Quantum Computing based on Majorana Fermions

Theoretical physicists at MIT recently reported a quantum computer design featuring an array of superconducting islands on the surface of a topological insulator. They propose basing both quantum computation and error correction on the peculiar behavior of electrons at neighboring corners of these islands and their ability to interact across islands at a distance. [8]

An international team led by Princeton University scientists has discovered an elusive massless particle theorized 85 years ago. The particle could give rise to faster and more efficient electronics because of its unusual ability to behave as matter and antimatter inside a crystal, according to new research.

The researchers report in the journal Science July 16 the first observation of Weyl fermions, which, if applied to next-generation electronics, could allow for a nearly free and efficient flow of electricity in electronics, and thus greater power, especially for computers, the researchers suggest. [7]

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.

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 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.

Researchers develop error correction method for quantum computing based on Majorana fermions

Theoretical physicists at MIT recently reported a quantum computer design featuring an array of superconducting islands on the surface of a topological insulator. They propose basing both quantum computation and error correction on the peculiar behavior of electrons at neighboring corners of these islands and their ability to interact across islands at a distance. "The lowest energy state of this system is a very highly entangled quantum state, and it is this state that can be used to encode and manipulate qubits," says graduate student Sagar Vijay, lead co-author of the paper on the proposed system, with senior author Liang Fu, associate professor of physics at MIT, and Timothy H. Hsieh PhD '15. As Vijay explains it, the proposed system can encode logical qubits that can be read by shining light on them. At the simplest level of explanation, the system can characterize the state of a quantum bit as a zero or a one based on whether there is an odd or even number of electrons associated with a superconducting quantum bit, but the underlying physical interactions that allow this are highly complex.

Earlier work by Fu, performed when he was a graduate student under topological insulator pioneer Charles Kane at the University of Pennsylvania, showed that placing a material known as an s-wave superconductor on the surface of another material that is a strong topological insulator produces special electronic states called Majorana fermions at a triple junctions, where three of these superconductors meet. This is called the "proximity effect." Thus, the system combines two of the most unusual materials discovered by modern science: superconductors, which allow electricity to flow without resistance, and topological insulators, which allow electricity to flow only on their surface but not through their interior.

The latest work by Fu, Vijay, and Hsieh explains how clusters of these superconducting islands, for example, a set of six islands encircling a single central island, produce these Majorana fermions at each triple junction. The clusters are called plaquettes. It is helpful to think of each Majorana fermion as half of an electron, so they always come in pairs, Vijay suggests. "There is a mathematical trick, which is that you can always write an electron as two Majorana fermions, but there are many physical systems where this actually is the most natural way of representing the system."

It is these Majorana fermions with their interactions amongst closest neighbors that lead to quantum entanglement. "Each superconducting island has a phase," Vijay explains. These phases can wind like the hands on a clock and a full rotation of the phase is called a vortex. "Each superconducting vortex on the topological insulator's surface binds a Majorana fermion. The neat thing is if I have a pair of Majorana fermions, and they are well-separated, it's as if the electron has become delocalized throughout the system, which is kind of a funny thing to think about," Vijay says. Engineering the ground state so that each of these superconducting islands winds a full rotation produces an interaction with electrons from each of the six surrounding islands, making this a six-body interaction. "By controlling the strength of the phase fluctuations, you can engineer many-body interactions between Majorana fermions," Vijay says. These many-body interactions lead to quantum entanglement and are a critical component for both the quantum computing and error correction that the researchers propose.

Another important component of the system is the concept of fermion number parity. "If I have collection of electrons, I would say that the fermion number parity is odd if there an odd number of electrons and the fermion number parity is even if there is an even number of electrons," Vijay explains. This fermion number parity, that is, whether there is an even, or odd, number of electrons associated with a particular superconducting island, can serve as the basis for a quantum bit, he says. "I want to think of a logical qubit as just the fermion parity of the Majorana fermions surrounding one of these islands," he says.

This fermion parity can be easily measured. However, Vijay notes, the moment you measure a quantum bit, it yields a definite quantity, whether 0 or 1, and can no longer sit in a quantum "superposition" of both 0 and 1. The trick to using this system at a quantum level then, perhaps counter intuitively, is to not measure the bits you want to preserve as quantum. "Compare this with the situation that we would have more intuition about, which is a spin system, where I have qubits, which are just the individual spins. If I stop measuring the state of two spins, those two spins are not entangled at all. So if I know the state of one spin, that in no way determines the state of another spin that's very far away. But that's not true in this highly entangled quantum system, because the nature of these interactions is such that the fermion parity of two particular islands that I'm not measuring will be entangled. Because of this property, something interesting happens, which is that it's impossible to flip the fermion parity of just a single island," he says.

A fundamental property of quantum computing is the ability of a quantum bit to simultaneously hold both a 0 and a 1 until a calculation or other logical operation fixes it as a 0 or a 1, at which point it loses its quantum state. Using the analogy of the famous Schrödinger's cat dilemma, Fu explains, "The motivation for this Majorana code is any time you want to observe the cat, whether it's alive or dead—even if you prepare the Schrödinger cat in a superposition between alive and dead—once you measure it, it's either alive or dead," Fu says. "The quantum information is already lost. At the moment you observe it, the quantum information is gone."

The researchers preserve their quantum information by continuously measuring the state of surrounding islands but not measuring the ones they define as logical qubits. Vijay summarizes it this way: "I do a measurement of the fermion parity of all of the islands except two, and I define that to be my logical qubit, because that's a two-level system. Both of the islands are locked in fermion parity, even or odd, so I have two states. I can do that with, let's say, four islands. I can stop the fermion parity measurements of four islands, and now I would have two logical qubits, so a pair of them are entangled, and then the other pair are entangled."

Vijay and Hsieh developed a mathematical solution, which they call the Majorana surface code, for correcting errors in this system. "I have this very special type of system where if an error occurs on the qubit that I'm not measuring, then the measurements of the other qubits will tell me what sort of error has occurred," Vijay says. "The actual protocols for doing the measurements and doing the quantum computing have been studied before, and that's known theoretically, but actually how to engineer one of these quantum states is rather difficult." (Hsieh is now a postdoc at the Kavli Institute for Theoretical Physics in Santa Barbara, California.)

Since errors in such a system are inevitable, the problem to solve is how to decode errors when they do occur, Vijay says. "We're doing measurements of all of the hexagonal islands except a pair of islands, so we have one logical qubit that's encoded in the system, and that logical qubit is in some state, which is some superposition of 1 and 0. I want to preserve that state." Using the method of excluding the quantum bits from measurements, he explains, "At time step 1, I measure fermion parity of all the other islands, at time step 2, I do it again, etc., and at time step 2, when I do the measurement, I notice that fermion parity is now different at a certain set of plaquettes, but this entangled quantum state is such that if I know the pattern, that tells me what has happened to the logical qubit, if anything at all, and what I need to do to the logical qubit in order to recover the original information that was stored in it. ... Then I have a course of action, which is when I read out this qubit, I have to interpret this information appropriately because such an error has occurred." For example, if the environment flipped a one to a zero, then the signature of that error is encoded in the pattern of excitations created around the logical qubit. The coding system would record that error, so whenever a later measurement of this logical qubit is taken, if it is read as a zero, then it should be interpreted as a one.

Vijay got interested in topological insulators while doing undergraduate research at Princeton University, where he received his bachelor's degree. He is in his third year as a graduate student at MIT and hopes to finish his doctorate in condensed matter theory in another two years. He grew up in the San Jose, California, area. [8]

After 85-year search, massless particle with promise for next-generation electronics discovered

Proposed by the mathematician and physicist Hermann Weyl in 1929, Weyl fermions have been long sought by scientists because they have been regarded as possible building blocks of other subatomic particles, and are even more basic than the ubiquitous, negative-charge carrying electron (when electrons are moving inside a crystal). Their basic nature means that Weyl fermions could provide a much more stable and efficient transport of particles than electrons, which are the principle particle behind modern electronics. Unlike electrons, Weyl fermions are massless and possess a high degree of mobility; the particle's spin is both in the same direction as its motion — which is known as being right-handed — and in the opposite direction in which it moves, or left-handed.

"The physics of the Weyl fermion are so strange, there could be many things that arise from this particle that we're just not capable of imagining now," said corresponding author M. Zahid Hasan, a Princeton professor of physics who led the research team.

The Weyl fermion possesses two characteristics that could make its discovery a boon for future electronics, including the development of the highly prized field of efficient quantum computing, Hasan explained.

For a physicist, the Weyl fermions are most notable for behaving like a composite of monopole- and antimonopole-like particles when inside a crystal, Hasan said.
This means that Weyl particles that have opposite magnetic-like charges can nonetheless move independently of one another with a high degree of mobility.

Weyl, who worked at the Institute for Advanced Study, suggested his fermion as an alternative to the theory of relativity proposed by his colleague Albert Einstein.
Although that application never panned out, the characteristics of his theoretical particle intrigued physicists for nearly a century, Hasan said. Actually observing the particle was a trying process — one ambitious experiment proposed colliding high-energy neutrinos to test if the Weyl fermion was produced in the aftermath, he said. [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 ν frequency. It means that the mass of the proton and electron are electromagnetic and the result of the electromagnetic induction, caused by the changing acceleration of the spinning and moving charge! It could be that the m_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

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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