



Undergraduate Student Research Positions with the ATLAS Toronto Group in 2023



Physics

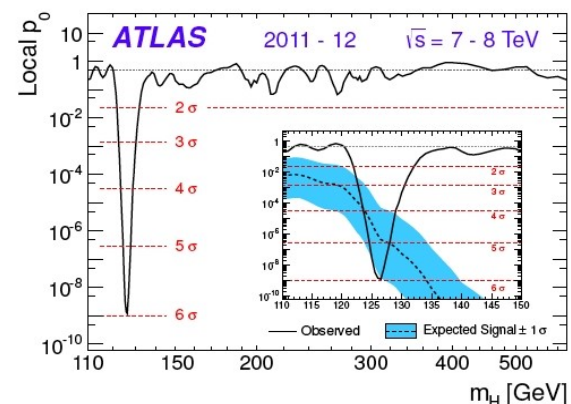
The [University of Toronto ATLAS group](#) has several summer student positions open to USRA recipients and other students for summer 2023. The group comprises seven faculty members ([Ilic](#), [Krieger](#), [Orr](#), [Savard](#), [Sinervo](#), [Teuscher](#) and [Trischuk](#)), five postdoctoral fellows and about 20 graduate students.

The ATLAS experiment at the [Large Hadron Collider \(LHC\)](#) at [CERN](#), in Geneva Switzerland, is studying the very highest collision energies ever observed in the lab. The most exciting discovery to date has been the observation of a [new particle at 125 GeV](#), with properties so consistent with the Standard Model Higgs boson that we claim it has been discovered! We are still analyzing the full dataset collected between 2016 and 2019 searching for new insights and discoveries. The next data collection period started in 2022, so we are starting to get new data to look at as well. Summer students will be working with us in projects involving data analysis and advanced instrumentation development. Perhaps something un-expected will emerge from the data-taking while you're looking!

Project topics and potential supervisors include:

- **Physics Studies for ATLAS:**

Simulation of physics events in the ATLAS detector and development of data selection and analysis techniques for specific physics channels. The LHC has been colliding protons at 13 TeV since 2015 and the group is involved in analysis of channels including multiple W and Z bosons, top quarks and Higgs bosons. There will be opportunities to look at some of the very newest 2023 data, with collisions now at 13.6 TeV. Who knows, perhaps we will make a discovery this summer!



Contact: [Bob Orr](#), or [Richard Teuscher](#)

- **Inner Tracker Upgrade Sensor and Readout Electronics R&D:**

The ATLAS experiment is replacing its inner detector with a new Inner Tracker (ITk), with the new device in place by 2026. The collision intensity and radiation background will mean that both the particle sensors and their associated readout electronics must be more radiation-tolerant and run at much higher data transfer speeds. In Toronto we will be building prototype silicon sensor assemblies in association with Celestica, a company specializing in the fabrication of high-density electronics. As part of this project we will be testing and characterizing miniature silicon sensors that have been irradiated in a reactor. This is to simulate how the real sensors will behave after being exposed to radiation from the LHC beams. We use a probe station, a Strontium-90 source, and a laser system at

low temperature to study the sensors. One, or more, students involved with this project will help to modify our sensor testing setup, take data with the miniature sensors, and help to understand the interesting physics of these devices. There is plenty of scope for electronics, hardware, software and most of all, thinking. All in the environment of a small self-contained experiment. The picture opposite shows one of our first complete silicon sensor modules, with its associated readout chips.



Contact: [Bob Orr](#) or [William Trischuk](#)

At CERN a student with, for example, an [IPP summer fellowship](#) will be able to join our efforts in understanding how the prototype ITk readout electronics responds to neutron and ionizing radiation dosage. This work will use intense radioactive sources. We will be focusing on tests of the ``production" versions of the readout chip, the so-called ABCStar.

Contact: [Richard Teuscher](#), [Pierre Savard](#) or [Nikolina Ilic](#)

We will consider applications from students not holding a USRA award, but USRA recipients are given priority. There may be some opportunity for some of these students to spend at least part of the summer at CERN, but that will depend on funding and the nature of the project.

For more information, contact the people listed above for each position.