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Addendum 11: A string theory of evolution

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"*If you want to understand the Universe,*
think in terms of energy, frequency, and vibration"
(Nikola Tesla)

The evolutionary hypothesis we are proposing in these pages has suggestive parallels with the so-called string theory —developed in the world of physics over the last few decades— which, at present, is considered the strongest candidate to become the "grand unified theory", unsuccessfully pursued by Einstein until the very end of his life. To highlight these similarities, we will first outline some of the most significant characteristics of the promising string theory, and then develop our specific proposal, highlighting the possible resonances between the two.

What is the world made of?

Humanity has pondered this question for thousands of years, but it wasn't until the last century that a convincing answer began to emerge. Today we know that ordinary matter is made up of atoms, which, in turn, are made up of three basic components: electrons orbiting a nucleus composed of neutrons and protons. The electron is considered a fundamental particle, but neutrons and protons are made up of smaller particles, known as quarks, which, in principle, are elementary. Our current understanding of the subatomic composition of the universe is summarized in the so-called Standard Model of particle physics. It describes both the fundamental particles that make up the material world and the forces by which these particles interact with each other. In total, there are twelve basic particles. Six of these are quarks —named up, down, charm, strange, top, and bottom— and the other six are leptons —electron, muon, tauon, and their three corresponding neutrinos. There are four fundamental forces in the universe —gravity, electromagnetism, and the weak and strong nuclear forces— each of which is produced by fundamental particles that act as carriers of those forces: the photon (the particle of

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ISSN 1825-7968 2025, 1: 95-128

light that mediates electromagnetic forces), the graviton (the particle associated with gravity), the eight types of gluons (the particles that carry the strong force), the W and Z bosons (the particles that carry the weak force), and, in addition, the recently discovered Higgs boson (which is responsible for the masses of other fundamental particles). As we said, the behavior of all these particles and forces is described very precisely in the Standard Model, but there is a notable exception with the force of gravity, since it has proven very difficult to describe microscopically. Therefore, formulating a quantum theory of gravity has become one of the central problems of theoretical physics over the last century.

The revolutionary emergence of the theories of relativity and quantum mechanics at the beginning of the 20th century radically transformed our view of the world. On the one hand, the classical concepts of space and time began to blur, and on the other, the seemingly absurd behavior of the elementary components of reality was revealed. But the indisputable fact is that, since then, these two surprising theories have been making predictions of enormous precision in countless experimental tests. The general theory of relativity has managed to clarify the force of gravity and the structure of space-time at the macroscopic level, and quantum mechanics has effectively described a large number of physical phenomena at the microscopic level. Over the past century, these two frameworks have proven capable of explaining the vast majority of the observed characteristics of the universe, from elementary particles to the cosmic totality as a whole.

The general theory of relativity describes the force of gravity within the framework of classical mechanics, while the other fundamental forces —the strong nuclear force, the weak nuclear force, and electromagnetism— are expressed within the framework of quantum mechanics. We could say, then, that general relativity is analogical, that quantum mechanics is digital, and that the two languages, in essence, are difficult to reconcile. Their mathematics are not compatible with each other. Therefore, physicists encounter enormous difficulties when trying to describe physical processes in certain situations where both gravity and the other fundamental forces are fully and simultaneously present, such as, for example, at the birth of the universe or at the center of black holes. It is therefore imperative to close the gap between general relativity and quantum mechanics once and for all. No further progress can be made without finding a grand unified theory capable of harmoniously describing all the forces of nature. The search for this unified theory is the basis of string theory.

ISSN 1825-7968 2025, 1: 95-128

Vibrating strings

String theory emerged accidentally in the late 1960s as an attempt to explain the strong force that binds protons and neutrons together inside atomic nuclei —roughly speaking, the theory suggested that the strong force was due to “strings” that bound particles attached to their ends—, but, years later, it was discovered that the mathematical structure of string theory also naturally allowed for a quantum description of the force of gravity, automatically making it a truly promising and attractive candidate for a quantum theory of gravity. Continuing research along these lines —in the mathematical realm— physicists began to find similarities between all particles. Thus, the theory has ultimately evolved into a general framework with the potential to unify not only all of nature's fundamental forces —including gravity—, but also the entire Standard Model of particle physics, in a manner consistent with the laws of quantum mechanics and general relativity, thereby enabling a unified explanation of both quantum and cosmological phenomena, from the frantic dance of quarks to the majestic swirl of galaxies.

According to string theory, the fundamental components of the universe are not zero-dimensional, structureless point particles, as traditionally thought, but tiny, vibrating, one-dimensional "strings" that act on the Planck length scale (10^{-35} m) and can be closed like a circular loop or open like a segment with two ends. Using a single parameter —the string tension— string theory is able to describe all known particles and forces, including gravity. The quantization of string vibrations introduces the principles of quantum mechanics, bridging the gap between the microscopic world of particles and the macroscopic realm of gravity. The different properties observed in particles —mass, charge, or spin— are nothing more than a reflection of the various resonant patterns —the various "sounds"— in which a string can vibrate. The "tone" of each string's vibration determines the nature of its effect. Thus, the different modes of oscillation of strings manifest themselves as the various particles. Just as the strings of a musical instrument have resonant frequencies at which they prefer to vibrate, the same is true in string theory. The presence of preferential vibrational modes may be the source of energetically stable configurations of matter. Each of a string's preferred vibration patterns —each musical "harmonic"— corresponds to a specific particle. The electron is a string that vibrates in a certain way, the up quark is a string that vibrates in a different way, and so on. The same idea also applies to each of the forces of nature —photons, gravitons, and so on. When strings interact with each other, they produce more elaborate sounds, as when several musical notes combine into a chord or a song.

ISSN 1825-7968 2025, 1: 95-128

If string theory is correct… the entire world is made only of strings! According to physicists, these strings are not "made of" anything smaller. They are the fundamental building block of reality.

The nature of reality is simpler and more elegant than we could ever have imagined. All matter and all the forces in the universe are ultimately nothing more than the manifestation of simple harmonic oscillations of a single basic microscopic object: tiny string-like strands of energy. These strings vibrate at different frequencies, and these vibrations interact with each other to form everything we see, from atoms to galaxies. The different frequencies and arrangements of the strings act like the various notes of a cosmic symphony. The universe as a whole is therefore not a mere collection of random particles, but a beautiful and orderly arrangement, similar to a carefully composed piece of music, produced by the resonance of an ocean of vibrating strings. It seems that string theory is beginning to unravel the “harmony of the spheres” posited by the Pythagoreans in ancient times.

Surprisingly, the reality that begins to be revealed through string theory goes far beyond the space-time universe perceived by our senses. The consequences of replacing point particles with vibrating microscopic strings are remarkable, because the simplicity and elegance of string theory paradoxically entails enormous complication. For the theory to be mathematically consistent, it requires the existence of additional dimensions, beyond the four —three spatial and one temporal— with which we are familiar in everyday life. The mathematics of string theory requires that the universe have not only the three spatial dimensions of common experience — length, width, and height— but six more, for a total of nine spatial dimensions, or a total of ten space-time dimensions. The original version of bosonic string theory required up to 26 dimensions; subsequent superstring theories limited that number to 10; and, finally, M-theory, the most recent unifying framework, requires a space-time with 11 dimensions to fully describe the universe. If these extra dimensions really exist… where are they?

String theory raises the possibility of two types of dimensions: large ones, the four that make up what we perceive as ordinary space-time, and six or seven tiny ones, so small, curved or folded in on themselves that, even if present, they are undetectable with current technology. Physicists use the idea of "compactification" to construct models in which space-time appears to be four-dimensional. Through this compactification, the six or seven additional dimensions are supposed to fold in on themselves to form tiny, imperceptible circles. A standard analogy for this idea is to consider a multidimensional object like a long garden hose. If you look at the hose from a great

distance, it appears to have only one dimension —its length— but if you look at it more closely, you discover that it contains a second dimension —its circumference. Similarly, according to string theory, the three spatial dimensions of ordinary experience are large and manifest, while the other six or seven dimensions are "wound up" into intricate shapes within the Planck length and are therefore undetectable.

Another approach to reducing the number of dimensions is the so-called "brane-world" scenario. Brane theory is an extension of string theory that includes multidimensional objects, called branes. These branes thus generalize the idea of particles and strings to entities that can have more dimensions. Thus, for example, a 0-brane is a zero-dimensional entity —a point particle—; a 1-brane is a one-dimensional entity —a line or string—; a 2-brane is a two-dimensional entity —a surface or membrane—; a 3-brane is a three-dimensional entity —a volume—; and a p-brane is a p-dimensional entity. Since few types of string theories have more than nine or ten spatial dimensions, p-branes can have p values up to 9 or 10. In this framework, physicists conceive of our observable universe as a three-dimensional brane (3-brane) floating in a space of additional, curled-up higher dimensions, a concept that differs dramatically from traditional cosmological models, and which therefore offers new insights into the origin and evolution of the cosmos.

String theory is currently a vibrant area of research that continues to experience rapid development. Due to its conceptual rigor, solid theoretical foundations, and mathematical elegance, string theory represents an exceptional intellectual achievement and continues to captivate the imagination of a large number of physicists and mathematicians. Despite this, it faces a significant challenge that has yet to be resolved: there is no direct experimental evidence to support its predictions. The theory is mathematically compelling, but, for the moment, it remains impossible to empirically test. To date, there is no experimental verification that string theory is the correct description of nature. One of the fundamental problems facing physicists is that string theory operates on energy scales much larger than those achievable with current particle accelerators, which, while achieving impressive energy scales, are nowhere near the levels needed to directly investigate string-related phenomena. Other problems that arise relate to the unimaginably tiny scale of strings, the hidden extra dimensions, the multiplicity of potential solutions, the extreme complexity of the mathematics involved, the lack of reference to the presence of an "observer", a fundamental characteristic of quantum mechanics... All of this makes the future of string theory uncertain, but at the same time, deeply hopeful. In fact, today, it remains the strongest and most attractive candidate to become the long-awaited unifying theory of physics

ISSN 1825-7968 2025, 1: 95-128

—the elusive "theory of everything"— capable of finally unraveling the mysteries of the universe at its fundamental level.

The elegant universe

American physicist and mathematician Brian Greene, a pioneer in the field of superstring theory, has made string theory accessible to the general public through his acclaimed popular science book, *The Elegant Universe: Superstrings, Hidden Dimensions, and the Quest for the Ultimate Theory*. Below, we reproduce some of the phrases from this work that refer to the central issue we are raising in this Addendum. [The page numbering corresponds to the Spanish version of the work, published by Ed. Crítica (Drakontos Bolsillo), in Barcelona, in 2006.]

P. 32: ... the observed particle properties (...) are a reflection of the various ways in which a string can vibrate. P. 33: ...each of the preferred patterns of vibration of a string in string theory appears as a particle whose mass and force charges are determined by the string's oscillatory pattern. (...) particle properties in string theory are the manifestation of one and the same physical feature: the resonant patterns of vibration —the music, so to speak— of fundamental loops of string. The same idea applies to the forces of nature as well. (...) force particles are also associated with particular patterns of string vibration and hence everything, all matter and all forces, is unified under the same rubric of microscopic string oscillations —the "notes" that strings can play. P. 37: If string theory is right, the microscopic fabric of our universe is a richly intertwined multidimensional labyrinth within which the strings of the universe endlessly twist and vibrate, rhythmically beating out the laws of the cosmos. P. 199: With the discovery of superstring theory, musical metaphors take on a startling reality, for the theory suggests that the microscopic landscape is suffused with tiny strings whose vibrational patterns orchestrate the evolution of the cosmos. P. 201: ... string theory provides a truly unified theory, since all matter and all forces are proposed to arise from one basic ingredient: oscillating strings. P. 211: (Each string on a violin) can undergo a huge variety (in fact, infinite in number) of different vibrational patterns known as resonances*, such as those shown in Figure 6.1. These are the wave patterns whose peaks and troughs are evenly spaced and fit perfectly between the string's two fixed endpoints. Our ears sense these different resonant vibrational patterns as different musical notes. The strings in string theory have similar properties. There are resonant vibrational patterns that the string can support by virtue*

ISSN 1825-7968 2025, 1: 95-128

of their evenly spaced peaks and troughs exactly fitting along its spatial extent. [Figure 6.1: Strings on a violin can vibrate in resonant patterns in which a whole number of peaks and troughs exactly fit between the two ends.] P. 212: Here's the central fact: Just as the different vibrational patterns of a violin string give rise to different musical notes, the different vibrational patterns of a fundamental string give rise to different masses and force charges. As this is a crucial point, let's say it again. According to string theory, the properties of an elementary "particle" —its mass and its various force charges— are determined by the precise resonant pattern of vibration that its internal string executes. [Figure 6.2: The loops in string theory can vibrate in resonance patterns —similar to those of violin strings— in which a whole number of peaks and troughs fit along their spatial extent.] P. 214: So we see that, according to string theory, the observed properties of each elementary particle arise because its internal string undergoes a particular resonant vibrational pattern. This perspective differs sharply from that espoused by physicists before the discovery of string theory; in the earlier perspective the differences among the fundamental particles were explained by saying that, in effect, each particle species was "cut from a different fabric". Although each particle was viewed as elementary, the kind of "stuff" each embodied was thought to be different. Electron "stuff", for example, had negative electric charge, while neutrino "stuff" had no electric charge. String theory alters this picture radically by declaring that the "stuff" of all matter and all forces is the same. Each elementary particle is composed of a single string —that is, each particle is a single string— and all strings are absolutely identical. Differences between the particles arise because their respective strings undergo different resonant vibrational patterns. What appear to be different elementary particles are actually different "notes" on a fundamental string. The universe —being composed of an enormous number of these vibrating strings— is akin to a cosmic symphony. (...) This overview shows how string theory offers a truly wonderful unifying framework. Every particle of matter and every transmitter of force consists of a string whose pattern of vibration is its "fingerprint." Because every physical event, process, or occurrence in the universe is, at its most elementary level, describable in terms of forces acting between these elementary material constituents, string theory provides the promise of a single, all-inclusive, unified description of the physical universe: a theory of everything (ToE). P. 296: ...masses and charges of particles in string theory are determined by the possible resonant vibrational string patterns. P. 297: According to string theory, the universe is made up of tiny strings whose resonant patterns of vibration are the microscopic origin of particle masses and force charges. P. 319: Another experimental signature

ISSN 1825-7968 2025, 1: 95-128

of string theory, having to do with electric charge, is somewhat less generic than superpartner particles but equally dramatic. The elementary particles of the standard model have a very limited assortment of electric charges: The quarks and antiquarks have electric charges of one-third or two-thirds, and their negatives, while the other particles have electric charges of zero, one, or negative one.

The harmonic pattern of evolution

Let us now recapitulate some central aspects of our research on the harmonic pattern of evolution, with a view to highlighting the suggestive parallels that emerge when comparing our proposal with string theory, which we have addressed in the preceding paragraphs.

To begin with, let us recall the general framework within which we are developing our hypothesis. We have stated that to achieve an integral understanding of the creative dynamics of evolution, it is necessary to consider at least three distinct realms within the One Reality: *non-dual absolute reality*, *potential relative reality*, and *spatiotemporal relative reality*:

—*Non-dual absolute reality*: Since all manifested reality inexorably appears in the form of interdependent dualities —object/subject, outside/inside, origin/end— we can understand them as polar manifestations of a reality that transcends them and is "prior" to that dualization. Physicists speak of infinite potential energy in the original quantum void, and sages speak of infinite diaphanous consciousness in the final mystical void. Our proposal is that these two voids are the same and unique absolute Emptiness, perceived by physicists objectively and by contemplatives subjectively, but which, in itself, is neither objective nor subjective, but the unity, identity, or indifference of both facets simultaneously.

—*Potential relative reality*: Since non-dual Emptiness completely lacks the slightest separation between subject and object, it cannot perceive itself in any way. Therefore, if it wishes to contemplate itself, it has no choice but to bifurcate into an original objective pole —basically energy— and a final subjective pole —basically consciousness— while fully maintaining its empty essence. Between the two poles, a vast spectrum of balances between both polar facets is instantly generated, running the gamut from the most basic states —of enormous energy and little consciousness— to the highest —of little energy and enormous consciousness. The different levels of this unified, entangled, archetypal, and potential spectrum of energy-consciousness are,

ISSN 1825-7968 2025, 1: 95-128

precisely, the “potential levels of stratified stability” that will be actualized, one after another, along the successive stages of universal evolution.

—*Spatiotemporal relative reality*: The entire spectrum of potential energy-consciousness —the universal wave function— is actualized —collapses— at each point-instant of the universal pixelated manifestation, recursively. In other words, the infinite and eternal Here-Now of the potential realm projects and identifies itself, instant after instant, in and as each finite and fleeting here-now of the manifested realm, in order to contemplate itself from that determined perspective and immediately return to its potential foundation. We can thus speak of a recursive toroidal dynamic, through which the entirety of the ever-present archetypal spectrum is progressively actualized and broken down in the world of space-time forms. In any case, we must not forget that everything happens in a single and same full Here-Now that encompasses within itself, entirely, all the illusory distances and durations of the dynamic cosmic hologram.

Within this general framework we have just outlined, the key to defining our "string theory of evolution" lies precisely in the leap from non-dual absolute reality to potential relative reality; that is, in the sudden polarization of fundamental non-dual Emptiness, which generates an illusory "distance" between the objective pole of energy and the subjective pole of consciousness, encompassing the entire spectrum of possible balances between the two facets. This "distance" between energy and consciousness is, precisely, the fundamental "string" of our hypothesis. The original pole of energy and the final pole of consciousness constitute the extreme "fixed points" of this integral, archetypal, and potential string we are proposing.

Well, when the polarization of non-dual Emptiness occurs, a bidirectional tension automatically arises between both extremes in an attempt to recover the original non-duality: an ascending and expansive current originating from the initial pole of "energy-(consciousness)" and a descending and contractive current originating from the final pole of "consciousness-(energy)". Both flows travel, in opposite directions, across the entire spectrum of potential levels of stability in which both polar facets are balanced, in different proportions. Moment after moment, these ascending and descending flows resonate with each other at a given level —a standing wave— of the energy-consciousness spectrum, thus "collapsing" the entire potential field into a specific event in the manifested world. This idea, as we have explained in other addenda, is clearly in tune with the entropic-syntropic theory of mathematician L. Fantappiè, and with the Transactional Interpretation of Quantum Mechanics of physicists J. Cramer and R. Kastner. All of this invites us to consider that the increase in complexity in the evolutionary process is not merely a product of chance, but a

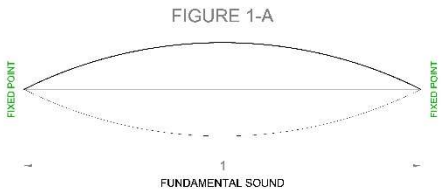
ISSN 1825-7968 2025, 1: 95-128

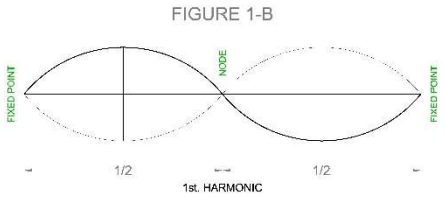
consequence of the joint work of expansive and entropic forces (forward in time) and cohesive and syntropic forces (backward in time), such that the unfolding of phenomena is no longer solely a function of initial conditions, but also depends on a final attractor. Although, of course, it should be clarified that the "temporal" language we are using is merely a semantic convenience to describe a process that is, in truth, instantaneous, since it does not occur in space-time but in the underlying potential unified field, which is, as we have said, timeless and spaceless.
The central theme of our evolutionary hypothesis revolves around the unexpected harmonic pattern in which these successive levels of stability of the potential energy-consciousness spectrum have emerged, one after another, in the manifested world. Let's recall some basic ideas of this hypothesis. The key to everything lies in standing waves, familiar to anyone who has played a musical instrument. The characteristic of these waves is that they divide the vibrating unit —string, tube, or hoop— into equal, complete sections. A guitar string, for example, having fixed ends, cannot vibrate in any old way; it must vibrate so that its ends remain motionless. This is what limits its possible vibrations and introduces integers. The string may undulate as a whole (see fig. 1-A), or in two parts (see fig. 1-B), or in three (see fig. 1-C), or in four, or in any other whole number of equal parts, but it cannot vibrate, for example, in three and a half or five and a quarter parts. In musical theory, these successive standing waves are called harmonic sounds.

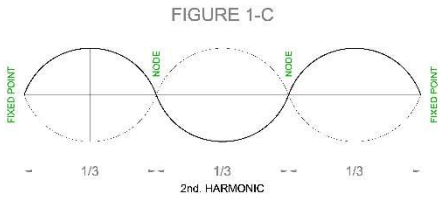
Let's imagine, for example, that a guitar string is tuned to the note C —the fundamental sound. If we vibrate half of its length —the first harmonic— we will obtain the same original note an octave higher. If we vibrate the third part —the second harmonic— we will obtain a different note, which in our case will be a G. That is, with the second harmonic, a new sound emerges. Taking the new note, in turn, as the fundamental sound, we can repeat the experiment as many times as we like, and thus, with each second harmonic, we will obtain successive, staggered new sounds. That is, vibrating one third of the length will produce a creative leap, and with the third of the third, another, and with the third of the third of the third, yet another, and so on. The unlimited series of these harmonics, starting from the "fundamental sound" of the entire original

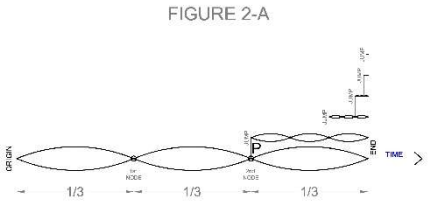
string, run exactly along the successive notes of the Pythagorean circle (spiral) of fifths, the entire hierarchy of levels of stability in the musical flow.

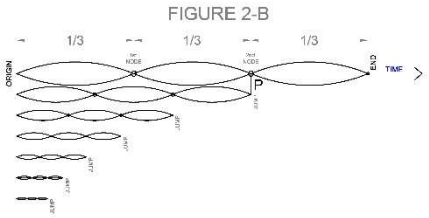
This simple fact provides the key to our hypothesis. The proposal is as simple as this: considering the entirety of time as a vibrating unit, the successive chained second harmonics, that is, the successive thirds of duration, will mark the emergence of evolutionary novelties. Or, to put it another way, the second harmonics will define those "potential levels of stratified stability" through which nature's creativity is channeled; that is, those rungs of the evolutionary ladder along which energy flows course in their ascending creative process of increasingly complex and conscious

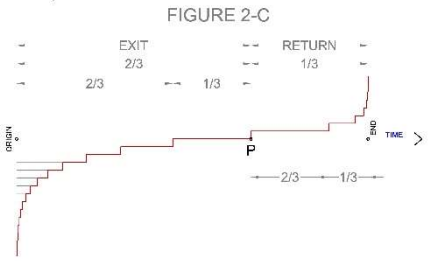












organisms. In Figs. 2-A, 2-B, and 2-C, we can graphically observe the overall process. Taking the entire temporal trajectory —from the "origin" to the "end"— as the fundamental sound, we have drawn the successive level jumps in both directions: in Fig. 2-B shows the section from the origin to the second node "P" of exteriorization —what is called the "exit" or "outward" section— and in Fig. 2-A, the stretch from that same second node to the end —the "return" or "inward" section. Fig. 2-C shows the joint trajectory, the global ladder of evolution.
In our research we have verified how, surprisingly, this simple scheme of chained harmonics fully fits the data provided by paleontology, anthropology, and history. Adjusting our theoretical framework with the dates of the appearance of matter —the

Big Bang— and organic life, we can see how the harmonic pattern marks the rhythm of emergence of each and every one of the stages in which the successive taxonomic levels of human phylogeny unfold: Kingdom: animal; Phylum: chordate; Class: mammal; Order: primate; Superfamily: hominoid; Family: hominid; and Genus: homo. The same then occurs with all the stages of maturation of our primitive ancestors: Homo habilis, H. erectus, archaic H. sapiens, H. sapiens (Neanderthal); and H. sapiens sapiens (Cro-Magnon). And the same thing happens again, once again, with the successive transformations experienced by humanity in its most recent history: the Neolithic, the Ancient Age, the Middle Ages, the Modern Age, and the emerging Postmodern Age. If, as we see, all these stages of Great History conform to the predictions of the harmonic pattern of rhythms, it is more than likely that our hypothesis can also give us the key to glimpse the successive stages that will unfold over the next few years, in a progressively accelerated process that will ultimately lead to a moment of infinite creativity —the Ω Singularity— in a couple of centuries, around the year 2217.

All of this is, indeed, unexpected and surprising, but it becomes practically definitive when we verify that the same harmonic pattern of rhythms that has behaved precisely when applied to the process of global evolution does the same when compared with the developmental process of each individual human being. Within the same timeframe, with the same pattern of unfolding and folding, passing through the same stages, our harmonic pattern of rhythms punctually, step by step, marks the successive phases of maturation of which embryologists and developmental psychologists speak, thus confirming the old idea of phylogenetic-ontogenetic parallelism and pointing, in a very concrete way, toward a surprising fractal and holographic universe.

Resonances between harmonic theory and string theory

Having made these brief approximations to our harmonic hypothesis of evolution and to the string theory of physics, we are in a position to suggest some clearly coincident points in both, and others that are probably disparate. But, overall, we believe that the two theories can be truly complementary and, therefore, mutually enriching.

The basic central idea in both proposals, each in its own field, is practically identical. String theory asserts that the different properties observed in elementary particles — mass, charge, or spin— are nothing more than a reflection of the various resonant patterns —the various “sounds”— in which a string can vibrate. Each of a string's

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preferred vibration patterns —each musical "harmonic"— corresponds to a specific particle. All matter and all the forces in the universe are ultimately nothing more than the manifestation of simple harmonic oscillations of a single basic microscopic object: tiny, string-like strands of energy. In the words of B. Greene: *"Here's the central fact: Just as the different vibrational patterns of a violin string give rise to different musical notes, the different vibrational patterns of a fundamental string give rise to different masses and force charges. As this is a crucial point, let's say it again. According to string theory, the properties of an elementary "particle" —its mass and its various force charges— are determined by the precise resonant pattern of vibration that its internal string executes."*

For its part, the harmonic theory of evolution reveals that the basic characteristics of each and every one of the fundamental stages of human phylogeny and ontogeny —both in the external and internal (energy/consciousness) aspects of individuals and collectivities (particles/interactions)— are defined by the successive second harmonics of the fundamental vibrating superstring —or integral brane— that constitutes the unified, entangled, archetypal, and potential field, source, support, and terminus of the entire phenomenal universe. Furthermore, it is precisely these linked second harmonics —the notes of the circle (spiral) of fifths— that mark the rhythm of emergence of the successive stages of global evolution and individual development, from the most elemental levels —simply energetic— to the highest —with progressive levels of complexity and lucidity.

Despite the difference in the language used in each of these proposals, the underlying resonance between them is obvious. On the other hand, as we have said, string theory investigates the most basic —fundamentally energetic— levels of the spectrum of manifested reality, while harmonic theory focuses primarily on the unfolding processes of life, mind, and spirit. Could these two theories be considered complementary approaches to a common reality? Would it be possible to harmonize both approaches to some extent? To clarify the situation, in the following sections we will briefly outline the perspective of the harmonic hypothesis on some of the key topics in string theory. In this way, by the end, the reader will have a few arguments to answer the questions we have just posed.

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—What are strings made of?

Within the world of string theory, there seem to be multiple answers to this question. Some physicists argue that strings are pure mathematical objects with specific properties and dynamics. That is, they believe they are simple numerical abstractions and therefore need no further explanation. Others, however, more optimistically, claim that strings, far from being mere metaphors or simple predictive devices, are, in fact, real objects, the tiny lines of energy that constitute the most basic form of existence, the fundamental and irreducible components of all matter and all the forces in the universe. They are not “made of” anything simpler. There is no object smaller than these strands of energy.

From the perspective of the harmonic theory we are developing, the panorama takes on new dimensions. As we have proposed, the ultimate reality of the universe —what we have called *non-dual absolute reality*— is "prior" to its polarization as energy-and-consciousness, such that this fundamental Void, in itself, is neither objective nor subjective, but the unity or identity of both facets. We could say, therefore, that the ultimate Void is, simultaneously and undifferentiatedly, potential energy and pure consciousness, that is, pure non-dual lucid light or luminous lucidity. Since there is no separation between subject and object in It, it cannot be perceived in any way —it is not "something" that can be seen by "anyone"— but, evidently, it is not "nothing" either, because, in fact, all entities in the universe —objective or subjective— are nothing other than partial and relative forms of this non-dual Void. Positivist science will never be able to access this intrinsically ineffable Void, because the mere attempt to describe it objectively places the researcher "outside" their non-dual realm. However, paradoxically, the Void we are speaking of, far from being a distant, mysterious, or unknown reality, is the closest, most intimate, and obvious experience of our existence. Is there anything more unquestionable than the Certainty-of-Being itself?... Do you, dear reader, doubt your own reality for a single instant?... Well, it turns out that this simple and pure, ever-present Self-Evidence that you are in your essence —prior to the slightest identification with any concrete form— is, precisely, the non-dual Emptiness that constitutes and encompasses all worlds. This simple Self-Evidence is the sole substance of the universe as a whole and of each and every entity that composes it! So, from this point of view, the radical answer to the question "*what are strings made of?*" can only be: "*strings —like all other things— are made of pure, self-evident Emptiness*". In any case, we'll try to give a less drastic answer below.

ISSN 1825-7968 2025, 1: 95-128

As we have explained, the ineffable *non-dual absolute reality* —pure formless Self-Evidence— if it wishes to contemplate itself in any way, has no choice but to bifurcate —apparently— into an objective pole —basically of energy— and a subjective pole —basically of consciousness— automatically generating a very broad spectrum of balances between both polar facets, which runs the gamut from the most basic states —of enormous energy and little consciousness— to the highest —of little energy and enormous consciousness—, and constitutes what we have called *potential relative reality*. Well, the entirety of this potential spectrum of subject-objective balances, created at the same original instant between the extreme fixed poles of energy and consciousness, is, exactly, the fundamental Superstring or integral Brane (i-brane) of our evolutionary hypothesis, whose vibrations give rise to all forms of universal manifestation. Let's look closely! According to our approach, this fundamental Superstring or integral Brane is a unified *potential* reality "prior" to its gradual *actualization* in space-time.

In a previous addendum, we mentioned that physicist and philosopher **R. Kastner**, extending the pioneering work of J. Cramer, has developed a new Transactional Interpretation of Quantum Mechanics, called Relativistic (RTI) or Possibilist (PTI), which holds that quantum wavefunctions do not so much move in the physical universe, but exist as "possibilities" in the multidimensional Hilbert space, from which transactions in the "real" universe emerge. Kastner proposes defining them with the term "potentia" —which Aristotle used to call the *capacity to be* something in the future—, in line with the statement by German theoretical physicist W. Heisenberg: "*Atoms or elementary particles are not real in themselves; they form a world of potentialities or possibilities, and not so much a world of things or facts*". Kastner calls for a new metaphysical category to describe these "not quite real possibilities", which, far from being mere abstractions, constitute a higher-dimensional world whose structure is described by the mathematics of quantum theory. The metaphor of the "iceberg" used by Freud to describe the human subconscious can equally be applied to the "ontological realm of possibilities" or "quantumland" proposed by Kastner. This "quantumland" refers to the mass of the iceberg that exists beneath our vision, while the tip, the space-time appearance, is only a small part of the entire physical universe. Quantum processes, although they occur outside of space-time, constitute a fundamental part of that universe.

Kastner's approach to an "ontological realm of possibilities" from which the concrete space-time world emerges is fully consistent with our proposal of a *relative potential reality* of harmonic sounds that is rhythmically actualized along the successive runs of

ISSN 1825-7968 2025, 1: 95-128

the evolutionary ladder. Similar ideas have been suggested from a wide variety of fields: physical, biological, psychological, spiritual, and so on.

For example, the physicist **D. Bohm**, clearly echoing this idea, postulates the existence of a fundamental reality —the "implicate order"— in which matter and spirit are unified, which unfolds, instant by instant, as the manifested universe —the "explicate order." Drawing on the surprising data of quantum physics, Bohm proposes the existence, at a very deep level, of an intrinsic order that, beyond space and time, envelops the totality of cosmic reality of relations. This intrinsic order would be projected at every instant into the manifest order, which, in turn, would be injected or introjected again, at every instant, into the intrinsic order. Bohm calls this continuous unfolding and folding between the implicate order and the explicate order "holo-movement," which constitutes the basic dynamic phenomenon from which all events of manifested reality in space-time emanate. The fundamental aspect of the implicate order is the simultaneous presence of a sequence of many degrees of involvement, while, on the contrary, in the explicate order all these degrees are present in an extended and manifest way.

Similarly, systems philosopher **E. Laszlo** posits the idea of an information field as the substance of the cosmos. Using the Sanskrit term *Akasha*, which the Hindu tradition uses to designate the ground that underlies all things and becomes all things, Laszlo calls this unified information field the "*Akashic* field". *Akasha*, he asserts, is a dimension in the universe that not only underlies all things within it, but also generates and interconnects them, preserving the information they have generated. It is the matrix of reality, the web of the world, the memory of the cosmos. *Akashic* cosmology conceives of the universe as an integral system that evolves through the interaction of two dimensions: a hidden or *akashic* dimension and an observable or manifest dimension. According to this model, the hidden dimension "in-forms" the manifest dimension, and the latter, in turn, "de-forms" the hidden dimension, modifying its information potential. This two-way interaction between the two dimensions constitutes a continuous loop of action and reaction, creating a progressive coherence in the manifest dimension, which, according to Laszlo, may explain why evolution is an informed rather than random process.

Deeply in tune with this, theoretical physicist **N. Haramein** posits a fundamental domain of information from which everything arises and to which everything returns. Nonlocal intercommunication, beyond any framework of space and time, is made possible by the unified spatial memory network formed by microwormholes of the basic holographic information field at the Planck scale. Memory and the recursive

ISSN 1825-7968 2025, 1: 95-128

feedback and feedforward information processes of the quantum vacuum —or holofield— enable learning and evolutionary behavior. The flow of dynamic information to and from this field may be the generative source of organized matter, self-organizing biological systems, and ultimately, self-aware entities. Haramein argues, in summary, that we live in a highly entangled and interconnected universe where a fundamental field of information, shared across all scales, drives evolutionary mechanisms in which the environment influences the individual and the individual influences the environment, in a non-local interconnected whole: a universe that is ultimately One.

Along the same lines, biochemist **R. Sheldrake** proposes a dynamic similar to Bohm's holomovement in which implicate, nonlocal, morphogenetic fields channel the collective memory of forms and behaviors to subsequent generations. Sheldrake places particular emphasis on the idea that the explicate order, in a way, enriches the implicate, time enriches eternity, because the finite contributes to the global order by reinjecting its contributions back into the whole. Each moment is a projection of the whole, but that moment is introjected back into the whole. The next moment involves, in part, a re-projection of that introjection, and so on. Thus, because each instant contains a projection of the reinjection of the preceding instants —constituting a certain form of memory— it resembles its predecessors, but is also distinct from them. According to this concept of projection and introjection, all entities in the universe are contributing to the deepest intrinsic nature, because we participate in the introjection of the manifest order into the implicate order, thus creating a higher order that, moment by moment, shapes the evolutionary dynamic.

This concept of a unified potential reality beyond space and time has been developed not only by researchers of the objective world of energy, but also by investigators of the subjective world of consciousness. Thus, for example, the psychiatrist **C. Jung** took up the medieval expression "*unus mundus*" —one world— to suggest the existence of an underlying unified reality from which everything emerges and to which everything returns. He asserted that it was extraordinarily probable that mind and matter were merely two different and complementary aspects of this transcendental *unus mundus*. Jung, together with the physicist **W. Pauli**, showed that the concepts of "archetype" and "synchronicity" reinforced precisely the existence of this underlying unity. Jung observed that the deeper layers of the psyche lose individual distinctiveness at greater depth —they become more collective— and that within this "collective unconscious" exist primordial dynamic patterns, which he called "archetypes." These archetypes are, in themselves, empty elements, virtualities, ideas in the Platonic sense, innate

ISSN 1825-7968 2025, 1: 95-128

tendencies, models devoid of content from which individual variations are formed. An archetype possesses, in principle, an invariable meaningful core that determines its mode of manifestation, but the way it is expressed in each case depends not only on this core but also on the material of the phenomenal world it relies on to make itself visible. Archetypes are not strictly psychic or material elements, but rather psychophysical realities belonging to the realm of the "psychoid", prior to a possible separation into those two domains that we perceive as split in our everyday reality. Archetypes would be part of that *unus mundus* that, according to scholastic philosophy, potentially contained matter and spirit and, therefore, could be understood as a realm of "spiritual matter" or "material spirit".

In resonance with this idea —the proposal to equate our *potential relative reality* with Bohm's "implicate order", Kastner's "quantumland", or Jung's "unus mundus"— psychologist **M. L. von Franz** argued that it was possible to apply Bohm's terminology to Jung's ideas, such that archetypes could be considered dynamic, unobservable structures of the implicate or folded order. Or, along the same lines, psychiatrist **S. Grof** has proposed that "*in an expanded version of holonomic theory, archetypes could be understood as sui generis phenomena, as cosmic principles woven into the fabric of the implicate order*".

After this brief recapitulation of various perspectives on *potential relative reality*, we are now ready to answer the question "*What are strings made of?*" in a less drastic and radical way than we did in our original answer: "*Strings —like all other things— are made of pure, self-evident Emptiness*". As we have explained, with the apparent polarization of fundamental non-dual Emptiness, an entire potential spectrum of subject-objective equilibria is instantly generated between the extreme fixed poles of energy and consciousness. It is precisely this **entire potential spectrum of energy-consciousness** that constitutes the **fundamental Superstring** or **integral Brane** (i-brane) of our evolutionary hypothesis, whose vibrations give rise to all forms of universal manifestation, from the most basic levels and dimensions —those of enormous energy and little consciousness— to the highest —those of little energy and enormous consciousness. As we have seen in the previous paragraphs, it is possible to contemplate this potential spectrum of energy-consciousness from a myriad of perspectives. It can be interpreted as the universal wave function, as Hilbert's multidimensional space, as the ontological realm of possibilities, as the potential quantum land, as the unified information field, as the implicate order, as the unified spatial memory network, as the morphogenetic holographic field, as the transcendental *unus mundus*, as the collective unconscious, as the world of psychophysical archetypes,

ISSN 1825-7968 2025, 1: 95-128

as the realm of the psychoid, as the world of Platonic ideas or intelligible world, as Whitehead's eternal objects...

The fact that this fundamental superstring has a potential and unified character has immediate implications. Let us recall, here, some phrases from B. Greene that we quoted earlier: "*Each elementary particle is composed of a single string —that is, each particle is a single string— and all strings are absolutely identical. Differences between the particles arise because their respective strings undergo different resonant vibrational patterns. What appear to be different elementary particles are actually different "notes" on a fundamental string*". Our proposal goes even a step further. We don't just say that *all strings are absolutely identical*, but we posit that **all strings are, in essence, a single and same potential superstring**, whose infinite possible modes of vibration actualize and collapse into the forms of different elementary particles and the rest of the entities in the multidimensional universe. If this proposal is correct, concepts such as "non-local reality", "entanglement", or "non-separability", so prevalent in texts on the quantum world, would be automatically clarified. After the laboratory verification of the so-called "EPR paradox", the existence in the real world of events that violate the old "principle of locality" —the assumption that two distant objects cannot influence each other instantaneously— has been demonstrated beyond a shadow of a doubt, thus confirming the "spooky action at a distance" so feared by Einstein. That is, if two particles have interacted at some point, the state of either will instantaneously affect the state of the other, regardless of the distance separating them. Since, as we are proposing, all elementary particles are nothing more than different vibration modes of a single fundamental potential superstring, this synchronized mode of behavior between entangled particles, far from being a spooky and inexplicable phenomenon, turns out to be a completely logical and natural occurrence. Because, as we have said, each point-instant —each finite and fleeting here-now— of the universal pixelated manifestation is nothing other than a sonorous expression of the same and unique infinite and eternal Here-Now of the potential integral brane, through which the ineffable non-dual, timeless and spaceless Emptiness tries to contemplate its invisible face in infinite ways, instant after instant… here-now… here-now… here-now…

—Where are the extra dimensions?

We have previously explained that a mathematically consistent string theory requires the existence of additional dimensions beyond the four we are familiar with in everyday

life: three spatial and one temporal. The mathematics of string theory requires that the universe have at least six more dimensions. If these extra dimensions truly exist… where are they? Physicists use the idea of "compactification" to construct models in which space-time appears to be four-dimensional. Through this compactification, the six or seven additional dimensions are supposed to fold in on themselves to form tiny, imperceptible circles. These dimensions are so curved, folded, and coiled around themselves within the Planck length that, even if they are present, they are undetectable with current technology. Another approach to reducing the number of dimensions is through brane theory, an extension of string theory that includes multidimensional objects, called branes. These branes generalize the idea of particles and strings to entities that can have more dimensions. Thus, for example, a 0-brane is a zero-dimensional entity —a point particle—, a 1-brane is a one-dimensional entity —a line or string—, a 2-brane is a two-dimensional entity —a surface or membrane—, a 3-brane is a three-dimensional entity —a volume—, and a p-brane is a p-dimensional entity.

In the initial summary of the harmonic theory of evolution, we saw how the leap from non-dual absolute reality to potential relative reality —that is, the sudden polarization of fundamental non-dual Emptiness— generates an illusory "distance" between the original objective pole of energy and the final subjective pole of consciousness, encompassing the entire spectrum of possible balances between the two facets. It is precisely this entire potential spectrum of energy-consciousness that constitutes the fundamental superstring or integral brane (i-brane) of our evolutionary hypothesis, whose vibrations give rise to all forms of universal manifestation, from the most basic levels and dimensions —those of enormous energy and little consciousness— to the highest —those of little energy and enormous consciousness. In the verification of our hypothesis, we have seen how, starting from the fundamental sound of the complete superstring, the successive chained second harmonics mark the characteristics and the rhythm of emergence of each and every one of the basic stages of the evolution of human phylogeny —according to the data provided by paleontology, anthropology and history— and of the development of our ontogeny —according to the data provided by embryology and developmental psychology.

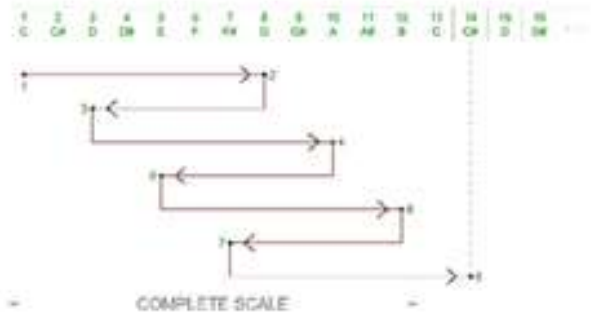
At this point, we'd like to include one more piece of information of particular interest to the topic we're discussing. When we previously explained the emergence of chained second harmonics, we said that if the guitar string in our example is tuned to the note C, its second harmonic —1/3 of its length— will be a G. Similarly, the second harmonic of this G will be a D. And that of this D will be an A. And if we repeat the

ISSN 1825-7968 2025, 1: 95-128

operation indefinitely, we'll obtain a chain of sounds —C, G, D, A, E, B#, C#, G#...— which are, exactly, the successive notes of the Pythagorean circle (spiral) of fifths. If, as we've seen, each note in this chain constitutes the characteristic sound of a given stage of evolution, with each third of the duration we obtain a new sound and, therefore, an evolutionary leap. Fig. 3-A indicates the successive fundamental sounds with their corresponding harmonics, and fig. 3-B indicates the order in which the chained second harmonics appear. As we can see, every seven leaps the original scale is surpassed and the same series of notes begins to repeat itself a semitone higher.

FIGURE 3-A

FIGURE 3-B



In our testing of the harmonic hypothesis against the evolutionary data, it can be seen how the transitions between these successive series of seven consecutive harmonics correspond exactly with the emergence of self-organized **life**, the self-conscious **mind**, and the self-reflective **intellect**. In a previous addendum, we outlined the entire evolutionary process by stating that at the original pole, the consciousness aspect was completely absorbed by the **energy** aspect, so that the entire journey since then has

ISSN 1825-7968 2025, 1: 95-128

been nothing but a progressive distancing and disidentification of the subjective from the objective side. In short, during the early stages of **matter** development, the consciousness side is absorbed by the energy side; with the emergence of **life**, the consciousness side leaps backward, separates itself from mere matter, perceives it, and can thus act upon it. With the emergence of the human **mind**, the conscious aspect leaps inward once more, and self-awareness appears, separating itself from mere subconscious life and thus increasing the capacity for action on the natural world. With the emergence of the rational **intellect**, the conscious aspect leaps back once more, allowing us to think about thought, thus exponentially increasing our understanding of how things work and, therefore, our capacity for intervention. This entire process is made possible by the presence, from the very original moment, of pure consciousness —the **Witness** of which Hindu tradition speaks— as the final pole.

In philosophy and systems theory, a holon is an entity that is simultaneously a whole and a part of a larger whole. That is, a holon is a system that has its own characteristics as an individual entity, but is also part of another, larger system. A dynamic hierarchy of holons is called a holarchy. According to our approach —recall— in the evolutionary universe, two antagonistic holarchies exist simultaneously: a decreasing and entropic holarchy of energies, in which maximum capacity is found at the original pole A, and a growing and syntropic holarchy of consciousnesses, in which maximum capacity is found at the final pole Ω. Describing the overall trajectory from an "inner" perspective, we have spoken of a holarchic process of consciousness that, starting from its absorption or identification at the original moment with the "external" facet of energy, progressively leaps "inward," generating successive emergent holons of greater depth, breadth, and lucidity, which, one after another, transcend and include all their predecessors. In essence, the process unfolds the basic potential of each and every successive structure of the evolutionary nested holarchy, avoiding exclusive identification with any one of them and embracing the entire spectrum already traversed, until finally reaching the pure Witness —the essence of consciousness of each and every level of development— which transcends and includes the entire process. This holarchic dynamic of consciousness has been described in detail by some authors —such as Sri Aurobindo and Ken Wilber— who have investigated, both experientially and theoretically, the final stages of this path of deepening into inner space.

Our proposal is that these **successive holons of the great evolutionary holarchy** are, precisely, the dynamic structures that unfold in the manifested universe, one after another, the **basic dimensions of the fundamental potential superstring or integral**

ISSN 1825-7968 2025, 1: 95-128

brane (i-brane). At the same original moment in which the apparent polarization of the fundamental non-dual Emptiness takes place, the entire spectrum of energy-consciousness is instantaneously generated between the extreme poles, with **all potential overlapping levels and dimensions present simultaneously**. Therefore, we call this fundamental potential reality the integral brane (i-brane). It is through the evolutionary process that these potential levels and dimensions are actualized, one after another, in and as the manifested world. Using the language of brane theory, we could say that after the original point-instant or 0-brane of dimension 0 —a point—, the one-dimensional 1-brane —a line or string—, the two-dimensional 2-brane —a surface or membrane—, the three-dimensional 3-brane —a volume—… and so on, successively, through the p-dimensional p-branes with p values up to 9 or 10, begin to emerge. The key that we want to highlight in this process is the fact that each of the successive branes transcends and includes the previous one, that is, the line transcends and includes the point, the surface transcends and includes the line, the volume transcends and includes the surface… Applying —and expanding— this idea to our evolutionary holarchy, we can pose the **chain of holons** as the **progressive dynamic expression of the basic dimensions of the fundamental potential superstring or integral brane**: 1) one-dimensional holon —strings or elementary particles—, 2) two-dimensional holon —atoms—, 3) three-dimensional holon —molecules (matter)—, 4) four-dimensional holon —cells (life)—, 5) five-dimensional holon —self-conscious beings (mind)—, 6) six-dimensional holon —rational beings (intellect)—… Ω) integral holon —transpersonal Witness. Everything seems to indicate that, ultimately, the purpose of cosmic dynamics is none other than to manifest in the world of forms, level after level, the entire spectrum of energy-consciousness of the potential foundation, in order to finally integrate, simultaneously, from the original pole of energy to the final pole of consciousness, thus revealing its intrinsic non-duality.

ISSN 1825-7968 2025, 1: 95-128

Figs. 7-A and 7-B show how the harmonic pattern in which the successive levels and dimensions of the basic energy-consciousness spectrum emerge is identical both in the process of unfolding human phylogeny —macrocosm— and in the process of unfolding its ontogeny —microcosm. The x-axis represents the temporal dimension, and the y-axis represents the multiple levels and dimensions of the basic energy-consciousness spectrum —that is, the evolutionary holarchy or "great chain of being". The only differences between the two graphs are, on the one hand, obviously, the time scale of each process, and, on the other, the level of the energy-consciousness spectrum at which the fundamental sound is located in each case. In the phylogenetic process of our species —in the macrocosm— the boundary is located at the interface between

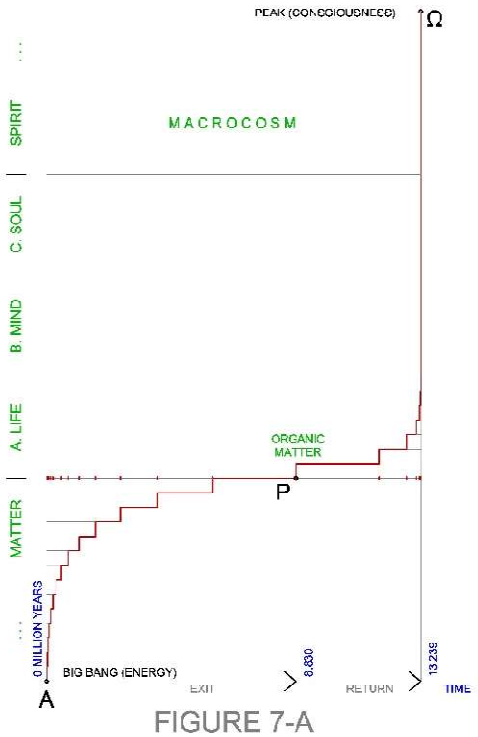


FIGURE 7-A

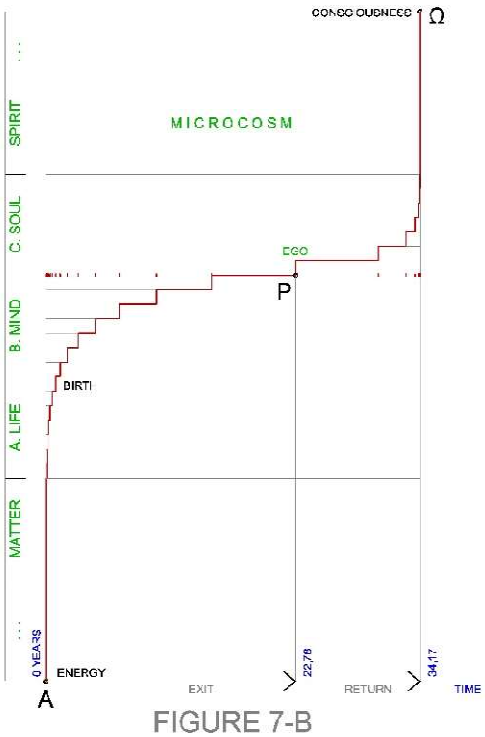


FIGURE 7-B

"matter" and "life," and in the human ontogenetic process —in the microcosm— it is located a couple of steps higher, between the "mind" and the "intellect" (or soul).

The entropic-synchronic theory and the transactional interpretation of quantum mechanics (see Fig. 15) allow us to understand how all events in the space-time universe arise, instant after instant, through the simultaneous and coordinated action in the potential realm of ascending flows from the original pole of energy and descending flows from the final pole of consciousness. These flows, resonating with each other at a specific level—high or low—of the energy-consciousness spectrum, "collapse" the

ISSN 1825-7968 2025, 1: 95-128

integral potential brane of the unified foundation into a specific finite brane of the manifested world. According to this scheme, the string theory proposed by physicists focuses its investigations on the lowest level of this spectrum of universal manifestation, on the one-dimensional brane of elementary particles, and asks about the location of the six or seven additional dimensions needed for the theory to be mathematically consistent. Where are these extra dimensions?

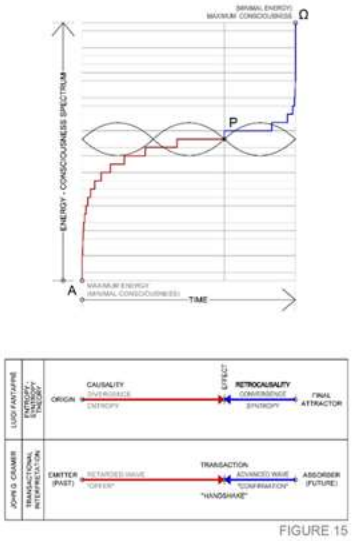


FIGURE 15

At this point, we believe that harmonic theory is in a position to provide a possible answer to this question. According to our approach, all dimensions of the manifested universe are fully present —from the very original instant in which the apparent polarization of the essential Void takes place— in the same and unique fundamental superstring or basic integral brane, in a unified, overlapping and potential form. The entire process of universal evolutionary manifestation is nothing other than the gradual actualization and unfolding of these potential levels and dimensions, through the collapse, instant by instant, of the basic integral brane into and as the successive forms of the great evolutionary holarchy —1-branes (particles), 2-branes (atoms), 3-branes (molecules), 4-branes (cells)…— which integrate more and more dimensions through progressively complex and conscious entities and organisms. In short, all dimensions are *potentially* present at every point-instant (0-brane) of the universal void, and *manifestly* present, progressively, in the successive levels of the evolutionary holarchy. This is the key to the great cosmic hologram in which we inhabit: the information of the *whole* is fully and potentially present in the most insignificant *part* of universal manifestation.

ISSN 1825-7968 2025, 1: 95-128

—A bold observation

In 1988, physicist Paul C. W. Davies and science journalist Julian Brown published a book titled *Superstrings: A Theory of Everything?*, which compiled a series of interviews conducted on the BBC with some of the most prominent proponents and opponents of string theory. Below, we reproduce some excerpts from the interview with theoretical physicist **John Ellis**. [The page numbers correspond to the Spanish version of the work, published by Alianza Editorial, in Madrid, in 1990.]

P. 196: (**J. E.**) *I think it's good to think in terms of classical strings, ... like, say, violin strings. We know that when you pluck a violin string, it can oscillate at many different frequencies —that it has different harmonics. The superstring is something like that. The different kinds of elementary particles, we think, will correspond to the different ways in which this loop can oscillate, quite similar to the different notes you can play on the same violin string. There are in fact, in principle, an infinite number of different ways in which the superstring can oscillate. ...* (Q) Are you saying **that the difference, say, between an up quark and a down quark is more or less entirely due to the different pattern of motion that occurs around that little loop?** (**J. E.**) *Correct. ...*

P. 198: (**J. E.**) *In fact,* ***what we call electric charge would be some kind of collective property of the string as a whole, and if the string were to oscillate in different ways, then it would appear to have a different electric charge.*** *...* (Q) In other words, **electric charge could be viewed as a quality of the string's motion, rather than something we simply add to a fundamental particle or object.** … (**J. E.**) *Yes, I think that would be a good way to think about it.* (Q) People often wonder about what electric charge is, and usually you can't say anything more than it's just a fundamental property, but you seem to be saying that **we could explain electric charge in terms of a kind of dynamics.** (**J. E.**) *Let's recall what we actually mean by electric charge. What we understand is that there's a field called the electromagnetic field, and that's what couples to electric charge and is responsible for holding electrons around the nucleus, or is responsible for radio waves, for example. Electromagnetic fields are, in fact, associated with particles called photons. These photons are, in turn, a different mode of oscillation of the string, exactly the same way that the electron is some mode of oscillation of the string. So,* ***what we call electric charge is really a coupling between different pieces of string that are oscillating in slightly different ways****, and the photon is no more or less elementary than the electron*. [**Bolding** added.]

ISSN 1825-7968 2025, 1: 95-128

Let us point out, at this point, a curious resonance that seems to occur between what we have proposed in our harmonic string theory and the ideas just presented by J. Ellis. (We apologize, in advance, for being so bold.) We know that an **up quark** has an electric charge equal to +2/3 of the elementary charge, that is, **+2/3 e**. We also know that a **down quark** has an electric charge equal to −1/3 of the elementary charge, that is, **−1/3 e**. Recall that these up and down quarks are the elementary particles that make up protons and neutrons, which form the atomic nuclei of all known matter (a proton is made up of two up quarks and one down quark, and a neutron is made up of two down quarks and one up quark). Similarly, the other quark pairs —charm and strange and top and bottom— have the same electric charges as up and down, that is, **+2/3 e** and **−1/3 e**.

In the previous section we said that the entire process of universal evolutionary manifestation is nothing other than the **gradual actualization and unfolding of the potential levels and dimensions of the basic integral brane, through successive collapses**, instant after instant, in and as the entire spectrum of forms of the great evolutionary holarchy, **starting with 1-branes (one-dimensional strings or particles)**, 2-branes (atoms), etc. We have also explained how these collapses originate in the potential superstring of primordial energy-consciousness by the resonance between the ascending flows coming from the original pole of energy and the descending flows coming from the final pole of consciousness, and they take place at a specific level of the energy-consciousness spectrum, starting from the lowest levels —1-branes— and gradually ascending to the Ω level. Let's look closely!, —remember fig. 15— in all cases where resonance occurs between these two antagonistic flows, the **ascending section** covers 2/3 of the entire string (i.e., **+2/3**) and the **descending section** covers 1/3 of the same string (i.e., **−1/3**)… doesn't this remind you of something?

Among the quotes from the interview with J. Ellis are: "*What we call electric charge would be some kind of collective property of the string as a whole*", "*Electric charge could be seen as a quality of the string's motion*", and also "*The difference, say, between an up quark and a down quark is more or less entirely due to the different pattern of motion occurring around that small loop.*". Doesn't all this sound a bit too similar to our harmonic string theory? Is it possible that these similarities are more than mere coincidences? Could there be something truly significant in these parallels? I'm not a physicist and therefore in no position to answer these questions. So, if any string theorists have the patience to read this addendum, it goes without saying that I, for one, would be delighted to hear their opinions. You tell me!

ISSN 1825-7968 2025, 1: 95-128

—Open and closed strings

Most versions of string theory involve two types of string: open strings, which form segments with two unconnected endpoints, and closed strings, which form circular loops. The former are topologically equivalent to a line interval, and the latter are topologically equivalent to a circle. Not all string theories contain open strings, but every theory must include closed strings, since interactions between open strings can always result in closed strings. Strings, both open and closed, interact with each other by splitting and joining. A closed string can split into two open strings, or two open strings can join to form a closed string. Strings can also form triplets of open, closed, or half-closed strings. Discoveries in string theory in the 1990s showed that open strings must always be the terminus of a class of objects called D-branes —a particular class of the p-branes we've been discussing— and the range of possibilities for open strings has greatly expanded. Since energy flows along strings, it can slip to one of their endpoints and disappear. This poses a problem, since conservation of energy dictates that energy cannot disappear from the system. Therefore, a consistent string theory must include places where energy can flow away when it leaves a string. These objects are, precisely, D-branes. Any version of string theory that allows open strings must necessarily incorporate D-branes, and all open strings must have their endpoints attached to these D-branes.

In our harmonic theory of evolution, we have also raised the two types of strings, both open and closed. In our case, the issue relates to the specific characteristics of the strings' endpoints. As we have seen, the fundamental potential superstring or integral multidimensional brane arises from the apparent polarization of non-dual Emptiness into an initial objective pole —basically of energy— and a final subjective pole —basically of consciousness— while fully maintaining its empty essence. All manifested reality is, therefore, infallibly subject-objective. There is no objective universe out there, apart from the observer who contemplates it. Everything, ultimately, is nothing more than an endless number of relative, apparent, and illusory perspectives of the absolute, ineffable, and non-dual Emptiness upon Itself, which arise and disappear moment after moment, through the interaction between the poles of energy and consciousness.

As we have explained, the apparent separation between these poles of energy and consciousness automatically generates a potential superstring that connects them and encompasses the entire spectrum of possible balances between both facets. Therefore, any subject-object interaction between two points, near or far, in the manifested world

ISSN 1825-7968 2025, 1: 95-128

occurs through a potential vibrating string between them, which collapses, instant after instant, into a certain level of the great holarchy of the universe, depending on the location of the centers of gravity of the entities or organisms that act as "subject" and "object" in this interaction. When the relationship occurs between supposedly independent entities, we can speak of "open strings", while when the connection occurs within a single entity or organism, we must speak of "closed strings", although —according to our approach— all strings are ultimately always closed, since all subjects and objects in the universe are, in truth, nothing more than polar expressions of a single, non-dual Emptiness.

In the addendum on toroidal evolution, we explained how any subject-objective interaction is, ultimately, a closed dynamic between the Void and forms. Let's recall a couple of ideas we presented earlier at this point. We said that the original quantum void proposed by physicists and the final mystical void experienced by contemplatives are none other than the same and unique Emptiness, perceived by physicists objectively and by contemplatives subjectively, but which, in itself, is neither objective nor subjective, but rather "prior" to that dual perspective. Similarly, we stated that non-dual Emptiness, in its attempt to see itself, apparently dualizes itself as an original pole —basically energy— and a final pole —basically consciousness—, thus generating an illusory distance between the two. But, we insist, this alleged space-time distance between the two poles is completely illusory, because in reality everything happens in the same and unique Here-Now, a-spatial and a-timeless of the ever-present Emptiness.

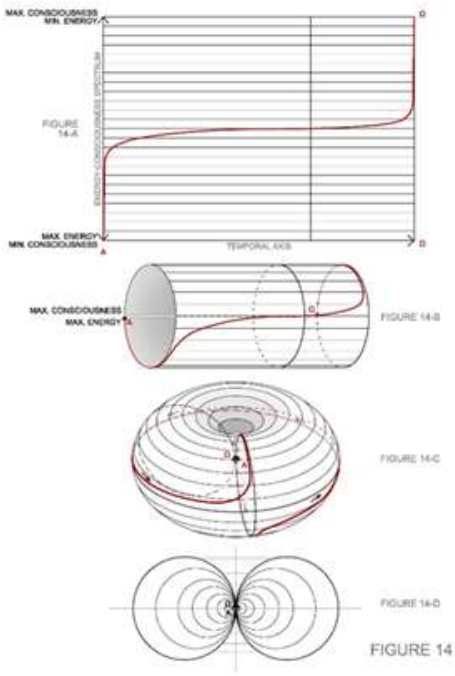


FIGURE 14

ISSN 1825-7968 2025, 1: 95-128

If we wish to graphically reflect these two ideas in any of the linear figures we have used up to this point —for example, in Figs. 7-A and 7-B, which previously schematized the global trajectories of universal evolution and individual human development, from the A pole of original energy to the Ω pole of final consciousness— we will have to perform a couple of maneuvers on that flat surface on which we have represented both graphs (see Fig. 14-A). First, if we have posited that energy and consciousness are not two different realities but merely the objective and subjective aspects of the same, single, ever-present Emptiness, we should unify the horizontal lines at the base and summit of the graph, since, as we have said, they represent, respectively, the levels of maximum energy and maximum consciousness, which are one and the same in fundamental reality. To do this, simply fold the flat surface of the drawing over itself, matching the upper line with the lower line, thus obtaining a cylinder (see fig. 14-B). Next, if we have stated that the temporal distance between the original instant A and the final instant Ω is illusory —since everything happens in the timeless Now— we should also unify the vertical lines on the left and right of the graph, since, as we have said, they represent, respectively, the original and final moments of all evolutionary and developmental processes. To do this, we must again fold our cylinder over itself until the extreme vertical lines coincide, thus obtaining a figure similar to a "doughnut" in which the central hole is reduced to a dimensionless point. This is what in geometry is called a "horn torus" (see Fig. 14-C). Considering what we have just explained —taking to their ultimate consequences the patterns that have been revealed in our research— everything points to a fascinating toroidal dynamic of energy-consciousness, instantaneous and eternal, as the key element for the integral understanding of the universe. According to this scheme, the flows originate from a dimensionless Center —on its A facet— follow a spiral trajectory —divergent vortex—reach the outer surface of the torus, and return to the same Center —on its Ω facet— through another spiral —convergent vortex—, from where they restart their interminable process.

It is essential to understand, here, the ultimate meaning of this central point of the "horn torus" we are proposing, for therein lies the seed of everything else. As we have seen, this Center is deduced, on the one hand, from the unified understanding of the infinite potential energy of the quantum void and the unlimited pure consciousness of the mystical void, and, on the other, from the perception of the illusory nature of time, and therefore, from the absolute simultaneity of the original pole A and the final pole Ω of all processes. The Center of this toroidal dynamic, which manifests as the space-time

universe as a whole and as each and every one of the structures that compose it, is, therefore, the same and unique non-dual Emptiness, formless, unlimited, timeless, ineffable, empty, and full, the source and goal of all worlds, absolute potentiality. We insist, this non-dual Center is one and the same in everything and everyone, its true nature, its ultimate identity.

We have previously proposed that the vibration of the illusory potential superstring of energy-consciousness created between the poles A and Ω generates, from the very original instant, a specific fundamental sound and a whole range of harmonics, which constitute the entire spectrum of archetypal potential levels and dimensions that are actualized, step by step, throughout evolution and history. Well, this same multi-leveled scheme of energy-consciousness that we have proposed in the potential superstring or integral brane of our hypothesis must now be applied to that vibrating "horn torus" that, as we have proposed, generates the entire universal process. We would then find ourselves with a toroidal dynamic deeply nested in an endless number of levels and dimensions —like a "matryoshka"— from the minuscule Planck scale to the cosmic totality, thus reflecting the radical fractal structure of the universe (see Fig. 14-D). The fundamental characteristic of this fascinating nested torus lies in the fact that the center is common and identical in all its levels, so that all universal flows, whatever the level or dimension of the energy-consciousness spectrum through which they unfold, begin and end in that ineffable non-dual center that unifies in itself the facets of source —A— and receptacle —Ω— of all worlds.

—A theory of everything?

As we have previously discussed, quantum mechanics accurately describes the microscopic structure of elementary particles, while general relativity masterfully explains the macroscopic activities of the universe. The problem facing physicists is that both theories, beautiful and effective when applied in their respective fields, turn out to be profoundly incompatible with each other. Given this situation, string theory —or M-theory— appears today as the strongest candidate to resolve this problem, as it has been able to develop a general framework with the potential to unify not only all the fundamental forces of nature —including gravity— but also the entire Standard Model of particle physics, in a manner consistent with the laws of quantum mechanics and general relativity, thus allowing for a unified explanation of both quantum and cosmological phenomena. Given the enormous potential and elegance of string theory,

ISSN 1825-7968 2025, 1: 95-128

many physicists hope that it will eventually develop to the point of fully describing our universe, becoming the definitive theory, the true "Theory of Everything" (or ToE)… but what exactly does the word "everything" mean in that expression?

Below, we will copy a couple of paragraphs from the "Note to the Reader" with which Ken Wilber begins his book *A Theory of Everything*, published by Ed. Kairós, in Barcelona, in 2001:

"*It is said that vibrating strings exist inside quarks, which constitute the fundamental units behind everything. But if this were so, it would be a strange and rather anemic totality, quite alien, moreover, to the richness of the everyday world. Strings may well constitute an important —even fundamental— part of the world, but in no case does it seem to be a very significant matter. You and I know that, if strings exist, they constitute only a small part of the overall picture, and we know this every time we look around, every time we listen to Bach, make love, are startled by a crash of thunder, are enraptured by a sunset, or contemplate a shimmering world that seems composed of something much larger than these thin, one-dimensional microscopic bands…*"

"*The Greeks had a beautiful word, Kosmos, which means the patterned Whole of all Existence, including the physical, emotional, mental, and spiritual realms. In their view, ultimate reality, then, was not so much the cosmos (the strictly physical dimension) as the Kosmos (which includes the physical, emotional, mental, and spiritual dimensions altogether). Kosmos referred not only to inanimate, insentient matter, but to the living Totality composed of matter, body, mind, soul, and spirit. If there is to be a true ToE, it must not focus exclusively on the cosmos but on the Kosmos! What has happened is that modernity has ended up reducing the Kosmos to the cosmos, the totality composed of matter-body-mind-soul-and-spirit to matter, to the point that, in the bland and anodyne world of scientific materialism, we are content with the idea that a theory that unifies the physical dimension really is a ToE…*"

As we explained previously, the entire process of universal evolutionary manifestation is, according to our approach, nothing more than the gradual actualization and unfolding of the entire range of dimensions that are present, unified, and overlapping, potentially, in the fundamental integral brane from the very original instant. Through repeated collapses, all these potential levels of the fundamental energy-consciousness spectrum unfold orderly in and as successive holons of the great evolutionary holarchy, starting with the most basic: the 1-branes (one-dimensional strings or particles), the 2-branes (atoms), etc. Up to now, the work of physicists developing string theory has focused almost exclusively on the lowest level of this spectrum, that is, on the one-

ISSN 1825-7968 2025, 1: 95-128

dimensional strings that manifest as the elementary particles of the Standard Model... and what about the rest of the spectrum?

As we have explained, our harmonic string theory of evolution has expanded the field of investigation of the string theory of physics to encompass the entire spectrum of manifested reality, from original energy to final consciousness, including all levels and dimensions in between, whether material, vital, mental, intellectual, or spiritual. By expanding the scope of study, it has become strikingly apparent how a simple harmonic pattern —the series of "notes" that constitute the Pythagorean circle (spiral) of fifths— brings about the emergence of each and every level of the process of evolution and development. It seems that Greene's "elegant universe" is, indeed, even more "kosmic", simple, and elegant than expected! Our research, on the other hand, has not only expanded the field of study to include the entire range of dimensions deployed throughout the evolutionary process, but has done so from an integral perspective, that is, taking into account the "external" and "internal" aspects of "individuals" and "collectivities." This has allowed us to trace the "harmonics" characteristic of each level of the spectrum, both in the organic and in the psychological, sociological, and cultural spheres. To complete the picture, harmonic theory has also included in its research space the potential spectrum of energy-consciousness —the fundamental superstring or integral brane— and, ultimately, non-dual Emptiness, that is, the simple, pure and ever-present Self-Evidence that is the true essence of everything and everyone in this fascinating game of universal manifestation.

String theory, as we have discussed, faces a significant challenge that it has yet to solve: there is no direct experimental evidence to support its predictions. The theory is mathematically compelling, but, for the moment, it remains impossible to test empirically. Given the unimaginably tiny size of strings and the unattainable energy scales at which they operate, to date there has been no way to verify in any way that string theory is a correct description of nature. From the integral perspective of the harmonic theory of evolution, it can be seen that the string theory of physics has focused its work almost exclusively on the lowest level of the spectrum of manifested reality, and, furthermore, it has done so only on the "external" aspects of "individuals" (elementary particles) and "collectivities" (interactions). Considering the enormous energies at play and the virtually complete lack of awareness at these levels of the manifestation spectrum, it is almost impossible, at least for now, to verify its proposals, either objectively or subjectively. If string theory were to expand its field of study —along the lines of the harmonic theory we are proposing— the panorama would change completely…

ISSN 1825-7968 2025, 1: 95-128

An integral string theory, which unifiedly investigated the entire spectrum of manifested reality, would allow for an exponential expansion of the possibilities for verifying the theory in countless areas, past or future, internal or external, individual or collective. For example, our harmonic hypothesis of evolution, by proposing very specific predictions about the events that will take place over the next two centuries on the accelerated journey toward the pole of the Singularity Ω, can be considered a fully scientific proposition, since any of its predictions in the various areas of manifested reality is completely falsifiable. Even the non-manifested spatiotemporal areas —*potential relative reality* and *non-dual absolute reality*— can be approached from very diverse perspectives, both theoretical and experiential, both objective and subjective. Recall the universal wave function, Kastner's potential "quantum land", Hilbert's multidimensional space, Bohm's implicate order, Sheldrake's morphogenetic holographic field, Haramein's spatial memory network, Laszlo's unified information field… This same realm —the potential energy-consciousness spectrum of the fundamental superstring— can also be approached from an inner perspective. Let us recall the world of psychophysical archetypes or Jung's collective unconscious, the intelligible reality or world of Platonic ideas, the eternal forms of the Akashic records of Eastern traditions, the vasanas of Yogachara Buddhism… Even the ineffable non-dual Emptiness —which positivist science will never be able to access, because the mere attempt to describe it objectively places the researcher "outside" its non-dual sphere— has been experienced by countless "awakened" beings in all the great non-dual traditions of wisdom, such as in philosophical Taoism, in Hinduism (Advaita Vedanta, Kashmiri Shaivism), in Mahayana Buddhism (Ch'an, Zen), in Vajrayana Buddhism (Mahamudrā, Dzogchen), in Judaism (Kabbalah), in Christianity (Rhenish and Castilian mysticism), in Islam—Sufism—… It seems that the time has come to break the narrow confines of the materialist paradigm and begin to propose broader worldviews, capable of integrating, without prejudice, all the facets in which the unfathomable Emptiness unfolds. Perhaps, in the end, we will discover that reality —our true reality— is far more fascinating than we could have ever imagined.