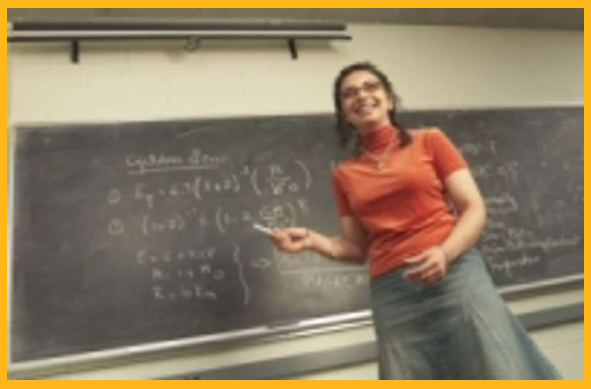
physics & astronomy

university of manitoba

Undergraduate Degree Programs

The department of Physics & Astronomy at the University of Manitoba is one of the best research-intensive departments in Canada. There is a world-class teaching program, and all department faculty are involved in vigorous, cutting edge research at the highest level. Our students can take advantage of the small class sizes after the first year. The department has an excellent professor-to-student ratio, ensuring that students receive as much attention as they want. Students that complete an undergraduate program in our department are very competitive on an international level, and thrive in the graduate programs of the finest universities throughout the world, in addition to prospering in the business and industrial settings of research and development.

These factors give our students a competitive advantage over students at either very large or very small schools. Summer research opportunities, a wide selection of courses, spacious facilities, and state-of-the-art laboratories and computer resources, provide a superior undergraduate Physics & Astronomy program. Tying this all together is a tightly knit student community that significantly enhances the experience.



UNIVERSITY OF MANITOBA

ONE UNIVERSITY. MANY FUTURES.

Learn How Your World Works!

Degree Programs

- Physics & Astronomy Majors
- Physics & Astronomy Honours
- Physics & Chemistry Joint Honours
- Physics & Biochemistry Joint Honours
- Physics & Mathematics Joint Honours
- Physics & Computer Science Joint Honours
- Three year General Degree with Physics Specialization
- Minor in Physics & Astronomy

Allen building, home of the Department of Physics & Astronomy.

What's It All About?

While physics is one of the most rigorous and mathematical of the sciences or of the fields of engineering, questions to ask yourself beyond whether you have a particular aptitude for math and science are:

- Are you more interested in questions of "why" and "how" things work than you are with simply making devices work?
- Are you intrigued with finding precise mathematical relationships that describe observable features of nature, and finding general statements that apply in a wide variety of different circumstances?
- Do you enjoy tinkering with things, such as cars or electronics, or have been involved with math or school projects, computers, or similar activities beyond what was required in school?
- Do you enjoy explaining things to others?
- Do you want to work on the most sophisticated frontiers of technology?

What can I do with a Physics degree?

The best way to answer this question is to see what students do after they've graduated. Many of our students do go on to graduate schools in Canada, the United States and overseas, including the top Universities in North America. However, the majority of graduates go on to study and work in fields outside of Physics and Astronomy. This is a testament to the versatility of the degree. Through Physics, students learn how to approach any technical problem.

Examples of career paths our students have undertaken, and possible future career paths for you include:

Graduate School
- Astronomy & Astrophysics
- Chemistry
- Mathematics
- Physics
- Statistics
- Biology/Biophysics
- Applied Physics

Engineering Graduate School
- Aerospace
- Biomedical
- Materials Science
- Mechanical
- Electrical

Professional Programs
- Medical School
- Law School

Employment
- Banking & Accounting
- Computer Programming
- Teaching in Secondary School
- Telecommunications
- Private & Government Laboratories – management
- Private & Government Laboratories – research & development

Aerial view of the University of Manitoba Campus and the Red River.

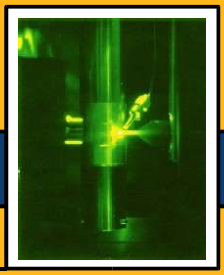
Transfer of a cobalt source for medical physics applications.

With a B.Sc. or M.Sc. degree, you are more likely to be employed in design and development, teaching, or administration than in research. In design or development, you might expect to work in an industry or government agency setting and work closely with engineers. In fact, many industry employers do not make a distinction between physicists and engineers at the B.Sc. level, and you might very well find yourself doing the same sort of work activity as others with engineering degrees.

The advantages of a physics degree are twofold:
- it increases your chances of employment in a "high-tech" field, where B.Sc. engineers are sometimes less qualified, and
- it makes you a more flexible and versatile employee, due to your broader training in math and science.

If your interests are in teaching, a B.Sc. qualifies you to teach at the high school level, after some education courses needed for certification, and at some colleges. As for administration, physicists and others with technical training are often in demand in industry and government, although many positions will require some field experience first.

A Ph.D. degree qualifies you to become a research scientist, either in an industry or government laboratory, or as a professor at a university, college, or community college. Research scientists are expected to have a high level of personal initiative and responsibility for their work. They are often involved in administration of laboratories, and many, particularly university faculty, spend a portion of their time teaching. A research career requires typically five to six years of graduate school, often followed by two or more years of postdoctoral research appointments, before a permanent job is sought. This is not a career to be undertaken lightly, but the faculty of the department of Physics & Astronomy will offer every possible opportunity and encouragement to those who choose to pursue this goal. Graduate students are well supported, and the education experience is financially self-sustaining. Holders of physics doctoral degrees are typically prime earners.



Degree Options

Physics & Astronomy Major Degree Program

This program offers a significant amount of specialization in Physics & Astronomy, while leaving considerable flexibility for you to pursue additional areas of interest during your course of study. This program incorporates the first three years of the Honours degree requirements, which are scheduled at a less intense pace over a four year time period. Of the 120 credit hours required to complete this program, 36 credit hours are free for you to choose.

Physics & Astronomy Honours Degree Program

The Honours degree program is designed to offer students the highest level of specialization in Physics & Astronomy at the undergraduate level, with the goal of preparing them to enter graduate school in these or closely related scientific or engineering areas. Of the 120 credit hours required to complete the program, 84 credit hours of Physics and Astronomy and up to 21 credit hours of Mathematics are specified. An optional path with increased emphasis on Astronomy is included. Students are encouraged to choose additional optional course from the Physics & Astronomy, Computer Science, Chemistry or Geophysics calendar to enhance their program.

Physics & Biochemistry Joint Honours Degree

The program combines courses from Physics, Biochemistry and Microbiology to provide a unique interdisciplinary program. This program consists of 126 credit hours of study spread over four years in these three fields. It is ideally suited for those students who are interested in working the exciting research areas currently opening up at the confluence of Physics, Chemistry and Biology.

Physics & Math Joint Honours Degree Program

The joint Physics & Astronomy/ Mathematics Honours program features a greater degree of specialization in mathematics, with less emphasis on experimental training, than the Physics & Astronomy Honours program. This challenging program, which is ideally suited for students interested in a career in theoretical physics, features 132 credit hours of study, of which all but 6 are from Mathematics and Physics & Astronomy. Students graduating from this program are well prepared to enter graduate school in these and closely related fields.

Physics & Computer Science Honours Degree

The joint Physics & Astronomy/ Computer Science Honours program combines core elements of the undergraduate Honours program in Physics & Astronomy with key courses from the Honours degree in Computer Science. Students benefit from exposure to practical problem solving in physical science using computational methods as well as by gaining specific expertise in computer operating systems, data structures and scientific computing. Of 120 credit hours required for the program, 108 credit hours are taken from the departments of Physics & Astronomy, Computer Science and Mathematics.

Physics & Chemistry Joint Honours Program

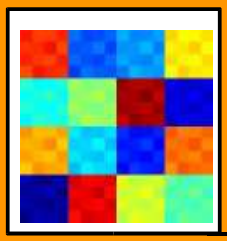
An exceptional interdisciplinary program that incorporates courses from Physics and Chemistry. This program consists of 120 credit hours of study spread over four years in these two fields. It is geared towards students who wish to work in the fascinating research areas of the material sciences.

Other Options

Programs of study for the three year General Degree with a specialization in Physics & Astronomy, as well as a Minor in Physics & Astronomy are also available. These programs are well suited to students who seek a diversified education in science with some advanced training in Physics & Astronomy. Both of these options incorporate a minimum of 12 credit hours selected from Physics & Astronomy courses at the 2nd and 3rd year level. The three year general program is sufficiently flexible that students can, with permission of the department, transfer to a four year Major program provided that the Majors course requirements are also met.

Computer Resources

The department operates numerous workstations for both class assignments and individual student projects. These stations are equipped with up-to-date scientific, mathematical and graphic software, and are networked externally, giving students access to e-mail and the Internet. Multimedia and inter-active teaching software is used. The department has Beowulf clusters for computational physics and is a member of WestGrid (the Western Canada Research Grid).



Laboratory Resources

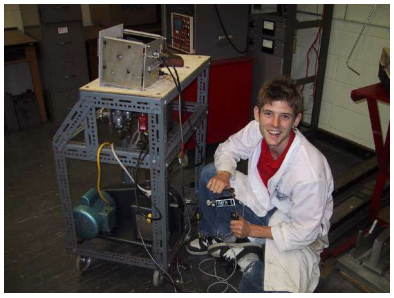
The general physics laboratories offer a wide selection of experiments in mechanics, heat, sound, electromagnetism and optics. The 3rd and 4th year laboratory courses use a wide range of state-of-the art measuring and detection equipment.

Facilities and faculty expertise make possible research in atomic, molecular and optical physics, bio- and soft condensed matter physics, condensed matter physics, subatomic and particle physics, medical physics, and theoretical physics in all the above areas. The department runs the Ewen remote observing site through the Glenlea Astronomical Observatory, whose pride is a 16" Meade LX200 Schmidt-Cassegrain telescope with research that is geared towards observations of Near Earth Asteroids (NEAs).

National Research Opportunities

Physics undergraduate students may spend a summer as full-time research participants in research programs at TRIUMF in Vancouver, B.C., Argonne National Laboratory outside Chicago, Jefferson Lab in Virginia, and Los Alamos National Laboratory in the U.S.A.

Closeup of the centre of the G0 detector at Jefferson Lab showing the phototubes.



Undergraduate research assistant working in the Nanomagnetism Research Group Laboratory during a summer session.

Special Work Opportunities

The department of Physics & Astronomy employs students each semester as teaching assistants and markers. Physics majors also work as research assistants and tutors. This wide range of employment opportunities is unusual for undergraduate physics students. In addition, the Faculty of Science and the National Science and Engineering Research Council of Canada (NSERC) provide scholarships for summer research internships. A large number of our undergraduate students have summer jobs in the research laboratories on and off campus.

Organization of Physics Undergraduate Students (OPUS)

Students in Physics & Astronomy usually belong to OPUS, whose purpose is to promote interest in the study of physics amongst the student body and general public, and to provide a tutoring service for 1st year physics courses. OPUS members have regular social and academic events including an annual trip of representatives that present their research work at the Canadian Undergraduate Physics Conference that is funded by the department.

What is Physics?

Physicists aim to understand a wide variety of phenomena observed in nature and produced by man. Below is a list of some of the questions that researchers at the department of Physics & Astronomy are studying. Some of these questions you would normally associate with physics, while others may surprise you.

Astronomy & Astrophysics
- How do galaxies form and evolve?
- What are the later stages of stellar evolution from neutron stars and supernova remnants?
- How do stars and planets form?

Atomic, Molecular and Optical Physics
- How do electrons scatter off atoms, and what are the plasmas from the collisions like?

Bio- and Soft Condensed Matter Physics
- Can ultrasonic waves help us understand and control the development of biological and food materials?
- How does DNA work? Can DNA be used in electronic devices?
- What are the functions of the protein associated with the sequenced genes from the Human Genome Project?

Condensed Matter Physics
- Can ultrasonic waves help us make new materials?
- How does matter behave on the nanoscale, and how do we use nanotechnology in electronics, optics, biotechnology and magnetic media?
- How does disorder change the properties of materials?
- Can we make new materials for "magnetic" refrigerators?

Subatomic Physics
- What is the proton made of?
- How does the "weak nuclear force" work?
- Is Einstein's theory of relativity really correct?
- Challenging the "Standard Model" by measuring the masses of exotic nuclei.

Medical Physics
- By using radiotherapy and imaging, can we find new ways to combat cancer?
- Are there better ways of detecting and diagnosing cancer, neurological disorders and stroke?

Academic Faculty

B. Bhakar, Associate Professor, Ph.D. (Delhi)
bhakar@cc.umanitoba.ca
theoretical physics

J. Birchall, Full Professor, Ph.D. (Birmingham)
birchall@physics.umanitoba.ca
subatomic physics - experiment

P. G. Blunden, Full Professor & Dept. Head, Ph.D. (Queen's)
blunden@physics.umanitoba.ca
www.physics.umanitoba.ca/~blunden
subatomic physics - theory

T. Chakraborty, Full Professor & Tier 1 CRC, Ph.D. (Dilbrugarh)
tapash@physics.umanitoba.ca
www.physics.umanitoba.ca/~tapash
nanoscale physics - theory

J. English, Associate Professor, Ph.D. (Australian National)
jayanne_english@umanitoba.ca
www.physics.umanitoba.ca/~english
astronomy - experiment

W. E. Ens, Full Professor, Ph.D. (Manitoba)
w_ens@umanitoba.ca
www.physics.umanitoba.ca/~ens
mass spectrometry - experiment

J. Fiege, Assistant Professor, Ph.D. (McMaster)
fiege@physics.umanitoba.ca
astronomy - theory

M. Gericke, Assistant Professor, PhD. (Indiana University)
gericke@physics.umanitoba.ca
subatomic physics - experiment

G. Gwinner, Assistant Professor, Ph.D. (SUNY Stony Brook)
gwinner@physics.umanitoba.ca
www.physics.umanitoba.ca/~gwinner
subatomic physics - experiment

C.-M. Hu, Assistant Professor, Ph.D. (Würzburg)
hu@physics.umanitoba.ca
www.physics.umanitoba.ca/~hu
nanoscale physics - experiment

P. D. Loly, Full Professor, Ph.D. (London)
loly@cc.umanitoba.ca
www.physics.umanitoba.ca/~loly
theoretical physics

T. A. Osborn, Full Professor, Ph.D. (Stanford)
tosborn@cc.umanitoba.ca
theoretical physics

J. H. Page, Full Professor, Ph.D. (Oxford)
jhpage@cc.umanitoba.ca
mesoscale & wave physics - experiment
www.physics.umanitoba.ca/~jhpage

S. A. Page, Full Professor, Ph.D. (Queen's)
spage@cc.umanitoba.ca
subatomic physics - experiment

R. M. Roshko, Full Professor & Assoc. Dean of Science, Ph.D. (Manitoba)
roshko@cc.umanitoba.ca
condensed matter/magnetism – experiment
www.physics.umanitoba.ca/~roshko

Academic Faculty (continued)

S. Safi-Harb, Associate Professor, Ph.D. (Univ. of Wisconsin, Madison)
samar@physics.umanitoba.ca
www.physics.umanitoba.ca/~samar
astronomy & astrophysics - experiment

K. S. Sharma, Full Professor, Ph.D. (Manitoba)
sharma@physics.umanitoba.ca
www.physics.umanitoba.ca/~sharma
mass spectrometry - experiment

B. W. Southern, Full Professor, Ph.D. (McMaster)
souther@cc.umanitoba.ca
www.physics.umanitoba.ca/~souther/frustrated
condensed matter/magnetism – theory

J. van Lierop, Assistant Professor, Ph.D. (McGill)
johan@physics.umanitoba.ca
www.physics.umanitoba.ca/~johan
condensed matter/nanomagnetism - expteriment

M. D. Whitmore, Full Professor & Dean of Science, Ph.D. (McMaster)
mark_whitemore@umanitoba.ca
www.physics.umanitoba.ca/~whitmore/whitmore
condensed matter - theory

G. Williams, Full Professor, Ph.D. (London)
gwill @cc.umanitoba.ca
condensed matter/magnetism - experiment

P. W. Zetner, Full Professor, Ph.D. (Windsor)
p_zetner@umanitoba.ca
atomic, molecular and optical physics - experiment

Contact Information

For more information please contact the student advisors via the department's office or visit our website.

http://www.physics.umanitoba.ca

Department of Physics & Astronomy
University of Manitoba
Winnipeg, Manitoba
R3T 2N2 Canada

tel: (204) 474-9817 fax: (204) 474-7622
email: physics@umanitoba.ca

Come join us!