Feeling Plasma's Pull

Computational physics student from Washington state finds niche at Princeton Plasma Physics Laboratory

By Allan Brettman

Whitworth University student Margaret Fairborn met U.S. Secretary of Energy Jennifer Granholm during an internship at Princeton Plasma Physics Laboratory. The Secretary attended an undergraduate fusion workshop panel and afterward met some participants, including Fairborn. (Photo by Shannon Greco)

It pays to listen to your professors.

Margaret Fairborn was a sophomore at Whitworth University in Spokane, Washington. Physics professor Kamesh Sankaran told her the American Physical Society was holding its annual convention in town and that Arturo Dominguez would be speaking. She should go, the professor advised.

Fairborn did and she heard Dominguez, a physicist and head of science education at the Princeton Plasma Physics Laboratory (PPPL), talk about astrophysics, fusion, fission, the clean energy applications of plasma, and how the sun is made of plasma.

"It was fascinating," Fairborn recalled of that day in October 2022.

Afterward, Dominguez chatted with a few students who stuck around, including Fairborn. He told them about the Science Undergraduate Laboratory Internships (SULI) program, supported by the Department of Energy's Office of Workforce Development for Teachers and Scientists.

Fairborn decided she'd apply for a SULI. And she decided PPPL in Princeton, N.J., would be her first choice of laboratory.

"I didn't really think I had a great shot," Fairborn said, assuming she lacked sufficient academic credentials and that her college was too small and not well known nationally.

But she was accepted to work at PPPL in summer 2023. "I was really excited," Fairborn said.

Friends, the Secretary, a big jelly doughnut and crullers

The 10-week internship was a whirlwind.

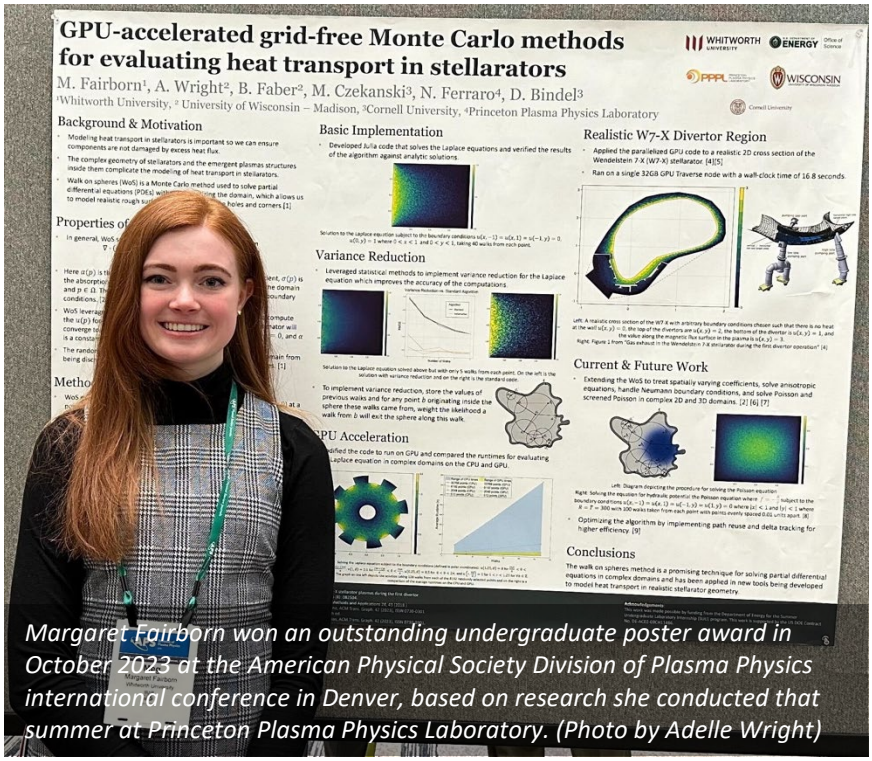
"I worked on a computing project involving heat transport in stellarators," Fairborn said, adding that she worked under the guidance of PPPL research scientist Adelle Wright.

"We used a new method that would allow you to look at a complicated stellarator domain," she explained. "Those have lots of weird edges and corners and rough surfaces. We used a fusion device called a tokamak. Different variations have been used at PPPL for years. In the lab, they say a tokamak looks like a big jelly doughnut and that the stellarator looks like a cruller, that twisty pastry."

In no particular order, Fairborn—"Meg" to her friends—listed three highlights from that internship: meeting like-minded students who she considers friends for life, winning an outstanding poster award at an international physics conference, and meeting Department of Energy Secretary Jennifer M. Granholm.

"She was visiting PPPL and came to a panel discussion that I was a panelist for—an undergraduate fusion workshop," Fairborn said. "Afterwards, Secretary Granholm was meeting people and having photos taken. I got to say hi to her and have a photo with her."

Plasma pulls her back to PPPL



Margaret Fairborn won an outstanding undergraduate poster award in October 2023 at the American Physical Society Division of Plasma Physics international conference in Denver, based on research she conducted that summer at Princeton Plasma Physics Laboratory. (Photo by Adelle Wright)

Heading toward summer 2024, Fairborn applied for another SULI as the program allows two internships. Again she targeted PPPL, attracted by its strong research reputation and the potential to expand her computational stellarator work.

For her second SULI, Fairborn also had familiarity with potential work for a 10-week internship. She secured a project that allowed her to do quantum computing for plasma physics, tapping into her personal history with computer coding and her budding interest in plasma physics.

Her project looked at how plasma will interact with the edge of a fusion device and its effect on tokamaks and stellarators, especially if there's an impurity in the plasma.

David Smith, a University of Wisconsin-Madison plasma physicist and fusion scientist who is based at PPPL, was Fairborn's mentor.

"Meg displayed strong determination while making significant progress on her research project—implementing quantum algorithms in quantum hardware emulators to improve fusion atomic data," said Smith.

"At many turns, Meg had to seek out strategies and solutions in a booming research area that didn't exist a few years ago, and Meg challenged herself to bridge the gap between computational tools and fundamental quantum theory," Smith said. "I suspect that Meg learned a lot from her SULI experience, but I can say with certainty that I learned a lot from Meg and her research."

Next step could be a cold one

As she completes her senior year at Whitworth University, Fairborn is preparing to apply to up to 10 universities to pursue a PhD in computational plasma physics.

"It's like plasma physics, but with a slightly more computational focus," she said.

“Both of my projects at PPPL involved coding. It's something that I've done a lot of in my coursework as well as in my internships. I think it's really a good tool for helping advance physics research and support experimentalists and theorists, and it's kind of a nice way to do math and work with computers and do the physics.”

Having participated in two consecutive SULI programs, Fairborn expects to take a break from work experiences in summer 2025.

Depending on where she enrolls for graduate school, she may opt for early enrollment.

More likely, though, she’ll spend the summer at home in Spokane, enjoying time with friends and family.

Margaret Fairborn, second from left, joins fellow SULI interns during an event at Princeton Plasma Physics Laboratory. (Photo by Abdel Kassir)

She also will perfect her preparation of a particular confection that may be of surprise to anyone who thinks she’s all about plasma physics and not much else.

“Ice cream,” Fairborn said. “I make homemade ice cream. It's kind of one of my hobbies. So I'm probably going to do a lot of that. Yeah, I run an ice cream club on my school's campus. I've made almost 200 flavors of ice cream.

“But since PPPL has a graduate summer school in plasma physics. I think I may go try to do that, too. Just for fun.”