You’ll often find students working out mathematical problems on our convenient whiteboards – placed all around campus – such as here, in our Quantum Nano Centre (QNC).

We’re on the same wavelength.

Apply your love of mathematics to the understanding of how the natural world works.

By taking more advanced courses in mathematics, you’ll be better equipped to understand the theoretical foundations of physics. You might contribute to discovering a new, more deeply unified theory of physics, or work out mathematically complex solutions to some of the great theoretical and/or technological challenges of our time. Mathematical Physics will give you advanced mathematical problem solving skills to prepare you for a wide range of careers or graduate studies.

Study in one of Canada’s largest and most highly respected physics programs, where your professors herald from various award-winning backgrounds – including Donna Strickland, the Nobel Prize winner in 2018 for Physics. With ties to the Perimeter Institute for Theoretical Physics and the Institute for Quantum Computing, take your education further than you thought possible.

Some modern theories of physics suggest this might be the case: our universe might be a holographic projection of a larger universe with extra dimensions.
PHYSICS STARTS HERE

PHYS 124 MODERN PHYSICS
Leap right in with an introduction to the most exciting areas of modern physics, including special and general relativity, quantum mechanics, particle physics, and cosmology.

This course will give you exciting ideas about what you can study in the upper years of your undergraduate degree. Look forward to:

› PHYS 444 Particle Physics
Learn about all things related to subatomic particles and their properties – including experimental methods, Feynman diagrams, and the Higgs mechanism.

› PHYS 476 General Relativity
Expand your thinking within the realm of the Einstein field equations, including the geometry of curved space-time and the weird and wonderful phenomenon of black holes.

› PHYS 467 Quantum Information Processing
An advanced course on quantum information and how quantum mechanics can be used to address computational complexity problems in physics.

› PHYS 461 Nanophysics
Discover the application of physics at the nanoscale – within the realms of biology, medicine, society, and tools/devices.

SKILLS ATTAINED WITHIN THIS MAJOR
› Advanced mathematical skills
› Qualitative and quantitative analysis
› Systematic, rigorous, and flexible problem solving
› Applied programming and data analysis
› Creative application of knowledge to design new technologies

RESEARCH OPPORTUNITIES IN PHYSICS AT WATERLOO

RECENT PROJECTS
› Quantum reference frames and the 3-body problem
› High field thermal conductivity of spin ice materials
› Inequalities witnessing quantum incompatibility in the Triangle Scenario
› Dark matter, conformal invariance and the Higgs Boson
› Exploring quantum gravity with gravitational waves

A PHYSICS FUTURE FOR ME!

One of the key advantages of a Physics degree is the diversity of career options – spanning science, engineering, and technology-related fields. With so many sectors it’s impossible to list them all here, but can range from communication technologies and aerospace industries to film special effects and video game programming.

BLACK HOLES

Research shows that black holes can behave like chemical systems, in that they can have liquid-gas phase transitions, triple points (like how water can be a solid, liquid, and gas all at once) and can even behave like superfluid helium – where it has zero viscosity and cannot be contained.

This image of an actual black hole is from the Event Horizon Telescope Collaboration. Dr. Avery Broderick, an associate professor in the Department of Physics and Astronomy, is a core member of the EHT Collaboration team and was integral to the production of the image you see here. Dr. Broderick works to explain the fundamental physics of black holes and their observable characteristics. You can look forward to learning from Dr. Broderick in your PHYS 358 Thermal Physics class.

Available in both the CO-OP AND REGULAR streams of study

Apply via the PHYSICAL SCIENCES entry program on OUAC, selecting MATHEMATICAL PHYSICS as the major

This program is offered jointly with the FACULTY OF MATHEMATICS
YEAR 1 (FALL)
- CHEM 120/120L† General Chemistry 1/Lab
- ENGL/SPCOM 193 Communication in the Sciences
- MATH 136 Linear Algebra 1 for Honours Mathematics
- MATH 137 Calculus 1 for Honours Mathematics
- PHYS 10 Physics Seminar
- PHYS 121/131L Mechanics/Lab

YEAR 1 (WINTER)
- CHEM 123† General Chemistry 2
- MATH 138 Calculus 2 for Honours Mathematics
- PHYS 10 Physics Seminar
- PHYS 122/132L Waves, Electricity and Magnetism/Lab
- PHYS 124 Modern Physics
- 1 Elective

YEAR 2
- AMATH 231 Calculus 4
- AMATH 250 Introduction to Differential Equations
- MATH 235 Linear Algebra 2 for Honours Mathematics
- MATH 237 Calculus 3 for Honours Mathematics
- PHYS 10 Physics Seminar
- PHYS 234 Quantum Physics 1
- PHYS 236 Computational Physics 1
- PHYS 242 Electricity and Magnetism 1
- PHYS 263 Classical Mechanics and Special Relativity
- STAT 230 Probability
- 1 Elective

YEAR 3
- AMATH 332 or PMATH 332 Applied Complex Analysis
- AMATH 351 Ordinary Differential Equations 2
- AMATH 353 Partial Differential Equations 1
- AMATH 373 Quantum Theory 1
- PHYS 10 Physics Seminar
- PHYS 342 Electricity and Magnetism 2
- PHYS 358 Thermal Physics
- PHYS 359 Statistical Mechanics
- PHYS 363 Intermediate Classical Mechanics
- STAT 231 Statistics
- 1 Elective

YEAR 4
- PHYS 10 Physics Seminar
- PHYS 434 Quantum Physics 3
- PHYS 442 Electricity and Magnetism 3
- 3 of AMATH 361, AMATH 456, AMATH 463, PHYS 444, PHYS 454, PHYS 476
- 3 Physics and/or Applied Mathematics Electives (300-level or higher)
- 2 Electives

† Year-One CHEM may be replaced by Year-One BIOL or EARTH courses.
* PHYS 334 may be substituted for AMATH 373
Course outline and schedule are subject to change at any time.
Course sequence may vary for students who choose the co-op system of study.

ugradcalendar.uwaterloo.ca/group/uwaterloo-faculty-of-science