Undergraduate Research Assistant

Research Division
Summer 2025 term

Posting Date: Jan 21st, 2024

About Us

SNOLAB is an international facility for world-class underground physics research. It has an expanding programme in astroparticle physics and underground science. Located in an air-conditioned cleanroom 2 km underground in the Vale Creighton Mine near Sudbury Ontario, with a suite of surface facilities and laboratories, SNOLAB is currently preparing for the next generation of experiments focusing on neutrino studies and the search for galactic dark matter. SNOLAB partners with several Canadian and foreign universities.

The Positions

Multiple positions are proposed at SNOLAB for the May-August term. The majority will be directly supported by SNOLAB and a handful will be funded by research grants through a partner university.
The SNOLAB positions aim at developing new techniques to expend the capabilities of the facility. The grant-funded positions are geared toward furthering specific experiments, with the work involving hardware improvement, data analysis, monte-carlo simulation and detectors shifts.
The list of opened positions (at the time of the posting) can be found at the end of this document. Other SNOLAB experiments may hire additional people as resources become available.

These are full-time positions.

SNOLAB is committed to equity in employment and encourage applications from all qualified applicants, including women, Indigenous persons, members of visible minorities and persons with disabilities. In accordance with Canadian immigration requirements, priority will be given to Canadian citizens and permanent residents. SNOLAB will provide support in its recruitment processes to applicants with disabilities, including accommodation that considers an applicant's accessibility needs.

Further information about SNOLAB may be found at www.snolab.ca

Criteria

Education:

Applicants must be 18 years or older, registered in post-secondary studies at an accredited institution or apprenticeship program, recent graduate (having graduated in the last 3-6 months) or individual returning to full-time or part-time studies in the next academic term.

Experience:

Owing to the broad range of topics, many profiles are sought after, including physics. chemistry, and engineering. Experience in basic data analysis, including data formatting, statistics, and computer programming will be an asset.
Candidates should be comfortable working in a team environment where frequent and open communication is encouraged and expected as part of the culture. Any additional experience working in a laboratory environment, especially a cleanroom environment, is also an asset.

Salary

Salary will be determined by education and qualifications within a 20-25 $/hr range. These positions are subject to availability of funding. To meet operational needs, shift work may be required.

To Apply (to SNOLAB directly)

Applications must be submitted to studentjobs@snolab.ca.
The application will include a cover letter, a resume and an unofficial transcript in a single PDF file with the name:
<FirstName>_<LastName>_Science_<AcademicYear(1st, 2nd,…)>_<HomeInstitution>.pdf
As a result of the automation process, different format will be automatically rejected.

The posting will remain open until the position is filled, but review of applications will commence on Feb 1st. SNOLAB thanks all applicants for their interest, however, only those students considered for an interview will be contacted.

Closing Date

Feb 1st, 2024

List of opened positions

Cryogenic Underground TEst facility (CUTE): Low-temperature (~mK) cryogenic technologies are used for a variety of applications in astroparticle, nuclear, and quantum physics. The CUTE facility at SNOLAB provides a low-background and vibrationally isolated environment for testing and operating these future devices. The successful candidate will be responsible for supporting the CUTE experimental program during the summer semester 2025. This will include hardware tasks, data analysis and/or simulation development depending on the interests of the candidate. Future experiments are expected to include an underground superconducting qubit run.

RadioActive isotope Measurement Program at SNOLAB (RAMPS): The half-life from long-lived radioactive isotopes can provide fundamental information necessary for a variety of fields of physics (rare-event searches, nuclear physics, geochronology etc.). The goal of the RAMPS pilot project is to perform novel measurements of long-lived isotopes using (or enhancing) existing SNOLAB detectors. The successful candidate would be responsible for aiding in the measurement of new isotopes, analyzing data from the pilot project measurements and developing new, SiPM (Silicon Photomultiplier) based, detectors to enhance future measurements.

Removal of Argon from Nitrogen: Noble gases are of considerable use in particle and astrophysics research. Frequently used as cover gases or sparging gases to either protect from potentially harmful background entering experiments or purifying systems. SNOLAB utilizes a large volume of nitrogen and argon, including in the underground liquid nitrogen plant. The problem facing SNOLAB is that the nitrogen produced underground contains an approximately 3% argon impurity that contains a radioactive isotope, ^{39}Ar, that can interfere with the experiments. Currently, two streams of research, engineering, and development are underway at SNOLAB: producing ultra-pure nitrogen by column distillation and the use of silver doped zeolites for the removal of Argon, Radon, and other impurities. Sample tasks include simulation of distillation systems, computational chemistry analysis of gas-zeolite interactions, design and construction of the distillation system, and the upscaling of zeolite test systems.

Low background laboratory: The Low Background Lab student will be engaged with the operation and analysis of data from the high purity germanium (HPGe) detectors, radon emanation system, alpha detector, neutron detectors, seismic/vibration sensors and other scientific instruments used within the SNOLAB material assay and screening program. In addition, characterization of the response of the detectors via Monte Carlo simulation will be performed.

DEAP-3600: DEAP-3600 is a dark matter detector using liquid argon as a target material. It has been taking data between Fall 2016 and Winter 2020, reaching excellent sensitivity to WIMP-nucleon elastic scattering. During that time, some unexpected alpha backgrounds have been identified. The detector is being modified to mitigate them allowing the detector to reach its maximum sensitivity. It also serves as a test bed for newly developed techniques aiming at making argon detectors the most sensitive in the world for high-mass WIMP dark matter. The successful candidate will participate in the hardware upgrade activities, including the recommissioning of the detector, as well as data taking and data analysis.

PICO: PICO operates dark matter search detectors using C3F8 which form superheated bubbles when it interacts with dark matter and/or various background particles. The project consists of the PICO-40 experiment which is currently operating and the PICO-500 experiment which is under construction. The successful candidate would be expected to take detector shifts on PICO-40, analyze data, calibrate and help in the general operation of the detector. The candidate would also help with the construction and assembly of the PICO-500 detector as needed.

SNO+: SNO+ is a multipurpose neutrino detector using organic liquid scintillator to search for neutrinoless double beta decay, detect anti-neutrinos and supernova neutrinos. The detector is currently operating in its pure liquid scintillator phase and in parallel is preparing for the tellurium phase. The successful candidate will be part of the detector group working on further automating shift taking for the detector and other aspects of the experiment. In addition, the candidate will support quality assurance and maintenance tasks as needed.

SNO+ Te Project: As part of the search for neutrinoless double beta decay with SNO+, two ultra-clean process plants have been constructed in the underground environment at SNOLAB. The first is a purification plant, while the second is a synthesis plant, also known as the TeDiol Plant, where the Tellurium-Butanediol complex is synthesized. The successful candidate will contribute to the final commissioning steps at the plant in preparation for the first test synthesis. They will also participate in developing a campaign to study both the properties and characteristics of the complex, as well as the final scintillator cocktail.

SuperCDMS: The Super Cryogenic Dark Matter Search (SuperCDMS) is a direct detection dark matter search experiment that is currently being constructed 2 kilometers underground at SNOLAB. The experiment will employ 24 cryogenic semiconductor detectors and aims to achieve world-leading sensitivity for dark matter interactions in the low mass range of 0.5 GeV to 5 GeV. The successful candidate would be expected to support the on-going installation effort, be involved in the operation and testing of the SuperCDMS cryogenic system and help with any other sub-system commissioning of the experiment.

Assay program: SNO+ utilizes a variety of assay systems to look for radon in the detector components, both in liquid and gas form. This is crucial for understanding the backgrounds in detail and therefore enabling the best possible physics outcomes. There are efforts to develop trapping capabilities and a new assay system utilizing scavengers. The successful candidate will be part of the assay group and learn the current systems. In addition, they will work on further developing the new systems for the experiment.

The QA program for SNO+ was established to control the purity of the scintillator by testing its optical properties, e.g., UV-Vis transparency can be affected by contaminants by showing an increase in absorption. The purification plant is going through an upgrade of the main distillation process. To confirm the efficiency of the process, a QA testing campaign will be required, and the successful candidate will take part in that QA program during commissioning and operations of the purification plant. The successful candidate will also help in improving the monitoring tools for quality control of the SNOLAB cleanroom environment.

Analytical Chemistry program: The selected candidate will join the Scientific Support Group, collaborating closely with the Chemical Technologists to provide analytical and technical support to SNOLAB and its experiments (SNO+ QA) both in the Surface Clean Lab and Underground Facility. The role involves advancing material characterization and quantification techniques using ATR-FTIR (Attenuated Total Reflectance Fourier-Transform Infrared), including the development of a spectral library for common materials and chemicals used at SNOLAB. Additional responsibilities will include sample collection, data analysis, and trend monitoring to support the ultrapure water system and various laboratory operations.