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[System Safety Society](#)


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Focus

Large Hadron Collider: Cause for ConCERN or Tempest in a Teapot?

 by **Sherry R. Deatrck**

 Pages **1** | 2

The European Organization for Nuclear Research, known as "CERN," is in the final stages of testing the Large Hadron Collider (LHC), the world's largest and highest energy particle accelerator. Built to replicate as nearly as possible the aftermath of the "Big Bang" so that scientists can better understand the nature of matter and anti-matter, and to verify the existence of such mysterious particles as the Higgs boson, it does so at potentially a very high risk. With more than 20 years of planning and billions of dollars spent, there's a great deal riding on the success of the LHC. But perhaps even more important, the earth's existence may be at stake. As of June 7, 2008, the LHC Safety Assessment Group's (LSAG) report has not been released to the public (although it is complete) and has not been subjected to peer review.

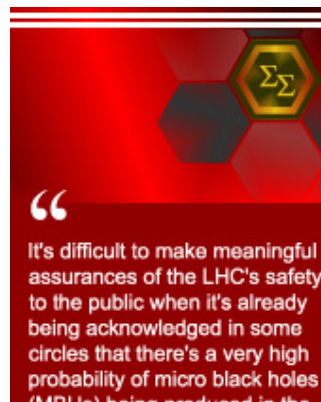
It's difficult to make meaningful assurances of the LHC's safety to the public when it's already being acknowledged in some circles that there's a very high probability of micro black holes (MBHs) being produced in the LHC. One respectable estimation of the probability puts it at more than 60%. Another source predicts one MBH would be produced each second.

The basis for their safety assurances comes only from theory, and in fact, from theories about theories. No one knows for sure what exactly is going to happen when the switch is flipped and the experiment begins in earnest, and the only serious attempt at a calmativie offered so far is that the MBHs will succumb quickly to "Hawking Evaporation." However, Hawking Evaporation is only a theory, and has not been proven or tested empirically.

In the original 20-page safety report, "Study of Potentially Dangerous Events During Heavy-Ion Collisions at the LHC," published in February 2003, CERN states: "Many new and exciting phenomena are expected to occur as a result of these very high energy collisions. It is hoped that some of them will be unpredicted and will point to new directions in our understanding of the structure of matter." There is a heated discussion raging in the blogosphere on the issue of LHC safety. Arguments on both sides are compelling as well as confusing. A preliminary hearing is set for June 16 in the lawsuit filed last spring by former nuclear safety officer Walter Wagner and Luis Sancho against the U.S. Department of Energy, Fermilab, the National Science Foundation and CERN. The lawsuit was filed in U.S. District Court in Hawaii and seeks to put the brakes on the experiment for at least four months after the LSAG issues its updated safety assessment report. The petition asserts that prior safety studies do not adequately address potential existential risks from operation of the LHC, and asserts that the probability could be estimated at close to 50%.

Briefly, the LHC occupies a 17-mile circular tunnel 300 feet below the earth's surface in Switzerland. Its purpose is to collide protons at near the speed of light, generating reams of data that has necessitated the development of a new computing infrastructure — known as the "Grid" — to analyze the results.

One of the four detectors spread around the circle is the CMS, which will track and measure thousands of particles that will arise after two protons collide. Another experiment, the LHCb, will study the decay of B-mesons to explain why matter and antimatter did not immediately annihilate with one another in the Big Bang leaving a universe composed of only photons.


[President's Message](#)
[From the Editor's Desk](#)
[TBD](#)
[In the Spotlight:](#)
[Application of System Safety to Prevention of Falls from Height in Design of Facilities, Ships and Support Equipment for Weapons Systems](#)
[A Software Tool for Domino Effect Risk Assessment in Industrial Plants](#)
[Focus:](#)
[Large Hadron Collider: Cause for ConCERN or Tempest in a Teapot?](#)
[Chapter News](#)
[Mark Your Calendar](#)
[Opinion \(Rimson\)](#)
[Opinion \(Benner\)](#)
[ISSRC 2008](#)
[Announcements](#)
[About this Journal](#)
[Classifieds](#)
[Advertising in eJSS](#)
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[Puzzle](#)


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Physicists' reputations are at stake, and indeed, the entire field of particle physics rests on these tests, according to CERN's director general, Robert Aymar. "If nothing new turns up below a [quark-quark] collision energy of 1 TeV, this would be very bad for particle physics, and for humanity." ["Life at the high-energy frontier" *Physics World*, Oct. 4, 2006.] If the LHC reveals the Higgs boson, the next step would be to build the International Linear Collider, to measure the Higgs boson more accurately, and at a cost of twice the amount of the LHC.

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Just what is a hadron, and why does CERN want to collide them? A hadron is a collection of quarks, or quarks and antiquarks. A proton is a hadron composed of two up-quarks and one down; a neutron consists of two downs and one up. Physicists hope that by colliding hadrons, they will prove the existence of the Higgs field, which would explain that space is not a void, but contains an invisible field that exerts a drag on matter as it passes through, giving it mass. Proof of the Higgs particle is paramount to modern physics. If it does not exist, there is no reason for fundamental particles to have mass. Some call it the "God particle."

Why is the LHC in a circular tunnel? In a nutshell, the protons will pick up speed with every lap until they are traveling at 99.9999991% of the speed of light. A proton will make over 11,000 laps per second. Superconducting magnets, operating at -271.25 Celsius (-456.25 degrees F.), are required to keep the protons in orbit. These magnets pose potential hazards. For instance, a loose screw could take off like a bullet once the magnet is turned on. On the other hand, if a magnet fails to operate during the beam projection, the protons could veer off and burn a hole into the LHC. In fact, the LHC is behind schedule because of a failure of a set of magnets during a test run in 2007. Helium filled the tunnel when a pipe burst. This incident was blamed on an engineering error.

But what of the potential for destruction of the earth when the LHC goes "live" later this year? (While the LHC is set to begin in late June, it probably won't be fully operational until September.) Professor Dr. Otto E. Rössler says the scientific community claims any black hole created by the LHC would destroy the earth in 50 million years. However, his own calculations indicate this time frame may in fact be closer to 50 months. [www.golem.de/0802/57477-4.html]

The risk of a doomsday scenario was indicated by Sir Martin Rees, with respect to the LHC's predecessor, the RHIC, as being at least a 1 in 50,000,000 chance. However risks with respect to LHC are based on new risk assumptions that opponents allege have not been adequately addressed. Accurate assessments of risks are impossible due to the present incomplete, or possibly hypothetically flawed, standard model of particle physics. Even if the probability of destruction by MHB is low, one must weigh the potential harm against the benefits to be obtained. The benefits are verification of the current model of physics, primarily. The risks are, on the other hand, over 6 billion human lives lost, not to mention the animal and plant life on earth.

[next page »](#)

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[Contact](#)
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[System Safety Society](#)


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Pages 1 | 2

James Blodgett, who holds a Master's degree in statistics and leads the Mensa Special Interest Group, Global Risk Reduction, posted an entry on the blog "LHC Concerns" that fairly summarizes the state of the argument and sets forth his independent research into the safety issues. He says that in the planning stages (over 20 years ago), physicists had no reason to fear the creation of MBHs. In 1999, Walter Wagner (who filed the current lawsuit to halt the LHC) suggested that the Relativistic Heavy Ion Collider could create black holes. Brookhaven published a paper discussing the RHIC's safety, and today that publication is cited to support the LHC's safety.

However, since that time, string theorists have suggested that colliders can create black holes. Also, the Hawking Radiation that is said to dissipate the black holes is unproven, and disputed by many. Blodgett goes on to say, "Part of the problem is that physicists are not risk analysts. They feel, correctly, that the theories that permit trouble are a small subset of all theories, so that trouble is not likely. As one physicist said to me, 'You do not understand probability. A probability of 0.001 means it is not going to happen.' Well, I have a master's degree in statistics. I do understand probability. What the physicist did not understand is that 0.001 times the value of Earth gives a tremendous negative expected value. We should NOT be taking chances like that."

Blodgett makes the analogy of an astronaut who faces risks with each shuttle launch. But, he says, "...a shuttle astronaut is a volunteer. A commercial airplane with a 0.001 risk would not be allowed to fly. A commercial airplane carries many passengers who did not volunteer for a risky mission. The Earth has 6.5 billion passengers, so we should hope for a risk to Earth that is less than that of a commercial airplane."

In areas of scientific risk, risk specialists use the precautionary principle, which reverses the burden of proof to the experimenters to show the safety of the experiment. According to Blodgett, however, many scientists are unaware of this principle and reluctant to use it even though the European Union has adopted it formally.

Finally, Blodgett says that estimates of the risks are subjective and widely variable. In 2004, he interviewed various physicists and asked for estimates of different components of collider risk. "As an example of the variability, estimates that Hawking radiation would fail ranged from 0% to 50%. The data are as follows: 0, 0, 1E-10, 0.001, 0.01, 0.01, 0.01, 0.02, 0.02, 0.07, 0.1, 0.1, 0.3, 0.35, 0.5. This was at the time that CERN was relying on Hawking radiation, before we were aware of the papers questioning its theoretical background. I guess that estimates would be higher now."

Perhaps Blodgett, the plaintiffs in the Hawaii lawsuit and others are making a mountain of a molehill. However, much lies in the balance. The LHC has already been delayed once after a mishap. Why not wait until we can be more secure in knowing what will happen to the black holes that even CERN scientists admit will be created when the LHC beams are fully

operational?

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[President's Message](#)
[From the Editor's Desk](#)
[TBD](#)
[In the Spotlight:](#)
[Application of System Safety to Prevention of Falls from Height in Design of Facilities, Ships and Support Equipment for Weapons Systems](#)
[A Software Tool for Domino Effect Risk Assessment in Industrial Plants](#)
[Focus:](#)
[Large Hadron Collider: Cause for ConCERN or Tempest in a Teapot?](#)
[Chapter News](#)
[Mark Your Calendar](#)
[Opinion \(Rimson\)](#)
[Opinion \(Benner\)](#)
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References

<http://public.web.cern.ch/Public/en/LHC/Safety-en.html> www.lhcfacts.org

Elizabeth Kolbert, "Crash Course: Can a seventeen-mile-long collider unlock the universe?" *New Yorker*, May 14, 2007.

"The Potential for Danger in Particle Collider Experiments" published at www.risk-evaluation-forum.org

Wikipedia: http://en.wikipedia.org/wiki/Talk:Large_Hadron_Collider

[« previous page](#)