Quantum Dot Biosensors

Quantum dots (QDs) have found so many applications in recent years, they can now be purchased with a variety of composite structures and configurations. [16]

Chemists have largely ignored quantum mechanics. But it now turns out that this strange physics has a huge effect on biochemical reactions. [15]

Recent developments in atomic-force microscopy have enabled researchers to apply mechanical forces to individual molecules to induce chemical reactions. [14]

A newly discovered collective rattling effect in a type of crystalline semiconductor blocks most heat transfer while preserving high electrical conductivity - a rare pairing that scientists say could reduce heat buildup in electronic devices and turbine engines, among other possible applications. [13]

Scientists at Aalto University, Finland, have made a breakthrough in physics. They succeeded in transporting heat maximally effectively ten thousand times further than ever before. The discovery may lead to a giant leap in the development of quantum computers. [12]

Maxwell's demon, a hypothetical being that appears to violate the second law of thermodynamics, has been widely studied since it was first proposed in 1867 by James Clerk Maxwell. But most of these studies have been theoretical, with only a handful of experiments having actually realized Maxwell's demon. [11]

In 1876, the Austrian physicist Ludwig Boltzmann noticed something surprising about his equations that describe the flow of heat in a gas. Usually, the colliding gas particles eventually reach a state of thermal equilibrium, the point at which no net flow of heat energy occurs. But Boltzmann realized that his equations also predict that, when gases are confined in a specific way, they should remain in persistent non-equilibrium, meaning a small amount of heat is always flowing within the system. [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.

Contents

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.

Getting hold of quantum dot biosensors

Quantum dots (QDs) have found so many applications in recent years, they can now be purchased with a variety of composite structures and configurations. Some are available suspended in a biologically friendly fluid, making them well poised to serve as biomarkers for single-molecule tagging and tracking. But suppose you wanted to trap and move one of these single nanoparticle tags the same way other biologists might grab tissue samples with a tweezer?

Harnessing the nano-tractor-beam like abilities of optical tweezers, researchers from the University of Melbourne, Australia, and Huazhong University of Science and Technology, China, developed an all-silicon nanoantenna to trap individual quantum dots suspended in a microfluidic chamber. The group will present their work at Frontiers in Optics + Laser Science APS/DLS (FIO + LS), held 17-21 September 2017 in Washington, DC.

"Conventional optical tweezers, based on laser beams tightly focused to small spots with microscope lenses, allow materials to be handled in a precise and non-contact manner," said Kenneth Crozier, a professor at the University of Melbourne and member of the research team. "The trapping of very small objects is rendered difficult, however, due to the fact that the trapping force varies approximately with the particle volume, and is small compared to the effect of random Brownian motion."

Trapping such small objects in a biologically useful construct is made even more difficult by the potentially destructive thermal effects of using metallic antennas to focus the trapping fields. "Here, we demonstrate the trapping of a very small object (namely a quantum dot) using an all-silicon nanoantenna," said Crozier. "We were literally able to see single quantum dots trapped by our nanoantenna, and capture movies showing their motion."

The new nanoantennas, which each consist of a silicon ring surrounding a pair of silicon cylinders, are made by electron beam lithography and reactive ion etching. The structure concentrates the infrared light used to trap the quantum dots into the small 50 nanometer gap between the cylinders.

Crozier and his group tested their antenna by attaching a microfluidic chamber, filled with CdSe/ZnS quantum dots suspended in a buffer solution, to the silicon chip. This was mounted in an optical microscope where incident green light stimulated the quantum dots signature fluorescence and a CCD camera captured the trapping in action.

"From the simulations we did before the experiments, we expected it to work, but we were not certain," Crozier said. "So it was very exciting to see the individual quantum dots being trapped when we actually did the experiments." With a frame rate of 30 frames per second, they were able to video the trapping of a single fluorescent quantum dot by a silicon antenna on their microfluidic coupled chip.

"We used low concentrations of particles because we wanted to make sure we were dealing with single quantum dots," said Zhe "Kelvin" Xu, a doctoral student at the University of Melbourne who performed the experiments. "That meant we generally had to wait a while for each quantum dot trapping event, on the order of one hour. And of course this means that we needed to be very attentive during experiments so as not to miss these trapping events."

In fact, the low concentrations of quantum dots that demanded such patience highlights a more general problem in biosensing their new trapping approach might be able to solve. According to Crozier, a classic problem with nanosensors that detect substances at low concentrations is that the small sensing area limits the rate at which molecules are delivered. Now with the power of the (optical) force, a potential use for the nanoantennas would be to increase the flux of molecules or other objects onto nanosensors.

"Being able to directly observe the trapping process via our microscope made us wonder about applying this to other nanomaterials," said Crozier. Looking to future applications, the world of nanosensing has much yet to be explored. "It would be very exciting to trap a single biological molecule with our antenna, and to directly observe this trapping process. This could also provide useful information that would help the nanosensor application." [16]

How Quantum Physics Is About to Revolutionize Biochemistry

Chemists have largely ignored quantum mechanics. But it now turns out that this strange physics has a huge effect on biochemical reactions.

One of the strange consequences of quantum mechanics is the phenomenon of indistinguishability—that two quantum particles can be impossible to tell apart, even in principle. This happens, in part, because it is impossible to determine the precise position of quantum particles. So when two particles interact at the same location, there is no way of knowing which is which.

That gives rise to some exotic behavior, particularly at low temperatures when large numbers of particles can behave in the same way. The indistinguishability of photons makes lasers possible, the indistinguishability of helium-4 nuclei at low temperature leads to superfluidity and the indistinguishability of other nuclei like rubidium leads to Bose-Einstein condensates. Indistinguishability is rich in mysterious phenomena.

But some quantum particles are not indistinguishable in this way. Electrons, for example, are forbidden from sharing the same state by a law known as the Pauli exclusion principle. And that leads to a different kind of physics. The interactions between electrons, governed by this Pauli exclusion principle, is called chemistry and it is equally rich in exotic behavior.

The worlds of chemistry and indistinguishable physics have long been thought of as entirely separate. Indistinguishability generally occurs at low temperatures while chemistry requires relatively high temperatures where objects tend to lose their quantum properties. As a result, chemists have long felt confident in ignoring the effects of quantum indistinguishability.

Today, Matthew Fisher and Leo Radzihovsky at the University of California, Santa Barbara, say that this confidence is misplaced. They show for the first time that quantum indistinguishability must play a significant role in some chemical processes even at ordinary temperatures. And they say this influence leads to an entirely new chemical phenomenon, such as isotope separation and could also explain a previously mysterious phenomenon such as the enhanced chemical activity of reactive oxygen species. [15]

New algorithm finds the optimal bond breaking point for single molecules

Recent developments in atomic-force microscopy have enabled researchers to apply mechanical forces to individual molecules to induce chemical reactions.

A research team from Spain and Germany has now developed a first-of-its-kind algorithm that determines the minimal force it takes to reach the optimal bond breaking point (BBP) at the molecular level to mechanically induce a chemical reaction. They report their findings this week in The Journal of Chemical Physics.

The algorithm can be applied to any molecule, including biological molecules like proteins as well as inorganic molecules. Their research has implications for numerous applications, including molecular machines, mechanically resilient and self-healing polymers, stress-responsive materials and catalyst design. The algorithm can also be used to explore how external electric fields can catalyze and control chemical reactions.

When studying mechano-chemical processes, researchers look for the mechanical response of the reactant molecule's minimum-energy structure. As the external force increases, the minimum energy and transition state structures on the force-modified potential energy surface become identical and the structure where this occurs is the sought-after BBP.

"Our work highlights that there exists another set of important points on the potential energy surface of a given system, namely the BBP, which needs to be taken into consideration for mechano-chemistry applications," said Wolfgang Quapp, a co-author of the paper who added that BBP is a new concept in mechano-chemistry.

The optimal BBPs of a potential energy surface are crucial, according to Quapp, because they provide information about the way in which tensile forces should be applied to trigger chemical transformations with the highest possible efficiency using the least amount of force.

The bond, bending and torsion of a molecule have varying stiffness. Therefore, determining the force-bearing scaffold of a molecule, to predict, for example, the point of bond rupture in an overstretched molecule, means that different directions of the external force should be tested.

"Our algorithm allows researchers to identify which part of a molecule is most susceptible to mechanical stress, and thus the algorithm is a significant step in the design of more efficient ways of harnessing mechanical energy to activate chemical reactions," Quapp said. "The importance of the optimal BBP resides in that it gives the optimal direction and magnitude of the pulling force. This necessitates an algorithm to easily find these types of points."

The algorithm is based on Newton trajectories, which come from the mathematical method of calculating zeros of a function. In the case of BBPs, the Newton trajectories are located near the reaction path of the chemical reaction under consideration. [14]

Scientists discover unique thermoelectric properties in cesium tin iodide

A newly discovered collective rattling effect in a type of crystalline semiconductor blocks most heat transfer while preserving high electrical conductivity - a rare pairing that scientists say could reduce heat buildup in electronic devices and turbine engines, among other possible applications.

A team led by scientists at the Department of Energy's Lawrence Berkeley National Laboratory (Berkeley Lab) discovered these exotic traits in a class of materials known as halide perovskites, which are also considered promising candidates for next-generation solar panels, nanoscale lasers, electronic cooling, and electronic displays.

These interrelated thermal and electrical (or "thermoelectric") properties were found in nanoscale wires of cesium tin iodide ($CsSnI_3$). The material was observed to have one of the lowest levels of heat conductivity among materials with a continuous crystalline structure.

This so-called single-crystal material can also be more easily produced in large quantities than typical thermoelectric materials, such as silicon-germanium, researchers said.

"Its properties originate from the crystal structure itself. It's an atomic sort of phenomenon," said Woochul Lee, a postdoctoral researcher at Berkeley Lab who was the lead author of the study, published the week of July 31 in the Proceedings of the National Academy of Sciences journal. These are the first published results relating to the thermoelectric performance of this single crystal material.

Researchers earlier thought that the material's thermal properties were the product of "caged" atoms rattling around within the material's crystalline structure, as had been observed in some other materials. Such rattling can serve to disrupt heat transfer in a material.

"We initially thought it was atoms of cesium, a heavy element, moving around in the material," said Peidong Yang, a senior faculty scientist at Berkeley Lab's Materials Sciences Division who led the study.

Jeffrey Grossman, a researcher at the Massachusetts Institute of Technology, then performed some theory work and computerized simulations that helped to explain what the team had observed. Researchers also used Berkeley Lab's Molecular Foundry, which specializes in nanoscale research, in the study.

"We believe there is essentially a rattling mechanism, not just with the cesium. It's the overall structure that's rattling; it's a collective rattling," Yang said. "The rattling mechanism is associated with the crystal structure itself," and is not the product of a collection of tiny crystal cages. "It is group atomic motion," he added.

Within the material's crystal structure, the distance between atoms is shrinking and growing in a collective way that prevents heat from easily flowing through.

But because the material is composed of an orderly, single-crystal structure, electrical current can still flow through it despite this collective rattling. Picture its electrical conductivity is like a submarine traveling smoothly in calm underwater currents, while its thermal conductivity is like a sailboat tossed about in heavy seas at the surface.

Yang said two major applications for thermoelectric materials are in cooling, and in converting heat into electrical current. For this particular cesium tin iodide material, cooling applications such as a coating to help cool electronic camera sensors may be easier to achieve than heat-to-electrical conversion, he said.

A challenge is that the material is highly reactive to air and water, so it requires a protective coating or encapsulation to function in a device.

Cesium tin iodide was first discovered as a semiconductor material decades ago, and only in recent years has it been rediscovered for its other unique traits, Yang said. "It turns out to be an amazing gold mine of physical properties," he noted.

To measure the thermal conductivity of the material, researchers bridged two islands of an anchoring material with a cesium tin iodide nanowire. The nanowire was connected at either end to micro-islands that functioned as both a heater and a thermometer. Researchers heated one of the islands and precisely measured how the nanowire transported heat to the other island.

They also performed scanning electron microscopy to precisely measure the dimensions of the nanowire. They used these dimensions to provide an exacting measure of the material's thermal conductivity. The team repeated the experiment with several different nanowire materials and multiple nanowire samples to compare thermoelectric properties and verify the thermal conductivity measurements.

"A next step is to alloy this (cesium tin iodide) material," Lee said. "This may improve the thermoelectric properties."

Also, just as computer chip manufacturers implant a succession of elements into silicon wafers to improve their electronic properties - a process known as "doping" - scientists hope to use similar techniques to more fully exploit the thermoelectric traits of this semiconductor material. This is relatively unexplored territory for this class of materials, Yang said. [13]

New invention revolutionizes heat transport

Heat conduction is a fundamental physical phenomenon utilized, for example, in clothing, housing, car industry, and electronics. Thus our day-to-day life is inevitably affected by major shocks in this field. The research group, led by quantum physicist Mikko Möttönen has now made one of these groundbreaking discoveries. This new invention revolutionizes quantum-limited heat conduction which means as efficient heat transport as possible from point A to point B. This is great news especially for the developers of quantum computers.

Quantum technology is still a developing research field, but its most promising application is the super-efficient quantum computer. In the future, it can solve problems that a normal computer can never crack. The efficient operation of a quantum computer requires that it can be cooled down efficiently. At the same time, a quantum computer is prone to errors due to external noise.

Möttönen's innovation may be utilized in cooling quantum processors very efficiently and so cleverly that the operation of the computer is not disturbed.

"Our research started already in 2011 and advanced little by little. It feels really great to achieve a fundamental scientific discovery that has real practical applications", Professor Mikko Möttönen rejoices.

In the QCD Labs in Finland, Möttönen's research group succeeded in measuring quantum-limited heat transport over distances up to a meter. A meter doesn't sound very long at first, but previously scientists have been able to measure such heat transport only up to distances comparable to the thickness of a human hair.

"For computer processors, a meter is an extremely long distance. Nobody wants to build a larger processor than that", stresses Möttönen.

The discovery is so important, that it will be published on February 1st, 2016 in Nature Physics which is the most prestigious scientific journal in physics.

The key idea in their research was to use photons to transfer the heat. Photons are particles that, for example, form the visible light. Previously scientists have used, for example, electrons as the heat carriers.

"We know that photons can transport heat over long distances. In fact, they bring the heat of the Sun to the Earth", Möttönen says.

The team came up with the idea to use a transmission line with no electrical resistance to transport the photons. This superconducting line was built on a silicon chip with the size of a square centimeter. Tiny resistors were placed at the ends of the transmission line. The research results were obtained by measuring induced changes in the temperatures of these resistors.

New physics

The Quantum Computing and Devices (QCD) group led by Prof. Möttönen was able to show that quantum-limited heat conduction is possible over long distances. The result enables the application of this phenomenon outside laboratories. Thus the device built by the team fundamentally changes how heat conduction can be utilized in practice.

Möttönen's previous research results have also been praised in the scientific community as well as the media. He has published articles in top journals, such as Nature and Science. However, there is a reason why this new discovery feels even better than previous breakthroughs:

"The research has been fully carried out in my lab by my staff. This really makes me feel like I hit the jackpot", Möttönen rejoices. [12]

Physicists create first photonic Maxwell's demon

Maxwell's demon, a hypothetical being that appears to violate the second law of thermodynamics, has been widely studied since it was first proposed in 1867 by James Clerk Maxwell. But most of these studies have been theoretical, with only a handful of experiments having actually realized Maxwell's demon.

Now in a new paper, physicists have reported what they believe is the first photonic implementation of Maxwell's demon, by showing that measurements made on two light beams can be used to create an energy imbalance between the beams, from which work can be extracted. One of the interesting things about this experiment is that the extracted work can then be used to charge a battery, providing direct evidence of the "demon's" activity.

The physicists, Mihai D. Vidrighin, et al., carried out the experiment at the University of Oxford and published a paper on their results in a recent issue of Physical Review Letters.

"Our work shows how photonics can be used as a platform to investigate the relation between energy and information," coauthor Oscar Dahlsten, at the University of Oxford and the London Institute for Mathematical Sciences, told Phys.org.

In the original thought experiment, a demon stands between two boxes of gas particles. At first, the average energy (or speed) of gas molecules in each box is the same. But the demon can open a tiny door in the wall between the boxes, measure the energy of each gas particle that floats toward the door, and only allow high-energy particles to pass through one way and low-energy particles to pass through the other way. Over time, one box gains a higher average energy than the other, which creates a pressure difference. The resulting pushing force can then be used to do work. It appears as if the demon has extracted work from the system, even though the system was initially in equilibrium at a single temperature, in violation of the second law of thermodynamics.

Over the years, physicists have resolved this apparent paradox by explaining that, even though the demon may not do work directly on the system, the demon does gain information from its measurements. Erasing this information from the demon's memory requires work, so that overall there can be no net gain in work.

In the photonic version, the physicists replaced the boxes of gas particles with two pulses of light. They implemented the demon using a combination of a photodetector, which can measure the number of photons from each pulse, and a feed-forward operation, which like the open door can escort the brighter beam (with more photons) in one direction and the dimmer beam (with fewer photons) in the other. The different beams fall on different photodiodes, which generate an electric current that goes to a capacitor, but from opposite directions. If the pulse energies were equal, they would cancel out. But the imbalance in the pulse energies—and in the resulting photoelectric charge—is what charges the capacitor.

Even though the researchers did not aim to realize optimal work extraction, it's possible that some type of Maxwell's demon could one day have practical applications.

"Often we have more information available than thermodynamics supposes," Dahlsten said, explaining that things are normally not fully random and have a degree of predictability. "We can then use demon set-ups such as this one to extract work, making use of that information. Similarly, we can use extra information to reduce work costs of, for example, cooling systems. Personally I think that sort of technology will have a real impact on meeting the energy challenge facing the world."

Due to differences between the photonic implementation and previous implementations of Maxwell's demon, traditional theoretical models do not provide a clear path for connecting work extraction to the information acquired by measurement in a fundamental way. So the researchers derived a new model that accounts for the subtleties of the new set-up, in which they relate work extraction to the information acquired by measurement.

The researchers hope that the new model will lead to a better understanding of the link between information and thermodynamics, which is necessary for understanding thermodynamics at the microscale and below. As the scientists explain, recent developments of technologies consisting of just a single or few particles require a better understanding of microscale thermodynamics, similar to how the steam engine drove scientists to better understand macroscopic thermodynamics in the 19th century.

A theory of of microscale thermodynamics could have a variety of applications, including making energy-harvesting technology more efficient. It could also allow researchers to investigate the role of quantum coherence in thermodynamics, with applications in quantum information technologies.

"We are already thinking of ways in which features such as entanglement can be introduced in future experiments based on this one, as our interests gravitate around quantum information," Dahlsten said. [11]

Scientists experimentally demonstrate 140-year-old prediction: A gas in perpetual non-equilibrium

Now for the first time, physicists at JILA, the National Institute of Standards and Technology, and the University of Colorado at Boulder have experimentally realized a three-dimensional cloud of gas that never reaches thermal equilibrium, just as Boltzmann predicted nearly 140 years ago. The work builds on research from 2002, in which a persistent non-equilibrium state was observed in a two-dimensional gas.

"It's a long-delayed realization, call it a vindication, of one of the great Boltzmann's many interesting ideas," coauthor Eric Cornell at JILA told Phys.org. "Boltzmann was trying to explain why things always 'decay.' You always see a swinging pendulum damp, while its pivot point heats up a little from friction. You never see the pivot point cool down and the swinging increase. In coming up with a powerful theory to explain this all-important physical truth, Boltzmann was startled to encounter some examples where his equations predicted that there would not be damping—something you don't see in experiment!

"Boltzmann's intellectual opponents seized on this anomaly as evidence that his equations were wrong. But his equations are right. It's just that, back then, no one could do those particular experiments. These days, we can do the experiments. We all owe so much to Boltzmann and his legacy. We thought it would be a fitting tribute to him, to vindicate one of his more controversial (at the time!) predictions."

The reason why it has taken so long to experimentally confirm Boltzmann's prediction is because of the difficulty in generating a gas and confining it in space in a way that satisfies two strict requirements. One, the gas must be perfectly spherical (or "isotropic"), and two, it must confined by perfect harmonic confinement, which helps to reduce the effects of friction.

To realize such a system, the scientists used a new magnetic trap with extra magnetic coils, which allows various parameters to be adjusted independently. Using this device, the researchers trapped a cold gas cloud of rubidium atoms in such a way that the gas behaves in "monopole mode." In this mode, the temperature and cloud size of the gas oscillate with opposite phases—as one increases, the other decreases, and vice versa.

The scientists explain that these "breathing dynamics" are analogous to the oscillatory exchange between kinetic and potential energy that occurs in the simple harmonic motion of a swinging pendulum. Just as a swinging pendulum eventually reaches a state of equilibrium when it comes to a stop, a typical confined gas reaches a state of thermal equilibrium when heat ceases to flow. In both cases, the state of equilibrium is reached due to increasing entropy, which causes damping, or a decrease in the amplitude of the oscillations.

Here, however, the natural increase in entropy is frustrated by the very specific nature of the confinement and the interaction between the atoms. As evidence for this, the scientists showed that the gas in monopole mode barely experiences any damping at all, and the little bit of damping that it does experience is likely due to imperfections in the trap, since no physical system can provide perfectly isotropic and harmonic confinement. The researchers observed the greatly suppressed damping by taking images of the gas cloud from different angles and at very short intervals using phase-contrast microscopy, which allowed them to see oscillations in the cloud size.

Besides vindicating Boltzmann, the results could also have implications for understanding other non-equilibrium systems, including life itself.

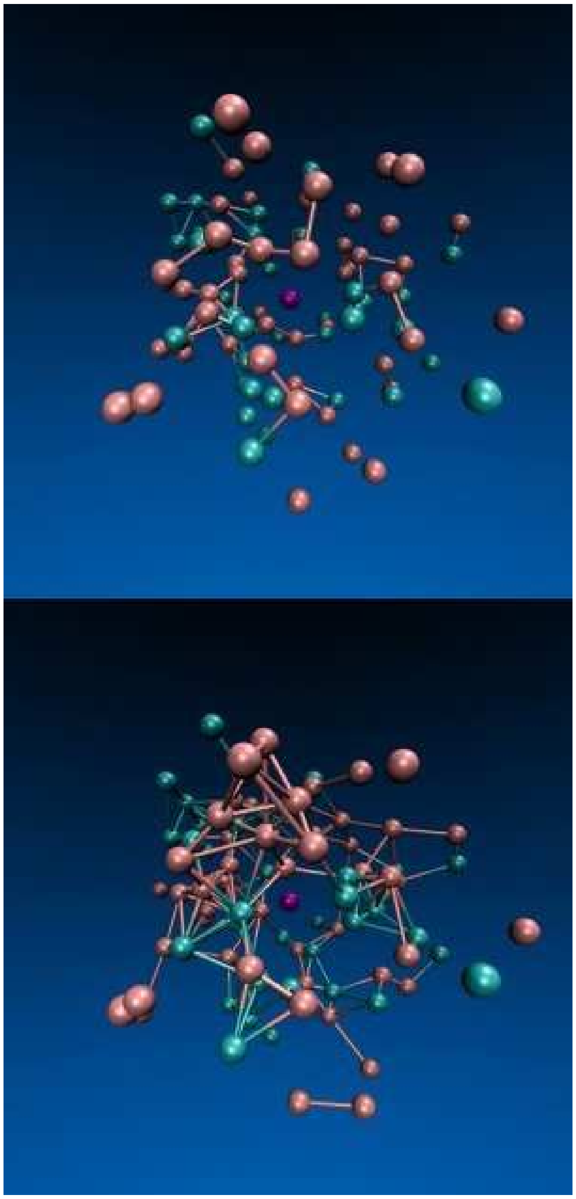
"Non-equilibrium physics—the physics of what happens far away from thermal equilibrium—is a hot topic in science these days," Cornell said. "A classic example of matter out of equilibrium is life. How does it come about? Why does it persist? Our particular experimental example is maybe a little too clean, too classical, to be completely relevant to most modern research, but it is a great example of a broader physics idea called 'integrability' which explains why some systems don't ever achieve thermal equilibrium." [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.



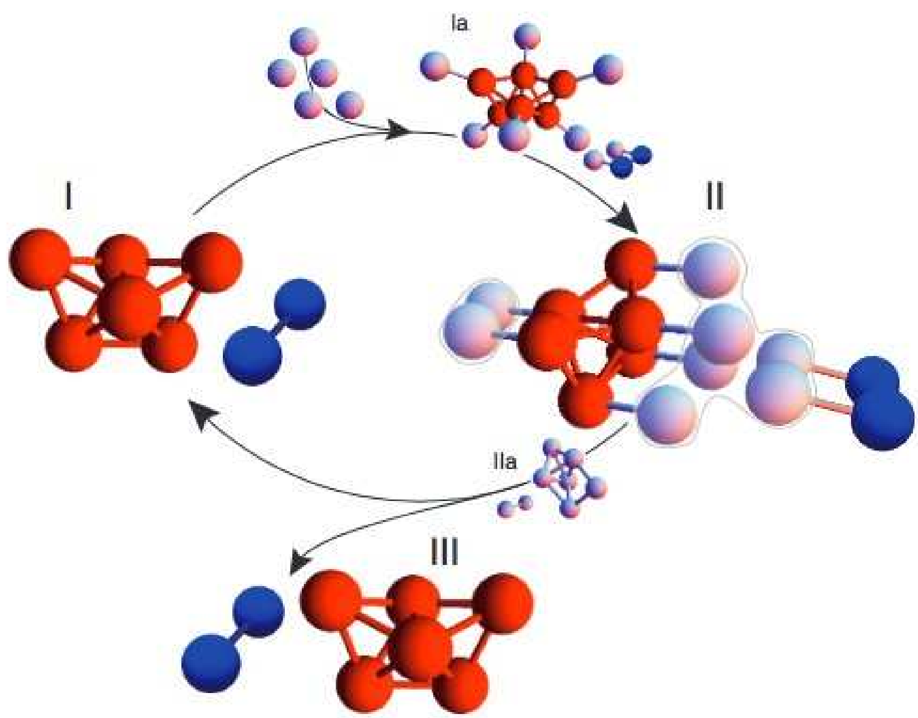
A computer simulation by Jeremy England and colleagues shows a system of particles confined inside a viscous fluid in which the turquoise particles are driven by an oscillating force. Over time (from top to bottom), the force triggers the formation of more bonds among the particles.

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.

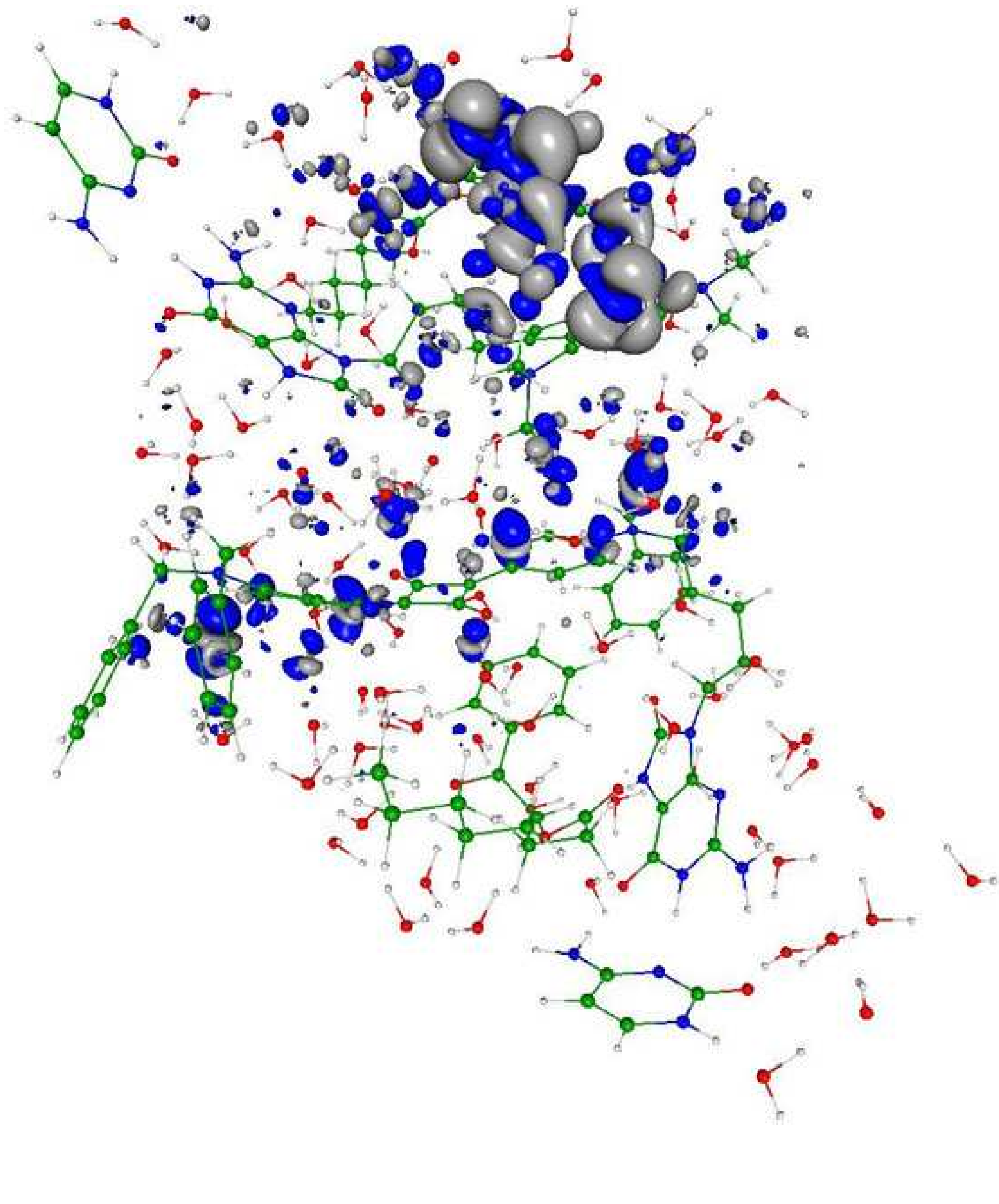
Our discovered phenomenon of the quantum entanglement in the prebiotic systems enhance the photosynthesis in the proposed systems because simultaneously excite two prebiotic kernels in the system by appearance of two additional quantum entangled excited states (Tamulis A, Grigalavicius M, Baltrusaitis 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 squarine 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 squarine 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 dp impulse difference and a dx 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 delta x position difference and with a delta p momentum difference such a way that they product is about the half Planck reduced constant. For the proton this delta x much less in the nucleon, than in the orbit of the electron in the atom, the delta p 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 delta x position with delta p 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 1/2spin creator particle to make equal the spins of the weak interaction, for example neutron decay to 2 fermions, every particle is fermions with ½ 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 ½ 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 then 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 $E = hv$ and $E = mc^2$, $m = hv / c^2$ that is the m depends only on the v 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_o 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 Bing 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 rate Mp=1840 Me. 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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