# THE INTEGRAL PARADIGM OF SCIENCE

## MANIFESTO OF THE LASZLO INSTITUTE OF NEW PARADIGM RESEARCH

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### *THE CONCEPT OF "INTEGRAL PARADIGM"*

Thomas Kuhn advanced the notion of "paradigm" as the set of assumptions that guide research in a field of science, in particular in physics. A more general concept is implied by Einstein's remark that science seeks the simplest possible scheme of thought that can tie together the observed facts. That scheme is the reference for all considerations and elaborations in the relevant disciplines and

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hence serves as the paradigm for work in those disciplines. The *disciplinary paradigm* is the simplest possible scheme of thought that can tie together the observed facts in a particular field of research; whereas the *integral paradigm* is the simplest possible scheme that can tie together the observed facts in the various relevant fields.

Assuming that the relevant fields in science are mutually coherent, discerning and stating an integral paradigm is a meaningful endeavor. It is of extraordinary importance today, given that while the range of observed facts has been growing exponentially, schemes that could tie them together are receiving scant attention. There are well-developed paradigms in physics and in biology, in psychology and in the social sciences, but there are no coherent schemes that would tie them together in an integral paradigm. Consequently science lacks the overview that only an integral paradigm can provide.

Philosophers have noted that observations do not in themselves determine the meaning attached to them: every observation is capable of a variety of interpretations. In deciding the best interpretation to attach to given observations, scientists are guided by ideals of simplicity and comprehensiveness. A valid paradigm can be defined as the simplest comprehensive interpretation of the observed facts. An integral paradigm, in turn, is the simplest comprehensive interpretation of the observed facts reported in sciences focused on a common field of research. This Manifesto offers a concise overview of the integral paradigm currently emerging in the physical, biological, and psychological sciences.

## *OVERVIEW OF THE EMERGING INTEGRAL PARADIGM OF PHYSICAL REALITY*

In view of findings coming to light at the frontiers of the physical sciences, the currently emerging paradigm of physical reality is proving to be very different from the paradigm of classical physics. The universe is not the arena of bits of matter moving in passive space and indifferently flowing time. As astronomer James Jeans noted over a hundred years ago, the universe is more like a big thought than like a big machine.

The concept of a thought-like world is familiar from the history of thought. Philosophers, scientists, and intuitive people in all walks of life have always questioned that the world would be as it is presented to our senses. Their doubts were well founded: the picture of the world emerging in the physical sciences differs fundamentally from the world-picture of common sense, and of the physics built on the intuitions of common sense. The world is not an ensemble of separate bits of matter obeying mechanistic laws; nor is it an arena for the motion of matter in passive space and indifferently flowing time. The world as the contemporary quantum sciences are discovering is an intrinsically whole quantum system, where all things are connected beyond the hitherto recognized bounds of both space and time. In this system, the phenomena that meet our eye are not units and ensembles of a substance called "matter," but sets and clusters of vibration. The vibrations are ordered: they are coherent. To use the term suggested by David Bohm, the universe we observe is an "in-formed" system of interconnected vibration.

Thinkers for millennia have known the concept of the world as vibration; it is an integral part of the wisdom traditions. It is present in the Sanskrit concept of *Akasha* and has appeared in the Vedic texts as early as 5,000 BCE. In the *Vedas* it

was traced to *shabda*, the first vibration that constitutes the universe, and to *spanda*, the vibration/movement of consciousness. The contemporary Indian scholar I.K. Taimni wrote:

> *There is … a mysterious integrated state of vibration from which all possible kinds of vibrations can be derived by a process of differentiation. That is called N.da in Sanskrit. It is a vibration in a medium … which may be translated as "space" in English. But ... it is not mere empty space but space which, though apparently empty, contains within itself an infinite amount of potential energy … This infinite potentiality for producing vibrations of different kinds in any intensity or amount is due to the fact that at the back of Akasha, or hidden within it, is consciousness.*[2]

This formerly esoteric notion is now reviewed at the cutting edge of quantum physics. Research on the ultra-small dimensions of the universe reveals that space is not empty and smooth, but filled with waves and vibrations. At the sub-quantum dimension, there is no such phenomenon as matter. The things that appear as solid, substantive "things" are standing and propagating waves: clusters of in-phase vibration.

> In one of his last lectures (Florence, 1944), Max Planck noted,
> "*As a man who has devoted his whole life to the most clear-headed science, to the study of matter, I can tell you as a result of my research about atoms this much: There is no matter as such. All matter originates and exists only by virtue of a force which brings the particles of an atom to vibration and holds this most minute solar system of the atom together."*[3]

[2] Taimni, I. K., *Man, God and the Universe*. Madras: The Theosophical Society, 1969.
[3] *Das Wesen der Materie* (The Nature of Matter], speech in Florence, Italy. *Archiv zur Geschichte der Max Planck Gesellschaft*, Abt. Va, Rep. 11 Planck, Nr. 1797.

The maverick genius Nicola Tesla concurred. Two years before Planck's pronouncement he advised that if we want to know the secrets of the universe we must think in terms of energy, frequency, and vibration.

The materialist concept of reality has run its course. Research in the physical sciences, in particular in the quantum domain, suggest that the things we observe in space and time are clusters of in-formed vibration.[4] According to Bohm, the observed features of the world are the consequence of the "in-formation" of the observable *explicate* order by the unobservable but fundamentally real *implicate* order.
The vibrations we observe are believed to have originated in the cosmic singularity known as the Big Bang. The energies entering the cosmos some 13.8 billion year ago "excited" the ground-state of the cosmos and brought it into vibration. The vibrations that *are* the currently observed universe are consequences of the Big Bang and manifestations of the excited state of the cosmos.

The excitation of the cosmic ground-state introduced space and time into the primordial ground-state. The universe we observe is the domain of spatially and temporally differentiated yet related vibration.

The sets and clusters of vibrations that that furnish space and time are complex and as we shall see coherent. There is no empty space and passive time in the universe. Space is a foaming, turbulent medium, filled with fields and forces. The term "vacuum" does not apply to it: space in the universe is a *plenum*.

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[4] If the world is in-formed vibration, question is, what is the world the vibration of? It is not of matter, because we have no independent evidence for the existence of a ground-substance we could identify as matter. This appears to be a metaphysical question not answerable with the methods of science. However, it may not need to be answered, for it is badly formulated: it suggests the classical and now obsolete subject-predicate concept of reality. We may have to accept that there is no thing or substance underlying the phenomena of vibration. The world is not the vibration of anything other than itself.

The observed and observable phenomena that ground the physical reality of the universe are vibrations resulting from the excitation of the cosmic ground-state. They are quantum particles: "quanta" known as *leptons* (electrons, muons, tau particles, neutrinos), *mesons* (pions), and *hadrons* (baryons including protons and neutrons). They range in size and complexity from quanta to living organisms, and from asteroids and planets to galaxies and the metagalaxy. Their vibrations produce the phenomena we perceive as physical entities. [5]

*OVERVIEW OF THE EMERGING INTEGRAL PARADIGM OF EVOLUTION*

According to mainstream theory, the phenomena we observe started to take on form and complexity in the wake of the Big Bang about 13.8 billion years ago. At that time. the cosmic singularity began to differentiate the emerging clusters of vibration. Since that epoch, the quantum particles that survived the mutually annihilating collision of particles and anti-particles in the new-born universe have been undergoing a nonlinear yet overall unidirectional process. That process is evolution in the largest, cosmological sense. Despite a widespread belief, it is not limited to the living world but embraces all aspects of change and development in the universe.

Thanks to the work of Darwin and Wallace, in the 19th century evolution has been recognized as a process of progressive change in the living world. Since the latter part of the 20th century it has been recognized as a universal process throughout space and time. It originated when the energies of the Big Bang catalyzed Planck-scale quantum particles and these particles radiated throughout

[5] The illusion in question is similar to that produced by the phenomenon of solitons. These are solitary waves that arise in water and other turbulent mediums. They roll along the surface, and when they meet they deflect each other. In many respects they behave as if they were separate objects, yet they are waves in a shared liquid medium.

the expanding spacetime. They acquired structure and complexity and, notwithstanding chaos and turbulence, they maintained a significant level of coherence. They clustered into atoms, and atoms clustered into molecules and molecular assemblies. On the astronomical level macroscale vibrations appeared: stars and stellar systems and entire galaxies.

The evolving universe not only brought into existence significantly coherent clusters of vibration, it proved to be extraordinarily coherent in its own right. As physicists Arthur Eddington and Paul Dirac noted in the middle of the 20th century, the universe's basic parameters are related by remarkable "coincidences." The ratio of the electric force to the gravitational force was known to be approximately $10^{40}$, and the ratio of the size of the universe to the size of elementary particles turned out to be about $10^{40}$ as well. This is surprising, since the ratio of the electric force to the gravitational force should be unchanging (these forces are constant), whereas the ratio of the size of the universe to the size of elementary particles should be changing (given that the universe is expanding). In his "large number hypothesis," Dirac speculated that the agreement between these ratios, one variable the other not, is more than mere coincidence. But if so, either the universe is not expanding, or the force of gravitation varies proportionately to its expansion.

More recently astrophysicist Menas Kafatos showed that many of the ratios among the parameters of the universe can be interpreted on the one hand in terms of the relationship between the masses of elementary particles and the total number of nucleons, and on the other in reference to the relationship between the gravitational constant, the charge of the electron, Planck's constant, and the speed of light.

The mass of elementary particles, the number of particles, and the forces between them display harmonic ratios. Moreover, the microwave background radiation  believed to be the remnant of the Big Bang  turned out to be coherent as well: it is dominated by a large peak followed by smaller harmonic peaks. The series of peaks ends at the longest wavelength Lee Smolin termed R. When R is divided by the speed of light we get the length of time independent estimates show is the age of the universe. When we divide in turn the speed of light by R (c/R), we get a frequency that equates to one cycle over the age of the universe. And when R is squared and divided by the speed of light ($c^2/R$) we get the measure of acceleration in the expansion of the galaxies.

The universe's parameters are precisely correlated: variations of the order of one-billionth of the value of some physical constants (such as the mass of elementary particles, the speed of light, the rate of expansion of galaxies, and two dozen others) would have resulted in a universe without stable atoms and stable interaction among them. Even a minute variation of some of the basic physical constants would have precluded the evolution of life. The universe proved to be a coherent system, with parameters finely tuned together and consistent with the system's overall dimensions.

The coherently structured universe served as the template for the evolution of coherently structured subsidiary systems. The systems that emerged in physically favorable regions of space and time display a measure of both intrinsic and extrinsic coherence. (Intrinsic coherence means that all parts of the systems are interconnected with, and responsive to, every other part, while extrinsic coherence means that the systems are coherently related to other systems and to their environment.)

It is statistically extremely improbable that systems of the observed coherence would have emerged in a random mixing of their components. Random mixing, even if encompassing a large number of systems over large time-scales, cannot account for the presence of the complex and coherent systems: the search-space even of relatively simple systems is so vast that random trial-and-error would have exceeded the available times. There were up to 13.8 billion years available for the evolution of atoms and other physical entities, and more than four billion for the evolution (at least on this planet) of living organisms. These dimensions of time, although enormous, are insufficient to explain the emergence of complex systems of the observed coherence through random interactions.

The atoms, molecules, and molecular assemblies that emerged in the universe display remarkable levels of coherence. Still higher levels of coherence characterize biological systems. Yet the probability that even a simple biological cystem would have come about through a random mixing of its components is negligible. The DNA-mRNA-tRNA-rRNA transcription and translation system is so complex and precise that it is unlikely that living organisms would have evolved through a chance assembly of their genetic constituents. (To produce the DNA of the common fruit-fly by a random mixing of its molecules would require more time than had elapsed since the birth of the universe. And according to Fred Hoyle, the probability that new species would emerge through a chance mutation of their genetic code is comparable to the probability that a hurricane blowing through a scrapyard assembles a working airplane.)

On the higher rungs of evolution, the systems that emerged exhibit truly staggering complexity and coherence. The human body, for example, is made up of $10^{14}$ cells, and each cell produces 10,000 bio-electro-chemical reactions every second. Every twenty-four hours $10^{12}$ cells die and are replaced. Molecules, cells,

and organ-systems resonate at the same or at compatible frequencies and interact at various speeds, ranging from the slow (among hormones and peripheral nerve fibers), to the very high (along the Ranvier rings of myelin-shielded nerves). The interactions are precisely correlated, involving quantum-type "entanglements" in addition to classical physical-biological interactions.

The evolution of systems is a widespread, quasi-universal process. Organic molecules, the basic elements of life, have been found under a wide range of physical and thermal conditions. A team of astrophysicists headed by Sun Kwok and Yong Zhang of the University of Hong Kong found 130 macromolecules present in the vicinity of active stars. They include glycine, an amino acid, and ethylene glycol, the compound associated with the formation of the sugar molecules necessary for life. Their presence around active stars suggests that they were ejected in the course of the stars' thermal and chemical evolution.

Organic molecules were discovered in interstellar clouds as well. The incidence of the most complex of these molecules, isopropyl cyanide, has been reported in 2014 by a team of researchers headed by Arnaud Belloche at the Max Planck Institute for Radio Astronomy. Its branching carbon structure is similar to that of the amino acids that form the basis of proteins in biological systems. The spontaneous self-assembly of DNA fragments a few nanometers in length into liquid crystals drives the formation of chemical bonds and creates chains of DNA. The self-organizing properties of DNA-like molecular fragments over billions of years may have produced the first DNA-like molecular chains on Earth.

Evolution is the lawful build-up of coherent complexity in space and time. The laws of nature are algorithms for the clustering of quanta, atoms, and molecular assemblies into complex and coherent systems.

One of the most basic algorithms is the Pauli Exclusion Principle. The Principle states that no two electrons orbiting the nucleus of an atom can occupy the same quantum-state at the same time. Electrons entering the gravitational zone of the nucleus are excluded from already occupied orbits are shifted into free orbits, thus filling up the energy shells surrounding the nucleus. Due to their selective exclusion, the particles captured by the gravitational field of the nucleus assemble into complex structures. In consequence the universe is not an undifferentiated heap or conglomeration of various particles, but a complex structure formed by the spatial and temporal ordering of the particles.

Atoms, complex and coherent clusters of vibration, bond into the complex and coherent clusters of molecules. Molecules bond into multi-molecular physical-chemical structures, and these are templates for the formation of still more complex and coherent biological structures. Some species of biological structures bond into socio-ecological structures. There is a consistent if nonlinear progression from level to level of structure and organization in the universe, with each level manifesting further elements of complexity and coherence.

Evolution in the biosphere increases the coherence of the evolving species and is not uniquely oriented toward optimizing the fitness of the species to their environment. If fitness were the goal of evolution, the biosphere would be populated by blue-green algae, amoebae, and other unicellular, colonial, and simple multi-cellular organisms. Many of these species have already achieved a

near-perfect fit to their niche, and nothing short of volcanic eruptions, sudden climatic change and natural catastrophes would lead to the alteration of their genetic structure. If fitness were the goal of evolution, simple and robust species would have spread and would dominate the web of life.

However, mainly super-fit simple organisms do not populate the biosphere. Species and populations often evolve beyond optimum fitness to their milieu. So-called extremophiles explore and survive in such high-risk environments as active volcanos, deserts, and the deep sea.

The Darwinian concept needs to be updated. There is an overriding goal behind the evolution of living species, but it is not fitness to the environment but the overall increase in the complexity and coherence of species.

There appears to be a formative factor present in the world, similar to the transcendental will, mind or consciousness proclaimed in the religions and spiritual traditions. In the context of science, this factor is the "in-formation" of the manifest dimension of the world by the underlying fundamental dimension. In the language of quantum theory, this indicates the in-formation of the manifest explicate order by the nonmanifest but fundamental implicate order.

*Overview of the emerging integral paradigm of mind*

The "in-formation" of the explicate order by implicate order is a key principle in understanding the nature of evolution, and of the human mind as it seeks to comprehend the evolving world. The universe is complex and coherent as a whole, and the systems that emerge in it evolve nonlinearly but consistently toward further complexity and coherence. The evolution of biological species in

the biosphere exhibits this evolution, and provides the ground for understanding it.

Evolution in the biosphere calls for a complex and enduring flow of information between living systems and their environment. In comparatively evolved (i.e. highly complex and coherent) systems this flow is articulated and controlled by a brain and nervous system. These organs and systems perform multiple services for complex and coherent systems. They enable the persistence of the systems in mapping the conditions under which energy- and information-flows within and between the systems and their environment can be maintained within a viable range. In highly evolved systems these conditions have a narrow range of error-tolerance: the dynamic equilibrium of the energies and resources that permit the complex living systems to maintain themselves in their environment are complex and precise. Errors need to be corrected before they impair the vital defenses of the systems and endanger their continued persistence. A sufficiently precise and detailed mapping of the environment, and of the relation between the given systems and their environment, is a precondition of the continued persistence of the systems.

However, an evolved brain and nervous system is more than an instrument of biological survival. The human brain is capable of mapping states and conditions that are not immediately relevant to the organism's survival. The organism proves to have "higher" needs in addition to satisfying the requirements of its survival. These needs can be understood in reference to the "in-formation" of the manifest domain of the universe by the nonmanifest fundamental domain.

The evolved brain and nervous system responds to subtle signals that supervene on the sensory signals that map the relation of the system to its environment.

The subtle signals are ordinarily masked by those that map the immediate needs of the system, but they appear in states of higher receptivitiy. In these "spiritual" or "mystical" states the in-formation of the organism by the nonmanifest fundamental domain is translated into perceptions that reach conscious awareness. The most widespread of these perceptions is a spontaneous seeking and valuation of the conditions toward which the organism is predisposed by its universal "in-formation." These conditions can be seen as coherence in life-experience.

The substance of human culture can be referred to the satisfaction of this coherence-seeking need of the species. Religion and spirituality, music, art, science, and philosophy in all their forms and manifestation serve do not serve the satisfaction of basic survival needs but the satisfaction of the need, the appetite for, coherence. The human species has achieved a high level of complexity but is lacking the integration of its complexity in a coherent bio-psychological system. Religion and spirituality, as well as science and philosophy and the various forms of culture find a common denominator in the search for coherence.

The orientation toward intrinsic coherence is the instinct and impetus for health and healing, while the orientation toward extrinsic coherence is manifestation of what we have been calling our social and ecological instinct. Without the drive for social coherence we would still be living in tribal societies based on blood relations, and without the drive for ecological coherence we would have destroyed our habitat even more than we do today.

So-called high-culture also responds to the drive for coherence. Coherence in life-experience calls for the meaningful ordering of the elements of our

experience, so as to produce esthetic satisfaction, spiritual fulfilment, mystical revelation, scientific or philosophical insight, or the perception of beauty and significance in nature. It is achieved rationally through science, and intuitively through religion and spirituality.

The aspiration for coherence may take the experiencer to enter the path to universal and unconditional love. Spiritual and mystical experiences inspire sensations of empathy and compassion, and lead the experiencer to seek the experience of love. Universal and unconditional love is a direct consequence of the species-wide drive toward coherence. Universal love is coherence with all things in nature and in society, and unconditional love is coherence with all things regardless of its consequences. Together they form a clear manifestation of the in-formation of our species with the cosmic drive toward complexity and coherence.

As a planetary species and global society, we have reached a high degree of complexity, but we are lagging in regard to coherence. The resurgence of the search for meaning and oneness through social togetherness, the renewed cultivation of spiritual and transcendental experiences, as well as the growing interest in popular forms of music, art, and literature indicate that we have the capacity and the will to restore our coherence. The rise of youth cultures that declare their aspiration for universal and unconditional love is perhaps the most hopeful indication that, despite the crises and chaos that beset us, we are on the way to a better and more balanced epoch in the history of human life on Earth.

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