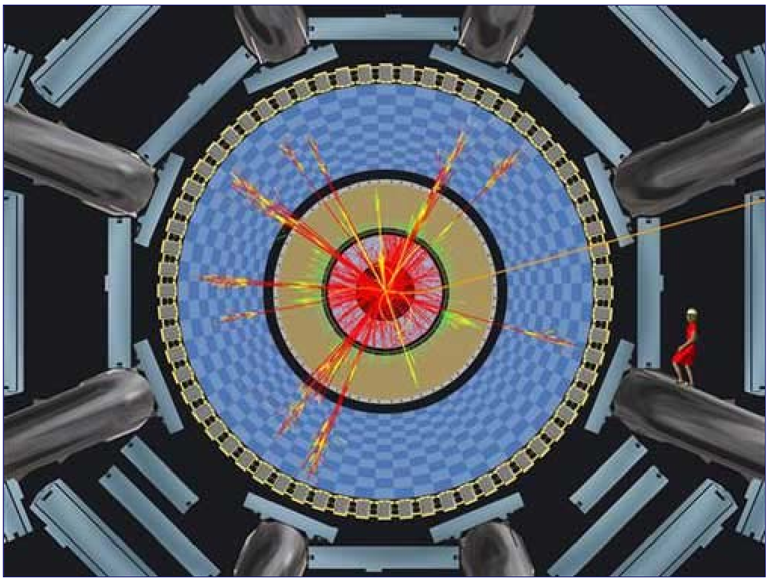
HEADLINES
ARCHIVE
ENVIRONMENT
REAL X-FILES
SCIENCE
ABOUT US
CONTACT US
CONTRIBUTORS
EARTHFILES SHOP
SEARCH IN DEPTH
SUBSCRIPTION
LOGIN
LOGOUT
HELP
RSS 2.0
Printer Friendly Page

Earthfiles, news category.

Updated - Part 1: Getting Close to the "Big Bang" Inside Large Hadron Collider?

Damaged LHC won't operate again until Spring 2009.

"We think there is a possibility that the LHC can produce black holes. Where the disagreement lies (with law suit physicists) is whether or not these black holes would be dangerous or not. … You try to do things as safely as possible, and we think the LHC is 100% safe. But there is always that little nervousness about what is going to happen when you turn all this on?"
- Joseph Lykken, Ph.D., Fermi Lab Particle Physicist



In some theories, microscopic black holes may be produced in particle collisions that occur when very-high-energy cosmic rays hit particles in our atmosphere. These microscopic-black-holes would decay into ordinary particles in a tiny fraction of a second and would be very difficult to observe in our atmosphere. The ATLAS Experiment offers the exciting possibility to study them in the lab (if they exist). The simulated collision event shown is viewed along the beampipe. The event is one in which a microscopic-black-hole was produced in the collision of two protons (not shown). The microscopic-black-hole decayed immediately into many particles. The colors of the tracks show different types of particles emerging from the collision (at the center). Computer graphic and actual Large Hadron Collider image below courtesy CERN LHC.

Update September 23, 2008 - Large Hadron Collider Damage More Serious and Won't Re-start Until Spring 2009.

CERN officials announced that damaged magnets after the first test firing on September 10, 2008, and large amounts of liquid helium that spilled into the LHC tunnel on September 19, means the LHC won't fire another proton beam before spring of 2009. Inside 17-mile-long circular tunnel of CERN's Large Hadron Collider (LHC) built underground near Geneva, Switzerland, and powered by a French nuclear reactor. Image courtesy CERN.

Updated September 22, 2008 - On the border between Switzerland and France, not far from Geneva, and three hundred feet underground, humans for the first time will try to reproduce subatomic energies similar to the universe's Big Bang. The European Organization for Nuclear Research, known in France as CERN, has built the world's biggest particle physics laboratory called the Large Hadron Collider, or LHC. The best known hadron particles are protons and neutrons, which are bound by the strong force, as atoms are bound by the electromagnetic force. CERN is made up of sixty European member states representing 500 universities and at least ten thousand physicists are participating around the planet.

> [Editor's Note: In particle physics, a hadron is a bound state of quarks. Hadrons are held together by the strong force, similar to how atoms are held together by the electromagnetic force. The best known hadrons are protons and neutrons.]

On September 10, 2008, the Large Hadron Collider fired its first single beam of protons around the 17-mile-long underground circular tunnel – but not two beams of protons colliding head-to-head near the speed of light.

There are at least four reasons for the proton collision delay. First, LHC wanted to try out the hardware and magnets. Even that gentle test caused an electric transformer to break down. Then, electrical connections between two magnets failed, causing the magnets to melt, which shut down the superconducting at near absolute zero temperature needed for LHC operations. The LHC demands so much power that France has dedicated one of its nuclear power stations to it. But because it needs so much power, transformers are going to periodically break down.

Fourth, shortly after the first test firing, hackers broke into the computers connected to the Compact Muon Solenoid Detector (CMSD) experiment and left this message: “We're pulling your pants down because we don't want to see you running around naked looking to hide yourselves when the panic comes.”

CERN now confirms that damage to the Large Hardon Collider is so serious that it won't operate again before some time in Spring 2009.

The lead scientist on that hacked Compact Muon experiment is Joseph Lykken, who received his Ph.D. in physics from MIT in 1982. Dr. Lykken has been a particle physicist for nineteen years at the Fermi Laboratory in Chicago, Illinois. Dr. Lykken told me that the hackers themselves in an ironic good deed closed the “hacked doorway” through which they entered. Further, none of the computers controlling the actual LHC proton beam collisions have any connections to the outside world for precisely the reason to prevent hackers from interfering with such a powerful laboratory.

Previous report and interview on September 9, 2008 Batavia, Illinois - Tomorrow morning at 9:30 AM local Swiss time on the border between Switzerland and France, not far from Geneva, and three hundred feet underground, humans for the first time are going to try to begin reproducing subatomic energies close to the universe's Big Bang. The European Organization for Nuclear Research, also known in French as CERN, has produced the world's biggest particle physics laboratory known as the Large Hadron Collider (LHC). CERN is made up of sixty European member states representing 500 universities. At least 10,000 physicists will be up in all time zones staring at computer monitors to see the first firing of the LHC.

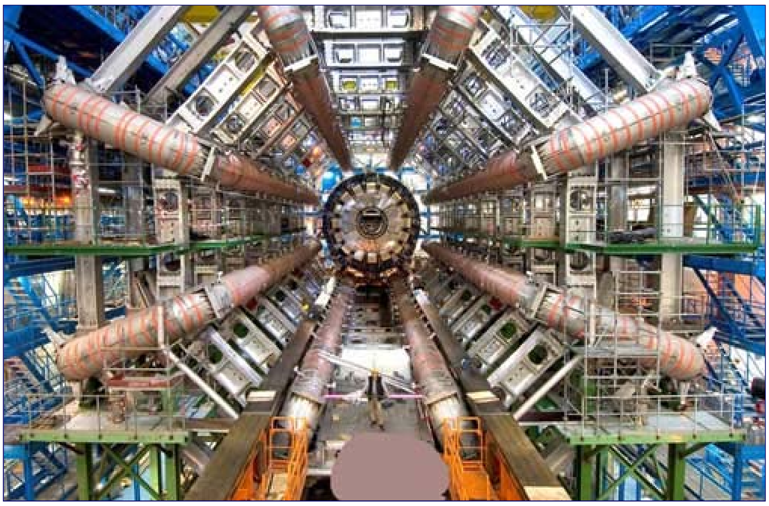
One American scientist who is heading one of the LHC experiments is Joseph Lykken, Physics Ph.D. from MIT in 1982. Dr. Lykken has been a particle physicist for nineteen years at the Fermi Laboratory in Chicago, Illinois, and is also a team leader on one of the LHC's experiments known as the Compact Muon Solenoid (CMS) experiment.

> [Editor's Note: *Wikipedia* - “The Compact Muon Solenoid (CMS) experiment is one of two large general-purpose particle physics detectors being built on the proton-proton Large Hadron Collider (LHC) at CERN in Switzerland and France. The muon (from the letter mu (μ)--used to represent it) is an elementary particle with negative electric charge. A muon can be thought of as a much heavier version of the electron. Due to their greater mass, muons do not emit as much bremsstrahlung radiation; consequently, they are highly penetrating, much more so than electrons.
>
> “Approximately 2600 people from 180 scientific institutes form the CMS collaboration building and operating the detector. CMS is designed as a general-purpose detector, capable of studying many aspects of proton collisions at 14 TeV, the center-of-mass energy of the LHC particle accelerator. It contains subsystems which are designed to measure the energy and momentum of photons, electrons, muons, and other products of the collisions. Outside the magnet are the large muon detectors, which are inside

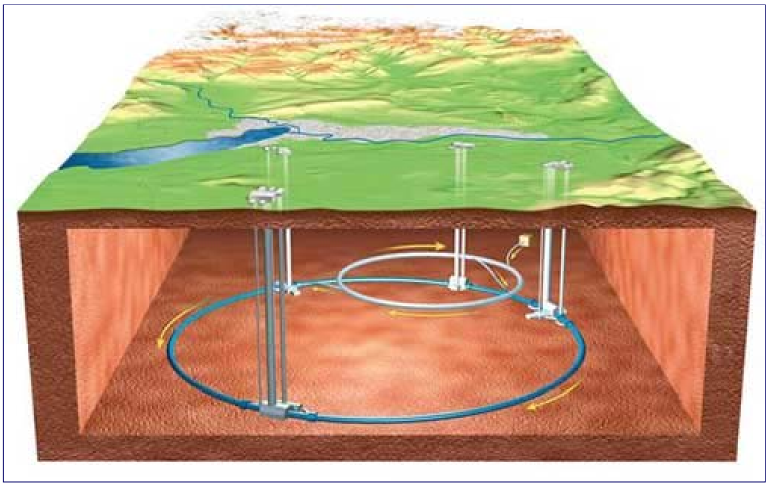
the return yoke of the magnet."]

I asked asked Dr. Lykken about a law suit filed by physicists a few months back to stop LHC because of the fear that protons colliding inside the 17-mile long, circular accelerator at near the speed of light will produce black holes that could swallow up Earth. The law suit stated there is a slight chance that Earth and humans could disappear into one or more black holes created by the LHC.

However, Dr. Lykken argues there is no danger and explained why he thinks the Large Hadron Collider is not only safe, but could finally bring Earth physicists some understanding about gravity, supersymmetry, dark matter and dark energy.



Looking straight down a segment of the 17-mile-long circular
Large Hadron Collider accelerator. Image courtesy CERN LHC.



This computer-generated image shows the location of the 17-mile-long (27 km)
Large Hadron Collider (LHC) tunnel (in blue) about 300 feet down on the Swiss-France border.
The four main experiments (ALICE, ATLAS, CMS, and LHCb) are located in underground caverns
connected to the surface by 50 meter to 150 meter pits. Part of the pre-acceleration
chain is shown in grey. Illustration courtesy CERN LHC.

Interview:

Joseph Lykken, Ph.D., Particle Physicist.

Joseph Lykken, Ph.D., Particle Physicist, Fermi Laboratory, Batavia, Illinois, and Team Leader of the CMS experiment, at the CERN Large Hadron Collider (LHC), Geneva, Switzerland: "The reason we collide protons is that first of all, it's easy to get hold of protons. We use a bottle of hydrogen gas and all you have to do with hydrogen gas is strip off the electrons from the atoms and you've got a beam of protons. So, protons are easy to get and they are also cheaper to accelerate than other kinds of particles. What we're trying to do is get to the highest possible energies in the collisions. So, protons – if you like, give us the most bang for the buck in terms of getting highest energy collisions.

> [Editor's Note: *Wikipedia* – "In physics, the proton is a subatomic particle with an electric charge of one positive fundament unit. Protons are observed to be stable and their theoretical minimum half-life of 1 x 10^36 years years. Grand unified theories generally predict that proton decay should take place, although experiments so far have only resulted in a lower limit of 1035 years for the proton's lifetime. In other words, proton decay has never been witnessed.
>
> However, protons are known to transform into neutrons through the process of electron capture. This process does not occur spontaneously, but only when energy is supplied. The process is reversible: neutrons can convert back to protons through beta decay, a common form of radioactive decay. In fact, a free neutron decays this way with a mean lifetime of about fifteen minutes."]

IS IT TRUE THAT THE OPPOSING BEAMS OF PROTONS WILL COLLIDE WITH EACH OTHER AT, OR NEAR, THE SPEED OF LIGHT?

That is true. They are going so close to the speed of light that it is very difficult to tell the difference between how fast they are going and the speed of light. The speed of light is about 186,000 miles per second. These protons are going only a few miles per hour slower than that.

THERE IS THE CONTROVERSY OF SOME PHYSICISTS WHO FILED A LAW SUIT AGAINST THE LARGE HADRON COLLIDER FIRING UP ON SEPTEMBER 10, 2008, BECAUSE THEIR HYPOTHESIS IS THAT COLLIDING PROTONS NEAR THE SPEED OF LIGHT COULD PRODUCE BLACK HOLES THAT COULD SWALLOW THE EARTH?

Yes, in fact, I had something to do with this myself because it was theories about extra dimensions of space, which is a very hypothetical idea, but it's an idea that leads to the notion that you can produce black holes in the laboratory than just out there in the universe. We think this is a possibility that you can produce black holes. Where the disagreement lies is whether or not these black holes would be dangerous or not.

Can LHC Destroy Earth with Black Holes?

CAN YOU ANSWER THE QUESTION: ON SEPTEMBER 10, WHEN THOSE PROTONS BANG INTO EACH OTHER AT NEARLY THE SPEED OF LIGHT, WHAT DO YOU THINK WILL HAPPEN IN TERMS OF BLACK HOLE GENERATION?

If I had to bet my own money, I would say it's quite a long shot that we can produce black holes at all. The reason I say that is if we were about to produce black holes at the LHC, I think we would already have seen something strange here at Fermi Lab in the high energy accelerator that we have here. So, I think it's unlikely that we'll make the black holes.

If we do make black holes, I would say with all the certainty I have as a scientist that they will almost immediately evaporate into ordinary particles. That will be very spectacular and interesting for us here as physicists, but it won't be any danger to the public.

WHY DO YOU FEEL SO CONFIDENT WHILE OTHER PHYSICISTS WENT SO FAR AS TO FILE A LAWSUIT?

The reason I feel so confident is that we are not the only people who build particle accelerators. Nature builds particle accelerators out in our galaxy. In fact, we have seen evidence for particle accelerators in our galaxy and other galaxies that are up to 10 million times as powerful as the LHC. Those very high energy particles produced by natural accelerators are hitting the Earth all the time. It's what we call cosmic rays.

> [Editor's Note: *Wikipedia* - "Cosmic rays are energetic particles originating from space that impinge on Earth's atmosphere. Almost 90% of all the incoming cosmic ray particles are protons, about 9% are helium nuclei (alpha

particles) and about 1% are electrons (beta minus particles). The term ‘ray’ is a misnomer, as cosmic particles arrive individually, not in the form of a ray or beam of particles. The origins of these particles range from energetic processes on the Sun all the way to as yet unknown events in the farthest reaches of the visible universe. Cosmic rays can have energies of over 1020 eV, far higher than the 1012 to 1013 eV that man-made particle accelerators can produce.”]

And we know, because we have detected cosmic rays, that some of the particles hitting Earth as cosmic rays have much higher energies than anything we are going to do at the LHC. And cosmic rays have apparently not produced black holes that swallow the Earth, otherwise we would not be here! This natural process of cosmic rays has been going on for billions of years.

Why Can Colliding Protons Produce Back Holes?

COULD YOU EXPLAIN WHY THE COLLISION OF PROTONS AT NEAR THE SPEED OF LIGHT COULD PRODUCE BLACK HOLES?

A black hole is an example of something where gravity is becoming very strong. Now, you might think that gravity is very strong any way because the Earth seems to pull on us with a lot of strength. But that’s because the Earth is a very large object. Even though gravity is a very weak force, we are pulled down to the surface of the Earth. But compared to the other forces of Nature like electricity and magnetism, gravity is a very, very weak force normally.

What we’re interested in is that in these very high energy collisions, we think those rules might change and that gravity might become a force as strong as the other forces. In that case, the natural thing for particles to do is to collapse into black holes.

IF THAT DOES HAPPEN AT LHC, DOES THAT MEAN YOU MIGHT FOR THE FIRST TIME ON EARTH YOU WOULD FINALLY HAVE PHYSICAL PARTICLES ASSOCIATED WITH GRAVITY IN YOUR HANDS, SO TO SPEAK?

Exactly. In particle physics, we’ve learned a lot about the other forces of Nature, but we haven’t been able to learn very much about gravity because it is such a weak force. If we could actually get our hands on something like a microscopic black hole, it would be a huge advance in our knowledge of gravity. Gravity, as Einstein told us, is related to the fabric of space and time. So, we would learn about space, time, gravity and probably about the origins of the universe.

Fermi Lab Is Having A Pajama Party to Watch LHC

WHAT WILL YOU BE DOING AT 9:30 AM CERN TIME, 3:30 AM EAST COAST TIME, ON WEDNESDAY, SEPTEMBER 10, 2008?

Here at Fermi Lab, we’re having a little party. It’s going to be very early in the morning for us, so we’re calling it a pajama party. But we’re all going to get together and we have a remote control room for the CMS experiment – the LHC experiment that I’m involved with. We’re actually going to see live what’s going on at Cern.

SO, YOU’RE GOING TO HAVE CHAMPAGNE BOTTLES AND WHAT WOULD WE SEE IF WE WERE WATCHING?

Usually what happens when you start up a beam like this, they can show you a profile of the beam through what they call ‘beam monitors.’ LHC needs instruments to tell them where the beam is and what it is doing, so we should be able to see some of the video taken from those beam monitors.

WILL THERE BE SOMETHING LIKE FLASHES OF LIGHT?

If the CMS detector works as we hope it does, we should be able to detect flashes of light and what we call ‘tracks of particles’ coming from any collisions that are produced.

AND IF THERE IS A BLACK HOLE THAT SWALLOWS THE EARTH, YOU ALL WOULD BE CELEBRATING WITH CHAMPAGNE AND WATCHING LIGHT RIGHT UP UNTIL…?

Right up until we are not anymore! (laughs)

WE WON'T EXACTLY KNOW UNTIL IT'S ALL FIRED UP AND RUNNING.

I think it's always the case for human civilization that when you push into the unknown, you're always a little bit nervous about what are you going to find and what's going to happen. I think that's only natural. Of course, you try to do things as safely as possible, and we think the LHC is 100% safe. But there is always that little nervousness about what is going to happen when you turn all this on? And we'll find out. We have 3,000 physicists just in our CMS experiment, so I think taken altogether, there will be 10,000 physicists (out of 20,000 estimated on Earth) and other computer-related technical people all standing up with their champagne glasses watching this big event.

WHAT WILL YOU SEE ON YOUR COMPUTER SCREENS?

We'll be using the actual computer monitors that show us the detectors, so it will be as if we are looking down into the tunnel and we will also have the readouts from all the electronics from inside the detector. From a physicist point of view, that is what is most interesting because that's showing us what is happening at the microscopic level in whatever the particle collisions are producing.

SO, SIMULTANEOUSLY ALL THE PHYSICISTS ON EARTH THAT ARE INVOLVED WITH THE LHC WILL BE WATCHING TOGETHER NO MATTER THE TIME ZONE. WHAT WILL BE THE FIRST HARD DATA THAT ALL OF YOU WILL BE WORKING ON?

The first evidence we will be looking for is what collisions have occurred. We don't expect the first collisions we see to be anything spectacular. But we never know. We've never done collisions at these energies before, so it will be interesting to look at the very first collision and try to figure out what is going on.

SINCE IT'S HAPPENING AT THE SPEED OF LIGHT, DOES THAT MEAN IT'S TURNED ON AND A SECOND LATER, YOU HAVE ALL OF THE NEW DATA?

We have to sift through the data electronically, not by humans, because there is too much data. But, we won't have all the data we want immediately. In order to do what we want in a search for the Higgs boson and supersymmetry, we will have to run the LHC for probably ten or fifteen years to get all of the data that we need.

WHEN IT'S FIRED UP, WILL PROTONS KEEP COLLIDING AND NOT STOP FOR HOURS, DAYS AFTER?

Yes, these experiments are designed to run 24 hours a day, 7 days a week, for perhaps six or nine months out of the year. That's one of the difficulties in designing the detectors and accelerators is to design them to be able to run near the speed of light for months at a time, producing billions and billions of collisions.

SO AFTER IT'S TURNED ON, IF THE LHC PRODUCED A HIGGS BOSON, YOU ALL WOULD PROBABLY FAINT?

Yes! We would be surprised, but stranger things have happened. Some experimenters have been very lucky and made discoveries almost immediately when they started up. We don't expect that to happen for LHC, but it has happened in the past for other experiments.

WHAT KIND OF GLITCH OR DISCOVERY WOULD IT TAKE TO STOP IT ALL?

There are many things that can go wrong here. We're talking about magnets that are cooled down to only 2 degrees above absolute zero by the world's largest set of refrigerators. Something could go wrong there. We're using enormous amounts of electricity going through all kinds of high voltage circuits. Something can go wrong there. As electronic detectors, we are using state-of-the-art incredibly complicated solid state materials. These things have not been tested altogether yet, so we don't know what is going to happen there. There are thousands of things that can go wrong and we're hoping not too many of them go wrong at the same time."

Click here to see LHC Musical Rap Video.

Continued in **Part 2:** Searching for Higgs Bosons, Dark Matter and Neutrolinos

---

More Information:

For further information about the Big Bang, dark matter and energy and other cosmic mysteries, please see reports below in the **Earthfiles Archive**:

- 08/07/2008 — CERN Announces Start Date for Hadron Collider
- 01/12/2008 — Our Milky Way Galaxy On Collision Course with Huge Gas Cloud - 40 Million Years from Now
- 10/18/2007 — A Quantum Math Description of Parallel Universes
- 08/10/2007 — Levitation Possible by Reversing Casimir Force
- 08/03/2007 — The Milky Way Is Devouring the Alien Sagittarius Dwarf Galaxy
- 05/15/2007 — Hubble Finds Dark Matter Ring
- 05/08/2007 — Exploded Star 5 Times Brighter Than Any Supernova Seen Before
- 01/07/2007 — Universe's Mysterious Dark Matter - First 3-D Map
- 01/07/2007 — Universe's Mysterious Dark Matter - First 3-D Map
- 06/25/2005 — "Junk DNA" That's Not Junk
- 04/01/2005 — What's Killing Off Marine Life Every 62 Million Years?
- 01/17/2004 — Part 2 - Is Dark Matter the "Heavy Shadow" of Light Matter?
- 01/13/2004 — Part 1 - Is Dark Matter the "Heavy Shadow" of Visible Matter?
- 10/25/2003 — Science Data Reinforces Invisible "Dark" Matter and Energy Make Up 96% of Our Universe
- 05/14/2003 — Hubble Telescope Finds "Ashes" of First Stars in This Universe
- 02/24/2002 — Mysterious Slowing of Pioneer Spacecraft 7 Billion Miles from Earth
- 12/20/2001 — Will Our Universe End With Its Final Light Frozen in Time?
- 12/14/2000 — A Pleiadian Star Tears Apart Black Interstellar Cloud

Black Holes:

- 01/25/2008 — Could Our Universe Be A Virtual Reality Processed By Other Intelligence?
- 12/19/2006 — First Stars - Or First Black Holes - in Universe?
- 11/27/2006 — Namibia Telescopes Find First "Gamma Clock" in Milky Way Galaxy
- 12/04/2005 — Central Black Hole Affects Massive Perseus Galaxy Cluster
- 11/09/2005 — Cosmic First Light and Black Hole At Our Galaxy's Center
- 03/03/2005 — What Made Five Strong Radio Bursts At the Center of Our Galaxy?
- 09/12/2000 — Black Holes - A Surprising Mass in the M82 Galaxy
- 09/06/2000 — Hubble Photographs Mystery Object in Centaurus Constellation
- 04/24/2000 — A Black Hole in the Big Dipper?
- 01/28/2000 — Black Hole Mystery at the Center of the Andromeda Galaxy
- 01/17/2000 — Chandra Telescope Helps Solve X-Ray Mystery

Websites:

Large Hadron Collider, CERN: http://public.web.cern.ch/public/en/LHC/LHC-en.html

CERN: http://lhc2008.web.cern.ch/LHC2008/index-E.html

Fermi National Accelerator Laboratory: http://www.fnal.gov/

Black Holes: http://en.wikipedia.org/wiki/Black_hole

Higgs Bosons: http://en.wikipedia.org/wiki/Higgs_boson

Supersymmetry: http://en.wikipedia.org/wiki/Supersymmetry

Dark Matter: http://en.wikipedia.org/wiki/Dark_matter

Dark Energy: http://en.wikipedia.org/wiki/Dark_energy

Credits