

Simple Chess Puzzle

Researchers at the University of St Andrews have thrown down the gauntlet to computer programmers to find a solution to a "simple" chess puzzle which could, in fact, take thousands of years to solve and net a \$1m prize. [11]

It appears that we are approaching a unique time in the history of man and science where empirical measures and deductive reasoning can actually inform us spiritually. Integrated Information Theory (IIT)--put forth by neuroscientists Giulio Tononi and Christof Koch--is a new framework that describes a way to experimentally measure the extent to which a system is conscious. [10]

There is also connection between statistical physics and evolutionary biology, since the arrow of time is working in the biological evolution also.

From the standpoint of physics, there is one essential difference between living things and inanimate clumps of carbon atoms: The former tend to be much better at capturing energy from their environment and dissipating that energy as heat. [8]

This paper contains the review of quantum entanglement investigations in living systems, and in the quantum mechanically modeled photoactive prebiotic kernel systems. [7]

The human body is a constant flux of thousands of chemical/biological interactions and processes connecting molecules, cells, organs, and fluids, throughout the brain, body, and nervous system. Up until recently it was thought that all these interactions operated in a linear sequence, passing on information much like a runner passing the baton to the next runner. However, the latest findings in quantum biology and biophysics have discovered that there is in fact a tremendous degree of coherence within all living systems.

The accelerating electrons explain not only the Maxwell Equations and the Special Relativity, but the Heisenberg Uncertainty Relation, the Wave-Particle Duality and the electron's spin also, building the Bridge between the Classical and Quantum Theories.

The Planck Distribution Law of the electromagnetic oscillators explains the electron/proton mass rate and the Weak and Strong Interactions by the diffraction patterns. The Weak Interaction changes the diffraction patterns by moving the electric charge from one side to the other side of the diffraction pattern, which violates the CP and Time reversal symmetry.

The diffraction patterns and the locality of the self-maintaining electromagnetic potential explains also the Quantum Entanglement, giving it as a natural part of the Relativistic Quantum Theory and making possible to understand the Quantum Biology.

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Author: George Rajna

Preface

Jeremy England, a 31-year-old assistant professor at the Massachusetts Institute of Technology, has derived a mathematical formula that he believes explains this capacity. The formula, based on established physics, indicates that when a group of atoms is driven by an external source of energy (like the sun or chemical fuel) and surrounded by a heat bath (like the ocean or atmosphere), it will often gradually restructure itself in order to dissipate increasingly more energy. This could mean that under certain conditions, matter inexorably acquires the key physical attribute associated with life.

[8]

We define our modeled self-assembled supramolecular photoactive centers, composed of one or more sensitizer molecules, precursors of fatty acids and a number of water molecules, as a photoactive prebiotic kernel system. [7]

The human body is a constant flux of thousands of chemical/biological interactions and processes connecting molecules, cells, organs, and fluids, throughout the brain, body, and nervous system. Up until recently it was thought that all these interactions operated in a linear sequence, passing on information much like a runner passing the baton to the next runner. However, the latest findings in quantum biology and biophysics have discovered that there is in fact a tremendous degree of coherence within all living systems. [5]

Quantum entanglement is a physical phenomenon that occurs when pairs or groups of particles are generated or interact in ways such that the quantum state of each particle cannot be described independently – instead, a quantum state may be given for the system as a whole. [4]

I think that we have a simple bridge between the classical and quantum mechanics by understanding the Heisenberg Uncertainty Relations. It makes clear that the particles are not point like but have a dx and dp uncertainty.

'Simple' chess puzzle holds key to \$1m prize

Researchers at the University of St Andrews have thrown down the gauntlet to computer programmers to find a solution to a "simple" chess puzzle which could, in fact, take thousands of years to solve and net a \$1m prize.

Computer Scientist Professor Ian Gent and his colleagues, at the University of St Andrews, believe any program capable of solving the famous "Queens Puzzle" efficiently, would be so powerful, it would be capable of solving tasks currently considered impossible, such as decrypting the toughest security on the internet.

In a paper published in the Journal of Artificial Intelligence Research today, the team conclude the rewards to be reaped by such a program would be immense, not least in financial terms with firms rushing to use it to offer technological solutions, and also a \$1m prize offered by the Clay Mathematics Institute in America.

Devised in 1850, the Queens Puzzle originally challenged a player to place eight queens on a standard chessboard so that no two queens could attack each other. This means putting one queen in each row, so that no two queens are in the same column, and no two queens in the same diagonal. Although the problem has been solved by human beings, once the chess board increases to a large size no computer program can solve it.

Professor Gent and his colleagues, Senior Research Fellow Dr Peter Nightingale and Reader Dr Christopher Jefferson, all of the School of Computer Science at the University, first became intrigued by the puzzle after a friend challenged Professor Gent to solve it on Facebook.

The team found that once the chess board reached 1000 squares by 1000, computer programs could no longer cope with the vast number of options and sunk into a potentially eternal struggle akin to

the fictional "super computer" Deep Thought in Douglas Adams' Hitchhiker's Guide to the Galaxy, which took seven and a half million years to provide an answer to the meaning of everything.

Professor Gent said: "If you could write a computer program that could solve the problem really fast, you could adapt it to solve many of the most important problems that affect us all daily.

"This includes trivial challenges like working out the largest group of your Facebook friends who don't know each other, or very important ones like cracking the codes that keep all our online transactions safe."

The reason these problems are so difficult for computer programs, is that there are so many options to consider that it can take many years. This is due to a process of "backtracking" – an algorithm used in programming where every possible option is considered and then "backed away" from until the correct solution is found.

Dr Nightingale said: "However, this is all theoretical. In practice, nobody has ever come close to writing a program that can solve the problem quickly. So what our research has shown is that – for all practical purposes – it can't be done."

Dr Jefferson added: "There is a \$1,000,000 prize for anyone who can prove whether or not the Queens Puzzle can be solved quickly so the rewards are high."

Chess has long provided the source for puzzles such as the traditional fable of the servant who, when asked to choose a reward by his king, asked for one grain of rice to be placed on the first square of a standard 8x8 chessboard, doubled in the next and so on until it was found there was not enough rice in the entire world.

The fable indicates the huge numbers involved when using just a standard sized chess board. When the board size increases the numbers become vast. [11]

Neuroscience's New Consciousness Theory Is Spiritual

As such, it has the potential to answer questions that once seemed impossible, like "which is more conscious, a bat or a beetle?" Furthermore, the theory posits that any system that processes and integrates information, be it organic or inorganic, experiences the world subjectively to some degree. Plants, smartphones, the Internet--even protons--are all examples of such systems. The result is a cosmos composed of a sentient fabric. But before getting into the bizarreness of all that, let's talk a little about how we got to this point.

The decline and demise of the mystical

As more of the natural world is described objectively and empirically, belief in the existence of anything that defies current scientific explanation is fading at a faster rate than ever before. The majority of college-educated individuals no longer accept the supernatural and magical accounts of physical processes given by religious holy books. Nor do they believe in the actuality of mystical

realms beyond life that offer eternal bliss or infinite punishment for the "souls" of righteous or evil men.

This is because modern science has achieved impeccable performance when it comes to explaining phenomena previously thought to be unexplainable. In this day and age, we have complete scientific descriptions of virtually everything. We understand what gives rise to vacuous black holes and their spacetime geometries.

We know how new species of life can evolve and the statistical rules that govern such processes. We even have a pretty good understanding of the exact moment in which the universe, and thus of all reality, came into existence! But no serious and informed scientist will tell you that at present we fully understand the thing each of us knows best. That is, our own consciousness.

One of science's last greatest mysteries

Although we've come along way since the time of Descartes, who postulated that consciousness was actually some immaterial spirit not subject to physical law, we still don't have a complete and satisfactory account of the science underlying experience. We simply don't know how to quantify it. And if we can't do that, how do we know whether those non-human life forms that are unable to communicate with us are also conscious? Does it feel like anything to be a cat? Most will probably agree that it does, but how about a ladybug? If so, how can we know which life forms are more conscious than others? Do animals that show impressively intelligent behavior and elaborate memory, like dolphins or crows, experience the world in a unified conscious fashion as we do? These questions are almost impossible to answer without a way to measure consciousness. Fortunately, a neuroscientific theory that has been gaining popular acceptance aims to do just that.

Integrated Information Theory to the Rescue

Integrated Information Theory (IIT), which has become quite a hot topic in contemporary neuroscience, claims to provide a precise way to measure consciousness and express the phenomenon in purely mathematical terms. The theory was put forth by psychiatrist and neuroscientist Giulio Tononi, and has attracted some highly regarded names in the science community. One such name is Christof Koch, Chief Scientific Officer at the Allen Institute for Brain Science, who now champions the idea along with Tononi. Koch may be best-known for bringing consciousness research into the mainstream of neuroscience through his long-term collaboration with the late DNA co-discoverer Francis Crick. Now Tononi and Koch are actively researching the theory along with an increasing number of scientists, some from outside the field of neuroscience like esteemed physicist and popular author Max Tegmark, who is joining the ranks of those who believe they've figured out how to reduce one of science's greatest secrets to numbers. Bits of information to be exact.

Okay, so we now know that the theory is kind of a big deal to notable scientists. But how exactly does IIT attempt to quantify something as ill-defined and seemingly elusive as consciousness?

IIT in a nutshell

Just like a computer, the brain stores and processes information. But it is how that information is shared throughout the brain network that gives rise to our rich and vivid conscious experience. Let's consider the act of observing a sunset. Thanks to advances in brain imaging, modern neuroscience tells us that there are a number of different and distinct regions active during this event, each of which process information about different features of that event separately. There's a region in the visual cortex (known as "V2") that processes the form and color of the yellow and orange sunrays against the clouds. There are auditory areas in the temporal lobe being fed information about the sound of the wind rushing past you as you stare off into the horizon. That rushing wind against your skin also generates patterns of electrical signals in the somatosensory cortex that create a sense of touch. There are many different things going on in distant places.

Yet somehow we perceive it all as one unified conscious experience.

According to IIT, this unified experience relies on the brain's ability to fuse together (or integrate) all that incoming sensory information as a whole. To measure the degree of integration, Tononi has taken mathematical principles formulated by American engineer Claude Shannon, who developed a scientific theory of information midway through the 20th century to describe data transmission, and applied them to the brain. IIT claims that these information measures allow one to calculate an exact number that represents the degree of integrated information that exists in a brain at any given moment. Tononi chooses to call this metric "Phi" (or Φ), which serves as an index for consciousness. The greater the Phi, the more conscious the system. It need not matter whether it's the nervous system of a child, or a cat, or even a ladybug.

Problem solved?

Sounds simple and straight forward enough, doesn't it? Isn't this what science has strived to do all along? To describe things objectively and strip away all mystery from foggily understood natural phenomena? Could this be the solution to demystifying consciousness, the thing philosophers have been battling over for centuries?

It may certainly answer some very important questions, but when you follow the theory to its logical conclusions things get pretty weird, and also, well, kind of neat.

But before we get to the weird conclusions let's start with the weird questions, which have essentially been ignored by modern physical science, and at first ponder may even seem unremarkable.

Some hard questions

How can physical processing create inner, subjective experience?

How can matter possess first person perspective?

How can mere electrical signals produce qualitative sensation and awareness?

Why should information "feel" like anything in the first place?

These questions are functionally synonymous and define what philosophers have dubbed the "hard problem of consciousness," a concept that many neuroscientists have embraced. Conversely, the "easy problem" (although it is also extremely difficult) is figuring out all the computational and cognitive mechanisms underlying consciousness, which is categorically different than describing experience. Previously, science has only concentrated on solving those questions related to the "easy problem of consciousness." Some still believe that questions about subjective experience can't be answered quantitatively, and are therefore only appropriate topics for philosophy. Others handle the situation by refusing to acknowledge the existence of consciousness altogether! However, the truth of consciousness is self-evident, and denying it is equivalent to denying one's own existence. IIT is unique in that it recognizes consciousness as a real phenomenon that can be described objectively and mathematically.

But does IIT really address the "hard problem of consciousness," i.e., how subjective experience arises from the physical?

The answer is not quite.

The brain stores and processes information, but how and why that information takes on the characteristic of "feeling like something" is left unexplained. IIT tells us how to measure the degree of consciousness (Φ or Φ), but does not tell us how different types of information acquire different subjective sensations, like the feel of a burning flame or an orgasm. As stated by philosopher Ned Block, it may be that Φ is correlated with consciousness, but does not play a role in its cause.

So how do proponents of Integrated Information Theory attempt to explain subjective experience?

Christof Koch's answer: Consciousness is a fundamental property of the universe. Wherever there is integrated information, there is experience. The theory takes its existence as a given and therefore doesn't have to explain the mechanism behind it. It's just a fact of nature that information has an inner side in addition to its bit-composed outer side.

Let's follow the logic of this idea and see how it holds up. We know that certain brain states feel like something. Brain states are just information states. Therefore, information feels like something. Sounds pretty solid. Under IIT, lower mammals like cats have conscious experience, as do insects, even if only to some miniscule degree. Such an idea would seem intuitive. Why should there be some magical point at which a nervous system spontaneously turns conscious, like a switch had been suddenly flipped? It is more likely that a continuum of experience exists along a gradient, going from the very simple, raw sensations of single celled organisms to the more complex qualitative awareness of the human-sort. But what about non-biological systems that integrate information?

Things start to get weird

What's interesting about IIT is that it doesn't require that a conscious entity be a living organism. Any system that can integrate information, whether it be carbon-based or composed of silicon chips and metal wires, should produce conscious states. As information processors, modern computers possess some amount of experience, but presumably so little that it may be undetectable by human observers. In fact, according to IIT, it actually feels like something to be your iPhone. This should please artificial intelligence researchers who often long for their creations to someday be "alive". In our technology driven world, IIT says that consciousness is both in our homes and in our hands.

Although all of this may seem pretty strange, the idea that machines can be conscious might not be entirely unfathomable, especially given the amount of science fiction that has instilled visions of self-aware robots into our psyche. Is this as far as the theory goes?

Nope.

If you are very clever (or perhaps very high) then upon reading the above you may have briefly considered the following question in some form or another. Aren't humans always exchanging information through a global network of interconnected computers that collectively store and integrate information in some complex fashion? Let's follow IIT down the rabbit hole.

The Internet wakes up

If we are to take IIT seriously, we must accept that a system such as the Internet can possess conscious states like that of a biological nervous system, as so long as information is being integrated in a similar fashion. This possibility has been explored by Christof Koch himself:

"Consider humankind's largest and most complex artifact, the Internet. It consists of billions of computers linked together using optical fibers and copper cables that rapidly instantiate specific connections using ultrafast communication protocols. Each of these processors in turn is made out of a few billion transistors. Taken as a whole, the Internet has perhaps 10^{19} transistors, about the number of synapses in the brains of 10,000 people. Thus, its sheer number of components exceeds

that of any one human brain. Whether or not the Internet today feels like something to itself is completely speculative. Still, it is certainly conceivable."

However, at the current time it seems highly unlikely that the Internet possesses the level of first-person experience as do you or I. Our brains have been shaped by evolution over millions of years in ways that have developed and refined its information processing capabilities. But still, the potential for a self-aware World Wide Web is surely there.

An information-based collective consciousness

That's right. The theory allows for the emergence of an abstract "superorganism" that is composed of many individual organisms. Many puzzling questions are to follow. If the web were to "wake up" so to speak, would it exhibit apparent forms of observable unified and coordinated behavior? Or would we simply be an unknowing unit in a larger system in the same way a neuron is unaware of its contribution to a mental state? It's not only fun to entertain the idea of a living entity that would possess essentially all the knowledge accumulated by humanity, but also scientifically productive.

In theory, there's almost no limit to how large a fully conscious system can grow and evolve in space. It is bound only by the rate of information and complexity growth, which we have seen tends to increase exponentially.

So far we've discussed consciousness that can span large distances with no palpable physical structure. But what about arrangements of information that are too small for the eye to see?

Protons that feel

IIT says that anything with a non-zero Φ has subjective experience. This includes subatomic particles. Koch writes:

"Even simple matter has a modicum of Φ [integrated information]. Protons and neutrons consist of a triad of quarks that are never observed in isolation. They constitute an infinitesimal integrated system."

This has profound consequences. It would mean that consciousness is spread throughout space like a cosmic web of experience. Of course awareness is greatest where there is significant information integration, but in essence, "mind" (or "psyche") is everywhere. IIT turns out to be a modern twist on an ancient philosophical view known as "panpsychism". But before you go dismissing the concept because of its name, you should know that intellectual heavy hitters such as Baruch Spinoza, Gottfried Leibniz, and William James are all considered panpsychists. Its central tenant is that all matter has a mental aspect, which makes consciousness universal. Koch goes on:

"The entire cosmos is suffused with sentience. We are surrounded and immersed in consciousness; it is in the air we breathe, the soil we tread on, the bacteria that colonize our intestines, and the brain that enables us to think."

A new spirituality constrained by science

So far Integrated Information Theory is the best candidate for a scientific doctrine that provides an objective description of consciousness. As such, it deserves that we consider the possibility of such seemingly radical ideas. Pondering questions previously deemed appropriate only for pot smoking college dorm-dwellers is now a task for the best and brightest scientific minds. Most rational thinkers will agree that the idea of a personal god who gets angry when we masturbate and routinely disrupts the laws of physics upon prayer is utterly ridiculous. This theory doesn't give credence to anything of the sort. It simply reveals an underlying harmony in nature, and a sweeping mental presence that isn't confined to biological systems. IIT's inevitable logical conclusions and philosophical implications are both elegant and precise. What it yields is a new kind of scientific spirituality that paints a picture of a soulful existence that even the most diehard materialist or devout atheist can unashamedly get behind.

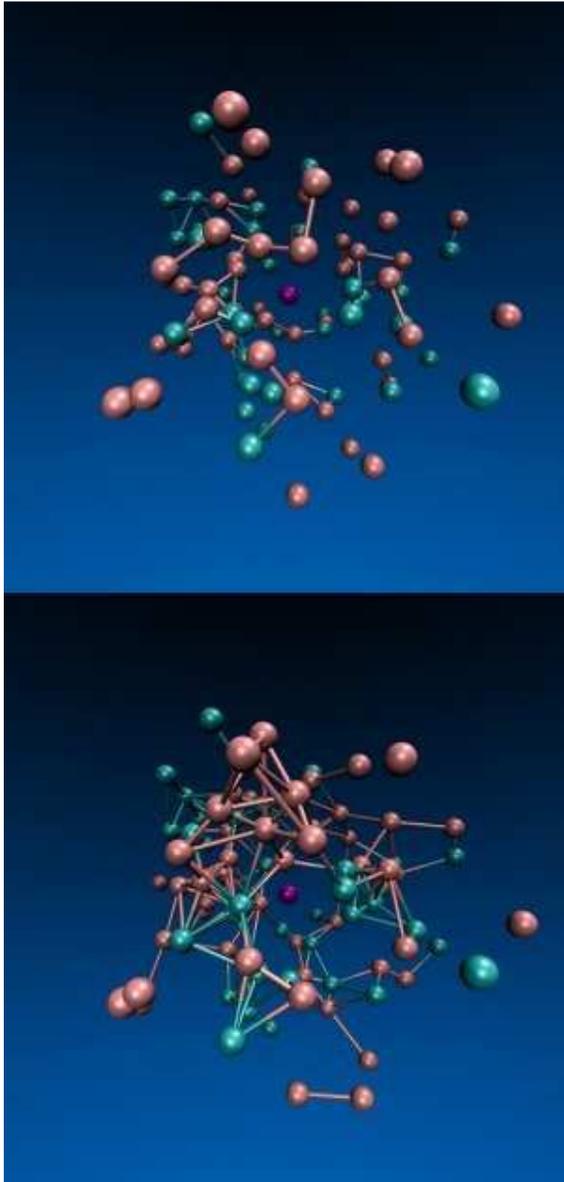
"The religion of the future will be a cosmic religion. It should transcend personal God and avoid dogma and theology. Covering both the natural and the spiritual, it should be based on a religious sense arising from the experience of all things natural and spiritual as a meaningful unity." -Albert Einstein [10]

This Physicist Has a Groundbreaking Idea about Why Life Exists

"You start with a random clump of atoms, and if you shine light on it for long enough, it should not be so surprising that you get a plant," England said.

England's theory is meant to underlie, rather than replace, Darwin's theory of evolution by natural selection, which provides a powerful description of life at the level of genes and populations. "I am certainly not saying that Darwinian ideas are wrong," he explained. "On the contrary, I am just saying that from the perspective of the physics, you might call Darwinian evolution a special case of a more general phenomenon."

At the heart of England's idea is the second law of thermodynamics, also known as the law of increasing entropy or the "arrow of time." Hot things cool down, gas diffuses through air, eggs scramble but never spontaneously unscramble; in short, energy tends to disperse or spread out as time progresses. Entropy is a measure of this tendency, quantifying how dispersed the energy is among the particles in a system, and how diffuse those particles are throughout space. It increases as a simple matter of probability: There are more ways for energy to be spread out than for it to be concentrated.



A computer simulation by Jeremy England and colleagues shows a system of particles confined inside a viscous fluid in which the turquoise particles are driven by an oscillating force. Over time (from top to bottom), the force triggers the formation of more bonds among the particles.

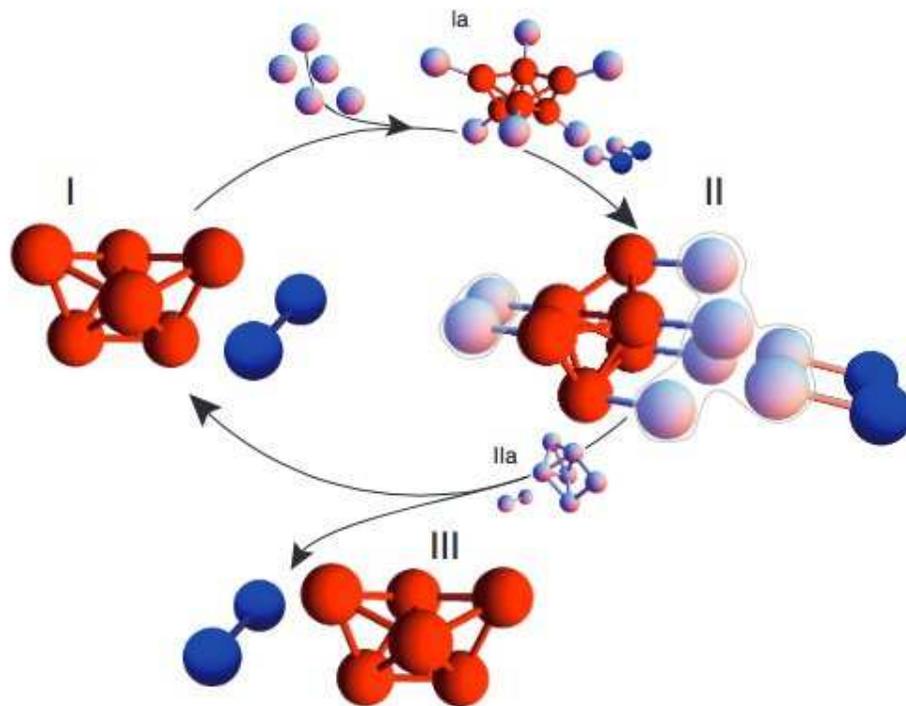
Thus, as particles in a system move around and interact, they will, through sheer chance, tend to adopt configurations in which the energy is spread out. Eventually, the system arrives at a state of maximum entropy called “thermodynamic equilibrium,” in which energy is uniformly distributed. A cup of coffee and the room it sits in become the same temperature, for example.

Although entropy must increase over time in an isolated or “closed” system, an “open” system can keep its entropy low — that is, divide energy unevenly among its atoms — by greatly increasing the entropy of its surroundings. In his influential 1944 monograph “What Is Life?” the eminent quantum physicist Erwin Schrödinger argued that this is what living things must do. A plant, for example, absorbs extremely energetic sunlight, uses it to build sugars, and ejects infrared light, a much less

concentrated form of energy. The overall entropy of the universe increases during photosynthesis as the sunlight dissipates, even as the plant prevents itself from decaying by maintaining an orderly internal structure.

Self-replication (or reproduction, in biological terms), the process that drives the evolution of life on Earth, is one such mechanism by which a system might dissipate an increasing amount of energy over time.

As England put it, "A great way of dissipating more is to make more copies of yourself."



Self-Replicating Sphere Clusters: According to new research at Harvard, coating the surfaces of microspheres can cause them to spontaneously assemble into a chosen structure, such as a polytetrahedron (red), which then triggers nearby spheres into forming an identical structure.

Scientists have already observed self-replication in nonliving systems. According to new research led by Philip Marcus of the University of California, Berkeley, and reported in *Physical Review Letters* in August, vortices in turbulent fluids spontaneously replicate themselves by drawing energy from shear in the surrounding fluid. And in a paper in *Proceedings of the National Academy of Sciences*, Michael Brenner, a professor of applied mathematics and physics at Harvard, and his collaborators present theoretical models and simulations of microstructures that self-replicate. These clusters of specially coated microspheres dissipate energy by roping nearby spheres into forming identical clusters. "This connects very much to what Jeremy is saying," Brenner said. [8]

Photoactive Prebiotic Systems

We propose that life first emerged in the form of such minimal photoactive prebiotic kernel systems and later in the process of evolution these photoactive prebiotic kernel systems would have produced fatty acids and covered themselves with fatty acid envelopes to become the minimal cells of the Fatty Acid World. Specifically, we model self-assembling of photoactive prebiotic systems with observed quantum entanglement phenomena. We address the idea that quantum entanglement was important in the first stages of origins of life and evolution of the biospheres because simultaneously excite two prebiotic kernels in the system by appearance of two additional quantum entangled excited states, leading to faster growth and self-replication of minimal living cells. The quantum mechanically modeled possibility of synthesizing artificial self-reproducing quantum entangled prebiotic kernel systems and minimal cells also impacts the possibility of the most probable path of emergence of photocells on the Earth or elsewhere. We also examine the quantum entangled logic gates discovered in the modeled systems composed of two prebiotic kernels. Such logic gates may have application in the destruction of cancer cells or becoming building blocks of new forms of artificial cells including magnetically active ones.

Significance Statement

Our investigated self-assembly of molecules towards supramolecular bioorganic and minimal cellular systems depends on the quantum mechanics laws which induce hydrogen and Van der Waals bindings (Tamulis A, Grigalavicius, M, *Orig Life Evol Biosph* 41:51-71, 2011).

In the work presented here, quantum entanglement takes the form of a quantum superposition of the active components in synthesized self-assembling and self-replicating living systems. When a quantum calculation of an entangled system is made that causes one photoactive biomolecule of such a pair to take on a definite value (e.g., electron density transfer or electron spin density transfer), the other member of this entangled pair will be found to have taken the appropriately correlated value (e.g., electron density transfer or electron spin density transfer). In our simulations, the separation distance of supramolecular bio systems changes took place during geometry optimization procedures, which mimic real-world intermolecular interaction processes.

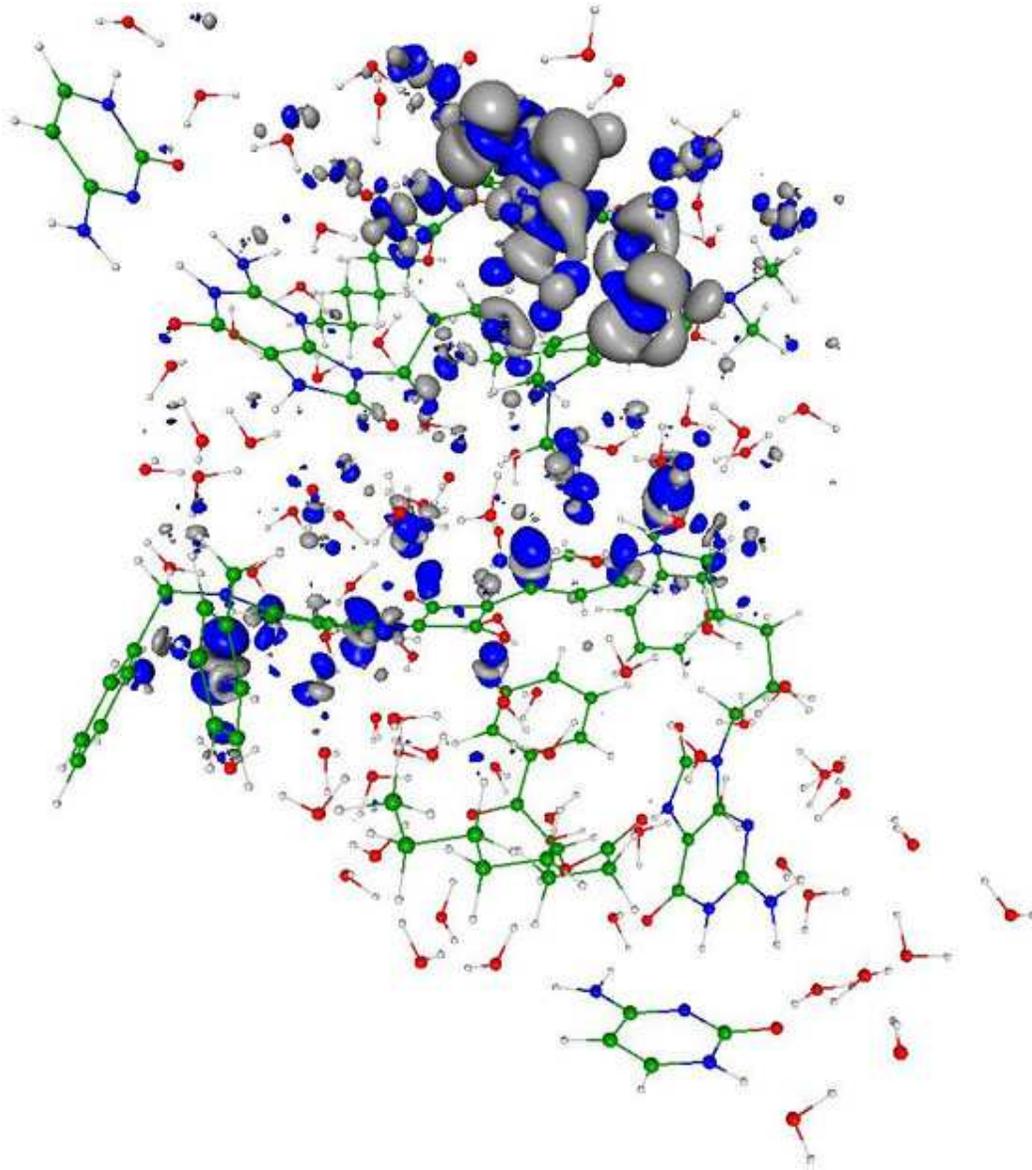
Our discovered phenomenon of the quantum entanglement in the prebiotic systems enhance the photosynthesis in the proposed systems because simultaneously excite two prebiotic kernels in the system by appearance of two additional quantum entangled excited states (Tamulis A, Grigalavicius M, Baltrusaitis J, *Orig Life Evol Biosph* 43:49-66, 2013; Tamulis A, Grigalavicius M, Krisciukaitis S (2014) , *J Comput Theor Nanos*, 11, 1597-1608, 2014; Tamulis A, Grigalavicius M, 8:117-140, 2014.). We can propose that quantum entanglement enhanced the emergence of photosynthetic prebiotic kernels and accelerated the evolution of photosynthetic life because of additional absorbed light energy, leading to faster growth and self-replication of minimal living cells.

We can state that: Livings are self-assembled and self-replicating wet and warm stochastically moving supramolecular systems where quantum entanglement can be continuously generated and destroyed by non-equilibrium effects in an environment where no static entanglement exists; quantum entanglement involve the biomolecule inside one living or between other neighboring livings.

This warm quantum coherence is basic for the explanation of DNA stability and for the understanding of brain magnetic orientation during migration in more than 50 species of birds, fishes and insects. Exists experimental evidence for quantum-coherent is used for more efficient light-harvesting in plant photosynthesis. Quantum entanglement exists in supramolecules determining the sense of smell and in the brain neurons microtubules due to quantum vibrations.

In the work presented here, we started to design and quantum mechanical investigations of the molecular logical devices which are useful for construction of nano medicine biorobots against the molecular diseases such a cancer tumors, and against the new kinds of synthesized microorganisms and nano guns.

Figure legend



You can see in the enclosed figure the quantum entanglement phenomenon in the closely self-assembled two synthesized protocell system due to the photo excited electron charge transfer from one protocell to another that leads to closer self-assembly and exchange of energy and information.

Visualization of the electron charge tunneling associated with the 6th (467.3 nm) excited state. The transition is mainly from squarone molecule of the first protocell situated in the bottom of this bi-cellular system to precursor of fatty acid (pFA) molecule of the second subsystem (in the top) and little from the 1,4-bis(N,N-dimethylamino)naphthalene molecule (in the top-right) to the same pFA molecule of the second subsystem (in the top). The electron cloud hole is indicated by the dark blue color while the transferred electron cloud location is designated by the gray color.

As a result, these nonlinear quantum interactions compressed the overall molecular system resulting in a smaller gap between the HOMO and LUMO electron energy levels which allows enhanced tunneling of photo excited electrons from the sensitizer squarone and (1,4-bis(N,N-dimethylamino)naphthalene) to the pFA molecule resulting in its cleavage. The new fatty acid joins the existing minimal cell thus increasing it in size. After reaching some critical size, the minimal cell should divide (i.e. self-replicate) into two separate smaller minimal cells. [7]

Quantum Biology

Researchers have long suspected that something unusual is afoot in photosynthesis. Particles of light called photons, streaming down from the Sun; arrive randomly at the chlorophyll molecules and other light-absorbing 'antenna' pigments that cluster inside the cells of every leaf, and within every photosynthetic bacterium. But once the photons' energy is deposited, it doesn't stay random. Somehow, it gets channeled into a steady flow towards the cell's photosynthetic reaction centre, which can then use it at maximum efficiency to convert carbon dioxide into sugars. Quantum coherence in photosynthesis seems to be beneficial to the organisms using it. But did their ability to exploit quantum effects evolve through natural selection? Or is quantum coherence just an accidental side effect of the way certain molecules are structured? [6]

Quantum Consciousness

Extensive scientific investigation has found that a form of quantum coherence operates within living biological systems through what is known as biological excitations and biophoton emission. What this means is that metabolic energy is stored as a form of electromechanical and electromagnetic excitations. These coherent excitations are considered responsible for generating and maintaining long-range order via the transformation of energy and very weak electromagnetic signals. After nearly twenty years of experimental research, Fritz-Albert Popp put forward the hypothesis that biophotons are emitted from a coherent electrodynamics field within the living system.

What this means is that each living cell is giving off, or resonating, a biophoton field of coherent energy. If each cell is emitting this field, then the whole living system is, in effect, a resonating field-a ubiquitous nonlocal field. And since biophotons are the entities through which the living system communicates, there is near-instantaneous intercommunication throughout. And this, claims Popp, is the basis for coherent biological organization -- referred to as quantum coherence. This discovery

led Popp to state that the capacity for evolution rests not on aggressive struggle and rivalry but on the capacity for communication and cooperation. In this sense the built-in capacity for species evolution is not based on the individual but rather living systems that are interlinked within a coherent whole: Living systems are thus neither the subjects alone, nor objects isolated, but both subjects and objects in a mutually communicating universe of meaning. . . . Just as the cells in an organism take on different tasks for the whole, different populations enfold information not only for themselves, but for all other organisms, expanding the consciousness of the whole, while at the same time becoming more and more aware of this collective consciousness.

Biophysicist Mae-Wan Ho describes how the living organism, including the human body, is coordinated throughout and is "coherent beyond our wildest dreams." It appears that every part of our body is "in communication with every other part through a dynamic, tunable, responsive, liquid crystalline medium that pervades the whole body, from organs and tissues to the interior of every cell."

What this tells us is that the medium of our bodies is a form of liquid crystal, an ideal transmitter of communication, resonance, and coherence. These relatively new developments in biophysics have discovered that all biological organisms are constituted of a liquid crystalline medium. Further, DNA is a liquid-crystal, lattice-type structure (which some refer to as a liquid crystal gel), whereby body cells are involved in a holographic instantaneous communication via the emitting of biophotons (a source based on light). This implies that all living biological organisms continuously emit radiations of light that form a field of coherence and communication. Moreover, biophysics has discovered that living organisms are permeated by quantum wave forms. [5]

Information – Entropy Theory of Physics

Viewing the confined gas where the statistical entropy not needs the information addition is not the only physical system. There are for example quantum mechanical systems where the information is a very important qualification. The perturbation theory needs higher order calculations in QED or QCD giving more information on the system as in the chess games happens, where the entropy is not enough to describe the state of the matter. The variation calculation of chess is the same as the perturbation calculation of physics to gain information, where the numbers of particles are small for statistical entropy to describe the system. The role of the Feynman graphs are the same as the chess variations of a given position that is the depth of the variations tree, the Information is the same as the order of the Feynman graphs giving the Information of the micro system. [9]

Information – Entropy Theory of Life

There is also connection between statistical physics and evolutionary biology, since the arrow of time is working in the biological evolution also.

The Fluctuation Theorem says that there is a probability that entropy will flow in a direction opposite to that dictated by the Second Law of Thermodynamics. In this case the Information is growing that

is the matter formulas are emerging from the chaos. So the Weak Interaction has two directions, samples for one direction is the Neutron decay, and Hydrogen fusion is the opposite direction. The living biological systems have also entropy lowering and information growing direction by building more complicated or entangled molecules, governed by the quantum mechanics and the general weak interaction. On the other hand there is the arrow of time; the entropy growing is lowering the information by dissipating these entangled or otherwise connected biomolecules, aging the living systems.

Creating quantum technology

Another area of potential application is in quantum computing. The long-standing goal of the physicists and engineers working in this area is to manipulate data encoded in quantum bits (qubits) of information, such as the spin-up and spin-down states of an electron or of an atomic nucleus. Qubits can exist in both states at once, thus permitting the simultaneous exploration of all possible answers to the computation that they encode. In principle, this would give quantum computers the power to find the best solution far more quickly than today's computers can — but only if the qubits can maintain their coherence, without the noise of the surrounding environment, such as the jostling of neighboring atoms, destroying the synchrony of the waves. [6]

Quantum Entanglement

Measurements of physical properties such as position, momentum, spin, polarization, etc. performed on entangled particles are found to be appropriately correlated. For example, if a pair of particles is generated in such a way that their total spin is known to be zero, and one particle is found to have clockwise spin on a certain axis, then the spin of the other particle, measured on the same axis, will be found to be counterclockwise. Because of the nature of quantum measurement, however, this behavior gives rise to effects that can appear paradoxical: any measurement of a property of a particle can be seen as acting on that particle (e.g. by collapsing a number of superimposed states); and in the case of entangled particles, such action must be on the entangled system as a whole. It thus appears that one particle of an entangled pair "knows" what measurement has been performed on the other, and with what outcome, even though there is no known means for such information to be communicated between the particles, which at the time of measurement may be separated by arbitrarily large distances. [4]

The Bridge

The accelerating electrons explain not only the Maxwell Equations and the Special Relativity, but the Heisenberg Uncertainty Relation, the wave particle duality and the electron's spin also, building the bridge between the Classical and Quantum Theories. [1]

Accelerating charges

The moving charges are self maintain the electromagnetic field locally, causing their movement and this is the result of their acceleration under the force of this field. In the classical physics the charges will distributed along the electric current so that the electric potential lowering along the current, by

linearly increasing the way they take every next time period because this accelerated motion. The same thing happens on the atomic scale giving a Δp impulse difference and a Δx way difference between the different part of the not point like particles.

Relativistic effect

Another bridge between the classical and quantum mechanics in the realm of relativity is that the charge distribution is lowering in the reference frame of the accelerating charges linearly: $ds/dt = at$ (time coordinate), but in the reference frame of the current it is parabolic: $s = a/2 t^2$ (geometric coordinate).

Heisenberg Uncertainty Relation

In the atomic scale the Heisenberg uncertainty relation gives the same result, since the moving electron in the atom accelerating in the electric field of the proton, causing a charge distribution on Δx position difference and with a Δp momentum difference such a way that they product is about the half Planck reduced constant. For the proton this Δx much less in the nucleon, than in the orbit of the electron in the atom, the Δp is much higher because of the greater proton mass.

This means that the electron and proton are not point like particles, but has a real charge distribution.

Wave – Particle Duality

The accelerating electrons explains the wave – particle duality of the electrons and photons, since the elementary charges are distributed on Δx position with Δp impulse and creating a wave packet of the electron. The photon gives the electromagnetic particle of the mediating force of the electrons electromagnetic field with the same distribution of wavelengths.

Atomic model

The constantly accelerating electron in the Hydrogen atom is moving on the equipotential line of the proton and it's kinetic and potential energy will be constant. Its energy will change only when it is changing its way to another equipotential line with another value of potential energy or getting free with enough kinetic energy. This means that the Rutherford-Bohr atomic model is right and only that changing acceleration of the electric charge causes radiation, not the steady acceleration. The steady acceleration of the charges only creates a centric parabolic steady electric field around the charge, the magnetic field. This gives the magnetic moment of the atoms, summing up the proton and electron magnetic moments caused by their circular motions and spins.

The Relativistic Bridge

Commonly accepted idea that the relativistic effect on the particle physics it is the fermions' spin - another unresolved problem in the classical concepts. If the electric charges can move only with accelerated motions in the self maintaining electromagnetic field, once upon a time they would

reach the velocity of the electromagnetic field. The resolution of this problem is the spinning particle, constantly accelerating and not reaching the velocity of light because the acceleration is radial. One origin of the Quantum Physics is the Planck Distribution Law of the electromagnetic oscillators, giving equal intensity for 2 different wavelengths on any temperature. Any of these two wavelengths will give equal intensity diffraction patterns, building different asymmetric constructions, for example proton - electron structures (atoms), molecules, etc. Since the particles are centers of diffraction patterns they also have particle – wave duality as the electromagnetic waves have. [2]

The weak interaction

The weak interaction transforms an electric charge in the diffraction pattern from one side to the other side, causing an electric dipole momentum change, which violates the CP and time reversal symmetry. The Electroweak Interaction shows that the Weak Interaction is basically electromagnetic in nature. The arrow of time shows the entropy grows by changing the temperature dependent diffraction patterns of the electromagnetic oscillators.

Another important issue of the quark model is when one quark changes its flavor such that a linear oscillation transforms into plane oscillation or vice versa, changing the charge value with 1 or -1. This kind of change in the oscillation mode requires not only parity change, but also charge and time changes (CPT symmetry) resulting a right handed anti-neutrino or a left handed neutrino.

The right handed anti-neutrino and the left handed neutrino exist only because changing back the quark flavor could happen only in reverse, because they are different geometrical constructions, the u is 2 dimensional and positively charged and the d is 1 dimensional and negatively charged. It needs also a time reversal, because anti particle (anti neutrino) is involved.

The neutrino is a 1/2 spin creator particle to make equal the spins of the weak interaction, for example neutron decay to 2 fermions, every particle is fermions with $\frac{1}{2}$ spin. The weak interaction changes the entropy since more or less particles will give more or less freedom of movement. The entropy change is a result of temperature change and breaks the equality of oscillator diffraction intensity of the Maxwell–Boltzmann statistics. This way it changes the time coordinate measure and makes possible a different time dilation as of the special relativity.

The limit of the velocity of particles as the speed of light appropriate only for electrical charged particles, since the accelerated charges are self maintaining locally the accelerating electric force. The neutrinos are CP symmetry breaking particles compensated by time in the CPT symmetry, that is the time coordinate not works as in the electromagnetic interactions, consequently the speed of neutrinos is not limited by the speed of light.

The weak interaction T-asymmetry is in conjunction with the T-asymmetry of the second law of thermodynamics, meaning that locally lowering entropy (on extremely high temperature) causes the weak interaction, for example the Hydrogen fusion.

Probably because it is a spin creating movement changing linear oscillation to 2 dimensional oscillation by changing d to u quark and creating anti neutrino going back in time relative to the

proton and electron created from the neutron, it seems that the anti neutrino fastest then the velocity of the photons created also in this weak interaction?

A quark flavor changing shows that it is a reflection changes movement and the CP- and T- symmetry breaking!!! This flavor changing oscillation could prove that it could be also on higher level such as atoms, molecules, probably big biological significant molecules and responsible on the aging of the life.

Important to mention that the weak interaction is always contains particles and antiparticles, where the neutrinos (antineutrinos) present the opposite side. It means by Feynman's interpretation that these particles present the backward time and probably because this they seem to move faster than the speed of light in the reference frame of the other side.

Finally since the weak interaction is an electric dipole change with $\frac{1}{2}$ spin creating; it is limited by the velocity of the electromagnetic wave, so the neutrino's velocity cannot exceed the velocity of light.

The General Weak Interaction

The Weak Interactions T-asymmetry is in conjunction with the T-asymmetry of the Second Law of Thermodynamics, meaning that locally lowering entropy (on extremely high temperature) causes for example the Hydrogen fusion. The arrow of time by the Second Law of Thermodynamics shows the increasing entropy and decreasing information by the Weak Interaction, changing the temperature dependent diffraction patterns. A good example of this is the neutron decay, creating more particles with less known information about them.

The neutrino oscillation of the Weak Interaction shows that it is a general electric dipole change and it is possible to any other temperature dependent entropy and information changing diffraction pattern of atoms, molecules and even complicated biological living structures.

We can generalize the weak interaction on all of the decaying matter constructions, even on the biological too. This gives the limited lifetime for the biological constructions also by the arrow of time. There should be a new research space of the Quantum Information Science the 'general neutrino oscillation' for the greater than subatomic matter structures as an electric dipole change. There is also connection between statistical physics and evolutionary biology, since the arrow of time is working in the biological evolution also.

The Fluctuation Theorem says that there is a probability that entropy will flow in a direction opposite to that dictated by the Second Law of Thermodynamics. In this case the Information is growing that is the matter formulas are emerging from the chaos. So the Weak Interaction has two directions, samples for one direction is the Neutron decay, and Hydrogen fusion is the opposite direction.

Fermions and Bosons

The fermions are the diffraction patterns of the bosons such a way that they are both sides of the same thing.

Van Der Waals force

Named after the Dutch scientist Johannes Diderik van der Waals – who first proposed it in 1873 to explain the behaviour of gases – it is a very weak force that only becomes relevant when atoms and molecules are very close together. Fluctuations in the electronic cloud of an atom mean that it will

have an instantaneous dipole moment. This can induce a dipole moment in a nearby atom, the result being an attractive dipole–dipole interaction.

Electromagnetic inertia and mass

Electromagnetic Induction

Since the magnetic induction creates a negative electric field as a result of the changing acceleration, it works as an electromagnetic inertia, causing an electromagnetic mass. [1]

Relativistic change of mass

The increasing mass of the electric charges the result of the increasing inductive electric force acting against the accelerating force. The decreasing mass of the decreasing acceleration is the result of the inductive electric force acting against the decreasing force. This is the relativistic mass change explanation, especially importantly explaining the mass reduction in case of velocity decrease.

The frequency dependence of mass

Since $E = h\nu$ and $E = mc^2$, $m = h\nu / c^2$ that is the m depends only on the ν frequency. It means that the mass of the proton and electron are electromagnetic and the result of the electromagnetic induction, caused by the changing acceleration of the spinning and moving charge! It could be that the m_0 inertial mass is the result of the spin, since this is the only accelerating motion of the electric charge. Since the accelerating motion has different frequency for the electron in the atom and the proton, they masses are different, also as the wavelengths on both sides of the diffraction pattern, giving equal intensity of radiation.

Electron – Proton mass rate

The Planck distribution law explains the different frequencies of the proton and electron, giving equal intensity to different lambda wavelengths! Also since the particles are diffraction patterns they have some closeness to each other – can be seen as a gravitational force. [2]

There is an asymmetry between the mass of the electric charges, for example proton and electron, can understood by the asymmetrical Planck Distribution Law. This temperature dependent energy distribution is asymmetric around the maximum intensity, where the annihilation of matter and antimatter is a high probability event. The asymmetric sides are creating different frequencies of electromagnetic radiations being in the same intensity level and compensating each other. One of these compensating ratios is the electron – proton mass ratio. The lower energy side has no compensating intensity level, it is the dark energy and the corresponding matter is the dark matter.

Gravity from the point of view of quantum physics

The Gravitational force

The gravitational attractive force is basically a magnetic force.

The same electric charges can attract one another by the magnetic force if they are moving parallel in the same direction. Since the electrically neutral matter is composed of negative and positive

charges they need 2 photons to mediate this attractive force, one per charges. The Big Bang caused parallel moving of the matter gives this magnetic force, experienced as gravitational force.

Since graviton is a tensor field, it has spin = 2, could be 2 photons with spin = 1 together.

You can think about photons as virtual electron – positron pairs, obtaining the necessary virtual mass for gravity.

The mass as seen before a result of the diffraction, for example the proton – electron mass ratio $M_p=1840 M_e$. In order to move one of these diffraction maximum (electron or proton) we need to intervene into the diffraction pattern with a force appropriate to the intensity of this diffraction maximum, means its intensity or mass.

The Big Bang caused acceleration created radial currents of the matter, and since the matter is composed of negative and positive charges, these currents are creating magnetic field and attracting forces between the parallel moving electric currents. This is the gravitational force experienced by the matter, and also the mass is result of the electromagnetic forces between the charged particles. The positive and negative charged currents attracts each other or by the magnetic forces or by the much stronger electrostatic forces!?

The gravitational force attracting the matter, causing concentration of the matter in a small space and leaving much space with low matter concentration: dark matter and energy. There is an asymmetry between the mass of the electric charges, for example proton and electron, can understood by the asymmetrical Planck Distribution Law. This temperature dependent energy distribution is asymmetric around the maximum intensity, where the annihilation of matter and antimatter is a high probability event. The asymmetric sides are creating different frequencies of electromagnetic radiations being in the same intensity level and compensating each other. One of these compensating ratios is the electron – proton mass ratio. The lower energy side has no compensating intensity level, it is the dark energy and the corresponding matter is the dark matter.

The Higgs boson

By March 2013, the particle had been proven to behave, interact and decay in many of the expected ways predicted by the Standard Model, and was also tentatively confirmed to have + parity and zero spin, two fundamental criteria of a Higgs boson, making it also the first known scalar particle to be discovered in nature, although a number of other properties were not fully proven and some partial results do not yet precisely match those expected; in some cases data is also still awaited or being analyzed.

Since the Higgs boson is necessary to the W and Z bosons, the dipole change of the Weak interaction and the change in the magnetic effect caused gravitation must be conducted. The Wien law is also important to explain the Weak interaction, since it describes the T_{\max} change and the diffraction patterns change. [2]

Higgs mechanism and Quantum Gravity

The magnetic induction creates a negative electric field, causing an electromagnetic inertia. Probably it is the mysterious Higgs field giving mass to the charged particles? We can think about the photon as an electron-positron pair, they have mass. The neutral particles are built from negative and positive charges, for example the neutron, decaying to proton and electron. The wave – particle duality makes sure that the particles are oscillating and creating magnetic induction as an inertial mass, explaining also the relativistic mass change. Higher frequency creates stronger magnetic induction, smaller frequency results lesser magnetic induction. It seems to me that the magnetic induction is the secret of the Higgs field.

In particle physics, the Higgs mechanism is a kind of mass generation mechanism, a process that gives mass to elementary particles. According to this theory, particles gain mass by interacting with the Higgs field that permeates all space. More precisely, the Higgs mechanism endows gauge bosons in a gauge theory with mass through absorption of Nambu–Goldstone bosons arising in spontaneous symmetry breaking.

The simplest implementation of the mechanism adds an extra Higgs field to the gauge theory. The spontaneous symmetry breaking of the underlying local symmetry triggers conversion of components of this Higgs field to Goldstone bosons which interact with (at least some of) the other fields in the theory, so as to produce mass terms for (at least some of) the gauge bosons. This mechanism may also leave behind elementary scalar (spin-0) particles, known as Higgs bosons.

In the Standard Model, the phrase "Higgs mechanism" refers specifically to the generation of masses for the W^\pm , and Z weak gauge bosons through electroweak symmetry breaking. The Large Hadron Collider at CERN announced results consistent with the Higgs particle on July 4, 2012 but stressed that further testing is needed to confirm the Standard Model.

What is the Spin?

So we know already that the new particle has spin zero or spin two and we could tell which one if we could detect the polarizations of the photons produced. Unfortunately this is difficult and neither ATLAS nor CMS are able to measure polarizations. The only direct and sure way to confirm that the particle is indeed a scalar is to plot the angular distribution of the photons in the rest frame of the centre of mass. A spin zero particles like the Higgs carries no directional information away from the original collision so the distribution will be even in all directions. This test will be possible when a much larger number of events have been observed. In the mean time we can settle for less certain indirect indicators.

The Graviton

In physics, the graviton is a hypothetical elementary particle that mediates the force of gravitation in the framework of quantum field theory. If it exists, the graviton is expected to be massless (because the gravitational force appears to have unlimited range) and must be a spin-2 boson. The spin follows from the fact that the source of gravitation is the stress-energy tensor, a second-rank tensor (compared to electromagnetism's spin-1 photon, the source of which is the four-current, a first-rank tensor). Additionally, it can be shown that any massless spin-2 field would give rise to a force indistinguishable from gravitation, because a massless spin-2 field must couple to (interact with) the stress-energy tensor in the same way that the gravitational field does. This result suggests that, if a massless spin-2 particle is discovered, it must be the graviton, so that the only experimental verification needed for the graviton may simply be the discovery of a massless spin-2 particle. [3]

Conclusions

There is also connection between statistical physics and evolutionary biology, since the arrow of time is working in the biological evolution also.

Prentiss, who runs an experimental biophysics lab at Harvard, says England's theory could be tested by comparing cells with different mutations and looking for a correlation between the amount of energy the cells dissipate and their replication rates. [8]

Exists experimental evidence for quantum-coherent is used for more efficient light-harvesting in plant photosynthesis. Quantum entanglement exists in supramolecules determining the sense of smell and in the brain neurons microtubules due to quantum vibrations.

In the work presented here, we started to design and quantum mechanical investigations of the molecular logical devices which are useful for construction of nano medicine biorobots against the molecular diseases such a cancer tumors, and against the new kinds of synthesized microorganisms and nano guns. [7]

One of the most important conclusions is that the electric charges are moving in an accelerated way and even if their velocity is constant, they have an intrinsic acceleration anyway, the so called spin, since they need at least an intrinsic acceleration to make possible they movement .

The accelerated charges self-maintaining potential shows the locality of the relativity, working on the quantum level also. [1]

The bridge between the classical and quantum theory is based on this intrinsic acceleration of the spin, explaining also the Heisenberg Uncertainty Principle. The particle – wave duality of the electric charges and the photon makes certain that they are both sides of the same thing.

The Secret of Quantum Entanglement that the particles are diffraction patterns of the electromagnetic waves and this way their quantum states every time is the result of the quantum state of the intermediate electromagnetic waves. [2]

These relatively new developments in biophysics have discovered that all biological organisms are constituted of a liquid crystalline medium. Further, DNA is a liquid-crystal, lattice-type structure (which some refer to as a liquid crystal gel), whereby body cells are involved in a holographic instantaneous communication via the emitting of biophotons (a source based on light). This implies that all living biological organisms continuously emit radiations of light that form a field of coherence and communication. Moreover, biophysics has discovered that living organisms are permeated by quantum wave forms. [5]

Basing the gravitational force on the accelerating Universe caused magnetic force and the Planck Distribution Law of the electromagnetic waves caused diffraction gives us the basis to build a Unified Theory of the physical interactions also.

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