Major in Physics
Major in Physics (Intensive)
Minor in Physics
Minor in Astronomy
for students starting in 2021
Why Physics?
A diverse universe around us, and we have many questions.
Galaxies: What caused galaxies to have different shapes?

Graphene: Why does it have such electric and mechanical properties?

Sun-Earth system: What’s the role of the Earth’s magnetic field?

Ocean wave: How do these waves affect the Earth’s temperature?

Hummingbird: How can they maintain this “suspension in air” position?

E.Coli bacteria: How can these bacteria navigate around?

Neutrons: How do we know they are made of three quarks?

Galaxies:

Graphene:

Sun-Earth system:

Ocean wave:

Hummingbird:

E.Coli bacteria:

Neutrons:
Galaxies: How long does it take the galaxies to form?

Ocean waves: Where does the Earth get the energy to initiate the waves?

Hummingbird: What dictates their bright colors?

Graphene: What kind of applications does it have?

Neutrons: Why neutron weighs much more than its three quarks?

E.Coli bacteria: Why some E.coli were so harmful to human?

Sun-Earth system: What is the best way to extract energy coming from the Sun?

Galaxies: How long does it take the galaxies to form?

Why Physics?

Physics is a powerful way to understand the natural world, hence giving solutions to human’s challenges.
Skill set after a university physics training

- Understanding the world (How things work?)
- Discovering relationships
- Quantitative thinking
- Hands on experience with wide range of equipment
- Problem identification and solving
- Designing research plans
- Communication skills (oral presentation, writing reports, ...)

Skill set after a university physics training
• **Physics Major (96 credits; 16 courses)**
  - Large flexibility in curriculum, lead to diverse career paths

• **Physics Major (Intensive) (144 credits; 24 courses)**
  - Comprehensive training in physics, targeted for students who want to pursue Master or PhD in physics or other science/technical disciplines

• **Astronomy Minor (36 credits; 6 courses)**
  - Suitable for all students (BSc or non-BSc) interested in the subject
  - Minimum physics and mathematics background needed

• **Physics Minor (42 credits; 7 courses)**
  - Skills learnt in could be useful in many science and non-science fields (e.g., chemistry, economics and finance)
Physics Major
(96 credits; 2 Sci core + 6 intro + 8 advance courses)

• **Aim**: Educating all-rounded physics students which best fit their interest and expertise

• Large flexibility in curriculum, lead to diverse career paths

• **Student-centered curriculum**
  - Learn the “**physics skill set**” first:
    - Mathematics, problem-solving, model-building, computing
  - Follow with core courses for physics undergraduates:
    - Years 1 and 2: fully integrating usage of calculus and vectors; stress daily connections
    - Years 3 and 4: formal training in physics with more abstraction and advanced mathematics
Physics Major (Intensive)
(144 credits; 2 Sci core + 10 intro + 12 advance courses)

• **Aim**: Educating physics students with a solid foundation on the subject in both breath and depth

• **Targeted for students who want to pursue further studies in physics and other science/technical disciplines**

• **Two majors**: Physics & Physics (Intensive) available for students
  - Can select **either** the regular Major or the Intensive option
  - **No penalty** for students who cannot complete the Intensive option
  - All required courses for the regular Major are included in the Intensive option
Physics Major Year 1 and 2

Skill Set Courses
- Computing
- Mathematics
- Model building
- Problem solving

Introductory Core Courses
- Calculus-based physics incorporated with vectors
- Stress daily-life connection
- Mechanics, Electricity & magnetism,
  Heat & thermodynamics, Quantum physics

Required Courses
- PHYS 1150 Problem Solving*
- PHYS 2150 Method in Physics I*
- PHYS 2155 Method in Physics II*
- PHYS 2160 Intro Compu Phys*
- PHYS 2055 Intro Relativity*
- PHYS 2250 Intro Mechanics
- PHYS 2261 Intro Heat & Thermo
- PHYS 2255 Intro E&M
- PHYS 2260 Intro Quantum

* Select 2 out of 5
Physics Major (Intensive) Year 1 and 2

PHYS 1150 Problem Solving
PHYS 2150 Method in Physics I
PHYS 2155 Method in Physics II

PHYS 2055 Intro Relativity
PHYS 2250 Intro Mechanics
PHYS 2261 Intro Heat & Thermo
PHYS 2255 Intro E&M
PHYS 2260 Intro Quantum

Skill Set Courses
- Computing
- Mathematics
- Model building
- Problem solving

Introductory Core Courses
- Calculus–based physics incorporated with vectors
  - Stress daily–life connection
- Mechanics, Electricity & magnetism,
  Heat & thermodynamics, Quantum physics

* Select 2 out of 6

COMP1117* Computer Programming
MATH1013* University Mathematics II
PHYS 1650* Nature of the Universe
PHYS 2160* Intro Computational Physics
PHYS 2650* Modern Astronomy
STAT 1603* Intro Statistics
Physics Major or Physics Major (Intensive)
Year 3 and 4

Advanced Core Courses
- Formal training in physics with more abstraction
- Advanced mathematical skills required
- Core undergraduate physics education

Selection of Themes
1. Course cluster to build expertise in specific area
2. Capstone project related to the theme
3. Enhanced training in physics for postgraduate studies

Optional:
May pursue 0, 1, or 2 themes to graduate

Astrophysics Theme
- Astronomy laboratory
- Cosmology
- Interstellar medium
- Observational astronomy
- Planetary science...

Computational Physics Theme
- Computational physics
- Data analysis & modeling in physics
- Machine learning in physics
- Theoretical physics...

Experimental Physics Theme
- Atomic & nuclear physics
- Laser & spectroscopy
- Physics laboratory
- Physical optics
- Solid state physics...

Theoretical Physics Theme
- Adv electromagnetism
- Adv quantum mechanics
- General relativity
- Particle physics
- Theoretical physics...
Four (optional) themes for physics or physics(intensive) majors

- **Optional** for students (may choose 0, 1 or 2 themes)

  - Help students to **build expertise** in specific areas
  - Enhanced training to prepare for postgraduate studies
  - Student **strength endorsed** by the Department with certificate of completion
  - **Completion of Intensive major and/or theme are important factors in HKU physics postgraduate admission consideration**
Physics Related Minors

• Minor in Astronomy
  ➢ Training on both observational and theoretical aspects
  ➢ Advanced courses in astrophysics continue to be offered to both undergraduate and postgraduate students.
  ➢ HKU continues to actively pursue astronomical research and recruit postgraduate students in astronomy.

• Minor in Physics
  ➢ A fundamental outlook on physics, with great flexibility to explore one’s interest
  ➢ Helpful for study of other science or non-science disciplines
Studying astronomy in HKU

• If I want to study astronomy, should I select the
  Minor in Astronomy?
  Major in Physics (Intensive) with Astrophysics theme?
  Major in Physics - Minor in Astronomy combination?

  – The Minor in Astronomy is suitable for science or non-science students with
    minimal physics and mathematics requirements
  – If you want to pursue postgraduate research in astronomy, then EITHER
    Major in Physics (Intensive) with Astrophysics theme OR Major in Physics -
    Minor in Astronomy combination is good
  – Slightly more restriction for the Major(intensive)+theme option: a 4000-
    level course, a project in astronomy
## Sample Major in Physics
### Year 1 & 2 Curriculum (minimum)

For students with
1. HKDSE Physics AND
2. HKDSE Extended Mathematics Module 1 or Module 2

<table>
<thead>
<tr>
<th>Year</th>
<th>Semester 1</th>
<th>Semester 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PHYS1150 Problem Solving</td>
<td>PHYS2250 Intro Mechanics</td>
</tr>
<tr>
<td></td>
<td>XXX</td>
<td>XXX</td>
</tr>
<tr>
<td></td>
<td>XXX</td>
<td>XXX</td>
</tr>
<tr>
<td></td>
<td>XXX</td>
<td>XXX</td>
</tr>
<tr>
<td>2</td>
<td>PHYS2150 Method in Physics I</td>
<td>PHYS2255 Intro Elect &amp; Magnetism</td>
</tr>
<tr>
<td></td>
<td>PHYS2261 Intro Heat &amp; Thermo</td>
<td>PHYS2265 Intro Quantum Physics</td>
</tr>
<tr>
<td></td>
<td>XXX</td>
<td>XXX</td>
</tr>
<tr>
<td></td>
<td>XXX</td>
<td>XXX</td>
</tr>
<tr>
<td></td>
<td>XXX</td>
<td>XXX</td>
</tr>
</tbody>
</table>

**For reference only, should consult your course schedule with Course Selection Advisor**
## Sample Major in Physics

### Year 1 & 2 Curriculum (minimum)

For students with
1. HKDSE Physics AND
2. HKDSE Extended Mathematics Module 1 or Module 2

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Semester 1</th>
<th>Semester 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH1011 University Maths I</td>
<td>PHYS1250 Fundamental Physics</td>
<td>PHYS1150 Problem Solving</td>
</tr>
<tr>
<td>XXX</td>
<td>XXX</td>
<td>XXX</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year 2</th>
<th>Semester 1</th>
<th>Semester 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS2150 Method in Physics I</td>
<td>PHYS255 Intro Elect &amp; Magnetism</td>
<td></td>
</tr>
<tr>
<td>PHYS2250 Intro Mechanics</td>
<td>PHYS2265 Intro Quantum Physics</td>
<td></td>
</tr>
<tr>
<td>PHYS2261 Intro Heat &amp; Thermo</td>
<td>XXX</td>
<td></td>
</tr>
<tr>
<td>XXX</td>
<td>XXX</td>
<td>XXX</td>
</tr>
</tbody>
</table>

**For reference only, should consult your course schedule with Course Selection Advisor**

Not counted towards Major requirements
Sample Major in Physics (Intensive)
Year 1 & 2 Curriculum

For students with
(1) HKDSE Physics AND
(2) HKDSE Extended Mathematics Module 1 or Module 2

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Semester 1</th>
<th>Semester 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS1150 Problem Solving</td>
<td>PHYS2250 Intro Mechanics</td>
<td></td>
</tr>
<tr>
<td>PHYS1650 Nature or MATH 1013</td>
<td>PHYS2055 Intro Relativity or</td>
<td></td>
</tr>
<tr>
<td>or STAT1603 or COMP1117</td>
<td>PHYS2255 Intro Elect &amp; Magnetism</td>
<td></td>
</tr>
<tr>
<td>XXX</td>
<td>XXX</td>
<td></td>
</tr>
<tr>
<td>XXX</td>
<td>XXX</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year 2</th>
<th>Semester 1</th>
<th>Semester 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS2150 Method in Physics I</td>
<td>PHYS2155 Method in Physics II</td>
<td></td>
</tr>
<tr>
<td>PHYS2261 Intro Heat &amp; Thermo</td>
<td>PHYS2055 or PHYS2255</td>
<td></td>
</tr>
<tr>
<td>PHYS2265 Intro Quantum Physics</td>
<td>PHYS2160 Intro Comp Phy or</td>
<td></td>
</tr>
<tr>
<td>XXX</td>
<td>PHYS2650 Modern Astro</td>
<td></td>
</tr>
<tr>
<td>XXX</td>
<td>Possible 3000-level courses</td>
<td></td>
</tr>
</tbody>
</table>

** For reference only, should consult your course schedule with Course Selection Advisor
## Sample Major in Physics (Intensive, astrophysics theme)
### Year 1 & 2 Curriculum

For students with
1. HKDSE Physics AND
2. HKDSE Extended Mathematics Module 1 or Module 2

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Semester 1</th>
<th>Semester 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS1150</td>
<td>Problem Solving</td>
<td>PHYS2250 Intro Mechanics</td>
</tr>
<tr>
<td>PHYS1650</td>
<td>Nature of the Universe</td>
<td>PHYS2055 Intro Relativity or</td>
</tr>
<tr>
<td></td>
<td>XXX</td>
<td>PHYS2255 Intro Elect &amp; Magnetism</td>
</tr>
<tr>
<td></td>
<td>XXX</td>
<td>PHYS2650 Modern Astronomy</td>
</tr>
<tr>
<td></td>
<td>XXX</td>
<td>XXX</td>
</tr>
<tr>
<td>Year 2</td>
<td>PHYS2150 Method in Physics I</td>
<td>PHYS2155 Method in Physics II</td>
</tr>
<tr>
<td></td>
<td>PHYS2261 Intro Heat &amp; Thermo</td>
<td>PHYS2055 or PHYS2255</td>
</tr>
<tr>
<td></td>
<td>PHYS2265 Intro Quantum Physics</td>
<td>XXX</td>
</tr>
<tr>
<td></td>
<td>XXX</td>
<td>XXX</td>
</tr>
<tr>
<td></td>
<td>XXX</td>
<td>Possible 3000-level courses</td>
</tr>
</tbody>
</table>

**For reference only, should consult your course schedule with Course Selection Advisor**
Advice for students who intends to do research after graduation

• **Keep your eyes wide open** – learn more about different sub-branches of physics

• **Learn about the surroundings** – find out more about the research being done in the Department (webpage, seminars, talk to teachers, …)
  http://www.physics.hku.hk/research

• **Watch out for emails** – get on the email list of the department (if you have declared or if you incline to declare majors) because information about many learning programs are announced this way

• **Give it a try!** – the only way to find out whether you like or you are capable to do research is to try doing it
Why Physics @ HKU?

- Faculty with diverse research interest
  
  *Broad range of courses taught by expert staff on that topic*; Outside experts invited to offer specialty courses

- Outstanding track record on research
  
  *Many channels for students to get involved*, e.g. research project courses, Summer Research Fellowship

- Long standing tradition of rigorous physics training
  
  *Alumni network* in business, education, government and academia
Research Areas of Academic Staff

➢ Research Areas of professoriate staff:

Atomic, Optical and Quantum Physics

Astronomy and Astrophysics

Experimental Condensed Matter and Material Science

Theoretical and Computational Condensed Matter Physics

Experimental Nuclear and Particle Physics
Why Physics @ HKU?

• Diverse learning experience
  *Students participated in long (semester long exchange), medium (8-week internship and research fellowship) and short (1-2 week summer course) term local and overseas experience outside HKU classrooms*

• A friendly learning environment
  Small class size; *Low student-to-teacher ratio (lower than 6:1)*

• Students as learning partners
  Students are *active participants in their learning*: through peer representatives to provide feedback to the department, or through direct participation of open forum organized by the department.
Outside Classroom Learning Opportunities

Overseas Summer Research Fellowship
(8 weeks during summer)

Participants engage in research field of their own choosing;
Physics Department match student’s interest with researchers

2019 summer

Marco Yeung (experimental nuclear physics) with Prof Shunji Nishimura, RIKEN

Kelvin Tsang (experimental particle physics) Prof Jeff Tseng, Oxford

Zhao Qingqing (computational condensed matter physics) Prof Owen Miller, Yale
Outside Classroom Learning Opportunities

Summer Internship
(8 weeks during summer)

Participants engage in **actual work in diverse environments** to apply their book knowledge.

2019 summer

*Elizabeth Kwok & Jason Siu (HK Science Museum)*

*Leo Lee (HK Space Museum)*

*Keith Tse & Billy Chu (Ho Koon Astronomical Centre)*
Participants get **first-hand working experience** both in and out of classroom settings in secondary schools.
Outside Classroom Learning Opportunities
Undergraduate Overseas Experiential Learning
(1-2 weeks)

Summer School on Observational Astronomy (Summer 2019)
Lectures and hands-on projects

CEFCA (Teruel, Spain)

12 HKU undergraduates who have taken advanced Astronomy courses
Outside Classroom Learning Opportunities
Undergraduate Overseas Experiential Learning
(1-2 weeks)

Together with Peking University & Seoul National University

Nishina School at RIKEN
(Tokyo, Japan)

5 HKU undergraduates who took nuclear physics course and training
Career Prospects

Government:
- Administrative Officer
- Executive Officer
- Scientific Officer (HK Observatory)
- Physicist (Health Department)
- Hong Kong International Airport

Industry & Commercial Firms:
- Assistant Manager
- Staff Accountant
- Computer Programmer
- Financial Consultant
- Researcher

Companies include: HSBC, Standard Chartered Bank, The Hong Kong Electric Co., others include publishing, communications, logistics, etc.

Education:
- School Teachers in local secondary schools and International schools
Where did our students go for further studies recently?

- Princeton University
- Stanford University
- University of Oxford
- University of Cambridge
- University of Chicago
- McGill University
- Columbia University
- University of Michigan
- Brown University
- Imperial College London
- Johns Hopkins University
- MIT (Massachusetts Institute of Technology)
- University of Texas at Austin
- California Institute of Technology
- University of California, San Diego
- University of California at Los Angeles (UCLA)
- University of Illinois – Urbana – Champaign
- Stony Brook University, State University of New York
- University of Tokyo
- Max Planck Institute for Radio Astronomy
- Universität Hamburg
- Leiden University
A final reminder on course selection

• Plan ahead beyond your 1st year, watch out for semester(s) the course is offered
• PHYS2150/2155 Methods in Physics I/II are extremely useful
• The courses required (hence, the number of credits) for the Major listed in the BSc syllabus is the minimum.
• Need more courses to better equip for research postgraduate studies! Ask your Course Selection Advisor for details.
• Questions? Come talk to us
  – Physics themes and Course Selection Guidelines
    https://www.physics.hku.hk/students/
  – Academic Advising
    https://www.scifac.hku.hk/current/ug/academic/aa
Thank you!

Please contact us at physdept@hku.hk for inquiries

HKU Department of Physics homepage:
http://www.physics.hku.hk/