Tests for Schrodinger Cats

While Bell inequalities have been proven to be an optimal tool for ruling out local realism in quantum experiments, Lucas Clemente and Johannes Kofler from the Theory Division of the Max Planck Institute of Quantum Optics (MPQ) in Garching, Germany, have now shown that inequalities can never be optimal for tests of macroscopic realism. [11]

Physicists have developed a new protocol to detect entanglement of many-particle quantum states using a much easier approach. The new protocol is particularly interesting for characterizing entanglement in systems involving many particles. These systems could help us not only to improve our understanding of matter but to develop measurement techniques beyond current existing technologies. [10]

Using some of the largest supercomputers available, physics researchers from the University of Illinois at Urbana-Champaign have produced one of the largest simulations ever to help explain one of physics most daunting problems. [9]

Many quantum technologies rely on quantum states that violate local realism, which means that they either violate locality (such as when entangled particles influence each other from far away) or realism (the assumption that quantum states have well-defined properties, independent of measurement), or possibly both. Violation of local realism is one of the many counterintuitive, yet experimentally supported, characteristics of the quantum world. [8]

Quantum entanglement—which occurs when two or more particles are correlated in such a way that they can influence each other even across large distances—is not an all-or-nothing phenomenon, but occurs in various degrees. The more a quantum state is entangled with its partner, the better the states will perform in quantum information applications. Unfortunately, quantifying entanglement is a difficult process involving complex optimization problems that give even physicists headaches. [7]

A trio of physicists in Europe has come up with an idea that they believe would allow a person to actually witness entanglement. Valentina Caprara Vivoli, with the University of Geneva, Pavel Sekatski, with the University of Innsbruck and Nicolas Sangouard, with the University of Basel, have together written a paper describing a scenario where a human subject would be able to witness an instance of entanglement—they have uploaded it to the arXiv server for review by others. [6]

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.

Contents

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Preface

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. In a new proposed experiment in this area, two toaster-sized "nanosatellites" carrying entangled condensates orbit around the Earth, until one of them moves to a different orbit with different gravitational field strength. As a result of the change in gravity, the entanglement between the condensates is predicted to degrade by up to 20%. Experimentally testing the proposal may be possible in the near future. [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.

Better tests for Schrodinger cats

In a classical world, objects have pre-existing properties, physical influences are local and cannot travel faster than the speed of light, and it is in principle possible to measure the properties of macroscopic systems without altering them. This is referred to as local realism and macroscopic realism, and quantum mechanics is in strong contradiction with both of them. While Bell inequalities have been proven to be an optimal tool for ruling out local realism in quantum experiments, Lucas Clemente and Johannes Kofler from the Theory Division of the Max Planck Institute of Quantum Optics (MPQ) in Garching, Germany, have now shown that inequalities can never be optimal for tests of macroscopic realism. Their results reveal a hitherto unknown radical difference in the mathematical structures of spatial and temporal correlations in quantum physics, and also provide a better tool for the search of Schrödinger cat-like states (PRL.116.150401, 15 April 2016).

Spin systems are a very simplified, stripped-down model of the interactions between particles making up a material. In the simplest of these models, each particle or "spin" can only be in one of two possible states: "up" or "down". The interactions between neighbouring particles try to align them either in the same or in the opposite direction, which is known as the Ising model, after the physicist Ernst Ising who studied it in his 1924 PhD thesis.

"Models in different dimensions or with different kinds of symmetries show very different physical behaviour. Our study shows that if one considers models with irregular coupling strengths, all these differences disappear as they are all equivalent to universal models," says Dr. Gemma De las Cuevas from the MPQ, Munich Local realism is the classical world view which assumes that objects have pre-existing properties and no influence can travel faster than the speed of light. In 1964, John Bell found that these assumptions put boundaries on the possible correlations between measurements on spatially separated objects. In local realism, spatial correlations need to obey certain inequalities, which are today called Bell inequalities.

In 1984, Arthur Fine proved that Bell inequalities are optimal in the sense that they form a tight boundary for all local realist theories. That means that the set of all Bell inequalities is both necessary and sufficient for local realism: all local realist theories obey the Bell inequalities and, in turn, obeying all Bell inequalities means that there is a local realist explanation for the observed data. Using entangled quantum states between two or more systems, such as photons or atoms, Bell inequalities can be violated. Such quantum violations were measured repeatedly over the past decades with ever increasing perfection. Thus, the world view of local realism has been conclusively ruled out experimentally.

Although quantum mechanics violates local realism, it does not allow for the transmission of information faster than light. This assumption of no-signalling is one of the pillars of special relativity theory. A violation of no-signalling would be in contradiction with causality and allow communication into the past. Quantum experiments can therefore only violate Bell inequalities, but not the no-signalling assumption.

Equally strange as the quantum violation of local realism is the famous paradox of Schrödinger's cat, where – in a thought experiment – a cat can be put into a superposition of being both dead and alive. Until today, many physicists accept superposition states of microscopic objects but are deeply unsatisfied with the fact that quantum mechanics would in principle allow such a strange behaviour also on the macroscopic scale. The classical world view called macroscopic realism forbids such macroscopic superposition states and asserts that macroscopic objects can in principle be measured without altering their state.

In 1985, Anthony Leggett and Anupam Garg showed that macroscopic realism puts a bound on the possible temporal correlations of sequential measurements performed on a single quantum system. These temporal correlations need to obey inequalities, which are now called Leggett-Garg inequalities.

In the past years, Leggett-Garg inequalities were violated in many experiments, albeit only with microscopic quantum systems, which did not rule out macroscopic realism. Whether or not one can put macroscopic objects, such as cats, in superpositions is experimentally not yet decided and is one of the most exciting open questions in the foundations of physics.

Although local realism is about correlations in space between at least two systems, and macroscopic realism is about correlations in time of a single object, the two concepts have many analogies, and the corresponding Bell and Leggett-Garg inequalities are almost identical mathematically. However, the work of Clemente and Kofler has now revealed a remarkable and hitherto unknown disanalogy. With a sophisticated dimensional analysis of probability spaces they were able to prove that Fine's theorem for local realism does not apply for macroscopic realism. In other words, Leggett-Garg inequalities do not form an optimal tight boundary for macrorealistic theories like Bell's inequalities do for local realism (see Figure).

Interestingly, it is the temporal analogy to the no-signalling assumption, which does the trick. This assumption, called no-signalling in time, demands that for macroscopic objects later measurement outcomes cannot depend on earlier measurements. It holds in macroscopic realism but is violated in quantum mechanics.

"In contrast to the Leggett-Garg inequalities, the combination of all no-signalling in time conditions is both necessary and sufficient for macroscopic realism. This reveals a striking difference between spatial correlations in tests of local realism and temporal correlations in tests of macroscopic realism", Clemente explains.

Consequently, experimentalists aiming at violating macroscopic realism should stop focusing on the Leggett-Garg inequalities, which they have done for so many years now. "Leggett-Garg inequalities unnecessarily limit the parameter space in which potential violations of macroscopic realism can be found. No-signalling in time is not only a better but even optimal condition for experiments which try to test whether there can be Schrödinger cats in nature", Kofler adds. [11]

New protocol to detect entanglement of many-particle quantum states

Quantum systems consisting of many particles can enter highly intricate states with strong so-called multiparticle entanglement. A new-found theoretical relation now allows extracting it with standard tools available in scattering experiments.

In quantum theory, interactions among particles create fascinating correlations known as entanglement that cannot be explained by any means known to the classical world. Entanglement is a consequence of the probabilistic rules of quantum mechanics and seems to permit a peculiar instantaneous connection between particles over long distances that defies the laws of our macroscopic world -- a phenomenon that Einstein referred to as "spooky action at a distance."

Developing protocols to detect and quantify entanglement of many-particle quantum states is a key challenge for current experiments because entanglement becomes very difficult to study when many particles are involved. "We are able to control smaller particle ensembles well, where we can measure entanglement in a relatively straight forward way," says quantum physicist Philipp Hauke. However, "when we are dealing with a large system of entangled particles, this measurement is extremely complex or rather impossible because the resources required scale exponentially with the system size."

Philipp Hauke and Peter Zoller from the Department of Theoretical Physics at the University of Innsbruck and the Institute for Quantum Optics and Quantum Information (IQOQI) at the Austrian Academy of Sciences in collaboration with Markus Heyl from the Technical University of Munich, and Luca Tagliacozzo from ICFO -- The Institute of Photonic Sciences have found a new way to detect certain properties of many-particle entanglement independent of the size of the system and by using standard measurement tools.

Entanglement measurable via susceptibility

"When dealing with more complex systems, scientists had to carry out a large number of measurements to detect and quantify entanglement between many particles," says Philipp Hauke. "Our protocol avoids this problem and can also be used for determining entanglement in macroscopic objects, which was nearly impossible until now."

With this new method theoretical physicists are able to use tools already well established experimentally. In their study, published in Nature Physics, the team of researchers give explicit examples to demonstrate their framework: The entanglement of many-particle systems trapped in optical lattices can be determined by laser spectroscopy, and the well-established technique of neutron scattering may be used for measuring it in solid-state systems. As the physicists have been able to show, the quantum Fisher information, which represents a reliable witness for genuinely multipartite entanglement, is in fact measurable. The researchers have highlighted that entanglement can be detected by measuring the dynamic response of a system caused by a perturbation, which can be determined by comparing individual measurements. "For example, when we move a sample through a time-dependent magnetic field, we can determine the system's susceptibility towards the magnetic field through the measurement data and thereby detect and quantify internal entanglement," explains Hauke.

Manifold applications

Quantum metrology, i.e. measurement techniques with increased precision exploiting quantum mechanics, is not the only important field of application of this protocol. It will also provide new perspectives for quantum simulations, where quantum entanglement is used as a resource for studying properties of quantum systems. In solid-state physics, the protocol may be used to investigate the role of entanglement in many-body systems, thereby providing a deeper understanding of quantum matter. [10]

Experimentation and largest-ever quantum simulation of a disordered system explain quantum many-particle problem

Using some of the largest supercomputers available, physics researchers from the University of Illinois at Urbana-Champaign have produced one of the largest simulations ever to help explain one of physics most daunting problems.

"This result was a fantastic collaboration between theory and experiment," explained Physics Professor Brian DeMarco, whose group led the experimental phase of the study. "One of the grandest and most impactful frontiers of physics is the quantum many-particle problem. We do not understand very well what happens when many quantum particles come together and interact with each other. This problem spans some of the largest scales in the universe, like understanding the nuclear matter in neutron stars, to the smallest, such as electron transport in photosynthesis and the quarks and gluons inside a proton."

DeMarco's group experiments with atoms gases cooled to just billionths of a degree above absolute zero temperature in order to experimentally simulate models of materials such as high-temperature superconductors. In these experiments, the atoms play the role of electrons in a material, and the analog of material parameters (like disorder) are completely controlled and known and can be changed every 90-second experimental cycle. Measurements on the atoms are used to expose new physics and test theories.

"In most cases, we lack predictive power, because these problems are not readily computable—a classical computer requires exponentially costly resources to simulate many quantum systems," added David Ceperley, a professor of physics whose team developed the companion simulation. "A key example of this problem with practical challenges lies with materials such as high-temperature superconductors. Even armed with the chemical composition and structure of these materials, it is almost impossible to predict today at what temperature they will super-conduct."

The different approaches to attacking a particularly important quantum many-particle problem by DeMarco's and Ceperley's groups came together in a new result published in Nature Physics. In their paper, "Probing the Bose glass-superfluid transition using quantum quenches of disorder," Carolyn Meldgin from DeMarco's group and Ushnish Ray from Ceperley's team share a new understanding of how disorder in a quantum material gives rise to an exotic quantum state called a Bose glass.

"A Bose glass is a strange and poorly understood insulator that can occur when disorder is added to a superfluid or superconductor," Meldgin said. In her experiments, Meldgin was able to use optical disorder to induce a Bose glass, and Ray exactly simulated the experiment using the Titan supercomputer.

In this work, Ceperley's group achieved the largest scale computer simulations possible of a disordered quantum many-particle system on the biggest supercomputers in existence. These computer simulations were able to simulate relatively large numbers of particles, such as the 30,000 atoms used in DeMarco's experiments.

Together, Meldgin and Ray were able to show something startling—that a dynamic probe in the experiment connects to the equilibrium computer simulations.

"In both cases, the same amount of disorder is required to turn a superfluid into a Bose-glass," Ray stated. "This result is critically important to our understanding of disordered quantum materials, which are ubiquitous, since disorder is difficult to avoid. It also has important implications for quantum annealers, like the D-Wave Systems device." [9]

Physicists find extreme violation of local realism in quantum hypergraph states

Determining whether or not multiparticle quantum states violate local realism can be challenging. Now in a new paper, physicists have shown that a large family of multiparticle quantum states called hypergraph states violates local realism in many ways. The results suggest that these states may serve as useful resources for quantum technologies, such as quantum computers and detecting gravitational waves.

The physicists, Mariami Gachechiladze, Costantino Budroni, and Otfried Gühne at the University of Siegen in Germany, have published their paper on the quantum hypergraph states in a recent issue of Physical Review Letters.

The properties of multiparticle quantum systems are described by quantum states, some of which can be represented on a graph where each point corresponds to a particle and each edge to the interaction between particles. While some quantum states can be represented by ordinary graphs, others are represented by hypergraphs. On an ordinary graph, two points can be connected by an edge, while on a hypergraph, a hyperedge can connect more than two vertices. Whereas an ordinary edge is usually drawn as a straight line between two vertices, a hyperedge is depicted as a curve that wraps around three or more vertices.

In the new study, the physicists discovered that quantum hypergraph states have perfect correlations that are highly nonlocal. As the scientists explain, this means that hypergraph states strongly violate local realism.

"We find a whole new class of elegantly described states that are highly entangled," Gachechiladze told Phys.org. "This class is a generalization of a well-known and heavily used family of graph states."

The physicists also showed that the greater the number of particles in a quantum hypergraph state, the more strongly it violates local realism, with the strength increasing exponentially with the number of particles. In addition, even if a quantum hypergraph state loses one of its particles, it continues to violate local realism. This robustness to particle loss is in stark contrast to other types of quantum states, which no longer violate local realism if they lose a particle. This property is particularly appealing for applications, since it might allow for more noise in experiments.

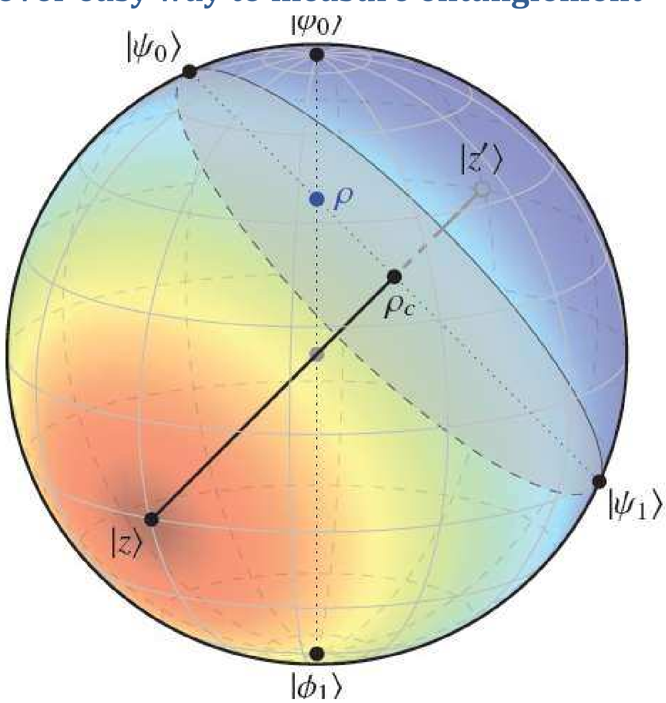
One such potential application is quantum computing, which may benefit because the exponential violation found here is expected to correspond to an exponential advantage for certain computation tasks. Another application is quantum metrology, where physicists take advantage of quantum properties to make extremely precise measurements that would not be possible using classical measurement techniques.

"High entanglement has been recognized to be the key for certain information-theoretic tasks," Gachechiladze said. "We find that some hypergraph states can be used in quantum metrology, namely, in measuring some parameters with a very high precision using quantum measurements. Such quantum-enhanced measurement strategies may play an important role in future precision experiments, such as in the search for gravitational waves."

The researchers will further explore these possibilities in the future.

"We plan to investigate more in the direction of entanglement properties," Gachechiladze said. "Also we are working towards an experimental proposal to create hypergraph states using photons or trapped ions. Finally, we would like to employ this set of quantum states in applications such as measurement-based quantum computation and error-correcting codes." [8]

Physicists discover easy way to measure entanglement—on a sphere



Entanglement on a sphere: This Bloch sphere shows entanglement for the one-root state ρ and its radial state ρc. The color on the sphere corresponds to the value of the entanglement, which is determined by the distance from the root state z, the point at which there is no entanglement. The closer to z, the less the entanglement (red); the further from z, the greater the entanglement (blue). Credit: Regula and Adesso. ©2016 American Physical Society

Now in a new paper to be published in Physical Review Letters, mathematical physicists Bartosz Regula and Gerardo Adesso at The University of Nottingham have greatly simplified the problem of measuring entanglement.

To do this, the scientists turned the difficult analytical problem into an easy geometrical one. They showed that, in many cases, the amount of entanglement between states corresponds to the distance between two points on a Bloch sphere, which is basically a normal 3D sphere that physicists use to model quantum states.

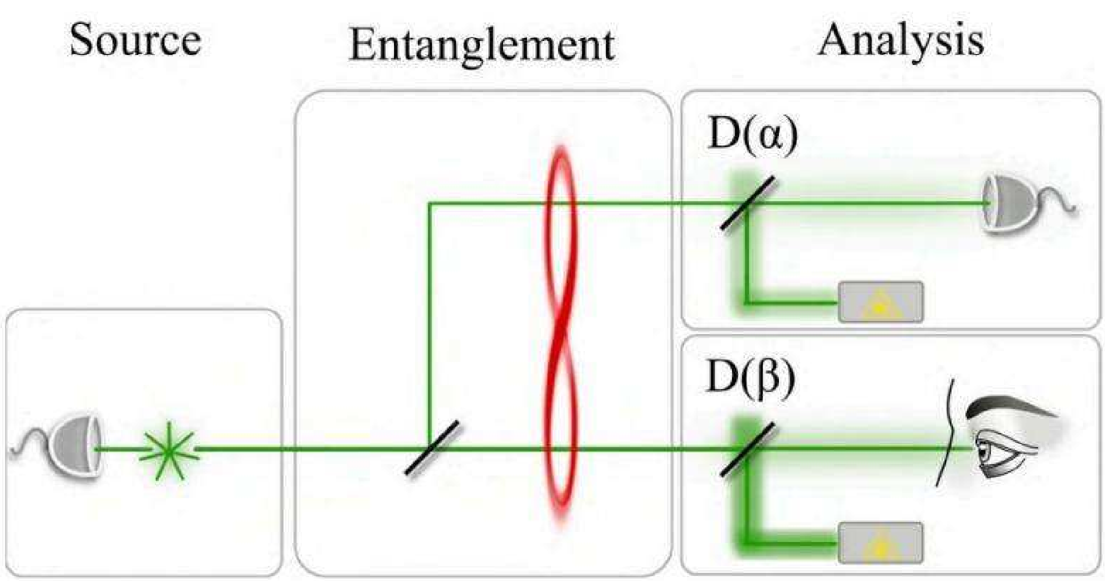
As the scientists explain, the traditionally difficult part of the math problem is that it requires finding the optimal decomposition of mixed states into pure states. The geometrical approach completely eliminates this requirement by reducing the many possible ways that states could decompose down to a single point on the sphere at which there is zero entanglement. The approach requires that there be only one such point, or "root," of zero entanglement, prompting the physicists to describe the method as "one root to rule them all."

The scientists explain that the "one root" property is common among quantum states and can be easily verified, transforming a formidable math problem into one that is trivially easy. They demonstrated that the new approach works for many types of two-, three- and four-qubit entangled states.

"This method reveals an intriguing and previously unexplored connection between the quantum features of a state and classical geometry, allowing all one-root states to enjoy a convenient visual representation which considerably simplifies the study and understanding of their properties," the researchers explained.

The simple way of measuring a state's entanglement could have applications in many technological areas, such as quantum cryptography, computation, and communication. It could also provide insight into understanding the foundations of thermodynamics, condensed matter physics, and biology. [7]

An idea for allowing the human eye to observe an instance of entanglement



Scheme of the proposal for detecting entanglement with the human eye. Credit: arXiv:1602.01907

Entanglement, is of course, where two quantum particles are intrinsically linked to the extent that they actually share the same existence, even though they can be separated and moved apart. The idea was first proposed nearly a century ago, and it has not only been proven, but researchers routinely cause it to occur, but, to date, not one single person has every actually seen it happen—they only know it happens by conducting a series of experiments. It is not clear if anyone has ever actually tried to see it happen, but in this new effort, the research trio claim to have found a way to make it happen—if only someone else will carry out the experiment on a willing volunteer.

The idea involves using a beam splitter and two beans of light—an initial beam of coherent photons fired at the beam splitter and a secondary beam of coherent photons that interferes with the photons in the first beam causing a change of phase, forcing the light to be reflected rather than transmitted. In such a scenario, the secondary beam would not need to be as intense as the first, and could in fact be just a single coherent photon—if it were entangled, it could be used to allow a person to see the more powerful beam while still preserving the entanglement of the original photon.

The researchers suggest the technology to carry out such an experiment exists today, but also acknowledge that it would take a special person to volunteer for such an assignment because to prove that they had seen entanglement taking place would involve shooting a large number of photons in series, into a person's eye, whereby the resolute volunteer would announce whether they had seen the light on the order of thousands of times. [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]

The Secret of Quantum Entanglement

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] When one of the entangled particles wave function is collapses by measurement, the intermediate photon also collapses and transforms its state to the second entangled particle giving it the continuity of this entanglement. Since the accelerated charges are self-maintaining their potential locally causing their acceleration, it seems that they entanglement is a spooky action at a distance.

Conclusions

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

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.

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 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. 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.

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