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CERN'S ATLAS EXPERIMENT: MORE THAN JUST SCIENCE!

BY MARIA ANNA VAN DRIEL, WWW.NEXTTRUTH.COM

This past July, I visited the European Organization for Nuclear Research (also known as CERN) in Switzerland. The physicists at CERN are asking questions such as what is the universe made of and how did it start? And to find answers, they are using some of the world's most powerful particle accelerators, including the Large Hadron Collider (LHC). My visit to CERN focused on research and experiments going on to find other dimensions and create artificial time tunnels (wormholes). During my visit to CERN, I was able to speak with physics professor and Ph.D. Bill Murray, whose involvement at CERN includes understanding the interactions and properties of the Higgs boson (an elementary particle) using the ATLAS detector at the LHC. He also searches for new physics, especially dark matter. Dr. Murray was the ATLAS Higgs convener from 2009 until 2011, physics coordinator from 2012 until 2014, and was right in the center of the Higgs discovery in July 2012. Most of his career, Dr. Murray was a researcher at the Rutherford Lab, in Oxfordshire and in 2013 became a professor at Warwick University, where he now teaches half time. A physics degree also lead Dr. Bill Murray to a Ph.D. position in Cambridge on the OPAL experiment at CERN.

Please continue reading to find out more about some of the advanced ideas CERN scientists have, details sur-rounding the ATLAS experiment, and Dr. Murray's personal experience around the discovery of the Higgs boson.

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Q: As a professor at Warwick University and a Ph.D. in particle and new physics, you explore the secrets of the Universe.
What inspired you to step into this world?

Dr. Murray: That's actually a hard one. I always found the ideas of particle physics, built on those two great pillars of quantum mechanics and relativity, fascinating, even at school. But, ultimately, it is the simplicity of the subject that appeals — you are exploring nature in one of the most fundamental ways, finding the building blocks of which the Universe is made and the interactions between them. That and the fact you do not have to write long essays!

Pictured above is the ATLAS Calorimeter, which was built by the European Organization for Nuclear Research (also known as CERN) to measure particle energies produced when protons collide in the center of the detector. (Photo by Maximilien Brice)

Q: As a child, we all have big dreams and deep wishes of what we want to become as an adult. Was it always your dream to become a physicist?

Dr. Murray: Yup, I am afraid so. At school I was sure I wanted to do research; the only question was if it would be fusion power or particle physics.

Q: You have a great interest for the research into the understanding of the interactions and properties of the Higgs boson using the ATLAS detector at LHC, as well as searching for new physics, especially dark matter. Were you personally present /involved when the Higgs boson was found in 2012?

Dr. Murray: Yes, I was right in the center of the Higgs discovery.

Q: The discovery of the Higgs boson is a triumph of human intellect! Can you describe what happened in that moment when the Higgs was dis-covered, as well as your personal feelings during this euphoric moment?

Dr. Murray: In 2011, as we started to see evidence. I was Higgs convener, which gave me a perfect and clear over-view of the different channels. I had the impression many people were working hard on their corner and didn't have time to see the whole picture. Many different search strategies were being employed at once, and as most of them drew a blank, they narrowed down the remaining region where the particle could hide. There was excitement at Easter, as early data seemed to show something far too easily ... but it quickly faded. Then in July 2011, a more credible signal seemed to emerge in the data ... only to be excluded in August.

Q: That had to give some frustrating feelings, searching for something that long but having it fade so quickly.

Dr. Murray: Yes it did. I had spent 15 years mostly on the Higgs search by then but always thought it was probably there. In October 2011, I had to give a lecture at Edinburgh University in front of my mother ... and Professor Peter Higgs. Just at that moment it seemed as if we had searched almost everywhere it should be and found nothing. It's the only time I spoke on it with a sinking feeling in my stomach that we had got it all wrong, it didn't exist. But by December, more data came in, and we finally started to see what ultimately proved to be the real thing... but we could not prove it yet.

Q: You almost missed all the excitement of the Higgs boson existence being proven.

Dr. Murray: On Friday, June 20, 2012, four days before the Higgs discovery seminar, I was at a meeting with about nine people, where ATLAS and CMS showed CERN management, and each other, their results at that point. It was electric … we had heard rumors, how could we not, but we were the only people in the world that knew the results from the two experiments matched up perfectly. On the big day the auditorium was heaving. I had a re-served seat; I walked confidently up to the door only about an hour early. (Some people had been queuing all night.) Than the security guard said he did not have my name on the list!

Fortunately, a few people in the crowd helped, saying, 'You have to let Bill in; this must be a mistake," etc. So I got my seat and had all the drama and excitement of seeing 48 years of study finally pay off.

"Maybe one collision in the hundred thousand million is making dark matter. We don't know ... we are trying to find it. We haven't seen dark matter yet." —Dr. Bill Murray

Q: What inspired you to become involved with the ATLAS project?

Dr. Murray: Well, the LHC was clearly the right accelerator to build and work on. The high energies and collision rates meant we could explore a new regime, where the physics we knew broke down. We were guaranteed a discovery. But ATLAS and CMS are similar experiments it was a random chance that led me to one not the other.

Q: Projects like ATLAS are a widely discussed topic in which people all over the world speculate of the plausible possibilities of artificial-created time tunnels and the connection between past, present, and future and how it is affecting evolution. What is your opinion about such speculations?

Dr. Murray: I am much more open to radical speculation than many of my colleagues. We know there is much we do not know, and the discussion of discovering black holes or even time tunnels was not impossible — just rather unlikely. When you are pushing beyond what is known, it is right to be excited. When you are claiming a discovery, it is right to be cautious. Our best theory of quantum gravity, string theory, requires these extra dimensions. And even boring, old general relativity seems to allow time travel! But it has to be done responsibly … we should not conjure up an expectation of such things, just a faint possibility.

Q: According to CERN's Website, the ALICE experiment is freeing the quarks from their bonds with the gluons after melting protons and neutrons that create the Quark-Gluon-Plasma. Has there been a successful experiment in shooting highly charged electrons or quarks containing an artificial code in basic intelligent information through plasma like the QGP? And what was the result of this experiment?

Dr. Murray: The plasmas created are bizarre and wonderful … more like a perfect liquid than a gas. Unfortunately, they evaporate almost immediately. However, yes, we do have the results of shooting both electron and quarks through the plasma. There is no time for an external gun, but sometimes a pair of quarks or electrons is created, much as happens in proton collisions. This could happen at the middle of the plasma but sometimes happens at the edge, and we can measure the two outgoing particles. The interesting thing is that electrons pass through the plasma scarcely interacting, which we see from the equality of their momenta. But quarks do not — if one passes through a lot of plasma, it loses energy very rapidly, scarcely emerging from the other side. This very strong interaction with quarks was a real shock.

Q: Many science fiction movies are written around the idea of this strange liquid (plasma) and being used, in such movies, as galactic portals from one world to another. If such a time tunnel, created in electromagnetic plasma, would be possible and safe for humans to use, would you step through?

Dr. Murray: As I said, I am open to radical speculations, but this is rather remote from LHC physics. Any extra-dimensional effects created, which they have not been :(would have been on a subatomic scale.

Q: The projects ATLAS and CMS have a broad physics program containing the Higgs boson, the studies of heavy-ion collisions, the search for new particles, and extra dimensions in the Universe. What do these dimensions mean based on or characterized by the methods and principles of

science?

Dr. Murray: Extra dimensions are an inescapable prediction of string theory, which is our best bet of a theory uniting gravity and quantum mechanics. String theory is frustrating for an experimental physicist, as it makes few testable predictions. But it does require a Higgs, supersymmetry, and an 11-dimensional world.

Q: So, why do we see 4D and 3D space and time?

Dr. Murray: Well, the normal hypothesis is that most of the space dimensions are 'curled up,' so a path in them quickly leads back to where it started. The normal analogy is an ant on a string: https://home.cern/about/physics/extra-dimensions-gravitons-and-tiny-black-holes.
Close up its all 3D; from a distance, the only distance is how far along the string is from the ant. If the extra dimensions just describe short, circular paths, we don't see them … you need a good resolution. And perhaps LHC, by having unequalled energy, will be able to access the short-range scale.

Q: What would we actually see?

Dr. Murray: Imaging a weight with a hole in it, threaded on a string ... if it is given some energy, it might just move down the string. That's normal behavior.
But if it starts to spin round the string, then its speed will be reduced. We will see it moving slowly; with lots of energy … our equations of motion (which do not know it can rotate about the string) stop working. We call it missing energy; we look for it but have not seen it yet.

Q: Can you explain some of the advanced ideas or theories from scientists and maybe even reveal what has already been found in projects like ATLAS, CMS, and ALICE?

Dr. Murray: To me, the two biggest discoveries are the Higgs and the strong interaction of the gluons plasma, of which these I think you know. Mostly our searches draw a blank. But the four large experiments have published about 1,000 papers searching for new things: https://twiki.cern.ch/twiki/bin/view/AtlasPublic/WebHome#Recently_submitted_Papers.

Q: Is the Higgs and the QGP the only thing LHC is focusing on?

Dr. Murray: There are so many things LHC can study that there is always something where the results look a bit unexpected — just by statistical chance. One is drawing attention right now: decays of B mesons involving pairs of electrons, muons, and taus. In the standard model, there is a democracy here — other than some effects just due to greater mass, the rates of these should be equal. But there are persistent hints that they are not … hints, I emphasize, not proofs. Measurements of things called R(K), R(K*), or BsK* mumu all seem to point to something unexpected. If it were true, it might be telling us about a new, previously unknown set of particles. But definitely a lot more data and careful analysis is needed.

Q: During the tour at CERN, you explained how particles are shot in opposite directions through the pipes, which creates an enormous force between the tunnels and how extreme strong magnates are being used to keep these particles in a strait orbit to create a clean collision. Is it possible that in this force, X-points or electromagnetic plasmas are created?

Dr. Murray: X-points I don't know, but EM plasmas we know are there. Normally, it is called 'electron cloud,' but it is a plasma. The charge of the beams can accelerate an electron toward the middle of the pipe, but the beams exit so fast that the electron ends up sailing on and colliding with the opposite wall — where it can liberate a few electrons and the free charge starts to build up. But it's really the result of the beam charge, not the magnetic field. It's a problem because the plasma then disrupts the beams, but fortunately it decreases with time ... the 'free' electrons are scrubbed out of the machine.

"The teleportation of the Eldridge? I don't think it happened. If it had really happened, the U.S. military would never have just hushed it up — they would have perfected it and then news would have leaked out." —Dr. Bill Murray

Q: Has there ever been an experiment in sending (intelligent) information absorbed by photon, for instance, through an artificial created (electro-magnetic plasma) time tunnel?

Dr. Murray: Photons or quarks certainly contain information. That's how we transmit data around! Alas, we have never seen any hint of a time tunnel actually being created or extra dimensions so far, so we know of no other dimensional places to look at.

Q: According to MIT, normally massless photons can behave like a molecule due a photonic interaction that's mediated by the atomic interaction.
Can such a reaction be felt by a biological system, such as humans, as a local effect in endothermic or exothermic reactions?

Dr. Murray: The particles involved in high-energy interactions can interact with biological systems. Most of the interactions are through electromagnetism, especially at low (everyday) energies. But neutrons only interact with the strong force, and neutrinos only through the weak, and thus hardly do so at all. However, an individual particle will generally not be seen — the energy is too low. However, in bulk then yes; they could be felt.

Q: When an artificial (electro) magnetic field is created in which the vibrations are altered due to infra or ultrasound, is it possible that shadowy smudges having a human form due to reflection(s), as in holographic duality, can be seen (or recorded in any form) within this field?

Dr. Murray: Changing an EM field with sound vibrations is possible, but it would be really hard to have a significant effect. If you work with audio frequencies, (1KHz?), then you are talking about EM wavelengths of 30km — really low radio frequencies. If the frequency of the EM is way faster than the audio, then the atoms are effectively static, and, yes, there are effects like lensing, etc., that can be introduced. I guess the biggest effect I can imagine would be to create density fluctuations in an acoustic wave and then observe that through the different lensing effects. So, yes, I guess you can make audio waves, or an impression of them, visible. But it would be a very small effect you would have to enhance in some way.

Q: After the 'Big Bang,' there was plasma present in the Universe in big amounts.
Some people speculate that plasmas like these contained a form of intelligent information, as in basic survival for instance, that traveled from other solar systems. What is your personal opinion in this idea?
Dr. Murray: The formation of the Universe certainly seems to allow various possible condensations, different in different patches. The Higgs field could have condensed in different ways, for example. Could this affect the QGP? I expect so. These are isolated patches — in each one you see itself, but then there must be boundaries between regions. How those would work is very unclear. I am afraid that's why I like lab experiments — you can see what you did and repeat it to see how results change.

"... THE DISCUSSION OF DISCOV-ERING BLACK HOLES OR EVEN TIME-TUNNELS WAS NOT IMPOS-SIBLE — JUST RATHER UNLIKELY."

Q: Is it possible for a manipulated QGP to create atoms, having the ability to evolve on its own by using chemical reactions that can be found in the Earth's atmosphere? Or does it need a controlled surrounding for staying stable to create matter as we know it?

Dr. Murray: Ordinary plasma does not have the energy to make atoms — though a quark-gluon plasm does. The particles created by a QGP are pretty random. An evolution through chemical reactions will not happen until electrons bind to them, which is much slower than the evaporation of the plasma. So they are just ordinary hot atoms when the plasma is gone. Within the plasma they behave in odd ways — the heavier cc states for example, which in vacuum exists, in a QGP melt away and are hardly seen. But even in vacuum these decay on 10-20s timescale.

Q: We all know the story of the teleportation of the Navy destroyer escort USS Eldridge in 1943 and the claims that Albert Einstein personally mentored this bizarre experiment in order to test his unified field theory. Has such a reaction in particles ever been observed or measured at ATLAS?
Dr. Murray: Yes, ATLAS does see forces undergoing 'action at a distance.' For example, we observed photons produced when two lead nuclei just miss each other. These photon pairs emerge into the detector while the lead nuclei, not having touched, continue on their paths. However, it does all seem consistent with quantum field theory, imposing the speed of light as a limit on information flow.

Q: I have one more question for you that many people would like to see answered by a physics professor and Ph.D. such as yourself. Has proof ever been found by a CERN scientist of plasma behaving like intelligent lifeforms with the ability of evolving an intellect on its own?

Dr. Murray: To be honest, I don't even know of people are looking for it. The plasma evaporates rapidly. We know it has 'flow'; bits of it moving at different speeds at it explodes, but this seems to be driven by pressures as it was made. Each plasma is different and unique. But it seems to me there is no time for any 'intelligent structure' to evolve. Bang, it's there, it blows up, and is gone. If you drop water on a very hot cooker, you get droplets sometimes that exist for a few seconds, insulated by a layer of steam so the main droplet does not touch the metal. Like that, the water dances and then bursts into a cloud of steam. I think the life of a QGP is like that — but speeded up 20 orders of magnitude.

Thank you Professor Murray for taking the time to speak with me and answering the questions in this interview in where you share your insights concerning e.g. the Higgs-boson and your personal experiences during the research and discovery.
Meeting you and hearing your story, it is plain to see you are not only an open-minded person but also a dedicated physicist to the research of what the Higgs-boson and the Higgs field has more to offer.
Again, thank you Professor Murray … it was more than interesting as it was revealing.

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The Higgs boson and beyond at the Royal Society Summer Science Exhibition (2014) **https://youtu.be/0cb207b8p5E**

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For more information about Dr. Murray, visit
http://mur-ray.web.cern.ch/murray/