Beyond the Standard Model

Although the discovery of the Higgs boson by the ATLAS and CMS Collaborations in 2012 completed the Standard Model, many mysteries remain unexplained. For instance, why is the mass of the Higgs boson so much lighter than expected, and why is gravity so weak? [9]

Last week, the detectors of the Large Hadron Collider (LHC) witnessed their first collisions of 2017. [8]

As physicists were testing the repairs of LHC by zipping a few spare protons around the 17 mile loop, the CMS detector picked up something unusual. The team feverishly pored over the data, and ultimately came to an unlikely conclusion—in their tests, they had accidentally created a rainbow universe. [7]

The universe may have existed forever, according to a new model that applies quantum correction terms to complement Einstein's theory of general relativity. The model may also account for dark matter and dark energy, resolving multiple problems at once. [6]

This paper explains the Accelerating Universe, the Special and General Relativity from the observed effects of the accelerating electrons, causing naturally the experienced changes of the electric field potential along the moving electric charges. 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 Relativistic Quantum Theories.

The Big Bang caused acceleration created the radial currents of the matter and since the matter 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.

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Probing physics beyond the Standard Model with the ATLAS Experiment

Although the discovery of the Higgs boson by the ATLAS and CMS Collaborations in 2012 completed the Standard Model, many mysteries remain unexplained. For instance, why is the mass of the Higgs boson so much lighter than expected, and why is gravity so weak?

Numerous models beyond the Standard Model attempt to explain these mysteries. Some explain the apparent weakness of gravity by introducing additional dimensions of space in which gravity propagates. One model goes beyond that, and considers the real world as a higher-dimensional universe described by warped geometry, which leads to strongly interacting massive graviton states. Other models propose, for example, additional types of Higgs bosons.

All these models predict the existence of new heavy particles that can decay into pairs of massive weak bosons (WW, WZ or ZZ). The search for such particles has benefited greatly from the increase in the proton–proton collision energy during Run 2 of the Large Hadron Collider (LHC).

The W and Z bosons are carrier particles that mediate the weak force. They decay into other Standard Model particles, like charged leptons (l), neutrinos (?) and quarks (q). These particles are reconstructed differently in the detector. Quarks, for instance, are reconstructed as localized sprays of hadrons, denoted jets. The two bosons could yield several combinations of these particles in the final states. The ATLAS Collaboration has released results on searches involving all relevant decays of the boson pair: ??qq, llqq, l?qq and qqqq (where the lepton is an electron or muon).

What do these searches have in common? In each, at least one of the bosons decays into a pair of quarks. When the sought-after particle is very massive, the two bosons from its decay are ejected with such high momenta that their respective decay products are collimated and the pair of quarks merge into a single large jet. This phenomenon provides a powerful means to distinguish the new physics signal from strong-interaction Standard Model processes. Figure 1 shows the distributions of the reconstructed mass of the candidate particle. Figure 2 shows the limit on the cross-section times branching ratio of a hypothetical particle described by one of the models.

So far, no evidence of a new particle has been observed. The search continues with increased sensitivity as ATLAS collects more data. [9]

Preparations for a new season of physics at the Large Hadron Collider

Last week, the detectors of the Large Hadron Collider (LHC) witnessed their first collisions of 2017. These test collisions were not for physics research, instead they were produced as part of the process of restarting the LHC. But have patience, data taking for physics will start in another few days.

Since particles began circulating in the large ring once more, the LHC's operators have been testing and adjusting 24 hours a day to turn the LHC into a veritable collision factory. Their work involves forming trains of bunches, building them up over the next few weeks to several hundred and then several thousand bunches per beam.

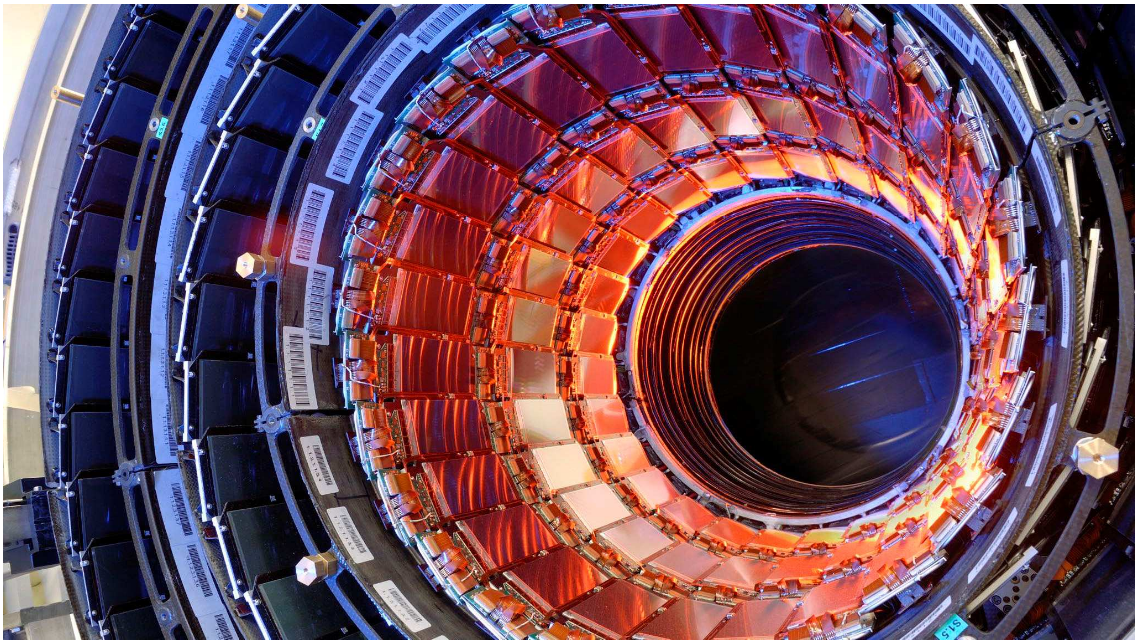
To establish this production line of particles, all of the accelerator's systems must be perfectly adjusted. The LHC is an extremely complex machine comprising thousands of subsystems and it takes weeks to adjust them all.

The first particles circulated on 29 April 2017 and, soon after, the operators started work on their long list of adjustments. They tested the radiofrequency system, which accelerates the particles. They brought the beam energy up to its operating value of 6.5 TeV. They tested the beam dump system, which ejects the particles into a block of graphite if required. They tested and aligned all the collimators – jaw-like devices that close around the beam to absorb stray particles. They carried out proton bunch ramp and squeeze cycles. Finally, they performed fine adjustments of the hundreds of corrector magnets, adjusting the trajectory of the beam to a precision of one micron at the collision points.

Last Wednesday, they started to collide the beams to be able to adjust the interaction points at the heart of the experiments. This step is carried out with so-called "pilot" beams, containing fewer than ten bunches and fewer protons than during the physics runs. These first collisions also allow the experiments to adjust their detectors.

In the coming days, the operators will continue to adjust and align the equipment. Once all of these steps are complete, they will be able to announce "stable beams", the long-awaited signal for the start of the new data-taking season for the experiments. [8]

Physicists Warming Up the LHC Accidentally Create a Rainbow Universe



After two years of extensive upgrades, the Large Hadron Collider was warming up on March 21 for another round of experiments when a circuit controlling one of its massive magnets shorted out. Dismayed, scientists began repairing the equipment, hoping for a short delay. Just yesterday, CERN announced that the LHC could restart within days.

Then the unexpected happened. As physicists were testing the repairs by zipping a few spare protons around the 17 mile loop, the CMS detector picked up something unusual. The team feverishly pored over the data, and ultimately came to an unlikely conclusion—in their tests, they had accidentally created a rainbow universe.

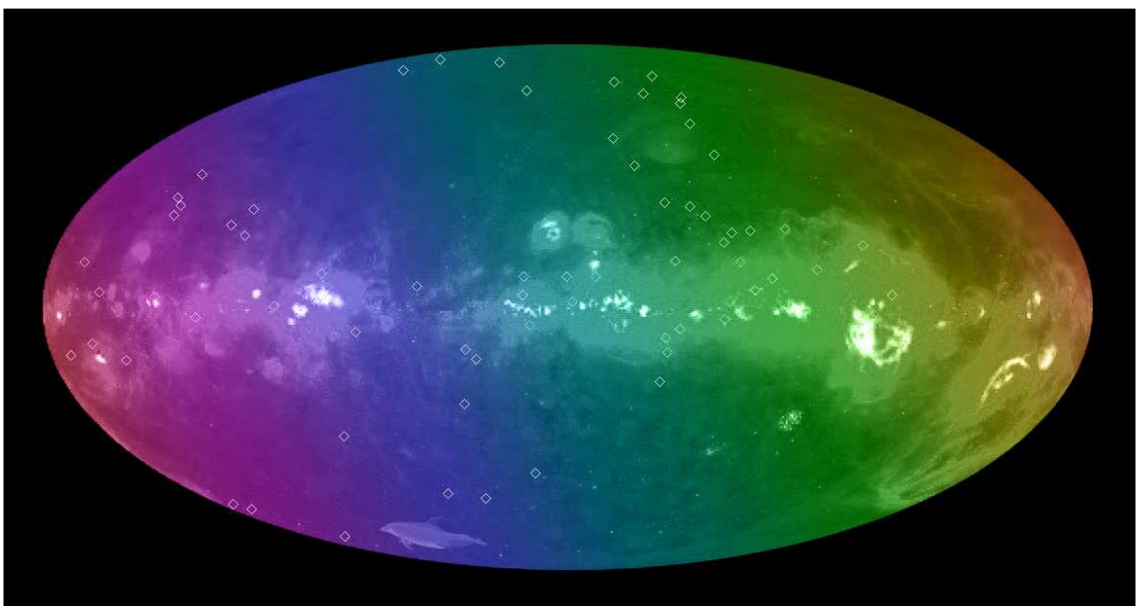
“Rainbow universes were pure speculation before this happened,” said Jessica Czerniski, the CERN physicist who was overseeing the warm-up procedures. “We had some solid math backing us up, of course, but none of us ever dreamed we would live to see this day.”

First proposed back in the early 2000s, the theory of rainbow gravity posits that different wavelengths of light are affected by gravity in different ways. Rainbow universes are thought to be a natural result of rainbow gravity, but with the peculiar qualities of not having distinct beginnings. In other words, rainbow universes have been around since forever, which has physicists stumped over the “creation” at the LHC.

“When I first saw the paper posted on the arXiv [a site for scholarly publications], I almost spit out my coffee,” said Randall Pattinson, a professor of physics at the Princeton University. “Rainbow gravity has some real physics behind it, but actually seeing evidence of it? It’s like finding an original edition Lisa Frank Trapper Keeper that your daughter wanted for her birthday. It’s almost too good to be true.”

Technicians close to the CMS detector reported hearing a loud noise, something of a cross between screeching metal and tearing cloth. In a thick haze that hung over the magnet, initially thought to be smoke from the short circuit, they saw a shimmering halo that spanned the full spectrum of visible light which vanished after a few seconds. Scientists studying the CMS data later confirmed the anomaly lasted for about 2.6 seconds.

Czerniski and her team would like to repeat the conditions that led to the appearance of the rainbow universe, though only after carefully analyzing the current CMS data. “We’d like to ensure that there aren’t any unanticipated consequences from attempting to create a more stable version of the rainbow universe,” she said, acknowledging that CERN is aware of the public’s concerns over its experiments. (When the LHC was first started, some people feared the powerful accelerator would create a black hole here on Earth.)



A visualization of the data captured by the CMS detector

Among the curiosities Czerniski and her colleagues need to sort out is an artifact in the data that, when recreated in three-dimensions, appears to be the ghostly outline of a dolphin. At first they thought it was merely the computer’s desktop wallpaper bleeding through a transparent window, but after confirming the terminal’s settings, they dove deeper into the data. Subsequent analysis suggested the apparition is real as it registered at five sigma. [7]

No Big Bang? Quantum equation predicts universe has no beginning

The widely accepted age of the universe, as estimated by general relativity, is 13.8 billion years. In the beginning, everything in existence is thought to have occupied a single infinitely dense point, or singularity. Only after this point began to expand in a "Big Bang" did the universe officially begin.

Although the Big Bang singularity arises directly and unavoidably from the mathematics of general relativity, some scientists see it as problematic because the math can explain only what happened immediately after—not at or before—the singularity.

"The Big Bang singularity is the most serious problem of general relativity because the laws of physics appear to break down there," Ahmed Farag Ali at Benha University and the Zewail City of Science and Technology, both in Egypt, told Phys.org.

Ali and coauthor Saurya Das at the University of Lethbridge in Alberta, Canada, have shown in a paper published in Physics Letters B that the Big Bang singularity can be resolved by their new model in which the universe has no beginning and no end.

Old ideas revisited

The physicists emphasize that their quantum correction terms are not applied ad hoc in an attempt to specifically eliminate the Big Bang singularity. Their work is based on ideas by the theoretical physicist David Bohm, who is also known for his contributions to the philosophy of physics. Starting in the 1950s, Bohm explored replacing classical geodesics (the shortest path between two points on a curved surface) with quantum trajectories.

Using the quantum-corrected Raychaudhuri equation, Ali and Das derived quantum-corrected Friedmann equations, which describe the expansion and evolution of universe (including the Big Bang) within the context of general relativity. Although it's not a true theory of quantum gravity, the model does contain elements from both quantum theory and general relativity. Ali and Das also expect their results to hold even if and when a full theory of quantum gravity is formulated.

No singularities, nor dark stuff

In addition to not predicting a Big Bang singularity, the new model does not predict a "big crunch" singularity, either. In general relativity, one possible fate of the universe is that it starts to shrink until it collapses in on itself in a big crunch and becomes an infinitely dense point once again.

Ali and Das explain in their paper that their model avoids singularities because of a key difference between classical geodesics and Bohmian trajectories. Classical geodesics eventually cross each other, and the points at which they converge are singularities. In contrast, Bohmian trajectories never cross each other, so singularities do not appear in the equations.

In cosmological terms, the scientists explain that the quantum corrections can be thought of as a cosmological constant term (without the need for dark energy) and a radiation term. These terms keep the universe at a finite size, and therefore give it an infinite age. The terms also make predictions that agree closely with current observations of the cosmological constant and density of the universe.

New gravity particle

In physical terms, the model describes the universe as being filled with a quantum fluid. The scientists propose that this fluid might be composed of gravitons—hypothetical massless particles that mediate the force of gravity. If they exist, gravitons are thought to play a key role in a theory of quantum gravity.

In a related paper, Das and another collaborator, Rajat Bhaduri of McMaster University, Canada, have lent further credence to this model. They show that gravitons can form a Bose-Einstein condensate (named after Einstein and another Indian physicist, Satyendranath Bose) at temperatures that were present in the universe at all epochs. [6]

The Big Bang

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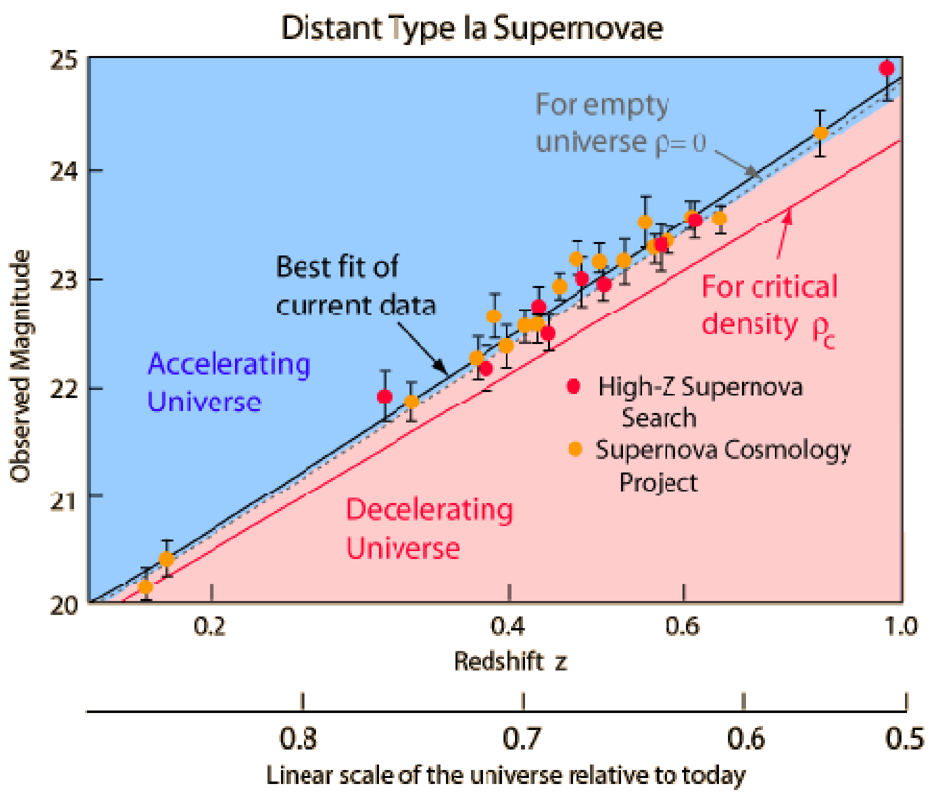
The positive and negative charged currents attracts each other or by the magnetic forces or by the much stronger electrostatic forces!?
The gravitational force attracting the matter, causing concentration of the matter in a small space and leaving much space with low matter concentration: dark matter 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.

Evidence for an accelerating universe

One of the observational foundations for the big bang model of cosmology was the observed expansion of the universe. [4] Measurement of the expansion rate is a critical part of the study, and it has been found that the expansion rate is very nearly "flat". That is, the universe is very close to the critical density, above which it would slow down and collapse inward toward a future "big crunch". One of the great challenges of astronomy and astrophysics is distance measurement over the vast distances of the universe. Since the 1990s it has become apparent that type Ia supernovae offer a unique opportunity for the consistent measurement of distance out to perhaps 1000 Mpc. Measurement at these great distances provided the first data to suggest that the expansion rate of the universe is actually accelerating. That acceleration implies an energy density that acts in opposition to gravity which would cause the expansion to accelerate. This is an energy density which we have not directly detected observationally and it has been given the name "dark energy".

The type Ia supernova evidence for an accelerated universe has been discussed by Perlmutter and the diagram below follows his illustration in Physics Today.



The data summarized in the illustration above involve the measurement of the redshifts of the distant supernovae. The observed magnitudes are plotted against the redshift parameter z. Note that there are a number of Type 1a supernovae around z=.6, which with a Hubble constant of 71 km/s/mpc is a distance of about 5 billion light years.

Equation

The cosmological constant Λ appears in Einstein's field equation [5] in the form of

$$R_{\mu\nu} - \frac{1}{2}R\,g_{\mu\nu} + \Lambda\,g_{\mu\nu} = \frac{8\pi G}{c^4}T_{\mu\nu},$$

where R and g describe the structure of spacetime, T pertains to matter and energy affecting that structure, and G and c are conversion factors that arise from using traditional units of measurement. When Λ is zero, this reduces to the original field equation of general relativity. When T is zero, the field equation describes empty space (the vacuum).

The cosmological constant has the same effect as an intrinsic energy density of the vacuum, ρ_{vac} (and an associated pressure). In this context it is commonly moved onto the right-hand side of the equation, and defined with a proportionality factor of 8π: $\Lambda = 8\pi\rho_{\text{vac}}$, where unit conventions of general relativity are used (otherwise factors of G and c would also appear). It is common to quote values of energy density directly, though still using the name "cosmological constant".

A positive vacuum energy density resulting from a cosmological constant implies a negative pressure, and vice versa. If the energy density is positive, the associated negative pressure will drive an accelerated expansion of the universe, as observed. (See dark energy and cosmic inflation for details.)

Explanatory models

Models attempting to explain accelerating expansion include some form of dark energy, dark fluid or phantom energy. The most important property of dark energy is that it has negative pressure which is distributed relatively homogeneously in space. The simplest explanation for dark energy is that it is a cosmological constant or vacuum energy; this leads to the Lambda-CDM model, which is generally known as the Standard Model of Cosmology as of 2003-2013, since it is the simplest model in good agreement with a variety of recent observations.

Lorentz transformation of the Special Relativity

In the referential frame of the accelerating electrons the charge density lowering linearly because of the linearly growing way they takes every next time period. From the referential frame of the wire there is a parabolic charge density lowering.

The difference between these two referential frames, namely the referential frame of the wire and the referential frame of the moving electrons gives the relativistic effect. Important to say that the moving electrons presenting the time coordinate, since the electrons are taking linearly increasing way every next time period, and the wire presenting the geometric coordinate. The Lorentz transformations are based on moving light sources of the Michelson - Morley experiment giving a practical method to transform time and geometric coordinates without explaining the source of this mystery.

The real mystery is that the accelerating charges are maintaining the accelerating force with their charge distribution locally. The resolution of this mystery that the charges are simply the results of the diffraction patterns, that is the charges and the electric field are two sides of the same thing. Otherwise the charges could exceed the velocity of the electromagnetic field.

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 Classical Relativistic effect

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.

Electromagnetic inertia and Gravitational attraction

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.

It looks clear that the growing acceleration results the relativistic growing mass - limited also with the velocity of the electromagnetic wave.

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.

If the mass is electromagnetic, then the gravitation is also electromagnetic effect caused by the accelerating Universe! The same charges would attract each other if they are moving parallel by the magnetic effect.

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.

Electromagnetic inertia and mass

Electromagnetic Induction

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Relativistic change of mass

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The frequency dependence of mass

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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. [1]

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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.

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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. [2]

Conclusions

Should the CERN team be successful in creating another rainbow universe, proof of a rainbow gravity could force physicists to rethink the origins of the universe—the Big Bang theory, for example, would likely be thrown out. But such a confirmation could also finally bridge general relativity with quantum mechanics. [7]

Motivated by the model's potential to resolve the Big Bang singularity and account for dark matter and dark energy, the physicists plan to analyze their model more rigorously in the future. Their future work includes redoing their study while taking into account small inhomogeneous and anisotropic perturbations, but they do not expect small perturbations to significantly affect the results. "It is satisfying to note that such straightforward corrections can potentially resolve so many issues at once," Das said. [6]

The accelerating Universe fits into the accelerating charges of the electric currents, because the Bing Bang caused radial moving of the matter.

Needless to say that the accelerating electrons of the steady stationary current are a simple demystification of the magnetic field, by creating a decreasing charge distribution along the wire, maintaining the decreasing U potential and creating the **A** vector potential experienced by the electrons moving by **v** velocity relative to the wire. This way it is easier to understand also the time dependent changes of the electric current and the electromagnetic waves as the resulting fields moving by c velocity.

It could be possible something very important law of the nature behind the self maintaining **E** accelerating force by the accelerated electrons. The accelerated electrons created electromagnetic fields are so natural that they occur as electromagnetic waves traveling with velocity c. It shows that the electric charges are the result of the electromagnetic waves diffraction.

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.

The electric currents causing self maintaining electric potential is the source of the special and general relativistic effects. The Higgs Field is the result of the electromagnetic induction. The Graviton is two photons together. [3]

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