Carleton University Physics Department

physics.carleton.ca

Research Faculty in the
Physics Department at Carleton University
Ottawa, ON, Canada

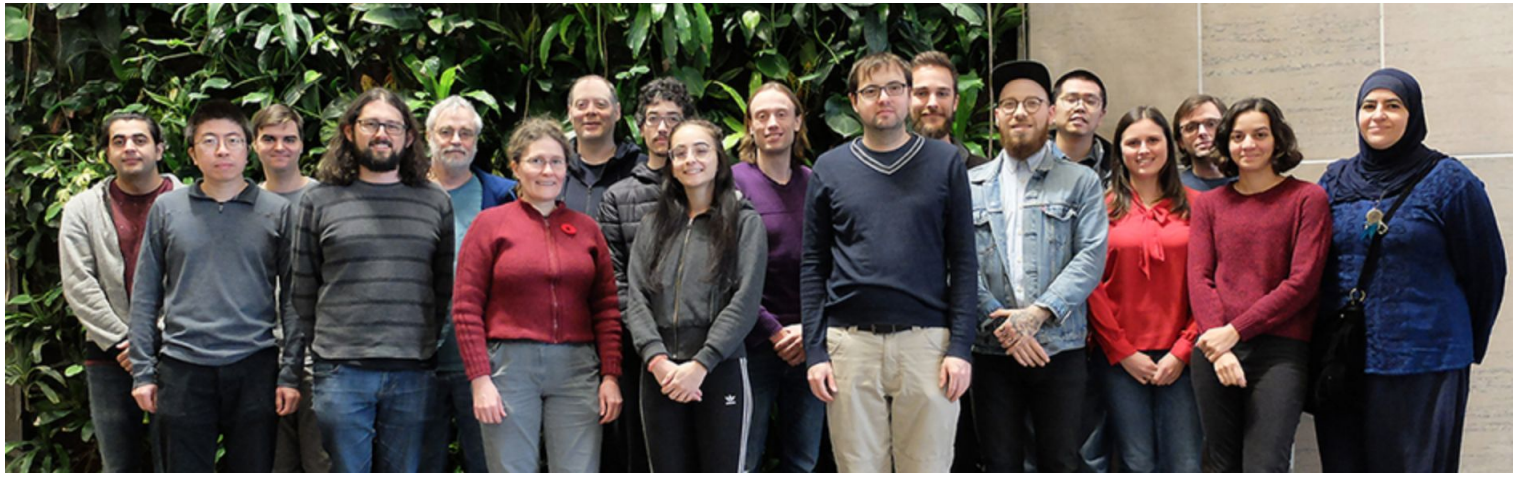
Carleton University

Outline

- Theoretical Particle Physics
- Experimental Particle Physics
- Medical Physics
- Adjunct professors

Carleton University

Theoretical Particle Physics



Carleton University

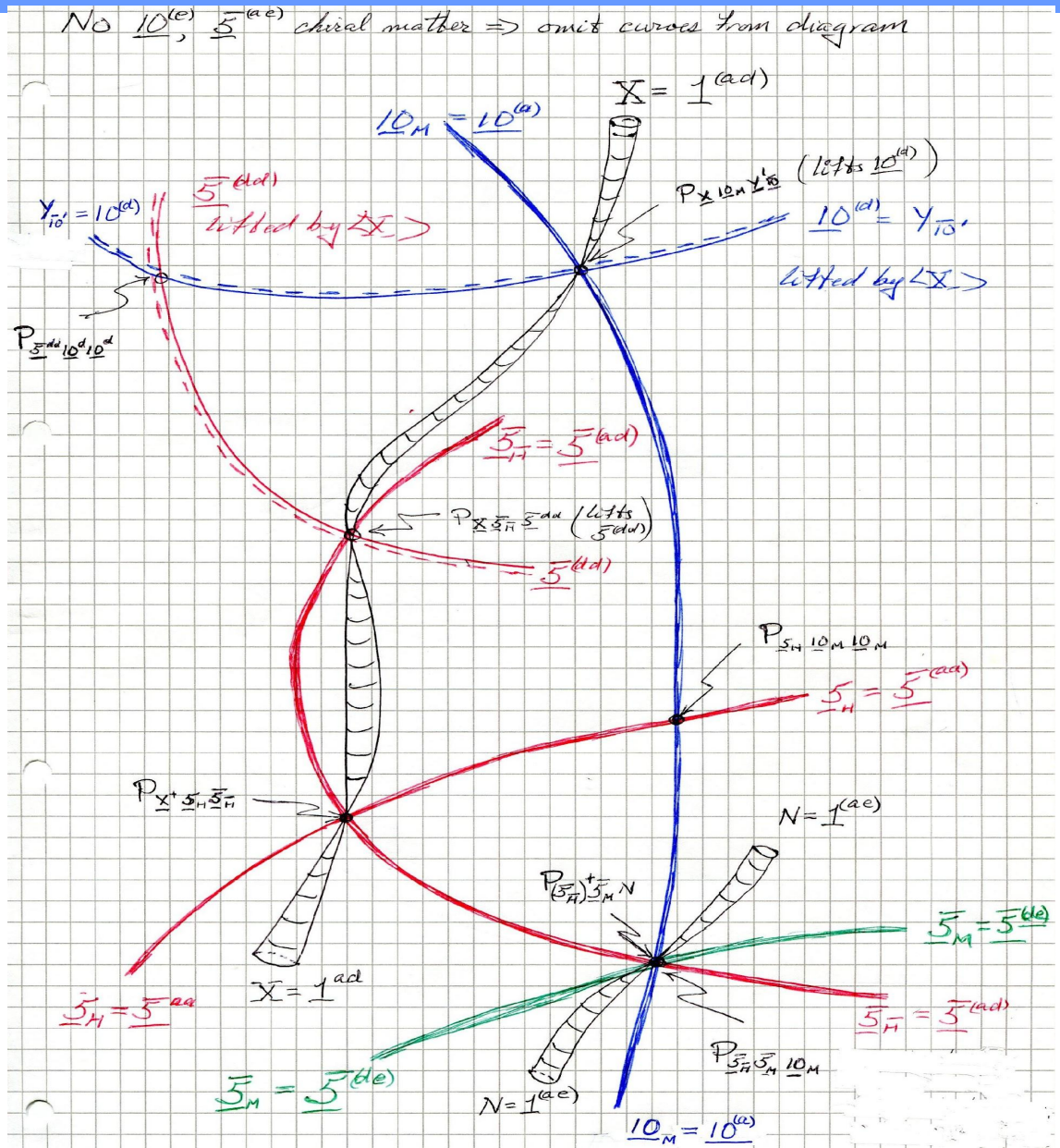
Professor Bruce Campbell

Theoretical Particle Physics

Professor of Physics

Ph.D. (McGill)

email: campbell [at] physics.carleton.ca



Carleton University

Professor Stephen Godfrey

Theoretical Particle Physics

Professor of Physics

Ph.D. (Toronto)

email:godfrey [at] physics.carleton.ca

with Jerome Claude, Taylor Gray, Alex Poulin

Particle Physics Phenomenology

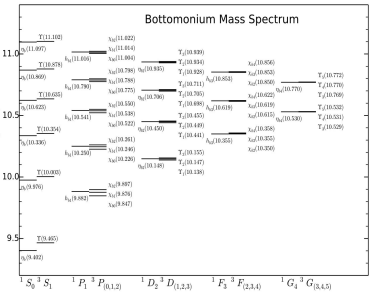
- Connect theory and experiment
- Predict experimental signatures of theories
- Interpret experimental results to identify the underlying theory

Dark Matter and Beyond the Standard Model Physics

- ~85% of the mass in the universe is Dark Matter
- Build models and study experimental signatures to solve these puzzles:
  - Constraints from early universe cosmology, indirect searches, etc
  - Studying blind spots in direct detection of generic models
  - What can we learn from complementary searches for Dark Matter

Hadron Physics

- Use models to predict properties of new hadronic states
- Use models to understand the exotic new hadrons
- Authors of Belle II Physics Book



Carleton University

Professor Thomas Grégoire

Theoretical Particle Physics

Professor of Physics

Ph.D (UC Berkeley, 2003)

email: gregoire [at] physics.carleton.ca

Looking Beyond the Standard Model to address various issues with the Standard Model

- Flavour physics
- Dark matter
- Breaking of the electroweak symmetry
- Matter-anti-matter asymmetry

Building and improving models

- Supersymmetry
- Little Higgs
- Twin Higgs

LHC phenomenology

- Understanding how LHC can put constraints, or even better discover some of the models above

Carleton University

Professor Seyda Ipek

Theoretical Particle Physics

Assistant Professor of Physics

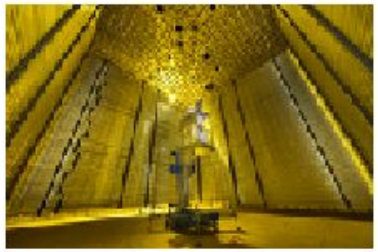
Ph.D.(U. of Washington)

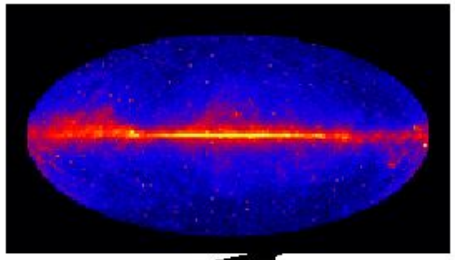
email: sipek [at] physics.carleton.ca

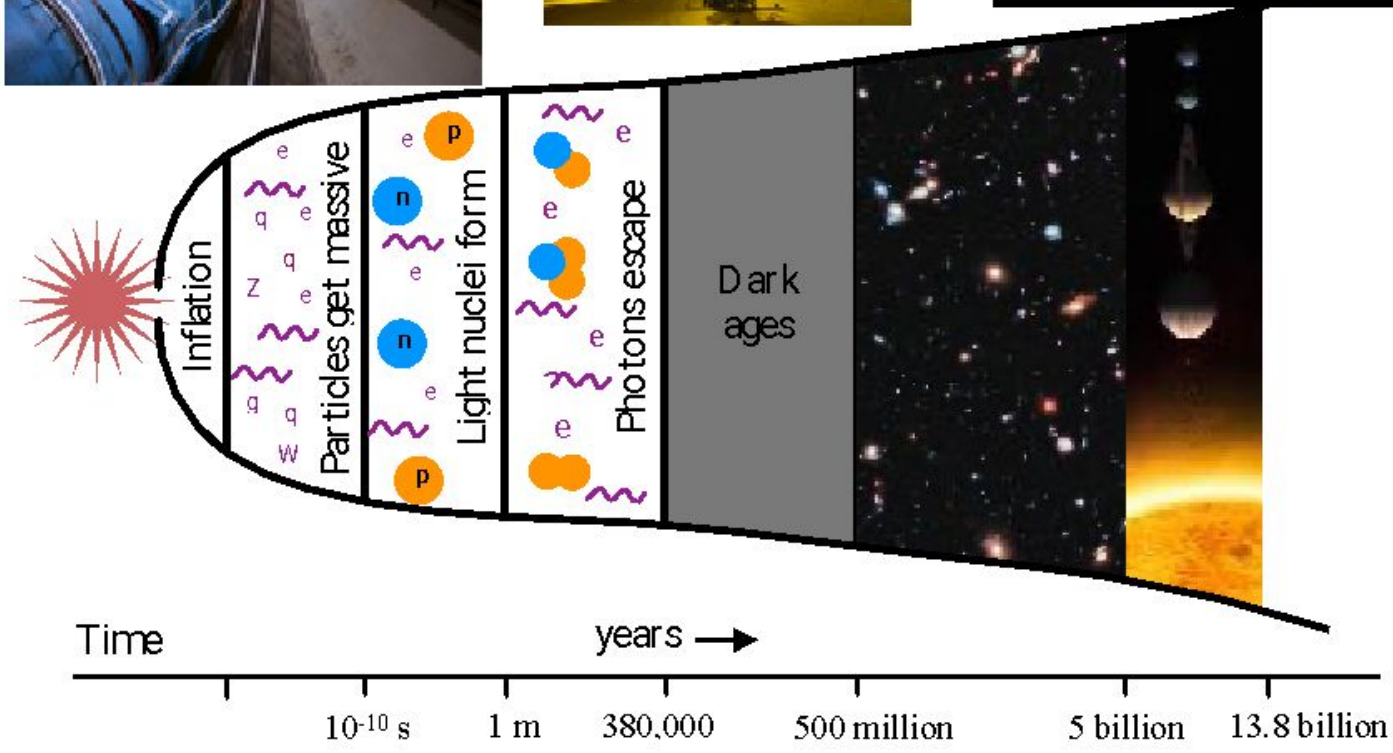
website:
seydaipek.com

Big mysteries in our Universe:

1. Why is there more matter than antimatter?
2. What is dark matter?
3. Why are neutrinos massive?







Carleton University

Professor Heather Logan

Theoretical Particle Physics (Phenomenology)

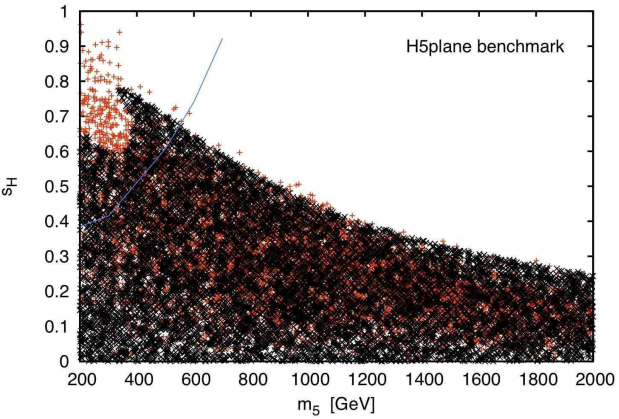
Professor of Physics

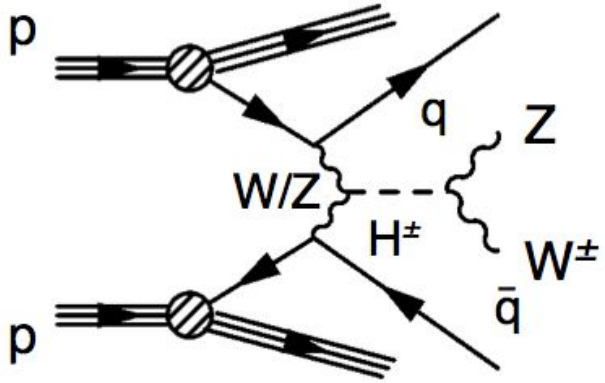
Ph.D.(U. California Santa Cruz) 1999

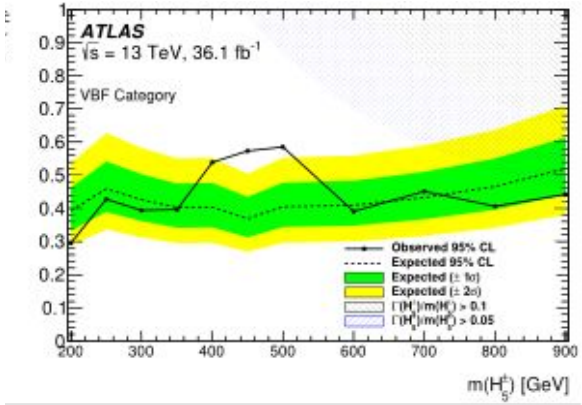
My current research focus is "extended" Higgs sectors: models with extra Higgs particles from extra fields that contribute to electroweak symmetry breaking.

- Distinctive features of models (e.g. H++, CP violation)
- Calculating new things as needed (like 1-loop decays)
- Constraints from theory, past experiments
- Making simulation tools for LHC searches

```
##########################################################
##                    GMCALC v1.4.0:                    ##
##          A calculator for the Georgi-Machacek model  ##
##        http://people.physics.carleton.ca/~logan/gmcalc/  ##
##########################################################
```

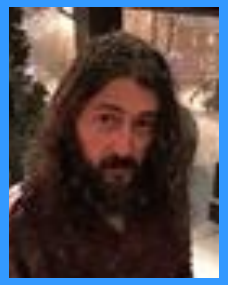






Professor Daniel Stolarski

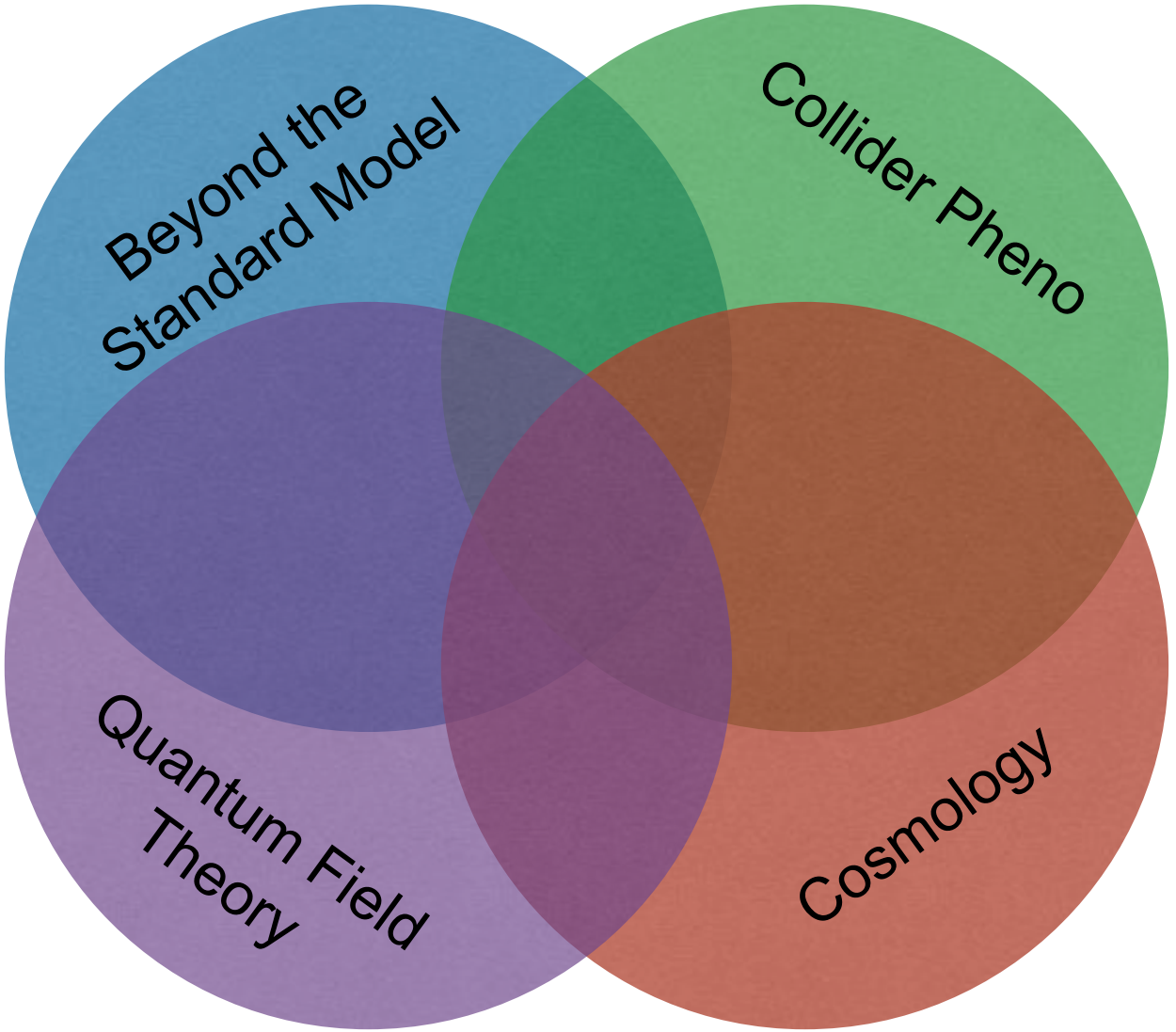
Theoretical Particle Physics



Associate Professor of Physics

Ph.D.(UC Berkeley) 2010

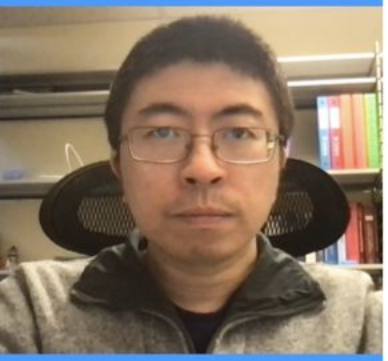
email: stolar [at] physics.carleton.ca



Carleton University

Professor Yue Zhang

Particle Physics and cosmology Theory



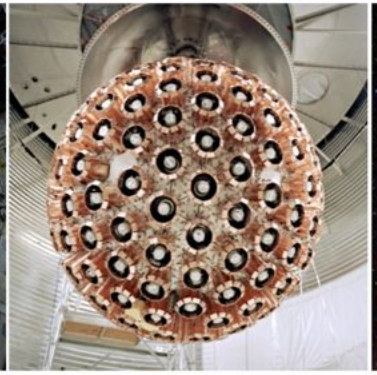
Assistant professor

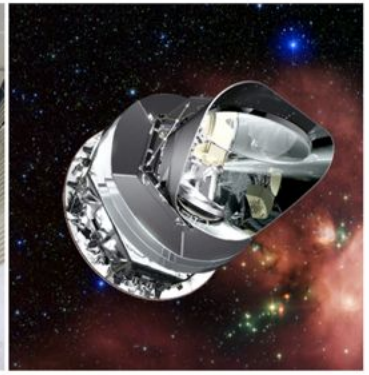
Ph.D., 2009,
Theoretical physics,
Peking University

Email: yzhang [at]
physics.Carleton.ca

Explore the Origin of Dark Matter

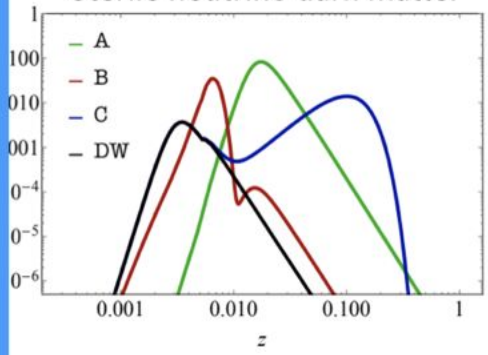
and related signals in cosmological and terrestrial experiments



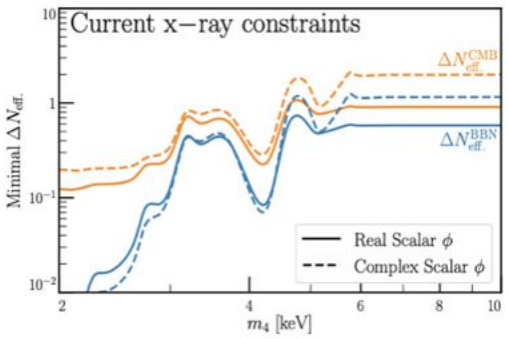


Some recent works

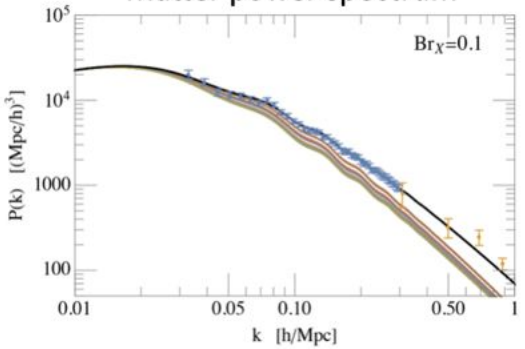
Sterile neutrino dark-matter

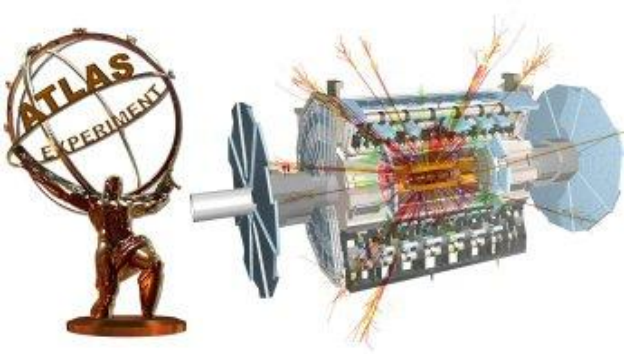


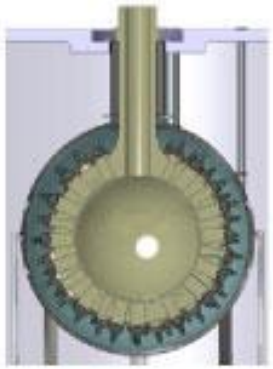
ΔNeff



Matter power spectrum







DEAP-3600

Experimental Particle Physics

Carleton University

Professor Mark Boulay

Experimental Particle Physics

Professor of Physics

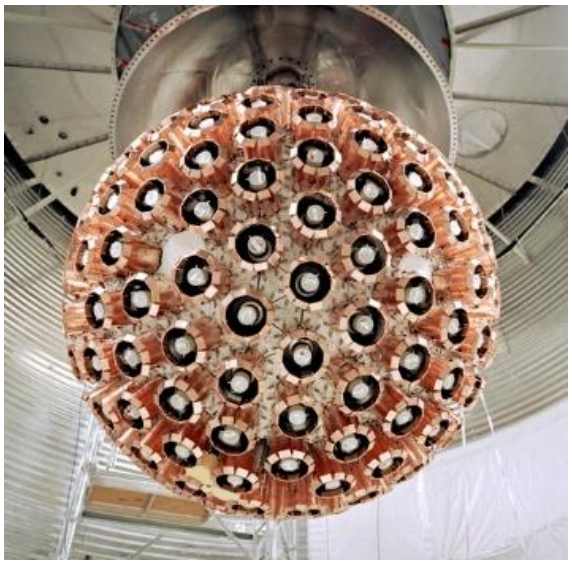
Ph.D. (Queen's)

email: [redacted]ulay [at] carle[redacted]

DEAP 3600

SNOLAB
Mining for knowledge
Creuser pour trouver... l'excellence

Search for Dark Matter Particles with DEAP-3600



Development of next-generation detectors and ultra-low radioactive background techniques

Solid state, cryogenic photon detection systems

Detector design, simulation, data analysis

Professor Razvan Gornea

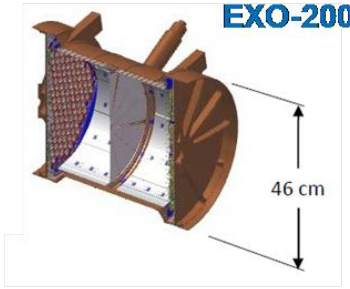
Experimental Particle Physics

Associate Professor of Physics
Ph.D. (U. of Montreal)

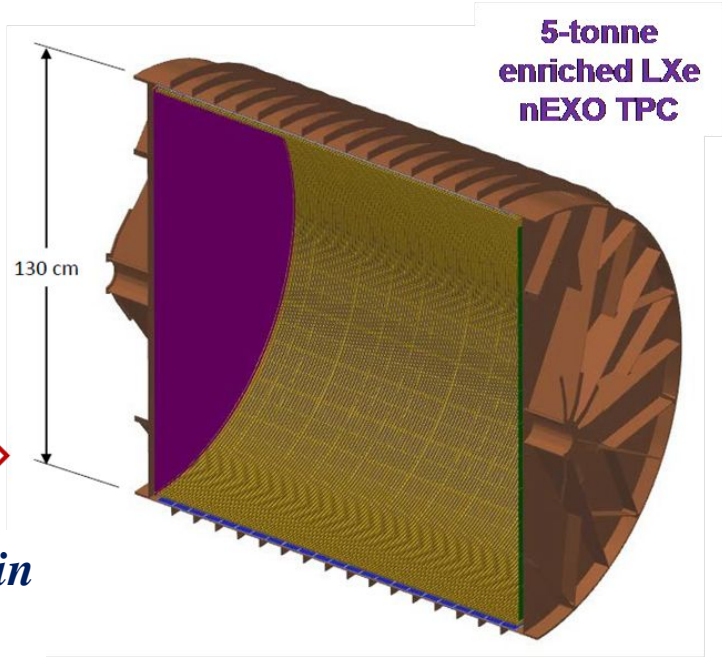
Razvan.Gornea [at] carleton.ca

Neutrinoless double beta decay search with ^{136}Xe

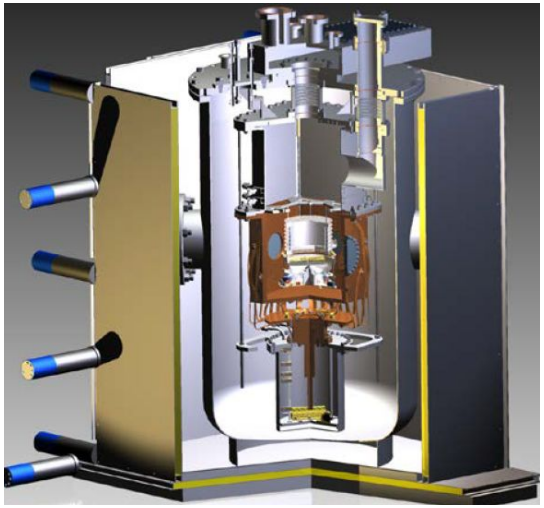
Designed and optimized from EXO-200 experience!



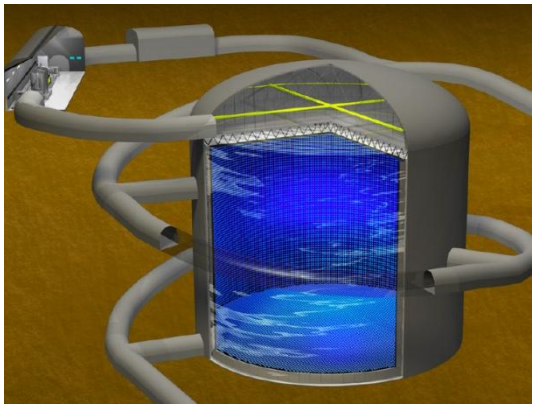
Evolution!



Ba ion tagging in LXe R&D

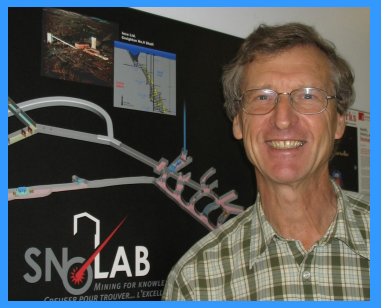


Participation to HyperK multi-physics project



Professor David Sinclair

Experimental Particle Physics

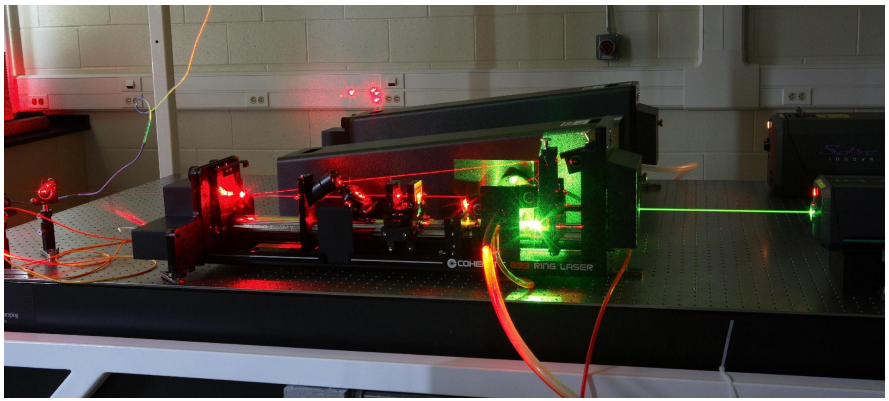


Professor of Physics

Ph.D. (Queen's)

email: sinclair [at] physics.carleton.ca

- Search for double beta decay in Xe
- Properties of Xe as a tracking chamber
- Detection of single ions of Ba through Resonant Laser Fluorescence



SNOLAB Construction
Development of New
Experimental Program

Carleton University

Professor Simon Viel

Experimental Particle Physics

Assistant Professor of Physics

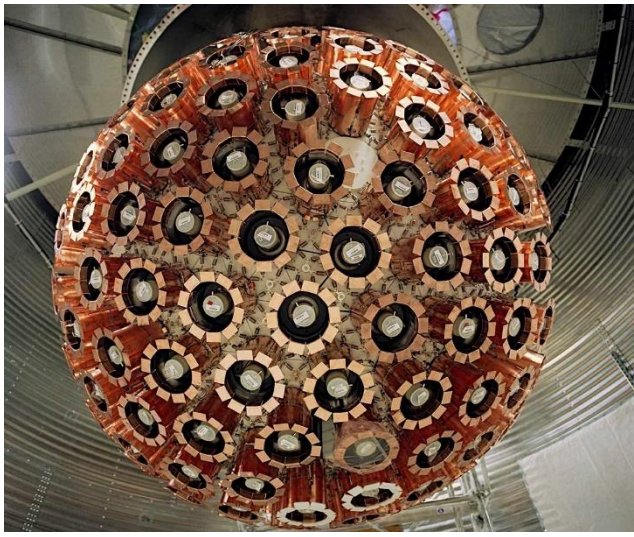
Ph.D. (UBC)

email: sviel [at] physics.carleton.ca

SNOLAB: DEAP-3600, DarkSide/Argo, nEXO

Main focus: Direct detection of **dark matter** with current and future noble-liquid experiments

Photodetector instrumentation



Research projects:

- Search for dark matter with **DEAP-3600** at SNOLAB (analysis coordinator)
- Simulation and design of **DarkSide-20k**, and a future multi-hundred tonnes liquid argon detector **Argo**, possibly at SNOLAB
- **Silicon photomultiplier** R&D for future detectors:
  - 3D digital silicon photomultipliers
  - **nEXO** search for neutrinoless double beta decay in xenon
  - Other applications

Carleton UNIVERSITY
Canada's Capital University

Professor Alain Bellerive
Experimental Particle Physics

Professor of Physics

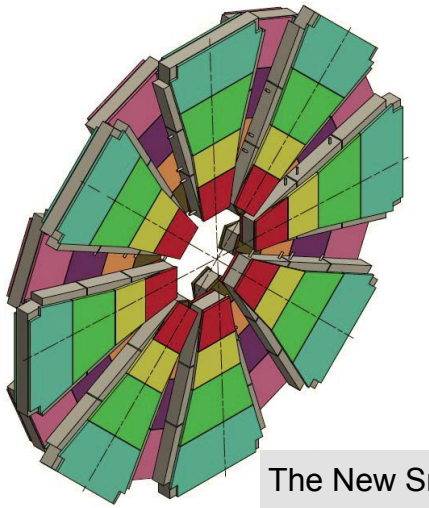
Ph.D. (McGill)

email: alainb [at] physics.carleton.ca

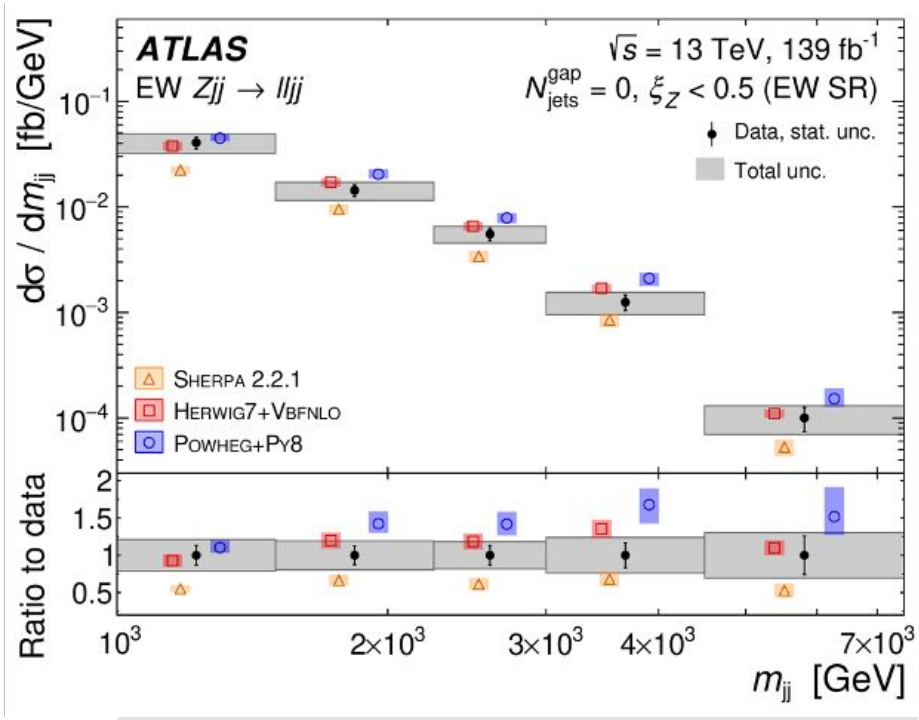
Main focus is on the **ATLAS** experiment at CERN. I am involved in the operation and characterization of the **muon detector** called the New Small Wheel (NSW) and in particular gas chambers called thin gap chambers (sTGC). The sTGC were built and assembled at Carleton. I work on simulation for the sTGC and pattern recognition with the ATLAS Muon System.

Involved in the analyses that use physics events with **jets, muons, W** and **Z bosons**.

Goals: Study W & Z bosons properties and Standard Model processes. Data mining.



The New Small Wheel

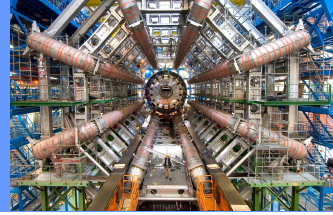


Measurements of the Total and Differential Z+jets Production Cross Sections at √s=13 TeV with the ATLAS Detector

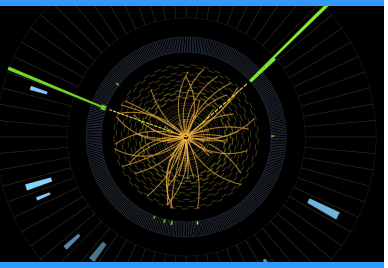
Carleton University

Professor Dag Gillberg

Experimental Particle Physics

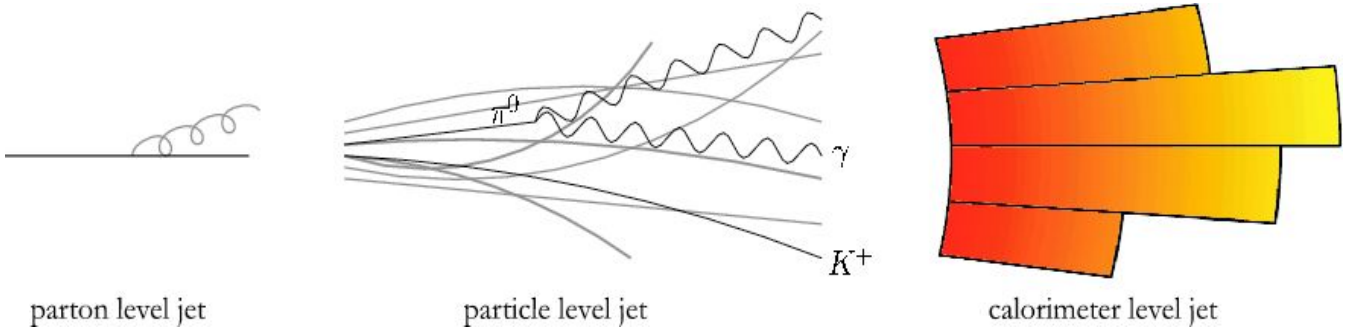


Associate Professor of Physics
Ph.D. (SFU)
email: dag [at] physics.carleton.ca



- Member of the **ATLAS** experiment at CERN
  Exploring fundamental nature of the Universe
- Research

1. Precision measurements of fundamental interactions (e.g. Higgs, *W* and *Z* bosons). Searches for new physics, e.g. dark matter.
2. Advanced data analysis; machine learning (BDT, deep NNs).
3. Particle reconstruction and calibration: measurement of "jets", using ***global particle flow***. Focus on future challenges with very high intensity beams.
4. R&D of particle detectors, including new **ATLAS inner tracker** (ITk) and new technologies (CMOS and GaN)



Professor Kevin Graham

Experimental Particle Physics

Professor of Physics
Ph.D. (Victoria)

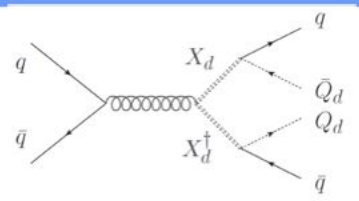
email:Kevin_Graham
[at] carleton.ca

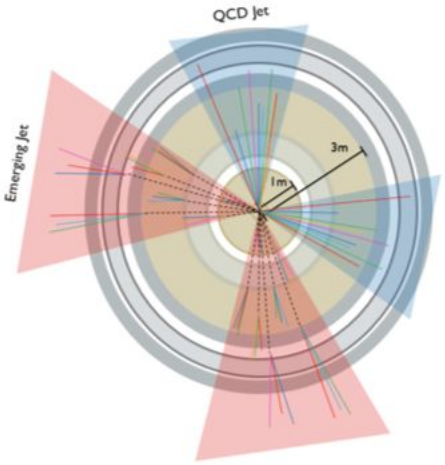
ATLAS Experiment

- ~13 TeV proton-proton collisions at the Large Hadron Collider

Physics Analysis

- jet calibrations
- searching for evidence of Dark Matter with ATLAS
  - 'emerging jets
  - 'soft unclustered energy patters'
- we are developing sensitive searches utilizing machine-learning tools



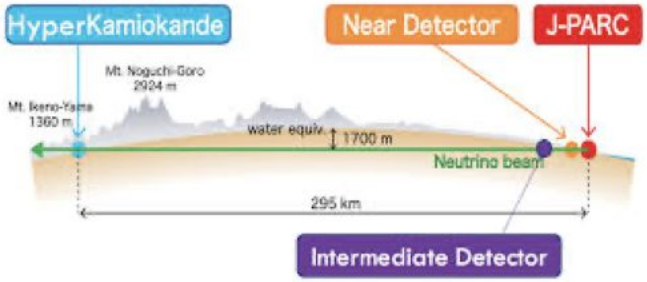


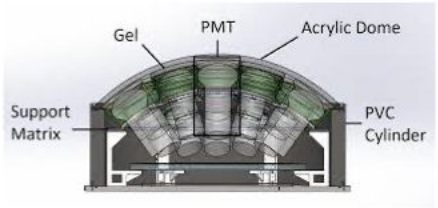
HyperKamiokande Experiment

- test for CP violation in neutrino sector and precision neutrino properties

Carleton Contributions

- mPMT development, construction, and testing
- Monte Carlo simulations and data analysis
- calibration systems



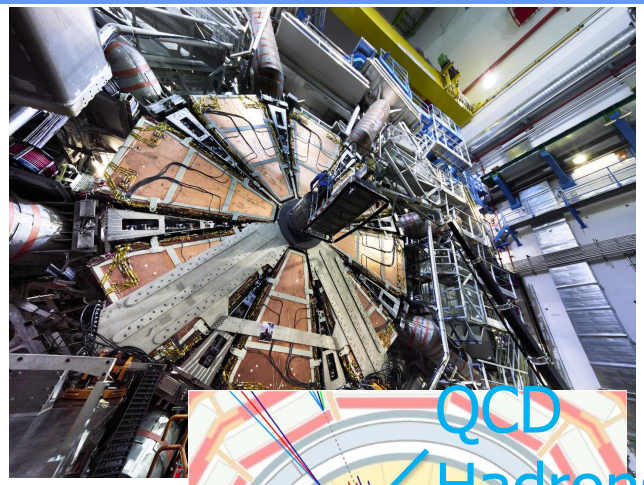


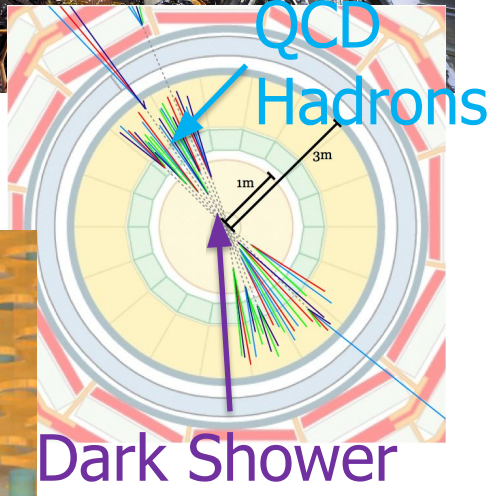
Professor Jesse Heilman

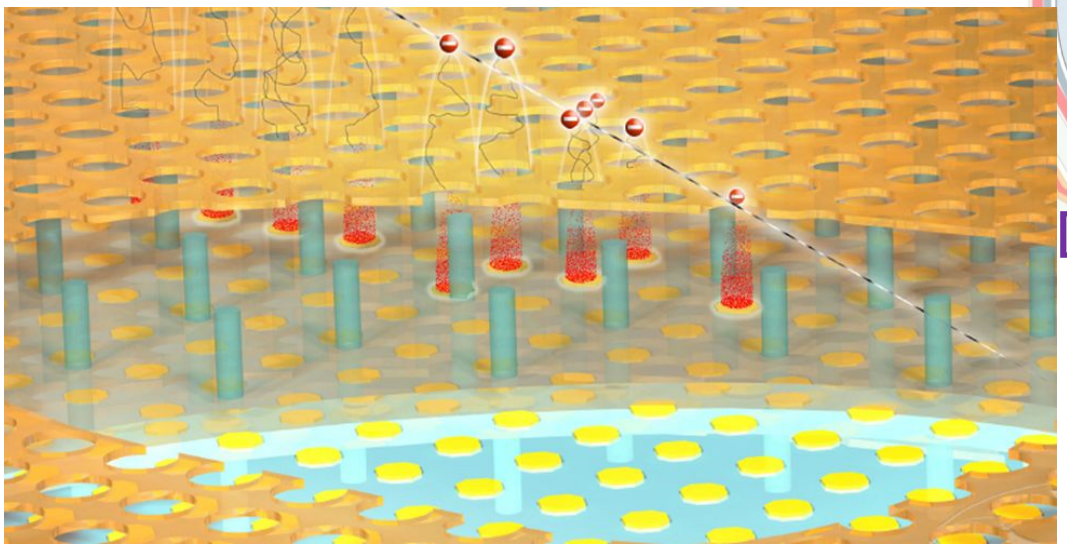
Experimental Particle Physics

Assistant Professor of Physics
PhD (UC Riverside)
email:
Jesse.Heilman [at].carleton.ca

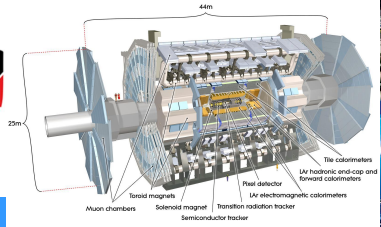
- Particle Detectors
  - ATLAS New Small Wheel
  - GridPix Time Projection Chamber
- Research Projects
  - Searching for Dark QCD at ATLAS
  - Rate dependent effects in GridPix TPC
- Actively seeking new students!

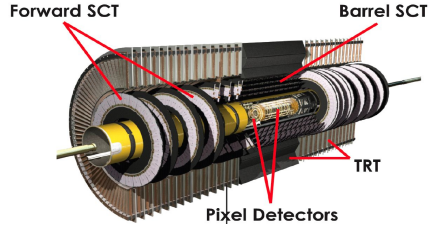






Carleton University





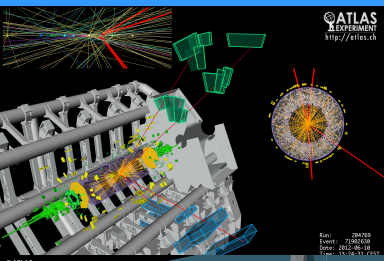
Professor Thomas Koffas

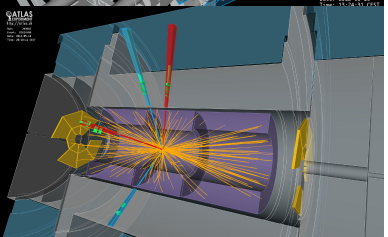
Experimental Particle Physics

Associate Professor of Physics
Ph.D. (Rochester)
email: koffas [at] physics.carleton.ca
ATLAS

My primary research interests are on experimental particle physics as a member of the ATLAS collaboration. ATLAS is a multi-purpose detector operating at the Large Hadron Collider at CERN. It searches for signals that will enable physicists to understand the fundamental laws of nature such as the acquisition of mass through the so-called Higgs mechanism. Enabling this research by using the appropriate detectors is what I currently focus on.

Over time I have worked on the ATLAS Tracker that reconstructs the tracks of charged particles primarily on the Transition Radiation Tracker. I then moved on to working on the reconstruction of electrons and photons in ATLAS. This constitutes the ground-work to a rich Higgs physics program via its decays to four leptons to which I played a leading role. This physics program will be enhanced with the new global particle flow approach that we are currently implementing in the ATLAS reconstruction software.





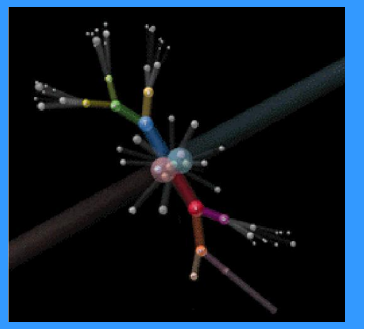
To enable future cutting edge research at the LHC, the ATLAS detector will be upgraded. I'm involved in the R&D and construction of the new ATLAS Inner Tracking (Itk) detector an all-silicon tracker to replace the current one in 2026 for the HL-LHC era. We are key contributors in the development and verification of innovative, radiation-hard microstrip sensor and readout ASIC technologies. **Graduate students will be contributing to all these research endeavors**

Carleton University

The ATLAS Experiment

Professor of Physics
Canada Research Professor
Ph.D. (Victoria)

email: vincter [at] physics.carleton.ca



Professor Manuella Vincter

Experimental Particle Physics

My primary research focus is on the ATLAS experiment based at the CERN laboratory in Switzerland where I am Deputy Spokesperson. ATLAS is a particle physics experiment that explores the fundamental nature of matter and the basic forces that shape our universe. The ATLAS detector searches for new discoveries in the head on collisions of protons at the highest energies ever produced in a lab.

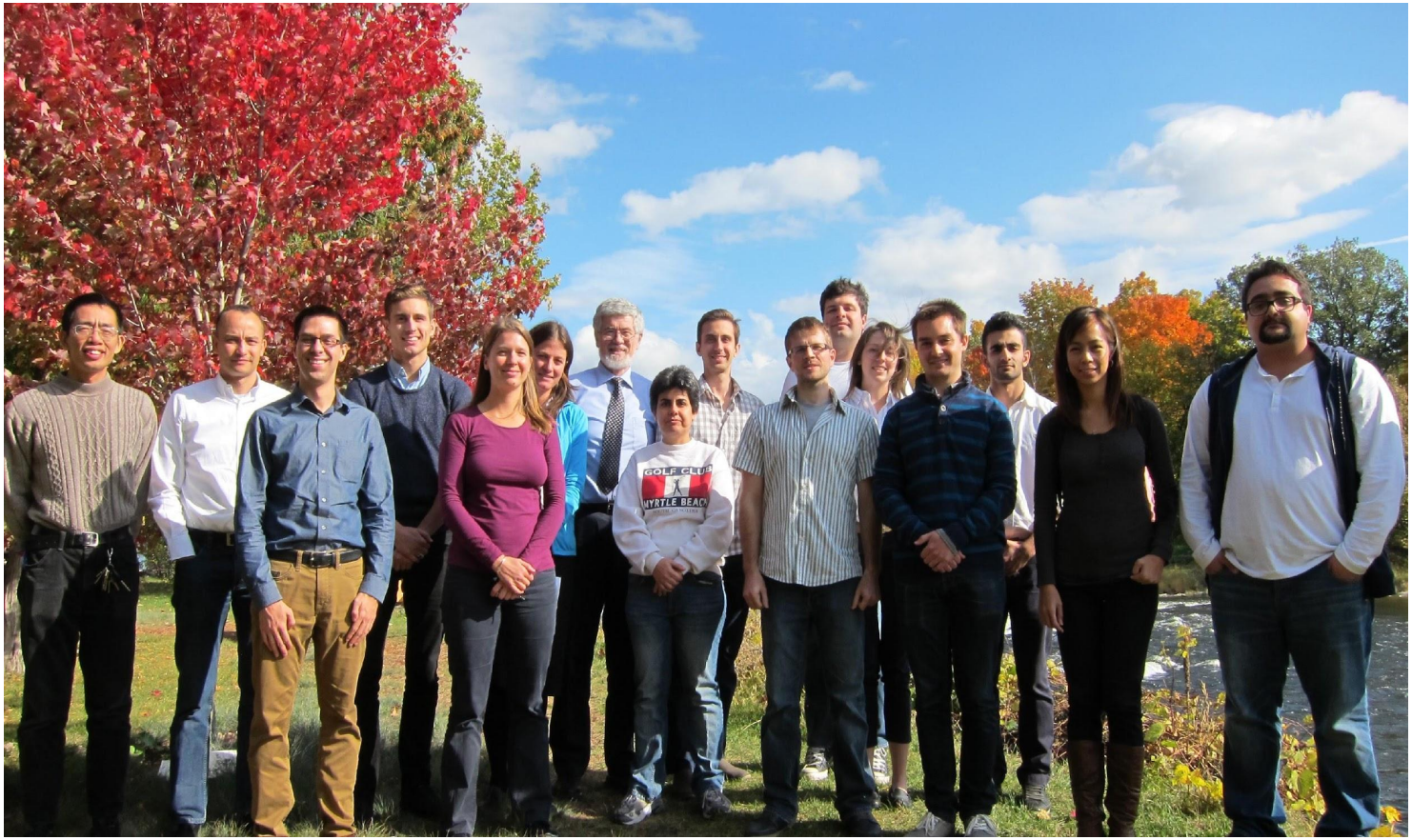
I work on the data collected during Runs 2 and 3 of the LHC. I'm particularly interested in precision measurements of Standard Model processes involving W and Z bosons. I am also involved in understanding the Standard Model nature of the Higgs Boson.

Within ATLAS, I am a reviewer of detector performance, Standard Model physics measurements, and new physics at the highest energies.

For more information about ATLAS, see http://atlas.ch/

Carleton University

Medical Physics



Professor Avery Berman

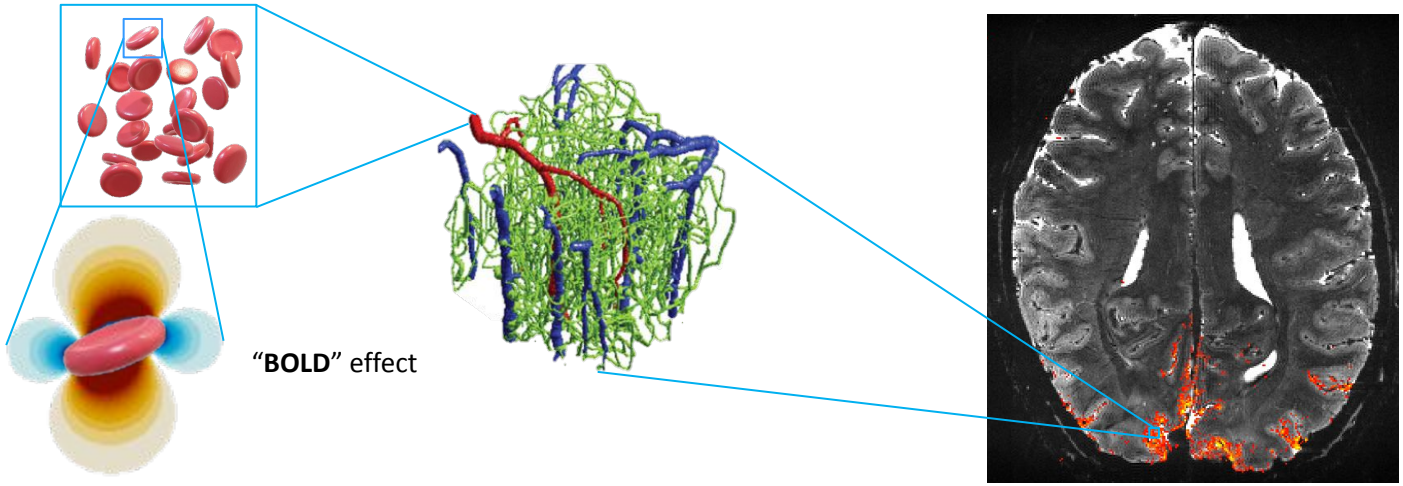
MR Physics and Physiology

Assistant Professor of Physics

Ph.D. Biomedical Engineering (McGill)

email: averyb [at] physics.carleton.ca

Develop **functional MRI** methods to image brain activity and vasculature with improved *physiological* and *anatomical* specificity



Applications

Neuroscience, Neurodegeneration (Alzheimer's), Vascular disease, Mental Health (depression)

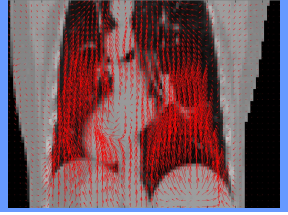
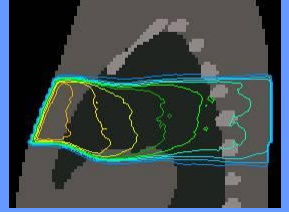
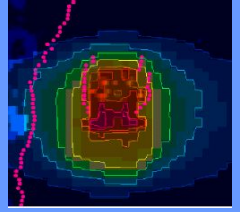
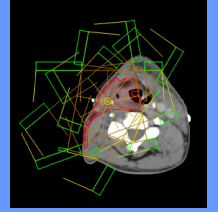
Projects

Computational + 3-T MRI-PET at The Royal

"Calibrating" the fMRI signal to measure oxygen metabolism (U of T)

Measuring small vessel blood flow, volume, and reactivity →

Developing high spatial resolution fMRI (Harvard)

Professor Emily Heath

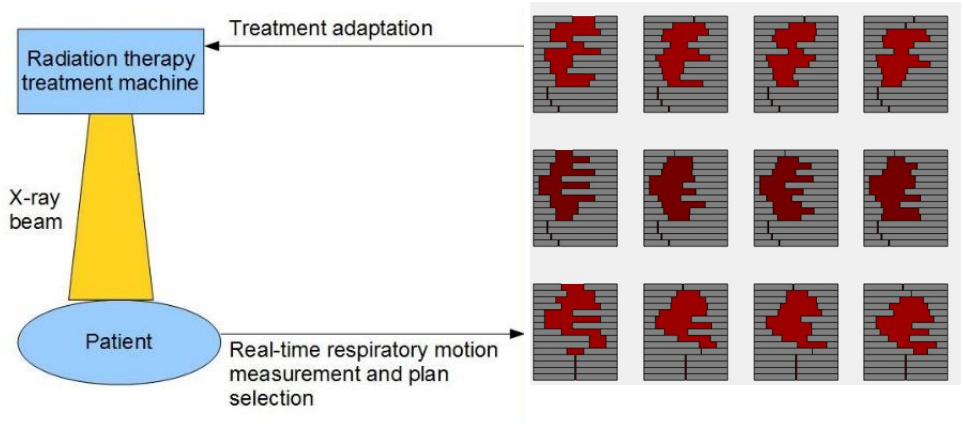
Associate Professor of Physics

Ph.D. (McGill)

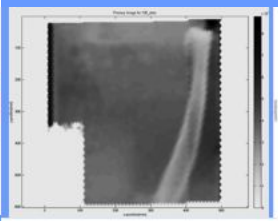
email: emily.heath [at].carleton.ca

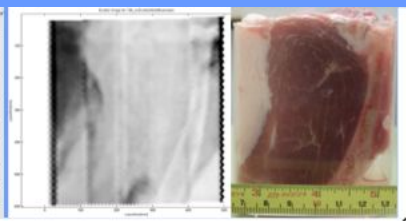
http://physics.carleton.ca/~eheath

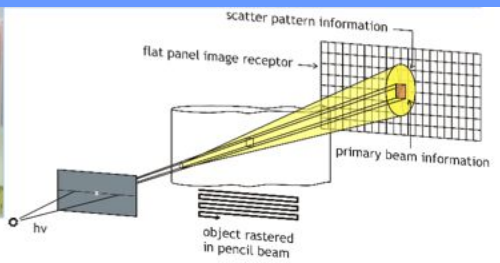
- Dose accumulation methods to account for patient anatomical changes during radiation therapy treatment
- Monte Carlo simulation of radiation therapy delivery accounting for beam and patient motion
- Robust treatment planning methods to account for uncertainties in radiation therapy delivery

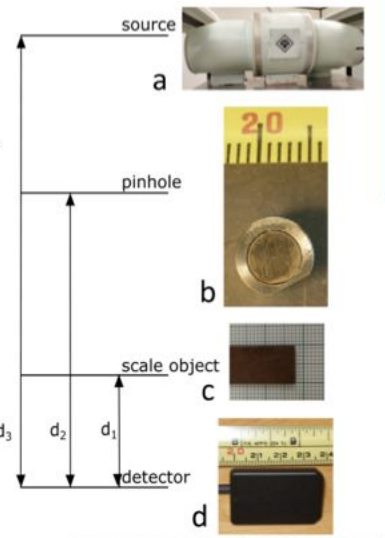


Carleton University









Professor Paul Johns

Medical Physics: X-ray imaging systems

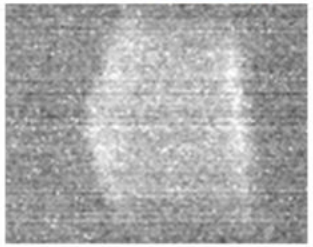
Professor of Physics (retired)

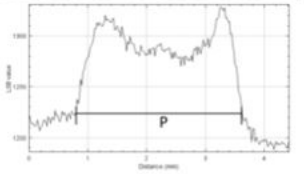
Ph.D. Medical Biophysics (Toronto)

Paul.Johns [at] carleton.ca

people.physics. ... /~johns

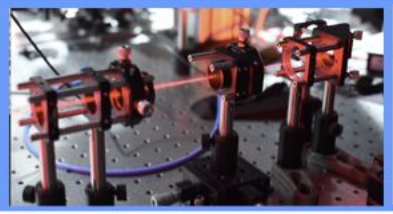
- X-ray scatter imaging
- Hybrid imaging using conventional shadow pictures + *low-angle scattered x rays*: signal from chem structure even for tissues (amorphous material x-ray diffraction).
- David Kemdirim – MSc – *spectrum optimization*
- C.Dydula, P.Johns, Rev. Sci. Instr. 2021 doi:10.1063/5.0055900

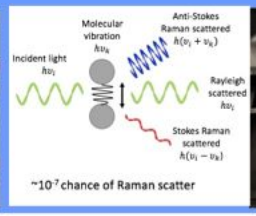


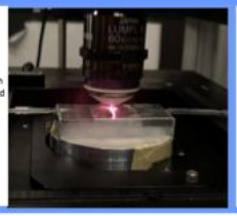


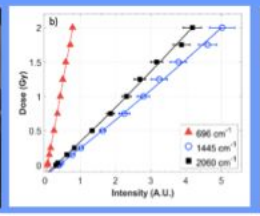
- X-ray tube source assessment
- *Radiation emission distribution* – a major determinant of image resolution. Measurement prototype using 30 µm pinhole + high-res detector (20 µm elements).
- E.Anderson,P.Johns, abs: Med.Phys.2022 doi:10.1002/mp.15896

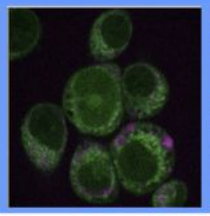
LLAMPE

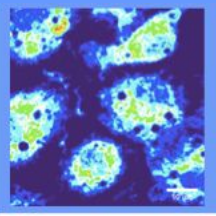












Associate Professor of Physics

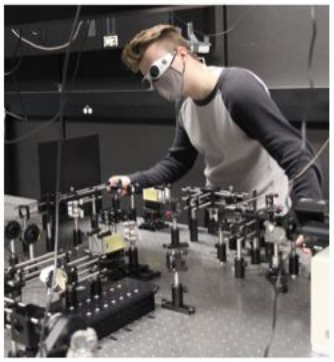
Ph.D. (U.Michigan, Ann Arbor)

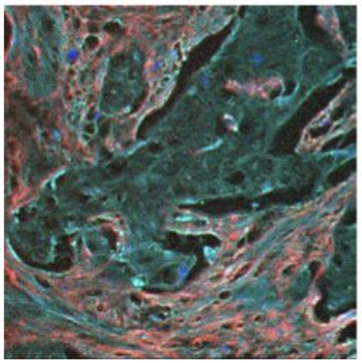
sangeeta.murugkar@carleton.ca

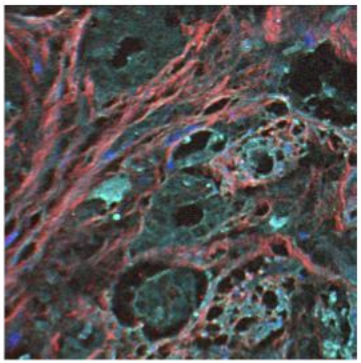
https://lampe.physics.carleton.ca/

Laboratory for Laser Assisted Medical Physics and Engineering

Develop (**nonlinear) optical imaging and spectroscopy** techniques for biomedical discovery research and applications







Applications

Low-dose research (Health Canada), Cancer detection (CHUM, Montreal)

Projects

- Develop high-resolution dosimetry to investigate effects of low-dose ionizing radiation
- Determine label-free biomarkers of metabolic and chemical response of cells and tissue
- Develop miniaturized portable optical imaging probes

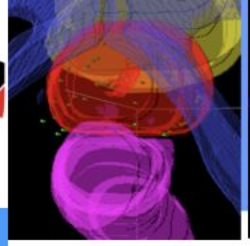
Carleton University

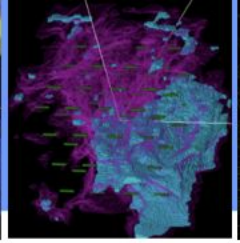
Canada Research Chair and Associate Professor of Physics

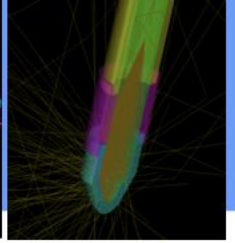
Ph.D. (Waterloo)

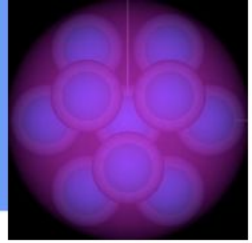
rthomson@physics.carleton.ca

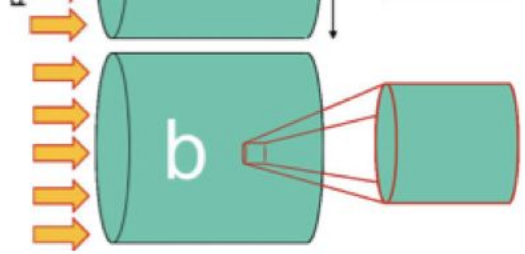
physics.carleton.ca/~rthomson









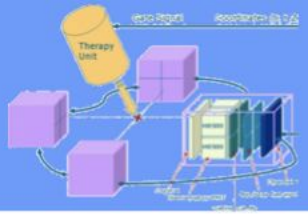


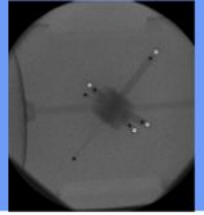
Professor Rowan Thomson

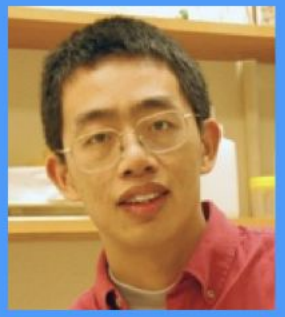
Medical Physics

- Theoretical and computational techniques for studying interactions of radiation with matter & applications in radiotherapy physics.
- Fast Monte Carlo simulations for brachytherapy:
  - Code development – egs_brachy
  - Applications for breast, prostate, eye, lung
  - Collaborations: Mayo Clinic, Laval/Quebec, Sunnybrook, Ottawa Hospital; international Task Groups
- Cellular dosimetry
  - Radiation transport and energy deposition in cells and subcellular structures
  - Nanodevices for radiotherapy
- Low energy electron transport: quantum versus classical modelling

Carleton UNIVERSITY
Canada's Capital University



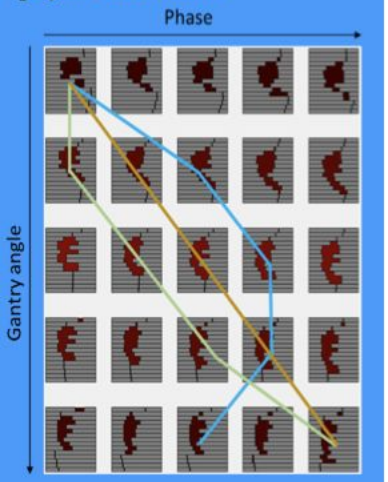




Associate Professor of Physics

Ph.D. (Univ. of Sci. & Tech. Of China)

email: txu [at] physics.carleton.ca



Professor Tong Xu

Medical Physics in

Motion compensation in medical imaging and therapy

Focus on the development of motion compensation techniques enabled by a real-time tracking of using positron emission isotopes.

Patient motion adaptation for Radiation therapy

Aperture Library Enabled Real-time Robust Adaptation ALERT-RA

Patient motion correction for PET imaging

Based on the PET list mode data

Patient motion correction for PET/MR scanner

Prospective MRI motion correction with PeTrack

MRI compatible Dynamic phantom

Carleton University

Adjunct Professors

Carleton UNIVERSITY
Canada's Capital University

Elsayed Ali (The Ottawa Hospital Cancer Centre)

Adjunct Research Professor

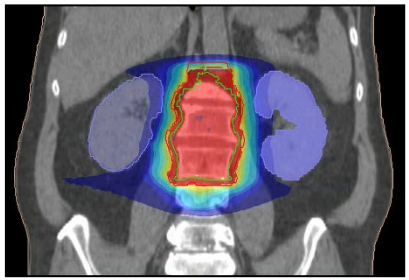
email:
elali@toh.ca

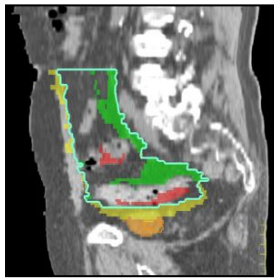
Overview of my research

- Clinical radiation oncology physics.
- About 2/3 computational and 1/3 experimental.
- At The Ottawa Hospital Cancer Centre facilities (~$50M).

Current projects

- CBCT-based planning and image quality improvements.
- AI methods for rapid-access palliative radiation therapy.
- Bowel segmentation, dosimetry and early toxicities.



Carleton University

Mustafa Bahran

SAR Visiting Professor

email: Mbahran[at] physics.carleton.ca

Physics Education Research

A measurement and assessment of the effectiveness of the Lab component of the introductory physics courses at Carleton University: Reinforcing physics content.

(Special Thanks to all of you who are helping in this project)

For 2017,18 and 19 the courses covered are:

BIT Physics: 1002A,B, 1003; 1007,8 Physics for Life Science Majors I,II; 1003,4 Physics for Science & Eng. Majors I,II; and 1001,2 Foundation of Physics I,II

The structure of these introductory physics courses is such that the laboratory activities are integrated within the course and represent 25%-35% of the course weight/grade. Usually the lecture is 3 hours/week, with tutorial every other week for 3 hours and a lab every other week for 3 hours. The current objectives of the lab activities include the goal of complementary reinforcement of physics content covered in the lectures. In this research first stage we intend to measure the effectiveness of this very goal. That is to say the effectiveness of the lab component of these courses to complementary reinforce the physics concepts given in the lecture within the student's learning process. Subsequently, after the completion of stage 1 we intend to measure student's tendencies toward the different components of these courses and the effectiveness of the labs with regards of the remaining goals of their design.

Carleton University

Rob deKemp
(at Ottawa Heart Institute)

Adjunct Research Professor

email:radekemp [at] Ottawaheart.ca

Development of three-dimensional attenuation, scatter and partial volume corrections for positron emission tomography.

Automated 3D cardiac image analysis and interpretation methods including kinetic modeling of Rb-82 blood flow and F-18-FDG metabolism measurements.

New isotope infusion/inhalation systems for Rb-82 and O-15-labeled tracers for control of total administered activity and activity rates. 3D reconstruction of coronary arteries and fusion of anatomic/functional images.control of infusion dose rates as well as total injected dose and volume.

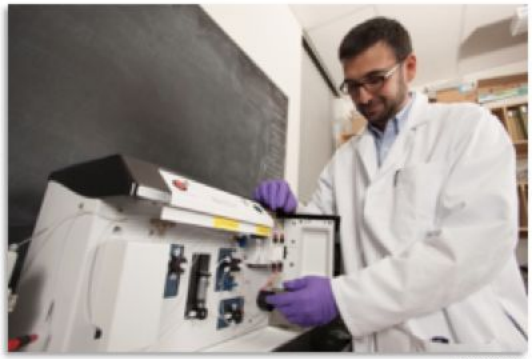
Raphael Galea

(at NRC, Ionizing Radiation Standards)

Adjunct Research Professor

Ph.D. Experimental high-energy physics (University of Toronto)

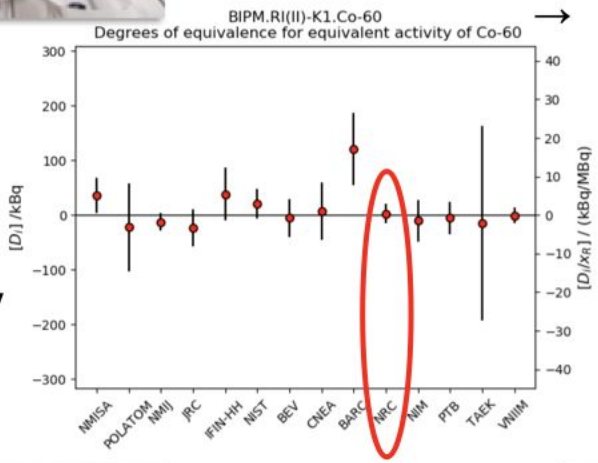
email: Raphael.Galea [at] nrc-cnrc.gc.ca



Radioactive Certified Reference Materials

Detectors: Wire Proportional Counters, Ion Chambers, Liquid/Solid Scintillation Detection, γ-spectroscopy (Si, Ge)

Radiochemical separation, target preparation, Radiochronometry



Radionuclide metrology: Detector Benchmarking MC, Fundamental Nuclear data determination, Primary Standardization Method Development, Radionuclide production

International comparison of radioactivity with the BIPM

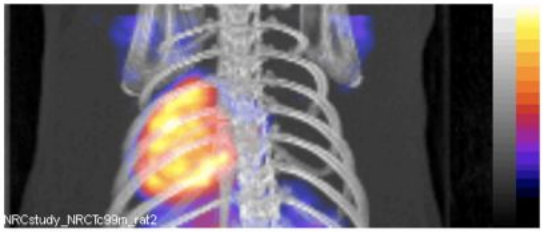


Image of a Rat's heart using ^{99m}Tc produced, purified and standardized at NRC.

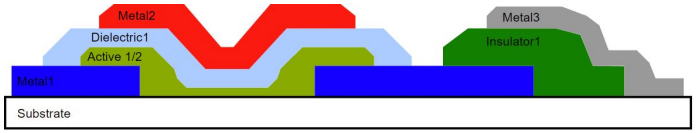
Ryan Griffin
(Team Lead – Electronics @ NRC)

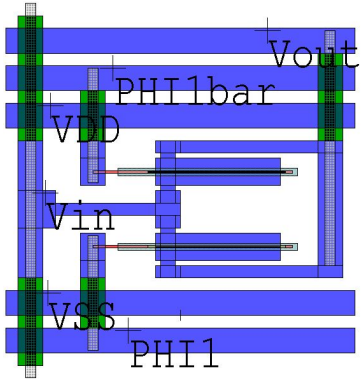
Adjunct Research Professor

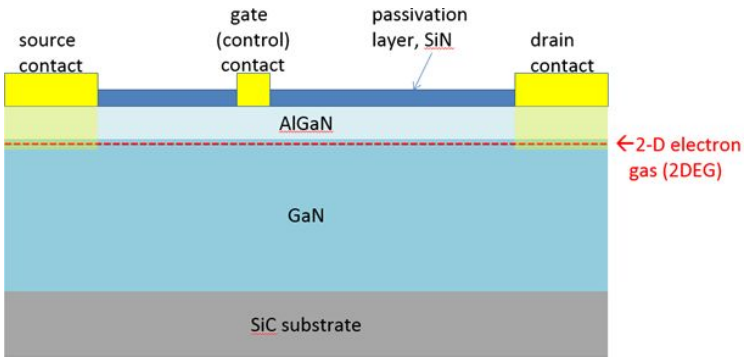
Ph.D. (Carleton)

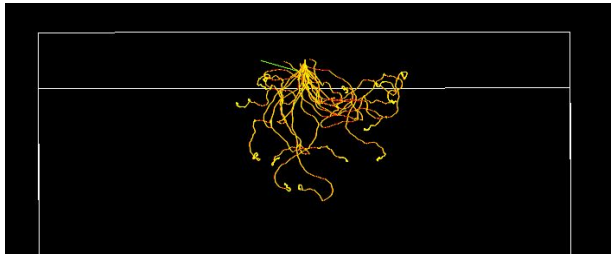
A medley of research:

- Printed Electronics (Additive Manufacturing)
- Gallium Nitride Electronics and Sensors for Harsh Environments
- Radon Monitoring









Malcolm McEwen

(at NRC, Ionizing Radiation Standards)

Adjunct Research Professor

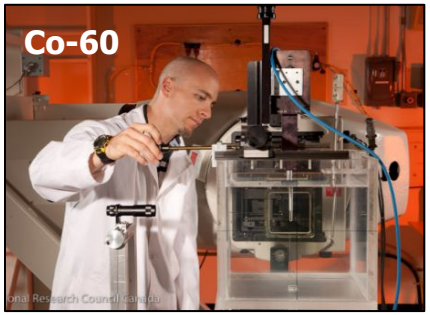
PhD - Radiation Physics (University of Surrey, UK)

email: Malcolm.McEwen [at] nrc-cnrc.gc.ca

Development of primary standards to measure absorbed dose

$$D_w = c\Delta T \rightarrow$$

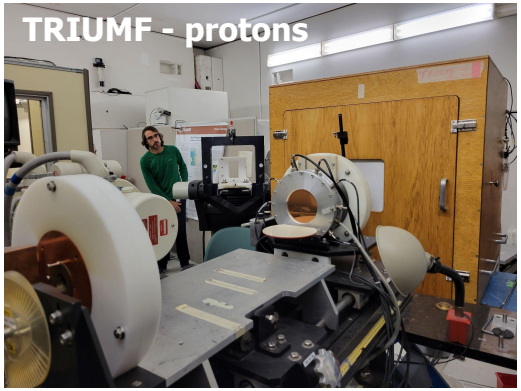
↓

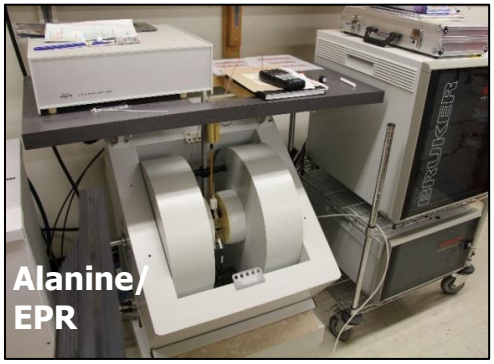


Characterization of detectors for various applications - different mechanisms: ionization chambers, solid-state detectors chemical dosimeters, film, *etc*

Radiation therapy - current and new beam modalities

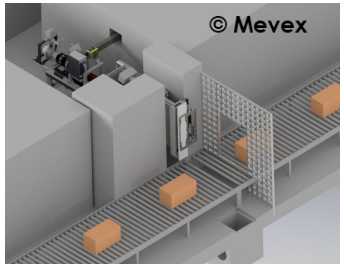
↓





Dosimetry for industrial processing (radiation sterilization of medical goods and devices)

←



Bryan Muir

(at NRC, Ionizing Radiation Standards)

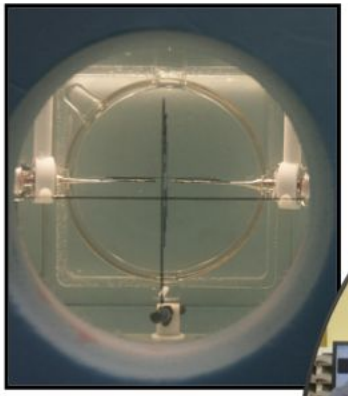
Adjunct Research Professor

Ph.D. - Medical Physics (Carleton University) 2013

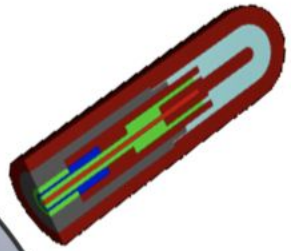
email:
Bryan.Muir
[at] nrc-cnrc.gc.ca

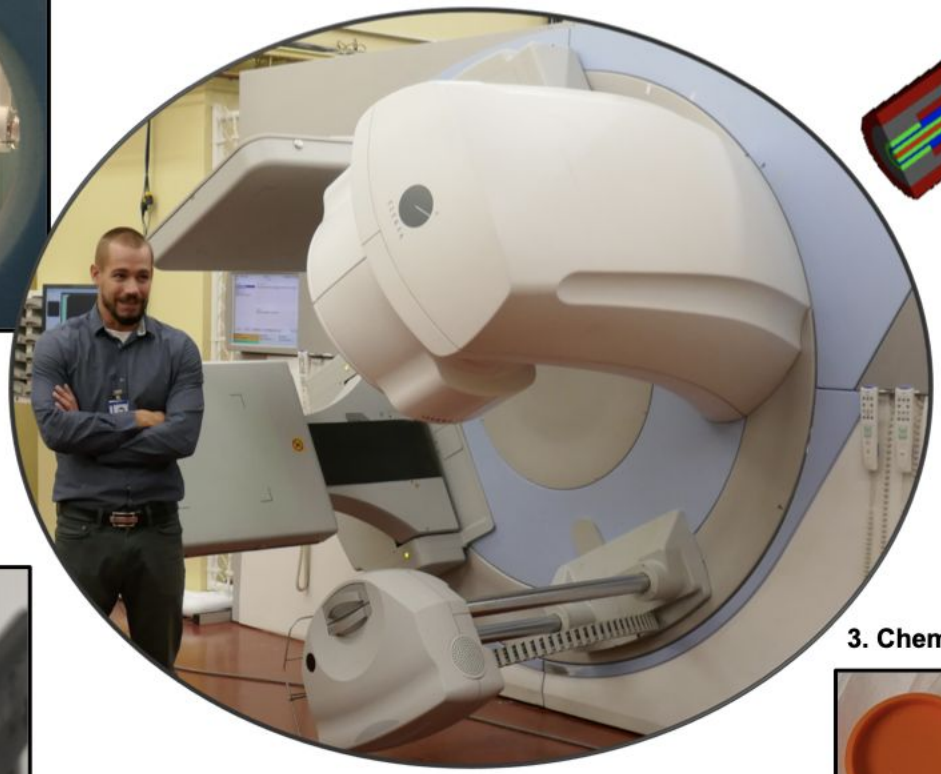
$$D_w^Q = MN_{D,w}^Q = Mk_Q N_{D,w}^{^{60}\mathrm{Co}}$$

1. Primary measurements



2. Secondary detectors





3. Chemical dosimeters

4. Detectors for novel treatments

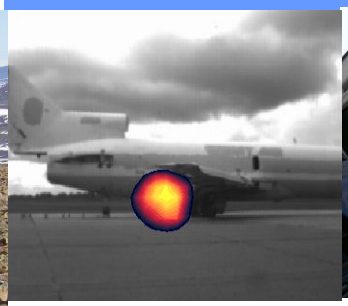
Graduate student supervision:

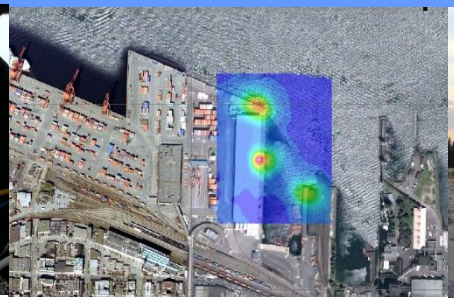
Rodi Surensoy (MSc 2022): Primary standards for low-energy electron beams

Victoria Howard (MSc 2025): Pyroelectric calorimeter with electrometer readout

Laurel Sinclair

(at Natural Resources Canada)




Adjunct Research Professor

Ph.D. Experimental particle physics (McGill)

laurel.sinclair [at] canada.ca

Mapping of radioactivity

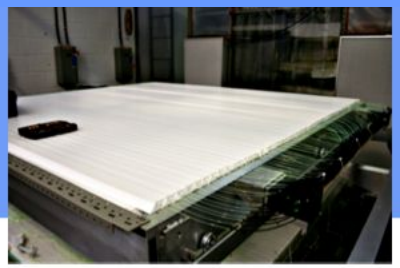
- Novel multi-crystal radiation detector for mounting on aerial or ground-based robotic platform
- Advanced statistical methods for unfolding of system response from radiometric survey data

Compton gamma imager

- Development of novel ~300-channel coincidence instrument for gamma imaging, including fieldable version for use by responders
- New multi-modal imager designs simultaneously exploit self-shielding and Compton imaging

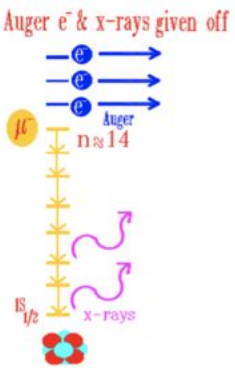
Carleton University

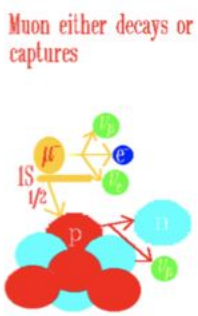


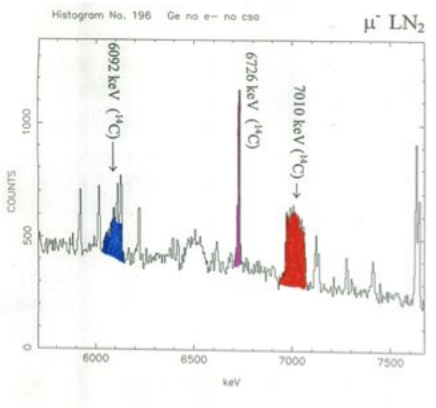


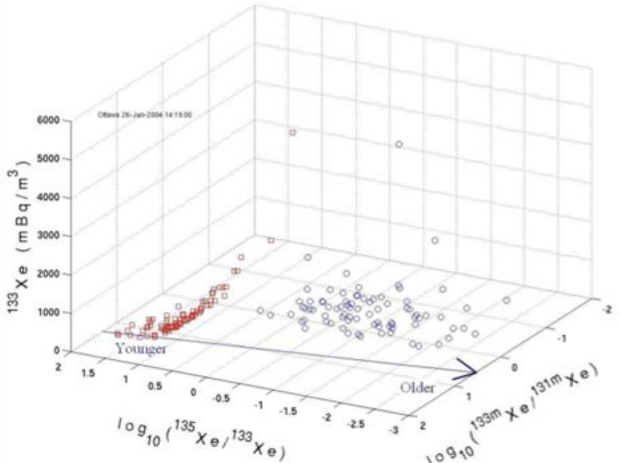

Dr. Trevor Stocki

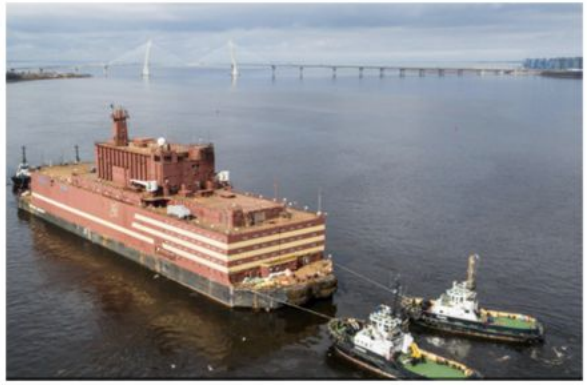
Adjunct Research Professor
Ph.D. (UBC)
email: trevor.stocki [at] hc-sc.gc.ca



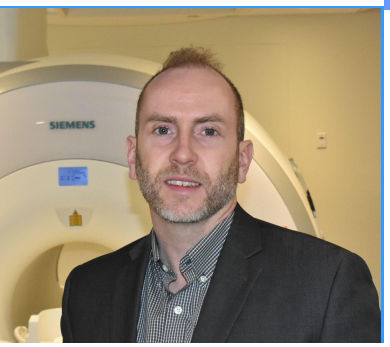








Reggie Taylor
(Institute of Mental Health Research)



The Le Royal
Mental Health - Care & Research
Santé mentale - Soins et recherche

Adjunct Research Professor

email:
reggie.taylor@theroyal.ca

Uses novel positron emission tomography (PET) and magnetic resonance imaging (MRI) methods to study the brain:

- Magnetic resonance spectroscopy (MRS) to measure metabolites involved in excitatory neurotransmission in schizophrenia.

- Assessing amyloid deposition in Alzheimer's disease using a PET tracer and comparing to advanced MRI techniques designed to measure glymphatic function.

Eric Vandervoort

(The Ottawa Hospital Cancer Centre)

Adjunct Research Professor

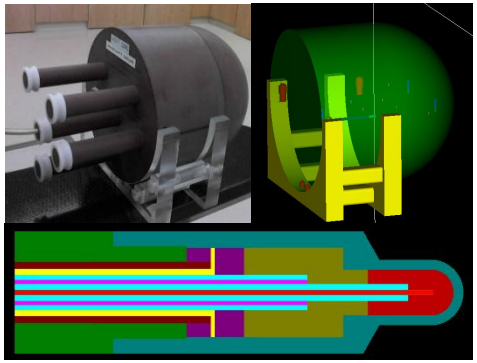
email: evandervoort [at] toh.ca

Overview: My research is in radiation oncology physics especially applications within stereotactic ablative radiosurgery

Projects that I am currently recruiting students for:

- Accurately modelling detector response in complex composite clinical fields (CyberKnife and VMAT delivery)
- Respiratory compensation in radiosurgery
- MRI planning for accelerated partial breast irradiation on the GammaPod system and eventually in-room image guidance

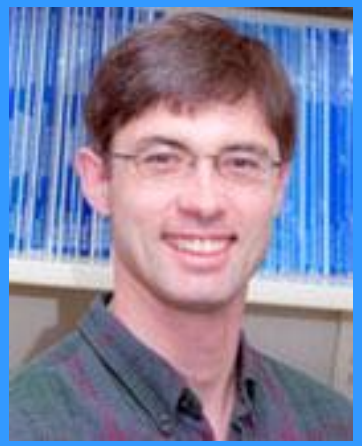
CyberKnife System



Realistic detector and phantom modelling

Gammapod System

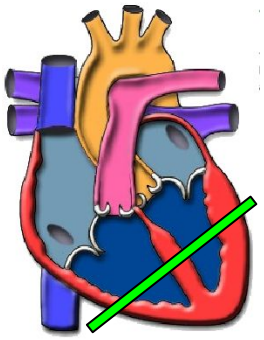
Glenn Wells
(University of Ottawa Heart Institute)

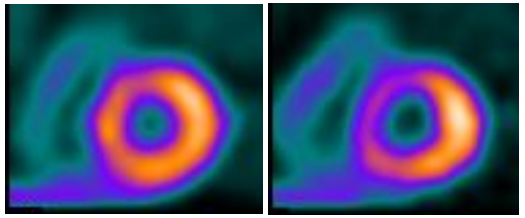


Adjunct Research Professor
Ph.D, FCCPM

email: gwells [at] ottawaheart.ca

Cardiac SPECT and SPECT/CT Imaging





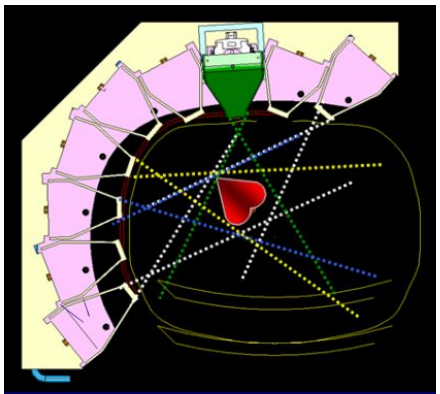
Rest Stress

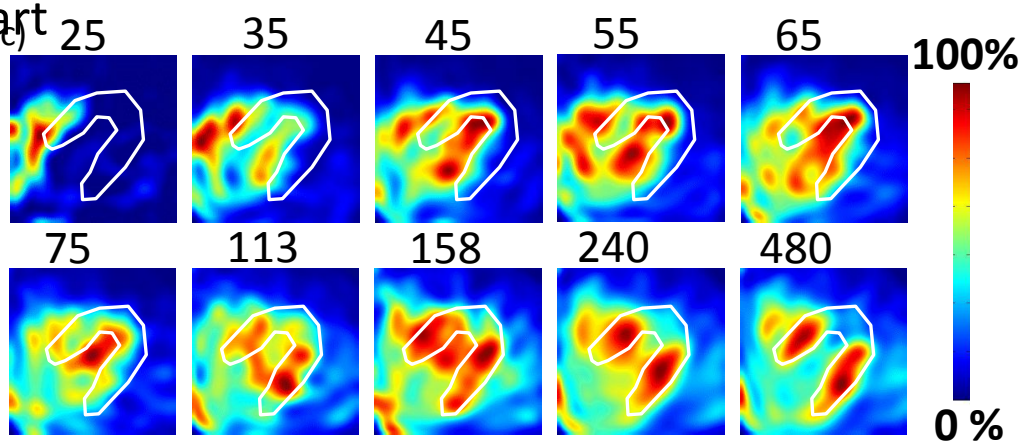
Cardiac pinhole SPECT

Image reconstruction and performance assessment.
Developing novel reconstruction approaches to improve image quality in cardiac imaging

Dynamic SPECT/CT imaging

Using novel stationary SPECT cameras to measure absolute blood flow in the heart





Ruth Wilkins

(Health Canada, Consumer and Clinical Radiation Protection Bureau)

Adjunct Research Professor

email:ruth.wilkins [at] hc-sc.gc.ca

My laboratory at Health Canada focusses on the biological effects of ionizing radiation. The main ongoing projects include:

Biological dosimetry is measuring the amount of ionizing radiation received by an individual using biological material. This type of dosimeter is essential when an individual is accidentally exposed and no physical dosimetry is available. Currently, the accepted method of biological dosimetry is the dicentric chromosome assay which involves examining chromosomes for characteristic damage caused by ionizing radiation, requiring weeks to process a sample from one individual. For large scale radiological events a rapid biological dosimeter is desirable. Our laboratory is currently exploring new techniques.

Exploring biological markers for radiation sensitivity to assist in predicting the response of patients to radiotherapy. An issue arises in radiotherapy when a patient does not have a normal response to radiation, i.e., they are more radiosensitive than normal resulting in negative side effects, or more radioresistant than normal, resulting in poor tumor control. We are examining several cytogenetic and molecular endpoints to identify a marker for radiation response.

Biomarkers for radiation exposure – alternative biomarkers for radiation exposure are being investigated for rapid, point-of-care dose estimations. These include genomic, proteomic and metabolomic endpoints as well as new techniques including Raman Spectroscopy.