

Abstracts and Summary of Publications on GUT, its Mathematics and Applications

This series of publications are the basis of the Grand Unified Theory (GUT) and its much broader extension, Grand Unification of Natural Dynamics (GUND). GUND encompasses macro and quantum gravity and unites all physical systems from dark to visible and organic to inorganic.

(1) The Mathematics of Singularities. Trans. National Academy of Science and Technology (Philippines), Manila, 1992, pp. 141 - 153.

Abstract. This is the initial development of the generalized fractal that provides the essential mathematics for the study of matter and its dark and visible components. It shows how a curve of any length can be shrunk into an infinitesimal neighborhood of a point with its length preserved, the essence of black hole formation. The paper paves the way for the development of the superstring as a physical concept and the basic constituent of dark matter. Its axial projection is a rapid sinusoidal curve. Shrinking it towards infinitesimal neighborhood enhances its frequency and raises its latent energy indefinitely. A black hole is massive concentration of non-agitated superstrings that accumulates in the eye of cosmological and atomic vortices.

(2) Probabilistic Mathematics and Applications to Dynamic Systems Including Fermat's Last Theorem, Proc. 2nd International Conference on Dynamical Systems and Applications, Dynamic Publishers, Inc., Atlanta, 1996, pp. 147 - 152.

Abstract. The paper characterizes undecidability and establishes that Fermat's last theorem is undecidable. It proposes probabilistic proof for undecidable propositions. Moreover, the paper has an introduction to the solution of the gravitational n-body problem presented at the World Congress of Nonlinear Analysts, that same year and published in Nonlinear Analysis, A-Series: Theory, Methods and Applications the following year.

(3).Exact Solutions of Fermat's Equation (Definitive Resolution of Fermat's Last Theorem (FLT). Nonlinear Studies, **5(2)**, 1998, pp. 227 - 254.

Abstract. The inability to resolve this problem for 360 years is attributed to the inadequacy of the underlying fields of FLT, namely, foundations, number theory, the real number system and analysis. Their critique is undertaken with special focus on Wiles' 127-page proof of this conjecture that bears all

the weakness of classical mathematics. The first major findings are: (1) FLT is undecidable in arithmetic, the *reals*, and \mathbb{R}^n , $n > 1$, (2) its underlying fields are ill-defined and, therefore, FLT itself is ill-defined, and (3) the characterization of undecidable propositions. It follows that FLT is not just undecidable, it does not make sense in these spaces. Rectification includes reconstruction of the real number system without the trichotomy and completeness axioms. The new space, called the new real number system, yields countable counterexamples to FLT proving that it is false. It resolves all the problems, paradoxes, contradictions and unanswered questions of the underlying fields except the Bieberbach conjecture and the Riemann hypothesis.

(4) The Solution of the Gravitational n-Body Problem. Presented at the 2nd World Congress of Nonlinear Analysts, Athens, 1996 and published in the special issue of Nonlinear Analysis, A-Series: Theory, Methods and Applications, **30**(8), Dec., 1997, pp. 5021 – 5032.

Abstract. The existence of long-standing unsolved problem reveals the inadequacy of the underlying fields, in this case, mathematics and physics. A thorough critique of both is undertaken. The main weakness of mathematics lies in its foundations stemming from lack of insights coming from recent discoveries such as the sources of ambiguity and lack of clarity regarding its subject matter. Its critique led to the reconstruction of the contradiction-free new real number system with new elements that models basic physical concepts such as the superstring, the basic constituent of matter, the concepts of time and distance and our universe as a super...super galaxy. The main critique of physics is the inadequacy of quantitative or computational modeling (previously called mathematical modeling) that simply describes the appearances of nature. Consequently it has left long-standing problems unsolved and fundamental questions unresolved such as what the basic constituent of matter and the structure of the electron are. The remedy is the introduction of qualitative modeling (formerly called dynamic modeling) that explains nature in terms of its laws. This was the crucial factor in the solution of the n-body and turbulence problems and resolution of fundamental questions. Their solution and resolution required the discovery of the initial 11 laws of nature that anchored the early formulation of GUT called the flux theory of gravitation.

(5) Superstring loop dynamics and applications to astronomy and biology. Nonlinear Analysis, Series A: Theory, Methods and Applications, **35**(8), (1999); pp. 959 - 985.

Abstract. The paper refines the fundamental physical principles of (4), includes four biological principles and introduces (a) dark number as the

qualitative model of the superstring, (b) the mathematics of its conversion to visible matter, (c) matter-anti-matter dynamics, (d) applications to astronomy and biology and (e) the new nonstandard analysis. It provides, for the first time, explanation of two recent spectaculars from space made possible nascent stars and galaxies and (ii) the "cannibalizing" activity of giant galaxies, including our Milky Way, that prey on their smaller satellite galaxies. Also, for the first time, the paper links brain waves to dark matter, provides insights on the functions of the brain, including learning, memory and intelligence, and proposes therapy for control of brain malfunctions like autism.

(6) Set-valued differential equations and applications to quantum gravity, Proc. 1st International Conference on Tools for Mathematical Modeling; published in: Mathematical Research, Vol. 6, 2000, St. Petersburg, pp. 58 – 69.

Abstract. The paper starts with the practical problem of solving differential equation of the form

$dy/dx = f(x)$, where $f(x)$ has the forms,

$f(x) = \sin^n 1/x$, $f(x) = \cos^n 1/x$, $f(x) = (\sin^n 1/x)\cos^m 1/x$,

and n and m are positive integers and the functions have set-valued limits at the origin. The notions of probability distribution over the set-values and the integral with respect to it are introduced to devise the generalized integral for set-valued functions. Then the integral is applied to calculations on prima and photons whose axial projections are set-valued.

(7) Recent verifications and applications, Proc. 1st International Conference on Tools for Mathematical Modeling, State Technical University of St. Petersburg, St. Petersburg, July 1999, pp. 74 – 89.

Abstract. The paper reviews present verification of the flux theory of gravitation in quantum physics and astronomy and applies qualitative modeling (formerly called dynamic modeling) to derive the structure of the superstring and prima.

[8] Dynamic Modeling and Applications, Proc. 3rd International Conference on Tools for Mathematical Modeling, State Technical University of St. Petersburg, Russia.

Abstract. The paper summarizes recent verification and applications of the then flux theory of gravitation to the study of the Cosmos, the solar system

and other applications but adds a new element to it: the role of the brain in the control of cancer.

(9) Quantum Gravity. Proc. Third International Conference on Dynamic Systems and Applications, 26 – 29 May 1999, released 2001, pp. 201 – 208.

Abstract. Quantum gravity is the dynamics of vortex flux of superstrings induced by primal flux spin. It is distinguished from macro gravity as dynamics of fluxes of superstrings. Quantum gravity encompasses quantum physics and extends its domain to dark matter. It explains the genesis of the atom where the toroidal fluxes of the protons in the nucleus induce coherent flux around it; the latter draws electrons into orbit, by flux-pressure complementarity. Quantum gravity explains all forces and interactions of nature at the biological, molecular, atomic and primal levels including electromagnetism, matter-anti-matter interaction, surface tension, osmosis and capillary action in the cells of living organisms as well as primal coupling and formation of the atom. The main laws of nature governing quantum gravity are energy conservation, flux compatibility and flux-low-pressure complementarity.

(10) Turbulence: Theory, Verification and Applications. Proc. 3rd World Congress of Nonlinear Analyst, Catania, 2000, published in the special issue of Nonlinear Analysis, Series A: Theory, Methods and Applications, 47(2001), pp. 5955 – 5966.

Abstract. The paper poses the turbulence problem: given the standard dynamics find a model that has predictive capability with respect to its internal and external dynamics and future state. The desired model is the theory of turbulence, as subtheory of FTG, anchored on 12 of its fundamental principles. The theory is applied to the study of earthquake, volcanic activity, tornado, typhoon and lightning. The major results are as follows:

- (1) Solves the turbulence problem and explains the dynamics of earthly turbulence.
- (2) Establishes correlation between solar eclipse, earthquakes and volcanic activity.
- (3) Provides the basis for generating the technology to terminate tornado, control typhoon partially and monitor seismic and volcanic activity that can be the basis for prediction.

(4) Establishes the dynamic relationship between under-ocean volcanic activity, *El Niño*, typhoon and drought.

(11) Chaos, Turbulence and Fractal. Indian J. Pure and Applied Mathematics, **32**(10), pp. 1539 – 1551. (In the original paper this article is incorrectly titled, The flux theory of gravitation IV: The theory of intelligence and evolution).

Abstract. The turbulence problem in (9) is generalized to the modeling problem: find a model for a physical system that has predictive capability on its internal, external and future states. The paper starts with a criticism of computational modeling namely:

(1) Computational model is static and unaffected by and not sensitive to emerging boundary conditions including interaction with other dynamic systems;

(2) It simply describes superficial dynamics but lacks predictive capability;

(3) Computation on the model simply reveals behavior of the mathematical space the model belongs to and has nothing to do with the physical dynamic system it models; in general computation, provides insights on differential equations and the real numbers;

(4) Local behavior, especially, at micro scale has no causal relationship with global behavior; for instance, the second law of thermodynamics that predicts increasing entropy for closed physical system is valid only locally; our universe has moved from the chaos of the Big Bang to the high level of order we now enjoy including biological order; therefore, the first law of thermodynamics is reversed globally.

(5) A differential equation which is indispensable in quantitative modeling and its solution have only local validity, a basic principle in the theory of differential equations. Conventional modeling is inadequate for dealing with ambiguous sets including chaos, turbulence and fractal; it is shown also that the real line is chaos. This paper identifies ambiguous sets and their common thread of uncertainty and identifies appropriate approaches for dealing with them. Among the ambiguous sets are large and infinite sets (being large and small depending on context), small and large numbers, micro component of turbulence, chaos and limit set of fractal. Deterministic mathematics does not apply to ambiguous sets. This paper proves, for the first time, that the real line is chaos. The alternative to computational modeling is qualitative modeling, i.e., physical theory anchored on the laws of nature at both fundamental states – dark and visible. Physical theory is not developed by computation alone but is based on synthesis of the collective human

experience and accumulated scientific knowledge. The main tool for qualitative modeling is qualitative or non-quantitative mathematics defined broadly as the complement of computational mathematics. The paper also summarizes the new mathematics required by FTG that, together with some computational mathematics, e.g., Pontrjagin maximum principle, constitutes its mathematical component.

(12) Theory of intelligence and evolution. Indian Journal of Pure and Applied Mathematics, **33**(1), 2003, 111 – 129.

Abstract. Ten laws of thought are discovered to explain such capability of the mind as learning and creativity. It explains how values are formed including mathematical reasoning.

(13) The mathematics of the new physics. Applied Mathematics and Computation, **130**(1), 145 – 169.

Abstract. With the terminating decimals as base space subject to the axioms of the so-called complete ordered field, \mathbb{R}^* , $+$, \times , without the axiom of choice or its variants, the standard topology is introduced. The space is extended and completed to what is called the new real line with the standard topology. The reconstructed new real line, \mathbb{R}^* , $+$, \times , has two new elements called dark and unbounded numbers. The domain of the additive and multiplicative operations is also extended to the new real line, \mathbb{R}^* , $+$, \times . The new real line is further extended to the new nonstandard analysis. The paper refines and extends the counterexamples to FLT to a combination of countable integers and new integers (now called decimal integers). The new arithmetic is also introduced as well as basic arithmetic of twin naturals, new integers and new nonstandard analysis. The integers and new integers are shown to be isomorphic; in this isomorphism 0 corresponds to the equivalence class of dark numbers represented by d^* . This isomorphism establishes that both the integers and the new integers are Peano naturals. It is from this class of numbers that the counterexamples to FLT are constructed.

(14) From macro to quantum gravity. Problems of Nonlinear Analysis in Engineering Systems, **7**(1) 2002; pp. 56 – 78.

Abstract. The paper summarizes the work that starts with the solution of the gravitational n-body problem and proceeds to develop gravitation in the large, that is, gravitation at the astronomical scale. It is extended to gravity at the atomic and biological scales called quantum gravity to form the flux theory of gravitation (now GUT); it explains surface tension in liquids as gravity at the molecular scale. The laws of nature are refined and some of the

mathematics of the superstring and black hole excerpted from [14,15} are as follows:

Theorem 1. A curve of any length can be deformed continuously into an oscillation in an infinitesimal neighborhood of a point with length preserved or even enhanced.

Theorem 2. Given oscillatory curve K of any length, real number $e > 0$ and line segment AB , there exists continuous deformation of K into a fine oscillatory curve inside some neighborhood of a line segment which preserves its length k .

Theorem 2 generalizes Theorem 1 since the segment AB can be confined to an arbitrary neighborhood.

Theorem 3. Given any oscillatory curve K , there exists continuous deformation of K , with length preserved, into an arbitrarily small neighborhood.

Theorem 4. Let K be oscillatory curve of any length k and let $b > 0$, $e = b/2 < K/2$. One can shrink oscillatory curve K into arbitrarily small neighborhood its length and amplitude satisfying $|K|/2^{n+2} < |K|/2^{n+1} \leq |K|/2^n$.

This theorem captures the behavior of superstrings and is the mathematical basis of black hole formation. Since the energy of an oscillatory motion (e.g., superstring flux) is proportional to frequency and infinitesimal oscillation has great frequency this deformation is energy enhancing and there is no upper bound for the amount of latent energy in a superstring.

Finally, the paper has graphics of the well known prima, simple and composite, including the quark, proton, and neutron, nucleus, basic cosmic or electromagnetic waves and cosmic waves of Types I, II and III. It has also graphics of generalized fractal.

The paper summarizes all previous papers by the author on gravitation. It notes, for the first time, that the theory unites the three principal dynamics of our universe, namely, macro and quantum gravity and cosmic waves where the last dynamics spans the first two, and thermodynamics. It explains all interactions of matter at the primal, atomic and biological scales including electromagnetism, matter-anti-matter interaction, surface tension, osmosis and capillarity action in the cells of living organisms. The paper also explains all forms of clustering including the genesis of the atom and molecules and stellar and galactic formation. It introduces three kinds of cosmic shock

waves: (1) Type I that includes brain waves, i.e., basic cosmic waves encoded with information from neural cluster, (2) Type II cosmic waves, e.g., shock waves from grinding of tectonic plates, stellar storms, stellar and galactic core turbulence and hot volcanic lava flow (used in predicting eruption) and (3) Type III cosmic waves, e.g., shock waves from nuclear and thermonuclear explosions and cosmic explosions such as collisions of stars called supernova and the Big Bang. Types II and III cosmic waves have the same internal fractal structure but differ in orientation with respect to their respective radius of propagation. The latter's axis is normal to the radius of propagation. The paper also formulates the nested fractal model of our universe from the super...super galaxy through the superstring.

(15) Vortex interaction. Problems of Nonlinear Analysis in Engineering Systems, 7(2) 2002; pp. 30 –44.

Abstract. The paper develops the fractal-reverse-fractal algorithm that allows one to locate, from any cosmological body, any other cosmological body belonging to any cosmological vortex of our universe and, conversely, from a vortex at any scale to the super...super galaxy, our universe.

(16) The new mathematics and physics. Applied Mathematics and Computation, 138(1), 2002, 127 – 149.

Abstract. The paper summarizes the new mathematics and FTG and some astonishing results of mathematics. It has detailed critique of J. M. Henle's non-nonstandard analysis (Mathematics Intelligencer, 1999) and includes the resolution of the unsolved problems, paradoxes, contradictions, puzzles, contradictions and unanswered questions of mathematics, physics, astronomy and cosmology except the Bieberbach conjecture and Riemann hypothesis. Among the more notable problems, paradoxes and counterexamples resolved and summarized here are: FLT, Goldbach's conjecture, Brouwer's counterexample to the trichotomy axiom, Banach-Tarski paradox and the natural or linear ordering of the new real line.

(17) Macro and quantum gravity, cosmic waves and applications. Applied Mathematics and Computation, 139(1), 2003, 23 – 36.

Abstract. The paper summarizes all previous results on the subject in the Series on the subject and extends them as follows:

(a) Explanation of the accelerated rapid radial expansion of our universe from FTG's viewpoint.

(b) Verification of Hubble's law in terms of the accelerated radial expansion of our universe including an explanation of this phenomenon.

(c) Counterexamples to Einstein's and Newton's law of gravitation, namely, cosmic debris such as asteroids and the thin rings of the larger planets of the solar system.

(d) Lays down the cosmological history and destiny of our universe.

(e) Explains the primordial black hole that exploded as Big Bang as the destiny of the core of previous universe and points to evidences of the existence of universes other than ours.

(18) Dynamic (now qualitative) Modeling and Applications. Proceedings, 4th International Conference on Tools for Mathematical Modeling, St. Petersburg, 2003, 167 – 182.

Abstract. Axiomatizes turbulence using dynamic modeling (now qualitative modeling) that explains gravity as part of its dynamics. It includes a comprehensive explanation of why the Columbia Space Shuttle crashed on February 1, 2003.

(19) Foundations of Analysis and the New Arithmetic. Nonlinear Analysis and Phenomena, **3(2)**, 2003, 13 pages.

Abstract. The paper reconstructs the real number system as decimals into the new real number system without the trichotomy and completeness axioms using the basic integers as building blocks (taking this as one of the axioms) and well-defined by two more axioms – the addition and multiplication tables of basic arithmetic. Taking the constructivist requirement that a real number is well-defined only by its digits, that is, when they are known or computable, we are able to build the new real number system without contradictions and paradoxes. Among the findings are: the standard real numbers (the decimals) are finite but unbounded (precise definition of countably infinite), therefore, discrete, free from contradictions, have natural ordering and enriched by the unique dark and unbounded numbers d^* and u^* , respectively. This new construction suits the needs of computing, especially, computer simulation, and physics since nature is discrete in view of the recent discovery of the basic constituent of matter, the superstring.

(20) Dynamic Modeling (now qualitative) of Chaos and Turbulence. Plenary lecture at the 4th World Congress of Nonlinear Analysts, Orlando, 2004, Nonlinear Analysis, **63(5-7)**, 2005, e519-e532.

Abstract. Applies dynamic modeling to chaos and turbulence as part of the standard dynamics and builds up the flux theory of gravitation as a general theory of turbulence. It uses Hubble's law to compute the present rate of radial expansion of our universe which is 840 km/sec and its acceleration of 10^{-10} .km/secsec. This is the rate at which matter in our universe, including the galaxies is radially dispersing outward. The paper also explains the black hole as massive cluster of non-agitated infinitesimal superstrings collected by the eye of a macro vortex such as star or galaxy. Left alone, a superstring, which is nested fractal fluxes of superstrings, shrinks towards infinitesimal superstring. This dynamics occurs in the calm, low-pressure region of the eye of a macro vortex. It explains that a black hole does not suck matter; it is the eye that nurtures and builds it up that does. Gravitational attraction itself is due to the suction by vortex eye. The opposite dynamics is: when a semi-agitated superstring is hit by cosmic shock wave of suitable energy, it converts to visible matter called primum, e.g., quark, electron and positron. Furthermore, the paper reveals prototypes of technology that converts dark matter to useful kinetic energy, electricity and magnetic repulsion presently used to power magnetic train. (The values obtained here are based on the corrected age of our universe – the original estimate of 8 billion years instead of the current estimate of the age of our universe of 14.7 billion years.

(21) The New Frontiers of Mathematics and Science, Part I. Theoretical Construction and Resolution of Issues, Problems and Unanswered Questions, Nonlinear Analysis and Phenomena, Vol I, January 2004,1 – 26.

Abstract. The paper has the most detailed elaboration to-date of dynamic modeling that led to the development of quantum and macro gravity. It well-defines and explains ill-defined physical concepts and phenomena such as quark, atom, black hole, dark matter and supernova.

(22) The pillars of the new physics and some updates. Nonlinear Studies, 14(3), 2007, pp 241 – 260.

Abstract. This paper summarizes the pillars of FTG, updates and uses FTG to identify and rectify the errors of physics and highlights new applications and explains the disastrous finite flight of the Columbia Space Shuttle. It explains many puzzles of physics such as metal fatigue and corrects present misinterpretation of certain phenomena such as thermonuclear explosion.

(23) The physics of the mind, accepted, The Science of Healing Outcomes.

Abstract. This paper explores the physics behind thought and sensation and its implications for mathematics and physics and science education. It explains telekinesis and other amazing capability of the mind such as that

displayed by what psychologists call moronic genius who computes huge numbers without knowing how that happens. Most of all, it describes how information is encoded, how they are recalled to the creative-integrative region for thought and creativity.

(24) The New Frontiers of Mathematics and Science, Part II. The new real number system: Introduction to the New Nonstandard Analysis. Nonlinear Analysis and Phenomena, Vol. II, January, 2005, pp. 15 – 30.

Abstract. This is the first formal construction of the new real number system \mathbf{R}^* , $+$, $'$, using only three simple axioms: (1) \mathbf{R}^* contains the additive and multiplicative identities, 0, 1; and (2) the addition and (3) multiplication tables of basic arithmetic, and its extension to the new nonstandard analysis. Limit in Bolzano-Weierstrass sense (which is ill-defined) is replaced by intuitive limit, that is, representation of a decimal by its standard Cauchy sequence and approximating any decimal to any level of accuracy by the k th term of its Cauchy sequence. The new real number system is finite but unbounded (countably infinite) and, therefore, discrete, has no contradiction, has natural ordering and is enriched by the unique dark number d^* and unbounded number u^* and the new integers (now called the decimal integers). The integers are embedded in \mathbf{R}^* which rectifies the fundamental flaw of number theory, that of having no valid axiomatization of the integers. In the new nonstandard analysis, every function is discrete. This suits the needs of computing, especially, computer simulation.

(25) Dynamic Modeling (now qualitative) and the new mathematics and physics. Neural, Parallel and Scientific Computations, **15**(4), 527 – 538.

Abstract. Surveys the classical and new mathematics involved in the new physics, i.e., GUT, and highlights the role of the new mathematics.

(26) The origin and evolution of biological species. accepted, The Science of Healing Outcomes (a medical journal).

Abstract. The paper identifies brain waves as the medium for the replication of the genetic content of biological species. It illustrates intelligence and organization and division of labor in lower species and their further advancement and defense against predators and ruminants that pasture on them in the case of plant species, e.g., plant species that produce toxins. It points to sensation as the basis of intelligence that allows a biological species to respond to the environment, survive and advance itself. It illustrates, with many examples, how species protect itself from other species that feed on it. It also points out that instinct is genetically determined and explains how it is actualized in plants and animals.

(27) Extending the reach of computation. Applied Mathematics Letters, **21**(10), 2008, 1074 - 1081.

Abstract. The paper applies the new real number system to discrete computation and quantum algebra.

(28) The theory of everything. Journal of Nonlinear Analysis and Phenomena, Volume II, No. 2, July, 2005, 44 pages (the author's submission for his nomination for the Nobel Prize for Physics, 2005).

Abstract. This is an expository paper that summarizes and consolidates the new physics developed in the flux theory of gravitation. The theory unifies all the forces and interactions of nature from dark matter through quantum and macro gravity and cosmology. (This was this host's submission for his nomination for the Nobel Prize for Physics, 2005)

(29) Dynamic (now qualitative) and mathematical models of physics. Proceedings of the 6th International Conference of Dynamics Systems, 2008; pp. 164 – 169.

Abstract. It provides dynamic and mathematical models of basic physical concepts, particularly, the photon, quark, neutrino, electron, proton, neutron and the nucleus.

(30) Basic physical concepts of the Hybrid Grand Unified Theory. Proc. International Conference on Recent Developments in the Mathematical Sciences and Applications, Dec. 25 – 28, 2009, GVP College of Engineering, JNT University, Vishakhapatnam, AP, India, 8 pages.

Abstract. Introduces the other inhabitants of our universe starting with the superstrings and moving on to the prima, atoms, cosmological vortices and black holes.

(31) By-passing Chaos With a Theory of Turbulence and Development. An article in the book, Finance Stochastics, World Scientific, London, 2001, edited by E. Perez, D. Bonzo (Eds.).

Abstract. This is the first axiomatic treatment of a new area of social science, namely, development science. It uses the same technique in the axiomatization of physics undertaken in the Series. Fundamental social principles are identified to anchor development science. Based on this theory, strategic positioning employed for the purpose of establishing scientific, trade, economic and technological equity between the Third World and the

developed world, particularly, the developed countries. This is the strategy for generating and accumulating tremendous accumulation of value to reach the threshold for industrial development.

(32) Probability Distribution In Mathematics, The Philippine Statistician. 40. 1-2 & 3-4. 1991, pp. 47 – 56.

Abstract. Introduces probability distribution as a tool for integrating set-valued functions.

(33) Qualitative model of the atom, its components and origin in the early universe, Nonlinear Analysis, C-Series: Real World Problems. 11(2009), pp. 29 – 38.

Abstract. This paper is the first qualitative model of the atom and its components as well as its origin in our early universe. The atom's components – proton, neutron (with its neutrino) and electron – are built on the prima, units of visible matter. Their qualitative models are obtained using some laws of nature. They yield new information such as the mass of the neutrino and how heavy isotopes of an atom form as well as the arrangement of the nucleons. It clarifies some presently unresolved issues such as what happens in thermonuclear explosion and whether it can be controlled to generate energy. It also explains the wave-particle duality of the primum and photon, metal fatigue, matter-anti-matter interaction and brittle and malleable materials and reviews the early phase of the development of our universe up to the formation of the first atom.

(34) Qualitative modeling for complex systems, Proc. 23rd International Conference on Operations Research, September 2009, Bonn, Germany, 10 pages (appears also in Problems of Nonlinear Analysis in Engineering Systems, in press).

Abstract. The paper introduces qualitative modeling for analyzing complex systems and solving complex problems and explaining natural phenomena in terms of natural laws. Its power is demonstrated by its role in the discovery of the basic constituent of matter, the superstring, the key to the solution of the gravitational n-body and turbulence problems. Qualitative modeling is applied to the equally difficult problem of development using a similar approach: discovering the relevant laws of society and production. The latter includes laws governing creation, accumulation and distribution of value and accumulation and utilization of surplus value. Then a theory of development is devised for formulating a strategy for development of underdeveloped countries. It notes that while the problem of underdeveloped countries is underproduction, i.e., scarcity of social surplus, the problem of developed

countries is just the opposite: overproduction of commodities that cannot be marketed leading to periodic disruption in the global economy called recession or depression in its worst form. These opposites provide basis for symbiotic relationship between the underdeveloped and developed countries and devising a strategy beneficial to both based on advanced scientific knowledge provided by the Grand Unified Theory to generate appropriate technology as the principal component of development.

(35) The mathematics of the grand unified theory. Keynote address at the 5th World Congress of Nonlinear Analysis, July 2 – 9, Orlando, Florida, Nonlinear Analysis, A-Series: Theory, Methods and Applications, 71 (2009) e420 – e431.

Abstract. This paper surveys the mathematics of the Grand Unified Theory, classical and new, and focuses on the construction of the new real number system \mathbf{R}^* .

(36) The new real number system and discrete computation and calculus. Neural, Parallel and Scientific Computation, 17 (2009), 59 – 84.

Abstract: The paper points out the inconsistency and ambiguity of the field axioms of the real number system and notes that the only clearly defined and consistent mathematical model of the real numbers is the set of terminating decimals. Inconsistency collapses a mathematical system since every statement in it is contradicted by another. The inconsistency in the real number system comes from the trichotomy and completeness axioms to which counterexamples have been found. To remove the inconsistency and ambiguity the real numbers are built on the additive and multiplicative identities 0, 1 and addition and multiplication tables of elementary arithmetic as its axioms that define the operations addition and multiplication, respectively. Then using 0 and 1 the terminating decimals are defined on which the nonterminating decimals are defined for the first time (prior to this the nonterminating decimals were simply arrays of digits most of which unknown). The g-norm is introduced where the g-norm of a decimal is itself. Then the g-closure of the terminating is the new real number system \mathbf{R}^* that includes the nonterminating decimal and the set-valued nonstandard number d^* called dark number which is a continuum. Then the decimals are joined together by the continuum d^* so that \mathbf{R}^* is a continuum. It is non-Archimedean and non-Hausdorff but its subset of decimals countably infinite, hence, discrete, Archimedean and Hausdorff. Highlighted in this paper are the counterexamples to FLT that prove it false and the proof of Goldbach's conjecture.

(37) The grand unified theory. Nonlinear Analysis, Series A: Theory, Methods and Applications **69**(3), 2008, 823 – 831. The paper is a contribution to the felicitation volume, special issue of Nonlinear Analysis on the occasion of 85th birth anniversary of Professor V. Lakshmikantham, founder of the broad and rapidly expanding field of nonlinear analysis and Editor-in-Chief of many renowned scientific journals.

Abstract. The paper is the first formal formulation and presents an overview of the Grand Unified Theory, introduces the ten most important natural laws and surveys the mathematics related to GUT's development and applications with more detail on the author's recent contribution, the new real number system.

(38) The generalized integral as dual of Schwarz distribution, in press, Nonlinear Studies.

Abstract. The paper develops the generalized integral and derivative of set-valued function called wild oscillation using rapid oscillation for approximation and deriving the probability distribution of wild oscillation as set-valued function for purposes of generalized integration. It applies the generalized integral to calculation on the photon

(39) Global geology and oceanography. Invited paper, International Journal of Earth Sciences and Engineering, in press

Abstract. The paper develops the theory based on GUT and applies it to lay down the cosmological history of Earth. It explains the reversal of the Earth's magnetic flux during its 25,000-year cycle and the regular reversal of Indian Ocean current with the summer and Winter Solstices.

(40) Revisiting the hybrid real number system, Nonlinear Analysis: Hybrid Systems, **3**(2) May 2009, 101-107 (co-authored with Bhaskar, T. G., Kovak, D., Lakshmikantham V.).

Abstract. The new real number system is combined with Ancient Indian thought to develop the hybrid real numbers.

(41) The unified theory of evolution, invited paper, International Journal of Biological Sciences and Engineering, in press

Abstract. Eleven laws of nature are discovered to update the theory of evolution. Among the latest findings are:

[42] Genetic alteration, modification and sterilization and applications to the treatment of genetic diseases, accepted, *The Journal of the Science of Heaibg Outcomes*; 11 paages.

Abstract. The paper formulates the theory behind genetic alteration, modification and sterilization based on the theory of evolution updated by the grand unified theory (GUT). The key element in the updated theory is the discovery that the medium for both the brain and the gene for doing their functions are brain waves, i.e., basic cosmic waves encoded with the vibration characteristics of a living cell such as the neuron or the cell of any tissue of living organism. The principal component of brain wave is the vibration characteristic of the gene. It is established that the gene projects brain waves that agitate and convert the superstrings in the cellular membrane to molecules that form the tissues of living things. The gene is turned on to do this task at the right place on cue from the environment there in accordance with the biological law, genetic activation.

Then appropriate technology is proposed for treatment of genetic diseases such as cancer, systemic lupus erythematosus, diabetes, muscular dystrophy and mental disorder, e.g., depression, without injury to normal cells. The methodology is called genetic modification; it uses a neutralizer gene to form a composite with the defective gene that removes its symptoms. The neutralizer gene resonates with the defective gene so that the brain waves it projects superperpose on the brain waves projected by the defective gene to produce composite brain waves that do not show the symptoms of the defective gene. In effect, a composite gene is produced without the harmful symptoms. For cancer, however, a more appropriate and effective treatment is genetic sterilization to prevent it from spreading to normal cells. Then the sterilized cancer cells become harmless; they die in the normal turnover of cells.

Genetic alteration involves introduction of a gene that produces desirable physical qualities such as the developed muscle of the weight lifter through the beneficial application of the induced alteration law that says: the possible sources of genetic alteration are: radiation (including the so called background radiation which are cosmic waves), direct exposure to foreign gene, frequent, consistent and sustained use of body part, chemical irritation and concentrated thought about and pre-occupation with or craving for an object, living or not, during pregnancy.

Again, as in the previous papers, the methodology employed is qualitative modeling.

(43) Extended Geometrical and Generalized Fractals, Chaos and Applications, a chapter in the ebook, *Fractal Classification and Applications*, in press, Nova Science Publishers.

Abstract. Starting with classical geometrical fractal in the plane we extend present classical technique of affine transformation for generating fractal by admitting other self-similar transformations, e.g., taking mirror image of generator, sliding over a curve and rotation, where finite generators are allowed. Such fractal is called extended geometrical. Geometrical fractal is a sequence of composite affine transformations of a geometrical figure. Affine transformation is a composite of contraction and translation. We further

extend geometrical fractal by broadening self-similarity to apply to general properties beyond geometrical such as branching property and circular, sinusoidal and vortical motion with applications to quantum and macro gravity and thermodynamics of the grand unified theory (GUT). We focus on generalized fractal and its applications to quantum and macro gravity and thermodynamics of GUT.

Since general properties are not always amenable to computation, the main tool of the present methodology of natural science – quantitative modeling that relies solely on computation and measurement – the appropriate methodology for GUT is qualitative modelling that relies on qualitative mathematics. Our universe is a nested generalized physical fractal with itself as the first term down through its fractal sequences that end up as tail sequences of superstrings in dark matter.

In view of the updated scientific knowledge provided by GUT, we reorient the priority in verifying validity of physical theory. We take as primary criterion for validity its ability to explain natural phenomena and, secondarily, invention of technology that works which requires prediction. Moreover, we clarify some natural phenomena and make some predictions.

(44) Mathematical Models on the way from Superstring to Photon (Co-authored with V. V. Gudkov, Professor of Mathematics, Department of Computer Science and Mathematics, University of Latvia). *Nonlinear Analysis*, 3(2002), pp. 375 - 382.

Abstract. The paper applies FTG to the physical dynamics of prima (elementary particles of quantum mechanics) and their clusters and interactions. The prima considered are the electron, up and down quarks (the second author uses right and left quarks, respectively, to stress the invariance of toroidal flux spin and induced flux under radial deformation, translation and rotation) and coupled prima like the neutrino, proton, neutron and the nucleus of an atom. The basic mathematical model of a segment of superstring is the helix as solution of the harmonic wave equation. Any primal cluster and interaction can be modeled by suitable combination of deformation, translation, rotation, reflection and attachment. The paper has data on the tremendous latent energy of dark matter. For example, a cubic meter of dark matter (vacuum of quantum mechanics) has latent energy content of 10^{18} kilograms that is convertible to kinetic energy using Einstein's mass-energy equivalence equation. A fundamental physical principle FTG is utilized here to suite the requirement of quantum gravity, namely, the flux compatibility principle that governs primal clustering and interaction.

(45) The Helix and Other Optimal Configurations of Matter and Applications (Co-authored with V. V. Gudkov). Nonlinear Analysis and Phenomena Vol. III, No. 2, 2006.

Abstract. The paper provides both qualitative and computational models of the common prima like the proton and neutron.

(46) Sustainable Economic-Industrial Development for Underdeveloped Countries (co-authored with Chandra Prakash Kamana, first author, and V.S.R.S. Sarma Salagrama), Proceedings, International Conference on “Accelerating Economic Revival Through Innovation and Reform” Feb. 5, 6, 2010, organized by the Department of Commerce and Industry, Corporate Economics and Management Studies and Women’s Christian College, Chennai, India.

Abstract. Proposes Strategic Positioning as the only strategy for sustainable development of the Third World in the present situation (see the article, Primer on Strategic Positioning on this website)

(47) Building Green to Attain Sustainability (co-authored with Chandra Prakash Kamana, first author, and V.S.R.S. Sarma Salagrama), Proceedings, International conference on "Emerging Trends in Engineering (ICETE-2010)", 20 – 21 February 2010, organized by Dr. J. J. Magdum College of Engineering (JIMCOE) in technical collaboration with Cafet-Innova Technical Society, in Dr. J. J. Magdum College of Engineering, Jaysingpur, Kolhapur District, Maharashtra, India.

Abstract. Points the way to find the lynchpin technologies for Strategic Positioning that can partake of the enormous global resources into a Third World Country for its sustainable development.

(48) Building Green – Practices and Challenges (co-authored with Chandra Prakash Kamana, first author and V.S.R.S. Sarma Salagrama). Proceedings of the International Conference on Environmental Sustainability with Green Building Technology (ICESGBT-10), 15 – 17 March 2010, organized by the Department of Civil Engineering, Meenakshi Sundararajan Engineering college, Chennai, India.

Abstract. Identifies the advantages of green building technology with respect to energy consumption, and comfort and convenience.

(49) Geometrical and Generalized Fractals, Chaos and Turbulence and Applications, chapter contribution to the book, Fractal Classification and Applications, in press, Nova Science Publishers, 53 pages.

Abstract. Starting with classical geometrical fractal in the plane we extend present classical technique of affine transformation for generating fractal by admitting other self-similar transformations, e.g., taking mirror image of generator, sliding over a curve and rotation, where finite generators are allowed. Such fractal is called extended geometrical. Geometrical fractal is a sequence of composite affine transformations of a geometrical figure. Affine transformation is a composite of contraction and translation. We further extend geometrical fractal by broadening self-similarity to apply to general properties beyond geometrical such as branching property and circular, sinusoidal and vortical motion with applications to quantum and macro gravity and thermodynamics of the grand unified theory (GUT). We focus on generalized fractal and its applications to quantum and macro gravity and thermodynamics of GUT.

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In view of the updated scientific knowledge provided by GUT, we reorient the priority in verifying validity of physical theory. We take as primary criterion for validity its ability to explain natural phenomena and, secondarily, invention of technology that works which requires prediction. Moreover, we clarify some natural phenomena and make some predictions.

(50) The Big Bang and What it Was, Chapter Contribution to the ebook, *The Big Bang: Theory, Assumptions and Problems*, in press, Nova Science Publishers. 56 pages

Abstract. The paper takes as its premise the occurrence of the Big Bang, a colossal explosion that gave rise to the birth of our universe. Then through sequences of mathematical and scientific reasoning called rational thought using the methodology of qualitative modeling the grand unified theory (GUT) is developed on laws of nature which establishes what it was that exploded. This is a new approach. In earlier development both the occurrence of the Big Bang and what caused it were taken as premises.

In its present development GUT builds its pillars – quantum and macro gravity and thermodynamics. Through the discovery of appropriate laws of nature, GUT well defines its fundamental physical concepts such as the

superstring, basic constituent of matter; matter and energy; dark matter; and charge and gravity. It also well-defines and explains other physical concepts: primum, photon, matter-anti-matter interaction, atom, cosmic waves, brittle and malleable materials, metal fatigue, turbulence, galaxy, black hole and supernova along with the conversion of dark to visible matter.

The cosmology of our universe is traced from its birth at Cosmic Burst 1.5 billion years from the start of the Big Bang through its evolution to the present as a super...super galaxy 10^{10} billion light years across and a local bubble in the timeless boundless Universe and predicts its destiny as black holes back in dark matter. The existence of universes other than ours is established from available evidences. Then it is deduced from this cosmology what the Big Bang was and what caused it.

(51) Our Fractal Universe and Applications. Invited keynote address at the 6th International Conference on Dynamic Systems and Applications, May 25 – 28, Atlanta, USA, to appear in the proceedings. 8 pages.

Abstract. The generalized nested fractal structure of our universe is described with itself as the common first term. A common feature of every cosmological vortex is the family of spiral trajectories that simply covers it along which visible matter falls through and spins around its eye. The Integrated Pontrjagin Maximum Principle is applied to find the equation of such a trajectory and solve practical problems.

II. Books and Monographs

(52) Introduction to Qualitative Control Theory. Kalikasan Press, Manila, 1991, 151 pages.

Abstract. This is the first development of qualitative or noncomputational mathematics applied to control theory. It focuses on the properties of relaxed trajectories and makes slight improvement of L. C. Young's integrated Pontrjagin maximum principle.

(53) On the undecidability of Fermat's last theorem, monograph published by the Press Center, University of the Philippines Los Baños, 1993. 40 pages

Abstract. The first broad sweep of the partial resolution of this problem which establishes its undecidability, reformulates it as a problem in \mathbf{R}^3 and provides the probabilistic solution to the reformulated problem. The question of truth of FLT is not considered here.

(54) Introduction to Qualitative Control Theory, Kalikasan Press, Manila, 1991.

Abstract. Adapts qualitative mathematics and modeling (introduced and the main contribution of this author's Ph.D. thesis, The Trajectories, Reachable Set, Minimal Level and Chain of Trajectories in a Control System, at the University of Wisconsin) to control theory. It has also a slight improvement of L. C. Young's Integrated Pontrjagin Maximum Principle.

(55) Diophantus: Introduction to Mathematical Philosophy (With Resolution of Fermat and Other Applications). Kalikasan Press, Manila, 1993, 156 pages.

Abstract. The resolution referred to here is probabilistic solution that says: with probability 1, FLT is true when $n > 2$. The book makes a thorough critique-rectification of mathematics including lack of awareness of the loss of certainty in infinite and very large spaces in mathematical and scientific pursuit. It introduces a totally new mathematical perspective. Several counterexamples to the axiom of choice are given. The calculus of set-valued functions is more fully developed and applied to oscillatory differential equations. A general theory of fractal provides some of the basic requirements towards the solution of the gravitational n-body problem. The book has the first partial resolution of Fermat's last theorem as undecidable in arithmetic, the reals and the Euclidean plane and the probabilistic solution of the reformulated problem in \mathbf{R}_3 . It points the way for dealing with undecidable proposition (proposition having no deterministic proof): the use of probabilistic mathematics. A critique of Wiles' initial offering of 1993 made it to the appendix while the book was in press. It is the first to point out that Wiles' main error is lack of insights from recent discoveries in mathematics such as characterization of undecidable propositions and the loss of certainty in infinite or very large spaces.

(56) The Hybrid Grand Unified Theory, co-authored with V. Lakshmikantham and S. Leela and published by Atlantis (a division of Elsevier Science, Ltd.), 2009; 185 pages. (Currently on the World Scientific best sellers list since May 2009; got on the #2 spot on the list in July in all categories; #1 on the best sellers list in mathematics as of October 3, 2009)

Abstract. The book updates the foundations of mathematics and applies the new real number system to develop the hybrid real number system. The main chapter, The Grand Unified Theory, formulates builds GUT on macro and quantum gravity using the new methodology of qualitative modeling. Then both qualitative mathematics and GUT are applied to develop the theory of turbulence and physics of the mind. The book concludes with an overview of

the grand unified hybrid system that combines modern and ancient scientific thought.

(57) Scientific Natural Philosophy, an ebook in press, Bentham Science Publishers, 2010, 305 pages.

Abstract. The aim of philosophy is to provide a total view of an aspect of reality, for our present pursuit, nature, the domain of natural science. Naturally, that view is relative to the level of advancement of the field of science concerned. The most important component of philosophy is methodology for it determines the nature of knowledge that can be achieved. For example, the current methodology of physics – quantitative modeling – describes the appearances of nature mathematically in terms of numbers, equations, functions or statistical trends. Thus, the knowledge it provides is only descriptive. In biology species are classified on the basis of their appearances, e.g., anatomical structure. However, this methodology has limitations and left long standing problems of physics unsolved and fundamental questions unanswered such as the gravitational n-body problem and what the basic constituent of matter and the structure of the electron are.

The introduction of qualitative or non-quantitative modeling that explains nature in terms of its laws not only solves and answers the long standing problems and fundamental questions but also deepens our knowledge beyond the appearances. It tells us how nature works and allows us to explain the internal dynamics and interactions of physical systems. It also allows us to devise technology guided by theory instead of appearances and properties of materials. At the core of both methodologies are mathematics, qualitative mathematics for qualitative modeling and computation and measurement for quantitative modeling. Therefore, mathematics is not only a language of sciences but also its indispensable tool for analysis. Consequently, mathematics plays a major role in philosophy as part of methodology and we shall devote a major part of this book to it.

Scientific natural philosophy is an updated philosophy of natural science different from and an improvement of all previous ones because it is based on major scientific development, innovations and discoveries during the last 12 years among which are the following:

(1) First and foremost was the introduction of qualitative modeling (formerly called dynamic modeling) in 1997 to solve the 200-year old gravitational n-body problem posed by Simon Marquiz de Laplace at the turn of the 18th Century. It explains nature and its dynamics, appearances, properties and motion in terms of its laws (natural laws). It is the complement of quantitative modeling (formerly called mathematical modeling). The main

tool of qualitative modeling is qualitative mathematics and that of quantitative modeling its complement, the combination of computation and measurement. Qualitative mathematics includes this daily activity of the mathematician or scientist: making conclusions, visualizing, trial and error, thinking backwards, thought experimenting, engaging in creative activity, intuition and imagination, negating what is known to find an opening into the unknown, altering premises to draw out new conclusions and any technique that yields results. It liberates the mind from unnecessary constraints and is the key to productive research. Abstract mathematical systems such as foundations, topology and the search for the laws of nature are qualitative mathematics. It is based on rational thought and analysis, quantitative mathematics on intuition. Consequently, qualitative modeling is also based on rational thought and analysis, quantitative modeling on intuitions.

(2) Since qualitative mathematics has liberalized the search for information for purposes of knowing nature and explaining its behavior and appearances it also increases the chance of error creeping into physical theory. Error includes contradiction, ambiguity, inadequacy and self reference. Therefore, to avoid error we tighten the filter of admissibility in the choice of concepts and axioms in the development of physical theory. In particular, we identify the sources of error to avoid them.

(3) To solve a long-standing problem or resolve unanswered question we find out why it defies solution or resolution and the first to check are its underlying fields. Therefore, we go through their critique-rectification to clear them of errors. This was the crucial first step in both the resolution of Fermat's last theorem [and the solution of the gravitational n-body problem.

(4) Qualitative modeling led to two important developments: (a) the discovery of the existence of two fundamental states of matter, dark and visible or ordinary matter, where the latter is directly observable and the former is not and known only by its effect on visible matter and (b) the discovery of the basic constituent of matter, the superstring.

(5) Qualitative modeling has also led to important discoveries in biology aside from the biological laws. One is the discovery that the brain and the gene have the same medium for doing their functions, namely, brain waves, i.e., basic cosmic waves encoded with the vibration characteristics of living cells. The main function of the brain is to control all body processes and its secondary function is providing the venue for thought processes. The gene's main function is to produce the tissues of plants and animals in the cellular membranes through the agitation of dark matter by the brain waves it projects and their conversion, first to prima, then to atoms and molecules and finally to the atoms and molecules of the tissues.

(6) Physical theory is a qualitative model of reality, in particular, nature. It is a mathematical system whose basic premises or axioms are laws of nature. Being so, any theoretical error is ultimately mathematical. While mathematics, erroneous or not, is totally harmless and essentially useless in the mind or its representation, mathematical error may have catastrophic impact in the real world through the application of erroneous or absence of theory. Therefore, we have given considerable effort to avoid mathematical error by identifying its sources and avoiding them or providing remedy. We cite disastrous failures in applications due to theoretical error.

(a) The disastrous final flight of the Columbia Space Shuttle, February 1, 2003 as being due to inadequate theory. In fact, in trying to explain why the disaster occurred three new laws of nature were discovered. In particular, the recurrent peeling of the insulation panels from the Shuttle when the Columbia Space Shuttle Program was resumed after two and a half years of suspension was never explained because there was no theory to do so. The program was scrapped for this reason [34].

(b) The failure to make a breakthrough in plasma research towards controlling thermonuclear reaction. After over half a century of this research no significant breakthrough has been made.

(c) Research in particle physics in search of the basic constituent of matter. Physicists have steadily raised the energy of the collider but they have not found even a candidate for basic constituent of matter since all they found are unstable elementary particles with half-life of split second. The basic constituent of matter must be indestructible otherwise our universe would have collapsed a long time ago. The large hadron collider in Cern, Switzerland was supposed to have been turned on last summer but there has been no report on it so far. Like thermonuclear research this has been going on for over half a century. Actually, the superstring has been staring at the physicists since 1811 when Ernest Rutherford discovered the electron, an agitated superstring.

(d) Cancer research. Geneticists and oncologists have been trying to understand this genetic disease for the purpose of developing the most effective treatment with the least side effect; this has been going on for a long time but no significant breakthrough has been registered so far, a case of lack of appropriate theory.

In each of these cases the culprit is theoretical error that includes erroneous, inadequate and absence of theory to guide the research.

Although 6(b), 6(c) and 6(d) are not as catastrophic as 6(a), the enormous amount resources, human and material, allotted to such failed research could have alleviated the desperate conditions in much of the Third World.

(7) The 11 laws of nature discovered in 1997 required to solve the gravitational n-body problem served as the initial axioms of the flux theory of gravitation which was later corrected and named the grand unified theory (GUT).

These are innovations, discoveries and advancement that distinguish the grand unified theory, which we now summarize and call the new physics, from all previous physical theories. It is much broader and more general than what Albert Einstein envisioned which was to describe gravity and electromagnetism by equations of the same form although this was modified by quantum physicists who joined in to include the strong and weak forces of physics in the unification. The grand unified theory that we now have is stronger and much broader for it explains the forces and interactions of nature and its appearances and, therefore, unifies as well the entire fields of natural science. It raises the quality of scientific knowledge from description of appearances of nature to knowledge of how nature works that includes explanation of its appearances. Research is in progress to broaden GUT beyond its pillars – macro and quantum gravity and thermodynamics – and into the grand unification of natural dynamics where natural dynamics includes interactions between physical systems and the latter broadened to include all motions of matter such as cosmic waves, the synchronized vibration of dark matter. This will not qualitatively alter scientific natural philosophy based on GUT for there is no change in perspective and methodology, only extension of domain.

All these developments are synthesized and integrated into scientific natural philosophy. It is distinguished from all previous philosophies of science because it is scientific in contrast to being speculative where the former rests on scientific knowledge. In particular cosmology is no longer speculative but knowledge provided mainly by macro gravity. Moreover, it is complete as it provides a full account of the evolution of our universe from its birth at Cosmic Burst to its destiny as cluster of black holes back in dark matter. Every application of GUT to solve a scientific problem requires the discovery of appropriate laws of nature to provide the solution. Thus, the application of GUT to explain the disastrous final flight of the Columbia Space Shuttle added three more natural laws to the theory of turbulence [23] to advance it to the enriched theory of turbulence. In trying to understand the role of the gene in the evolution of biological species and how it produces the tissues of a living thing 11 biological laws were discovered to develop the theory of evolution based on GUT. Five learning principles were also

discovered in the applications of GUT to investigate the brain's functions. This is an aspect of innovation in scientific methodology. In traditional methodology existing knowledge is applied to solve some problems. Here, given a scientific problem a theory is devised to provide the solution. Therefore, in this new methodology a scientific problem serves as catalyst for the advancement of science. It is clear that physical theory is the embodiment of our knowledge of the domain of a field of natural science and that without a theory we have, at best, a collection of information about it.

We have some new knowledge that enriches scientific natural philosophy:

(1) The laws of nature are transitory and their manifestation is simultaneous with the respective emergence of physical systems or natural phenomena that reveal them. For example, the biological laws that we now enjoy were non-existent immediately after the cosmic burst when only simple prima (a primum is unit of visible matter) existed. They will all vanish as our universe reaches its destiny as cluster of black holes.

(2) Our universe is a local bubble in the boundless and timeless Universe of dark matter and there is ample evidence of the existence of other local universes like ours. There are two kinds of local universes: ordinary resulting from the steady shrinking of the superstrings that gives rise to nested fractal sequences of regions of depression that, in turn, evolve into nested fractal sequences of cosmological vortices of superstrings like the galaxies and stars, and special universes like ours whose birth was triggered by a big bang. A big bang is explosion of a black hole, the destiny of a previous universe. Our universe was due to the explosion of a black hole, the destiny of the core of a previous universe that created a super...super depression in dark matter that evolved into a super...super galaxy 10^{10} light years across.

(3) GUT has brought us to the threshold of a new technological Epoch, the epoch of GUT technology that runs on dark matter directly or indirectly. Examples of the former are the magnetic train and the electric power plant both of which run on fluxes of superstrings. Like the steam engine which was invented before the development of the science of thermodynamics they were invented before the development of GUT based on knowledge of the property of the material used, mainly magnet. Therefore, they are considered conventional. An example of GUT technology is the electromagnetic engine for mass transit system. Its invention which is still at the research and development phase is directly guided by GUT (the invention can only be announced; details cannot be discussed at this time). Another example which is still at the research stage (not even at research and development) is the appropriate technology for genetic alteration, modification and sterilization for the treatment of genetic diseases.

We provide selective theoretical applications of GUT and its methodology of qualitative modeling that spill over into several fields of natural science and its boundary with psychology – physical psychology.

Finally, scientific natural philosophy is materialist and focuses on explainable physical reality.

In the Pipelines: An ebook, Symposium on the Grand Unified Theory, for Nova Science Publishers; probable completion: 2012.

I owe much of my achievements to others:

R. A. Favila and M. Sambandham opened the doors to mathematics and science; L. C. Young inspired and trained me well and V. Lakshmikantham discovered and walked me over to the frontiers of science and mathematics.

Regrets?

I could have trained world-class scientists and mathematicians and contributed a great deal to national development if only the leadership knew better.

My biggest regret, however, is unlike China and Vietnam where the leaders have a vision for development that they turned into a material force for progress, prosperity and peace, we have had only caretakers since the Commonwealth period.

