

# News Background (You can use this. It is a news release that provides background on its issue.)

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## Renewed particle collider risk

There is a small chance that upcoming particle collider experiments by the Large Hadron Collider (LHC) at the CERN research facility in Europe may destroy Earth. The risk is small because the science that enables trouble is speculative, as is all science in areas that have not yet been explored. However, most of the science that enables trouble is based on reasonable theories that have appeared in peer-reviewed journals, so the risk is not zero.

The risk is not zero, but claiming zero risk is the official policy of CERN. "Zero risk" is precisely equivalent to that famous statement, "Nothing can possibly go wrong."

The scientists involved are not evil. They always had reasons to think that the risk was low. However, successive safety considerations evaporated. To their credit, after much of that evaporation CERN did another safety study and developed new safety considerations. Subsequently, several scientists developed ways to circumvent the new safety considerations—ways that require new speculative science. The new safety considerations have reduced risk because trouble now requires another level of speculation, but risk has not been eliminated. CERN then declared that the risk was zero, and demonstrated safety by taking the risk of starting the LHC. They were right for the moment. After several years of LHC operation, we are still here.

The new risk arises because 1) the new LHC has been redesigned to double energy and explore new territory. Safe operation at lower energy does not guarantee safety in this new range. 2) a new physics paper based on new theory predicts black hole production at the energy level of the rebuild LHC. The LHC is expected to reach this level in May 2015.

## Evaporating Safety Considerations

At first, particle colliders seemed safe because there were no known failure modes. An environmental impact statement for the LHC mentioned radiation, but this would be controlled because the LHC was to be located underground. Then in 1999 a letter published in *Scientific American* asked whether upcoming colliders might create micro black holes. This was answered by calculations that showed that black hole creation would require energy beyond the reach of any collider. At about the same time, several physics papers based on new string theory predicted black hole production at colliders, eliminating that safety consideration. These papers projected that micro black holes would evaporate via Hawking radiation, a prediction echoed by a safety study commissioned by CERN. Shortly afterward, several papers were published that questioned whether Hawking radiation, which has never been observed, would work as predicted. These papers were independent of the collider controversy, but they reduced the validity of Hawking evaporation as a safety consideration. Another potential collider product was a strangelet, a particle of strange matter which might catalyze conversion of normal matter into more strange matter, turning Earth into a small ball of strange matter. A safety study for an earlier collider said this was unlikely because strangelets would have positive charge and not attract normal matter. A

subsequent physics paper predicted that strangelets would have negative charge. Another safety consideration was that cosmic rays with more energy than the LHC have apparently been hitting Earth since its formation, and we are still here. However, micro black holes made by cosmic rays would retain the momentum of the cosmic ray. If they behave like neutrinos, most would zip right through the Earth without hitting anything. Even if they do hit a particle, they would absorb that particle and continue. A black hole with the momentum of a cosmic ray would have to absorb thousands of particles to slow below escape velocity from Earth. Given neutrino-level collisions, the biological probability of any cosmic-ray-created black hole ever accreting enough particles to slow below escape velocity, even given creation of billions of black holes over Earth's history, is very small. However, the LHC collides two particles moving in opposite directions. Their momentum cancels. In most cases it would not cancel precisely, leaving enough momentum so that most micro black holes made by this process would still be moving faster than escape velocity. However, calculations indicate that hundreds per year would be moving slower than escape velocity. These would be captured by Earth. Therefore this safety consideration does not survive scrutiny.

After loss of these safety considerations, CERN, to their credit and the credit of a few critics who badgered them, commissioned a new safety study. As part of this new study, Giddings and Mangano published a paper that developed a new safety consideration involving white dwarf stars and neutron stars, bodies whose high gravity should reliably capture micro black holes, breathing new life into the cosmic ray consideration. Subsequently a few scientists and critics developed new speculative science that would invalidate Giddings and Mangano.

We contend that the risk was never high because science that enables risk was always speculative. We contend that this risk was reduced by Giddings and Mangano because circumventing their new safety consideration requires a new level of speculative science. However, we contend that the risk is not zero because speculative science is sometimes true. New theory predicting black hole production at the energy level of the rebuilt LHC increases risk.

The policy implications are complex. Some experiments should never be conducted. An experiment with even a small probability of destroying Earth seems in this class. The negative expected value (value times probability) is still humongous even if the probability might be low because the value to be lost is seven billion human lives, plus all future humans, plus sentient animals and our beautiful biosphere. However, the results of dangerous science just might save us from other risks, and just might enable expansion of humanity into the universe. But these favorable results do not seem a likely result of LHC research. If they are achievable, it would seem that we could achieve them with science that is less dangerous. CERN is not comparing risks with benefits because they contend that there is no risk.

The European group LHC Kritik has posted a related news release, which also contains link to their website, at: [http://www.oekonews.at/index.php?mdoc\\_id=1097987](http://www.oekonews.at/index.php?mdoc_id=1097987) . View it in Google Translate if you can't read German.

## **Where to find studies mentioned here**

Citations and details are on a reference list at <http://www.risk-evaluation-forum.org/links.htm>

## **About Risk Evaluation Forum**

Risk Evaluation Forum is a website that advocates careful consideration of existential risks (risks to the existence of the human species.) At the moment, it is focused on the collider issue. It is located at <http://www.risk-evaluation-forum.org> .