# Strongly Linked Quantum Particles

*Scientists have created a crystal structure that boosts the interaction between tiny bursts of light and individual electrons, an advance that could be a significant step toward establishing quantum networks in the future. [10]*

*Researchers from Stanford have advanced a long-standing problem in quantum physics – how to send "entangled" particles over long distances. [9]*

*Scientists at the University of York's Centre for Quantum Technology have made an important step in establishing scalable and secure high rate quantum networks. [8]*

*As do all advancing technologies, they will also create new nightmares. The most worrisome development will be in cryptography. Developing new standards for protecting data won't be easy. The RSA standards that are in common use each took five years to develop. Ralph Merkle, a pioneer of public-key cryptography, points out that the technology of public-key systems, because it is less well-known, will take longer to update than these — optimistically, ten years. And then there is a matter of implementation so that computer systems worldwide are protected. Without a particular sense of urgency or shortcuts, Merkle says, it could easily be 20 years before we've replaced all of the Internet's present security-critical infrastructure. [7]*

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*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 build the Quantum Computer.*

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## Preface

While physicists are continually looking for ways to unify the theory of relativity, which describes large-scale phenomena, with quantum theory, which describes small-scale phenomena, computer scientists are searching for technologies to build the quantum computer.

Australian engineers detect in real-time the quantum spin properties of a pair of atoms inside a silicon chip, and disclose new method to perform quantum logic operations between two atoms. [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.

## Nanoscale cavity strongly links quantum particles

Today's networks use electronic circuits to store information and optical fibers to carry it, and quantum networks may benefit from a similar framework. Such networks would transmit qubits—quantum versions of ordinary bits—from place to place and would offer unbreakable security for the transmitted information. But researchers must first develop ways for qubits that are better at storing information to interact with individual packets of light called photons that are better at transporting it, a task achieved in conventional networks by electro-optic modulators that use electronic signals to modulate properties of light.

Now, researchers in the group of Edo Waks, a fellow at the Joint Quantum Institute and an Associate Professor in the Department of Electrical and Computer Engineering at the University of Maryland, have struck upon an interface between photons and single electrons that makes progress toward such a device. By pinning a photon and an electron together in a small space, the electron can quickly change the quantum properties of the photon and vice versa. The research was reported online Feb. 8, 2016 in the journal Nature Nanotechnology.

"Our platform has two major advantages over previous work," says Shuo Sun, a graduate student at JQI and the first author of the paper. "The first is that the electronic qubit is integrated on a chip, which makes the approach very scalable. The second is that the interactions between light and matter are fast. They happen in only a trillionth of a second—1,000 times faster than previous studies."

## Constructing an Interface

The new interface utilizes a well-studied structure known as a photonic crystal to guide and trap light. These crystals are built from microscopic assemblies of thin semiconductor layers and a grid of carefully drilled holes. By choosing the size and location of the holes, researchers can control the properties of the light traveling through the crystal, even creating a small cavity where photons can get trapped and bounce around.

"These photonic crystals can concentrate light in an extremely small volume, allowing devices to operate at the fundamental quantum limit where a single photon can make a big difference," says Waks.

The results also rely on previous studies of how small, engineered nanocrystals called quantum dots can manipulate light. These tiny regions behave as artificial atoms and can also trap electrons in a tight space. Prior work from the JQI group showed that quantum dots could alter the properties of many photons and rapidly switch the direction of a beam of light.

The new experiment combines the light-trapping of photonic crystals with the electron-trapping of quantum dots. The group used a photonic crystal punctuated by holes just 72 nanometers wide, but left three holes undrilled in one region of the crystal. This created a defect in the regular grid of holes that acted like a cavity, and only those photons with only a certain energy could enter and leave.

Inside this cavity, embedded in layers of semiconductors, a quantum dot held one electron. The spin of that electron—a quantum property of the particle that is analogous to the motion of a spinning top—controlled what happened to photons injected into the cavity by a laser. If the spin pointed up, a photon entered the cavity and left it unchanged. But when the spin pointed down, any photon that entered the cavity came out with a reversed polarization—the direction that light's electric field points. The interaction worked the opposite way, too: A single photon prepared with a certain polarization could flip the electron's spin.

Both processes are examples of quantum switches, which modify the qubits stored by the electron and photon in a controlled way. Such switches will be the coin of the realm for proposed future quantum computers and quantum networks.

## Quantum Networking

Those networks could take advantage of the strengths that photons and electrons offer as qubits. In the future, for instance, electrons could be used to store and process quantum information at one location, while photons could shuttle that information between different parts of the network.

Such links could enable the distribution of entanglement, the enigmatic connection that groups of distantly separated qubits can share. And that entanglement could enable other tasks, such as performing distributed quantum computations, teleporting qubits over great distances or establishing secret keys that two parties could use to communicate securely.

Before that, though, Sun says that the light-matter interface that he and his colleagues have created must create entanglement between the electron and photon qubits, a process that will require more accurate measurements to definitively demonstrate.

"The ultimate goal will be integrating photon creation and routing onto the chip itself," Sun says. "In that manner we might be able to create more complicated quantum devices and quantum circuits." [10]

## Physicists set quantum record by using photons to carry messages from electrons almost 2 kilometers apart

Their work is described in the online edition of Nature Communications.

Scientists and engineers are interested in the practical application of this technology to make quantum networks that can send highly secure information over long distances – a capability that also makes the technology appealing to governments, banks and militaries.

Quantum entanglement is the observed phenomenon of two or more particles that are connected, even over thousands of miles. If it sounds strange, take comfort knowing that Albert Einstein described this behavior as "spooky action."

Consider, for instance, entangled electrons. Electrons spin in one of two characteristic directions, and if they are entangled, those two electrons' spins are linked. It's as if you spun a quarter in New York clockwise, an entangled second coin in Los Angeles would start to spin clockwise. And likewise, if you spun that quarter counter-clockwise, the second coin would shift its spin as well.

Electrons are trapped inside atoms, so entangled electrons can't talk directly at long distance. But photons – tiny particles of light – can move. Scientists can establish a necessary condition of entanglement, called quantum correlation, to correlate photons to electrons, so that the photons can act as the messengers of an electron's spin.

In his previous work, Stanford physicist Leo Yu has entangled photons with electrons through fiber optic cables over a distance of several feet. Now, he and a team of scientists, including Professor Emeritus Yoshihisa Yamamoto, have correlated photons with electron spin over a record distance of 1.2 miles (1.93 kilometers).

This nonlinear optical wave guide converts the wavelength of a single-photon signal to a common telecom wavelength.

"Electron spin is the basic unit of a quantum computer," Yu said. "This work can pave the way for future quantum networks that can send highly secure data around the world."

To do this, Yu and his team had to make sure that the correlation could be preserved over long distances – a key challenge given that photons have a tendency to change orientation while traveling in optical fibers.

Photons can have a vertical or horizontal orientation (known as polarization), which can be referenced as a 0 or a 1, as in digital computer programming. But if they change en route, the connection to the correlated electron is lost.

This information can be preserved in another way, Yu said. He created a time-stamp to correlate arrival time of the photon with the electron spin, which provided a sort of reference key for each photon to confirm its correlation to the source electron.

To eventually entangle two electrons that had never met over great distances, two photons, each correlated with a unique source electron, had to be sent through fiber optic cables to meet in the middle at a "beam splitter" and interact. Photons do not normally interact, just two flashlights beams passing through one another, so the researchers had to mediate this interaction called the "two-photon interference."

To ensure the two-photon interference, they had another issue to overcome. Photons from two different sources have different characteristics, like color and wavelength. If they have different wavelengths, they cannot interfere, Yu said. Before traveling along the fiber optic cable, the photons passed through a "quantum down-converter," which matched their wavelengths. The down-converter also shifted both photons to a wavelength that can travel farther within the fiber optic cables designed for telecommunications.

Quantum supercomputers promise to be exponentially faster and more powerful than traditional computers, Yu said, and can communicate with immunity to hacking or spying. With this work, the team has brought the quantum networks one step closer to reality. [9]

## Team finds the 'key' to quantum network solution

Working with colleagues at the Technical University of Denmark (DTU), Massachusetts Institute of Technology (MIT), and the University of Toronto, they have developed a protocol to achieve key-rates at metropolitan distances at three orders-of-magnitude higher than previously.

Standard protocols of Quantum Key Distribution (QKD) exploit random sequences of quantum bits (qubits) to distribute secret keys in a completely secure fashion. Once these keys are shared by two remote parties, they can communicate confidentially by encrypting and decrypting binary messages. The security of the scheme relies on one of the most fundamental laws of quantum physics, the uncertainty principle.

Today's classical communications by email or phone are vulnerable to eavesdroppers but quantum communications based on single particle levels (photons) can easily detect eavesdroppers because they invariably disrupt or perturb a quantum signal. By making quantum measurements, two remote parties can estimate how much information an eavesdropper is stealing from the channel and can apply suitable protocols of privacy amplification to negate the effects of the information loss.

However, the problem with QKD protocols based on simple quantum systems, such as single-photon qubits, is their low key-rate, despite their effectiveness in working over long distances. This makes them unsuitable for adaptation for use in metropolitan networks.

The team, led by Dr Stefano Pirandola, of the Department of Computer Science at York, overcame this problem, both theoretically and experimentally, using continuous-variable quantum systems. These allow the parallel transmission of many qubits of information while retaining the quantum capability of detecting and defeating eavesdroppers. The research is published in Nature Photonics.

Dr Pirandola said: "You want a high rate and a fast connection particularly for systems that serve a metropolitan area. You have to transmit a lot of information in the fastest possible way; essentially you need a quantum equivalent of broadband.

"Continuous-variable systems can use many more photons but are still quantum based. Our system reaches extremely high speeds by three orders of magnitude higher than ever before over a distance of 25 kilometres. Its effectiveness above that distance decreases rapidly however.

"Nevertheless, our protocol could be used to build high-rate quantum networks where devices securely connect to nearby access points or proxy servers." [8]

## Quantum Computing Is About to Overturn Cybersecurity's Balance of Power

"Spooky action at a distance" is how Albert Einstein described one of the key principles of quantum mechanics: entanglement. Entanglement occurs when two particles become related such that they can coordinate their properties instantly even across a galaxy. Think of wormholes in space or Star Trek transporters that beam atoms to distant locations. Quantum mechanics posits other spooky things too: particles with a mysterious property called superposition, which allows them to have a value of one and zero at the same time; and particles' ability to tunnel through barriers as if they were walking through a wall.

All of this seems crazy, but it is how things operate at the atomic level: the laws of physics are different. Einstein was so skeptical about quantum entanglement that he wrote a paper in 1935 titled "Can quantum-mechanical description of physical reality be considered complete?" He argued that it was not possible.

In this, Einstein has been proven wrong. Researchers recently accessed entangled information over a distance of 15 miles. They are making substantial progress in harnessing the power of quantum mechanics.

Einstein was right, though, about the spookiness of all this.

D-Wave says it has created the first scalable quantum computer. (D-Wave)

Quantum mechanics is now being used to construct a new generation of computers that can solve the most complex scientific problems—and unlock every digital vault in the world. These will perform in seconds computations that would have taken conventional computers millions of years. They will enable better weather forecasting, financial analysis, logistical planning, search for Earth-like planets, and drug discovery. And they will compromise every bank record, private communication, and password on every computer in the world — because modern cryptography is based on encoding data in large combinations of numbers, and quantum computers can guess these numbers almost instantaneously.

There is a race to build quantum computers, and (as far as we know) it isn't the NSA that is in the lead. Competing are big tech companies such as IBM, Google, and Microsoft; start-ups; defense contractors; and universities. One Canadian start-up says that it has already developed a first version of a quantum computer. A physicist at Delft University of Technology in the Netherlands, Ronald

Hanson, told Scientific American that he will be able to make the building blocks of a universal quantum computer in just five years, and a fully-functional demonstration machine in a little more than a decade.

These will change the balance of power in business and cyber-warfare. They have profound national security implications, because they are the technology equivalent of a nuclear weapon.

## Let me first explain what a quantum computer is and where we are.

In a classical computer, information is represented in bits, binary digits, each of which can be a 0 or 1. Because they only have only two values, long sequences of 0s and 1s are necessary to form a number or to do a calculation. A quantum bit (called a qubit), however, can hold a value of 0 or 1 or both values at the same time — a superposition denoted as "0+1." The power of a quantum computer increases exponentially with the number of qubits. Rather than doing computations sequentially as classical computers do, quantum computers can solve problems by laying out all of the possibilities simultaneously and measuring the results.

Imagine being able to open a combination lock by trying every possible number and sequence at the same time. Though the analogy isn't perfect — because of the complexities in measuring the results of a quantum calculation — it gives you an idea of what is possible.

There are many complexities in building a quantum computer: challenges in finding the best materials from which to generate entangled photon pairs; new types of logic gates and their fabrication on computer chips; creation and control of qubits; designs for storage mechanisms; and error detection. But breakthroughs are being announced every month. IBM, for example, has just announced that it has found a new way to detect and measure quantum errors and has designed a new qubit circuit that, in sufficient numbers, will form the large chips that quantum computers will need.

Most researchers I have spoken to say that it is a matter of when — not whether — quantum computing will be practical. Some believe that this will be as soon as five years; others say 20 years. IBM said in April that we've entered a golden era of quantum-computing research, and predicted that the company would be the first to develop a practical quantum computer.

One Canada-based startup, D-Wave, says it has already has done it. Its chief executive, Vern Brownell, said to me in an e-mail that D-Wave Systems has created the first scalable quantum computer, with proven entanglement, and is now working on producing the best results possible for increasingly complex problems. He qualified this claim by stressing that their approach, called "adiabatic computing," may not be able to solve every problem but has a broad variety of uses in optimizing computations; sampling; machine learning; and constraint satisfaction for commerce, national defense, and science. He says that the D-Wave is complementary to digital computers; a special-purpose computing resource designed for certain classes of problems.

The D-Wave Two computer has 512 qubits and can, in theory, perform 2^512 operations simultaneously. That's more calculations than there are atoms in the universe — by many orders of magnitude. Brownell says the company will soon be releasing a quantum processor with more than 1,000 qubits. He says that his computer won't run Shor's algorithm, an algorithm necessary for cryptography, but it has potential uses in image detection, logistics, protein mapping and folding, Monte Carlo simulations and financial modeling, oil exploration, and finding exoplanets.

So quantum computers are already here in a limited form, and fully functional versions are on the way. They will be as transformative for mankind as were the mainframe computers, personal computers, and smartphones that we all use.

As do all advancing technologies, they will also create new nightmares. The most worrisome development will be in cryptography. Developing new standards for protecting data won't be easy. The RSA standards that are in common use each took five years to develop. Ralph Merkle, a pioneer of public-key cryptography, points out that the technology of public-key systems, because it is less well-known, will take longer to update than these — optimistically, ten years. And then there is a matter of implementation so that computer systems worldwide are protected. Without a particular sense of urgency or shortcuts, Merkle says, it could easily be 20 years before we've replaced all of the Internet's present security-critical infrastructure.

It is past time we began preparing for the spooky technology future we are rapidly heading into. [7]

## Quantum Computing

A team of electrical engineers at UNSW Australia has observed the unique quantum behavior of a pair of spins in silicon and designed a new method to use them for "2-bit" quantum logic operations.

These milestones bring researchers a step closer to building a quantum computer, which promises dramatic data processing improvements.

Quantum bits, or qubits, are the building blocks of quantum computers. While many ways to create a qubits exist, the Australian team has focused on the use of single atoms of phosphorus, embedded inside a silicon chip similar to those used in normal computers.

The first author on the experimental work, PhD student Juan Pablo Dehollain, recalls the first time he realized what he was looking at.

"We clearly saw these two distinct quantum states, but they behaved very differently from what we were used to with a single atom. We had a real 'Eureka!' moment when we realized what was happening – we were seeing in real time the `entangled' quantum states of a pair of atoms." [5]

Researchers have developed the first silicon quantum computer building blocks that can process data with more than 99 percent accuracy, overcoming a major hurdle in the race to develop reliable quantum computers.

Researchers from the University of New South Wales (UNSW) in Australia have achieved a huge breakthrough in quantum computing - they've created two kinds of silicon quantum bit, or qubits, the building blocks that make up any quantum computer, that are more than 99 percent accurate.

The postdoctoral researcher who was lead author on Morello's paper explained in the press release: "The phosphorus atom contains in fact two qubits: the electron, and the nucleus. With the nucleus in particular, we have achieved accuracy close to 99.99 percent. That means only one error for every 10,000 quantum operations."

Both the breakthroughs were achieved by embedding the atoms in a thin layer of specially purified silicon, which contains only the silicon-28 isotope. Naturally occurring silicon is magnetic and therefore disturbs the quantum bit, messing with the accuracy of its data processing, but silicon-28 is perfectly non-magnetic. [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 $E = h\nu$ and $E = mc^2$, $m = h\nu / c^2$ that is the $m$ depends only on the $\nu$ 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

As do all advancing technologies, they will also create new nightmares. The most worrisome development will be in cryptography. Developing new standards for protecting data won't be easy. The RSA standards that are in common use each took five years to develop. Ralph Merkle, a pioneer of public-key cryptography, points out that the technology of public-key systems, because it is less well-known, will take longer to update than these — optimistically, ten years. And then there is a matter of implementation so that computer systems worldwide are protected. Without a particular sense of urgency or shortcuts, Merkle says, it could easily be 20 years before we've replaced all of the Internet's present security-critical infrastructure. [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]

The key breakthrough to arrive at this new idea to build qubits was to exploit the ability to control the nuclear spin of each atom. With that insight, the team has now conceived a unique way to use the nuclei as facilitators for the quantum logic operation between the electrons. [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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