

# MATHEMATICAL PHYSICS

CO-OP OR REGULAR



**TOP 10** Mathematician ranked among top 10 jobs from 2011-2017 – Comcast.com

## *Study the math of the laws of nature*

Discover the mathematical and theoretical underpinnings of the laws of nature, such as the foundations of quantum theory with its applications in nanotechnology, the structure of spacetime and cosmology, fluid mechanics and atmospheric physics. Learn from researchers associated with the Institute for Quantum Computing, the Waterloo Institute for Nanotechnology, and the nearby Perimeter Institute for Theoretical Physics, as well as fellows of the world-renowned Fields Institute for Research in the Mathematical Sciences.

### NICK'S FAVOURITE COURSES

- › **AMATH 251 Introduction to Differential Equations:** This course involves three key parts of applied mathematics – theoretical and computational analysis of differential equations, as well as modelling applications in science and engineering.
- › **AMATH 271 Introduction to Theoretical Mechanics:** This course covers the mechanics of particles from a mathematical perspective, including projectiles with air resistance, oscillations, gravity and orbits of planets and comets. This course also presents an introduction to Einstein's theory of special relativity, which describes the unusual behaviour of particles moving at speeds close to the speed of light.
- › **AMATH 361 Continuum Mechanics:** If you've ever wondered why the ketchup won't come out of the bottle unless you tap the bottom, this course is for you. It covers the analysis of stress and strain, and derives the basic equations (conservation laws) that govern solid motion, fluid flow and materials that have both fluid and solid characteristics (viscoelastic materials).
- › **PHYS 234 Quantum Physics 1:** This course complements Quantum Theory 1 (AMATH 373) with an introduction to formalism of quantum physics and to operators. You learn about quantization, the uncertainty principle, and bound states in square wells.
- › **PHYS 363 Intermediate Classical Mechanics:** This course covers non-inertial frames of reference, calculus of variations, coupled oscillations and normal modes, and Hamiltonian dynamics.

**#1** in Canada for partnerships with employers

**96.6%** of grads are employed within 2 years

NICK

MATHEMATICAL PHYSICS,  
CO-OP

### WHY MATHEMATICAL PHYSICS?

I chose to study mathematical physics because it's the perfect balance between applied math and theoretical physics. You learn so much about applied math that can be useful in so many different fields, while the theoretical physics aspect paints a deeper, more satisfying picture of how everything around you works.





# WATERLOO IS A GLOBAL LEADER IN CO-OPERATIVE EDUCATION



Nick's extracurriculars include playing in an intramural men's soccer league.

## CO-OP STUDENTS AT WORK

Co-op bridges the gap between the classroom and the real world. Find opportunities to connect classroom theory with applications in a wide range of employment settings. During your co-op work terms, you will assume various job responsibilities, pick up new work-related skills, and earn competitive salaries.

### TYPICAL CO-OP POSITIONS

- › Physics Technician, Grand River Hospital, **Nick's third work term**
- › Analytics Research Assistant, Department of Defense, **Nick's fourth work term**
- › Engineering Development Student, Bruce Power Inc., Kincardine
- › Design Engineer – Quality Assurance, Avvasi Inc., Waterloo
- › Defence Scientist, DRDC, Ottawa
- › Quality Assurance Specialist, Maplesoft, Waterloo
- › Radiation Effects Modelling Research Assistant, TRIUMF, Vancouver

## STUDY AND CO-OP SEQUENCE 1\*

YR.	TERM	REGULAR	SEQ. 1
1	Fall	Study	Study
	Winter	Study	Study
	Spring	Off	<b>Work</b>
2	Fall	Study	Study
	Winter	Study	<b>Work</b>
	Spring	Off	Study
3	Fall	Study	<b>Work</b>
	Winter	Study	Study
	Spring	Off	<b>Work</b>
4	Fall	Study	Study
	Winter	Study	<b>Work</b>
	Spring		Study
5	Fall		<b>Work</b>
	Winter		Study

\* This study-work sequence is one of 4 choices of co-op sequences.

## UNDERGRADUATE RESEARCH OPPORTUNITIES

Each Spring term, the Department of Applied Mathematics organizes an active undergraduate research program supported by NSERC Undergraduate Summer Research Awards (USRAs). There are also research awards available if you're an international student.

Mathematical Physics faculty members are active in a number of research areas including quantum information theory, nanotechnology, quantum gravity, cosmology, fluid mechanics, and statistical physics. In addition, you can pursue summer research opportunities with the Perimeter Institute.

## CAREER OPPORTUNITIES IN MATHEMATICAL PHYSICS

In the Mathematical Physics program, you'll develop a very strong understanding of a wide range of mathematical disciplines and then learn how to apply these to a variety of physical problems. You could embark on an exciting research career in fields such as cosmology, relativistic quantum information, quantum computing, physical oceanography, or atmospheric science and pursue graduate studies at Waterloo or top international schools. A training in mathematical physics opens many doors – you'll be well-prepared for graduate studies not only in physics and applied mathematics, but even engineering.

There are also many career opportunities outside academia for you including emerging industrial fields such as quantum computing and nanotechnology.

## GRADS AT WORK

- › Chief Software Modeller, RPM Technologies, Toronto
- › Technology Development Fellow, Harvard School of Engineering and Applied Sciences, Cambridge MA
- › Research Assistant, Mount Sinai Hospital, Toronto
- › Research Assistant, Wyss Institute for Biologically Inspired Engineering, Cambridge
- › Field Applications Engineer, Nanometrics – Seismic Monitoring Solutions, Ottawa
- › Technical Program Manager, Google, Washington DC
- › Analyst, Reactor and Radiation Physics, AMEC NSS, Toronto
- › Senior Researcher, IQB Information Technologies, Vancouver
- › Technology Development Fellow, Harvard School of Engineering and Applied Sciences, Cambridge MA



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