So is it the Higgs, or is it?

Some time today scientists at Cern will declare the results of the quest for the elusive particle and it should be a definite statement, says s ananthanarayanan

SCIENTISTS at the European Organisation for Nuclear Research (Cern) in Geneva and collaborators the world over have been working on the mass of data collected at the Large Hadron Collider, including some collected since August last year when part results were known. The target to put together the work of different groups and make the announcement is this very day. Although there are no indications of what the announcement may be, it should be a definitive statement: Is there a Higgs, is there no Higgs, or does the data still not allow us to say? If it is the third answer, it would be with reasons of why the answer is not one of the first two.

To review the context, physics — which seemed to have nearly answered "all questions" about nature at the end of the 19th century — was knocked off balance by new discoveries. These were radioactivity, the structure of the atom, the emission of light of specific colours by atoms – which defied explanation by science – Newtonian mechanics, gas laws, heat laws, laws of optics and electromagnetic theory that was known till then. But the crisis was resolved and answers came in the form of the *quantum theory* and *quantum mechanics* – that nature actually exchanged energy in discrete packets and moved from one state to another distinct state by the emission or absorption of energy. This theory, which must be used to make sense of the "very small" world of atoms and the like, applies perfectly to our everyday, largescale world too, the refinement from the Newtonian view being quite negligible at the larger scale.

Except for one important difference — the theory has nothing to say about the force of *gravity*, the force of attraction between objects that have mass. At the level of atoms, the forces that act are electrical forces, or short-range nuclear forces, which are sizeable forces, packing the energy that leads to the emission of all kinds of radiation. As for the gravitational force, atomic particles have such low mass that this force becomes inconsequential. This apart, quantum theory does not even treat this force. As gravity is a very real thing, being the main force at the cosmic scale and also very successfully explained and computed by non-quantum physics, there has been great effort to unify quantum physics and classical relativistic physics.

A promising line has been the *String Theory* developed by Stephen Hawking – where nature is sought to be explained by more than the usual dimensions of space and time by including details hidden because they are very compact, and reveal themselves usually only when distances are very small and, hence, energies are very high, which are conditions that are found within atoms and nuclei. The electrical force between charged particles is explained in quantum theory as carried by the electromagnetic field and arising through an exchange of virtual particles of electromagnetic radiation — which is to say, particles of light, or photons. Using similar construction, String Theory provides an explanation for the force of gravity as arising from the exchange of a massive particle, called the *Higgs Particle*. The theory proposes a number of qualities of this particle but cannot say its mass, except that it is quite large, being the carrier of so faint an interaction.

The photon was well known when it was proposed as the carrier of the electromagnetic force. But the Higgs Particle has not been seen and, hence, the quest. As the Higgs Particle is so massive, it can arise only in very high energy interactions of atomic particles. If it is found, then this would be a verification of a consequence of String Theory and a confirmation that it is a theory on the right track.

Higgs Particle

Interactions of atomic particles are brought about, for experiments, with the help of particle accelerators. These are arrangements of magnets and electric fields to race charged particles to nearly the speed of light. The Large Hadron Collider is a "super accelerator" 27 km long and it pushes a pair of streams of protons, which are pretty heavy particles, to unprecedented energies, in opposite directions, and gets them to collide. The collision thus gets double the energy and this can be large indeed. The energy of collision is many times the expected energy of the Higgs Particle, of somewhere near the equivalent of 170 proton masses. With millions of collisions taking place, there is hence a chance of some Higgs Particles arising and getting detected.

A rule of quantum mechanics is that in the pairs of parameters, position and momentum or energy and lifetime, lowering or raising the intrinsic uncertainty of one affects the other in the opposite way. In other words, if we measure the position of a particle very accurately, this puts a limit on how well we can estimate its speed. But if we allow a range of values for the position, then it is possible to be closer to its correct speed. It is the same with an energy-lifetime pair — if uncertain about energy, the intrinsic uncertainty in the lifetime is low. As the Higgs Particle is expected to have high energy, it follows that it must have a very short lifetime, which implies — even if it were created in the LHC collisions, it would not wait to be detected — it would decay in a trice!

The arrangements in the experiments at Cern are thus not to directly detect the Higgs but to detect its *decay products*. But with just millions of millions of events and the elusive chance of Higgs creation, the data that has to be examined is gigantic. All the data generated would fill 100,000 CDs every second. Even with "filtering" to allow only "promising" data, there would 27 CDs a second. No doubt, there are mechanised arrangements for data scrutiny, but it takes great doing and universities and teams around the world have pitched in. During the efforts, whose results were announced in August 2011, they looked at only a "window" of 155-495 proton mass equivalent.

This was to a large extent because this is the most accessible window — at lower energies, there is great "glare" of "noise" signals. Hence, like the drunk who searched for his key under the streetlight, not because he lost it there but because it was well lit, Cern looked for the Higgs where they were best equipped to find it; sound thinking, both Cern and the drunk.

But in August 2012, Cern reported that in that window, the Higgs did no appear to be. It was treated as a positive result — a vast area had been ruled out. "The particle is running out of places to hide," Rolf Dieter Heuer, Cern director, told a press conference in Mumbai. The search had to be continued at lower energies, with measures to overcome the distortion due to greater non-event data. Cern had promised results by end 2012 but they rescheduled an announcement in July. There is excitement, like the courthouse before the murder trial or the stands before the heavyweight finals, but we must hear what Cern says today.

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The battle of ideas

Buying up patents is big business. But the system that was designed to protect the small investor is being twisted by big companies who are using it to stifle the small guys, writes mark prig

GADGET shopping is never easy — incomprehensible technical specifications, huge price differences between shops and the underlying fear your new toy will be obsolete in a few weeks anyway. But, consumers are facing another issue, one that threatens the entire electronics industry: patent disputes leading to some of the biggest-selling gadgets being pulled off shelves.

Last week Apple won an injunction stopping Samsung Electronics selling its Galaxy Tab 10.1 tablet in the USA, giving the iPhone maker a significant win in the global smartphone and tablet patent wars. It is the latest in a seemingly endless battle of claims that has also seen the iPhone pulled from German shelves for a short time.

The problem revolves around highly technical, and often broad patents granted around everything from using your finger on a screen to the way a 3G mobile network works. It has led to a situation condemned as absurd even by those at the heart of it, with billion-dollar patent disputes seeing products pulled from shelves and legal rows and court hearings.

"It's become a ridiculous situation," says Matt Barrie of freelancer.com, the world's largest online outsourcing marketplace, and a supporter of entrepreneurs who has over 25 patents filed around the world. "Patents were designed to protect the small inventor, but it has been twisted and turned into a racket by the big companies to stifle the small guys."

Buying up patents is big business, with the major players competing bitterly for the most lucrative. AOL, facing a slump in sales, agreed in April to sell and licence 800 patents to Microsoft in a $1.1 billion sale. But even that pales into insignificance when compared to bankrupt tech company Nortel, which last year put its 6,000 patents up for auction as part of a liquidation, with the portfolio being sold to Apple and a consortium of other tech companies including Microsoft and Ericsson for $4.5 billion – outbidding a $3 billion offer from Google, who's recent $13 billion purchase of Motorola is also believed to have been largely for its portfolio of patents.

Barrie says the big losers in the patent wars are consumers, small businesses and inventors – the very people the system was designed to protect. "A patent is only as good as your ability to defend it, so for a small firm it is virtually impossible," he says. "The only people winning here are the lawyers, and those costs get passed on to consumers. In Europe, there is some common sense and you can't patent software. In the USA something similar has to happen – it is unsustainable, you have this multi-directional fight between Google, Apple, Facebook, Microsoft and others, and it's not productive for anyone."

Apple has been at the heart of the patent war since 2010, and last week's injunction against Samsung comes less than a week after Apple suffered a setback when a federal judge in Chicago dismissed its patent claims against Google's Motorola Mobility unit. Judge Richard Posner ruled that an injunction barring the sale of Motorola smartphones would harm consumers.

Apple boss Tim Cook said recently, "Is it a problem for innovation? I think from our point of view it's important Apple not be the developer for the world. We can't take all of our energy and all of our care and finish the painting and then have someone else put their name on it." He admits that "the system is broken" and claims that firms who are suing Apple are using the system in a way it was not intended.

The patent war is delaying and, in some cases, stopping new products. Earlier this year a battle over a phone's ability to turn text into links saw HTC's flagship handsets delayed in the USA. Chief executive Peter Chou says, "We think this is not healthy to the industry, this is not good for innovation and this is not fair to smaller companies. If it's not going to stop, small companies will never be able to compete with big companies. So this has to be rationalised."

Some of the biggest firms are now taking drastic measures to avoid being caught out. Qualcomm, which owns many prized patents around wireless technologies like 3G and 4G, says it plans to create a separate unit for its chip business as part of efforts to protect the licensing side of its business from any lawsuits against the company.

Many in Silicon Valley, the heart of the world's electronics industry, claim that firms are now more concerned with patents than creating new products. Elias Bizannes, an entrepreneur in Silicon Valley who works with small startups, believes the system has led to legal action being used as a tool to make money.

The Independent, London

Ingenious inventions ~ but who owned them?

Laser: Physicist Gordon Gould battled for almost 30 years to secure patents for the laser. Many scientists were working in the area, but he was the first to use the word after creating a design at Columbia University.

Car: George Selden, a patent attorney, took out a patent on the motor car in 1895 and many in the industry paid him a licensing fee. Henry Ford and others held out and an eight-year battle ensued, which included a challenge for Selden to build a car, which fell apart. His patent was declared invalid.

Windscreen wipers: Robert Kearns secured a patent for the design of intermittent windscreen wipers in 1967. Ford, Chrysler and others came up with systems of their own and Kearns sued. The case lasted until 1995 when the US Supreme Court awarded him $30 million.

Airplanes: The Wright brothers were fiercely protective of the designs after building the first successful airplane in 1903 and set about suing those they felt had infringed their patents.

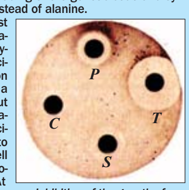
Inhibitions and variations

tapan kumar maitra **explains the action mechanism of antibiotics**

ACCORDING to their character of action, antibiotics are subdivided into bacteriostatic (tetracyclines, chloramphenicol and others) and bactericidal (penicillines, ristomycin, and others) categories. Each antibiotic is characterised by a specific antimicrobial spectrum of action. Some antibiotics are inactivated in the presence of animal and plant proteins and only a few have a powerful antibacterial action, which does not decrease in the presence of protein matter of animal tissues and, at the same time, is not toxic (in certain concentrations) for humans.

The action mechanism of antibiotics varies. Penicillin inhibits the synthesis of polymers of the bacterial cell wall (it hinders the use of muramic acid by bacteria), which leads to an increase of cells incapable of multiplication. Sometimes the action of penicillin leads to the formation of L-forms in the shape of pleomorphic protoplasmic structures. Thus, penicillin has a lethal effect, not on the given population but on its offspring. The selective action of penicillin on microbes hinders the penetration of glutamic and other amino acids through the cytoplasmic membrane of pathogenic cocci unable to synthesise amino acids which are vitally important for the existence of these bacteria. Penicillin inhibits the ability of the bacterial cell to absorb protein components — amino acids — and it inhibits the synthesis of the enzyme system and also of adaptive enzymes.

Streptomycin inhibits the incorporation of some amino acids in protein synthesis and attacks the bacterial enzyme with the participation of which the introduction of pyruvic acid into the tricarbonic acid cycle by its union with oxalacetic acid takes place. This antibiotic inhibits the activity of biotin-containing enzymes, catalysing the union of carbon dioxide with carbonic acids; it disturbs reading of the genetic code and synthesises leucine instead of alanine.



Inhibition of the growth of staphylococcus under the influence of penicillin (P), chloramphenicol (C), streptomycin (S) and tetracycline (T).

Of special interest is the action mechanism of streptomycin on tubercle bacilli. This preparation does not have a sterilising action but inhibits the respiration of tubercle bacilli, which leads to the inhibition of cell reproduction and toxin formation. At the same time, the stimulation of tissue respiration occurs in the patient as well as an increase in the ability of the macro-organism to destroy tubercle bacilli and their toxins.

The selective action of streptomycin on the tubercle bacillus is due to the fact that the permeability of cell membranes in the bacilli and in the tissue cells of animals and humans differs due to the dissimilar chemical structure of the cytoplasm of these organisms. There is data showing that streptomycin inhibits the capacity of bacterial cells of the colibacillus to oxidise fumaric and glutamic acids. This leads to an inhibition of adaptive enzyme production.

Chloramphenicol is a specific inhibitor of the biosynthesis of bacterial protein. It comes into action with the peptidyl transferase area of 50S ribosome. Competing with the aminoacyl end of the aminoacyl tRNA, chloramphenicol blocks the formation of the peptide bond. Tetracyclines, lincomycin, erythromycin, kanamycin, neomycin, spectinomycin, sparsomycin, fucidine and others belong to the group of antibiotics that inhibits protein biosynthesis in bacteria at the ribosome level. The antibiotic rifampicin suppresses protein biosynthesis by inhibiting the activity of RNA polymerase.

Antifungal antibiotics impair the intactness of the cytoplasmic membrane in fungi; antineoplastic antibiotics suppress the synthesis of nucleic acids in bacterial and animal cells and bind with DNA which serves as the matrix for RNA synthesis; bruneomycin leads to sharp inhibition of the synthesis of DNA or to its destruction.

There are various hypotheses and theories that have not entirely revealed the action mechanism of antibiotics, and this question has not been completely solved. The activity of antibiotics is expressed in International Units. For example, one IU of penicillin (Oxford unit) is the smallest amount of preparation inhibiting the growth of a standard *Staphylo-coccus aureus* strain. Recently the method of determining the activity of antibiotics according to the weight of the preparation received wide application.

One unit of activity (AU) corresponds to the activity of 0.6 micrograms (ug) of the chemically pure crystalline sodium salt of benzylpeni-cillin. Consequently, in one microgram of sodium salt of benzylpenicillin there may be 1,667 AU, and in one microgram of potassium salt, 1,600 AU. For practical purposes, both preparations are manufactured with an activity not less than 1,550 AU.

The concentration of dry preparations as well as of solutions is expressed as the number of micrograms of active substance in one gram of preparation or in one microgram of solution. More than 40 antibiotics and 200 medicine preparations are produced in India today. These are subdivided into the following seven groups: penicillins (including semisynthetic methicillin, oxacillin, ampicillin) and cephalosporins; broad-spectrum antibiotics (tetra-cyclines and their derivatives); the streptomycin group (streptomycin, neomycin, etc); reserve antibiotics (erythromycin, chloramphe-nicol, oleandomycin, ristomycin, novobiocin); antifungal (levorin, nystatin, griseofulvin, amphotericin); antituberculous (streptomycin, kanamycin, phlorimycin, etc); and antineoplastic (bruneomycin, olivo-mycin, etc).

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