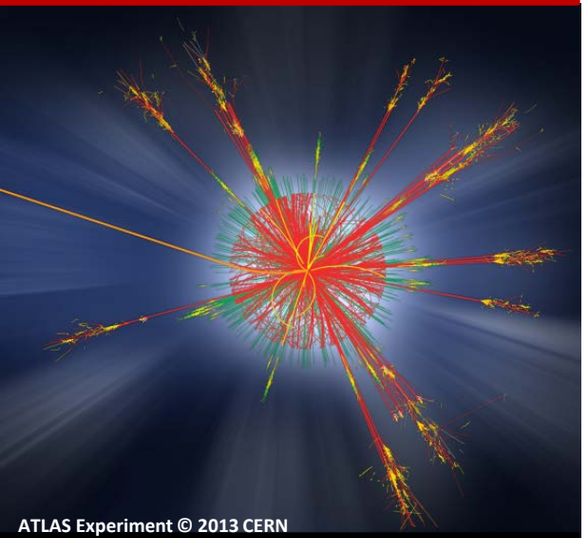
Carleton UNIVERSITY

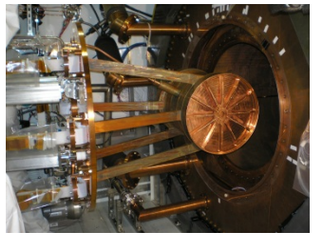
# Graduate Program in Experimental and Theoretical Particle Physics




physics.carleton.ca

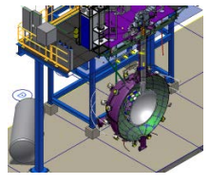
## SNOLAB

Two kilometres underground near Sudbury is Canada's leading-edge facility for the study of astroparticle physics. SNOLAB may house several experiments, including the **Enriched Xenon Observatory (EXO)** and **the DEAP Dark Matter Experiment.**



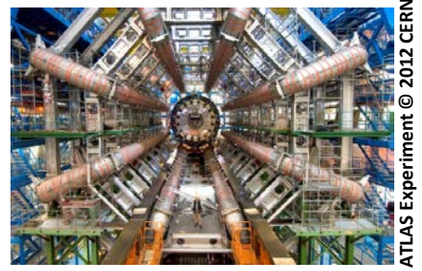
**EXO** has made the 1st measurement of the regular double beta decay of $^{136}$Xe to $^{136}$Ba and currently leads the world in the search for the neutrinoless decay. Discovery of this process would provide new insight into the properties of neutrinos, including the first measurement of the neutrino mass scale. EXO continues to develop detector technology towards the next search phase including liquid and gaseous Xe Time Projection Chambers and Ba ion laser tagging techniques.

**DEAP** is a liquid argon scintillation counter designed for low background, low energy threshold detection of nuclear recoil events consistent with WIMP dark matter. More than 85% of the universe consists of unknown dark matter. Its direct detection would be a most exciting discovery!

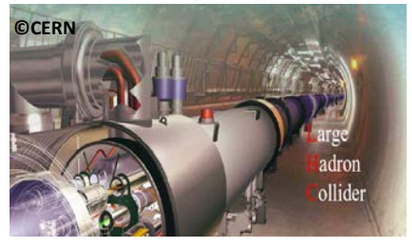


## ATLAS

is a particle physics experiment that explores the fundamental nature of matter and the basic forces that shape our universe. The ATLAS detector at the CERN Laboratory in Switzerland is used to search for new discoveries in the head-on collisions of protons at the highest energy ever produced in a laboratory.




**Carleton University** was a key participant in the discovery of a new particle consistent with the Standard Model Higgs boson. The Carleton group's other analysis interests include studies of electron/photon and jet production as well as searches for Supersymmetry. This group also played a critical role in the construction of the ATLAS detector by building portions of the Forward Calorimeter and is continuing with new construction projects. All of our graduate students regularly travel to the CERN laboratory to take part in all aspects of the experiment.




Carleton UNIVERSITY

## The Physics Department is a member of the

# Ottawa-Carleton Institute for Physics

Université d'Ottawa
University of Ottawa
Carleton University

## ocip.ca

For more information about M.Sc. or Ph.D. studies at the Carleton University Physics Department visit:

**physics.carleton.ca/prospective-graduate-students**

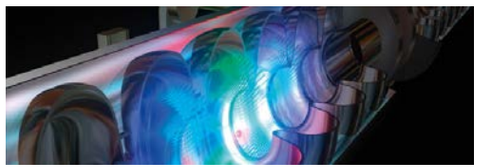
or email:
**grad_supervisor@physics.carleton.ca**

To apply online:
**graduate.carleton.ca/apply-online**

2013/10

## International Linear Collider

The Carleton ILC group focuses on the development of a large volume Time Projection Chamber as the main charged particle tracking for the multi-purpose detector to be built at the **International Linear Collider** (ILC). The bulk of this group's ILC development work is in the form of Time Projection Chamber readout studies. The Carleton group is a member of a world-wide initiative involved in the development of ILC detectors called the **LCTPC Collaboration.**



## Technical Facilities

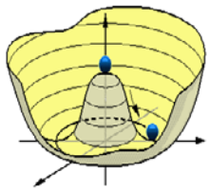
The Carleton University Physics Department enjoys excellent technical facilities for detector R&D, including large instrumentation assembly areas, clean rooms for precision work, and a well-equipped machine shop. These facilities, coupled with our highly qualified technical staff, will help you get a first-class high-tech training while pursuing your graduate degree.

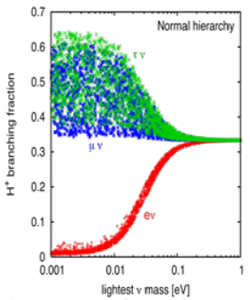
## Theoretical Particle Physics

***Some of our research topics include…***

**LHC phenomenology:** Predicting LHC signatures of physics beyond the Standard Model such as SUSY, extra-dimensions, little Higgs, and technicolor to help experimentalists find or exclude those models and find ways to distinguish them.

**Electroweak symmetry breaking:** Study of exotic models that try to explain the origin of mass: multi-Higgs models, Little Higgs models, super-symmetry, extra-dimensions, etc...






**Dark matter:** Predicting dark matter abundance and signature in various models to explain the missing mass of the universe.

**Superstring theory:** Candidate theory of quantum gravity that unifies all the known forces. Studies of exotic phenomena such as non-commutative geometry and mirror symmetry.

## *Want more info?*

***physics.carleton.ca/research***

**K .Graham:**
mabuse@physics.carleton.ca
**D. Sinclair:**
sinclair@physics.carleton.ca

**physics.carleton.ca/exo**
**physics.carleton.ca/deap**

**G. Oakham:**
oakham@physics.carleton.ca
**A. Bellerive:**
alainb@physics.carleton.ca
**T. Koffas:**
koffas@physics.carleton.ca
**M. Vincter:**
vincter@physics.carleton.ca

**physics.carleton.ca/atlas**

**A. Bellerive:**
alainb@physics.carleton.ca
**M. Dixit:**
msd@physics.carleton.ca
**physics.carleton.ca/ilc**

**J. Armitage:**
armitage@physics.carleton.ca

**physics.carleton.ca/cript**

$$\mathcal{L} = -\frac{1}{4}F_{\mu\nu}F^{\mu\nu} + i\bar{\psi}\gamma^{\mu}D_{\mu}\psi + |D^{\mu}H|^2 + \lambda_{ij}\bar{\psi}_i\psi_j H^*$$

**Theoretical Particle Physics group**
*physics.carleton.ca/theory*

**B. Campbell:** campbell@physics.carleton.ca
**S. Godfrey:** godfrey@physics.carleton.ca
**physics.carleton.ca/~godfrey**
**T. Grégoire:** gregoire@physics.carleton.ca
**P. Kalyniak:** kalyniak@physics.carleton.ca
**H. Logan:** logan@physics.carleton.ca
**physics.carleton.ca/~logan**

## Program information

**M.Sc. Program** 5 Courses + Thesis
**Ph.D. Program** 4 Courses + Thesis
Exceptional students can be fast-tracked into the Ph.D. program after one year of M.Sc.

**M.Sc.** typically consists of Thesis and
- Computational Physics
- Quantum Mechanics
- Relativistic Quantum Mechanics
- Physics of Elementary Particles
- Experimental Techniques of Nuclear & Particle Physics

**Ph.D.** consists of Thesis and typically
- Quantum Field Theory
- Particle Physics Phenomenology
- Advanced Topics in Particle Physics Phenomenology
- One other course

Research groups organise regular seminars and meetings. OCIP runs fall and spring graduate seminars along with an annual December Symposium and more general colloquia.

**Financial Support:** All students are guaranteed a competitive funding package consisting of teaching assistantship, research assistantship and/or scholarships. Outstanding students automatically receive enhanced scholarships.