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This article was originally published in : Advances in Systems, Signals, Control and Computers. Vol. 3. Pages 119-123. 1998 (symposium). Centre for Engineering Research, Technikon Natal, Durban, South Africa. Copyright by the Publisher: IAAMSAD and the South African branch of the Academy of Nonlinear Sciences. The version presented here has been extensively revised.

The Fractal Organization of Nature

Part 6. Summary (4 Conservation Laws Code in Triplets)

(I recommend the reader consult the "preface" or "guide" to this paper, which may be found at ["About the Papers: An Introduction"](#) (section III)).

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Abstract

(revised Feb., 2009)

(See: [The Fractal Organization of Nature \(Table\)](#))

A General Systems model of the Universe is presented, based on a fractal paradigm. A 4x3 "metric" or fractal algorithm is proposed as the organizing principle of the Microphysical, Biophysical, Astrophysical, and Metaphysical realms. The algorithm is expressed through the conservation laws and forces of physics, the families of elementary particles, the dimensions of spacetime, the quantum rules of atomic order, the structure of baryons, alpha particles, carbon atoms, carbon's molecular and crystal bonds, DNA, the genetic code, gravitation, and the nucleosynthetic pathway of stars. The human mind has discovered this order both intuitively and rationally, where it finds expression in the 4x3 (and 4x4) patterns of mythological, occult, religious, philosophical, and scientific "world systems" and cosmologies.

A general model of the human "[metaphysical realm](#)", and a model of the [unified field theory](#) are presented as examples of how the fractal algorithm may be used in system modeling. In its most general form, the 4-part algorithm consists of an input of energy, followed by two complementary conservation modes, concluding with a restorative force which either returns the system to its original state, or elevates it to a "harmonic complexion" or resonant analog of the original state (the various levels of the model

hierarchy).

Introduction

The concept of hierarchical order is fundamental to General Systems theory (Bertalanffy, 1968). The exposition of fractal geometry (Mandelbrot 1983) raised a new paradigm of natural order which offered a theoretical and mathematical basis for systems generally and their hierarchical characteristics specifically: it is the fractal nature of the Universe we see in its hierarchical structure, systemic character, and organic connectivity. Self-similar replication and harmonic resonance are natural features of fractal structures and organizations.

Physical evidence for the operation of a universal 4x3 fractal algorithm producing a resonant cosmic order is presented in [table 1](#). This is a hierarchical arrangement which encompasses 4 realms: Microphysical, Biophysical, Astrophysical, and Metaphysical (human conceptual). The fractal algorithm which produces this hierarchy is a 4x3 complex drive created by free energy in four conservation modes: entropy (dimensionality), raw energy (mass), symmetry (charge), and causality (the "Interval"). The emergent properties of this system in operation often require a 4x4 representation, including "Information".

Each realm of the hierarchy is characterized by a dominating center of mass, energy, or information, the site of the 4x3 fractal algorithm or energy pattern which organizes the general structure of the realm. In the Microphysical Realm this center is the atomic nucleus; in the Biophysical Realm it is the nucleus of the cell; in the Astrophysical Realm it is the galactic nucleus; in the Metaphysical Realm, it is the human brain, contemplating body/spirit (intuitive mode), or unified theories of matter/energy (rational mode). Individual levels within each realm have their own centers of structure, dynamics, or information.

Such a universal pattern can have only the most general of characteristics. I have designated its horizontal 4-component in structural terms as: Unit, Pair, Group, emergent New Unit; the group category is the locus of the 4x3 energy pattern which produces the emergent New Unit. This emergent unit then becomes the basis of the next level in the hierarchy. George Land (1973) and August Jaccaci (1980) have characterized this structural series in dynamic terms as: Accretive, Replicative, Mutualistic (Land), or: Gather, Repeat, Share, Transform (Jaccaci). The vertical 3-component of the matrix (including its 4th emergent level) Jaccaci identifies as a simple repetition of the horizontal series (see: "[Introduction to General Systems](#)"). In its most complete form ("World Systems"), these parameters resolve to: 1) an input of free energy followed by symmetry-breaking, establishing a joint dimensional conservation domain (spacetime) for light and matter; 2, 3) two complementary conservation modes: 2) raw energy conservation (mass, momentum, kinetic and potential energy); 3) symmetry conservation (charge, spin, inertial forces); 4) restorative, transformative, or evolutionary forces (the 4 forces of physics) which either return the system to its original state immediately (as in matter-antimatter annihilations), or evolve a resonant analog of the original state (the various levels of the hierarchy - entropy and symmetry driven "harmonic complexification").

Readers familiar with the theory of "Chaos" may recognize a familiar pattern in the model: beginning with a "linear" or simple input (cell 1), passing to a stage of bifurcation (cell 2), progressing to a stage of greater complexity including secondary bifurcations (cell 3), and finally a "chaotic" stage (cell 4) which predictably settles in the "fractal basin" of a 4x3 (or 4x4) "strange attractor" (the precise physical nature of the attractor, however, is unpredictable). Like a true fractal algorithm, the output of one level becomes the input of the next, the self-feeding iterations producing new self-similar expressions at ever-higher levels of information and system complexity. The model is scale-invariant, not only vertically with each row, but also with respect to the four major realms. (See: "*Chaos: Making a New Science*" by James Gleick, Viking Penguin Inc., 1987)

This work has been carried out in large part for presentation to the annual meetings of the [Creative Problem Solving Institute \(CPSI\)](#), Buffalo, NY, USA.

Microphysical Realm: Level 1 - Particles and Baryons

(3 energy "families" each of 4 elementary particles); (3 quarks each of 4 charges)

(Atoms: 3 particles (protons, neutrons, electrons) x 4 quantum numbers (n,l,m,s)

(See: "[Table 1](#)")

Within the microphysical realm, the level 1 ("Particles") mass center is the baryon (cell 4 - baryons are the class of particles containing 3 quarks, such as protons, neutrons, and their heavier relatives). The baryon is a 4x3 structure, composed of three quarks each carrying 4 charges: electric, spin, "color", and "flavor". The baryon contains an internal field of 8 gluons (gluons are the force carriers of color charge). There are 3 color charges ("red, green, blue" - not actual colors, just labels of convenience), and each quark carries one color charge. Gluons are composed of color-anticolor charges in every combination (except green-antigreen, which is doubly neutral), and move at velocity c from one quark to the next, exchanging color charges. This round-robin exchange of color charges between quarks via the gluon field constitutes the strong force at the internal baryon level (level 1). A secondary manifestation of the strong force exists between (rather than within) baryons in compound atomic nuclei (level 2), mediated by mesons carrying "flavor-antiflavor" charges (the [Yukawa meson](#) exchange strong force between protons and neutrons or "nucleons").

Row 1 begins with light, the primordial energy source. The second or pairing cell of row one has many possible expressions, including space and time, electric and magnetic fields, positive and negative electric charge, north and south magnetic poles, up and down spin, matter-antimatter, quark and lepton pairs, gluon pairs, etc. The third cell is the site of the 4x3 fractal expression. In row one this is the remarkable and unexplained existence of 3 energy "families" each of 4 elementary particles: 1) the up, down quarks paired with the electron and electron neutrino; 2) the charm, strange quarks paired with the muon and muon neutrino; 3) the top, bottom quarks paired with the tau and tau neutrino. This "particle metric" may be derived from the "dimensional metric" of spacetime. In any case it decays and reduces to the baryon of cell 4. Symmetry-breaking and quark confinement define the final "emergent new unit" of row 1 cell 4, the highly stable proton with its single electron, the foundation stone of the Microphysical realm and the material Universe.

(See: "[The Higgs Cascade and the Weak Force IVBs](#)", an expansion of row 1 into a 4x4 General Systems model of the "Big Bang".) (See also: "[The Origin of Matter and Information](#)".)

Microphysical Realm: Level 2 - Atoms and Elements

In level 2 (atoms) the mass center is the atomic nucleus, from hydrogen with one proton to uranium with 92 protons and 146 neutrons, heaviest among the naturally occurring elements. The first elemental product of fusion, helium, is a 4x3 resonance, 4 nucleons each composed of 3 quarks. This is the "alpha particle", a configuration so stable that it is the favored construction unit of the nucleosynthetic pathway, the "brick" of element building and the periodic table. The emergent property of the elemental series is its electron shell structure, enabling production of the succeeding molecular level. In general, the electron orbits of any atom can be characterized in terms of 4 quantum numbers: orbital number and angular momentum (n, l), magnetic moment (m), and spin orientation (s). The pairing structure in cell 2 is the proton-electron pair; the alpha particle is the 4x3 resonance of cell 3; the closed or completed electron shell of the inert or non-reactive "noble gases" is the defining exclusionary "membrane" of row 2 cell 4.

Microphysical Realm: Level 3 - Molecules and Crystals

In level 3 (molecules) carbon is the mass center; incredibly, we can cite five 4x3 resonances for this atom. Carbon's nucleus is a triple 4x3 resonance, composed of 3 alpha particles each of 4 baryons; carbon has 4 bonding sites in its third electron shell; carbon produces a tetrahedral bonding pattern in its crystal form and in many organic compounds. No other atom in the periodic table has so many 4x3 resonances, nor does any other atom have a 4x3 resonance in both its nucleus and its electron shell. Fred Hoyle's famously predicted nuclear resonance energy level of C12, permitting the formation of carbon from beryllium in the nucleosynthetic pathway of stars, is yet another remarkable property of

the 4x3 fractal algorithm leading to the evolution of life.

The emergent property is carbon's ability to produce linked and cyclic molecular systems of incredible size, complexity, and diversity ("organic" molecules and chemistry). Crystal growth and replication at this level illustrates the innate capacity for self-similar assembly by even the simplest molecules. The second cell or pairing function consists of the ability of the electron shell to form various types of bonds with other ions, electrons, and electron shells, including covalent, ionic, and hydrogen bonds. The delimiting or boundary condition of the 4th cell is the exclusion of impurities during crystal growth and expansion.

Microphysical Realm: Level 4 - Cyclic Chemical Systems

In level 4 (functional and cyclic chemical systems), linked and replicating organic chemical systems acquire and exchange energy, evolved perhaps in response to diurnal and/or tidal cyclic energy inputs. The organizing center of level 4 is RNA-DNA, 4 nucleotides each of 3 chemical groups: sugar, phosphate, and a nitrogenous base. RNA links and catalyzes chemical systems which acquire, store, and degrade energy. The emergent property of RNA-DNA is replication. RNA replication is the serendipitous property of a molecular system primarily devoted to "metabolic" activities of energy and enzyme transfer. This notion is helpful in terms of understanding the thermodynamic rationale for replication/reproduction. Significant chemical evolution toward living systems will require some form of accurate replication (perhaps foreshadowed by crystal growth) and some form of conservation (such as a restricted or closed heritable genetic system) serving as a "keeper dog" on the upward evolutionary ratchet to prevent backsliding and the entropic destruction of information.

The anomalous "self-interest" (in terms of individual survival) of a cyclic and replicating chemical system is derived generally from the structure and "identity" of the atomic realm, and particularly from the intraspecific molecular competition of DNA with its own copies for the limited materials necessary to continue replication. A crystal has order and identity, grows, replicates, and expels impurities from its lattice, but we would not call it "selfish". Life is a "liquid crystal" - the structure and function of any molecular system, cell, or species is the consequence of a fundamental atomic order and identity projected and elaborated into higher levels of complexity and information. The aggressive and "selfish" nature of living systems is due to their competitive origin, a characteristic we retain and easily recognize. The most common and potent "metric" of this atomic order is the 4x3 systemic principle embodied in carbon. Wherever we find life in the Universe, we expect it will be based on the replicating, linking chemistry of carbon chains and rings. It is significant for the origin of life that water also shares the tetrahedral bonding pattern of the carbon molecule.

The notion that the primordial chemical evolution of a replicating molecule is a purely chance event, seems, in view of the 4x3 structure and coding protocol of RNA/DNA, an overestimate of the difficulty. Because carbon itself is so completely a 4x3 system expression, we can view the structure of the RNA/DNA double helix as a projection of the atomic order of carbon into the molecular configuration of this molecule, making its evolution far more likely than chance alone would dictate, and hence also making life everywhere in the Universe a far more likely product of suitable environmental conditions. (See: [Newton and Darwin: the Origin and Abundance of Life in the Cosmos](#)). The pairing function of level 4, cell 2 is the double helix; the delimiting function of cell 4 is the specificity of pairing partners: cytosine pairs only with guanine, adenine pairs only with thymine (or with uracil in RNA). The emergent property is replication.

Replicating, genetic, metabolic, and enzymatic functions are all combined in the RNA/DNA molecule. Once such a molecule appears, it will immediately begin competing with copies of itself for the limited chemical resources it requires to make more copies, and so initiate a furious evolutionary scramble (at the prebiotic molecular level) toward the aggressive ("greedy") "self-interested", living, chemical, defended walled fortress that is the cell.

See also: "A Simpler Origin for Life" by Robert Shapiro. *Scientific American*, June, 2007, pages 46-53 (and on www.sciam.com).

Biophysical Realm: Levels 5 -> 8: Cells -> Gaia

(DNA: 4 nucleotides code in triplets)

The major feature of the first level of the biophysical realm involves the coordination and consolidation of the various chemical systems of level 4 by DNA, 4 nucleotides coding in triplets (the genetic code), producing amino acids within an enclosed, self-maintaining, and self-reproducing "living" cell. Chemical systems which previously functioned and replicated more or less independently achieve a *collective system identity* in a mutualism or symbiosis regulated by DNA. All higher biology is the evolution of collective system identity, structural form, perceptual refinement, and thermodynamic function. The cell nucleus (and/or DNA) is the massive information center controlling the cellular level, and ultimately, all biological organizational levels above it. DNA replication is the pairing function of cell 2; amino acid synthesis via the genetic code is the 4x3 fractal expression in cell 3; and the cell membrane is the delimiting and defensive structure of cell 4.

Above the level of the genetic code, the operation of the 4x3 algorithm is evidenced through the structure and dynamics of the biophysical system. The pairing, or repeating function is expressed through cell division, sexual reproduction, and speciation; the sharing, or group function is expressed through specialization and mutualism at every level from the organelles of cells to the organs of individuals to the niches of species to the functional, interactive components of ecosystems.

At the level of organism the cells acquire a higher, functionally interactive, shared identity; at the level of species, individuals may acquire a family and social identity, genetically and/or psychologically expressed (ants, bees, termites vs social vertebrates). Specialized organelles, organs, individuals, structural adaptations and niches develop in ever wider mutualisms to more efficiently process energy. Ecosystem interactions and bio-geochemical cycles at the global level are the largest biological system expressions (Gaia) (the exchanges of carbon dioxide and oxygen between plants and animals, water and nitrogen cycles, etc.). The planet itself is the massive central organizer at the level of Gaia (the physical mass, gravitational field, rotation, magnetic field, and orbit of the Earth, retaining the atmosphere, producing daily and yearly cycles, deflecting cosmic rays, etc.). (For a discussion of the biological role of humans, see: "[The Human Connection](#)", and "[The Information Pathway](#)".)

Astrophysical Realm: Level 9 - Stars

(gravitation: 4 third-order equations)

(Kepler's 3 laws)

The first cell of level 9 contains the mass particles and aggregates that will eventually condense to form the planets and stars of this first row of the Astrophysical Realm. These mass aggregates range from interstellar gas and dust particles to meteoroids, comets, asteroids, moons, planetimals, and full size planets up to and including "brown dwarfs" ("failed stars" of less than 50 -100 Jupiter masses). This cell recapitulates and carries forward the planetary size range of Gaia in the last biophysical level (row 8). Hence in this first cell we can place all the particles of the primordial solar nebula, including our own planet Earth and similar bodies, provided only that they are not so massive that they become stars. (We consider here only the abiotic properties of planets, such as total mass.)

In cell 2 of level 9 the pairing function is evidenced by gravitational orbits, and the Earth-Moon and Earth-Sun pair are obvious examples. The star-planet pairing is of special significance for the creation of life; this union seems to represent a type of astrophysical male-female bonded pair, with the planet in the female role. In cell three we place the family group of planets of our solar system (or any stellar system), with the 4x3 algorithm function represented by Kepler's 3 laws of planetary motion expressed in 4 dimensional spacetime.

Another expression of the 4x3 or "social" dynamic in the 3rd cell is the gravitational interaction among the planetary members of the system as they form in the primordial solar nebula. These primitive interactions account for many features of the mature planetary system we see today - the various orbital positions and periods of the surviving planets, including their eccentricities, their daily

rotation periods and axes of orbital inclination, even the compositions of the planets and the continuing history of their bombardment by asteroids, meteorites, and comets. Our relatively huge moon is a major part of this story (in addition to causing the ocean tides, the Moon stabilizes the seasonal character of Earth's weather), and the role of the giant planets is extremely significant in the evolutionary history of Earth and all the inner planets, and is still being puzzled out. Much of Earth's water, for example, seems to have arrived via comets flung at us by Jupiter. Various important extinction events in Earth's biological history (including the extinction of the dinosaurs) have apparently been caused by the impact of large asteroids, which threaten us still.

In cell 4 we place our Sun, or stars generally, in which the obvious emergent property is the onset of nuclear fusion, the gravitational conversion of bound to free energy and the production of heat and light. The Sun actually represents the first stage of gravitational symmetry conservation - the conversion of asymmetric bound energy (mass) to symmetric free energy (light). In all smaller bodies we see only gravity's entropy conservation role - the gravitational transformation of space to time. (See: "[The Double Conservation Role of Gravitation](#)".) The Sun's radiance is the evidence of a completed symmetry conservation circuit. (See: "[The Solar Archetype](#)".)

Astrophysical Realm: Level 10 - Galaxy (nucleosynthetic pathway)

Stars are the units of the first cell of level 10; the pairing function is expressed commonly as binary stars. In our case the Sun - Jupiter pair must suffice as an example of a "failed" binary star. In the third cell of level ten I place the 4x3 nucleosynthetic pathway. This is a 4x3 process regulated by the alpha particle (helium nucleus) (4 nucleons each containing 3 quarks), whose extraordinary stability makes it the construction unit of choice, or "brick" of nuclear fusion. Helium and carbon are the first major resonances of the 4x3 nucleosynthetic pathway; oxygen is the next alpha unit above carbon and its unusual abundance (and significance for life) represents the commonly seen 4x4 expansion of the fractal (4 alpha particles each of 4 nucleons). The elemental series continues upward in alpha particle units and should reach a third major resonance in chromium 48, four carbons each of three alpha particles. This combination is highly radioactive, however (due to overcrowding of the protons), and the resonance settles at iron 56 with the addition of another alpha particle plus four extra neutrons. Iron is the last element that yields energy in fusion; all heavier elements require energy inputs (as from supernova implosions and explosions). Thus as the 4x3 resonance fails, so too does the exothermic yield of excess nuclear binding energy.

As in the previous Solar System or stellar level, the third cell of the galactic level is rich with structural elements, in addition to the nucleosynthetic pathway. At the galactic level, in a spiral galaxy such as our own Milky Way, we find an extensive disc composed of four arms containing many stellar "nurseries" or star-forming regions, a central bulge surrounded by a "halo" of globular star clusters, giant molecular clouds, nova and supernova remnants, a variety of stellar types, sizes, colors, and stages from brown dwarfs to red giants, collapsed stars including white dwarfs, neutron stars, and black holes, remnants of captured dwarf galaxies, and finally a supermassive black hole dominating the exact galactic center, much as the nucleus of an atom or a biological cell dominate their respective domains. Black holes represent a second step in the gravitational conversion of bound to free energy: not only is "proton decay" common in their interiors, but over time, the entire mass of a black hole is converted to light via Hawking's "quantum radiance".

In the final cell of level 10 we have the galaxy itself, a gigantic composite structure which can generate within itself all the 92 elements of the periodic table, the first structure of the hierarchy actually large and complex enough to produce its own life form from the raw material of the "Big Bang" - hydrogen and helium. While humans are children of the Earth-Sun "marriage", all in turn are children of the Milky Way galaxy, our true "island" home in the spacetime ocean of the Universe.

Astrophysical Realm: Level 11 - Universe (4 third-order equations)

Galaxies are the units of level 11; the pairing function is typified by the Milky Way - Andromeda pair; such pairs are thought necessary to draw out the spiral arms in which new stars and their associated planetary systems are preferentially formed. In the third cell we find great clusters and "walls" of galaxies, surrounding immense "voids", the largest structural elements of the Universe, resembling a "foam" of soap bubbles on an astronomical scale of thousand of galaxies and hundreds of millions of light years. The fractal algorithm of this cell is simply the gravitational force itself, characterized by Einstein as 4 third-order equations - the changing rate of gravitational acceleration in x, y, z, t. Here too, we place the 4x3 form of the Unified Field Theory - the four forces of physics and three energy states - light, matter, charge. In the final cell of level 11 we place the Universe as we know it, a spacetime domain approximately 14 billion years old and also about 14 billion light years in its maximum spacetime dimension. (See: "[A Spacetime Map of the Universe](#)".)

As at the planetary level, there is also a "social" function served by the galaxy clusters, involving the gravitational interactions of the galaxies upon each other. Such perturbations, occurring over eons of time, stir the great molecular clouds of gas and dust, keeping the galaxies "young" and active, producing new stars and elemental products for potential new life forms.

The entire Universe is necessary for the creation of Earth life, for only the "Big Bang" can create the 4 dimensions and 3 particle classes (hadrons, leptons, bosons), and the 3 families of 4 elementary particles which initiates level 1. Furthermore, its vast size is necessary to provide a time dimension of sufficient duration for the creation of heavy elements in stars and galaxies, and the evolution of life.

The tendency of the chemical elements to produce complex information systems such as life can ultimately be referred to matter's search for antimatter through the electrical interactions of the chemical bond. This search can also be seen as the attempt of matter to recover its original condition of universal unity, connection, and symmetry, "as it was in the beginning", when all energy existed in the form of light in the first instant of the Big Bang.

Astrophysical Realm: Level 12 - "Multiverse" ([4 conservation laws connected in triplets](#))

The Universe itself is the unit in the first cell of level 12; in the pairing function of cell two we find the Universe - Antiuniverse pair which nearly annihilated each other during the "Big Bang"; the matter residue of this colossal matter-antimatter explosion forms the material component of the Universe we know today. In the third cell we find a subset of the "Multiverse", the set of all possible electromagnetic Universes. All such universes will have a 4x3 metric or algorithm like our own, and all will be characterized by the conversion of free energy into mass (those that do not simply remain as undifferentiated light). These universes will differ in their physical constants, insofar as this is physically possible within the electromagnetic energy type; certainly they can vary in size, if nothing else. The 4x3 "metric" of this cell is the metaphysical origin of all the others below it, as found in the 4x3 representations of the Deity in various world religions, mythologies, and systems of mystical, occult, and spiritual principles and laws - and in our metaphysical systems of scientific or natural laws, which are all constructions of the human mind. In the final cell of the hierarchy, we place the "whole" Multiverse, the complete set of all possible universes of all possible energy types, and First Cause, the ultimate representation of the Deity and Natural Law, and the ultimate source of the energy, particles, and order of our universe, the "Big Bang", and row 1. (See: "[The Higgs Boson and the Weak Force IVBs](#)".)

Although there is an inevitable circularity about such arguments, the concept of the Multiverse is a "logical" way we have of explaining the value of the physical constants in our Universe which make our life form possible. Constants (for example G and c, among many others) must be adjusted with exquisite precision with respect to each other to produce a Universe in which our particular life form can evolve. One explanation for this accommodation is the Multiverse theory in service of the so-called "Anthropic Principle": we quite naturally find ourselves living in that unique Universe, perhaps one of infinitely many Universes, whose physical constants, just by chance alone, happen to favor the evolution of our particular life form.

Perhaps other life forms inhabit the other Universes - they, too, may think it strange how nicely the physical constants of their various Universes just happen to favor their various life forms - but how could it possibly be otherwise in any *evolved* system? This view does not deny the existence of "First Cause", but suggests that any notion of a "Divine Being" may be far grander than we had traditionally imagined, or could possibly have imagined. (The Hindus have apparently come closest to this view.)

This scenario also suggests that while in one sense our experience of life is accidental (a chance event in a chance Universe), in another sense it is quite inevitable (because of the large (infinite?) number of Universes, many suitable for life of some form), and that our own Universe may even be a cyclic phenomenon on a scale which is far beyond our poor powers of comprehension.

In brief, we need the Solar System to provide our Earth and Sun; we need the Galaxy to provide our heavy elements; we need the Universe to provide sufficient space and time; and we need the Multiverse to provide life-friendly physical constants and laws. See also: "[The Information Pathway](#)"; "[The Human Connection](#)".

We cannot prove or disprove either the rational or the intuitive version of the ultimate origin of reality; it is really a question of personal taste what one chooses to believe, since both views finally reduce to faith, trust, or belief of one sort or another. What we really need to comprehend is that *we are the Universe* in its (locally) conscious, self-aware, and creative form. This is the universal significance of humanity, beyond the local reproductive schemes of Gaia. *Life is what we choose to make it.* Choose wisely: choose beauty, symmetry, harmony, symbiosis. (See: "[Is There Life After Death?](#)")

Metaphysical Realm: Overview

The Metaphysical Realm is both the "alpha and omega", first and the last stage in the cycle of manifestation, as it provides the template, law, ideal form, or archetypical principle from which manifestation springs, and toward which it evolves, during the "redemption" or return of matter to a state of perfect symmetry. (Light devolves to matter, which then evolves back to light.)

Concerning the Metaphysical Realm itself, we know little. As it is dimensionless, the Metaphysical Realm may not have levels, but may simply have aspects or attributes instead; the trinities and quadruplicates of various religions and mythologies seem to represent intuitive perceptions of these aspects or characteristics of the Metaphysical Realm.

In the Christian religious tradition, we can identify the Father with Conservation, the Son with Symmetry (the broken symmetry that produced manifestation representing Christ's sacrifice and the interaction of Spirit with the World); the Holy Ghost with Entropy, intrinsic motion, or Divine Will and evolutionary direction, and Mary (humanity) with Causality-Information, "karma" and history, the Virgin representing the symbolic or spiritual impregnation of humanity and the material world with the Divine Gnosis or "Word" - humanity's innate awareness of a generalized spiritual realm. (See: "[A Religious Interpretation of the Energy Tetrahedron](#)").

Structure in the Metaphysical Realm has been intuitively suggested through visions of the "sacred city of Jerusalem" (a golden city surrounded by 4 walls, each wall with 3 gates - Revelations 21: 10 - 27). The structural levels of angels, archangels, cherubim and seraphim, Heaven above and hell below, the Trinity and the devil, are all part of the Christian popular mythology concerning the structure of the metaphysical level. Every religion and mythology has its own version of the structure and contents of the metaphysical level; this structure is obviously what most religions and mythologies concern themselves with.

Rationally or "scientifically", the metaphysical realm appears as a level of principle or physical law and "given" physical constants which seem to precede the appearance of the manifest realm of light, spacetime, and the particles of matter.

The "[Tetrahedron Model](#)" is a representation of the 4x3 structure (4 triangles) of the metaphysical realm in the mode or aspect of physical law, comprising the generative principles of the manifest universe. Such a representation has only become possible to the human mind in the last century, following upon the great revolution in physics wrought by the theories of General Relativity and Quantum Mechanics.

In terms of General Systems, the "Tetrahedron Model" in its "physics mode" is not a more "correct" interpretation of the metaphysical realm than any of the many intuitive representations offered by religion or mythology; it is simply in a different characterization, a quartet of physically relevant principles, which is useful in its own special way, just as the other models are useful in ways peculiar to themselves. All models of the metaphysical realm are "wrong", in that they must be incomplete, and therefore none can possibly be fully adequate to their task; nevertheless, some are useful for specific purposes.

For a scholarly treatment of the more unusual psychedelic and occult properties of the Metaphysical Realm, see the [memorial website of Prof. J. C. Gowan \(Sr.\)](#), and his books: "Trance, Art, Creativity", and "Operations of Increasing Order."

For the comparative purposes of a General Systems survey, we are most interested in the intuitive models of the metaphysical realm that exhibit a 4x3 "metric", a trinity or a four-part structure, as these are isomorphic with our physical, natural models. Two ancient, outstanding examples of these, one Eastern and one Western, are the I Ching and Astrology, which have been used for millennia as occult structural models of the Metaphysical Realm. Every religion and mythology attempts to model this realm, and to make the fractal or resonant connection "as above, so below". Three- and/or four-part structures are common in intuitive metaphysical and cosmic models. Because this is a reversible equation ("as below, so above"), we can also hope to understand the hidden, invisible, and immaterial structure of the Metaphysical Realm through General Systems models of the physical world here below (as provided by science), and extend these to the ethereal, nonmaterial, unmanifest, ideal, and "spiritual" planes above.

Metaphysical Realm: Intuitive
(4 Elements x 3 Qualities)
(the Holy Trinity x the 4 Living Creatures)
(4 male and 4 female "trigrams")

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The metaphysical realm (human thought) contains two modes, intuitive and rational. The mass center of the metaphysical realm is the human brain, itself divided into two halves, which are apparently related to the two modes of understanding and thought. Only rational and intuitive "World Systems" are considered here. The intuitive category includes religious, mythological, mystical, spiritual, and occult world views, organized conceptually around the general relationship between body and "spirit", or "manifestation" and spiritual or religious law; rational systems include philosophy and science, organized conceptually around the general relationship between matter (bound energy) and light (free energy), or the physical Universe and natural or scientific law. (See: "[Combined Table of Rational and Intuitive "World Systems"](#)".)

The metaphysical realm includes all the output of the human mind, rational and intuitive, religions and scientific, for all are the products of abstract thought. A symphony, automobile, religious tract, or scientific text are all examples of ideas made manifest, and in this sense they all represent conservation modes or conserved products of the metaphysical realm. Humans are apparently the only animal which can actually make its "dreams come true".

Remarkably, a 4x3 "metric" underlies not only the Western religious traditions as found in the Bible, but also occult cosmologies, Western and Eastern. Among other examples, the metric is explicitly expressed in the vision of New Jerusalem, the celestial city of four walls each with 3 gates, and the vision of the four "Living Creatures" surrounding the throne of God, the Trinity. The occult examples, independently derived, are both perfect 4x3 systems, Astrology with 4 Elements and 3 Qualities, the I Ching with 4 sets of male and female "trigrams", exactly isomorphic with the 3 families of 4 elementary particles and their antiparticles. (See also the "Traditional Supernatural" section of the "[Fractal Table No. 1](#)".)

The Western creation myth (Genesis), is also strikingly similar to our current rational model, the "Big Bang". In both, the Universe begins as light, enjoys a brief period of symmetry (the garden of Eden vs particle-antiparticle symmetry), experiences a disastrous "fall" into "sin" ("symmetry-breaking" - single particles in real time), resulting in expulsion from the garden. Then follows a long period of "redemption" toward the original condition of "grace" (the forces return the world of matter to light, creating life in the process). Evidently, the human mind has intuited the fractal structure of the Cosmos (and itself), thousands of years before science could produce the physical evidence. "Man created in the image and likeness of God", "as above, so below", "man the measure of the Cosmos", and similar statements are simply intuitive affirmations of Cosmic fractal and resonant structure.

In the "Multiverse" version of cosmic structure, even the "scientific" (astrophysical) hierarchy ends with a hypothetical or metaphysical superstate. In the "traditional supernatural" or Christian religious version corresponding to this 4-part hierarchy, we have: God the All-Creator (Multiverse), Christ the Son (our Universe), Archangel (Galaxy), Angel (Sun). Below this celestial and astrophysical hierarchy we find Gaia (Mother Earth - level 8) and humanity (species level 7) in the Biophysical Realm. (See also: "[The Higgs Boson and the Weak Force IVBs](#)" where this hierarchy is represented in five stages because Earth together with humanity are appended to the 4-part astrophysical set as an electromagnetic "ground state".)

Metaphysical Realm: Rational

([4 Conservation Laws Connected in Triplets](#))
([4 forces x 3 energy forms \(light, particles, charge\)](#))

The Unified Field Theory is the rational equivalent of intuitive "World Systems". Here we find 4 conservation laws connected in triplets - as diagrammed in the "[Tetrahedron Model](#)": the 1st law of thermodynamics (energy conservation); the 2nd law of thermodynamics (entropy); "Noether's Theorem" (symmetry conservation), and Causality-Information ("Karma"). A representation of the Unified Field Theory in its full [4x4 format](#) (including the restorative activity of the field vectors) is exhibited in [Table 1](#) and briefly explained below (see also: "[Symmetry Principles of the Unified Field Theory](#)").

Other than the economy and universality of its format, the feature of particular interest in the [rational model](#) is its emphasis on the conservation of certain symmetries associated with free electromagnetic energy (light). Thus when light is converted to particles in the "Big Bang", its raw energy is conserved as mass, momentum, and other time-dependent variables, whereas its various symmetries are conserved as time-independent charges. Among these broken but conserved symmetries I associate electric charge with the jump from the symmetric 2-dimensional wave form of light to the time-asymmetric 4-dimensionality of matter. The gravitational charge is associated with the asymmetric, specific, 4-dimensional "location" of bound energy (Interval > 0), vs the symmetric, undefined, 2-dimensional "non-locality" of light (Interval = 0). The number or "identity" charge of the weak force is associated with the symmetric anonymity of photons vs the specifiable identity of the leptonic

elementary particles, including the leptoquark (neutrinos are the explicit form of identity charge, which is carried implicitly by the massive leptons). Finally, the color charge of the strong force is an internal, quantum mechanical asymmetry of baryons associated with the partial (sub-elementary) charges of quarks, which must be confined to whole quantum units of charge to allow symmetry and charge conservation.

The conservation parameters of the dimensional domains of free and bound energy are characterized by entropy and symmetry "gauges" or "drives": "velocity c" gauges the entropy drive and "non-local" metric and distributional symmetry of light or free energy, creating, expanding, and cooling space, while simultaneously suppressing the time dimension and maintaining metric symmetry. "Velocity T" gauges the entropy drive of bound energy's time dimension, creating, expanding, and decaying history, the temporal analog of space. "Velocity G" (gravity) is the conversion gauge or force between these primordial or pure drives of [spatial and temporal entropy](#), the intrinsic motions of light and time.

Inertial forces protect the symmetry of the spacetime metric, charge conservation protects the symmetry of the particle metric. Gravity produces the time dimension of matter via the annihilation of space, thus creating an entropically equilibrated spacetime, the joint dimensional conservation domain of free and bound electromagnetic energy. The dimensions of spacetime are entropy domains; *the charges of matter are the symmetry debts of light* ("Noether's Theorem") (see: "[A Description of Gravitation](#)").

The theory has 4 physical forces to account for; these comprise the [table's horizontal axis](#). Vertically I identify 4 electromagnetic energy states and their associated conservation laws: free energy (general energy conservation); particles (causality and raw energy conservation); charges (symmetry conservation); field vectors or force carriers, (forces which pay, or demand payment of, conserved debts, restoring symmetry).

Reading the matrix in the same order as an English paragraph: in the first row, free symmetric energy (light) is the initial input, creating two superimposed conservation domains, one for its wave form (the dimensional metric of spacetime), and one for its material form (the quantized particle spectrum of matter, or the "particle metric"). The weak force produces an asymmetric transformation (decay) of certain particle-antiparticle pairs, yielding a single particle (leptoquark) which breaks the symmetry of the initial free energy state. The first row thus reproduces the creation of matter in the "Big Bang".

The second row represents conservation in the particle domain, in terms of raw energy, time and causality, and particles. Here the energy of light is converted to the mass and momentum of particles, space is gravitationally converted to time, sub-elementary quarks and gluons produce baryons and mesons; the weak force is represented by the elementary leptonic series, the electron and its heavier kin, the muon and tau. Raw energy debts must be paid immediately (as by inertial forces, or the conversion of free energy to mass and momentum).

In the third row the various charges of matter are represented as conserved symmetry debts of light. Unlike raw energy debts, symmetry debts can be paid in time at some future but indefinite date (charge conservation); the time dimension and charge conservation imply and require each other (meanwhile, gravity pays the entropy-interest on matter's mass and charge-conserved symmetry debt). This is one of several ways that entropy and symmetry are connected. One charge is associated with each force and each charge/force represents a specific symmetry debt of light - see above. The forces also have a specific or implied relationship to basic entropy drives, both positive and negative. Gravity pays the entropy-interest on matter's mass and symmetry debt, supplying the energy to create bound energy's time dimension, "negative" spatial entropy-energy subtracted from the "positive" spatial entropy-energy of expanding and cooling spacetime, decelerating the cosmic expansion.

In the final row, the field vectors of the four forces pay the symmetry debts held by the conserved charges of row 3, returning the system to free energy and maximum entropy (light has the most entropy and symmetry of any energy form). The summary or general form is thus: massless, symmetric light creates massive, asymmetric particles bearing charges producing forces which act to

return the material system to its original symmetric state of light. This program is executed immediately in the annihilations of virtual particle-antiparticle pairs, but occurs much more slowly (but occurs nevertheless) in real time in the absence of antimatter. Entropy and symmetry conservation, in their primordial forms as the intrinsic dimensional motions of light ("velocity c"), time ("velocity T"), and gravity ("velocity G"), in the service of energy conservation and causality, are the ultimate motivating principles or driving forces of the Universe. Charge invariance (including the "Lorentz Invariance" of Special and General Relativity) is the key to understanding the local action of the forces. (See: "[Global vs Local Gauge Symmetry in the Tetrahedron Model](#)".)

For a discussion of the role of Information in the return of the material system to its symmetric origins, see: "[The Information Pathway](#)". For a more complete discussion of the gravitational system, see: "[Gravity, Entropy, and Thermodynamics](#)".

Conclusion

The material universe can be modeled as a nested hierarchy of increasing size, a treatment which is artificial in terms of its evolution in either time or complexity. Nevertheless, the hierarchy reveals a recurring 4x3 structural and dynamic pattern at every level, including the human conceptual, or "metaphysical realm". This recurring pattern is the essential indicator of a universal General System, the algorithm of a cosmic fractal, apparently latent in free energy, expressing itself in terms of dimensions, particles, charges, forces, conservation laws, and the elaborated and emergent products of their interaction.

The fractal hierarchy is evidently the least-energy pathway to produce the physical structure and phenomena of the Cosmos. The replication of self-similar systems into a nested structural hierarchy has an associated advantage in the transmission and sharing of energy and information via the principle of harmonic resonance. For more on the 4x3 General System pattern, see: "[Synopsis of the Principles of The Energy Tetrahedron](#)".

Links:

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References

- [1] Ludwig Von Bertalanffy, "General System Theory", George Braziller, 1968, 295p. + xxiv
[2] Teilhard de Chardin, "The Phenomenon of Man", Harper and Row, 1959, 318p.
[3] [John Curtis Gowan, "Trance, Art, Creativity", Privately printed, 1975, 448p. + xxvi](#)
[4] August T. Jaccaci, In: Patricia A. Galagan, "Growth: Mapping its Patterns and Periods", Training and Development Journal, November 1989
[5] George T. Lock Land, "Grow or Die: The Unifying Principle of Transformation", Random House, 1973
[6] Benoit B. Mandelbrot, "The Fractal Geometry of Nature", W. H. Freeman Co, 1983, 468p.
Ervin Laszlo, "The Relevance of General Systems Theory", George Braziller Inc., 1972
J. D. Barrow and F. J. Tippler. "The Anthropic Cosmological Principle". Oxford University Press 1986.
Armand Delsemme, "Our Cosmic Origins". Cambridge University Press 1998.
James Gleick, "*Chaos: Making a New Science*", Viking Penguin Inc., 1987.

See also: "A Simpler Origin for Life" by Robert Shapiro. *Scientific American*, June, 2007, pages 46-53 (and on www.sciam.com).

See also: "The Origin of Life" by James Trefil et. al. *American Scientist* May-June 2009 Vol. 97 No. 3 pages 206-213.

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