernadsky's studies of life and the interactive effect of life on the Earth as a whole. As Vernadsky showed, living organisms themselves cannot be characterized by increasing entropy. And as a whole, life itself, as an organizing principle, has the characteristic of progressing to ever higher forms of life, and transforming the non-living parts of the Earth, increasingly, into artifacts of life. That evolutionary development of living organisms has always proceeded toward life forms characterized by higher energy flux densities and capabilities for transforming the environment, is evidence of this.

As Kepler, Leibniz, LaRouche and others have shown, even apparently totally abiotic processes, such as the motions of the planets in the solar system, or the physics of the catenary, require a reference to human creativity. Thus, LaRouche insisted that the principle of creativity, and life, are universal principles, everywhere active and present in the universe, regardless of their momentary embodiment. That is, the *anti-entropy of the universe is always irreversibly increasing*.

Though the potential for life may, apparently, lack the willful quality of the type expressed by human creative potential, it, nevertheless, exhibits a power to develop

10. This writer is actively engaged in the effort, to concretize the application of this artistic principle to science through a type of "anti-entropic calculus" that would supersede, but not entirely replace, the reliance on conventional mathematics in science.

11. We are guided in the study of this emotional power by Schiller's *Letters on the Aesthetical Education of Man*, Wertz translation, in addition to LaRouche's extensive writings on this subject.

12. This is a subject for investigation under the rubric of psychology in the sub-category of psychopathology.

higher forms of existence, as in the evolution of higher life-forms. Also, in a different way, abiotic processes as well.

Thus, life itself can only be characterized as a process of generating increasing potential. Shouldn't the biological sciences turn their attention to the study of this potential?

Similarly, in the abiotic domain. Current cosmology is simply a mess: a hodge-podge of mathematical theories that is constantly befuddled by the experimental evidence that the universe exhibits a tendency to generate higher forms of organization and existence. Already the evidence gleaned from expanded exploration capabilities, such as the Hubble Space Telescope, and similar Earth- and space-based devices, has provided science with ample evidence of anti-entropic organization.

Instead of trying to interpret this evidence from the standpoint of the assumption of universal increase in entropy, shouldn't science turn its attention to studying these phenomena as the effect of an irreversibly anti-entropic universe? Such an approach would eliminate the reliance on mathematical constructs such as "dark matter" and "dark energy." While this author has no opinion as to the ultimate existence of dark matter or dark energy, its existence is hypothesized at this point purely for mathematical reasons that flow from the acceptance of a universal increase in entropy. Further study may show that irreversible anti-entropy needs no such entities, or, at least will shine a light on them.

A similar case can be made for micro-physics.

Further, breaking down the division between physics and biophysics, in the direction of Pasteur and Vernadsky, is essential. As their investigations in crystallography and the biogenic migration of atoms show, life produces unique physical effects that are characteristically anti-entropic. Thus, as LaRouche insisted, instead of trying to understand living processes from the standpoint of abiotic physics, a reverse approach is needed. Experimental evidence exists that processes that occur in the abiotic domain only under extreme conditions, as for example the creation of quasi-crystals with five-fold symmetry, are characteristic at "normal" conditions under the influence of life. This, and other phenomena, indicate that a universal anti-entropic tendency links the abiotic, biotic and cognitive domains.

As LaRouche emphasized, such investigations cannot proceed from the bottom up under separation of abiotic, biotic and cognitive domains. But, if we take as our foundation, the irreversibly anti-entropic character of the human mind, we will find that the universe in which we are blessed to live, is, happily, just like us.