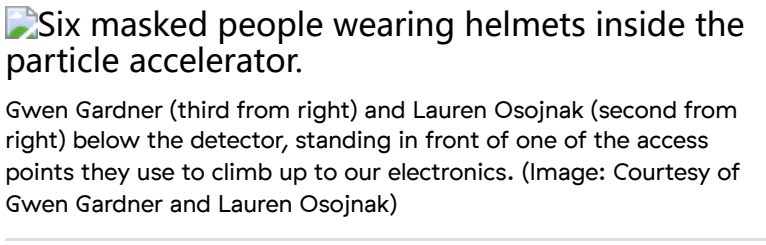
SCIENCE & TECHNOLOGY

What it's like to be stationed at a particle accelerator

Gwen Gardner and Lauren Osojnak, Ph.D. candidates in physics, describe their work as part of the Penn ATLAS team at the Large Hadron Collider.

Physics doctoral students Gwen Gardner (https://live-sas-physics.pantheon.sas.upenn.edu/people/gwen-gardner) and Lauren Osojnak (https://live-sas-physics.pantheon.sas.upenn.edu/people/lauren-osojnak), part of Penn's ATLAS team (https://web.sas.upenn.edu/pennatlas/), are involved in the largest general-purpose particle detector experiment at the Large Haldron Collider (LHC).



Six masked people wearing helmets inside the particle accelerator.

Gwen Gardner (third from right) and Lauren Osojnak (second from right) below the detector, standing in front of one of the access points they use to climb up to our electronics. (Image: Courtesy of Gwen Gardner and Lauren Osojnak)

On July 5, 2022, the European Organization for Nuclear Research, more commonly referred to as CERN, brought all LHC systems online for its third run. This came after a three-year-long maintenance and upgrade phase, and on the tail of the 10th anniversary of one of the most significant discoveries associated with CERN: the Higgs boson, "the fundamental particle associated with the Higgs field, a field that gives mass to other fundamental particles such as electrons and quarks."

The LHC, located in Geneva on the Franco-Swiss border, is the world's largest and most powerful particle accelerator, a 27-kilometer ring of superconducting magnets. It speeds up and increases the energy of a beam of particles by generating electric fields that accelerate the particles, and magnetic fields that steer and focus them, which gives researchers a rare glimpse into the basic constituents of matter.

Over 600 institutes and universities around the world use CERN's facilities. Gardner and Osojnak describe their work as part of Penn's team.

"What I do right now is mostly instrumentation work. It's hands on, dealing with electronics and writing what we call low-level code, which just means that the code that we write is meant to interact with electronics and hardware," says Gardner. "This is more along the lines of the kind of stuff you might study in electrical engineering. Most of us here learn enough of it to get by from research experience."

"I work on the transition radiation tracker of ATLAS," says Osojnak. "That involves a lot of time in the control room, which is really exciting, especially since the start of run three last week. I didn't get to be in the actual control room for the first beams of Run Three, but I got to be in one of the other ATLAS buildings with a bunch of people watching it occur and cheering with everyone, which was really fun. The other half of my time is dedicated to working on a supersymmetry analysis."

"I always say that what I'm doing is kind of like looking for a needle in a haystack, but not even knowing if there is a needle at all," explains Osojnak. "Not everything matches up exactly as we think that it should if the standard model was the end of the story. So, one way that it could make sense is if every particle had basically a mirror image particle of itself and the standard model was doubled. That's what super symmetry is. But there are other options. It could be that instead of having this mirror image super symmetry, there could be a mirror image with a little crack in the mirror, and that might be the missing piece. But then that begs the question, 'How specific do we go?' If it's a broken symmetry, maybe it's just chaos and there is a multiverse theory and this super symmetry is just a garbage theory. The philosophical implications of it are interesting."

Read more at *OMNIA*. (https://omnia.sas.upenn.edu/story/omnia-qa-whats-it-be-stationed-particle-accelerator)

CREDITS

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