

Proton Escaping the Molecule

Imagine what it would be like to watch how the individual atoms of molecules rearrange during a chemical reaction to form a new substance, or to see the compounds of DNA move, rearrange and replicate. Such capability would give unprecedented insight to understand and potentially control the processes. [8]

In order to explain the intricacies of hydrogen activation above and beyond experimental findings, quantum chemical calculations were carried out in cooperation with Professor Max Holthausen (Goethe University Frankfurt). [7]

In a combination of experiments and theory the diffusion of individual atoms in periodic systems was understood for the first time. The interaction of individual atoms with light at ultralow temperatures close to the absolute zero temperature point provides new insights into ergodicity, the basic assumption of thermodynamics. [6]

In a scientific first, a team of researchers from Macquarie University and the University of Vienna have developed a new technique to measure molecular properties – forming the basis for improvements in scientific instruments like telescopes, and with the potential to speed up the development of pharmaceuticals. [5]

In the quantum world, physicists study the tiny particles that make up our classical world - neutrons, electrons, photons - either one at a time or in small numbers because the behaviour of the particles is completely different on such a small scale. If you add to the number of particles that are being studied, eventually there will be enough particles that they no longer act quantum mechanically and must be identified as classical, just like our everyday world. But where is the line between the quantum world and the classical world? A group of scientists from Okinawa Institute of Science and Technology Graduate University (OIST) explored this question by showing what was thought to be a quantum phenomenon can be explained classically. [4]

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.

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Preface

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 Δx and Δp uncertainty.

Molecular selfie reveals how a chemical bond breaks: Proton is seen escaping the molecule

Imagine what it would be like to watch how the individual atoms of molecules rearrange during a chemical reaction to form a new substance, or to see the compounds of DNA move, rearrange and replicate. Such capability would give unprecedented insight to understand and potentially control the processes.

The simple idea of watching how molecules break, or transform, during chemical reactions has, until now, been unfathomable since it requires tracking all of the atoms, which constitute a molecule, with sub-atomic spatial and few-femtosecond temporal resolution. Hence, taking such "snapshots" with a combined spatio-temporal resolution to witness a molecular reaction was considered fodder for science fiction. Exactly 20 years ago, one of the ideas proposed considered using the molecule's own electrons to image its structure: Teach the molecule to take a selfie! The idea was brilliant but impossible to implement - until today.

In their recent study, reported in Science, ICFO researchers from the Attoscience and Ultrafast Optics Group in collaboration with researchers from the USA, the Netherlands, Denmark and Germany, have reported on the imaging of molecular bond breakup in acetylene (C_2H_2) nine femtoseconds after its ionization. The team was able to track the individual atoms of the isolated acetylene molecule with a spatial resolution as small as 0.05 Ångström - less than the width of an individual atom - and with a temporal resolution of 0.6 femtoseconds. What's more, they were able to trigger the breakup of only one of the bonds of the molecule and see how one proton leaves the molecule.

"Our method has finally achieved the required space and time resolution to take snapshots of molecular dynamics without missing any of its events, and we are eager to try it out on other molecular systems such as chemical catalysts and bio-relevant systems" said Jens Biegert, ICREA professor at ICFO and leader of the research.

Teaching a molecule to take a selfie

The team developed a world-leading ultrafast mid-IR laser source and combined it with a reaction microscope to detect the 3D momentum distribution of electrons and ions in full kinematic coincidence. In the experiment, a single isolated acetylene molecule was oriented in space with a short laser pulse. A strong enough, follow up, infrared pulse liberated one electron from the

molecule, accelerated it on a returning trajectory and forced it to scatter off its own parent molecular ion, all within only 9 femtoseconds.

Benjamin Wolter explained, "the flight path and kinetic energy of all collision fragments were recorded with the reaction microscope similar to a big particle physics experiment."

After some clever data processing, the team was able to extract the entire molecular structure and, moreover, they could show that orienting the molecule along the electric field of the laser, or perpendicular to it, completely changed its dynamics. In one case, the molecule underwent vibrational motion with the laser field, while in the other case a C-H bond was clearly broken. The experiment is the first direct visualization of bond cleavage and observation of the proton during its departure from the $[C_2H_2]^{2+}$ ion, something that was never seen before.

"We took one electron, steered it along a specific path with the laser and scattered it off an isolated molecule to record its diffraction pattern" said Biegert, "it is mind-boggling to imagine the length and time scales of the experiment. The fantastic cooperation between experimentalists and theorists, atomic physicists and quantum chemists from ICFO, Kansas State University, Max-Planck-Institut für Kernphysik, Physikalisch Technische Bundesanstalt, Center for Free Electron Laser Science/DESY/CUI, Aarhus University, Friedrich-Schiller University Jena, Leiden University, and Universität Kassel made it possible to achieve such feat". [8]

Non-metal catalyst splits hydrogen molecule

Hydrogen (H_2) is an extremely simple molecule and yet a valuable raw material which as a result of the development of sophisticated catalysts is becoming more and more important. In industry and commerce, applications range from food and fertilizer manufacture to crude oil cracking to utilization as an energy source in fuel cells. A challenge lies in splitting the strong H-H bond under mild conditions. Chemists at Goethe University have now developed a new catalyst for the activation of hydrogen by introducing boron atoms into a common organic molecule. The process, which was described in the *Angewandte Chemie* journal, requires only an electron source in addition and should therefore be usable on a broad scale in future.

The high energy content of the hydrogen molecule meets with a particularly stable bonding situation. It was Paul Sabatier who in 1897 detected for the first time that metals are suitable catalysts for splitting the molecule and harnessing elementary hydrogen for chemical reactions. In 1912 he was awarded the Nobel Prize for Chemistry for this important discovery. The hydrogenation catalysts mostly used today contain toxic or expensive heavy metals, such as nickel, palladium or platinum. Only ten years ago non-metal systems based on boron- and phosphorous compounds were discovered which allow comparable reactions.

"My doctoral researcher, Esther von Grotthuss, has achieved yet another major simplification of the non-metal strategy which requires only the boron component", says Professor Matthias Wagner from the Institute of Inorganic and Analytical Chemistry of Goethe University Frankfurt. "What we additionally need is just an electron source. In the laboratory we chose lithium or potassium for this. When put into practice in the field, it should be possible to substitute this with electrical current."

In order to explain the intricacies of hydrogen activation above and beyond experimental findings, quantum chemical calculations were carried out in cooperation with Professor Max Holthausen (Goethe University Frankfurt). Detailed knowledge of the reaction process is very important for the system's further expansion. The objective lies not only in replacing transition metals in the long term but also in opening up the possibility for reactions which are not possible with conventional catalysts.

The chemists in Frankfurt consider that especially substitution reactions are highly promising which permit easy access to compounds of hydrogen with other elements. Expensive and potentially hazardous processes are still mostly used for such syntheses. For example, the simplified production of silicon-hydrogen compounds would be extremely attractive for the semiconductor industry. [7]

Physicists observe diffusion of individual atoms in light bath

In a combination of experiments and theory the diffusion of individual atoms in periodic systems was understood for the first time. The interaction of individual atoms with light at ultralow temperatures close to the absolute zero temperature point provides new insights into ergodicity, the basic assumption of thermodynamics.

Quantum physicists at University of Kaiserslautern have published their results together with colleagues in the journal Nature Physics.

Diffusion is a universal physical phenomenon, describing the motion of particles in their particular environment, whether solid, liquid or gaseous. The first observation of Robert Brown and the subsequent explanation by Albert Einstein are already more than a hundred years old: Robert Brown observed the random, irregular dithering movement of pollen in a liquid. Albert Einstein and his colleague Marian Smoluchowski interpreted this "Brownian motion" correctly as a result of random collisions of molecules of the liquid with the pollen. The diffusion in complex systems goes one step further and can have very diverse characteristics: Tumor movement in living organisms, DNA transport within cells, ion flow in batteries, moving atoms on surfaces - all these are diffusion processes in complex systems.

Uncovering of the underlying mechanisms is of great interest as these could reach far into daily applications one day. Physical studies of ultracold atoms, carried out at the University of Kaiserslautern, now provide an understanding of diffusion in periodic structures, relevant for various complex systems.

Physicists at the University of Kaiserslautern together with scientists from the Universities of Erlangen-Nuremberg and Kyoto in Japan have made an important step towards the fundamental understanding of complex diffusion and the interpretation of their experimental data. For the study, published in the prestigious journal Nature Physics, the Kaiserslautern team around Professor Widera (Department of Physics and State Research Center OPTIMAS) developed a novel model system: A single atom is cooled by lasers near to absolute zero temperature and trapped by light within a near-perfect vacuum. The atom is then transferred into an environment of a light field in which the light-absorption and light-emission of the atoms act as collisions with other particles. In this environment, the diffusion can be readily set and the motion of the atom be tracked by a camera.

In parallel, theoretical physicists from Erlangen-Nuremberg and Kyoto developed a model for the description of the dynamics of the system. A central aspect here was to understand the processes in terms of the physical phenomenon of ergodicity. Due to the excellent agreement between experiment and theory, diffusion processes can now be understood beyond Brownian motion. These results have potentially an impact on the understanding of various complex systems in medicine, biology, physics and engineering in the future.

Fundamentals of diffusion

The motion of individual cells in the body or the transport of charge carriers in energy storage systems can be understood only in the context of the particular environment. The particles within the environment encounter permanent collisions with a cell or a carrier, thus influencing their motion. These processes can in many cases be described through Brownian motion by Einstein's theory. Sometimes the observations can, however, not be described within this model, and in some cases this non-Brownian dynamics are not obvious at first glance. The scientists of the three universities have succeeded in showing both theoretically and experimentally, how the diffusion in certain complex systems can be characterized.

Ergodicity is a key to understanding complex diffusions

A central aspect of the study was to investigate the atomic system on time scales that are relevant for the establishment of ergodicity. Ergodicity is a basic assumption of thermodynamics and an important factor for the description of diffusion processes. In simple words, the ergodicity hypothesis states that in an ensemble of particles, the motion of a single particle is representative for the entire ensemble. This assumption is usually valid for all observed phenomena in our everyday lives. Strictly seen, this applies, nevertheless, for most systems only on very long time scales. The scientists could now show in their study that even seemingly "normal" diffusion processes in certain cases may violate ergodicity on surprisingly long time scales. These findings have interesting implications for understanding the diffusion in complex systems and can help, for example, to re-evaluate and interpret observations and measurements in biological systems. [6]

New method to differentiate molecules could yield faster and cheaper medicines

In a scientific first, a team of researchers from Macquarie University and the University of Vienna have developed a new technique to measure molecular properties – forming the basis for improvements in scientific instruments like telescopes, and with the potential to speed up the development of pharmaceuticals.

The study, titled "Quantum Optical Rotatory Dispersion" and published in interdisciplinary journal Science Advances today, developed a new technique to allow chemists to learn about the position of atoms in a molecule – called quantum optical rotatory dispersion.

This quantum method measures the chirality of molecules, which is essentially how asymmetric the molecules are and is used across fields like biology, biomechanics and physics, and has a practical application in pharmaceuticals among other sectors.

The team found that quantum methods can allow for a more precise analysis of properties of molecules – meaning molecules can be examined even with a low concentration of the molecule or with less light. This new technique enables a more gentle analysis of samples that, for example, may be damaged by light.

"We've found a way to analyse delicate samples by using less light," said lead author Nora Tischler, who carried out the research as part of her PhD, which she completed at Macquarie University between 2012 and 2016.

"We hope to see this proof of concept built upon to eventually see efficiencies in the pharmaceutical sector, to help develop new medicines more productively."

Macquarie's Associate Professor Gabriel Molina-Terriza from the Department of Physics and Astronomy co-authored the study, alongside postdoctoral fellow Xavier Vidal and researchers from the Austrian Academy of Sciences and University of Vienna. The lead author was jointly enrolled at the University of Vienna and Macquarie University as part of a cotutelle PhD program, spurring the international partnership between the two teams.

"We sought out to understand how light couples to matter – which is at the core of many common instruments. Ultimately we hope our findings can be used to find new ways to improve instruments like optical sensors and telescopes," said Associate Professor Molina-Terriza. [5]

Bridging the gap between the quantum and classical worlds

In the quantum world, physicists study the tiny particles that make up our classical world - neutrons, electrons, photons - either one at a time or in small numbers because the behaviour of the particles is completely different on such a small scale. If you add to the number of particles that are being studied, eventually there will be enough particles that they no longer act quantum mechanically and must be identified as classical, just like our everyday world. But where is the line between the quantum world and the classical world? A group of scientists from Okinawa Institute of Science and Technology Graduate University (OIST) explored this question by showing what was thought to be a quantum phenomenon can be explained classically.

They have recently published their results in Physical Review Letters.

"We wanted to know about the relationship and interactions between light and matter," Prof. Denis Konstantinov, author and leader of OIST's Quantum Dynamics Unit said. "By light we mean electromagnetic fields: radio waves, microwaves, or light. They are all described by the same laws in physics. By matter, we mean a collection of tiny particles, like atoms or electrons."

Specifically, the team was interested in strong coupling in light-matter interactions where there are a large number of particles that make up the matter. Strong coupling is when the light and the matter are both affected by the interactions. In most circumstances, the light is not affected when light and matter interact. For example, a boat in the ocean is affected by the waves, but the ocean is not really affected by the presence of the boat. Strong coupling is interesting because both the boat (matter) and waves (light) are strongly affected by the interaction with the other. Generally, this has been thought of as a quantum effect. However, the researchers wanted to explore the boundary between the quantum and classical worlds.

"Everyone agrees that if you have a collection of a large number of quantum particles it is classical and if you have light trapped in a cavity, it is also classical," Konstantinov said. "But then, if we bring them together and strongly couple them, it somehow becomes quantum. This didn't seem quite right to us."

To see whether this type of strong coupling could be explained classically, the researchers took a collection of tens to hundreds of millions of electrons on the surface of liquid helium, which exists at very low temperatures. They then brought the electrons into a cavity containing electromagnetic microwaves. From there, the electrons and the waves could interact and the team observed changes in both the electrons and the electromagnetic waves.

"We saw strong changes in the electromagnetic wave frequency while they were interacting with the electrons and strong changes in the electrons' activity as well," Konstantinov said. "This is a signature of strong coupling."

From there, they successfully created a classical model that described the phenomenon of strong coupling that they were seeing experimentally. This meant that strong coupling with large amounts of particles could be categorized in the classical world instead of the quantum world as previously thought.

"The transition from the quantum world to classical behaviour is not really clear. But in this case we have shown where the quantum ends and the classical begins," Konstantinov said. "However, while this strong coupling itself is classical, it does not mean that nothing is quantum. You can bring this system to a quantum regime by introducing non-linearity like a qubit."

Qubits are units of quantum information that are integral to quantum computing because they exist in a superposition of two states and can hold a much larger amount of information compared to a regular bit used in normal computers. Understanding strong coupling and their relation to qubits could be significant for the development of quantum computing.

"Strong coupling is very important for quantum computing," Konstantinov said. "If you have strong coupling you can exchange quantum information between qubits, light, and particles, which can serve as quantum memory." [4]

The Bridge

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

Accelerating charges

The moving charges are self maintain the electromagnetic field locally, causing their movement and this is the result of their acceleration under the force of this field. In the classical physics the charges will distributed along the electric current so that the electric potential lowering along the current, by linearly increasing the way they take every next time period because this accelerated motion.

The same thing happens on the atomic scale giving a Δp impulse difference and a Δx way difference between the different part of the not point like particles.

Relativistic effect

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

Heisenberg Uncertainty Relation

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

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

Wave – Particle Duality

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

Atomic model

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

The Relativistic Bridge

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

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

The weak interaction

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

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

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

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

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

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

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

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

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

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

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

The General Weak Interaction

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

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

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

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

Fermions and Bosons

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

Van Der Waals force

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

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

Electromagnetic inertia and mass

Electromagnetic Induction

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

Relativistic change of mass

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

The frequency dependence of mass

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

Electron – Proton mass rate

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

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

Gravity from the point of view of quantum physics

The Gravitational force

The gravitational attractive force is basically a magnetic force.

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

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

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

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

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

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

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

The Higgs boson

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

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

Higgs mechanism and Quantum Gravity

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

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

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

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

What is the Spin?

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

The Graviton

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

Conclusions

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

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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