Equivalence Principle of Microgravity

According to Albert Einstein's theory of relativity, all bodies in a vacuum regardless of their properties are accelerated by the Earth's gravity at the same rate. This principle of equivalence applies to stones, feathers and atoms alike. Under the conditions of microgravity very long and precise measurements can be carried out to determine whether different atoms of different mass actually "fall equally fast". [5]

We can show that the Equivalence Principle is based on the Electromagnetic Force. The changing acceleration of the electrons explains the created negative electric field of the magnetic induction, the electromagnetic inertia, the changing relativistic mass and the Gravitational Force, giving a Unified Theory of the physical forces. Taking into account the Planck Distribution Law of the electromagnetic oscillators also, we can explain the electron/proton mass rate and the Weak and Strong Interactions.

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Preface

Today the most popular enigma is the gravitational force after founding the Higgs boson experimentally. Although the graviton until now is a theoretical particle, its existence is a necessary basis of the Quantum Gravitation and the Theory of Everything.

The electromagnetic origin of mass gives an explanation of the inertia, the relativistic change of mass and also the gravitational force.

Equivalence Principle

In the physics of general relativity, the equivalence principle is any of several related concepts dealing with the equivalence of gravitational and inertial mass, and to Albert Einstein's observation that the gravitational "force" as experienced locally while standing on a massive body (such as the Earth) is actually the same as the pseudo-force experienced by an observer in a non-inertial (accelerated) frame of reference. [4]

Einstein put to the test with two precision laser experiments in space

For the first precision measurements in space with cold atoms, potassium and rubidium are suitable candidates. In preparation for the measurements two experiments were conducted at the same time onboard a sounding rocket launched from Kiruna, Sweden, on January 23. Preliminary analysis of the data shows that the campaign was successful. The Humboldt Universität zu Berlin (HU) and the Ferdinand-Braun-Institut, Leibniz-Institut fuer Hoechstfre-quenztechnik (FBH) test modern laser technologies within the framework of the projects KALEXUS and FOKUS. The demanding technology demonstrators lay the foundations for the precision tests of the equivalence principle with so-called potassium and rubidium atom interferometers as well as for further experiments aiming at tests of Einstein's theory of relativity. Researchers are hoping that eventually these experiments will provide the information needed to address one of the greatest challenges of modern physics: The unification of gravity with three other fundamental interactions into one comprehensive theory.

Laser experiments with potassium and rubidium atoms: KALEXUS and FOKUS

A stable laser system for the manipulation of potassium atoms was set up in the project KALEXUS under the guidance of the Optical Metrology group at HU. The centerpiece consists of two micro integrated semiconductor laser modules developed by FBH. In KALEXUS the wavelength of these laser modules is matched to an atomic transition of potassium. During the six-minute period of microgravity the experiment automatically stabilizes the wave-length of both lasers. In addition, the laser system can autonomously switch back and forth between the laser sources during flight. After all, such experiments are not easy to repeat, and scientists cannot take corrective action during the flight. Moreover, the measurements may not be compromised if one of the lasers should fail.

Another laser module designed by FBH and assembled by HU took part in the FOKUS cam-paign, which is managed by Menlo Systems. A laser was stabilized to an atomic transition of rubidium in order to demonstrate the technological maturity of corresponding technology for subsequent drop

tests of atoms under microgravity conditions. The laser system also allows for clock comparisons. Here, the frequency of an "optical oscillator", the laser, is compared to the frequency of a quartz oscillator that "ticks" in the radio frequency range, like a modern wristwatch. The general theory of relativity presumes that the "ticking" of all clocks is affected by gravity in the same way, regardless of how these clocks are implemented physically and technically. An initial test in April 2015 confirmed the suitability of such "atomic clocks" and of the laser systems required to test the general theory of relativity in space. The goal is now to confirm the initial results after some technical improvements have been applied to the sys-tem.

Two applications of technology in direct comparison

The two experiments use different types of lasers from the FBH. This allows a comparison of the different laser technologies for the application scenario. The centerpiece of the FOKUS module is a DFB (Distributed Feedback) laser, which emits light in a narrow frequency or wavelength range at 780 nm. This spectrally narrow bandwidth is one of the key requirements for the laser module, which is used for the spectroscopy of rubidium atoms and thus for precision measurements.

KALEXUS uses an ECDL concept (Extended Cavity Diode Laser), which thanks to an external grating, provides an even narrower linewidth. The laser is optimized for spectroscopic measurements with potassium atoms and emits at a wavelength of 767 nm. However, the external grating makes it potentially more prone to malfunction - as opposed to the monolithic structure of the FOKUS laser. Ultimately, the palm-sized modules have to withstand the mechanical loads during rocket launch with accelerations of up to 15 times the acceleration of gravity and have to function trouble-free in space. [5]

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 $\boldsymbol{E = h\nu}$ and $\boldsymbol{E = mc^2}$, $\boldsymbol{m = h\nu / c^2}$ that is the $\boldsymbol{m}$ depends only on the $\boldsymbol{\nu}$ 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 $\boldsymbol{m_o}$ 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.

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]

The Gravitational force

The gravitational attractive force is basically a magnetic force.

The same electric charges can attract one another by the magnetic force if they are moving parallel in the same direction. Since the electrically neutral matter is composed of negative and positive charges they need 2 photons to mediate this attractive force, one per charges. The Bing Bang caused parallel moving of the matter gives this magnetic force, experienced as gravitational force.

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

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

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

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

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

The Graviton

In physics, the graviton is a hypothetical elementary particle that mediates the force of gravitation in the framework of quantum field theory. If it exists, the graviton is expected to be massless (because

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

The 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.

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.

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.

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