ATLAS Experiment for Supersymmetry

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Higgs boson decaying into bottom quarks. Now, scientists are tackling its relationship with the top quark. [9]

Usha Mallik and her team used a grant from the U.S. Department of Energy to help build a sub-detector at the Large Hadron Collider, the world's largest and most powerful particle accelerator, located in Switzerland. They're running experiments on the sub-detector to search for a pair of bottom quarks— subatomic yin-and-yang particles that should be produced about 60 percent of the time a Higgs boson decays. [8]

A new way of measuring how the Higgs boson couples to other fundamental particles has been proposed by physicists in France, Israel and the US. Their technique would involve comparing the spectra of several different isotopes of the same atom to see how the Higgs force between the atom's electrons and its nucleus affects the atomic energy levels. [7]

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. The diffraction patterns and the locality of the self-maintaining electromagnetic potential explains also the Quantum Entanglement, giving it as a natural part of the relativistic quantum theory.

Contents

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Preface

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]

ATLAS experiment searches for natural supersymmetry using novel techniques

In new results presented at CERN, the ATLAS Experiment's search for supersymmetry (SUSY) reached new levels of sensitivity. The results examine a popular SUSY extension studied at the Large

Hadron Collider (LHC): the "Minimal Supersymmetric Standard Model" (MSSM), which includes the minimum required number of new particles and interactions to make predictions at the LHC energies. However, even this minimal model introduces a large amount of new parameters (masses and other properties of the new particles), whose values are not predicted by the theory (free parameters).

To frame their search, ATLAS physicists look for "natural" SUSY, which assumes the various corrections to the Higgs mass comparable in magnitude and their sum close to the electroweak scale (v ~ 246 GeV). Under this paradigm, the supersymmetric partners of the third-generation quarks ("top and bottom squarks") and gluons ("gluinos") could have masses close to the TeV scale, and would be produced through the strong interaction at rates large enough to be observed at the LHC.

In a recent CERN LHC seminar, the ATLAS Collaboration presented new results in the search for natural SUSY, including searches for top squarks and gluinos using the full LHC Run-2 dataset collected between 2015 and 2018. The new results explore previously uncovered, challenging regions of the free parameter space. This is achieved thanks to new analysis techniques improving the identification of low-energy ("soft") and high-energy ("boosted") particles in the final state.

ATLAS' search for top squarks was performed by selecting proton–proton collisions containing up to one electron or muon. For top-squark masses less than the top-quark mass of 173 GeV (see Figure 1), the resulting decay products tend to be soft and therefore difficult to identify. Physicists developed new techniques based on charged-particle tracking to better identify these decay products, thus significantly improving the experimental sensitivity. For larger top-squark masses, the decay products are boosted, resulting in high-energy, close-by decay products. Physicists improved the search in this regime by using, among other techniques, more precise estimates of the statistical significance of the missing transverse momentum in a collision event.

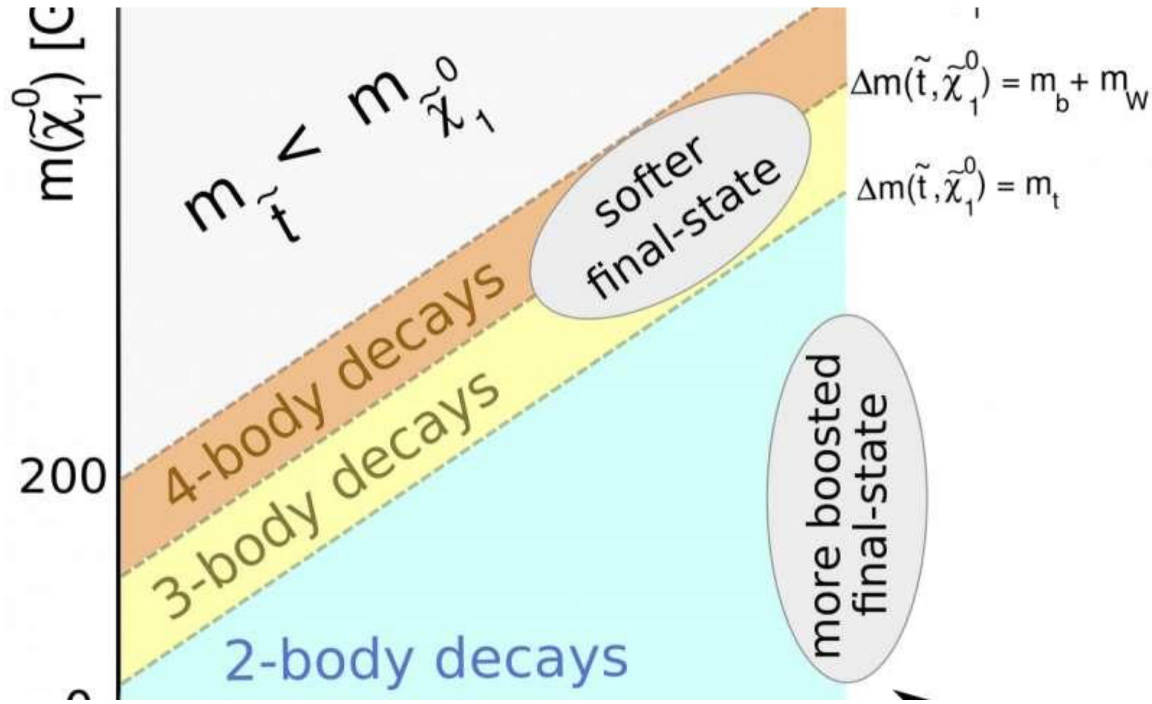


Figure 1: Schematic representation of the various topologies of top-squark decays in the scenarios presented at today's seminar (see link in footer). The region where the top-squark is lighter than the neutralino is not allowed in the models considered. Credit: ATLAS Collaboration/CERN

The new search for gluinos looks at events containing eight or more "jets"—collimated sprays of hadrons—and missing transverse momentum generated by the production of stable neutralinos in the gluino decays, which, similar to neutrinos, are not directly detected by ATLAS. Physicists employed new reconstruction techniques to improve the energy resolution of the jets and the missing transverse momentum, allowing them to better separate the putative signal from background processes. These take advantage of "particle-flow" jet algorithms that combine information from both the tracking detector and the calorimeter system.

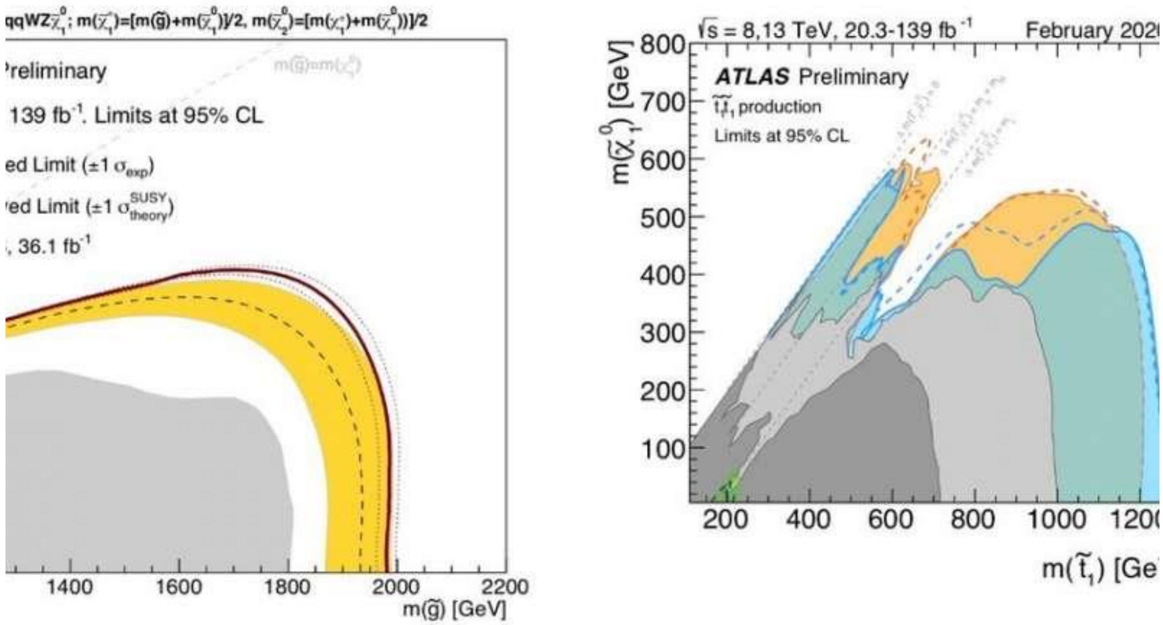


Figure 2: Updated exclusion limits on (left) gluino and (right) top-squark production including the new results presented by ATLAS at the CERN LHC seminar today. Credit: ATLAS Collaboration/CERN

ATLAS physicists also optimised their event-selection criteria to enhance the contribution of possible SUSY signals compared to the Standard Model background processes. No excess was observed in the data. The results were used to derive exclusion limits on MSSM-inspired simplified models in terms of gluino, top-squark and neutralino masses (see Figure 2).

The new analyses significantly extend the sensitivity of the searches and further constrain the available parameter space for natural SUSY. The exclusion of heavy top squarks is extended from 1 to 1.25 TeV. The search continues. [12]

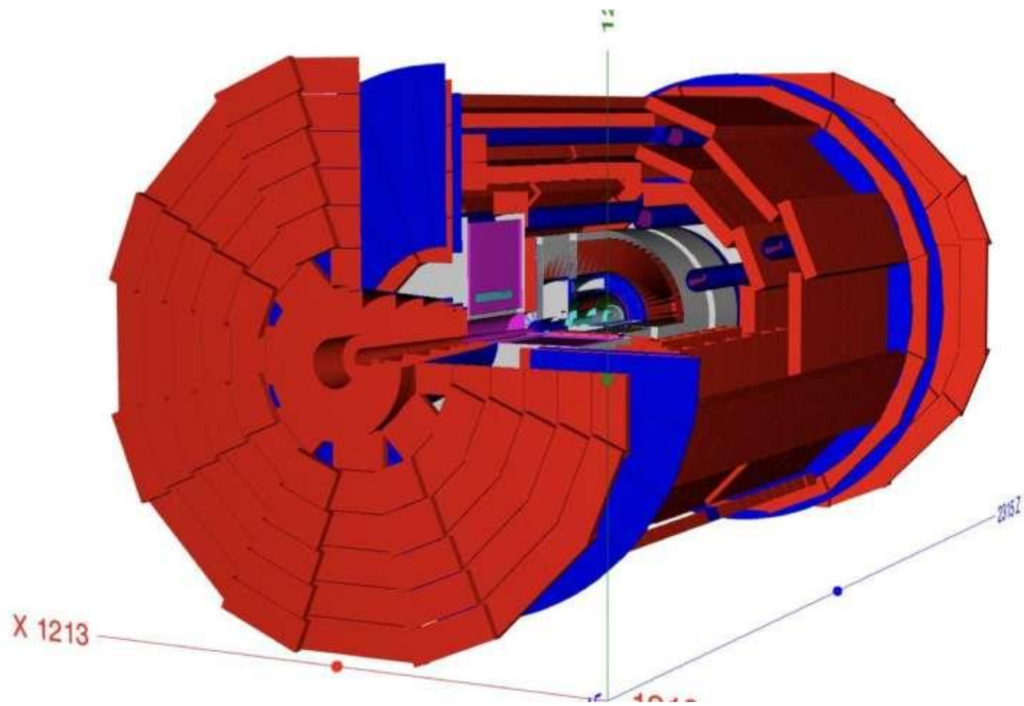
ATLAS Experiment releases 13 TeV LHC open data for science education

The ATLAS Collaboration at CERN has just released the first open dataset from the Large Hadron Collider's (LHC) highest-energy run at 13 teraelectronvolts (TeV). The new release is specially developed for science education, underlining the collaboration's longstanding commitment to students and teachers using open-access ATLAS data and related tools.

"The ATLAS Collaboration is proud to make public these data for advanced learning," says Karl Jakobs, ATLAS spokesperson. "Our high-energy collision open data, recorded during the second run of the LHC, provide insight into the real world of particle-physics analysis. Students, scholars and interested people will be able to reproduce ATLAS physics results in a fully realistic manner, understanding for themselves the fascinating study of nature at its deepest level."

The ATLAS Collaboration makes public 10 inverse femtobarns (fb^{-1}) of the 13 TeV data. For context, this corresponds to about 1 quadrillion proton-proton collisions (that's 1 followed by 15 zeros), or 500,000 produced Higgs bosons. It is also approximately the same amount of data that the ATLAS Collaboration used to discover the Higgs boson in 2012. Explore ATLAS Open Data using the software and tools available here, or on the CERN Open Data Portal.

Alongside impressive new open datasets, the ATLAS Collaboration has also released new simulated datasets, web-based and offline analysis software, as well as extensive documentation and tutorials. "These are the tools of a particle physicist's trade, allowing us to go from data-taking to physics measurements and eventually discovery," says Arturo Sánchez Pineda, co-leader of the ATLAS Open Data team (University of Udine, ICTP and INFN, Italy). "Simulated datasets allow physicists to compare theory with real data. They are based on theoretical models of the expected physics processes taking place in the collisions, together with a detailed description of the ATLAS detector. By providing such resources, we hope to empower students, professors and dedicated self-learners worldwide to learn and teach experimental particle physics, as well as the computer science behind the field."



Animation of ATLAS detector using ROOTJS. Credit: CERN

"Do-it-yourself discoveries"

One of the most exciting features of the new ATLAS Open Data release is its ability to put learners in the role of the discoverer. "For the first time, students will be able to 're-discover' the Higgs boson (in three different decay channels) and can even search through the data for physics beyond the Standard Model, such as dark matter," explains Kate Shaw, co-leader of the ATLAS Open Data team (University of Sussex, U.K.). "These new avenues for study will greatly enhance understanding of the experimental side of data analysis—a particular advantage for budding researchers."

The ATLAS Open Data team worked closely with students and teachers during the development, carefully curating the release to ensure that students get the best educational experience straight out of the box. "We wanted to build upon our experience with the 8 TeV open data release by providing more complex physics analyses for study and shortening the required setup process," says Leonid Serkin of the ATLAS Open Data team (University of Udine, ICTP and INFN, Italy). "This time, students can access the datasets, write analysis code and begin producing results within minutes with the help of cloud computing and tools such as the CERN ROOT analysis framework. The millions of independent 13 TeV collision events can thus be analysed from almost any commercial computer."

Enriching global physics education

Every year, hundreds of students on every continent explore ATLAS Open Data as part of their curriculum. Their scope can range from one-day high-school projects to in-depth analyses for their Master's thesis.

For example, at the University of Montréal, Canada, Jean-François Arguin uses ATLAS Open Data to reproduce a more realistic research environment for his second-year undergraduate students. "It makes a welcome change from learning from books, which is how physics is traditionally taught," he explains. "Using ATLAS Open Data, the students spend three weeks recreating the major particle discoveries of the late 20th century: the Z boson, W boson and top quark. The process develops their skills as researchers, which are not always correlated to the ones they develop through traditional courses."

Preparing students for research work is also an important part of Lund University's (Sweden) program. There, Else Lytken and Caterina Doglioni divide their undergraduate students into mini-analysis groups, each focusing on one ATLAS Open Data analysis. "An important part of this course is the reconstruction and identification of particles, as well as the understanding of analysis strategies," says Lytken. "ATLAS Open Data plays a key role in introducing students to these concepts while letting them feel like a physicist."

Now, students and teachers turn their eyes to the possibilities of 13 TeV. "The students can't wait to get their hands on a Higgs boson," adds Doglioni. "It's an incredibly exciting prospect: to follow the steps of that famed discovery, using real data from the experiment that found it."

While the world takes its first look at 13 TeV open data, the ATLAS Collaboration is already preparing its next release of educational content. Look forward to more tools, tutorials and analyses to be published this year, as the ATLAS Open Data project continues to grow. [11]

ATLAS Experiment adds more pieces to the Higgs boson puzzle

The Higgs boson was discovered in 2012 by the ATLAS and CMS Experiments at CERN, but its coupling to other particles remains a puzzle.

Fortunately, the LHC provides many windows into measuring Higgs boson couplings. There are four main ways to produce the Higgs boson: through the fusion of two gluon particles (gluon-fusion, or ggF), through the fusion of weak vector bosons (VBF), or in association with a W or Z boson (VH), or one or more top quarks (ttH+tH). There are also five main channels in which Higgs bosons can decay: into pairs of photons, W or Z bosons, tau leptons or b quarks. Each of these processes brings unique insights into the Higgs boson properties.

Thanks to the unprecedented quantities of Higgs bosons produced at the LHC, all of the above production and decay modes have now been observed. In a new result presented by the ATLAS Collaboration, using data collected through 2017, the measurements for each of these processes have reached the significance threshold of five standard deviations, beyond which their existence is considered established.

The Higgs boson yields for most of the combinations of production and decay have been measured (see figure) and have been found to agree with Standard Model predictions. The measurement of the cross sections for each production mode in proton–proton collisions at 13 TeV, assuming the decays occur as predicted by the Standard Model, are the most precise ones obtained to date.

Physicists have also begun to explore the Higgs boson puzzle in a new way. In the latest analyses, instead of counting Higgs bosons inclusively in the major production and decay modes, ATLAS physicists have measured Higgs boson topologies separately for smaller regions of phase-space: different ranges of Higgs boson transverse momentum, numbers of associated jets, and numbers and kinematic properties of associated weak bosons and top quarks. Using these smaller puzzle pieces, called "simplified template cross sections" (STXS), allows physicists to better separate the measurement process from the interpretation in terms of theoretical properties. Ultimately, it provides a finer-grained picture of Higgs boson couplings at the LHC and more stringent tests of the Standard Model.

Among the STXS regions considered in the analysis, some have already been measured with good precision at the LHC, but no deviation from the Standard Model has been observed so far. These measurements allow physicists to further enhance the sensitivity on the coupling properties of the Higgs boson to the other elementary particles. Further, they have set constraints on new physics theories – such as the "two-Higgs doublet model", which introduces additional Higgs bosons, and the hMSSM supersymmetric model – which are more stringent than those reported previously by ATLAS.

These measurements will continue to improve as more data from Run 2 and beyond are included, providing a yet-finer picture of the properties of the Higgs boson. [10]

Who gets their mass from the Higgs?

The Higgs field is like an endless ocean through which all matter swims. Some particles are like sponges and sop up mass as they lumber along, while others are as sprightly as tiny minnows and dart right through.

The Higgs theory is a beautifully simple explanation as to why some particles are massive while others are not. But not all predictions of the Higgs theory have been experimentally tested yet. That's why scientists on the CMS experiment at the Large Hadron Collider are putting the Higgs boson under a microscope and trying to determine how it fits into the delicate ecosystem of particles.

"We know that the Higgs interacts with massive force-carrying particles, like the W boson, because that's how we originally discovered it," said scientist Patty McBride from the U.S. Department of Energy's Fermi National Accelerator Laboratory, which supports the research of hundreds of U.S. scientists on the CMS experiment. "Now we're trying to understand its relationship with fermions."

Fermions are particles that click together to form the invisible scaffolding inside atoms. Bosons, on the other hand, are the physical manifestation of forces and perform tasks such as gluing fermions together.

In June 2014, scientists on the CMS experiment published a paper in *Nature* showing that the Higgs boson has a relationship with fermions by measuring the rate at which it decays into tau leptons, a heavier cousin of the electron. Later, both the CMS and ATLAS experiments found evidence of the Higgs boson decaying into bottom quarks. Now, scientists are tackling its relationship with the top quark.

"The relationship between the Higgs and the top quark is particularly interesting because the top quark is the most massive particle ever discovered," McBride said. "As the 'giver of mass,' the Higgs boson should be enormously fond of the top quark."

Because the top quark is much more massive than the Higgs boson, it's impossible for a Higgs boson to decay into a pair of top quarks. Luckily, there is another way to measure how strongly the Higgs boson couples to top quarks: looking for the rare case of simultaneous production of top quarks and a Higgs boson.

"Higgs boson production is rare – but Higgs production with top quarks is rarest of them all, amounting to only about 1 percent of the Higgs boson events produced at the LHC," said Chris Neu, a physicist at the University of Virginia who worked on this analysis.

In a paper published today in the journal *Physical Review Letters*, scientists on the CMS experiment report observing a statistically significant abundance of events in which the Higgs boson is produced in association with two top quarks. The CMS result for this rare Standard Model process with a significance of 5.2 sigma constitutes the first observation that exceeds the 5 sigma threshold physicists require. The ATLAS experiment has also submitted a paper on the same phenomenon for publication.

To get these results, the CMS experiment looked for Higgs bosons based on the numerous possible signatures it can leave behind in the detector.

"A top quark decays almost exclusively into a bottom quark and a W boson," Neu said. "The Higgs boson, on the other hand, has a rich spectrum of decay modes, including decays to pairs of bottom quarks, W bosons, tau leptons, photons and several others. This leads to a wide variety of signatures in events with two top quarks and a Higgs boson. We pursued each of these and combined the results to produce our final analysis."

Exploring the Higgs boson's relationship with the top quark further could also be a possible window to new physics, according to Fermilab Deputy Director Joe Lykken.

"Pinning down this coupling will tell us a lot about the behavior of the Higgs and how it might also interact with other particles we haven't discovered, like dark matter," Lykken said. "Deeply understanding how the Higgs interacts with known particles could help lead us to physics beyond the Standard Model." [9]

A quark like no other: Searching for 'bottom quark'

A University of Iowa physicist is at the forefront of the search for a missing particle that could prove whether the Higgs boson—believed to give mass to all matter—exists.

Usha Mallik and her team used a grant from the U.S. Department of Energy to help build a subdetector at the Large Hadron Collider, the world's largest and most powerful particle accelerator, located in Switzerland. They're running experiments on the sub-detector to search for a pair of bottom quarks—subatomic yin-and-yang particles that should be produced about 60 percent of the time a Higgs boson decays.

Evidence of these bottom quarks would confirm the existence of the Higgs boson, sometimes referred to as the "God particle." The Higgs' apparent discovery in 2012 seemed to support the Standard Model, the prevailing theory in physics about how the laws governing the universe work.

But since that find, there's been a hitch: The bottom quarks expected to arise from a Higgs boson's decay have yet to be seen, and scientists need that to happen to know for sure the Higgs, in fact, exists.

"Until we're sure whether it's a Standard Model Higgs or an imposter mixed with another kind of Higgs, we are desperate to learn what is beyond the Standard Model. The Higgs is our window beyond the Standard Model," Mallik says.

Still, the quest remains complicated: A Higgs boson is created about once in 10 trillion tries. Moreover, Higgs bosons decay into other particles almost instantly after they are produced, which makes detecting and defining their decaying constituents—such as the bottom quarks—even more challenging.

Mallik and her team hope to observe bottom quarks by following the post-collision clutter that arises from the decay of the Higgs or other new heavy particles similar to it.

"It's basically identifying, picking that needle in the haystack while not getting fooled by something else," says Mallik, who spent the past academic year at ATLAS, one of four particle detectors at the Large Hadron Collider. "That is the challenge."

Mallik, three postdoctoral researchers, a graduate student, and a software engineer from the UI have all been at ATLAS sifting through the voluminous data produced by the collisions. Their work is funded through the High Energy Physics program, part of the U.S. Department of Energy's Office of Science.

Anindya Ghosh, a first-year UI graduate student from India joined Mallik's group in 2015 after hearing her speak the year before at the Indian Institute of Technology in Madras, India. Ghosh worked with the ATLAS experiments over most of last summer.

He calls it "a fantastic place" to be, with hundreds of scientists, students, and teachers joined in the same quest.

"It's a really great opportunity for a new student like me to learn from the experts," Ghosh says.

The attempt to understand the underpinnings of the universe—and human existence—has always fascinated Mallik.

"It's always interested me," she says. "How did we come into being? What led to our universe? It's a fundamental question in many forms." [8]

Physicists plan to seek Higgs force in atomic spectra

A new way of measuring how the Higgs boson couples to other fundamental particles has been proposed by physicists in France, Israel and the US. Their technique would involve comparing the spectra of several different isotopes of the same atom to see how the Higgs force between the atom's electrons and its nucleus affects the atomic energy levels.

The effect of the Higgs force is tiny, but the researchers say the test would involve technologies that already exist and that some of the required measurements have already been made. The measurement would provide important information about how the Higgs couples to electrons and quarks, and would complement data gleaned from collisions using the Large Hadron Collider (LHC) at CERN.

Important mysteries

After discovering the Higgs boson at the LHC in 2012, particle physicists now want to understand how it couples to matter such as electrons and quarks. Any deviations in these couplings from the Standard Model of particle physics could reveal whether the Higgs mechanism is responsible for the masses of charged fermions, including the electron. A new way of measuring these deviations has been proposed by Cédric Delaunay of the CNRS, France, Roee Ozeri and Gilad Perez of the Weizmann Institute of Science in Israel and Yotam Soreq of the Massachusetts Institute of Technology in the US.

According to the Standard Model, the Higgs coupling creates an attractive force between the electron and the nucleus. This force decays rapidly with distance from the nucleus, which means it will have a much greater effect on electrons in S orbitals (which overlap the nucleus) than on electrons in P, D or F orbitals (which do not). The energies of photons emitted when an electron moves from a P, D or F orbital to an S orbital would therefore be greater than if the Higgs force were not present.

One way of looking for this difference would be to use different isotopes of the same nucleus. As the isotopes would have different numbers of neutrons, the Higgs force should be greater for those isotopes with more neutrons. That would lead to a difference in energy between the same atomic transition in different isotopes – the Higgs shift.

Linear thinking

The problem is that there are other isotopic differences in atomic spectra that are much larger than those related to the Higgs force. The mass shift (MS) is related to the effect of the different masses of isotopic nuclei and the field shift (FS) to the different charge distributions found in different isotopes. While the MS and FS are fiendishly hard to calculate, there is a well-known linear relationship that links the FS and MS parameters to the observed shifts.

The team's idea is to measure the shifts of two different transitions in four isotopes of the same atom and display the data on a "King plot". If there is no Higgs coupling, the data will be represented by a straight line. But if there is a Higgs coupling – and it is described by the Standard Model – there will be a tiny deviation from a straight line. It is likely that this deviation will be too small to measure, but if the Higgs coupling is much larger than predicted by the Standard Model, the researchers say it should be measureable using state-of-the-art atomic spectroscopy.

Delaunay and Soreq told physicsworld.com that such a measurement could provide important information to particle physicists who are trying to understand how the Higgs couples to quarks and electrons – something that will be difficult to extract from LHC collision data. "The method we propose is an example – the first one as far as we know – of how table-top experiments may give us complementary information," they explain. "This is important to better understand the origin of the mass of the building blocks of matter – is it the Higgs mechanism, or other, unknown sources?"

"Intriguing new application"

"Qualitatively, their arguments make sense," says Andrei Derevianko of the University of Nevada, Reno. "However, detailed atomic-structure analysis is needed – and they are clearly aware of this need – to make sure that the effect is indeed as large as they claim."

Marianna Safronova of the University of Delaware also thinks that the proposal could be viable, but points out that a successful experiment would have to accurately separate the effects of the weak interaction. She also agrees with the team's conclusion that ytterbium isotopes would be a good place to look for the effect, buts adds that calcium may be another viable candidate. Dmitry Budker, an experimental physicist at the University of California, Berkeley, told physicsworld.com that he plans to collaborate with the team to try to make the measurements. "It is not yet clear what specific atomic system – which atoms and/or ions – will be best for this, and so it is also not clear where the experiments will be done. I see an exciting possibility of potentially doing these tests in a range of systems and at different laboratories and facilities." [7]

Quantum entanglement

Measurements of physical properties such as position, momentum, spin, polarization, etc.

performed on entangled particles are found to be appropriately correlated. For example, if a pair of particles is generated in such a way that their total spin is known to be zero, and one particle is found to have clockwise spin on a certain axis, then the spin of the other particle, measured on the same axis, will be found to be counterclockwise. Because of the nature of quantum measurement, however, this behavior gives rise to effects that can appear paradoxical: any measurement of a property of a particle can be seen as acting on that particle (e.g. by collapsing a number of superimposed states); and in the case of entangled particles, such action must be on the entangled system as a whole. It thus appears that one particle of an entangled pair "knows" what measurement has been performed on the other, and with what outcome, even though there is no known means for such information to be communicated between the particles, which at the time of measurement may be separated by arbitrarily large distances. [6]

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 $\boldsymbol{E = h\nu}$ 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. [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 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]

Conclusions

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.

The accelerated charges self-maintaining potential shows the locality of the relativity, working on the quantum level also. [1]
The Secret of Quantum Entanglement that the particles are diffraction patterns of the electromagnetic waves and this way their quantum states every time is the result of the quantum state of the intermediate electromagnetic waves. [2]

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