

Holography, Higgs Field and Quantum Gravity

The gravity of a black hole swallows the matter around it. The link between tensor networks and quantum entanglement may prove useful in studying the physics of black holes, some physicists propose. [5]

The magnetic induction creates a negative electric field, causing an electromagnetic inertia responsible for the relativistic mass change; it is the mysterious Higgs Field giving mass to the particles. The Planck Distribution Law of the electromagnetic oscillators explains the electron/proton mass rate by the diffraction patterns. The accelerating charges 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 self maintained electric potential of the accelerating charges equivalent with the General Relativity space-time curvature, and since it is true on the quantum level also, gives the base of the Quantum Gravity.

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Preface

Popular questions about the Higgs Field:

- 1.) If the Higgs field is responsible for imbuing particles with mass, and mass is responsible for gravity, is it possible that the Higgs field will provide the missing link between general relativity and quantum mechanics i.e. could the Higgs field be the basis of a quantum theory of gravity?
- 2.) Can the theoretical Higgs Field be used as the “cause” of relativistic momentum or relativistic kinetic energy of a moving body?
- 3.) Does Einstein's General Relativity need to be adjusted for the Higgs field?
- 4.) Since the Higgs field gives most particles mass, and permeates all space, then GR needs the Higgs field to be a theory of space?
- 5.) So where GR is highly curved, the Higgs field is also curved? And does a highly curved Higgs field affect the way particles acquire mass? For that matter, a curved space-time would also curve electromagnetic field?

How can we answer these questions?

There is an explanation of the magnetic effect caused by the electric current from the observed effects of the accelerating electrons, causing naturally the experienced changes of the electric field potential along the electric wire. 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). 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]

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. 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. [2]

Holography entangles quantum physics with gravity

If you want to understand gravity, it makes sense to study black holes. Nowhere else can you find so much gravity so conveniently compacted into such a relatively small space.

In a way, in fact, black holes are nothing but gravity. As Einstein showed, gravity is just the warping of spacetime, and black holes are big spacetime sinks. All the matter falling in gets homogenized into nothingness, leaving behind nothing but warped spacetime geometry.

As black holes swallow more matter, they get bigger, of course. But curiously, it's the black hole's surface area, not its volume, that expands in proportion to how much stuff the black hole consumes. In some way, the black hole's event horizon — the spherical boundary demarcating the points of no return for objects falling in — keeps a record of how much a black hole has eaten. More technically, a black hole's surface area depends on its entropy, as John Archibald Wheeler's student Jacob Bekenstein showed in the 1970s.

In the 1990s, other physicists (notably Gerard 't Hooft and Leonard Susskind) developed this insight further, proposing the "holographic principle": Information contained in a three-dimensional volume can be completely described by the two-dimensional boundary surrounding it. Just as an ordinary holographic image represents a 3-D scene on a 2-D flat surface, nature itself can store information about the interior of a region of space on the surface enclosing it.

If you think about it, it's not entirely crazy. There are familiar ways that the information in a 3-D space can be contained on its boundaries. Just imagine a room full of 3-D objects with mirrors on the walls. You can reconstruct everything in the 3-D room from the images on the 2-D mirrors.

In 1995, physicist Juan Maldacena developed the holographic idea further. In essence, he showed that quantum math describing physics in three spatial dimensions without gravity can be equivalent to math describing a four-dimensional space with gravity. (Such an equivalence of two different mathematical descriptions is called a duality.)

Maldacena's insight suggested that holography might be the key to merging gravity with quantum mechanics. Physicists have sought a way to incorporate gravity into a quantum field theory for decades. If Maldacena is right, then apparently all you need is an extra dimension of space (which is provided naturally in superstring theory). Given an added dimension, spacetime with gravity emerges from the physics described by quantum field theory on its boundary.

Lately this idea has resurfaced in a new context. Some physicists have proposed that gravity has something to do with quantum entanglement — the spooky connection between distant particles that befuddled Einstein. And it seems that the holographic duality identified by Maldacena has something to do with the gravity-entanglement connection.

“The emergence of spacetime in the gravity picture is intimately related to the quantum entanglement ... in the corresponding conventional quantum system,” Mark Van Raamsdonk of the University of British Columbia argued in a 2010 paper. “It is fascinating that the intrinsically quantum phenomenon of entanglement appears to be crucial for the emergence of classical spacetime geometry.”

More recent work relates the gravity-entanglement link to mathematical tools called tensors. Describing entanglement in complicated systems of many particles is made easier by using networks of tensors to quantify how multiple particles are entangled. Using tensor networks, physicists have developed algorithms that enable simpler analysis of quantum matter such as superconductors. That work has been going on for years. Newer work with tensor networks has provided insights into how the holographic principle relates entanglement to gravity.

“It looks like important physical objects, such as curved space-times ... emerge naturally from entanglement in tensor network states via holography,” writes physicist Román Orús of Johannes Gutenberg University in Germany.

In particular, a formulation of tensor networks called MERA (for multi-scale entanglement renormalization ansatz) seems especially promising with respect to understanding gravity. MERA tensor networks describe patterns of entanglement in certain complicated quantum systems, generating a geometry reminiscent of the extra-dimensional space that Maldacena discussed in his duality. In other words, it’s a real-life realization of the quantum field theory-gravity duality.

“When seen from this perspective,” writes Orús, “one would say that geometry (and gravity) seems to emerge from local patterns of entanglement in quantum many-body states.” Thus, he points out, the tensor network approach supports the conclusion suggested in previous work by Raamsdonk and others: “Gravitational spacetime emerges from quantum entanglement.”

This link between tensor networks, entanglement and gravity may prove useful in studying the physics of black holes or in investigating the quantum nature of spacetime at very small distances, Orús proposes.

Mathematical details of how tensor networks connect entanglement to the geometry of spacetime are beyond the scope of basic blogging. If you want the whole story of Hilbert space, entanglement renormalization and unitary and isometric tensors, start with Harvard physicist Brian Swingle’s 2012 paper in Physical Review D. (A preprint is available, and a paper with further developments is available here.) Orús has posted a more recent (and more accessible) survey of the field.

In that paper he points out that much of the current progress in tensor networks owes its impetus to the development of quantum information theory, the hot topic of the 2000s. “As for today, one could perhaps talk about a new ‘quantum gravity era’ of tensor networks that is just starting,” he writes. “The future looks certainly very exciting.” [5]

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. [1]

The Relativistic Quantum Mechanics

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.

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.

The Heisenberg Uncertainty Relation

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.

The General Relativity - 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. [2]

Electron - Proton mass rate

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. In the maximum intensity no diffraction patterns with equal intensity that is no fermions only bosons. 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 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.

In Quantum Field Theory (QFT), particles are described by excitations of a quantum field that satisfies the appropriate quantum mechanical field equations.

The excitations of the quantum field mean diffraction patterns in my theory. [2]

Higgs Field

The Higgs mechanism is a result of something called a field that extends throughout space, even where no particles are present. This notion is probably most familiar to you from a magnetic field. You feel a force between a magnet and your refrigerator even when “nothing” is there. A field can fill “empty” space. The Higgs field extends throughout space. Elementary particles acquire their masses by interacting with this field. It is kind of like space is charged and particles get mass through their interactions with this charge.

The Higgs boson is not directly responsible for mass. The Higgs field is. The boson is a particle that tells us our understanding of this mechanism is correct. It also is a big clue as to where that field came from in the first place. Its discovery tells us that what we expected to be true was indeed correct, and it gives us clues as to what else might underlie the Standard Model. [4]

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.

In my opinion, the best explanation of the Higgs mechanism for a lay audience is the one invented by David Miller. You can find it here: <http://www.strings.ph.qmul.ac.uk/~jmc/epp/higgs3.html> .

The field must come first. The boson is an excitation of the field. So no field, no excitation. On the other hand in quantum field theory it is difficult to separate the field and the excitations.

The Higgs field is what gives particles their mass.

There is a video that gives an idea as to the Higgs field and the boson. It is here:

<http://www.youtube.com/watch?v=RIg1Vh7uPyw> . Note that this analogy isn't as good as the Miller one, but as is usually the case, if you look at all the analogies you'll get the best understanding of the situation.

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 Weak Interaction

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

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.

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 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

This link between tensor networks, entanglement and gravity may prove useful in studying the physics of black holes or in investigating the quantum nature of spacetime at very small distances, Orús proposes. [5]

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.

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