Physics & Astronomy

Focus of study

The Department of Physics & Astronomy at McMaster is research intensive, with a strong commitment to excellence in teaching. Our unique undergraduate programs begin by teaching students the fundamental concepts and ideas through which physics has transformed the modern world. Students learn how to translate these ideas into the elegant language of mathematics, solve questions and develop understanding.

The Department of Physics & Astronomy at McMaster offers the following programs:

- **Honours Physics** – A balance of theoretical and experimental (lab) courses that are a solid basis for any specialization. Early introduction to scientific computing.
- **Honours Astrophysics** – Students study the physics of planets, stars, galaxies and cosmology in addition to core physics. Students also learn about observations and image analysis.
- **Honours Medical and Biological Physics** – Students learn how to study physics in medicine and biologically relevant problems using the techniques and tools of physics. The program includes relevant Anatomy and Biochemistry courses as well as specialized physics courses with topics in membranes and soft materials, medical physics, molecular biophysics, and computation and laboratory methods.

These program options allow the student flexibility in course selection. The opportunity is available for interdisciplinary studies possibly leading to a minor in another subject. In addition, the Department offers combined Honours programs or Specializations.

Undergraduate student research

Each summer between 25 and 30 undergraduates participate in paid research positions within the Department of Physics & Astronomy. In addition, the Department fully funds the summer undergraduate students to present their research at the Canadian Undergraduate Physics Conference (CUPC), which is held at various locations across Canada each year.

Possible careers

Physics & Astronomy students develop a range of skills that are easily transferred to careers in a range of fields. Graduates have pursued careers in the following:

- Aerospace industry
- Big Data
- Education
- Energy sector
- Finance and financial risk analysis
- Graduate Studies
- Medical School
- Government labs
- High-tech industry
- Industrial R&D
- Law
- Manufacturing industry
- Medicine
- Medical physics
- Nuclear industry
- Fundamental research
- MBA
- …and much more!

The Physics & Astronomy programs have a unique structure that reflects McMaster’s reputation for innovative, effective teaching:

<table>
<thead>
<tr>
<th>Level II</th>
<th>Level III</th>
<th>Level IV</th>
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</thead>
<tbody>
<tr>
<td>What you learn</td>
<td>Translate the ideas into mathematics:</td>
<td>Apply what you learned to understand:</td>
</tr>
<tr>
<td>The big ideas behind:</td>
<td>Quantum mechanics</td>
<td>Schrödinger’s eq.</td>
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<tr>
<td>Electromagnetism</td>
<td>Maxwell’s eq.</td>
<td>Particle/nuclear physics</td>
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<tr>
<td>Thermodynamics</td>
<td>Statistical mechanics</td>
<td>Astrophysics</td>
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<tr>
<td>Relativity</td>
<td>Einstein’s eq.</td>
<td>Medical and biological physics</td>
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</table>

How you learn it

- In-class peer group discussion and analysis of the new concepts – active learning.
- Guided exposition in small (20-40 students) lectures. Get to know your profs!
- Group and individual project and presentation courses. Gain research experience: year-long thesis with a faculty supervisor.

Don’t Memorize – Understand Why

Students in Physics & Astronomy don’t memorize facts or equations. Instead, they learn how to formulate questions that strike to the core of a subject, and learn to answer these questions using problem solving. Physics & Astronomy is about seeking a deep, fundamental understanding of the behaviour of the natural world.

Physics & Astronomy are Universal

An undergraduate degree in Physics & Astronomy is a good choice for anyone who seeks an understanding of the world at its most fundamental level. Physics underlies all other sciences. Its power comes from this universal nature and the fact that training in physics provides transferrable skills in experimental design, modelling, computing, critical thinking and problem solving. Many students enter a program in Physics & Astronomy because they want to understand physical reality using the language of mathematics. Students appreciate the challenge and excitement of experimentation in the laboratory through witnessing new physical phenomenon, hands-on testing and development of new theories.

Graduates from our Honours programs are well prepared to apply to professional schools in the following areas:

- Dentistry
- Bachelor of Education
- MBA
- …and much more!
Co-op opportunities

Co-op programs in Honours Physics and Honours Medical and Biological Physics are available beginning in Level III. These are five-year programs, which include two 8-month work terms. Employment rates have been consistently excellent. Examples of past co-op work terms include:

- Astronomy (NASA, Canadian Space Agency)
- Condensed matter physics (Paul Scherrer Institute)
- Biophysics (BioREM Technologies)
- Nuclear/particle physics (CERN, TRIUMF, SNOLAB)
- Quantum computing (IQC – Institute for Quantum Computing)
- Geophysics (Environment Canada)
- Energy sector (Bruce Power, AECL, OPG)
- Technology (Xerox, Research in Motion, Defence Research & Development Canada)
- Health physics (Sunnybrook Health Sciences & Regional Cancer Centre, Cancer Care Manitoba)

Level II Programs

<table>
<thead>
<tr>
<th>Honours Astrophysics  (Honours B. Sc.)</th>
<th>Honours Mathematics and Physics  (Honours B. Sc.)</th>
<th>Honours Medical and Biological Physics  (Honours B. Sc.)</th>
<th>Honours Physics  (Honours B. Sc.)</th>
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<tbody>
<tr>
<td>See Admission Notes 1, 2</td>
<td>See Admission Note 3</td>
<td>See Admission Notes 4, 5</td>
<td>See Admission Note 1</td>
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<tr>
<td>Enrolment in this program is limited and possession of the published minimum requirements does not guarantee admission. Selection is based on academic achievement but requires, as a minimum, completion of any Level I program with a Grade Point Average of at least 5.0 including:</td>
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<td>• 6 units from MATH 1A03, 1AA3, 1LS3, 1LT3, 1X03, 1XX3, 1ZA3, 1ZB3</td>
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ADMISSION REQUIREMENTS

ADMISSION NOTES

1. Completion of MATH 1B03 or 1ZC3 is required by the end of Level II and is strongly recommended in Level I.
2. Completion of ASTRON 1F03 is required by the end of Level II and is strongly recommended in Level I.
3. MATH 1C03 and 1MP3, although not required, are strongly recommended, if not completed in Level I.
4. Completion of BIOLOGY 1A03, CHEM 1AA3 and MATH 1B03 is required by the end of Level II. Completion in Level I is strongly recommended. BIOLOGY 1M03 is recommended.
5. Completion of BIOPHYS 1S03 or MEDPHYS 1E03 is recommended in Level I.
6. Prior to registration, students should carefully review the prerequisites of courses they anticipate taking in subsequent sessions as well as the admission requirements of programs they may seek transfer to.

Science I Course List: ASTRON 1F03, BIOLOGY 1A03, 1M03, BIOPHYS 1S03, CHEM 1A03, 1AA3, ENVIRSC 1C03, 1D03, GEOG 1HA3, 1HB3, MATH 1A03, 1AA3, 1B03, 1LS3, 1LT3, 1MP3, MEDPHYS 1E03, PHYSICS 1A03, 1AA3, 1D03, 1CC3, PSYCH 1F03, 1X03, 1XX3, SCIENCE 1A03

Upcoming events

Physics & Astronomy Information Night

Wednesday, March 21, 5:30 pm - 7:00 pm, Room ABB 273