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Where from Mass Came in the Universe? Did the Mass Originate from a Zero Rest Mass less Particle in Higgs Field

Pranab Kumar Bhattacharya[1,*], Rupak Bhattacharya[2], Ritwik Bhattacharya[3], Upasana Bhattacharya[4], Rupsa Bhattacharya[5], Dalia Mukherjee[5], Oaindrila Mukherjee[6], Debasis Mukherjee[5], Runa Mitra[7]

[1]Department of Pathology, School of Tropical Medicine Kolkata, 108, C.R. Avenue, Kolkata, West Bengal, India
[2]Freelancer Theoretical Physicist, Kolkata West Bengal, India
[3]B.Com, Calcutta University, Kolkata, West Bengal, India
[4]M.Sc. Student, Calcutta University, Kolkata, West Bengal, India
[5]Student, Kolkata, West Bengal, India
[6]BHM (Honours) IGNOU of Residence, Swamiji Road, South Habra, West Bengal, India
[7]Social Worker, B K Mitra Palliative Care Barrackpore, West Bengal, India

Abstract

A very interesting hypothesis based upon the possibility of a "Zero Rest Mass Particle in Higgs Field" in the Universe is described in this study. This is review of some hypothesis on mathematical basis on possibility of zero rest mass particles in the earliest moments of the Big Bang where Higgs Particles fused to give mass in Higg's Scalar Field. The hypothesis is validated and considered the same truly correct that the zero rest mass sub quark 2 particles do exists/ or existed in this universe ever in atomic structures and in universe and their possible implications as future source of energy, time travel. The value of the electron mass, in particular, remains deeply mysterious even in our most advanced speculations about unification and string theory.

Keywords: *Zero rest mass, Big Bang Theory, Higg's Field, universe, particles, energy*

****Author for Correspondence*** E-mail: profpkb@yahoo.co.in

INTRODUCTION

Very few people with their knowledge of extreme level of applied mathematics/theoretical physics often do speak of quantum fields theories, The relativistic quantum field theory, beginning with quantum electrodynamics, or QED, classical field theory of electromagnetism, mathematical unification of electricity with magnetism, Schrodinger equation, Lorentz transformation of space time, Gauge theory, String theory (there are three (03) types of string theory, 26 dimensions, at least 10 dimensions. In 26 space-time dimensions, we people cannot make concept beyond three or four dimensions when time is taken as fourth dimension and there are 26 dimensions! These extra un-human physical states (many such dimensions may be as littlie than our four dimensional space time or may be too small and even microscopic) probably remain around us winding up disappearing from the human eyes and super-machine spectrums. Therefore string theory, i.e. quantum mechanics is only consistent if the dimension of space time becomes 26. By looking at quantum mechanics of the relativistic strings in normal modes, one mathematician of very high level knowledge can only deduce that the quantum modes of the strings look just like the particles, we see in space time, whose mass depends on their spins movement according to formula of the universe laws! And some of the particle states of a closed string must have zero mass with two units of spin; that was the first basis of our concept "Mass from mass less, i.e. zero rest mass particles" and then mass came from another particle. Now on July 2nd 2012, it had been proved beyond doubt in LHC experiment of CERN in Geneva; though the declared particle does not follow Prof. Peter Higgs (who is now NL in physics) particles equations and properties, Brane theory is another important one and we have a lengthy discussion in the thread at BAD Astronomy and Universe Today forum www.bautforum.com. This very theory is required to understand the presence of an object or a particle in the string theory that are not actually strings, but of higher dimensional objects, or even points, it helps to know the formulation of "Maxwell's equations" in the languages of differential forms, because Brane theory is what that tells us that the sources of charges in the Maxwell equations are zero-dimensional objects (Thanks to Mr. Brane). Gauge field strengths that are p+2-forms turn out to have sources that are p-dimensional objects. My eldest brother "Professor Pranab" called these as p-branes. In the regular Maxwell equations in dimension D=4 space time dimension, the electric and magnetic fields are so highly packed together into the field strength F, which actually satisfies the Brane equation F=dA, where, d is the exterior derivative, and A is the vector potential, a one-form. The two-form *F is the dual of F relative to the spacetime volume four-form (The subscripts on F, etc, that mathematics tells us that the Maxwell equations couple electrically to sources that are points, or zero-branes, as zero-dimensional objects with zero (?) and our universe started with that zero rest mass particle at planck's time of Big Bang in fact. Brane theory when was put in string theory, came out Superstring theories that contain electromagnetism, but they also contain field strengths that are three-forms, four-forms and on up. These field strengths obey equations just like the Maxwell equations, and their sources can be analyzed in the same manner as above. Suppose we start in d space time dimensions with a vector potential A that is a p+1-form. Then F is a p+2-form, ? is a d-form (because it's the volume element of d-dimensional spacetime), *F is a (d-p-2)-form, and d*F is a (d-p-1)-form. Superstring theories are now related with theories even with gravity, so these p-dimensional localizations of charges must lead to space-time in curvature. Space time is always curved. A p-brane space time whose metric solves the equations of motion for a (p+2)-form field strength in d space time dimensions can be described using p space coordinates along the p-brane and (d-1-p) space coordinates orthogonal to the p-brane.

There's yet a problem with me, and my eldest Prof. Pranab added the gravity again in p-branes, however. Most p-brane space times turn out to be then totally unstable. Super symmetry could however stabilize p-branes, but only for the certain values of p and d (I am not disclosing that this time here). But I must say it can stabilize p-brane with gravity also. Two of the most important p-branes in string theory are the two-branes in space time dimension d=11 and the five-branes in d=10. So, there must be at least ten dimensions and gravity must be a particle and not a simple force according us (Prof. Pranab kr Bhattacharya & myself). We termed the particle for gravity as "Graviton". Since, I am here talking about a unique space-time metric, we are obviously in the low energy limit of string theory. But p-branes can be protected from quantum corrections by the super symmetry, if they just satisfy an equality between mass and charge which was known as the BPS condition. These branes will be then known as BPS branes. For any string propagating and oscillating in flat 26-dimensional space time with many coordinates Xm(s, t) can give rise to four different quantum mechanically consistent string theories, depending on the choice of boundary conditions (horizons) of flat space-time used to solve the equations of particle motion. The choices may be, according to us, can be divided into two categories as my eldest Prof. Pranab says:

A. When the strings may remain open (with their free ends open) or when the strings remain closed (with free ends joined together in various kinds of loops).
B. Whether the strings can be placed in orientable manner (you can then blindly tell any person in which directions you're then traveling along the strings) or they may remain un orientable fashion (you can't then tell in which direction you're traveling along the strings).

So, there will be four different combinations of options to a person of knowledge of super high mathematics/physics, giving rise to the four string theories (Open (plus closed) with orientation (yes); Open (plus closed) with orientation (Not); closed with orientation (yes); and closed with orientation (Not)). Now, when string particles are made of boson particles, it's just as well to us that bosonic string theory becomes totally unstable, because that could not be any realistic theory to begin with, and two identical particles (let me say quark and antiquark particles) here can remain in same quantum state and stable. In the real world, we see around us even the smallest multi-cellular living creature like "The ant" or a simple "Fly" consisted of stable matters made from fermions particles (quarks at finest particle level) that satisfy the "Pauli Exclusion Principle" where two identical particles must not be in the same quantum state at the same time and same moment. Notice, we told this earlier that in the open string theories also may contain closed strings. Why is this? and how this? Because an open string free ends can sometimes join its two free ends and become a closed string loop and then again break apart again into an open string.

In pure closed string theory, the analog of that process does not occur. Adding fermions to string theory introduces a new set of negative norm states or ghosts, to add to the ghost states that come from the bosonic sectors. String theorists learned that all of these bad ghost states decouple from the spectrum when two conditions are satisfied: the number of space time dimensions is ten (10), and in theory of super symmetric, so that there should be equal numbers of bosons and fermions in the spectrum.

Fermions particles have more complicated boundary conditions than bosons particles, so unraveling the different possible consistent superstring theories took researchers quite a bit of doing. Super string theory requires a super space time. The simplest way so to examine a superstring theory is to create to what is called super space. In super space, in addition to the normal commuting coordinates X, a set of anti-commuting coordinates are added. For open superstrings, the choices turn out to be restricted by conditions too complicated to explain here.

It turns out that the only consistent theory has un oriented strings, and (?) have the same handedness, with an SO(32) gauge symmetry included by attaching little charges to the ends of the open string. These charges are called Chan Paton factors. The resulting theory is called Type-I. Closed string oscillations can be separated into modes that propagate around the string in different directions, sometimes called left movers and right movers. If ?1 and ? have opposite handedness, then they also have opposite momentum, and hence travel in opposite directions. Therefore they provide a way to tell which direction one is traveling around the string. Therefore these strings become oriented. This is called Type-IIA superstring theory. Because ?1 and ?2 have opposite handedness, this theory winds up being too symmetric for real life. Every fermion has a partner of the opposite handedness, which is not what is observed in our real world, where the neutrino particles come in a left-handed version but not a right-handed version. The real world seems to be thus chiral, which means having a preferred handedness for mass less particles in fermions. But Type-IIA superstring theory is a non chiral theory.

There remained also no way to add any gauge symmetry to Type-IIA superstrings, so here also the theory fails as a model of the real world. If ?1 and ?2 have the same handedness, and the string is oriented, then we get Type-IIB superstring theory. This theory is again chiral, and so there will be again mass less fermions that must not have partners of the opposite handedness, as is not observed in our world today.

However, there is no way to add a gauge symmetry to the Type-IIB theory. So, there isn't a way to include any of the known forces other than gravity. If ?1 and ?2 have the same handedness, but the string is un oriented, that turns out to just gives the closed string part of the Type-I theory. This seems to have exhausted all of the obvious options before two of us. But there's actually something more crazy that can be done with a closed string that yields two more important superstring theories.

The left-moving and right-moving modes of a string can be separated and treated as different theories. In 1984, it was realized that consistent string theories could be built by combining abosonic string theory moving in one direction along the string, with a super symmetric string theory with a single ?1 moving in the opposite direction. These theories are famous as heterotic superstring theories {see and click on the following links}: http://www.bautforum.com/showthread.php/52489-Superstrings-Could-Be-Detectable-As-They-Decay?p=1169460#post1169460]
*entanglement,
*symmetry breaking [see and click the link]
http://www.bautforum.com/showthread.php/80592-Symmetry-or-Breaking-thesymmetry-what-was-the-laws-of-nature?highlight=Pranab
http://www.bautforum.com/showthread.php/52489-Superstrings-Could-Be-Detectable-As-They-Decay?highlight=Pranab] or super symmetry, and we try our best to analyze the ridiculously small or conceptualize the incomprehensibly large. Just as Willie Sutton once famously explained that he robbed banks because "He had not food for long a time and that it is bank where the money is preserved, and with that money he could purchase food for him and his family and that must not be described as any criminal act because everyone has right to live on the planet", so we do these things because, "that's where the unknown is". It is an amazing and very sexy like women in fact, however, that occasionally this sophisticated calculations give me answers (I don't know how my eldest Prof. Pranab understands me so well, being a Professor and medicos in the discipline of pathology, but he really understands me and has in-depth study on theoretical physics probably much depth, to publish a lot of papers in world's leading journals as either peer reviewed comments or letter to editor or correspondence articles in Physics or theoretical physics or astronomy or cosmology} to childlike questions about our daily familiar things. Here I'd like to describe how work on subnuclear forces, the world of quarks and gluons, casts brilliant new light on one such child-like question: QED, for short, was pioneered by Feynman, NL Schwinger NL and Tomonaga NL in the 1940s. In quantum realistic field theory, the behaviors and properties of elementary particles can be calculated using a series of diagrams, which was then called Feynman diagrams; we all know it, that properly account for the creation and annihilation of virtual particles [particles and antiparticles]. But with the quantum loop, calculation comes here with a very big problem. In order to properly account for all virtual processes in the loops, one must integrate over all possible values of momentum, from zero momentum to infinite momentum. But these loop integrals for a particle of spin J (double spin) in D dimensions take the approximate form:

$I_{loop\sim\int P}{}^{4j-8}d^DP$

If the quantity 4J+D–8, becomes negative, then the integral behaves fine for infinite momentum (or zero wavelength, by the de Broglie relation). If this quantity is zero or positive, then the integral takes an infinite value, and the whole theory threatens to make no sense because the calculations just give infinite answers. The world that we see has dimension, D=4, and the photon is a particle that has spin J=1. So, for the case of electron-electron scattering, these loop integrals can still take infinite values. But the integrals go to infinity very slowly, like the logarithm of momentum, and it turns out that in this case, the theory can be renormalized so that the infinities can be absorbed into are definition of a small number of parameters in the theory, such as the mass and charge of the electron. Quantum electrodynamics was so a re-normalizable theory, and by the 1942, this was regarded as a most solved relativistic quantum theory. But the other known particle forces, the weak nuclear force that makes radioactivity, the strong nuclear force that holds neurons and protons together, and the gravitational force that holds us on the earth, weren't so quickly conquered by QED theoretical physics. In the 1960s, particle physicists reached towards something called a dual resonance model in an attempt to describe the strong nuclear forces. The dual model was never that much successful model while describing particles, but it was understood by 1970s that the dual models were actually quantum theories of relativistic vibrating strings and displayed very intriguing mathematical behavior. Dual models came to be then called string theory as a result.

But in 1971, a new type of quantum field theory came on the scene that explained the weak nuclear force by uniting it with electromagnetism into electro weak theory, and it was shown to be re-normalizable. Then similar wisdom was applied to the strong nuclear force to yield quantum chromodynamics, or QCD, and this theory was also re-normalizable. But the string theory that was once proposed for the strong interactions must contain a mass less particle with spin J=2. In 1974, the question finally was asked: could string theory be a theory of quantum gravity? The possible advantage of string theory was that the analog of a Feynman diagram in string theory is a two-dimensional smooth surface, and the loop integrals over such a smooth surface lack the zero-distance, infinite momentum problems of the integrals over particle loops. In string theory infinite momentum does not even mean zero distance, because for strings, the relationship between distance and momentum is roughly like the parameter '?' (pronounced alpha prime) is related to the string tension, the fundamental parameter of string theory, by the relation. The above relation implies a minimum observable length for a quantum string theory of the zero-distance behavior which is so problematic in quantum field theory, becomes irrelevant in string theories, and this makes string theory very attractive as a theory of quantum gravity. If string theory is a theory of quantum gravity, then this minimum length scale should be atleast the size of the Planck length, which is the length scale made by the combination of Newton's constant, the speed of light and Planck's constant although as we shall see later, the question of length scales in string theory is complicated by string duality, which can relate two theories with seemingly different length scales.
http://www.nature.com/news/2011/110922/full/news.2011.554.html#comment-id-27107

What is the Real Origin of Mass? Has Mass an Origin at All?
www.sciencenews.org/view/generic/id/48016
http://uk.reuters.com/article/comments/idUSTRE78L4FH20110922
http://www.bautforum.com/showthread.php/107287-Where-Went-the-Antimatter?s=3c147e931063a3c6c5e855ce0b089b2f
http://semciencia.haaan.com/?p=1116

We all know that whatever we see in this observable universe is three dimensional in configure and even a minute dot when you put it on a paper at tip of your gel pain and every 3 (three) dimensional object must have mass. That mass may be originated here in this planet or in very high temperature of GEV or TEv at earliest moment of the universe Big Bang. Our human eye can see only at best four dimensions when you consider the time as another dimension and we can feel only three arrows of time but not the future time. Mass less things, so, should not exist in this part of universe! Even the photon, the boson, in particle physics concept has its mass in condensation as when it passes in front of a heavy star or planet (object), the gravity pull light towards it and in fact it moves in wave or cone fashion (past and present cone from a light source) in the deeper space time.

The concept of mass is probably one of the first things we read in our mechanics class of ninth standard in our school syllabus. Classical mechanics is, literally, unthinkable without mass.

Newton's second law of motion, I read in class nine also says that the acceleration of a body is given by dividing the force acting upon it by its mass. So, a body, when it is there within previews of gravity, without mass wouldn't know how to move, how to spin, [A particle with a mass must have a spin – may be full, may be twice, may be ½, may be 1/3 may be ¼th and so on] because you'd be dividing it's movement accelerations and everything by a number zero. The result is so obviously infinity. Also, please consider the Newton's laws of gravity; it is the mass of an object that governs the strength of the force it exerts. So, a force is made of particle and must have mass whatever negligible it is. One cannot build up any object that gravitates, out of material that does not, so, one can't get rid of mass without getting rid of gravity in this observable universe. I don't know about our soul. It may be mass less when it has no dimension in 3D universe; and may be, in other, many dimensions. Mass less is only thus possible when, and where gravity becomes totally zero.

Finally, the most basic feature of mass in mechanics is that it is always conserved. For example, when you bring together two bodies, the total mass becomes just the sum of the individual masses. This assumption is so deeply ingrained that it was not even explicitly formulated as any law. But how mass did once originate in this universe? Why it was originated? Who gave you that mass? Who gave you the spin movement? I questioned these several times, since 1992, to my eldest Prof. Pranab, to my class teachers in school and colleges and to my friends. Altogether, in the Newtonian and Einstein framework, it is so difficult to imagine what would constitute an "origin of mass,'' or even what this very word actually and possibly mean to me! In those frameworks, mass just is what it is, a primary concept. Later developments in mathematics make the concept of mass seem less irreducible. Look at Einstein's famous equation of special relativity theory, written in that way, betrays the prejudice that we should express energy in terms of mass. But we can write the same equation in the alternative form! Can I? Should I? When expressed in this form, it suggests the possibility of explaining mass in terms of energy. Then mass is energy or in other ways, I can also say energy is also mass. Was Einstein himself aware of this possibility from the beginning? Indeed, his original 1905 paper is entitled, "Does the inertia of a body depend on its energy content?" and it derives not Einstein was thinking about fundamental physics, mass, $m=E/c^2$, E=mc2; $m=E/c^2$; $E=mc^2$. Today, modern particle accelerators came in to life. For example, in the large electron positron collider (LEP), at the CERN laboratory near Geneva, beams of electrons and antielectrons (positrons) were accelerated to enormous energies. Powerful, specially designed magnets controlled the paths of the particles, and caused them to circulate in opposite directions around a big storage ring. The paths of these beams intersected at a few interaction regions, where collisions could occur. [After more than a decade of fruitful operation, in which world's leader scientists played a leading role, the LEP machine was dismantled in 2000. It was making way for the large hadron collider (LHC), which will use the same tunnel. LHC will collide protons instead of electrons, and will operate at much higher energy. Hence the past tense.]

See our comments in the Science Insider Link

http://news.sciencemag.org/scienceinsider/2009/11/critics-of-god.html

See our article in the Science News Journal of American society of Science & APS Link

http://www.sciencenews.org/view/generic/id/46865/title/Comment

When a collision between a high-energy electron and a high-energy positron occurs, we often observe that many particles emerge from the event. The total mass of these particles can be thousands of times the mass of the original electron and positron. Thus mass can be created, physically also, from energy with the formula m=E/C2. Is that not?

What Matters for Matter?

Having convinced myself and my eldest brother Prof. Pranab Kr Bhattacharya that the question of the origin of mass might makes sense, let us now come to grips with it, in the very concrete form that it takes for ordinary matter also. Ordinary matter is made from atoms; we people of class tenth standard know it. The mass of any elementary particles "atoms" is concentrated within their nuclei. Atom consists of proton, neutron, positron and electrons in orbits; we all know that. The surrounding electrons are very crucial for understanding how atoms do interact with each other, and thus it is truth for chemistry, biology, free radicals, channel system, proteonemics, physiology, human diseases, medicine, CNS and PNS neuronal activities, physics and electronics. But we all know that electrons provide less than a part in a thousand of the mass! Rather Nuclei of atom, provide the lion's share of mass, assembled from protons and neutrons. All this is a familiar, well-established story, dating back eighty or ninety years or more and syllabus of class seven or eight standard school in our time. Newer developments and discovery are perhaps less familiar, to common people, science graduates or master degrees besides who deals with higher physics or applied mathematics; but by now no less well established, is the next step: protons and neutrons are made from at least six types quarks its sub particles colour, and gluons;

Quark gluonplasma. So the real source of most of the mass of matter can be traced, ultimately, back to quarks particles and gluons. Gluons were considered as mass-less!.

QCD: What It Is?

The theory of quarks and gluons is described very well in quantum chromo dynamics, or QCD. QCD is nothing but a generalization of quantum electrodynamics (QED). The origin of QED came from a physics Nobel prize winner Richerd Feynmen of MIT and if you can understand that from a book I shall advice you for a nice description of quantum electrodynamics; I highly recommend *QED: The Strange Theory of Electrons and Light*, by Richard Feynman himself. The basic concept of QED is the response of photons to electric charge. The particles in QED are building blocks of all matter, and forces in this universe, we mathematicians and theoretical and particle physicists know. All these particles have exceptionally super heavy mass when they are in Gev temperature.

Then where and why is the Zero mass particle? And search for it.

Atoms are today no more elementary particles. But elementary particles are today in higher physics.

Leptons	First family	Second family	Third family	Forces	Messenger particles
Electron	muon	tau		Electromagnetic Force	Photons
Neutrino	neutrino neutrino				
Electron	muon	Tau			
Quarks	Up	charm	Top	Weak Force particle	W particles Z
	Down	Strange	Bottom	Strong force	Gluons?

Besides these, some other at least 100 particles have been proposed to explain the standard Big Bang model; and where from the mass came, and some are, meson particle; Kaon, spinors, spinons, W particle, Z particle, Preons. Lamda particles, Omega particles, Charmonium particle, Bottomonium particles, Salam particles etc. But it was in zero or even near zero rest mass in Gev.

A photon particle is one that gets emitted from stars and interstellar mediums and absorbed without ever having a significant life of its own. So, it is not a particle you can observe directly, but it can have effects on things you do observe to make an object visible. In other words, light (Photon) makes everything visible to us. Quarks particle was first proposed by Professor Gell-Mann N.L. in 1963, as the finest inner constituent of protons, neutrons and certain other subatomic particles. “A lot of intelligent people of world then thought that the quarks were a simple mad, schizophrenic, brain crack ideas”. As research further was carried out in deepest level, who then believed Professor Gell man, it finally turned out that quarks signified one of the deepest and finest insights into the nature of building blocks of all matter since the prescient reflections of the ancient Greek atomists. Many scientists have tried, but so far none have succeeded in digging more deeply in seeking matter’s ultimate constituents. One paper, for instance, proposed that quarks and electrons alike are composed of more basic entities and named them “neutrinos particles(?)”. Older many suggestions are also invoked names like “Spinors” by Hoyel Narliekar and “Preons”. So far, neither their names nor the evidence for them matches that of quarks. Near than five decades after Gell-Mann conceived them, quarks retain their standing as the indivisible building blocks of every known tangible minute substance in the world even the dot you gave by tip of the gel pen. Quarks are responsible for more than 99.9% of ordinary matter. No example provides better reason to beware of blind dismissals of novel ideas. And no story better illustrates the power of science to deduce aspects of reality deeply hidden from human senses.

So Let Me See the Atomic Deconstruction

In the ancient days of science’s infancy, great physicists’ mathematics thinkers pondered deep questions about matter such as, how finely it could be sliced and diced. One group of Greeks proclaimed that matter could be cut only so much before reaching a limit they labeled with the alluring term *atomos*, un-cuttable and that is 99 cut of an apple. Millennia later, chemists and physicists built their sciences upon the foundation provided by the idea of "atom". But the triumph of atomism unveiled a confusion to us. As it developed, the Greek notion of "atom" contained two different concepts. On the one hand, it meant the smallest unit of a substance. On the other, it was supposed to mean un-splittable? But those turned out, not to be the correct inference. Atoms are indeed the smallest units of the chemical elements, but can (very dramatically) be split today. A century ago, physicists had realized that atoms have their parts and were on the verge of figuring out atomic architecture. Ernest Rutherford's assistants had witnessed alpha particles bouncing off a thin sheet of gold foil, as astounding; Rutherford later said, as tissue paper repelling artillery fire. He soon figured out that the alpha particles had encountered atomic nuclei, the specks in the center of every atom occupying almost none of the space but concentrating almost all of the mass. Scientists spent the next half century tearing the nucleus apart in search of matter's ultimate constituents. By in the 1950s, those efforts had produced perplexity. Atomic nuclei contained two types of particles, or nucleons: the proton and the neutron. Observations of cosmic rays and experiments with atom smashers, though, disclosed numerous other seemingly basic particles, with weird names like pion, lambda, delta and sigma, threatening to exhaust the Greek alphabet. Enrico Fermi famously muttered that he might as well have been a botanist if he had to remember so many odd names. Amidst that chaos, Gell-Mann saw a pattern. In 1961 he (and independently Yuval Ne'eman) perceived an analogy between some arcane mathematics and the properties of the known particles. Gell-Mann sorted the particles into tables, reminiscent of the periodic table of the chemical elements devised by the Russian chemist Dmitri Mendeleev almost a century earlier. Just as Mendeleev had predicted the existence of previously unknown elements based on gaps in his chart, Gell-Mann forecasted the discovery of new particles. As certain classes of particles came in groups of eight, he called his system "the eight fold way", although subsequent comparisons to Eastern mysticism annoyed him. "I meant it as a joke", he once proclaimed. Mendeleev's periodic table accomplished much more than predicting new elements. It also served as an early warning sign that atoms were not indivisible. His table showed that when listed in order by weight, atoms displayed patterns in their properties: columns in the table contained families of similar elements. Such a repetitive pattern of properties suggested that atoms within a column possessed arrangements similar to others in their family implying that there were some internal parts to arrange. In much the same way, the regularities in Gell-Mann's tables implied deeper structure in nature's basic particles. At the time, many physicists believed that the protons, neutrons and cousin particles might all be equal partners in a conspiracy to create themselves. Inother words, no one particle was truly basic, each was a combination of some of the others (perhaps even including itself). This "bootstrap" principle avoided the need to declare any one particle the ultimate chip off the atomic block. Gell-Mann, though, found what he described in his 1964 paper introducing quarks as a "simpler and more elegant scheme". All the relatives of protons and neutrons in the subatomic zoo, including the proton and neutron themselves, had been then explained as composites made from three basic building blocks. Each had its own label by Gelmanns Group like up down strange charm. He chose the name quark (the squawk of a gull) from a line in James Joyce's *Finnegans Wake*: "Three quarks for Muster Mark". (Independently, the physicist George Zweig suggested a similar idea, calling the building-block particles "aces" (Not quite as catchy a name). Quarks was for long period challenged by high level orthodox physics on several levels, violating at least three prevailing principles. "One of them was that the neutron and proton were elementary, they were not composed of anything simpler", Gell-Mann himself ultimately said facing such huge challenges by world top particle physicists said during the Princeton interview. Second, quarks had to be permanently trapped inside the observable particles, also defying beliefs held by many physicists. "That was a crazy idea, they thought," he said. Third, quarks possessed the awkward property of fractional electric charge, something never observed (even to this day) for a subatomic particle. All observable charged particles possess some integral multiple of the charge on an electron, the smallest unit of charge that nature offers. "The idea of particles with fractional charges that was considered to be a crack idea too", Gell-Mann said. "So, the quarks had three strikes against them, from these three principles, all wrong, of course".

Quarks Idea Started to Proliferate

Over the years, support for the quark idea grew, though, even as Gell-Mann's original elegant picture became somewhat more complicated. A new particle further discovered in 1974 in mathematical calculation implied the existence of a fourth quark, called charm (a sort of partner for the strange quark, just as up partnered with down). Three years later evidence turned up for another quark. This one was called bottom, naturally requiring a sixth quark, the top, not definitively discovered until 1995. Most experts today doubt whether there will be any more quarks. But nobody can say for sure that quarks themselves will forever reign as the ultimately un-splittable units of matter. "So far nothing has pointed in that direction, of another layer of constituents underlying the quarks", Gell-Mann says. "But you can't rule it out completely, of course. We know that the present theory, the standard Big Bang model, is a low-energy approximation of some kind to a future theory, and who knows what will happen with a future theory?"

Lack of real evidences for quark parts didn't prevent some people like me, from calculating the possibility, though. One new scheme, for instance, describes particles that could combine to make not only quarks but also leptons, the electron and its relatives, and bosons, the particles that carry forces governing interactions between other particles. In a published paper describing this idea (arxiv.org/abs/0907.2538), Eckart Marsch of the Max Planck institute for solar system research in Germany calls such all-purpose building blocks "spinons", he termed his particle. Using mathematical symmetry principles similar to those underlying quarks, he shows how spinons and their antimatter counterparts could combine to create particles resembling the known quarks, leptons and bosons. Three spinons, for example, two of one kind, one of another, could make particles with electric charge of +2/3, like the up quark, or –1/3, like the down quark. Other combinations of three spinons would reproduce the properties of electrons and their cousins. Unions of two spinons could produce bosons such as the W particles responsible for transmission of the weak nuclear force. One combination of two spinons even reproduces properties expected of the hypothetical Higgs boson, about to be the subject of an intense search at the world's newest atom smasher, the large Hadron collider at the CERN laboratory on the outskirts of Geneva (SN: 7/19/08, p. 16). Past suggestions about composite quarks have failed when tested by experiment, and no one would be surprised if the spinon idea also fails to overturn the scientific consensus.

Language Barriers

Gell-Mann, meanwhile, remains active in theoretical research at the Santa Fe Institute in New Mexico, where he however could continue to pursue his crack ideas that were sometimes at odds with establishment of his views. He shifted himself and his interest now in linguistics, for instance, and collaborated with researchers at Santa Fe and in Moscow studying distant (in time) relationships among human languages. And that established his concept "In that collaboration we seem to be finding more and more evidence that a very large fraction of the world's languages, although probably not all, are descended from one spoken quite recently something like 15,000 to 20,000 years ago", Gell-Mann says. Language surely originated much earlier than that, he says, but most languages still around today may have descended from this mother of (nearly) all mother tongues, tentatively labeled Borean (as in "the north wind"). Of course, again many experts resist his idea. "For some reason, in this country and in Western Europe, most tenured professors of historical and comparative linguistics hate the idea of distant relationships among human languages, or at least the idea that those can be demonstrated", Gell-Mann said. "They put a tremendous burden of proof on anyone who wants to say that languages are related in this way, by this common descent". And so, once again Gell-Mann faces what he calls the "negative principles of the establishment". "Eventually, I think everybody will be convinced that these relationships really exist", he says. "In the meantime, we're fighting one of these battles". And just as there's no evidence of constituents of quarks, there's no evidence that Gell-Mann will stop fighting such battles anytime soon.

Breaking the Symmetries is the Law of Nature in Quarks and Strings Theories

To explain simultaneously, the symmetries and charges of the observed hadrons, *the quarks are also required to have an electrical charge,* which is a fraction of the electronic charges "e". Thus an up (u), and down (d) quarks have charges +2/3e and –1/3e respectively. In this, a proton thus consists of 2down (d) quarks, and lup (u) quarks (Close EJ-, introduction of quarks and protons p3 -88; academic press; New York. 1979). The lamda particles consist of 1up quark, 1 strange quarks and 1 down quark. Similarly, Omega particles ? consist of 3 trange quarks (S3). Pion particles (tr) consist of lup quark and 1anti down quark (u d-). Kaon of (us), Charmonium of (can cc-) and Bottomonium particles consist of (bb-). Similarly strange hadrons are made using squarks. The iP particles are bound state of charm and anti charm qnarks. It is meson particle.

Although quark model was very successful in classifying the observed hadrons; in 1960, it became clear that the simple quark model was inadequate. In addition to quark flavor, quark must carry additional quantum number, which was later known as on "color" and each quark flavor comes in distinct color, there are really as many as quark colours as we thought". There are red, green, and blue up quarks and they were then denoted as ur, ug, Up, and ub. They are identical in all respect (mass, charge, and so on) except in their colour, similarly colour are present in other quarks like (dr, dg, db, sr, sg, sb, br, bg, bb, tr, tg tb, Rb, and so on). The existence of strongly interacting partic1es with spin ½, is the quarks particles that have half-integral spin and as such, they are known as fermions. But the difference from fermions particle from the quark is that quarks, carry an extra quantum number 'color', which the fermions do not carry.

The quarks as carry these possible colors and hadrons as consist of mixture of quarks and color and as such, the hadrons are colorless. In the particles and even all the structures in the Universe are in constant spin motion. Particles like electrons, neutrons, protons and quarks are in Rt. handed or in Lt. handed spin movement.

In QCD, we believe that hadrons are built up from smaller building blocks of quarks bound together by some kinds of QCD forces. Protons contain several such quarks, spinning in opposite direction. Spin effects play a very crucial role at very early stage of quark structure of hadrons. Actually, the quark model gave the first satisfactory explanation of magnetic movement of the proton and neutron by having their partic1es made from two kinds of flavors called up and down with the electrical charges of +2/3 and –l/3 of the proton charges, respectively. The proton is thus made of 2u quarks and 1d quarks and neutron is made of 2d quarks and lu quarks, thus giving the observed charges of +1 and O; because all have the spin as proton. The right total spins for the proton' and neutrons is obtained by having the u and d quarks' in opposite direction *giving a total spin which is the difference between u-d quarks* spin. But quarks with opposite electric charges spinning in opposite direction have their magnetic movements all pointing in the same direction and added upto a large value. To *explain why the proton with a positive charge has a NzagneticfnOmentro", ghly three tinies the Dirac value and wi(hnocharges'has 00000magnmc mom.entcorrosponding.rollghlJl.double, theDirac value for a particle with negative charge*

A Smaller Particle then Quarks-Possible at All? Suggested by Rupak Bhattacharya First? Yes

The big question to present authors was that whether further elementary particles in QCD was possible than quark itself? Geonium is a man made atom created at liquid helium temperature in ultra high vacuum from an individual electron in magnetic and electron trapping fields. For this atom, the electron gyro magnetic ratio, g=20,000,000,000,110(60) had been measured in micro wave spectroscopic experiments after subtraction of quantum electrodynamics shifts. The g-g Dirac=11x10-11 excess over the value g Dirac=2. For the theoretical Dirac point, electron suggest for the electron of nature a corresponding excess radius Rc-R DiracCoverthe Dirac radius R Dirac=0 and must be a spatial structure [Bhattacharya Rupak, Bhattacharya Ritwik, Mukherjee Dahlia and Bhattacharya Pranab, Sub2 quark particles possible? Threads www.extremeastronomy.com Forum discussion Topic Search “pranab”]. A near dirac particles, an electron radius Re=10–20 cm must be present. To explain definitely the standard Big Bang model cosmology, a zero mass particle is highly required which indicates from nothing state (zero mass) resulted a spontaneous quantum jump and initiated Big Bang and these particles and antiparticles were in spin ½ (dirac point particles). So far, quark particles and its sub quarks energy colors has been discovered. In 1974, Abdul Salam and others pictured the electron, a particle on the level of a quark as composed of three sub quarks, each 1010 times heavier than electron mass in Gev mass, as like a proton is composed of three spin ½ particles. This is Salam particles, according to name of Professor Abdul Salam, who received Nobel Prize for his “Gauge theory” based on his particle, in physics. The big question to present authors “Is it possible to have a subX sub or Sub2 quarks particles, all tightly bound to nucleus? The particle subX quarks, smaller and smaller, less and less imperfect near dirac particles held together by stronger and stronger forces and with ever increasing mass in Gev. Probably in the beginning of our universe in the Big Bang moment, such a particle existed as nothing state that decayed in to finally quark- anti quark pair; “Finally Nucleon and Anti Nucleaon Particle”. Is it possible that gravity which we describe as force is made of a particle_ called by us “Graviton”? Rupak particle suggested by Rupak Bhattacharya as “R particle” is such a particle of zero total relativistic energy or mass of bond pair.

Neutrino Particles

Those who are reading our blog, you are all familiar with electromagnetic interactions from our daily experience like charges that repel one another; opposite charges attract. The earth acts like a giant magnet. Indeed matter itself is held together by electromagnetic interactions between electrons and nuclei. With the exceptions of the neutrinos, all elementary particles have electromagnetic interactions either through charges or through magnetic property. Or the ability to directly interact with charges or magnetic moment. In 1960, the only known elementary particles apart from hadrons were leptons: electron, muons and neutrinos. And there was suspicion that there might be two types of neutrinos. Both, the electron and muon are electromagnetically interacting. Early in the century, it was discovered that some nuclei are unstable against decay into residual nuclei and electrons or positrons. There were two important characteristic of these so-called decays: 1) they were “slow”; that is to say that the life times of the decaying nuclei corresponded to an interaction that was much weaker than that of characteristic electromagnetism; 2) Energy and momentum were missing. If one examined the spectrum of the electrons that were emitted, it was clear that to preserve energy, momentum and angular momentum in the decay, it was necessary that there be another decay product present. The decay product needed to be “Zero or nearly Zero mass” and to have half-integral spin. Pauli first made this observation and Fremi later gave this product name as “Neutrinos”. With the development of Fremis theory of “Weak Interactions”, more was learned about the properties of the particle “Neutrinos”. The neutrino has a spin of ½ and a very low probability of interacting with matter. The predicted cross section for the interaction of beta decay neutrino with nucleons is about 10-43 cm2. Thus one of these neutrinos would, on the average, pass through a light year of lead without interacting at all. The beta decay reactions can be written as z—(z-1)+e++v; z—(z+1)+e++v- by the failure to detect neutrinos less double beta decay namely the process z—(z-2)+e++e+. It was established that neutrinos (?) and anti neutrinos (?) were included as different particles. Neutrinos can pass through even the center of the earth without leaving a trace and is immune to many of the forces that bind up matter together including electromagnetic forces. All accepted standard models in the cosmology and in particle physics, assume that neutrinos are mass less. But as per Mr. Rupak Bhattacharya and Prof. Pranab Kr Bhattacharya, "Neutrinos are not exactly the zero mass particles in the Universe". They calculated that these wooly mammoth allegedly must carry a mass of 17000 electron volts (Kev) and so it could not be the earliest particles in the creation of the Universe according to present authors. It was the "Rupak particles". Then what was the earliest particle in the universe? As we in previous chapter discussed, according to Mery Gelman, the earliest particles were quarks and anti quarks. The gospel of Big Bang is then supposed to have been explosion from zero volume at zero time of a corpuscle containing the cosmic soup of these quarks and anti quarks particles, where in the corpuscle energy were equivalent to mass and radiation and flash. The particles and their anti particles were in constant annihilation and went into radiation and flash. What we authors want to mean that at about trillion and trillion degrees of temperature of cosmic soup (about 1015 K) the elementary particles and radiation was just interchangeable. In the primordial fireball or in cosmic soup, the particles and antiparticles were being in constant annihilation and were again created although the total energy of combined radiation and matter of the soup was constant.

However in the quantum chromo dynamics (QCD), another particle was proposed as the earliest particles in the universe. They were the nuetrinos particles. The neutrinos were also non-zero mass particles. The idea that neutrinos may have no mass was of about 40 years old. The successful unification of the weak and electromagnetic force field implies that there should be as many as kinds of neutrinos, as there are different kinds of electron like particles. The question of mass of the neutrinos had been of great interest since Fremi's first analysis of ß decay to the present time. There is till no confirmed mass evidence that neutrinos have a non-zero mass (Bhattacharjee Rupak and Bhattacharya Pranab Kumar, 1994).

All accepted models in the cosmology and in particle physics assume that neutrinos are massless or so. The heaviest neutrinos in Gev temperature range from í to r electron volts. But the scientists found that this wooly mammoth allegedly carries a mass of 17,000 electron volts (kev). By the radioactive beta decay process, a process in which an unstable nucleus in the radioactive isotopes emits both, an electron and a neutrino, of decay of electrons. Rupak Bhattacharya and I myself recorded the energy of decay electrons by sending them into a crystal where they knock other electrons creating a current that provided a measure of energy where a big 17 Kev regularly appeared, taken from the energy of a few electrons. The energy was then obviously 17 Kev, neutrinos and 1% of their emitted neutrinos belonged to heavy neutrinos.

Neutrinos can pass through the entire earth without leaving a trace and it is immune to many of forces that bind the matter including electromagnetic forces. So, neutrinos are ghostly sub atomic particles; so feebly in their interaction with ordinary matter that they can happily pass through earth without stopping. They have almost never been observed outside he controlled environment of the big accelerator laboratories of USA and CERN in Europe. Neutrinos are even more common in the universe then the photons, only because probably the Big bang left a sea of very low energy neutrinos that permeated every corner of this Cosmos. On 30th march 2006, the US laboratory, "Fermi lab" reported first result from a neutrinos experiment called "MINOS" (Main injector neutrino oscillation search) in Soudan mine at a depth of 776 m in Minnestoa 732 km away. The MiINOs experiment showed that there is a short fall in the number of muon nutrinos if they are detected a long distance away from their point of production. Nutrinos are elementary particles where all neutral counterparts of charged leptons namely the electrons, the muons and t leptons, all of which take participation in the weak interactions. Determination of neutrinos particles still remain notoriously difficult from the point of view of experiments and got challenges in the particle physics of highest depth research. At this moment when writing this book, there is no information of even values of their individual masses. Mr. Rupak Bhattacharya however proposed their value as m1<3 ev; ml<170 Kev; mj<18.2 Mev may be the masses of different muon neutrinos numbers.

It is worth noting that direct detection of VJ was reported in 2006 for the first time only from Fermi laboratories USA. The presence of neutrino oscillation was reported in 2006 March experiment by Fermilab. Direct observation of NUTAU E872 [DONUT] experiment implies existence of distant and non vanishing mass for nutrion flavors. In particular, as per Rupak Bhattacharya there are now three masses m1, ml, mj and three angels that mix neutrinos flavours denoted by ?12, ?23, and ?13. In addition, according to Rupak, neutrinos may also have anti r particles i.e. they are fermions which are their own antiparticles.

But neutrinos might have a non-zero mass. For electron neutrinos, the mass is 10-6 ev. A mass in excess of 1 ev would then be significant since neutrinos would then contribute mass than stars (Stars like sun) to the mass density of the universe. The universe would be then closed if the mass of neutrinos would be between 25 and 100 eV. There were then three types of neutrinos in the Big Bang moment: 1) “Electron Neutrinos” had a mass of 20 ev, 2) “Muon neutrinos” had a mass of 0.5 Mev and 3) “Tat neutrinos” had a mass of 250 Mev. In the QCD, studies suggest that the primordial universe was dominated by neutrinos of zero mass rather than by quarks with its colour. A natural scale then emerged determined by maximum distance neutrinos that could stream freely as the universe expanded, before the neutrinos slowed down on account of their mass below the scale of super cluster i.e. galaxies formation. In this neutrinos theory, then no preexisting fluctuation then survived and the first structure then collapsed and formed galaxies.

According to another theory, [Theory of Rupak Bhattacharya and Pranab Bhattacharya], in Grand unified theories, the electron was treated as neutrinos (ve) and the quarks that made nucleon were at different state of a single neutrinos particle.

In the simplest of Mr. Rupak Bhattacharya’s theory the small neutrinos mass was given by a formula by Mr. Rupak Bhattacharya Mv=mD2/M; where mD is the quark color mass and M is the mass which may be as large as the unification scale of 1014 to 1015 Gev. As a result of Mr. Rupak Bhattacharya’s equation Mv=Md2, there occurs three sets of generation of earliest particles.

Thus, in addition of electron there is generation of muon [mu=206 me] and also “R particles” [Rupak Neutrinos mR=3500 me]. These R particles are then very similar and close to graviton particles and correspondingly there are three neutrinos ve, vμ and vr. This theory suggests that m(ve)<<m(vμ)<<m(vr). So, as per Mr. Rupak Bhattacharya and Pranab Bhattacharya’s theory, ve, vμ, vt and vr are coherent mixture with quarks in case of electron.

Neutrinos produced in nonlinear ß decay might be v1cos? +v2sin?, where v1 and v2 are the mass eigen state and ? is the mixing angle [Bhattacharjee Rupak and Bhattacharya Pranab Kumar]. Those are in favor of neutrinos particles and suggested that the primordial synthesis of nucleon in nucleon synthesis was from neutrinos. Whatever be the long standing debate regarding the quarks or neutrinos particles as the earliest particles in the universe that remained in the corpuscles of cosmic egg, the density fluctuation happened at 10–35 sec after the initial Big Bang moment within the corpuscle which resulted due to temperature variation to about 1011 K when nucleon synthesis probably started. Beyond this temperature only electron and its antiparticles positrons could evolve and still involved in annihilation and creation exchanged with their equivalent energies in the form of electromagnetic radiation.

The temperature further dropped down from an overall 1011 K to a temperature of only one hundredth and as great as 109[1,00,00,00,000 i.e. one Trillion degrees]. This was a practically significant landmark, for that temperature, the radiation density became too small for electron, positron pairs to be produced [The surface temperature of our sun is only 5000 K]. These happened only after

100 sec of Planck time. But we authors want to mention one important thing that we know what happened in the ~1 s of planks time of Big Bang.

But we do not still know what happened in the first ten thousandth of a second of Big Bang singularity. This is probably the big question to all theoretical physicists till now and before us where the law of universe is hidden.
So the cosmic soup so far consisted of quarks and antiquarks, electrons and it's antiparticles anti electrons or positrons. The particles and antiparticles were in constant annihilation and radiation as per Einstein's famous equation E=mC2. At 109 K temperature, matter was produced and the universe is today made of matter i.e. hadrons. (Proton, Neutron, lepton, Electrons). But in the Big Bang moment, universe started it's voyage with equal numbers of matter and antimatters. Electrons and positrons were created and were in constant annihilation, liberating burst of energy and radiation. Thanks to the creator of the Big Bang (If at all he is there at that point of starting the Big Bang moment) that during the nucleon synthesis, antiproton were not at least created. If at all antiproton, antineutron were created, they were at least in separate compartment and did not come into contact [Matter and antimatter as soon as come in contact both are destroyed and their entire rest mass converts into radiation and energy is known as entropy or annihilation. Prof, S.W. Hawking in his famous book "The Brief history of Time", nicely said, "If you even meet your anti you (Mirror image of You) don't hand shake with him you will turn into flash, radiation and energy at once".

In the standard Big Bang model (SM) of electroweak interactions in fact as described by Salam relies on a scalar particle W bosons, and the Higgs particle, associated with the field responsible for the spontaneous electroweak symmetry breaking that I told you/readers of this blog article previously. The existence of the Higgs particles has yet to be established experimentally in LHC, while its mass, mH, is not also yet till day fixed by any theory before Professor Peter Higgs and Rupak Bhattacharya (here the second author) is awarded the highest prize and honor of this planet.

Direct searches for the Higgs boson at the LEP e+e- collider and the Tevatron p p collider in 2010 have led, respectively, to probably a lower mass bound of mH>114.4 GeV and to an exclusion in the range 162–186 GeV at 95% confidence level (CL). Indirect constraints from precision measurements favor the mass range mH<158 GeV at 95% CL. Also, recent studies show that current Monte Carlo simulations do not describe the Higgs particle mass line shape above 300 GeV. These effects are estimated to amount to a further additional uncertainty on the theoretical cross section, and hence on the limits, of about 4% at mH=300 GeV and 10–30% for mH of 400–600 GeV. The Higgs particle, up to this day, is nothing more than just a theoretical entity that stems only from particle physics' standard model. Still, many of the particles that mankind has discovered, and in fact, many of the principles that have been proven by experimental data, started out as predictions from mathematical solutions. Hence, if we look back at history, we can only summarize that the zero mass particle may very well exist. All we need is the right equipment for the job to confirm (or to disprove) its existence and right now, it looks like we are soon to have one. Among the major objectives of the creation of the much touted LHC or large Hadron collider at CERN is to find the elusive Higgs particle or zero mass particle if any. In fact, discussion of the LHC and the Higgs boson is almost inseparable. Let me hope for finding the boson are pinned on two massive detectors at the LHC: the ATLAS or A Toroidal LHC apparatus and the CMS or compact muon solenoid. These two detectors have the same goals but their designs are radically dissimilar. So, how do these scientists intend to lure the Higgs particle or a zero mass particle and the particle that gave mass from its hiding place? Well, theoretically, we should need to collide two quarks with a minimum of 1 TeV of energy. Unfortunately, our regular particle accelerators won't do the trick. For this task, they would need what are known as colliders. But don't accelerators already allow particles to collide? Well, in a way, yes. However, typical collisions in particle accelerators are between projectile particles and none moving target particles. Now, compare this with a collision wherein both particles are moving at high velocities and meeting another particle in Higgs field as Mr. Rupak Bhattacharya and Prof Pranab kumar Bhattacharya suggested? The question is not solved yet! World's scientists had been trying so for about two decades to detect the Higgs particles, but they have so far failed. The "D Zero" experiment was performed at Fermilab and Tevatron particle accelerator near Chicago in Illinois in the US and at that time the experiment suggested that there might be then multiple versions of the Higgs head-on.

You just imagine three cases:

(1) A truck speeding towards a stationary car.
(2) A truck speeding head-on towards a car cruising at the same speed.
(3) Two trucks speeding head on toward one another at the same speed.

Now could you get the picture? That's why you would need two particles (say Proton Proton or PP) with equal masses and velocities speeding almost near to speed of light head-on to provide the biggest collision scenarios. And that's also the reason why you would need colliders and not just ordinary particle accelerators and smasher. The LHC (it is so far the largest PP/or Proton-proton collider LHC) is not now the only collider in the world, as the world already had others like the large electron-positron collider (LEP) at CERN Geneva and the Stanford linear collider (SLC) in California US. The LHC, was designed as such that it would be able to provide the highest liberated energies, as it was capable of smashing two protons at energies of minimum 7 TeV each, much higher than what is needed to pry out the shy "Zero mass particles" to appear for a fraction of a second. The LHC was buried 300 ft beneath the border of France and Switzerland, and it was 17 miles long [26 km which are far heavier particles than electrons, to energies of up to 14 trillion electron volts (TEV)], took 14 years in the making, and something like 7,000 top graded selected scientists engineers, physicists from around the world came to its grand opening in October 2009. We, the poor economic people may love those the citizens of twenty European countries who had been willing to pony up their $8 billions pounds form their own pockets as their tax just for LHC, just for something whose findings may have huge relevance to the frontiers of scientific theory, for understanding the law of our universe, for creating the mini Big Bang, for understanding the correctness of equation of Einstein's famous equation E=Mc2; but I must say, I personally believe that all these discoveries will have zero relevance to the practicalities of everyday life leading for people of world and physicists or mathematicians or in people in terms of their economics improvement, their development, their food, their lodging or their education. It appeared before me simple wastage of money. Like great arts and great pictures of Van Ghog like many Nobel literatures, it may fundamentally recast our most and finest way of understandings of the essence of our existence in the universe, but it won't certainly invent anything how to improve life of 70% poor of the world, needed, nor it will solve how to solve next impending war for our global food crisis, global economics, nor it could open the door to unemployed mathematicians or physicists at very large except for some few. It may bring some day, Nobel prizes in physics, at best for three men and that's all. A full description of the ATLAS and of its physics performance can be however found on the website of CERN, if any one wants. The experiment started taking data during December 2010, and one of its primary goals was the search for the standard model (SM) of the Big Bang theory, presence of the Higgs particle, Higgs field and zero mass particle if any existed in TEV during 10~35 sec of the Big Bang. The main aim was "zero mass" particle production mechanism at that LHC was through gluon-gluon fusion, while the qq-qqH process, or Vector Boson fusion (VBF), accounted for about 20% of the total cross section. Next-to-leading order (NLO) corrections are of major relevance in particular for the gluon-gluon fusion production, with K-factors ranging from 1.7 to 2.0.

Main Search Channels and Experimental Aspects

In the next section, I shall discuss in this blog a few search channels for the standard model Higgs particles which will be reviewed, together with the most relevant experimental aspects.

H----? ?

This was the channel relevant for Higgs masses if it was found below 150 GeV. The main background was the irreducible continuum, and other backgrounds are ? jet or jet/jet events, the latter being rejected mainly through isolation cuts and p 0 rejection. The normalization of the background can be done through the fit of the side bands with respect to the signal peak. Key points for this channel were the electromagnetic calorimeter resolution and the determination of the primary interaction vertex, which defined the photons direction. At low luminosity (2.1033 cm-2s-1), the primary vertex was fitted using the tracks from the underlying event, with a resolution, along the direction of the beam, of 40 um. At high luminosity (1034 cm-2s-1), with in average 23 interaction vertexes for each bunch crossing, the possibility of reconstructing the photon direction using the calorimeter information alone became more relevant. The vertex position resolution that could be obtained at ATLAS from the reconstruction of the photon direction done using only the EM calorimeter was 1.6 cm. The expected signal significance that could be obtained in this channel, computed for NLO cross sections, and for an Higgs mass of 120 GeV, is 6.3. So, please look, Higgs particle is not again mass less particle. Higgs boson mass ranges 134–158 GeV, 180–305 GeV, and 340–465 GeV. It must possess mass in GeV? Then where is the zero mass particle at Planck moment? Did it really exist in the earliest time of Big Bang standard model (SM)? and did mass came from particles in the Higgs Field? The "D Zero" experiment was set up and observed collisions between protons and anti-protons (P+P-) and was so designed to examine the reason why the world is composed of only normal matter rather than its opposite: anti-matter. They found that the collisions resulted in pairs of muons 1% more often than anti-muon particles. So, there was the asymmetry that could have been proved and however explained why matter has come to dominate over anti-matter in this world, and antimatter in fact does exist rather than the two annihilating each other. But we see only matter. No antimatter has been observed in our visible world. Where did they go? Does that exist in the inner structure of atoms of matter? Then the total structure of atom would go into annihilation, radiation and energy. No matter would be possible ever. Matter was possible that it dominated over the antimatter. Otherwise, there would be no galaxies, no stars, no nebulas, no supernovas, no novas, no planet, no planetismal, no asteroids, even no earth, no exo planets, no seas, no water, no human, no animal, no trees or they changed themselves, their property from anti matter to matter in their character? Or did they separate in the early time of nucleon synthesis in a completely separate compartment to form another universe called anti matter universe (Rupak Bhattachary and prof Pranab kumar Bhattacharya's theory). This effect, which was first proposed by Andre Shakarov the NL in peace and is a well-known theory to be called CP violation, had been seen before but not to the same degree as seen in "D Zero", and the degree of such asymmetry {Thank you God you created asymmetry to prove ourselves) found in the latest results was greater than can be accounted for by the standard model of Big Bang. The researchers said at that time, the results could be explained by the existence of minimum five Higgs particles with all similar masses (so again Higgs particles also had mass and not a zero mass particle), with one having a negative electric charge, one negative and three neutral. The theory is now called the "Two-Higgs Doublet Model", though not much popular one. The standard Big Bang model however do accommodates only one Higgs doublet, never the two, and while scientists think of the Higgs as a single particle never and not five particles' combination. We (Rupak and myself explain this rather on different ways why only one Higgs particle 'w' only one is seen, because the other three will be seen as W particles and Z particles and bosons particles].

Adding another Higgs doublet adds many theoretical physicists, applied mathematicians like Rupak Bhattacharya have come to regard the standard model as incomplete since it does not explain at all of what particles gravity is made of or describe dark matter or dark energy. An extension to the standard model, known as "super symmetry," proposes that each particle has a more massive "shadow" partner particle, effectively doubling the number of known particles. Such a scheme could accommodate the two-Higgs doublet model. So far no experimental evidence has been found for the existence of such "shadow" particles or mirror particles.

The other channels in LHC are:

H----ZZ*----4-Leptons Channel

Key points for this channel were optimal efficiency and resolution in the reconstruction of electrons and muons. Main background is the irreducible ZZ*/?*---4---leptons, while other reducible backgrounds are Z, b+b- and r+r- and t+t- particles [our zero mass particle and the particle that gave mass is however r+r-]. This channel provided a rather clean signature over the full possible ranges of Higgs masses, with a statistics smaller than for other channels. There should be too many Higss particles.

For Higgs Masses above 200 GeV, This Channel Becomes the "Golden" Channel for SM Higgs Searches, VBF, H---WW

This Channel was One of the Most Relevant for those Higgs Particle Masses between 125 and 190 GeV

Besides these, there are other two very complicated channels for searching "zero mass particle" at 14 TEV. The ATLAS experiment was a multi-purpose experiment designed for the observation of a wide span of physics signatures, in the p-p collisions at 14 TeV.

A Further Collider for Higgs Particle and "Zero Mass Particle" and the Particle That provided First Mass! i.e. Mass Came from Mass Less Hypothesis?

An international consortium stepped the pace by announcing in Beijing, China, a design for the World's most expensive atom smasher, with approximately US $8.7 billion (AU $11.6 billions) named as "International Linear Collider (ILC)". In this ILC, a double tunnel, each 31 km long, particle physicists will collide electrons and their antimatter opposites, positrons, at energies of 500 billion electron volts. The scheme, which could be extended to 50 km and generation of a trillion electron volts will hurl these particles at close almost near to the speed of light (99%). The resultant collision is expected to unlock even the dark matter and dark energy, the invisible, enigmatic substances that together are thought to comprise 96% of the mass of our visible universe. If all goes well, ground will be broken in 2012 and the collider itself will be fired up at the end of the next decade.

Now, if one looks at pictures called "famous Feynman diagrams", one may look it like childish scribbles game, but their naïve appearance is misleading to me. Feynman diagrams are associated no doubt with definite mathematical rules that specify how likely it is for the process they depict, to occur. The rules for complicated processes, perhaps involving many real and virtual charged particles and many real and virtual photons, are built up in a completely specific and definite way from the core process. It is like making constructions with Tinker toys.

The particles are different kinds of sticks one can use, and the core process provides the hubs that join them. Given these elements, the rules for construction are completely determined. In this way, all the contents of Maxwell's equations for radio waves and light, Schrödinger's equation for atoms and chemistry, and Dirac's more refined version including spin; all this, and more, is faithfully encoded in the squiggle.

At this most primitive level, QCD is a lot like QED, but in bigger sense. The diagrams look similar, and the rules for evaluating them are also similar, but there are more kinds of sticks and hubs. More precisely, while there is just one kind of charge in QED, namely, the electric charge, QCD has three different kinds of charges. They are called colors, for no good reasons. We can label those charges as "red", "white", "green" and "blue"; or alternatively, if we want to make drawing easier, and to avoid the colors of the Indian flag, we can use red, green, and blue.

So, every quark particle in QED must possesses one unit of one of the color charges in QCD as further elementary. In addition, quarks come in different "flavors". The only ones that play a role in ordinary matter are two flavors called *u* and *d*, for up and down [Of course, quark "flavors" have nothing to do with how anything tastes in your tongue]. And, these names for *u* and *d* don't imply that there's any real connection between flavors and directions. [Don't blame on me; when I get the chance, I give particles dignified scientific-sounding names like axion and anyon]. There are *u* quarks with a unit of red charge, *d* quarks with a unit of green charge, and so forth, for six different possibilities altogether. And instead of one photon that responds to electric charge, QCD has eight color gluons particles that can either respond to different color charges or change one in to another. So, there is quite a large variety of sticks, and there are also many different kinds of hubs that do connect them. It seems to me like things could get terribly complicated and so messy. And so they would, were it not for the overwhelming symmetry of the theory. If you interchange red with blue everywhere, for example, you must still get the same rules. The more complete symmetry allows you to mix the colors continuously, forming blends, and the rules must come out the same for blends as for pure colors. I won't be able to do justice to the mathematics here, of course. But the final result is noteworthy, and easy to convey: there is one and only one way to assign rules to all the possible hubs so that the theory comes out fully symmetric. Intricate it may be, but messy it is not!

With these understandings, QCD is faithfully encoded in squiggles and the force between quarks emerges from squiggles. We must have definite rules to predict how quarks and gluons do behave with each other and how they interact. The calculations involved in describing specific processes, like the organization of quarks and gluons into protons, can be very difficult to carry through, but there is no ambiguity about the outcome. The theory may be either right or wrong, there's nowhere to hide

How do I Know that I am Right at All?

Through future experiment only; experiment is the ultimate inference of any scientific law.

There are many experiments that can test the basic principles of QCD. Most of them require rather very sophisticated analysis, basically because we don't get to see the underlying simple stuff, the individual quarks and gluons, directly. But there may be one kind of experiment that comes very close to doing this, and that is what I'd like to explain to you now.

Let me discuss what had been observed at LEP. But before entering into details, I'd like to review a fundamental point about quantum mechanics, which is necessary background for making any sense at all of what happens. According to the principles of quantum mechanics, the result of an individual collision is unpredictable. We can, and do, control the energies and spins of the electrons and positrons precisely, so that precisely the same kind of collision can occurs repeatedly; nevertheless, different results emerge. By making many repetitions, we can determine the probabilities for different outcomes. These probabilities encode basic information about the underlying fundamental interactions; according to quantum mechanics, they contain all the meaningful information. When we examine the results of collisions at LEP, we find there are two broad classes of outcomes. Each happens about half the time.

In one class, the final state consists of a particle and its antiparticle moving rapidly in opposite directions. These could be an electron and an antielectron (e+e-) a muon and an anti muon (u+U-) or a r and an anti r (r+r-). The little superscripts denote signs of their electric charges, which are all of the same absolute magnitude. These particles, collectively called leptons, are all closely similar in their properties. Leptons however do not carry any color charges, so their main interactions are with photons, and thus their behavior should be governed by the rules of QED.

This is reflected, first of all, in the simplicity of their final states. Once produced, any of these particles could, in the language of Feynman diagrams, attach a photon using a QED hub, or alternatively, in physical terms, radiate a photon. The basic coupling of photons to a unit charge is fairly weak, however. Therefore each attachment is predicted to decrease the probability of the process being described, and so the most usual case is no attachment. In fact, the final state, including a photon, does occur, with about 1% of the rate of simply e-e? ? (and similarly for the other leptons). By studying the details of these 3-particle events, such as the probability for the photon to be emitted in different directions (the "antenna pattern") and with different energy, we can check all aspects of our hypothesis for the underlying hub. This provides a wonderfully direct and incisive way to check the soundness of the basic conceptual building block from which we construct QED. We can then go on to address the extremely rare cases (.01%) where two photons get radiated, and so forth. For future reference, let's call this first class of outcomes "QED events."

The other broad class of outcomes contains an entirely different class of particles, and is in many ways far more complicated. In these events, the final state typically contains ten or more particles, selected from a menu of pions, rho mesons, protons and antiprotons, and many more. These are all particles that in other circumstances interact strongly with one another, and they are all constructed from quarks and gluons. Here, they make a smorgasbord of Greek and Latin alphabet soup. It's such a mess that physicists have pretty much given up on trying to describe all the possibilities and their probabilities in detail. Fortunately, however, some simple patterns emerge if we change our focus from the individual particles to the overall flow of energy and momentum. Most of the time, in about 90% of the cases, the particles emerge all moving in either one of two possible directions, opposite to one another. We say there are back-to-back jets.

(Here, for once, the scientific jargon is both vivid and appropriate.) About 9% of the time, we find flows in three directions; about .9% of the time, four directions; and by then we're left with a very small remainder of complicated events that are hard to analyze this way. I'll call the second broad class of outcomes "QCD events". Representative 2-jet and 3-jet QCD events, as they are actually observed, are displayed.

Now if you just squint a little, you will find that the QED events and the QCD events begin to look almost quite similar. Indeed also, the pattern of energy flow is qualitatively the same in both QED and QCD cases, that is, heavily concentrated in a few narrow jets. There are two main differences according myself. One, relatively trivial, is that multiple jets are more common in QCD than in QED. The other is much more profound. It is that, of course, in the QED events, the jets are just single type particles, while in the QCD events the jets are sprays of several types of particles. In 1993, while my eldest Dr Pranab kr. Bhattacharya wrote a letter to Prof Stephen W Hawkings as PhD candidate in human pathology in university of Calcutta, as well as posted as senior lecturer of pathology at Calcutta School of Tropical Medicine, kol-73, he tried to give the explanation of these phenomena.

We were able to predict the results of these experiments before they were performed.
As a historical matter, we discovered QCD and asymptotic freedom by trying to come to terms with the MIT-SLAC "scaling" experiments done at the Stanford Linear Collider in the late 1960s, for which Jerome Friedman, Henry Kendall, and Richard Taylor won the Nobel Prize in 1990. Since our analysis of the scaling experiments using QCD was (necessarily) more complicated and indirect, I've chosen to focus here on the later, but simpler to understand, experiments involving jets.

The basic concept of asymptotic freedom is that the probability for a fast moving quark or gluon to radiate away some of its energy in the form of other quarks and gluons depends on whether this radiation is "hard" or "soft". Hard radiation is a radiation that involves a substantial deflection of the particle doing the radiating, while soft radiation is radiation that does not cause such a deflection. Thus hard radiation changes the flow of energy and momentum, while soft radiation merely distributes it among additional particles, all moving together. Asymptotic freedom says that hard radiation is rare, but soft radiation is common. This distinction explains why on the one hand there are jets, and on the other hand why the jets are not single particles. A QCD event begins as the materialization of quark and antiquark, similar to how a QED event begins as the materialization of lepton-antilepton. They usually give us two jets, aligned along the original directions of the quark and antiquark, because only hard radiation can change the overall flow of energy and momentum significantly, and asymptotic freedom tells us hard radiation is rare. When a hard radiation does occur, we have an extra jet! But we don't see the original quarks or antiquarks, individually, because they are always accompanied by their soft radiation,which is common.

By studying the antenna patterns of the multi-jet QCD events we can check all aspects of our hypotheses for the underlying hubs. Just as for QED, such antenna patterns provide a wonderfully direct and incisive way to check the soundness of the basic conceptual building blocks from which we construct QCD. Through analysis of this and many other applications, physicists have acquired complete confidence in the fundamental correctness of QCD. By now experimenters use it routinely to design experiments searching for new phenomena, and they refer to what they're doing as "calculating backgrounds" rather than "testing QCD"!

Many challenges remain, however, to make full use of the theory. The difficulty is always with the soft radiation. Such radiation is emitted very easily, and that makes it difficult to keep track of. You get a vast number of Feynman graphs, each with many attachments, and they get more and more difficult to enumerate, let alone calculate. That's very unfortunate, because when we try to assemble a proton from quarks and gluons, none of them can be moving very fast for very long (they're supposed to be inside the proton, after all), so all their interactions involve soft radiation. To meet this challenge, a radically different strategy is required. Instead of calculating the paths of quarks and gluons through space and time, using Feynman graphs, we let each segment of space-time keep track of how many quarks and gluons it contains. We then treat these segments as an assembly of interacting subsystems.

Actually in this context, "we" means a collection of hard-working CPUs. Skillfully orchestrated, and working full time at teraflop speeds, they manage to produce quite a good account of the masses of protons and other strongly interacting particles. The equations of QCD, which we discovered and proved from very different considerations, survive this extremely intense usage quite well. There's a big worldwide effort, at the frontiers of computer technology and human ingenuity, to do calculations like this more accurately, and to calculate more things.

The Ingredients of QCD, Lite and Full-Bodied

With the answer in hand, let's examine what we've got. For our purposes it's instructive to compare two versions of QCD, an idealized version, I call QCD Lite, and the realistic Full-Bodied version. QCD Lite is cooked up from massless gluons, massless *u* and *d* quarks, and nothing else. (Now you can fully appreciate thewit of the name.) If we use this idealization as the basis for our calculation, we get the proton mass low by about 10%. Full-Bodied QCD differs from QCD Lite in two ways. First, it contains four additional flavors of quarks. These do not appear directly in the proton, but they do have some effect as virtual particles. Second, it allows for non-zero masses of the *u* and *d* quarks.

The realistic value of these masses, though, turns out to be small, just a few percent of the proton mass. Each of these corrections changes the predicted massof the proton by about 5%, as we pass from QCD Lite to Full-Bodied QCD. So, we find that 90% of the proton (and neutron) mass, and therefore 90% of the mass of ordinary matter, emerges from an idealized theory whose ingredients are entirely massless.

The Origin of (most) Mass

Now we have shown you the theory that describes quarks and gluons, and therefore has to account for most of the mass of matter. We, authors have described some of the experiments that confirm the theory. And we have displayed successful calculations of hadron masses, including the masses of protons and neutrons, using this theory. In a sense, these calculations settle the question. They tell us the origin of (most) mass. But simply having a computer spit out the answer, after gigantic and totally opaque calculations, does not satisfy our hunger for understanding. It is particularly unsatisfactory in the present case, because the answer appears to be miraculous. The computers construct for us massive particles using building blocks, quarks and gluons, that are themselves massless.

The Equations of QCD Lite Output Mass without Mass, which Sounds Suspiciously like Something for Nothing. How did it Happen?

The key, again, is asymptotic freedom. Previously, we discussed this phenomenon in terms of hard and soft radiation. Hard radiation is rare, soft radiation is common. There's another way of looking at it, mathematically equivalent, that is useful here. From the classical equations of QCD, one would expect a force field between quarks that falls off as the square of the distance, as in ordinary electromagnetism (Coulomb's law). Its enhanced coupling to soft radiation, however, means that when quantum mechanics is taken into account, a "bare" color charge, inserted into empty space, will start to surround itself with a cloud of virtual color gluons. These color gluons fields themselves carry color charge, so they are sources of additional soft radiation. The result is a self-catalyzing enhancement that leads to run away growth. A small color charge, in isolation, builds up a big color thunder cloud. All this structure costs energy, and theoretically the energy for a quark in isolation is infinite. That's why we never see individual quarks. Having only a finite amount of energy to work with, nature always finds away to short-circuit the ultimate thunder cloud. One way is to bring in an antiquark. If the antiquark could be placed right on top of the quark, their color charges would exactly cancel, and the thunder cloud would never get started. There's also another more subtle way to cancel the color charge by bringing together three quarks, one of each color.

In practice these exact cancellations can't quite happen, however, because there's a competing effect. Quarks obey the rules of quantum mechanics. It is wrong to think of them simply as tiny particles, rather they are quantum-mechanical wavicles. They are subject, in particular, to Heisenberg's uncertainty principle, which implies that if you try to pin down their position too precisely, their momentum will be wildly uncertain. To support the possibility of large momentum, they must acquire large energy. In other words, it takes work to pin quarks down. Wavicles want to spread out. So, there's a competition between two effects. To cancel the color charge completely, we'd like to put the quark and antiquark at precisely the same place; but they resist localization, so it's costly to do that. This competition can result in a number of compromise solutions, where the quark and antiquark (or three quarks) are brought close together, but are not perfectly coincident. Their distribution is described by quantum mechanical wave functions. Many different stable wave-patterns are possible, and each corresponds to a different kind of particle that you can observe. There are patterns for protons, neutrons, and for each entry in the whole Greek and Latin smorgasbord. Each pattern has some characteristic energy, because the color fields are not entirely cancelled particles and because the wavicles are somewhat localized. And that, through is the origin of mass. A similar mechanism, though much simpler, works in atoms. Negatively charged electrons feel an attractive electric force from the positively charged nucleus, and from that point of view they'd like to snuggle right on top of it. Electrons are wavicles, though, and that inhibits them. The result, again, is a series of possible compromise solutions.

These are what we observe as the energy levels of the atom. When I usually give the talk on which this article is based, at this point I use Dean Dauger's marvelous "Atom in a Box" program to show the lovely, almost sensuous patterns of undulating waves that describe the possible states of the simplest of atoms, hydrogen. In its absence, I will substitute a classic metaphor.

The wave patterns that describe protons, neutrons, and their relatives resemble the vibration patterns of musical instruments. In fact, the mathematical equations that govern these superficially in very different realms are quite similar. Musical analogies go back to the prehistory of science. Pythagoras, partly inspired by his discovery that harmonious notes are sounded by strings whose lengths are in simple numerical ratios, proposed that "All things are Numbers". Kepler spoke of the music of the spheres, and his longing to find their hidden harmonies sustained him through years of tedious calculations and failed guesses before he identified the true patterns of planetary motions.

Einstein, when he learned of Bohr's atomic model, called it "the highest form of musicality in the sphere of thought". Yet Bohr's model, wonderful as it is, appears to us now as a very watered-down version of the true wave-mechanical atom; and the wave-mechanical proton is more intricate and symmetric by far!
I hope that some artist/nerd will rise to the challenge, and construct a "Proton in a Box" for us to play with and admire. The understanding of the origin of mass that I've sketched for you here is the most perfect realization we have of Pythagoras' inspiring vision that the world can be built up from concepts, algorithms, and numbers. Mass, a seemingly irreducible property of matter, and a byword for its resistance to change and sluggishness, turns out to reflect a harmonious inter play of symmetry, uncertainty, and energy. Using these concepts, and the algorithms, they suggest pure computation outputs, the numerical values of the masses of particles we observe.

CONCLUSION

Still, as we have already mentioned, our understanding of the origin of mass is by no means complete. We have achieved a beautiful and profound understanding of the origin of most of the mass of ordinary matter, but not of all of it. The value of the electron mass, in particular, remains deeply mysterious even in our most advanced speculations about unification and string theory. And ordinary matter, we have recently learned, supplies only a small fraction of mass in the Universe as a whole. More beautiful and profound revelations surely await discovery. We should continue to search for concepts and theories that will allow us to understand the origin of mass in all its forms, by unveiling more of Nature's hidden symmetries. Eliminating mass enables us to bring more symmetry into the mathematical description of nature.

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