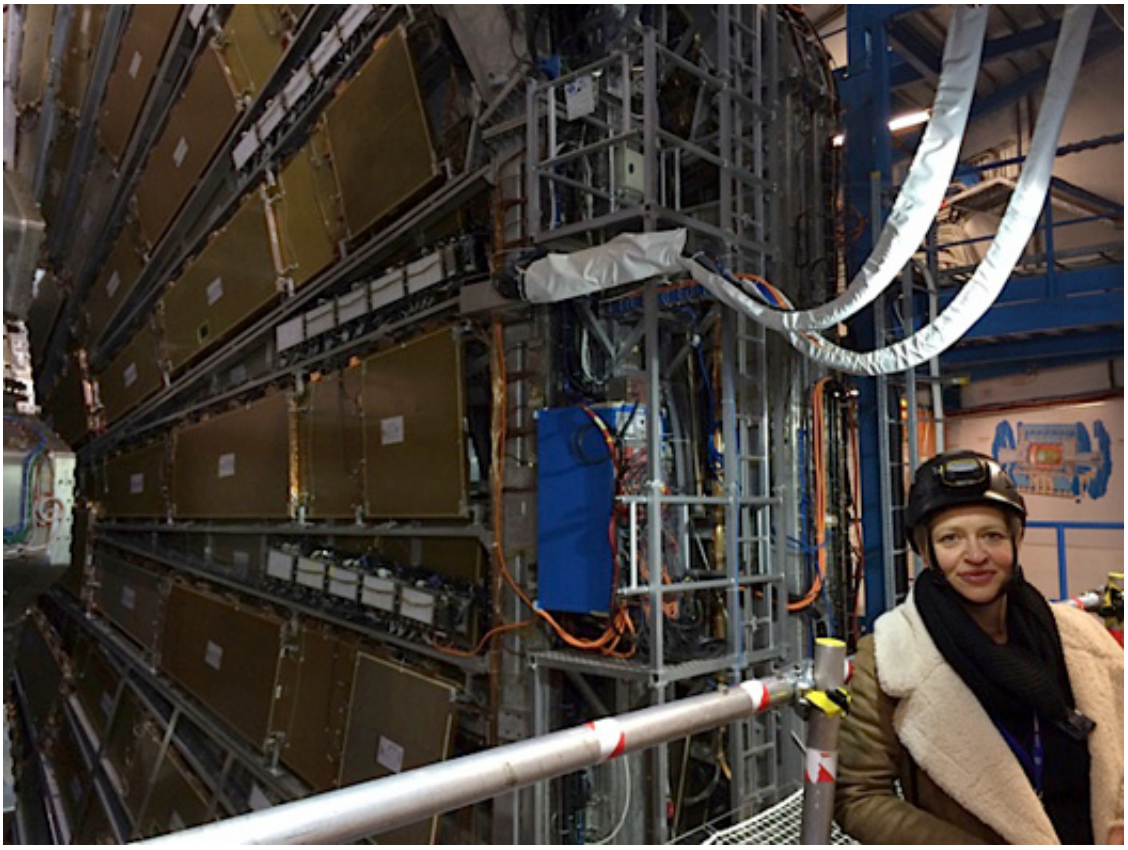
High hopes as Large Hadron Collider pumps protons to ever higher energy

June 4 2015, by Robert Sanders



Beate Heinemann at the ATLAS detector at CERN in 2013. The experiment began collecting data from proton collisions as a souped-up LHC came online this month.

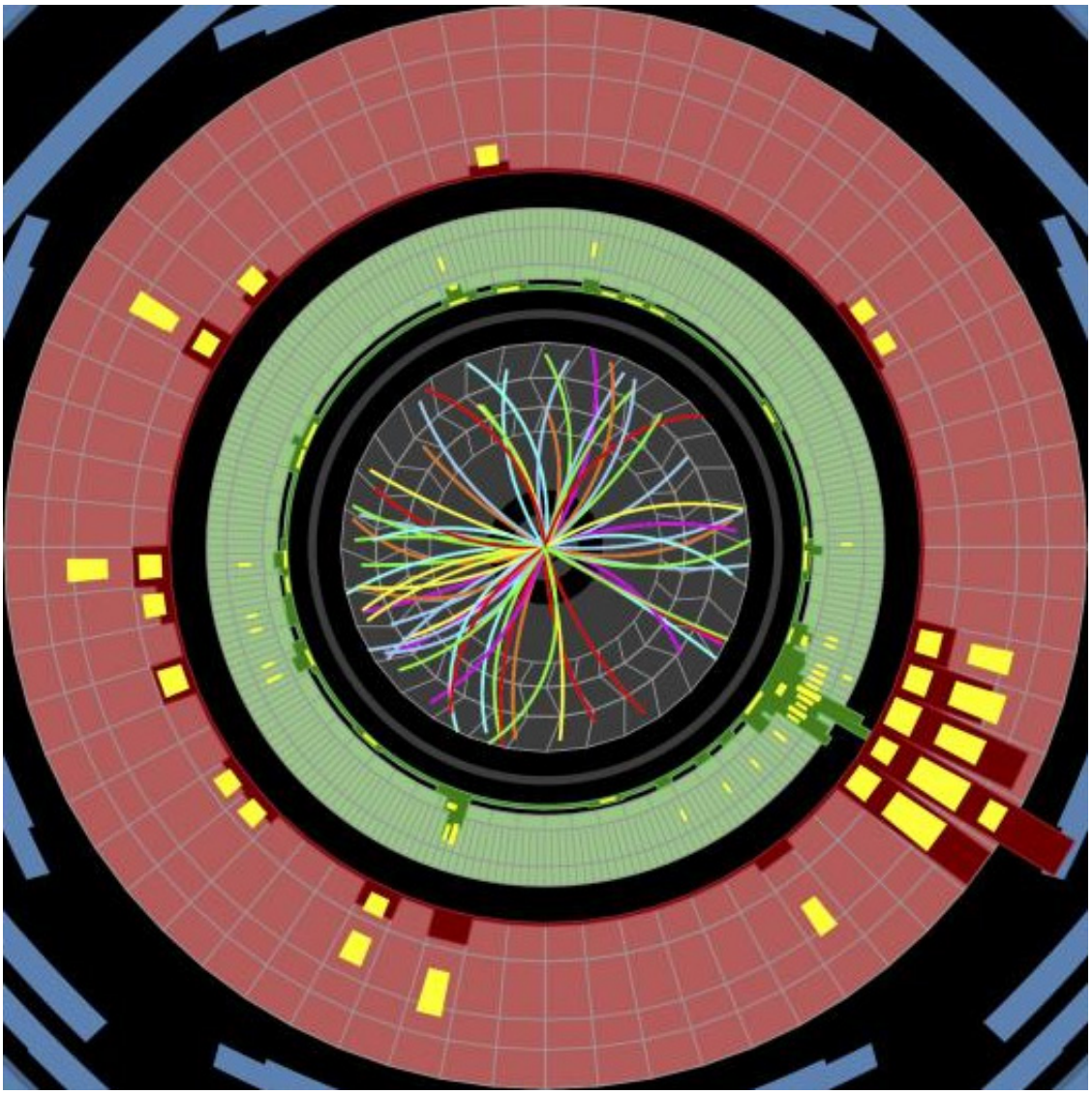
Physicists from UC Berkeley and around the world hope for new and fundamental discoveries as the world's most powerful particle

accelerator, the Large Hadron Collider in Geneva, Switzerland, officially restarted operations yesterday at a much greater energy than ever before.

The Large Hadron Collider, or LHC, accelerates beams of protons to immense energy and then smashes them together to simulate conditions in the early universe. It was shut down for upgrades for more than two years, and initial tests run on May 21 achieved a record-breaking 13 teraelectronvolts (TeV), compared to 8 TeV before shutdown. One TeV, or 1 trillion eV, is the energy of motion of a flying mosquito, but packed into a space a trillion times smaller than a mosquito.

"The LHC is now producing collisions with 60 percent higher energy than during the previous run between March 2010 and March 2013, when we discovered the Higgs boson," said Beate Heinemann, a UC Berkeley professor of physics, senior scientist at Lawrence Berkeley National Laboratory and deputy spokesperson for the ATLAS collaboration, which co-discovered the Higgs boson in 2012 with the rival CMS group. "A higher energy, better detector and increased intensity give us high hopes that we might find again new fundamental particles or laws of physics, something that was just beyond the capabilities of the first run."

The Higgs discovery resulted in a 2013 Nobel Prize in Physics to Peter Higgs and François Englert, who first proposed the existence of the particle that gives mass to every other elementary particle.



Protons collide at 13 TeV, sending showers of particles through the ATLAS detector during tests on May 20. Credit: ATLAS

"The increased energy available in the current run of the LHC provides new opportunities to discover completely unexpected phenomena," said ATLAS member Marjorie Shapiro, a UC Berkeley professor of physics and Berkeley Lab senior scientist.

The May tests allowed scientists to set up systems to protect the machine

and detectors from particles that stray from the edges of the beam. This was an important part of the process that allowed the experimental teams running various detectors, including ATLAS, to switch on their experiments fully today and begin collecting data from proton beams colliding inside complex detectors.

"We are looking, for instance, for dark matter, supersymmetry and extra dimensions of space, and in all cases the increased energy dramatically improves our chance to see it," Heinemann said.

The joint UC Berkeley/LBNL ATLAS group consists of about 40 people, including 10 graduate students. About 10 undergraduates also contribute to the research each year. The LHC and ATLAS experiments are located at the European Center for Nuclear Research (CERN) in Geneva.

Two Berkeley Lab physicists, Tova Holmes and Laura Jeanty, ask their ATLAS colleagues what they hope to see during LHC's Run 2 in a new podcast, the first of a series called "In Particular" about particle experiments at CERN.

Provided by University of California - Berkeley

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