

**Inevitable incompleteness of all theories:  
An epistemology to continuously refine human  
logics towards cosmic logics**

**by**

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First Talk

# **A proposal to organize $i^2$ -EPR**

(International Institute for Exploring Physics with Reality)

**Using process based reality epistemology that must evolve  
with our evolution.**

Second Talk

**Process based reality epistemology applied to  
optical phenomena**

**The purpose of these talks is to generate sufficient doubts in your minds regarding the current paradigm of thinking behind doing science.**

First Talk

# A proposal to organize $i^2$ -EPR

(International Institute for Exploring Physics with Reality)

**Why  $i^2$ -EPR?  
Is it really warranted?**

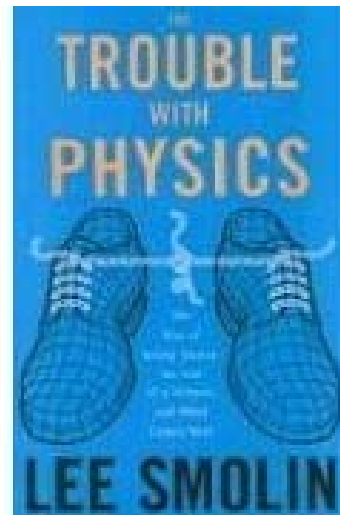
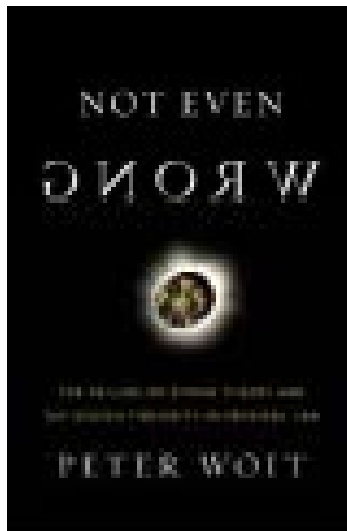
How can we promote the *discovery* of actual *realities* in nature driven by *cosmic logics* (ontology) rather than staying limited to the *invention* of realities that are esthetically pleasing to our *human logics* (epistemology)?

How can we promote *innovations* by focusing on understanding the interaction *processes* in nature promoting wealth creation (material & spiritual) at all levels ?

# “Trouble with Physics” !

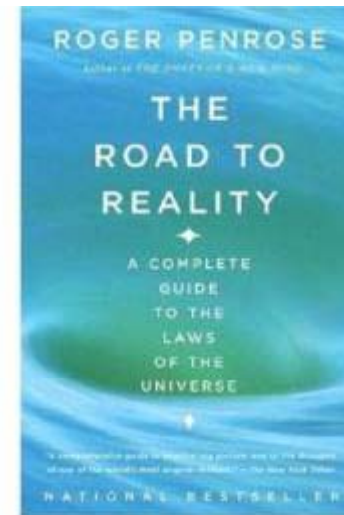
**QM epistemology does not support seeking reality (visualization of actual physical interaction processes) in nature !**

Well known theoretical physicists have begun to speak out that there are serious problems with the current paradigm, philosophy and direction of physics !



“A Different  
Universe:  
Reinventing  
Physics from  
the Bottom  
Down”

**Robert Laughlin**



Like Ptolemy’s time when they were enamored with the spherical **symmetry** centering the Earth, we are worshipping esthetically pleasing perfect mathematical symmetry !

Unfortunately, a perfect symmetry would have made an unchanging and un-evolving universe contrary to our observations !

## **The cosmic universe is one indivisible system, but we are failing to unify our different theories**

Today we have over half a dozen or more “solved puzzles” or theories that are logically congruent and self consistent in mapping the behavior of different domains of nature:

- (i) Classical theory,
- (ii) Special relativity,
- (iii) General relativity,
- (iv) Quantum Mechanics, QED, QCD
- (v) Cosmology,
- (vi) String Theory,
- (vii) Etc.

Our failure to merge these separate “solved puzzle” pieces into one harmonious bigger puzzle even though the number of operating forces behind all possible transformations are only four, is a clear indication that we need to think differently. We need to anchor our thinking on the interaction processes, not just measurable outcomes.



**“If I have seen further than other men, it is by standing on the shoulders of giants.”**

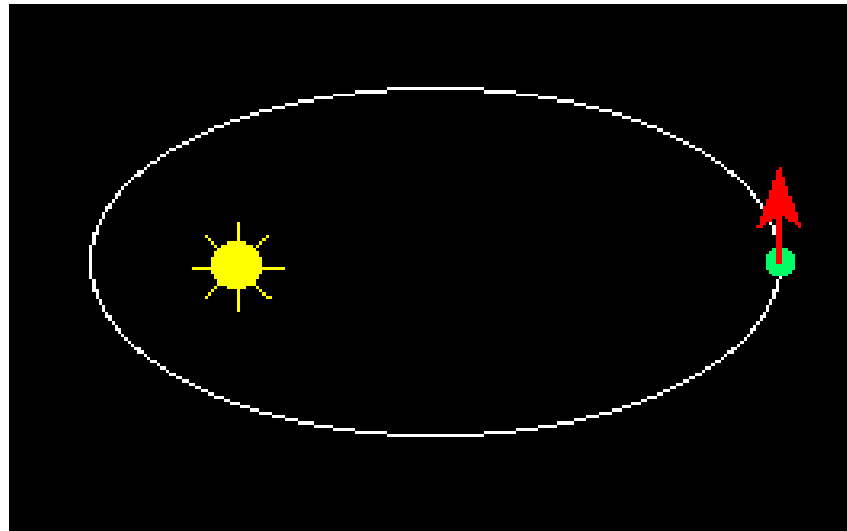
Today we are both **fortunate and confused** because our guiding giants have been divided among themselves for many many decades. Current consensus epistemology has stifled us from seeking out the realities behind the processes that drive the cosmic evolution.

**It is time to see “further” again by standing on a high pyramid built over the shoulders of many more giants than Newton had the privilege to exploit. But, the purpose must be focused on discovering nature’s actual reality rather than inventing them!**

The Cholula Pyramid, with its widest base of all the pyramids, offers us the opportunity to accommodate the largest number of big and little giants!

# Newton's formulation of gravitational force law and related math was designed to model the process by which the planets rotate around the Sun

Classical physics seeks reality - processes experienced by the interacting entities under the influence of the forces.



Newton derived Kepler's empirical laws of planetary motion formulated by analyzing life-long measurement data made by Tycho Brahe.

**Quantum Mechanics is happy predicting only the probability of the outcome of an experiment – not the processes of interactions.**



## Classical physics nurtured the emergence of quantum physics by underscoring Reality Epistemology

- Maxwell presented his comprehensive equations on electromagnetism in 1864 by synthesizing the rules of electricity and magnetism developed by Coulomb, Ampere, Gauss and Faraday, all of whom lived between 1736 and 1867.
- Lorentz utilized this knowledge to correctly attribute the generation of light by atoms as due to dipole like undulations of electrons in atoms validated by observation of Zeeman effect in 1896 in which magnetic field splits the spectral lines.
- This dipole model with multiple absorption lines led to the development of a quite accurate model of dispersion theory with distinct “oscillator strengths” for the different absorption lines, which was corroborated many decades later after quantum theory was fully developed.
- Before the end of 19th century, Rydberg-Ritz formula captured the discreteness of atomic spectra and validated by Bohr’s 1913 “simple” quantum theory by quantizing the orbital angular momentum:

$$\nu = cR_y \left( \frac{1}{n^2} - \frac{1}{m^2} \right)$$

- Planck in 1903 discovered through mathematical manipulation of measured blackbody radiation the generalized quantum aspect of all emission and absorption of radiation by matter:

$$u(\nu, T) = \frac{8\pi h\nu^3}{c^3} \frac{1}{\exp(h\nu / kT) - 1}$$

- Noteworthy also was the derivation of “A and B coefficients” by Einstein
- By 1924, before the advent of formal quantum mechanics, Bose-Einstein statistics was published
- “Proper” Quantum formalism was developed in 1925 and within three decades, we have learned that the entire universe is made out of electrons protons and neutrons using only four forces!

## **BUT! After 82 years of the evolution of QM, it has failed to nurture the emergence of its follow-on theory keeping physics stagnant for more than thirty years!**

- The photon is quantized as a Fourier monochromatic mode of the vacuum, which exists over all space and time, physically violating causality and conservation of energy. Currently the problem is “resolved” by using classical mathematical Parseval’s theorem, a derivative of the Fourier theorem itself. This may appear more benign and less glamorous compared to “managing” the “infinities “ in QED, but it is nonetheless hiding violation of causality.
- An elementary particle cannot carry multiple values of the same critical dynamical parameter that is part of its physical description at the same instant. The parameter cannot be multi-valued at the same time.
- Unfortunately, rapidly accelerating successes of the mathematical QM formalism and the concomitant exuberance diverted us from keeping ourselves anchored to Reality Epistemology, methodology to discover reality rather than inventing reality.
- For generations students have been trained to “crank the equations” instead of nurturing their inquiring minds. If “nobody understands quantum mechanics”, yet the formalism works, then we ought to have been urging the students with proactive encouragements that there must be something seriously wrong with our interpretations, our epistemology for QM.
- Physical interpretation of QM formalism has failed to appreciate the fundamental difference between diffraction and interference even though both are essentially superposition integral. But diffraction is grouping and re-grouping of a perturbed wave front, which is undulation of the cosmic tension field under equilibrium. The process naturally promotes the evolution of angularly stable and sustainable wave packet. In contrast, interference due to multiple superposed well formed beams is the sum of the undulations simultaneously experienced by interacting material dipole, the energy transfer being square modulus of the sum of the complex field amplitudes. Thus, well formed beams do not re-distribute each others energies by themselves – energy absorbability of detecting dipoles are modulated by the superposed fields – a local effect, not non-local..

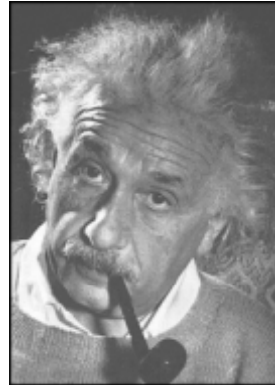
# “Ask and ye shall receive!”

But our flexibility in framing the question determines our success & progress!

## Does ether or ether-like medium exist?

Einstein never questioned the validity of “time” as a physical parameter. Yet, the real measurable parameter is the frequency of different harmonic undulators, which gives us an indirect tool to measure only time intervals, not running time. We can manipulate the physical parameter - frequency, but not time.

But, Einstein was always an honest enquirer of reality that exists independent of homo-sapiens!



## “What are light quanta?”

Near the end of his life Albert Einstein wrote

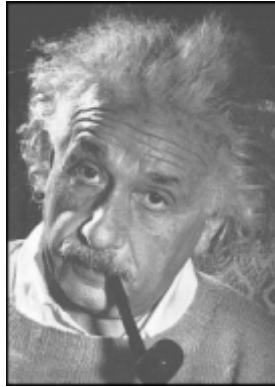
**“All the fifty years of conscious brooding have brought me no closer to the answer to the question: What are light quanta? Of course today every rascal thinks he knows the answer, but he is deluding himself.”**

Recently Arthur Zajonc wrote:

“We are today in the same state of “learned ignorance” with respect to light as was Einstein.

In Optics & Photonics News, Oct 2003: Special Issue, “The Nature of Light: What is a Photon”; Ed. C. Roychoudhuri & R. Roy.

**Space as a medium is the ultimate frontier for physics & light consists of divisible wave packets as Planck always assumed!**

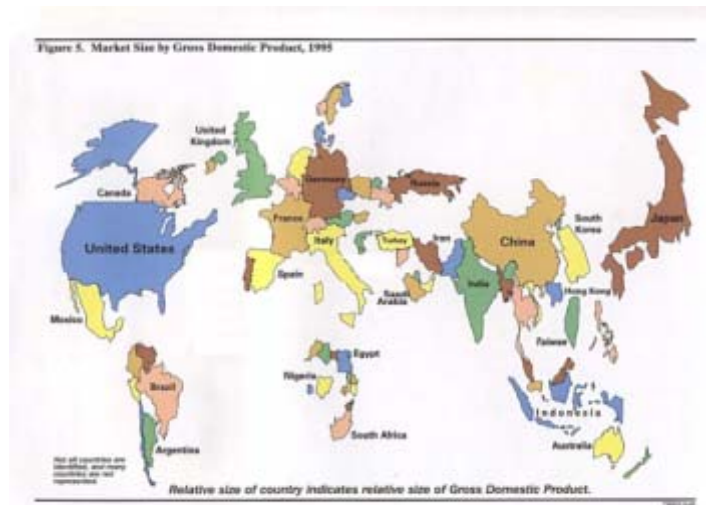


**But broad successes of relativity tells us that the appearance of superluminal velocity is a tool to challenge diverse physical theories and to re-structure and bring congruencies among them.**

1. Winful's interpretation that group velocity is not a propagational delay, is an excellent example.
2. Fernandez's attempt to develop Sequential Relativity is a second example.

# But, trouble is everywhere, not just with physics!

The economic epistemology in action has not been congruent with the collective & sustainable evolution of the biosphere!



Sustainable evolution requires balance of forces behind the evolutionary needs and drives !

**The right working model for the global economy has to evolve through trial and error, but only if we focus on the core principle of the biospheric evolution.**

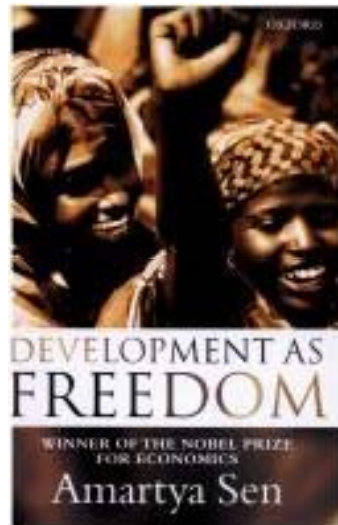
**Self Actualization For Everybody (SAFE),  
or, SAFE-ty is the prime directive!**

**Biospheric sustainability is inseparable from the collective well being of all the species! Diversity is not just “political correctness”, it is at the very root of our sustainability.**

**The Nobel laureate poet, Rabindranath Tagore, said it aptly:  
“Those whom you are leaving behind,  
Are constantly pulling you down!”**

## Let us briefly visit the socio-econo-political sphere.

Doing science with complete intellectual honesty requires complete economic and political freedom without fear of reprisal either financial or professional!

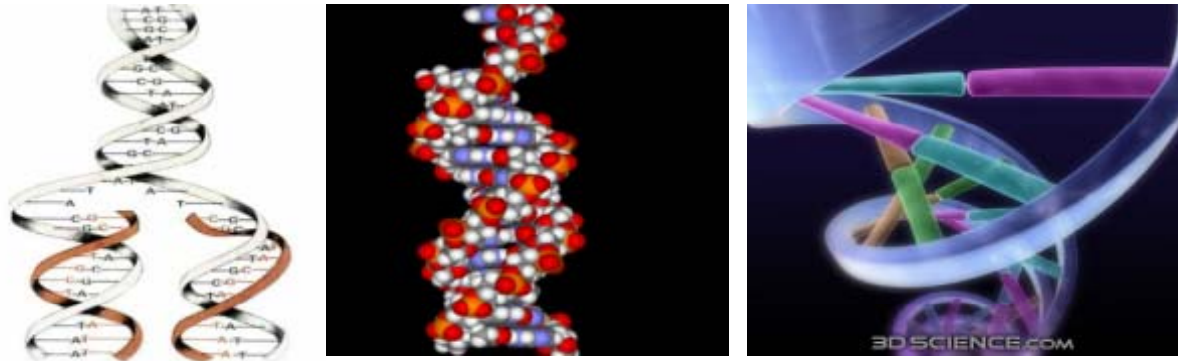


As I perceive, my prime directive is to live and let live while I explore the meaning and purpose of the cosmic universe to find out my functional role in it.

But if I do not have the right and the access to the infrastructure to generate the necessary material and spiritual wealth, I cannot nurture the well being of my body-mind inspite of all the ongoing developments, all the freedom and all the democracy!

Imagine the quality and quantity of scientific advancement if all of the billion school age children gets access to both material and spiritual wealth to pursue their dreams of self-actualizing their natural talents!

# Root of wealth creation: Who invented the art of invention and entrepreneurship?



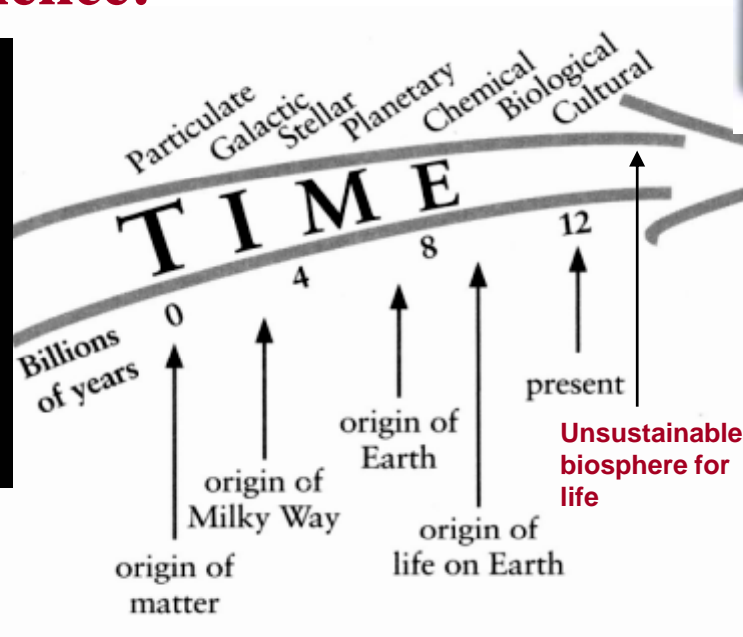
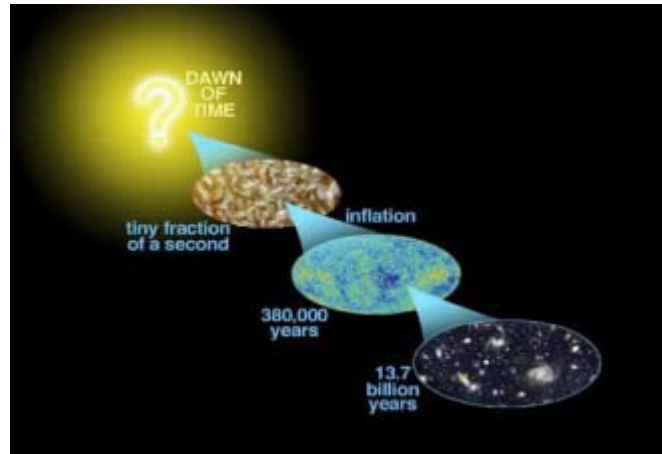
Spiraling structure repeats itself from cosmic galaxies to the origin of living molecules !

## It is the GACT-collective. The art is more than 3-billion years old!

- The GACT's decided to collectively and protectively embed themselves within the central core of a pair of helical molecular chains. This allowed them to have access to both the freedom and infrastructure to process other molecules in the biosphere and selectively create the necessary material wealth for their well being and continuous evolution.
- The GACT's in viruses and those in humans must work collectively, for there is nothing that is poison in the overall biospheric activities.
- All human body has 10 trillion human cells along with 100 trillion symbiotic microbes. GACT's provide the intelligence.
- Do we have the freedom to think and invent our way of living without being influenced by the 100-trillion microbes?
- **Our sustainable human evolution critically depends upon sustainable evolution of the living biospheric collective! Denial of individual well-being is equivalent to self-destructive act against our collective well being!**



**Our destiny is to journey to other solar systems  
by navigating through  
the Cosmic Medium -- the final frontier of  
science!**



- But, our current rocket technologies are woefully poor!
- Theories of relativity are conceptual bottlenecks!
- QM epistemology limits our visualization of the quantum processes in the cosmic medium!
- **How can we venture to design rockets that can “surf” the electromagnetic waves, waves that travels unperturbed for billions of light years leveraging the cosmic medium?**

**Let us get back to our  
scientific problem !**

**“Ask and ye shall receive!”**

**But, only if our epistemology guides us to  
ask the right question, and then only  
nature yields the “visual picture” behind its  
interaction processes!**

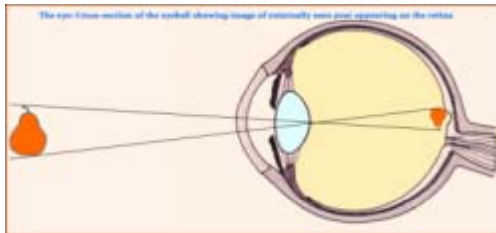
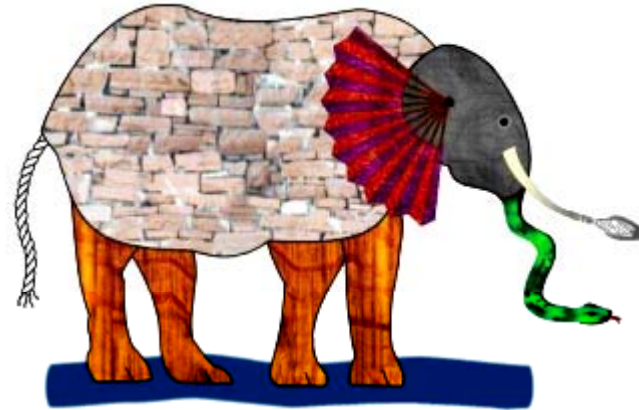
**We can learn to visualize the invisible processes in the femto-scopic domain of the cosmic world all around us only when we gather the wisdom to acknowledge that we are literally blind.**

**We do not see anything!**

**We only interpret the patterns registered by the rods and cones, congruent with our biological evolutionary needs, dictated collectively by the molecules GACT constituting our DNA!**

**Similar limitations are suffered by all our experimental sensors. After all they are also built out of atoms and molecules.**

**We are still Buddha's blind men who were instructed more than 2500 years ago to diligently employ the CC-LC-(ER)^2 epistemology to reconstruct the cosmic elephant!**



**Reminder:**

- We don't "see". We are blind. We manipulate & interpret sensory chemical input.
- Barriers to our minds are self imposed, many a times collectively!
- We have found only useful "working rules", not inviolable LAWS!
- Above images are from web.

• Only by demanding conceptual continuity (CC) by imposing logical congruence (LC) among all the observations by all the blind men did they reconstruct the elephant with some semblance to reality, but outer reality only. Extracting and extrapolating more reality from a useful theory help finds its strengths and limits. Finding such limits help formulate new theories. Emergentism and reductionism (ER) are essential to appreciate the emergence of the whole living and conscious elephant out of constituent molecules! Can consciousness be understood this way?

- To visualize the processes in the micro world of interactions, we must cultivate the humility to accept that we are literally blind!
- All of our information is what our sensors tell us. Like the blind men, the sensors themselves do not see & experience everything and they are not capable of reporting everything they experience.

**It is surprising that an ancient Indian spiritual sage provides the core of epistemology for science!**

# **All of our theories are necessarily provisional and incomplete!**

The model of nature, which our human logics aided mathematics construct, is limited by our model of thinking (epistemology). Neither the correctness of a mathematical theory nor the limited set of measurements that we can perform can guarantee that our theory has captured the final cosmic logics we seek for!

## **Incomplete information paradigm, $i^2$ -P**

- First, all of our theories are based on incomplete sets of observations in contrast to the infinite number of incessant interaction processes behind the cosmic evolution.
- Second, all the measured information are necessarily incomplete because (i) the interactants respond to each other using a limited set of their normal “quantum compatible characteristics” (not all four forces are operative) and (ii) the measured transformation data are usually “censored” by our complex measuring systems.

## **Is there hope for us to do better?**

- **All “correct” scientific theories have always been superseded and/or invalidated by new theories!**

# What is an observation?

**It is the *Superposition Effect as Measured Transformation (SEMT)* between some entities in our experiments.**

- **1.** We do not know completely even a single entity, whether an elementary particle or a complex system, in every detail under different conditions of interactions.
- **2.** All sensors (interactants, or detector-detectee) have inherent restrictive rules of engagements with each other, which limit the observables that we can record. A detector is incapable of “reporting” to us everything that it experiences.
- **3.** Thus, we are for ever deprived of complete information regarding any observation even for a very well defined experiments.
- **4.** So, science of modeling or mapping nature will always be a “work in progress”. We are forced to organize a finite set of observations predictable by an equation that can be logically completed only by incorporating human logic supported hypotheses, some of which may or may not be congruent with the eventual cosmic logic we are seeking to discover.
- **5.** **A logically complete equation is also logically closed to accommodating any radically different logic.** If the “successful” equation, like that of Schrödinger's, can accommodate a wide variety of observations, we may suffer from the illusion that it represents a “complete” theory!
- **6.** We are thus forced to accept a dialectical contradiction in mapping nature. We must build a map only for a “local terrain” and even that has to be based on incomplete knowledge of the terrain, while our vision is to create roads to map the entire cosmic forest. Thus, all of our theories are, by definition, provisional and incomplete. Most likely they contain mistaken concepts (hypotheses) and hence cannot be simply slapped together to create one integrated cosmic map (a theory of everything).
- **7.** Only choice is to advance iteratively by frequently stepping backward to identify and reject some of the human logic (hypotheses) from individual “solved” maps, which are not convertible to cosmic logic.
- **8.** **CC-LC-(ER)<sup>2</sup> epistemology** is the proposed tool to facilitate this iterative distilling process to steadily convert human logic into the desired cosmic logic allowing the construction of self-congruent bigger maps in multiple steps.

**Logically dissecting  
the observation process  
or  
the superposition effect as measured  
transformation (SEMT)**

**SEMT provides the foundational information to CC-LC-(ER)<sup>2</sup>  
epistemology**



# Universality of superposition effects as measurable transformation (SEMT) is at the core of doing science

- 1. **Measurable transformation:** We can scientifically measure only re-producible quantitative *transformations* that are experienced by our interactants (or detector-detectee, or sensor-sensee).
- 2. **Energy exchange:** Any transformations in measurable physical parameters requires *energy exchange* between the interactants.
- 3. **Force of interaction** The energy exchange must be guided by a *force of interaction* between the interactants and it must be strong enough to facilitate the exchange of energy, which are usually constrained by the characteristic limitations of each interactant.
- 4. **Physical superposition:** All force rules being distance dependent, energy exchange between the Interactants requires that they must experience each other as *locally present or physically superposed* entities (experience each other within their sphere of influence). Superposition effect is an **active local process**, not a passive mathematical principle !
- 5. **Sensors register and report incomplete information about the sensees:** All sensors wear vision- limited “quantum goggles” and report through “band-limited” communication channel. Thus, we are for ever challenged to re-construct cosmic logics to solve the little cosmic puzzles. Putting them together into one cosmic puzzle is even more formidable starting with only incomplete information.

*The conceptual framework behind all mathematical formulations must accommodate these universal steps behind all quantitative measurements.*

## Re-visiting superposition effects as measured transformation (SEMT) in view of the four force rules!

- 1. Gravitational force (GF):** All cosmic entities, from galaxies, stars, planets, atoms and elementary particles, the entire observable material universes is effectively superposed on each other as far as GF is concerned. GF is weak; its range is very long.
- 2. Electromagnetic force (EMF):** Stability of atoms, molecules and their all possible transformations, including their interactions with electromagnetic waves (light, etc.) are all dictated by this force. A dominant part of the biospheric evolution is driven by this force. EMF is relatively stronger than GF, but the range is shorter. The superposition effects due to the EMF from the molecules of two different human bodies are essentially negligible (un-entangled) on a first order analysis.
- 3. Weak Nuclear force (WNF):** Radioactivity and related isotopic nuclear transmutations are a byproduct of this force. The range of WNF is of the order of the size of the atomic nuclei. The superposition effects due to two radioactive atomic nuclei within the same bound molecule is negligible within the first order analysis.
- 4. Strong nuclear force (SNF):** Our slow physical evolution relies on the stability of an array of nuclei held together by this SNF, built into stable atoms and molecules by the EMF and held on the surface of the Earth under the atmosphere by the GF. The superposition effects due to two atomic nuclei within the same bound molecule is negligible within the first order analysis.

While the emergent observable material and light based universe may generically appear as NON-LOCAL, a careful analysis of SEMT tells us that all measured phenomena are necessarily LOCAL since all forces of interactions have a finite physical range ! Entanglement is operative within the operating range of the force.

**Back to the proposal:**

$i^2$ -EPR

# Executive Summary

## Mission

- **1. Research:** Our objective is to discover, visualize, understand and some times gainfully emulate (to advance our technologies) the real physical processes behind diverse interactions that are at the root of incessant cosmic and biospheric evolutions. Our focus is on discovering actual realities in nature driven by cosmic logic rather than inventing the ones that are aesthetically pleasing to our human logic. Our responsibility is to facilitate proactive evolution of our epistemology of modeling natural phenomena as our knowledge advances. All research projects must have simultaneous and explicit goals of fundamental research and some relevant applications. Nature becomes the evaluator of the research. There is no better validation of some fundamental research that finds successful real world application.
- **2. Education:** Promote an educational philosophy that encourages the students to persistently enquire, visualize and understand the processes behind all interactions in nature while being conscious of their scientific epistemology. Everything that we “see” is nothing but a creative interpretation of the chain of transformations experienced by the sensors (or assemblies of sensors) that we use to observe nature. Science has so far formulated an array of working rules to model nature none of which can be declared as inviolable laws as yet. We have generated several “solved” jig-saw-puzzles which are not yet unifiable into one coherent puzzle to map the indivisible cosmic system.
- **3. Outreach:** Organize local and international seminars and conferences disseminating (i) the results of research, and (ii) the evolving & effective model of research (scientific epistemology).
- **4. Economic wellbeing:** Disseminate new technology innovation potentials to attract enhanced economic support through proper local channels.

## Structure

- **1. A Virtual Global Institute:** A limited number of agreeable institutions from several countries will organize their own local centers (i<sup>2</sup>-EPR) at their own cost, congruent with their institutional mission and local governance. The local centers will adhere to the core vision and mission of the i<sup>2</sup>-EPR consisting of representatives from all the local centers.
- **2. Organizational principles:** The interactions between the local centers should be driven by (i) symbiosis, (ii) synergy and (iii) food-chain (iv) eco-driven (v) competitions, which are behind the successful and sustainable evolution of our organic biospheric system.

## Approach (Why we will succeed?)

- Nature being a creative **system engineer** we should be humble but creative *reverse engineers* to extract the *working rules* behind natural *processes* in nature and aid to technology advancements that are congruent with our sustainable evolution, for we need ~~20~~ long time to understand the *purpose of the cosmic evolution* and our role in it.

# Why we will succeed?

**Humble acceptance of “incomplete information paradigm”**

**And**

**A genetic algorithm based on our GACT experience with built-in incessant feedback loops:**

- (i) Conceptualization and application for real world evolutionary needs (technology) are inseparable.
- (ii) Recognition that we must emulate our activities based on the biospheric and cosmic evolutionary principles.
- (iii) Recognition that we still do not know all the principles of evolutionary processes.
- (iv) Recognition that our epistemology and corresponding actions must also continuously evolve as our knowledge advances.
- (v) Recognition that such evolving epistemology requires a pro-active plan for feed back loops between “starting epistemology” to “research concept” to “validation by technological applications” to “enhanced epistemology”, ad-infinitum!

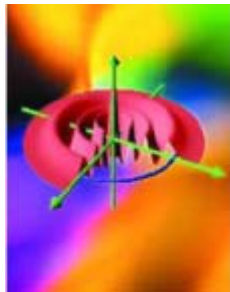
**Successful evolutionary intelligence is gathered through frequent pro-active feed back loop!**

# We have been building up our organizational successes!

## Acknowledgements

1. OSA & SPIE: For providing the platforms to raise the following question even though the main stream physics community believes that it is no longer an issue!
2. NSG, OTRR: For financial sponsorship of “nature of light” conferences & related publications.
3. CRC/Taylor & Francis: Book to be published soon on the “nature of light”.
4. INAOE: - For holding the W-EPR providing all the expenses.

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Editors: C.  
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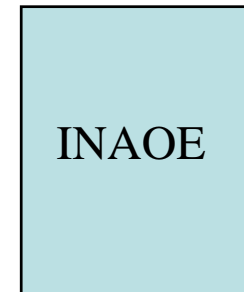
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2008



**W-EPR**

# **Background & Justification**

## Why another research organization?

- **Deviation from Reality:** While technologies have been advancing successfully, the fundamental understanding of actual processes in nature has not only stalled for almost 50 years, it has seriously deviated into justifying mysticism by promoting non-causality, non-locality, teleportation, multi-universe, etc., which are hard to experimentally invalidate.
- **“Nobody understands Quantum Mechanics” even though it works!:** If nobody understands QM even after 82 years’ of developing the formalism and its successful predictions, then we ought to acknowledge that there is some serious flaw with our epistemology to map or understand nature. Interpretation of QM and its successes to predict observations are not mutually congruent in seeking actual reality in nature. Classical physics, by being faithfully congruent to seeking reality in nature, gave birth to QM. But QM has failed to give birth to its progeny due its assumption that it is “complete”.
- **From Geocentric to Homocentric:** After overriding Ptolemy’s Geocentric vision, we are back on imposing Homocentric vision on all the enquiring minds by re-directing them to model nature as dictated by our human mathematical logic, instead of seeking actual reality. Being stifled by the quantum philosophy, we are emulating the ‘invention culture’ from our technological successes and imposing that on to physics. We are now deeply engaged in inventing realities rather than discovering the actual realities behind nature’s evolutionary processes.
- **Cosmic vs. Human logic & CC-LC-(ER)<sup>2</sup> epistemology:** Our cumulative experience indicates that nature’s evolutionary processes consist of logical patterns & organizations. Although only partial, our consistent successes have been based on applying limited human logic to reach out to unknown cosmic logic. Our efforts to refine and elevate human logic to possible cosmic logic has been advancing based on the model of CC-LC – pro-actively extend *Conceptual Continuity* among as many diverse natural phenomena as possible by imposing *Logical Congruence*. Our *belief* in this CC-LC epistemology and intuitive *faith* in one continuous and logically functioning universe have been paying off enormously. The next formal step of epistemology is to extract and *Extrapolate Realities* (ER) embedded into our successful equations. Next, we recognize that current physics has been developed based essentially on reductionism: matter as elementary particles and radiation as photons. We now recognize that emergent properties of complex system is more than the “sum of the constituent elements”. So, our epistemology must formally recognize another iterative feed back loop of *Emergentism & Reductionism* (ER) to refine the properties of both fundamental entities and complex systems. Thus our reality epistemology can be summarized as iterative and cyclic use of the steps CC-LC-(ER)<sup>2</sup>.
- **“Did the tree fall?”:** We now know that all advanced specie contain large assembly of diverse symbiotic and some non-symbiotic organisms. Our 10 trillion-cell human body carries 100 trillion diverse symbiotic microbes. To what extent our human thought processes are influenced by the convergent-divergent self interests of these two groups of co-habiting cells? In the absence of any human being in a forest, the fallen trees are properly taken care of by trillions of local microbes and more “advanced” organisms! Homocentric philosophies are counter to our healthy evolution.
- **Conscious Epistemology:** Do we really understand how our thinking process evolves? Can we identify & understand how all the factors that influence our conclusions after collating diverse observations? Epistemological awareness is crucial for us.



# Organized global minorities are trying to bring changes!

They are catalyzing changes in scientific epistemology!

- **Status-quo of the main stream:** Existing basic (working ) theories must not be challenged! All the main stream institutions and journals around the globe pro-actively rejects that progress in physics is being stifled by accepting that all the current theories are correct as they are within their respective domains. They agree that the universe is one continuum. Yet they ignore the message of failure over many decades of intensive attempts to unify the separate little maps (“solved” jig-saw-puzzles) into one coherent structure.
- **NPA:** Founded in 1994, this group has just finished their 12<sup>th</sup> conference at the University of Connecticut. NPA nurtures the enquiring minds of their members who are seeking reality in nature
- **Small “out-of-box” conferences at Vexjo University & other institutions.**
- **Individual well-known authors challenging the status-quo:** (i) Roger Penrose, “The Road to Reality” (2004) (ii) Nobel Laureate Robert Laughlin, “A Different Universe” (2005), (iii) Lee Smolin, “The trouble with Physics” (2006).
- **Individual web sites:** Many individuals, rejected and disenchanted by the main stream academia, have opened their personal websites explaining their alternate opinions about all the currently accepted physics theories.
- **Role of i<sup>2</sup>-EPR:** We hope to synergize the energy of all these brave souls by facilitating their collaborative interactions through a virtual global institution respecting individual independence & freedom..

## Proposed philosophy behind $i^2$ -E P R

- **Vision:** The grand vision is to nurture the emergence of a global culture that accepts the responsibility of proactive conscious designing of our future as the basis for our sustainable evolution within the biosphere.

The scientific vision is to re-establish physics as a discipline that is firmly engaged to discover the objective reality of nature as it happens, rather than inventing mathematically self-congruent model of homocentric reality and impose that on the nature. The idea is to continuously explore visualize and imagine the actual *processes* that are going on behind all the various interactions leading to incessant evolution of the biospheric and the cosmo-spheric evolutions.

- **Pragmatic dimension:** Sustainable evolution is the prime desire evident from the genetic coding of all the specie. We need continuous expansion of our knowledge of various organizational structures in nature to develop newer technological tools products and engineering for our well being that are congruent with the rules of interactions in nature. Thus looking at nature as a creative system engineer and behaving ourselves as reverse engineers to emulate nature's *processes* is the best successful model for us. Science engineering economics and politics are inseparable social enterprises for our survival.

- **Spiritual dimension:** What are the meaning and *purpose* of our lives? Can we control and design our fate? The emergence of the spiritual dimension out of our scientific (reverse engineer) thinking started taking shape as we slowly started to appreciate the ever harmonizing organizations behind diverse processes in nature. We realized the dialectical state of our fate in nature – we are simultaneously the masters of our well being and yet insignificant ‘pawn’ in the evolutionary scheme of things in the “infinite” cosmos.

- **Approach, the p-cubed logic !** The *purpose* of science is to understand the *purpose* of the cosmic and biospheric evolution so we understand our *purpose* (role) in it. So our approach should focus on understanding the ongoing incessant interaction *processes* behind the magnificent cosmic evolution. in nature. Clearly nature is a creative system engineer. She is our ultimate peer! We should be creative reverse engineers, extract the organizational rules behind ongoing *processes* in nature and then emulate them as beneficial technologies that are congruent with our sustainable evolution. This approach will keep us anchored to nature's reality.

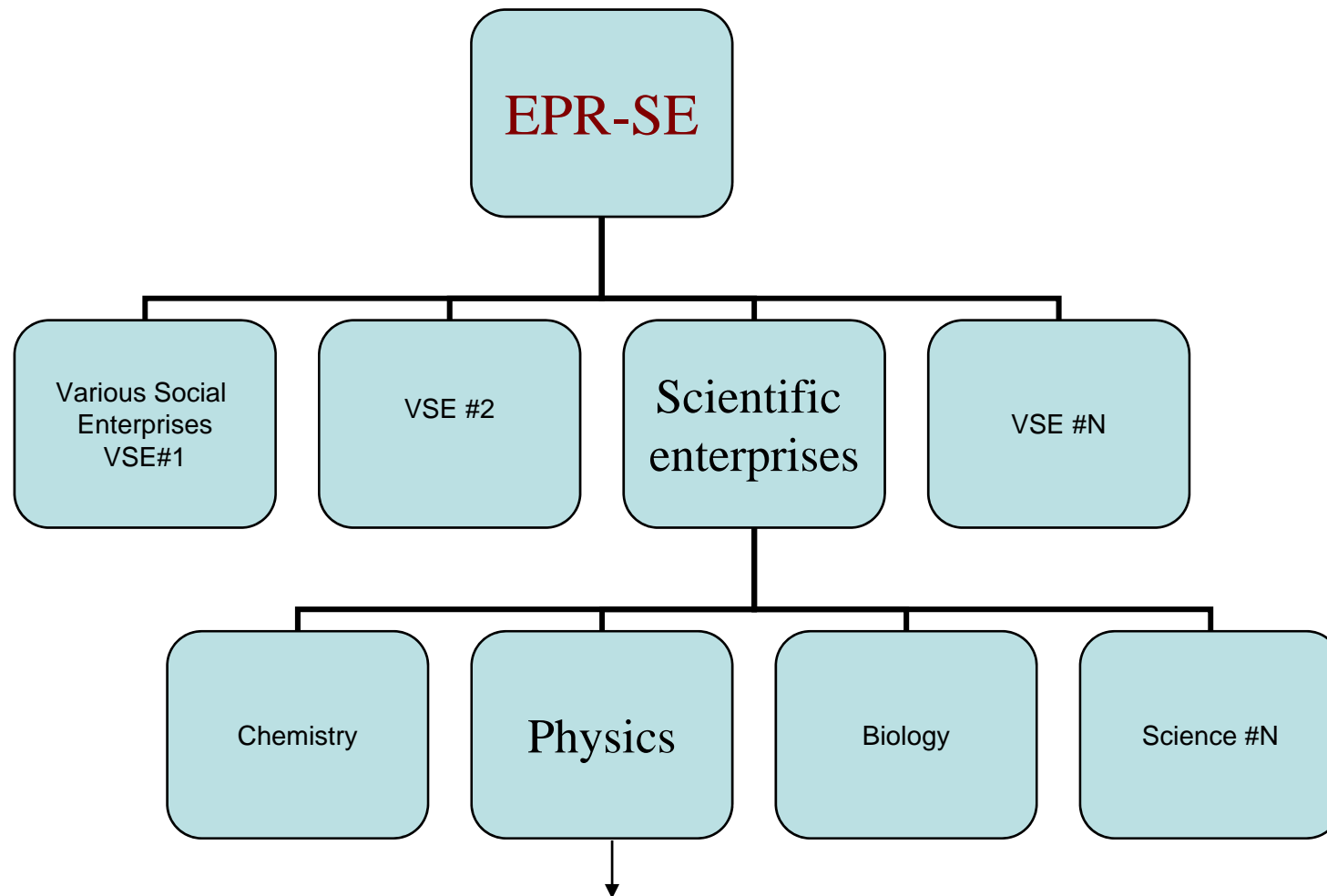
# All major organized human enterprises must define its “pragmatic guiding star”, an infallible vision!

- **Prime directive:** Live and let live. Today we know enough to destroy the biosphere and hence ourselves, and yet we are not knowledgeable enough to model and nurture the biosphere in every scientific detail to assure our co-dependent survival. And we are very far from becoming space-farer en-masse to migrate to another earth-like planet.
- **Nature is a creative system engineer:** Irrespective of our diverse spiritual beliefs, we have been successfully evolving for millennia in human form as reverse engineers by developing technologies (from discovering fire and rockets to medicine delivering nano particles in blood) by understanding & emulating the working processes and the underlying working rules behind diverse natural phenomena.
- **Science-technology-economy-politics (STEP) and sustainable evolution:** In every step of our evolution from primitive to modern days, STEP functions have always necessarily been and always will be inseparable from each other because the sustainable evolution is our prime directive and embedded in our genes.
- **STEP leads to enquiry based spiritualism, or becomes STEPS:** Healthy spirituality, or the enquiry about meaning, purpose and future vision of life, individualistic or biospheric, evolves through systematic observation of nature’s evolutionary processes. We find the organizational patterns and working rules in them and then use those rules intelligently for our personal evolution congruent with the collective evolution.
- **Like all social enterprises, i<sup>2</sup>-EPR will have a focused objective:** It is scientific - keep on mapping nature’s interaction processes with increasingly higher level of integrations of wide ranging natural phenomena. But our “guiding star” is the aspiration to understand the meaning & purpose of the cosmic evolution and our role in it by being a facilitator to sustainable evolution by promoting technology innovations as creative-reverse-engineers!

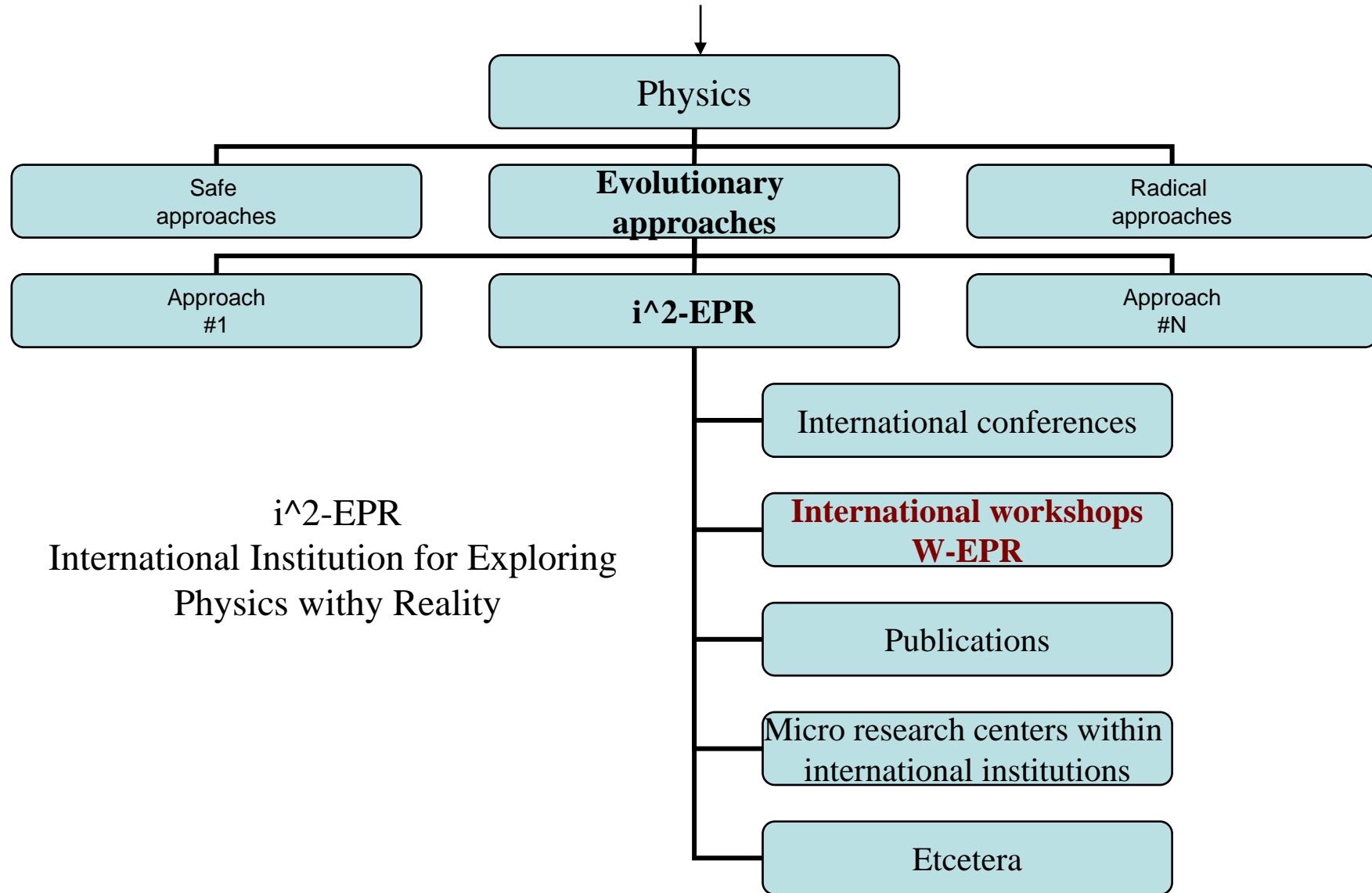
## Proposed structure of $i^2$ -E P R

- **A Virtual Global Institute:** A limited number of agreeable institutions from several countries will organize their own local institutes (i-EPR) at their own cost, congruent with their institutional mission and local governance. All these i-EPR will adhere to the core vision of the  $i^2$ -EPR. The international virtual global center, composed of representatives from all the i-EPR's, will have the role of a facilitator. Because funding is local, all the research activities will reside in the local institutes. The international body will only facilitate the coordination of the short- and long-term research programs to be complementary to each other to maximize the collective speed and productivity of all.
- **Organizational principle:** We shall emulate to the best of our knowledge the organizational principles behind the best organically evolving system to our knowledge – the collective evolution of lives in the biosphere. They are driven by (i) symbiosis, (ii) synergy and (iii) food-chain (iv) eco-driven (v) competition. It is not pure “survival of the fittest”. The organizational principles must be pro-actively congruent towards empowerment of the local centers and individual researchers and rules must be designed for guiding rather than controlling and stifling activities.

# Exploring paths to realities for sustainable evolution (EPR-SE)



Continued



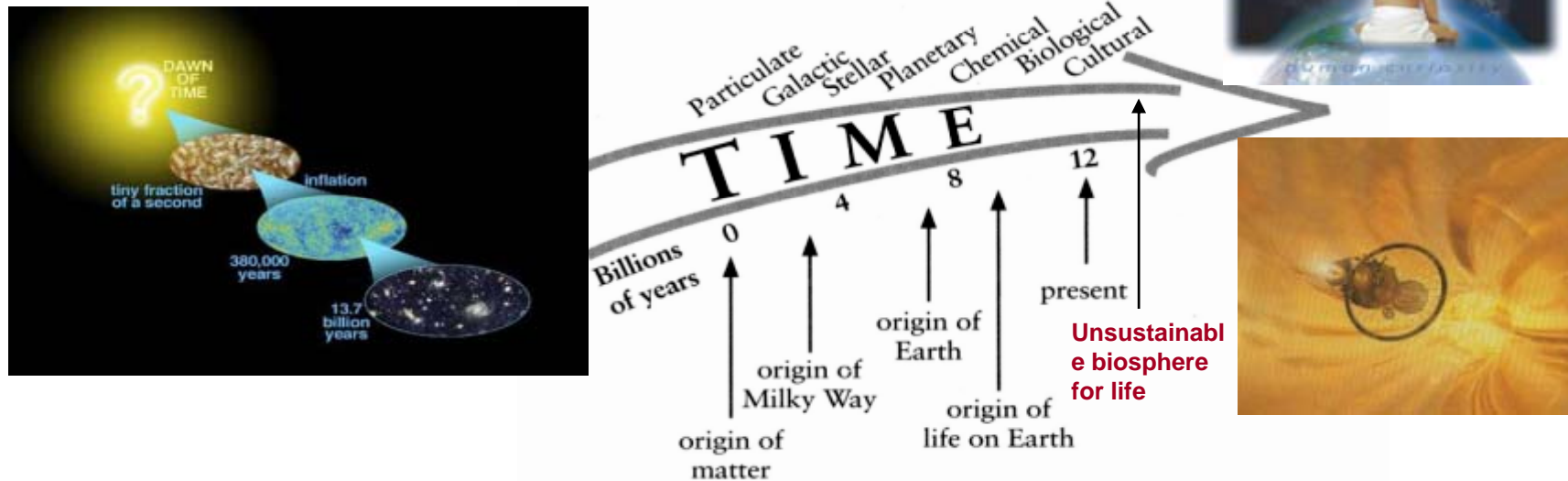
## Why virtual and why global?

- **Dichotomy of academic freedom and strangulation:** All important human social enterprises are meant to be organized and managed to maximize the collective benefit to the entire society – empowerment of all by allowing development of new knowledge and their dissemination. Unfortunately, self-interests of well organized groups have always taken precedence. New knowledge and information are used to maintain the privileged position and the associated benefits. The livelihood (economic survival) depends upon being able to “fit into” the main stream. “Acceptance” and “Group-think” are pragmatism! [See Smolin’s book]. New scientific concepts that can potentially challenge those currently in main stream, can challenge the structural power and access to limited Government funds from those who are in decision making positions including all those who rely on the benefits percolating down from these power positions. Thus, “nobody understands quantum mechanics” is not sufficient reason to challenge the interpretations of quantum mechanics. Teleportation and Quantum Computing are drawing enormous funds!
- **Why Global? Avoid strangulation:** Only properly funded institutions can attract brilliant minds. Academic institutions are still the biggest draw of minds. Thus, a university would be the best place to start such a research institute. Unfortunately, an out-of-box research center based in a single university could face strangulation at birth! A globally distributed organization will have a much higher probability of succeeding in its eventual mission.
- **Why Global? Magnitude and weight of the proposed research problem :** The proposed research problem is enormously important and burdensome. It requires global attention and global participation. Midwifery for the birth of the progeny of Quantum Mechanics (QM) will require intensive attention from many creative and unorthodox scientists just as were required for the birth of QM out of Classical Physics.

# Why bigger vision?

Do we want sustainable evolution for the human specie?

Then we need to prepare not just for the global warming of today, but for the solar warming that is coming in about a billion years from now!



- But, our current rocket technologies are woefully poor!
  - Theories of relativity are conceptual bottlenecks!
- QM epistemology limits our visualization of the quantum processes in the cosmic medium!
- **How can we venture to design rockets that can “surf” the electromagnetic waves, waves that travels unperturbed for billions of light years leveraging the cosmic medium?**



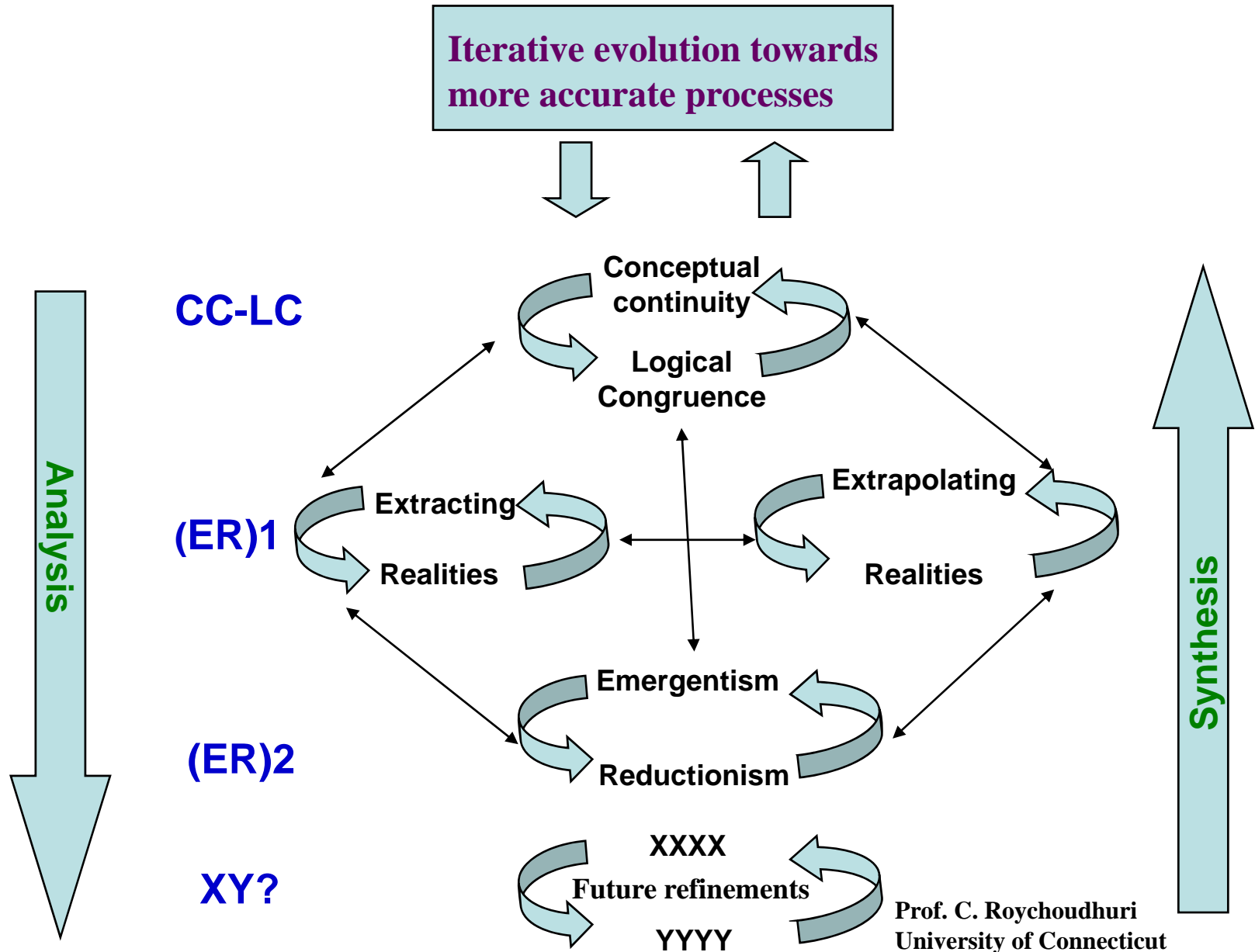
# **How to accelerate collective wisdom, collective learning towards accelerated evolution of human intelligence?**

- **Nature being a creative system engineer, we should become humble reverse engineers**
- **We need more frequent feed back generations and assessments! Bacteria are great examples to emulate!**

## Epistemic loops!

- We are for ever challenged to create a map of cosmic logic starting with the imagined human logics!
- We need ever iterative and cyclical refinements and rejections for our theories and hypotheses. This epistemology is applicable to all domains human evolutionary needs.

# Epistemology to refine incomplete information towards actual realities



# Why seek reality through such complex iterative loops?

**Manifest and emergent material universe is real and causal. It is subtle, complex and *elusive*, but it is neither mystical nor *an a-causal illusion* !**

We need to understand the real physical processes behind the emergence of both the irreducibly stable elementary particles as well as the most complex systems out of these elementary particles. Then we can emulate the processes to assure our sustainable evolution, which will give us time to understand the meaning & purpose of the universe and our role in it !



Where does the color come from? Photons do not have any colors! Neither are the water droplets colored inside the fountain ! [Photo taken from the web.]

- You will not find a rainbow if you go inside the fountain. That is why nobody goes to dig out the “pot of gold at the end of the rainbow”.
- Yet, it is a reality in nature & not an illusion,. It can be observed only by color-interpreting frequency sensitive sensors and only at the focal plane of an imaging system looking at the fountain and only when the Sun is behind the imaging sensor (observer & his orientation).
- The emergence of the complex rainbow, “which is not there”, and its mystical beauty are elusive but causal, and definitely not an illusion! Understanding the processes behind its formation and observation process help us understand the local weather conditions. This emergent phenomenon is now well understood through reductionism in terms of the fine water droplets, the rules of their dispersive refraction and imaging properties of a lens. We can also enjoy the esthetic beauty! Complex “new” emergent properties can be understood using reductionism intelligently and iteratively.

## Building the case for CC-LC-(ER)<sup>2</sup> epistemology for i<sup>2</sup> - E P R activities

- **CC-LC:** Physics is synonymous with seeking *Conceptual Continuity (CC)* among diverse observed phenomena by iteratively and creatively constructing *Logical Congruence (LC)* among them all to find a higher level of organization leading to coherent maps of nature.
- **(ER)<sub>1</sub>:** *Extracting and Extrapolating Reality (ER)* from an equation when it is working broadly have two great benefits. First, “extraction” of reality aids visualization of some correctly predicted phenomenon that was not originally anticipated. Second, “extrapolation” of potential reality either to visualize some processes deeper than before or an attempt to integrate a different phenomenon within this theory will help understand the limits and “bottle necks” of the theory. **This will help refine and correct a theory to a higher level of integratability with other theories.**
- **(ER)<sub>2</sub>:** *Emergentism & Reductionism (ER)* are the next higher level pair of epistemic tools refine/reject some hypotheses from some theories that prevent us from integrating different theories harmoniously into one coherent structure. We need to iteratively refine our theories and hypotheses to map *emergent* properties of complex systems that are built out of *reduced* properties of the elementary constituents. Emergentism and reductionism are inseparable complementary modes of enquiries.

# CC-LC

## Conceptual continuity – Logical Congruence

1. Newton's laws of motion formulated after decades' of observations is one excellent example of CC-LC.
2. Tyco Brahe's observations formulated as laws of planetary motion by Kepler and mathematically formulated by Newton as inverse square law for gravitation is another outstanding example of CC-LC.

# **(ER)1**

## **Extracting and extrapolating realities**

More than a century long observations and measurements on electricity and magnetism generated four laws: (i) Coulomb's law, (ii) Faraday's law, (iii) Ampere's law and (iv) non-existence of magnetic monopole. Maxwell's mathematical brilliance in adding "displacement current" formulating them into a coherent set of differential equations gave rise to the famous wave equation for electromagnetic waves and electromagnetism was born

## (ER)2

### Emergentism and Reductionism

1. Congruence between classical dispersion theory based on bulk dipolar behavior of material molecules and its subsequent validation by quantum theory of individual dipole, providing the correct “oscillator strengths” is an excellent example of *(ER)2*.
2. I predict that the resolution of wave-particle duality will derive from this segment of reality epistemology. Accepting Huygens-Fresnel integral as literally true [*(ER)1*] implies the cosmic medium contains electromagnetic tension field (*Reductionism*) whose undulation is the *Emergent* EM wave.



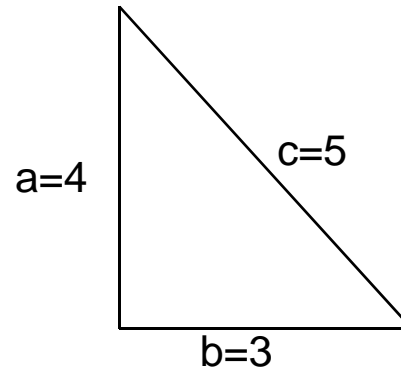
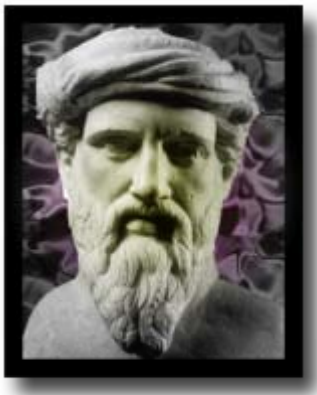
**Mathematical congruency and visual symmetry & elegance are insufficient guides to extract nature's objective reality**

**CC-LC-(ER)<sup>2</sup> epistemology is a critical tool!**

**Consider two examples:**

- 1. Pythagoras' theorem and**
- 2. Ptolemy's Geocentric planetary model**

## Comparing Pythagoras' equation for a right-angled triangle with that of Chandra's seventh grade alternate solution



Proposal at my 7th grade home work

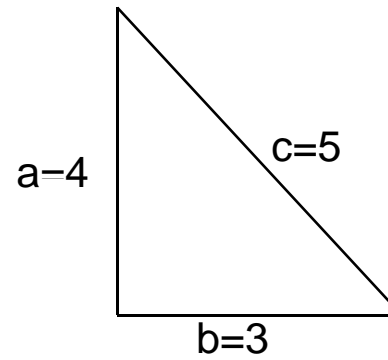
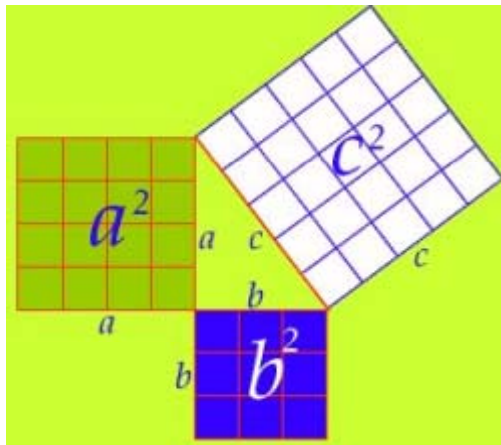
$$c^2 = a^2 + b^2$$

$$c = 2a - b, \text{ provided, } (b/a) = (3/4)$$

Very different mathematical logics can arrive at the same prediction!

The proposed alternate solution to Pythagoras' equation is completely general.

What are the differences? How can we leverage them?



The total number of unit squares on the hypotenuse is exactly equal to the sum of those on the other two sides.

$$c^2 = a^2 + b^2$$

$$c = 2a - b, \text{ provided } (b/a) = (3/4)$$

$$c^2 = 4a^2 + b^2 - 4ab = 4a^2 + b^2 - 4a(3/4)a$$

$$c^2 = a^2 + b^2$$

It does not give the elegant “physical picture” of Pythagoras.  
But the ratio relation has geometric meaning.

**Very different mathematical logics can arrive at the same prediction! Consider Schrödinger's wave equation and Heisenberg's matrix formalism for quantum mechanics!**

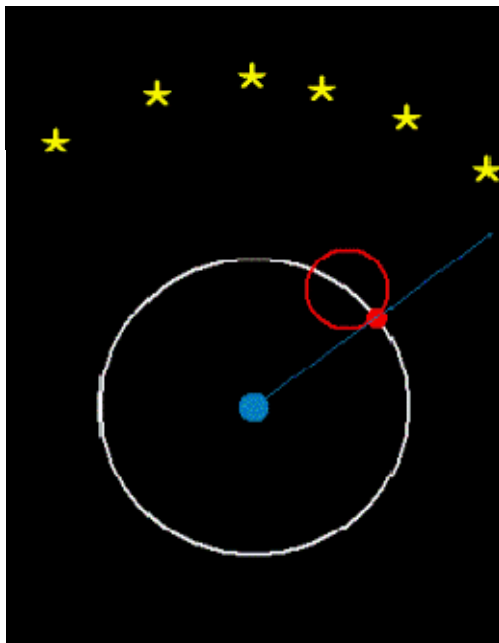
## Our scientific history is replete with multiple mathematical models to match the same observed results

- **A famous one:** Schrödinger proved that his “wave” equation and Heisenberg's matrix representation are mathematically equivalent and both produce essentially same results analyzing the same phenomenon.
- **Consequence:** *Schrödinger's wave equation has more built-in physical realities than the Copenhagen Interpretation (CI), imposed by the “matrix” group, allows for.* CI group admonished us not to look for physical pictures for quantum mechanical interactions. It is time to over-ride this restriction and start creating “visual models” for these processes. Purpose of physics is to understand the physical processes going on in nature. *Can matrix formalism also be used as a guide to extract physical pictures for quantum processes?*
- **A less known one:** Wolf’s mathematical representation of the classical coherence theory is identical to Glauber’s quantum mechanical representation, which is known as the Optical Equivalence Theorem derived by Sudarshan.
- **Consequence:** Quantization of electromagnetic field has not given us any new results or any deeper understanding of the phenomenon we describe as “coherence” of EM fields. *Is the second quantization an advancement or a bottle-neck to understand the physical processes behind light-matter interactions?*

## Revivability of Ptolemy's Geocentric planetary model !

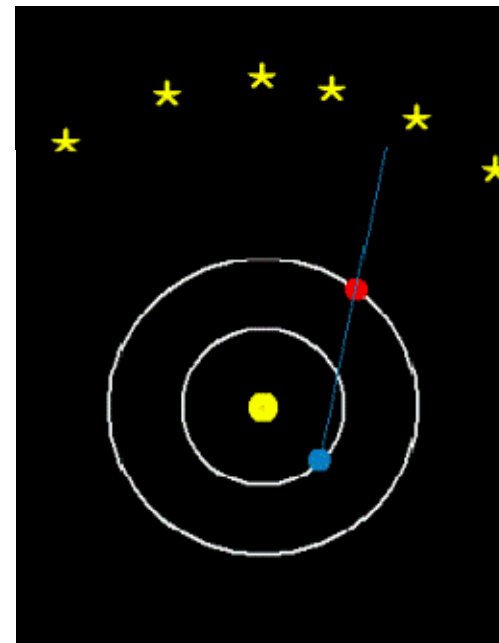
Even visualization is not enough to guide us into discovering nature's reality

Many different human logic (mathematics) can solve the same problem different ways. Ptolemy's Geocentric planetary model can be successfully updated with nine different "epicycles" for each of the nine planets. This is far fewer "free parameters" than most of the recent "successful" string theories require!



**Ptolemy**

vs.

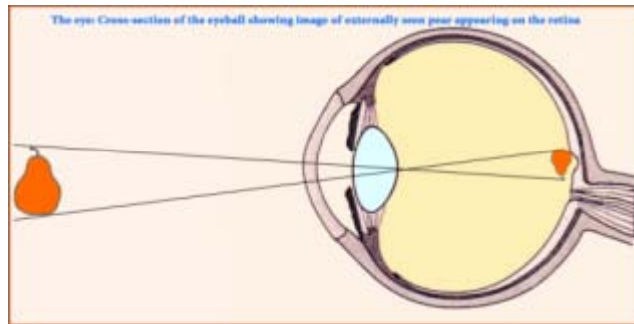


**Copernicus**

Pictures are from the web.

# Understanding subtleties behind observations before applying CC-LC-(ER)<sup>2</sup> epistemology

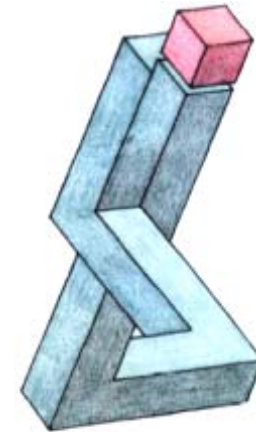
Real world is really real if we spend time to find the conceptual continuity amongst our diverse observations by imposing logical congruency through all ! Our lack of fathoming the real processes undergoing in the micro universe may appear elusive, but it does not mean that the real universe is non-causal, non-local and mystical ! Emergence of complex properties can also be logically mapped.



Human neural-nets reconstruct the reality out of the inverted digital image formed on the rods and cones of our retina. Subjective re-interpretation restores objective reality.



Elusive but real. Choose between young or old woman by differentiating mouth vs. necklace.



A real illusion. Looks real but impossible to construct in reality.

Personally, I really am not totally objective about the outside universe. I simply cannot be! I “see” what is really functionally important for my survival in the real world with my limited number of sensors. My thinking and interpretations are also colored by my genetic endowment, 100 trillion symbiotic microbes and bacteria, my family and social training and my personal knowledge and ego driven by my own successes and failures! Objectivity of our interpretations have to be refined by repeated application of CC-LC-(ER)<sup>2</sup> epistemology. [Above pictures are taken from the web.]

## **An example of conceptual integrative power of CC-LC-(ER)<sup>2</sup> epistemology**

**We are expecting major new developments based on this  
over-arching understanding:**

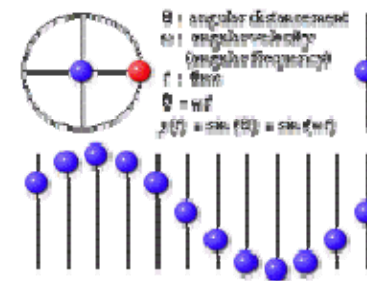
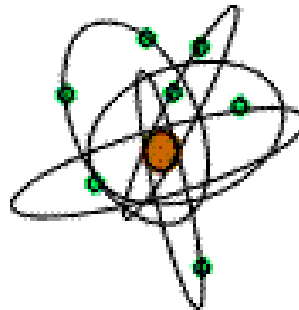
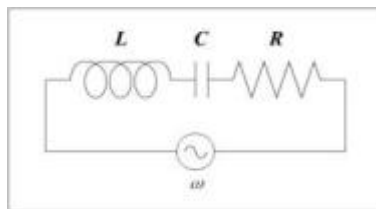
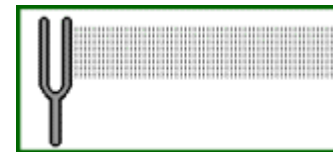
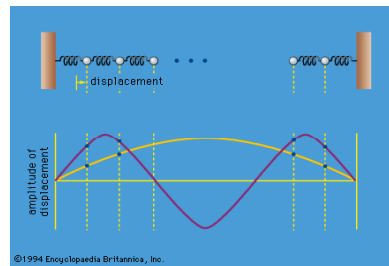
- There is a preponderance and universality of harmonic undulations (internal and external).

However,

- Only a rare few constitute physically propagating waves !

# Our universe is dominated by various harmonic undulators. There interactions are amplitude driven. But very few of them are really waves!

Everything observable in this universe are built out of a few stable elementary particles, which are all emergent in the cosmic medium with some intrinsic internal harmonic undulation or spin. Even the complex macro systems like the Solar system and the galaxies have their own characteristic internal harmonic undulations. Even human technology is replete with mechanical and electrical harmonic undulators. Only rare few harmonic undulations are waves in reality like those on water surfaces !



$\sin 2\pi\nu t$  or  $\cos 2\pi\nu t$ ; frequency  $\nu$  is inverse of the harmonic period  $\tau$



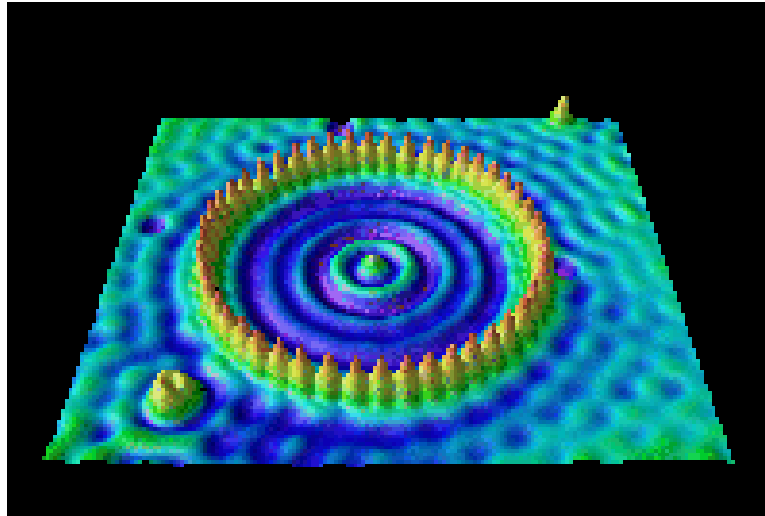
# We are really no longer fundamentally limited by Heisenberg's Uncertainty Relation (HUR)

HUR is essentially a corollary of Fourier theorem

And the “Mother” theorem has never been elevated to the status of a principle of Physics !

And, now our visualization capability has reached the atomic domain that was unimaginable during Heisenberg's time!

$$\langle \Delta x \rangle \approx 10nm; \quad \langle \Delta p \rangle \approx 0$$
$$\langle \Delta x \rangle \langle \Delta p \rangle \approx 0, \text{ not } \geq 1 !$$



Scanning tunneling micrograph of 48 iron atoms arranged in a circle by picking and placing one atom at a time

1. By ignoring HUR, while the core achievements of QM do not suffer at all, the QM philosophy can get rid of all the unnecessarily assigned mysticisms like non-causality, non-locality, teleportation, etc. in measurements that defies our **SEM** process as we have defined.
2. Does the structure of Schrödinger's “wave equation” really represent a propagating wave? A propagating wave require second derivative of time equated to second derivative of space coordinate.
3. Are elementary particles and atoms really non-local and “dispersive” probability waves? Then how could we manipulate Angstrom size individual atoms using modern nano-tipped tools?

C. Roychoudhuri; Foundations of Physics, **8** (11/12), 845 (1978); "Heisenberg's Microscope - A Misleading Illustration".

## In fact, Bell's theorem does not represent superposition effects that we are forced to measure by the detecting dipoles

We imply EM fields operate on each other:  $\psi_{1,2} = a e^{i\phi_{1,2}} \Rightarrow \psi * \psi = 2[1 + \cos(\phi_1 - \phi_2)]$

In reality, it is the dipoles that sum the joint stimulations by all the superposed fields and imposes its QM rules for their susceptibility to induced polarizations:

$$D = \vec{d}^* \cdot \vec{d} = ({}^{(1)}\vec{\chi} \cdot \vec{\psi}^* ({}^{(1)}\vec{\chi} \cdot \vec{\psi})) = {}^{(1)}\chi^2 a^2 |e^{i\phi_1} + e^{i\phi_2}|^2 = 2 {}^{(1)}\chi^2 a^2 [1 + \cos(\phi_1 - \phi_2)]$$

The benignly neglected  $\chi$  in Bell's theorem contains all the necessary physics of reality. This susceptibility jointly depends upon all the key parameters of the simultaneously present EM fields and those properties of the detector molecules prescribed by QM rules (constraints) – the frequencies of the fields, the QM allowed dipole frequencies of the detector set by the transition rules, explicitly electric and magnetic vectors of the EM fields and the corresponding induced vectors for the detecting molecule embedded in any anisotropic medium, the Poynting vectors of the incident EM fields, etc. Real engineers worry about all these factors when they design some serious system that must not fail. In fact, the generalized fringe intensity D due to r-number of different EM fields is a quite complicated dictated by the detecting dipoles due to their linear and non-linear susceptibilities:

$$\vec{d}_r = \sum_n ({}^{(n)}\vec{\chi}(\hat{p}, \hat{P}, \nu) \cdot \hat{a}[a(t)e^{i(2\pi\nu_r t + \phi_r)}])^n \Rightarrow \text{Energy transfer: } D = \sum_{r,s} \vec{d}_r^* \cdot \vec{d}_s$$

**They key point is that Bell's inequality relation does not apply to the measurement of real physical superposition effect due to EM waves, because EM waves by themselves do not interfere.**

## Another example of application of CC-LC-(ER)<sup>2</sup> epistemology in compliance with SEMT:

We discover that we have been missing something rather fundamentally simple for millennia!

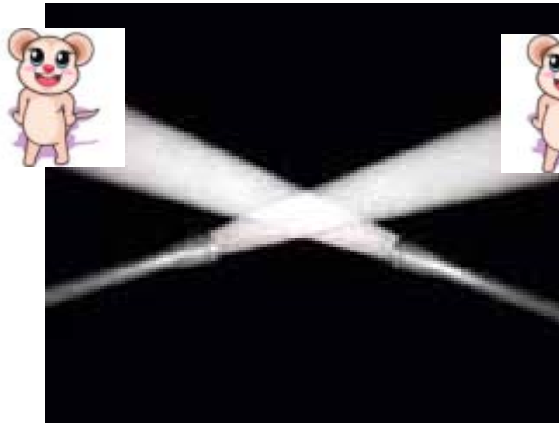
- Light beams by themselves do not suffer propagational redistribution of energy after they cross each other! EM waves do not interact with each other. Energy re-distribution (interference fringes) are produced by detecting dipole molecules.
- Alternately speaking, the superposition effects (interference fringes) as measured transformation (SEMT) due to light beams can become observable only when some interacting material dipoles are simultaneously stimulated by all the superposed beams on them. *Interference phenomenon is necessarily local.*

**Interpretational and technological implications are enormous !**

As an example, Quantum computation that requires (i) production of a single indivisible photon, (ii) imposing data on it, (iii) propagating it, (iv) receiving and detecting it (the same original photon) may be impossible!

# Examples of absence of superposition effects from light beams in the absence interacting material dipoles !

Trillions of unwanted beams can cross the path of our desired light beam before we can receive and analyze the unmodified properties carried by the beam.



## Otherwise

The visual world would have been full of spatial and temporal scintillations (speckles).



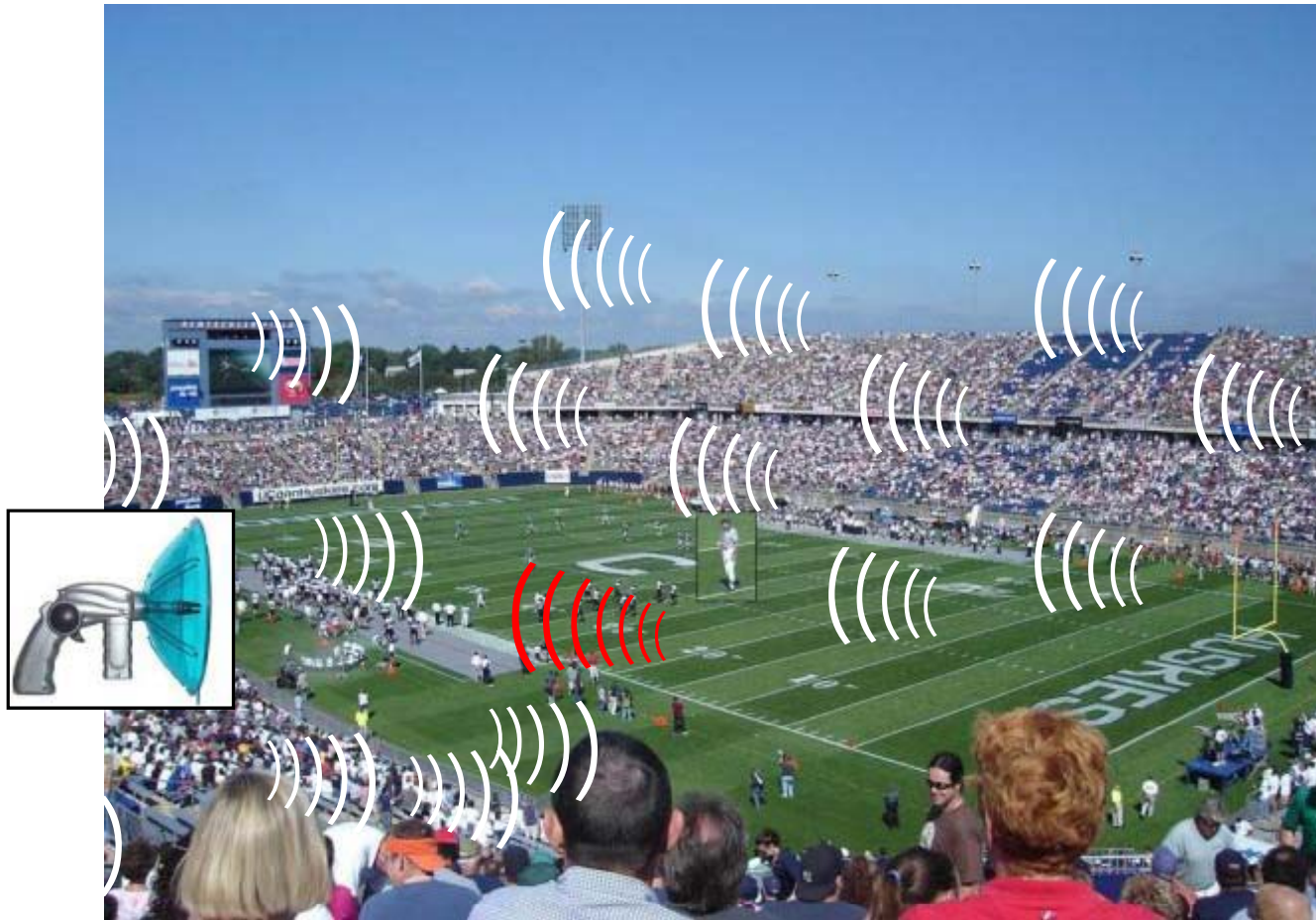
WDM internet data would have been destroyed by temporal interference (heterodyne effect).



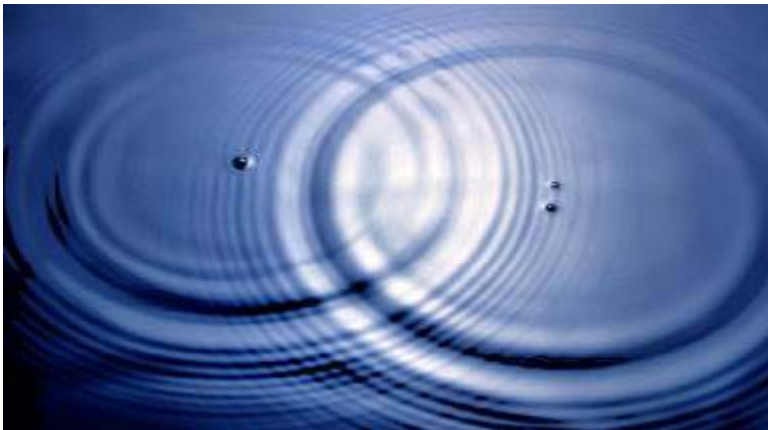
Expanding universe, indicated by Doppler shift, would not have been measurable.

Well formed light beams cross each other without modifying each others spatial and/or temporal energy distribution.

**Light and sound beams pass through each other essentially undistorted from one corner to another in a crowded stadium, unperturbed by millions of other beams !**



**Even water waves pass through each other without perturbing each others collective behavior except at the locations of actual superposition !**



- Harmonic undulations on a water surface and their propagation remains undistorted, even though the water in the LOCAL-regions of superposition show the modified resultant undulations.
- Wave forms by themselves do not interfere. **It is the supporting medium that is observable and hence shows local superposition effects.** If water did not scatter light, we would have needed pressure sensors, as we need photo detector for light.
- **Unfortunately the cosmic medium in which light is emergent is not yet directly observable to us to display “local interference” of light beams.**

**Non-interference of wave forms is a generic property of nature !**

## Summary of the results expressed in the published papers listed before that provide both improved understanding of classical and quantum optics and potential for a wide variety of technological innovations (tomorrow's talk)

- **1. Superposition effects due to EM waves are created by detectors:** (i) Accordingly changing the detectors or modifying their physical properties by secondary external fields will change the outcome due to the same set of superposed optical fields. (ii) The definition and the theory of coherence need to be expressed in terms of correlation of multiple dipole undulations of the same detector induced simultaneously by multiple fields rather than as field-field correlations. Consequently new and more accurate theory and measurement techniques can be developed for characterizing very short pulses.
- **2. Optical signals and responding material dipoles are all space, time and energy finite:** (i) Generalized theory of spectrometry based on finite pulses conform to classical formulas for time integrated records, but time-frequency band width product (spectral resolution) is not a fundamental limit of nature but a function of our sensor arrangements. (ii) Pulse broadening through “dispersive” media is due to “time diffraction” just as space-finite aperture introduce fringe broadening.
- **3. Light beams by themselves do not produce mutual energy re-distribution (interference fringes) either in space or in time:** (i) Mode-lock laser theory needs to be modified in terms of properties of saturable absorbers (interacting dipoles) leading to more innovations in short pulse laser technology. (ii) The concept of ‘photons interfere only with themselves’ (Dirac) needs to be fundamentally revised, which will open up newer and better way of creating possible practical quantum computers, etc.

# It is time to frame great new questions to generate great new break through knowledge about the ongoing *processes in nature*

- Great questions of any time are framed based on existing observations. If the answer is right, it will necessarily lead to new observations and hence new questions beyond the original question.
- Biologists, as humble reverse-engineers, diligently emulating the chemical processes behind all living activities, have found an over-arching and integrating working principle – the DNA helix – across all living things!
- Physicists have been happily playing with almost half a dozen separate “solved puzzles” and trying to force fit them together for over half a century even though they are not logically self-congruent for the desired merger.

We have proposed a measurement driven epistemology, CC-LC-(ER)<sup>2</sup>, to explore the reality of nature. It will allow iterative refinement of our separate theories, by rejecting or modifying untenable hypotheses, to increasingly higher planes of mutual congruence & integratability towards cosmic logic and hence cosmic reality even though we can only start with incomplete and mutually incongruent theories!





**“To myself, I seem to have been only like a boy playing on the seashore, and diverting myself in now and then finding smoother pebble, or a prettier shell than ordinary, whilst the great ocean of truth lay undiscovered before me.”**

**We need to restore this audacious Newtonian humility in doing science, instead of declaring that nature’s reality is forever beyond our “visualization”!**

**It is time to see “further” again by standing on a high pyramid built over the shoulders of many more giants than Newton had the privilege to exploit. But, the purpose must be focused on discovering nature’s actual reality rather than inventing them!**

## **It is impossible to formulate a proof that can establish the infallibility of a scientific ‘law’! -- CR**



**Healthy doubt to keep on challenging what appears to be valid, is the only insurance for the sustainable evolution of human minds!**

There is no absolute truth for us. All of our knowledge is incomplete as it maps only a fraction of the ongoing processes in the cosmic universe. Our individualized 100 billion neural cells are not capable of articulating all the truths of the universe even if any one of us really knew them all. Historically, truths we excavate out of nature come in small and large packages that we must learn to integrate and re-integrate coherently with time.

We are luckier today because we now have a pyramid of many giants built over many centuries. Let's have the courage to climb on the top of the pyramid built out of all the giant scientists!

## List of recent publication by the author based on CC-LC-(ER)^2 epistemology & non-interference of light

1. "Shall we climb on the shoulders of the giants to extend the REALITY horizon of Physics?" by C. Roychoudhuri, invited talk at the 4th International Conference on "Quantum Theory-Foundational Reconsiderations", at Vaxjo U., Sweden, Jun.11-16, 2007; to be published in 2007.
2. "Can classical optical superposition principle get us out of quantum mysticism of non-locality and bring back REALITY to modern physics?" by C. Roychoudhuri, invited talk at the ETOP conference at Toronto, Jun.3-5, 2007; to be published in 2007 by SPIE;
3. *The Nature of Light: What Is a Photon?* by C. Roychoudhuri, A. F. Kracklauer & Kathy Creath,; CRC Press (2007); in preparation.
4. "Can a deeper understanding of the measured behavior of light remove wave-particle duality?" by C. Roychoudhuri, SPIE Proc.**Vol.6664**, paper #2 (to be published, Aug. 2007).
5. "Can we get any better information about the nature of light by comparing radio and light wave detection processes?" by C. Roychoudhuri and P. Poulos, SPIE Proc.**Vol.6664**, paper #12 (to be published, Aug. 2007).
6. "Can the hypothesis 'photon interferes only with itself' be reconciled with superposition of light from multiple beams or sources?" by C. Roychoudhuri, N. Prasad and Q. Peng, SPIE Proc.**Vol.6664**, paper #24 (to be published, Aug. 2007).
7. "Bi-centenary of successes of Fourier theorem! Its power and limitations in optical system designs" by C. Roychoudhuri, invited paper, Proc. SPIE Vol. **6667**, paper #18 (Oct. 2007).
8. "If EM fields do not operate on each other, why do we need many modes and large gain bandwidth to generate short pulses?" by C. Roychoudhuri, N. Tiffessa, C. Kelley & R. Crudo,; SPIE Proceedings, Vol. **6468**, paper #53 (2007).
9. "Locality of superposition principle is dictated by detection processes" by C. Roychoudhuri, Phys. Essays **19** (3), September 2006.
10. "Spectral Super-Resolution by Understanding Superposition Principle & Detection Processes", by C. Roychoudhuri and M. Tayahi, Intern. J. of Microwave and Optics Tech., July 2006; manuscript ID# IJMOT-2006-5-46:  
<http://www.ijmot.com/papers/papermain.asp>.
11. "Various ambiguities in re-constructing laser pulse parameters" by C. Roychoudhuri and N. Prasad, proceedings of the October, 2006 IEEE-LEOS Annual Conference, Montreal, Canada; invited.
12. "Do we count indivisible photons or discrete quantum events experienced by detectors?" by C. Roychoudhuri and N. Tiffessa, Proc. SPIE Vol.**6372**-29 (2006).

## List of recent publication by the author based on CC-LC-(ER)^2 epistemology & non-interference of light (list-p.2)

13. “If EM fields do not operate on each other, how do we generate and manipulate laser pulses?” by C. Roychoudhuri, D. Lee and P. Poulos, Proc. SPIE Vol. **6290**-02 (2006).
14. “Are dark fringe locations devoid of energy of superposed fields?” by C. Roychoudhuri and C. V. Seaver, Proc. SPIE Vol. **6285**-01 (2006), invited.
15. “A critical look at the source characteristics used for time varying fringe interferometry” by C. Roychoudhuri and N. Tiffessa, Proc. SPIE Vol. **6292**-01, (2006), invited.
16. “Role of the retinal detector array in perceiving the superposition effects of light” by C. Roychoudhuri and V. Lakshminarayanan, Proc. SPIE Vol. **6285**-08 (2006).
17. “Reality of superposition principle and autocorrelation function for short pulses” by C. Roychoudhuri, Proc. SPIE Vol. **6108**-50 (2006).
18. “If superposed light beams do not re-distribute each others energy in the absence of detectors (material dipoles), can an indivisible single photon interfere by/with itself?” by C. 18. Roychoudhuri, SPIE Conf. Proc. **5866**, pp.26-35 (2005).
19. “If superposed light beams do not re-distribute each others energy in the absence of detectors (material dipoles), can an indivisible single photon interfere by/with itself?” by C. Roychoudhuri, Proc. SPIE Vol. **5866**, pp.26-35 (2005).
20. “*The Nature of Light: What Is a Photon?* Eds. C. Roychoudhuri, Katherine Creath and A. F. Kracklauer, Proc. SPIE Vol. **5866** (2005); Year of Einstein Special Conference.
21. “Propagating Fourier frequencies vs. carrier frequency of a pulse through spectrometers and other media” by C. Roychoudhuri, Proc. SPIE Vol. **5531**, 450-461(2004).
22. *The Nature of Light: What is a Photon?*, Guest Eds. C. Roychoudhuri & R. Roy, Optics & Photonics News Trends; special issue of OPN, October 2003. [<http://www.osa-opn.org/abstract.cfm?URI=OPN-14-10-49>].
23. “Measuring properties of superposed light beams carrying different frequencies” by D. Lee and C. Roychoudhuri, Optics Express **11**(8), 944-51, (2003), [<http://www.opticsexpress.org/abstract.cfm?URI=OPEX-11-8-944>].
24. “Limits of DWDM with gratings and Fabry-Perots and alternate solutions” by C. Roychoudhuri, D. Lee, Y. Jiang, S. Kittaka, M. Nara, V. Serikov and M. Oikawa, Proc. SPIE Vol. **5246**, 333-344, (2003), invited.

# Thank you for thinking of becoming a cosmo-evolution congruent realist!

Our destiny is to journey to other solar systems by navigating through the Cosmic Medium -- the final frontier of science!

