Astroparticle Physics Group Summer Student Employment

APPLICATION DEADLINE: Friday, February 5th, 2021

The Experimental Particle Astrophysics Group at Queen's University has openings for undergraduate summer researchers in summer 2021. The group is actively involved in the design, construction, and operation of next-generation experiments that seek to answer fundamental questions in particle physics and astrophysics, including searches for dark matter particles, studies of neutrinos and neutrino properties, and investigations into advanced detector technologies. Much of our experimental work takes place at SNOLAB, the world-leading, ultra-low background particle astrophysics laboratory located 6800' underground in Vale's Creighton mine, near Sudbury (see www.snolab.ca). Some of the summer research activities could take place at SNOLAB.

The following experiments anticipate hiring one or more students this summer. Please send a cover letter, a cv and a copy of a recent transcript by e-mail to the contact for each of the experiments you are interested in. Successful candidates will have strong academic records in Physics, Engineering Physics, Chemistry, or a related discipline and will have some relevant experience demonstrating potential for research. Students eligible for NSERC USRA or other fellowship support are strongly encouraged to apply.

Students completing their year who are interested in the Accelerated Master's program can contact the research groups below for information about research possibilities, and apply to the Physics Department.

Germanium Point Contact Detector and Machine Learning Lab
Our lab studies high-purity germanium detectors that have applications in both searches for dark matter and neutrinoless double-beta decay. We also develop machine learning algorithms to support data analysis in particle astrophysics experiments. We have recently received a very large point contact germanium detector for next-generation experiments, and are looking for students to help us model and characterize this detector, as well as to work on other projects. Opportunities are available to participate in data analysis, design, as well as for hands-on experience working with the detectors and electronics in our lab at Queen's. Specific projects will be chosen to align with the skills that a student wishes to develop over the summer (hardware/software or both).
Contact: Ryan Martin (ryan.martin@queensu.ca)

DEAP and DarkSide are experiments using liquid argon to search for dark matter. Opportunities include data analysis on DEAP, and simulating and testing the data acquisition system for DarkSide.
Contact: Philippe Di Stefano (distefan@queensu.ca)

NEWS-G has developed novel spherical gas detectors that are exceptionally sensitive to low energy interactions. A large volume spherical detector has been built and is currently being installed underground at SNOLAB to search for low-mass dark matter particles and other rare low energy interactions. Prototype detectors are currently being built and tested at the Queen's NEWS-G lab. Summer positions are available to assist with the data taking at SNOLAB and Queen's, with the dark matter search and calibration data analysis, and with the development and testing of novel detector technologies.
Contact: Guillaume Giroux (gg42@queensu.ca)

PICO searches for dark matter using bubble chambers. In these detectors, the superheated liquid undergoes phase transitions when recoiling nuclei from WIMP interactions deposit energy in the fluid. These phase transitions are detected using sensitive piezo-electric transducers and video cameras. PICO-40L is the current phase of the experiment and is currently being commissioned underground at SNOLAB. The next phase of the experiment, PICO-500, is currently in the design stage. Potential summer positions include assisting with the detector operation, dark matter search and calibration data analysis, and design and testing of PICO-500 components.
Contact: Diana Turner (diana.turner@mcdonaldinstitute.ca)

LiquidO is a new particle detection technique which uses an "opaque" liquid scintillator to confine light near the points of energy deposition (by particle interactions). The light gets collected by wavelength-shifting fibres and detected by silicon photomultipliers. A small testbench detector is being constructed to study/optimize the properties of this detector.
Contact: Mark Chen (mchen@queensu.ca)

SNO+ will study fundamental properties of neutrinos using a 780 tonne liquid scintillator target. The experiment is currently operating at SNOLAB. Potential summer research activities include data analysis, assisting in the preparation of calibration systems and calibration sources, participating in the development of tellurium process systems and procedures, and operating the detector during data taking.
Contact: Alex Wright (awright@queensu.ca)

The IceCube and P-ONE experiments are looking for neutrino interactions in the Antarctic Ice and in the water off the coast of Vancouver, respectively. The experiments are in different operational phases, with IceCube taking data and P-ONE working on the preliminary design. Students could be involved with simulations and data analysis on either or both projects while working toward gaining an understanding of the calibration potential of P-ONE.
Contact: Ken Clark (kjc5@queensu.ca)