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## Protons and Champagne Mix as New Particle Collider Is Revved Up

By [DENNIS OVERBYE](#)

BATAVIA, Ill. — Science rode a beam of subatomic particles and a river of Champagne into the future on Wednesday.

After 14 years of labor, scientists at the [CERN](#) laboratory outside Geneva successfully activated the [Large Hadron Collider](#), the world's largest, most powerful particle collider and, at \$8 billion, the most expensive scientific experiment to date.

At 4:28 a.m., Eastern time, the scientists announced that a beam of protons had completed its first circuit around the collider's 17-mile-long racetrack, 300 feet underneath the Swiss-French border. They then sent the beam around several more times.

"It's a fantastic moment," said Lyn Evans, who has been the project director of the collider since its inception in 1994. "We can now look forward to a new era of understanding about the origins and evolution of the universe."

Eventually, the collider is expected to accelerate protons to energies of seven trillion electron volts and then smash them together, recreating conditions in the primordial fireball only a trillionth of a second after the Big Bang. Scientists hope the machine will be a sort of [Hubble Space Telescope](#) of inner space, allowing them to detect new subatomic particles and forces of nature.

An ocean away from Geneva, the new collider's activation was watched with rueful excitement here at the Fermi National Accelerator Laboratory, or Fermilab, which has had the reigning particle collider.

Several dozen physicists, students and onlookers, and three local mayors gathered overnight to watch the dawn of a new high-energy physics. They applauded each milestone as the scientists methodically steered the protons on their course at CERN, the European Organization for Nuclear Research.

Many of them, including the lab's director, Pier Oddone, were wearing pajamas or bathrobes or even nightcaps bearing Fermilab "pajama party" patches on them.

Outside, a half moon was hanging low in a cloudy sky, a reminder that the universe was beautiful and mysterious and that another small step into that mystery was about to be taken.

Dr. Oddone, who earlier in the day admitted it was a "bittersweet moment," lauded the new machine as the result of "two and a half decades of dreams to open up this huge new territory in the exploration of the natural world."

Roger Aymar, CERN's director, called the new collider a "discovery machine." The buzz was worldwide. On the blog "Cosmic Variance," Gordon Kane of the [University of Michigan](#) called the new collider "a why machine."

Others, worried about speculation that a black hole could emerge from the proton collisions, had called it a doomsday machine, to the dismay of CERN physicists who can point to a variety of studies and reports that say that this fear is nothing but science fiction.

But Boaz Klima, a Fermilab particle physicist, said that the speculation had nevertheless helped create buzz about particle physics. "This is something that people can talk to their neighbors about," he said.

The only thing physicists agree on is that they do not know what will happen — what laws and particles will prevail — when the collisions reach the energies just after the Big Bang.

"That there are many theories means we don't have a clue," said Dr. Oddone. "That's what makes it so exciting."

Many physicists hope to materialize a hypothetical particle called the Higgs boson, which according to theory endows other particles with mass. They also hope to identify the nature of the invisible dark matter that makes up 25 percent of the universe and provides the scaffolding for galaxies. Some dream of revealing new dimensions of space-time.

But those discoveries are in the future. If the new collider were a car, then what physicists did Wednesday was turn on an engine that will now warm up for a couple of months before anyone drives it anywhere. The first meaningful collisions, at an energy of five trillion electron volts, will not happen until late fall.

Nevertheless, the symbolism of the moment was not lost on all those gathered here.

Once upon a time the United States ruled particle physics. For the last two decades, Fermilab's Tevatron, which hurls protons and their mirror opposites, antiprotons, together at energies of a trillion electron volts apiece, was the world's largest particle machine.

By year's end, when the CERN collider has revved up to five trillion electron volts, the Fermilab machine will be a distant second. Electron volts are the currency of choice in physics for both mass and energy. The more you have, the closer and hotter you can punch back in time toward the Big Bang.

In 1993, the United States Congress canceled plans for an even bigger collider and more powerful machine, the Superconducting Supercollider, after its cost ballooned to \$11 billion. In the United States, particle physics never really recovered, said the supercollider's former director, Roy F. Schwitters of the [University of Texas](#) in Austin. "One nonrenewable resource is a person's time and good years," he said.

Dr. Oddone, Fermilab's director, said the uncertainties of steady Congressional financing made physics in the United States unduly "suspenseful."

CERN, on the other hand, is an organization of 20 countries with a stable budget established by treaty. The year after the supercollider was killed, CERN decided to build its own collider.

Fermilab and the United States, which eventually contributed \$531 million for the collider, have not exactly been shut out. Dr. Oddone said that Americans constitute about a quarter of the scientists who built the four giant detectors that sit at points around the racetrack to collect and analyze the debris from the primordial fireballs.

In fact, a remote control room for monitoring one of those experiments, known inelegantly as the Compact Muon Solenoid, was built at Fermilab, just off the lobby of the main building here.

“The mood is great at this place,” he said, noting that the Tevatron was humming productively and still might find the Higgs boson before the new hadron collider.

Another target of physicists is a principle called supersymmetry, which predicts, among other things, that a vast population of new particle species is left over from the Big Bang and waiting to be discovered, one of which could be the long-sought dark matter.

The festivities started at 2 a.m. Chicago time. Speaking by satellite, Dr. Evans, the collider project director at CERN, outlined the plan for the evening: sending a bunch of protons clockwise farther and farther around the collider, stopping them and checking their orbit, until they made it all the way. He noted that for a previous CERN accelerator it had taken 12 hours. “I hope this will go much faster,” he said.

Twenty minutes later, the displays in the control room showed that the beam had made it to its first stopping point. A few minutes later, the physicists erupted in cheers when their consoles showed that the muon solenoid had detected collisions between the beam and stray gas molecules in the otherwise vacuum beam pipe. Their detector was alive and working.

Finally at 3:28 Chicago time (10:28 a.m. at CERN), the display showed the protons had made it all the way around to another big detector named Atlas.

At Fermilab, they broke out the Champagne. Dr. Oddone congratulated his colleagues around the world. “We have all worked together and brought this machine to life,” he said. “We’re so excited about sending a beam around. Wait until we start having collisions and doing physics.”

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