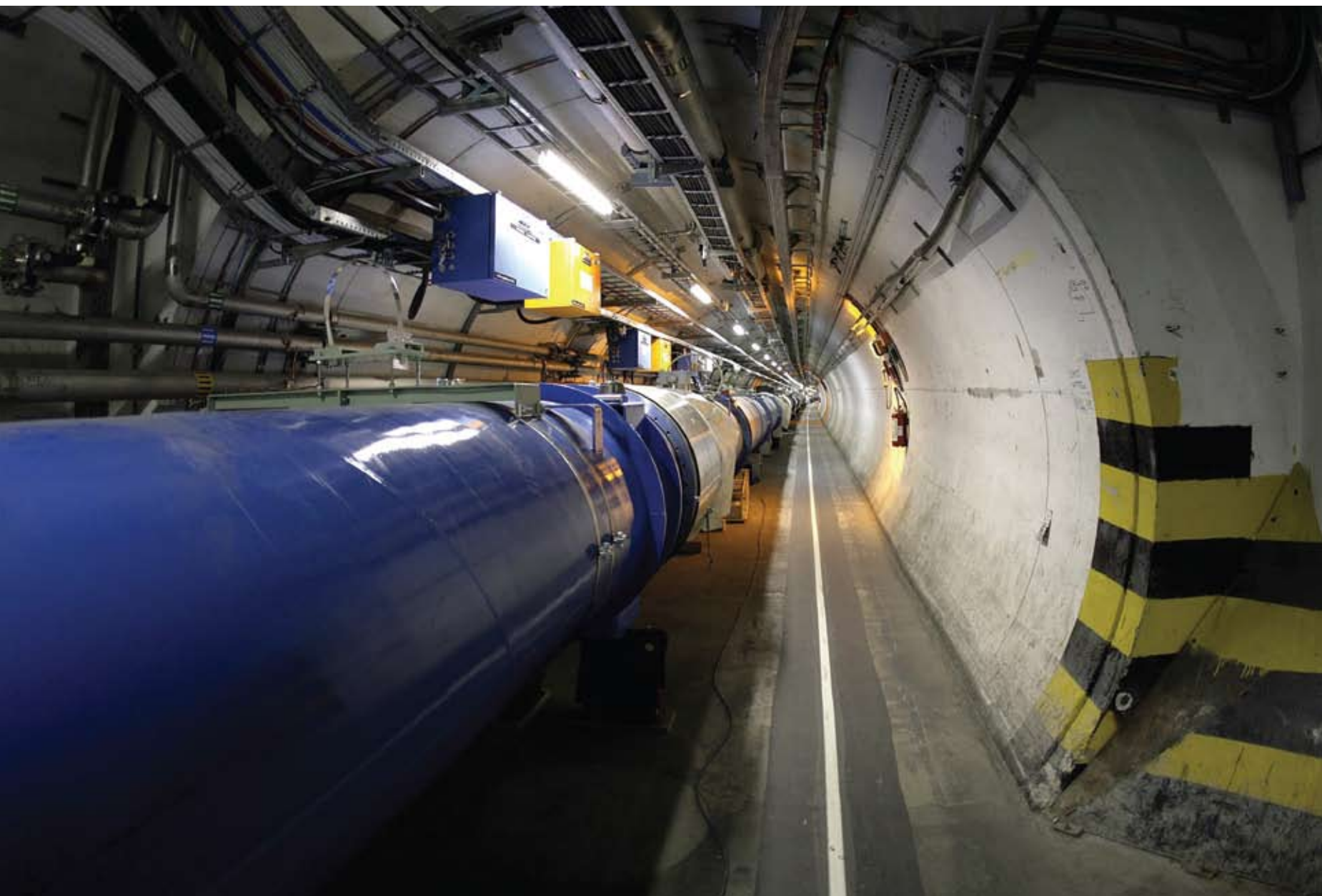


DOWN THE RABBIT HOLE

CAL POLY EXPLORES MYSTERIES OF FAMED SUPER COLLIDER

BY MATT LAZIER





Jennifer Klay

PHYSICS PROFESSOR JENNIFER KLAY and five Cal Poly students are playing a part in heavy-duty scientific experimentation at the world's largest supercollider near Geneva, Switzerland.

But you'd do just as well to think of their work as a history lesson. The most ancient of history, in fact – as in: What happened in the first few moments of the existence of our universe?

That's what Klay, her students and about 7,000 other scientists from around the world hope to get a glimpse of through their work on the Large Hadron Collider.

The facility – a 17-mile-long, ring-shaped tunnel built 328 feet beneath the Franco-Swiss border – operated successfully for the first time in September before shutting down for additional work after a malfunction. The supercollider – built at the European Organization for Nuclear Research (CERN) with a price tag of as much as \$10 billion – is expected to be up and running again in the spring.

Klay, who joined Cal Poly's faculty in January 2007, has been involved for more than seven years in one of the four experiments that will be undertaken at

the massive particle accelerator. It's called A Large Ion Collider Experiment, or ALICE, and its aim is no less than to recreate (on a smaller scale) the conditions of the Big Bang by smashing particles together in a vacuum at nearly light speed, then studying the ensuing soup of subatomic particles in the fraction of a second it takes them to cool into more familiar nuclear matter.

Think of it like water, Klay said, which can exist in several states – liquid, steam, ice. Nuclear matter is the same way, normally acting like a liquid.

“The protons and neutrons in the nucleus, we are trying to boil to create this steam we call quark-gluon plasma,” Klay said. “It's the stuff the universe was made of. We want to answer the question: How did it go on to become the normal nuclear matter we know now? From there, we want to understand things

about it: How viscous is it? Is it transparent or opaque? We want to study these kinds of observable qualities.”

Klay became involved in the Large Hadron Collider along with a group of fellow researchers at the Lawrence Berkeley National Lab in Berkeley, where she was doing post-doctorate work. She continued her work on the collider while working as a staff scientist at the Lawrence Livermore Lab in Livermore.

When she came to Cal Poly, she immediately sought grant funding from the National Science Foundation to hire student assistants and get the university involved in the supercollider project. She received a three-year, \$267,000 grant last year then set about finding students interested in taking part.

That wasn't difficult. Ryan Ward, Alexander Donoghue and Scott Lewis quickly signed on.

‘THE PROTONS AND NEUTRONS IN THE NUCLEUS... IT'S THE STUFF THE UNIVERSE WAS MADE OF’

“I've always been fascinated with subatomic particles and how things get weird” at that level, said Ward, a third-year physics student who is also pursuing a master's degree in math. “Plus, this is the biggest machine of its kind in the world. It's the largest man-made concentration of

energy in the world. If that isn't exciting, I don't know what is.”

Donoghue, a fourth-year physics major, agreed, calling it “a chance to be part of history.”

“It was an opportunity to widen my field of knowledge,” he said. “The stuff I did isn't directly in my field of interest. But we had to figure out all the elements of making (our part of the experiment) work. We had to use every element of physics.”

Specifically, the students have been working on a 50-ton electromagnetic calorimeter, or EMCAL – a collection of lead bricks that detects photons, electrons and other charged particles. (Through much of Klay's seven years working on ALICE, she worked to help persuade the U.S. Department of Energy to fund EMCAL. The energy department agreed last year to commit \$10 million.)

In October 2007, Klay took Lewis, Donoghue and Ward to CERN to test a prototype of the EMCAL. The prototype was placed into the beam line of a lower-energy accelerator, and the students helped collect data for one week. The test was a success. CERN published a paper on the research, co-authored by the students.

Physics students Christopher Brown and Brandon Boswell later joined the group. Over the summer, they went with Ward and Klay to CERN to work on the EMCAL and undergo training on a complex computer program that will analyze the massive amounts of computer data collected in ALICE.

Brown, Boswell and Ward presented some of their research on the project at the annual meeting of the American Physical Society's Division of Nuclear Physics in Oakland in late October.

And Klay said Cal Poly's involvement in the Large Hadron Collider and ALICE will continue. She hopes to add more students to the group and already is planning a trip to the collider in summer 2009.

"I don't think Cal Poly has ever been involved in an experiment of this magnitude," Klay said. "What it says is, 'We can do it here at our institution.'" □