Arts and Science Physics

Info Session for ASC1
This Evening’s Info Session

- **Purpose:**
  - to provide info for ASC1 students interested in physics degree plans

- **Why study physics?**

- **Prof. Bob Gooding:** Undergraduate Chair / Honours Physics Advisor
- **Prof. Rob Knobel:** Head, Department of Physics, Engineering Physics and Astronomy
Physics Degree Plans

Bachelor of Science (Honours)  B.Sc.(Honours)  
4-year degree

There are 3-year General B.Sc. available too but we won’t discuss these.

Physics Minors: Minor (Arts) and Minor (Science)
## Honours Degrees in Physics

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<th>Concentration – Degree Plan</th>
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### Major

- 72.0 credits are specified credits in physics and math
- with 48.0 credits electives: allows you some room to pursue other interests (including a Minor in another field)
- permitted to take PHYS 590 Research Thesis in 4th Year
- possible to go to grad school with this degree
# Honours Degrees in Physics

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## Specialization

- heavy concentration in specified courses → best preparation for grad school
  - Physics (99/120 specified credits)
  - Astrophysics (102/120 specified credits)
  - Mathematical Physics (105/120 specified credits)

*Note: in the Specialization degree plans, you cannot take a minor.*
## 2nd Year for Physics and Astrophysics

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<td>PHYS 239 Electromagnetism</td>
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<td>PHYS 242 Relativity and Quanta</td>
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<tr>
<td>MATH 280 or 221 Advanced (Vector) Calculus</td>
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<td>MATH 231 Differential Equations or</td>
<td>MATH 225 Differential Equations</td>
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<td>PHYS 216 Introduction to Astrophysics</td>
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## Specialization

### 2nd Year for Mathematical Physics

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| MATH 280 Advanced Calculus               | MATH 281 Introduction to Real Analysis     |
| MATH 231 Differential Equations          | MATH 210 Rings and Fields                 |

Some MAPH students squeeze in (or take in 3rd year)

| STAT 268 Statistics and Probability I    | STAT 269 Statistics and Probability II    |
2\textsuperscript{nd} Year MATH Courses

- you really need to complete vector calculus (MATH 280 or MATH 221) and differential equations (MATH 231 or MATH 225) in your 2\textsuperscript{nd} year

- very important for 3\textsuperscript{rd} year PHYS courses that follow
3rd Year for Physics and Astrophysics

Major, Specialization Physics and Specialization Astrophysics
- PHYS 316 and 317 Mathematical Methods in Physics (full-year)
- PHYS 344 and 345 Quantum Mechanics (full-year)
- PHYS 350 3rd year Lab: full-year course, includes project in Winter term
- PHYS 372 Thermodynamics

Specialization Physics and Specialization Astrophysics take in addition
- PHYS 321 Advanced Mechanics

Specialization Astrophysics takes
- PHYS 315 Physical Processes in Astrophysics

available course: PHYS 334 Electronics for Physicists
4th Year for Physics and Astrophysics

Major, Specialization Physics and Specialization Astrophysics

- PHYS 432 EM Theory

Specialization Physics and Specialization Astrophysics take in addition

- PHYS 453 Advanced Lab (term-length)
- PHYS 590 Honours Research Thesis (also Specialization Mathematical Physics takes)
- 6.0 credits choice of physics at the 400 level

Major takes

- 6.0 credits choice of physics at the 400 level or above (allowed to count PHYS 315 Astrophysics to satisfy)

Specialization Physics also required to take

- PHYS 444 Advanced Quantum or PHYS 472 Statistical Mechanics
- PHYS 480 Solid State Physics
- PHYS 490 Intro Nuclear and Particle Physics

Specialization Astrophysics also required to take

- PHYS 414 General Relativity
- PHYS 435 Stellar Structure and Evolution
4th Year Physics Courses

to choose from, include:

- General Relativity
- Stellar Structure and Evolution
- Advanced Lab
- Advanced Physics Design Project
- Laser Optics
- Solid State Physics
- Nanoscience and Nanotechnology
- Intro Nuclear and Particle Physics
- Advanced Quantum Theory
- Statistical Mechanics
- Intro Medical Physics

- 4th year Honours Physics Thesis
Physics Minor

- “Science Minor” is a bit of a misnomer – Science students can complete a Physics Minor (Arts)

- **Minor (Arts) 24.0 units beyond 1st year**
  - can count ASTR 101, ASTR 102, PHYS P20 or P22

- **Minor (Science) 36.0 units beyond 1st year**
  - specific PHYS and MATH courses

- Students who have completed **PHYS 117** (and done well) may be approved to take 200-level PHYS courses and can be accepted into a Physics Minor
Accelerated Master’s in Physics

- get an M.Sc. degree after you complete your B.Sc. (Honours) degree, with an extra year “4+1”
  - full M.Sc. degree with research thesis
  - apply in your 3rd year; start in the summer after 3rd year in a paid(!), research position
  - continue your PHYS 590 thesis in that same research group
  - able to take 1-2 graduate PHYS courses in your 4th year that “double count” towards your BScH and MSc
  - become a Master’s student in the summer after 4th year, continue research
  - complete MSc research, thesis and requirements in your 5th year
FAQ

- What if I don’t have linear algebra (MATH 110 or MATH 111)?
  - MATH 110 or 111 is required for all Honours Physics degree plans
  - you can still choose Physics and will be admitted (normal plan admission thresholds apply)
  - this summer, try to take an approved, transferable course somewhere (at least 3.0 units worth)
  - if you don’t, then absolutely must take linear algebra in your 2nd year along with the other 200-level MATH courses
  - and talk to me (Physics Advisor)
I’m taking PHYS 117 and I really like physics. Can I get into a physics degree plan?

- yes, it’s possible if you have an A+ or A in both PHYS 117 and MATH 121
- need to talk to me (Physics Advisor)
  - entry into a Physics degree plan will require manual intervention
FAQ

- Is Study Abroad possible for Physics students?
  - yes, each year ~1-2 students go on study abroad for one term or the full-year, in their 3rd year
  - England and Australia are “popular”; recent students have also gone to Ireland, the Netherlands, France, Hong Kong
FAQ

☐ Are QUIP Internships available for Arts and Science Physics students?
  - yes, although QUIP is fairly new and not so many students have done it (2 students this year)
  - in recent years we are seeing more and more internship postings for physics, e.g.
    ☐ National Research Council
    ☐ Ontario Power Generation (nuclear)
    ☐ Defense Research and Development Canada
After Graduation?

- about 50% of Canadian physics graduates go on to graduate school
  - in physics, astronomy, but also in math, engineering, chemistry, medicine, MBA, law…
- top students from Queen’s have been admitted to the top physics graduate schools in Canada, USA, UK and abroad
  - e.g. Princeton, MIT, Harvard, Caltech, Stanford
- careers after graduation, with or without more school include
  - e.g. education, research in government labs or industry, technology-related industry, medical physics, software and computing, finance and management consulting

- a physics education and degree give you: problem-solving skills, abstract and critical thinking ability and quantitative capabilities (incl. math and computing) at the highest level
  potential employers know: a physics degree isn’t easy!
Why Study Physics?
Because Physics is Cool, that’s why!
How Much Food?

does a goose need to eat to prepare for migrating 3,000 km?