



# ENG

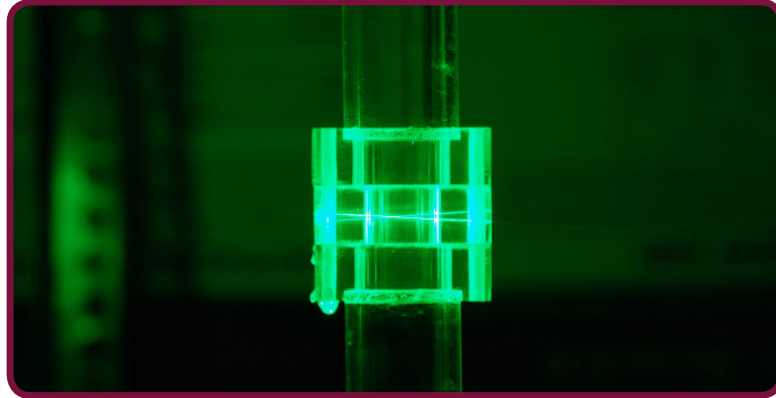
# PHYS

Graduate  
Studies  
Viewbook



ENGINEERING  
Engineering Physics

# ENGINEERING



An interdisciplinary field of study where new and **advanced materials, devices and systems** are engineered based on our **fundamental understanding** of physics.

## FACILITIES

Centre for Emerging Device Technologies

Canadian Centre for Electron Microscopy

Brockhouse Institute for Materials Research

Centre for Advanced Nuclear Systems

Biomedical Sensors Lab

Biophotonics Lab

Nano- and Micro-devices Lab

Silicon Photonics Labs

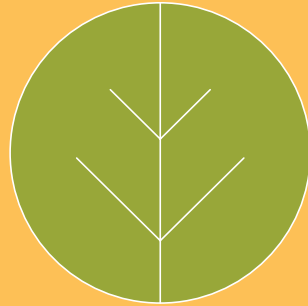
McMaster Nuclear Reactor

Photovoltaics Labs

# PHYSICS



**digital**



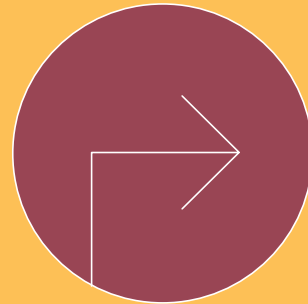
**environment**



**health**



**discovery**



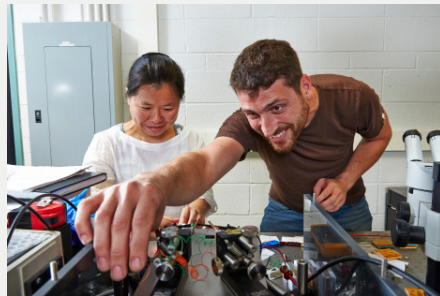
**leadership**



**energy**

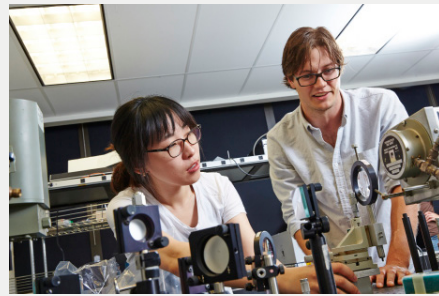
Our faculty and students are pushing the forefront of modern physics to better the world through **technological advancement**. We are developing today's and tomorrow's **advanced technologies** in fields as diverse as **Nano- and Micro- Devices Engineering, Nuclear Engineering, Photonics Engineering, Biomedical Engineering, and Smart Systems**.

# Students may choose from a wide range of cutting-edge specialties including...



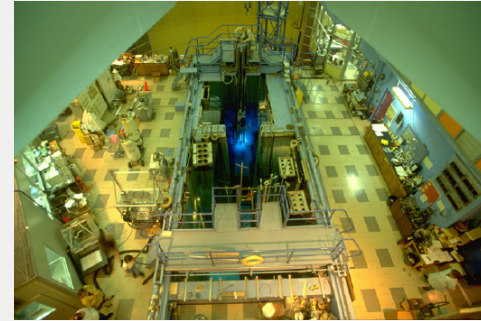
## Nano- and Micro-Devices Engineering

Develop revolutionary nanotechnologies for information, communication, and sensing applications that enable tomorrow's technology



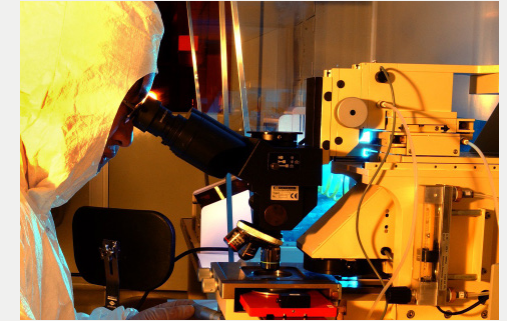
## Photonics Engineering

Engineer the quantum particle of light for communications and manufacturing



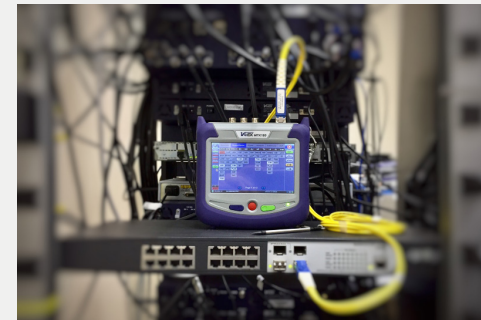
## Nuclear Engineering

Innovate energy technologies for today and tomorrow to support a carbon-free future and a healthier world



## Biomedical Engineering

Engineer biomedical sensors and systems to improve human health and well-being



## Smart Systems Engineering

Smart systems that integrate various sensors and actuators to analyze and control a process



## Interdisciplinary Engineering

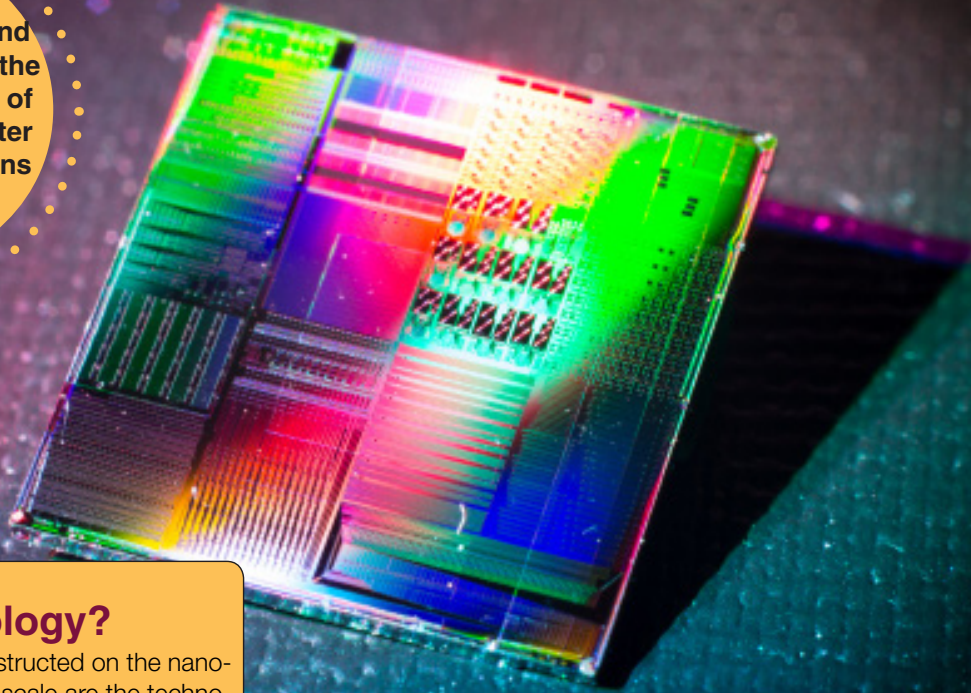
Engineer novel solutions by applying concepts from mechanical, chemical, materials, electrical and other disciplines

# Nanotech

Nanotechnology and micro-systems are the technological core of the current computer and communications revolution.

## What is nanotechnology?

Devices that are constructed on the nanometer or micrometer scale are the technological backbone of modern society.



## Dr. Ray LaPierre

Photovoltaics, infrared photodetectors, betavoltaics, thermoelectrics, quantum computing

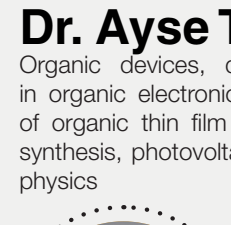
## Dr. Rafael Kleiman

Photovoltaics, solar testing and instrumentation, III-V and Si solar materials, light trapping



## Dr. Ryan Lewis

Synthesis of novel semiconductor nanostructures and materials, quantum nanostructures, optoelectronic devices, sensors, integrating III-V materials on Si



## Dr. Ayse Turak

Organic devices, degradation at interfaces in organic electronics, modeling and tailoring of organic thin film morphology, nanoparticle synthesis, photovoltaics, surface and interface physics



## Dr. John Preston

Pulsed laser deposition of materials, self-assembly of nanostructures, photovoltaics, thermoelectrics

# Photonics

## What role does photonics play in the real world?

The application of light extends to industries including medicine, biophotonics, sensors, displays, nanotechnology, manufacturing, and traditional optical engineering.

The branch of science & engineering that involves the generation, control, & detection of light to provide useful applications for society.



### Dr. Jonathan Bradley

Si photonics, integrated optics, lasers, photonic materials, optical communications, sensors, microphotonic systems



### Dr. Andy Knights

Si photonics, Si optical circuits, Si integrated optics



### Dr. Adrian Kitai

Luminescent materials and devices, large area electronics such as solar cells and displays



### Dr. Peter Mascher

Thin film technology, silicon nanostructures, silicon photonics, luminescence, optical characterization, ellipsometry, positron annihilation spectroscopy, point defects in materials

# Biomedical

## What is biomedical engineering?

The study of biological molecules, cells and tissues for disease detection, diagnosis, and treatment.

The application of light (photonics) and nano- and micro-devices in health and medicine.



## Dr. Qiyin Fang

Biophotonics, fluorescence lifetime imaging (FLIM), optical biopsy & imaging guided therapy, advanced endoscopy, optofluidics sensing, smart healthcare sensor networks



## Dr. Leyla Soleymani

Biosensors, point-of-care diagnostics, lab-on-a-chip, DNA detection, health monitoring, nanofabrication



## Dr. Chang-qing Xu

Lasers & sensors, bacterial sensors, biomedical lasers for diagnosis and treatment, periodically poled lithium niobate, optical sensors and systems, laser applications

# Nuclear

## What role does nuclear engineering and energy systems play in the real world?

The design of energy systems and alternative energy sources; nuclear reactor physics, safety, and operation; the design of next generation nuclear reactors; the investigation of industrial and medical uses of nuclear materials.

Application of scientific principles, engineering design and analysis, computer modeling and simulation, and government regulation for the peaceful use of nuclear energy.

### DID YOU KNOW?

McMaster has Canada's most powerful research reactor and the nation's only major neutron source.



### Dr. David Novog

Nuclear safety, reactor physics, thermalhydraulics, multiphysics reactor analysis, nuclear fuel and fuel cycles, severe accident modelling, emergency response and mitigation

### Dr. Adriaan Buijs

Reactor core physics, reactor modelling, reactor design, Monte Carlo methods, data analysis



### Dr. John Luxat

Nuclear safety analysis, nuclear safety thermalhydraulics

### Dr. Shinya Nagasaki

Nuclear fuel and waste management, safety assessment of repository and nuclear fuel cycle facilities, migration of actinides, fission products and heavy metals in the geosphere and biosphere, nuclear technology in society, nuclear proliferation





# Smart Systems

Smart systems integrate various sensors and actuators to analyze and control a process.

## What is smart systems engineering?

A system that takes measurements, makes a decision and implements changes to a system based on advanced sensor information, actuators, feedback and other control mechanisms.



**Dr. Qiyin Fang**  
Smart healthcare sensor networks



**Dr. Leyla Soleymani**  
Biosensors, point-of-care diagnostics, lab-on-a-chip, DNA detection, health monitoring, nanofabrication

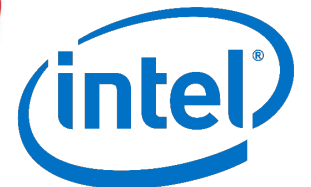


**Dr. Chang-qing Xu**  
Optical sensors and systems, laser applications



**Dr. Rafael Kleiman**  
Micro-electro-mechanical systems (MEMS)

Some of the  
**COMPANIES**  
where our alumni and  
graduate co-op students work



some of the

# CAREERS

our alumni now have

[For a comprehensive list, see our past Employment Reports on our Co-op and Careers webpage under Resources]

Multidisciplinary  
Design Engineer

Director of  
Business  
Development

Manufacturing  
Engineer

Post Doctoral  
Fellow

VP of Research  
and Development

Professor

Senior  
Systems Engineer

Senior Business  
Analyst

Entrepreneur

Project  
Engineer

**DISCOVER ENGINEERING PHYSICS...**



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**NOTES:**

