THE UNIVERSITY OF WINNIPEG

FACULTY OF SCIENCE

COMPUTATIONAL PHYSICS

From the transistor to the internet to the quantum computer, physicists have always played a leading role in the development of new computing hardware and methods. Computational physics is the study of physics using computational methods. It is an expanding field that combines computer science, physics, and applied mathematics to solve complex problems.

In the computational physics stream, you will learn all about the fundamental laws of nature, while developing real world skills in numerical methods and coding, as well as data handling and visualization. You will also learn about leading edge techniques such as quantum computing and machine learning.

Professors in the physics department conduct research in subatomic physics, medical physics, theoretical physics, and applications to developing fields of technology like digital agriculture. All of these research areas make use of computing to solve problems, and many students participate in research using computational resources under the direction of faculty. As with the main physics program, students may find summer employment with the various research groups. If you are interested in becoming a teacher, both physics and computer science are teachable subjects in education.

This program leads to a **Bachelor of Science degree (4-year Honours)**, which provides excellent preparation for entry into graduate programs in computer science or physics, and direct entry into industry where analytical and computing skills gained in the program are in demand.

Also, please see other related fact sheets: "Physics" and "Medical Physics"

SAMPLE CAREERS

The analytical and computing skills developed in obtaining a Computational Physics degree can be applied to almost any field imaginable, including engineering, finance, climate modelling, agriculture, space science, astronomy, computer gaming and animation. Data scientists, for example, are in high demand in all of the social, life, and natural sciences, as well as the government, health, and insurance sectors.

SAMPLE COURSES

Scientific Computing with Python is an introduction to the Python programming language. After basic introductions to the programming language, students will learn about data visualization, and apply programming to a variety of scientific problems.

Mathematical Physics I and II provide you with all the mathematical tools you need to succeed in your upper-level physics courses. They also provide the mathematical basis for understanding many computer algorithms and numerical methods

Quantum Mechanics describes the world as we understand it at the microscopic level, and includes wave properties of matter, probabilistic interpretation of wave-functions, solution of the Schrodinger equation, and an introduction to quantum computing.

Honours Thesis is the pinnacle course of the physics program, where students, under the direction of a research physicist, propose a computational physics problem to solve, conduct research to solve the problem, and present their work as a short thesis and presentation.

MORE SAMPLE COURSES

- Thermal and Statistical Physics
- Electricity & Magnetism
- Fundamentals of Digital Electronics
- Subatomic Physics
- General Relativity
- Numeric and Symbolic Computing

SAMPLE FIRST YEAR

PHYS-1101(6) Foundations of Physics
PHYS-2102(3) Scientific Computing OR PHYS-2112(3) Scientific Computing with Python
MATH-1103(3)/1104(3) Introduction to Calculus I and II
RHET-1103(3) Academic Writing: Science, or any other section of Academic Writing (if required)
ACS-1903(3)/1904(3) Programming Fundamentals I and II
6 credit hours Humanities

NOTE: *This sample first year is representative of the courses you may take. For many of our programs, you may choose another set of courses and still be well on your way to a degree. Also, for most programs you do not have to take 30 credit hours (five full courses) in your first year.*

"The math and problem-solving skills I learned while studying physics made learning about computer science a natural path to follow. Using this combined skill set, I was able to do exciting research with professors from both Physics and Applied Computer Science departments at UWinnipeg. The level of mentorship I received meant I built unique in-demand skills while also gaining practical experience."

- Michael Honke (BSc Physics), Software Developer at Ziva Dynamics | Physics Simulation and Graphics Developer

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HOW TO APPLY

For details on application requirements and deadlines, and to apply online, please visit: **uwinnipeg.ca/apply**

For more information contact a student recruitment officer at welcome@uwinnipeg.ca or 204.786.9844.

In any case where the University's Academic Calendar and this fact sheet differ, the current Calendar takes precedence.

CONTACT US

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