Physics Undergraduate Curricula @ CUHK
2019 Applicants could join us via
(JUPAS 4601 CUHK Science -> Physics major)
(JUPAS 4690 Enrichment Stream in Theoretical Physics)

A most stimulating subject for young minds ......
Physics at CUHK: Curriculum Framework

- Designed to deliver Physics Program Learning Outcomes: **Knowledge, Professional & Generic Skills, Values & Attitude**
- **Physics (through JS 4601)** and **Enrichment Stream in Theoretical Physics (JS 4690)**
- 47/57 compulsory units provide solid physics background and basket of skills
- At least 24/15 elective units provide flexibility in learning to fit to students’ academic plan and career goal
You should choose CU *Physics/Enrichment Stream in Theoretical Physics* if you

- are interested in Physics and exploring how Nature works
- want to acquire a strong physics background to tackle a wide range of science and engineering problems
- interested in understanding the many modern applications of Physics and engaging in their future development
- talented in Physics together with outstanding preparation in mathematics and other science subjects at HKDSE level
- want to prepare well for frontier research in postgraduate studies
Highlights (*Physics*)

- Provide students with a solid grasp of fundamental concepts, analytic, numerical, computational, and research skills, as well as basic experimental skills.
- A balanced mix of lectures, tutorials, problem-solving sessions, seminars, group discussions, projects and undergraduate research opportunities delivers knowledge and skill set for further studies and employment skills.
- Compulsory courses provide an all-round foundation and a pool of elective courses.
Highlights (Enrichment Stream in Theoretical Physics)

- Provide students with a solid grasp of fundamental concepts, analytic, numerical, computational, and research skills, as well as basic experimental skills
- A balanced mix of lectures, tutorials, problem-solving sessions, seminars, group discussions, projects and undergraduate research opportunities delivers knowledge and skill set for further studies and employment skills
- Compulsory courses provide an all-round foundation and a pool of elective courses focusing on theoretical physics and mathematics
- Enhanced project learning and undergraduate research opportunities
- Enhanced interaction via small-group discussion classes
- Perfect for students with the talent and ambition of pursuing postgraduate studies at the master's and doctoral levels in physics and related fields
Two paths to join CUHK Physics in 2019

1. Choose *Enrichment Stream in Theoretical Physics (JS 4690)* in JUPAS
2. Choose *Science (JS 4601)* in JUPAS and declare *Physics* as your major after admission

- **Declaring in early Year 1**
  - obtained Level 5 or above in a HKDSE subject (Physics/Combined Science with Physics (Level 5))

- **Declaring by end of Year 1**
  - obtained C+ or above in PHYS 1111/1113 (University Physics I/Classical Mechanics)

- **Declaring no later than end of Year 2**
  - taken *(NOT necessarily ALL PASSED)* a set of courses, including PHYS 1111/1113 (University Physics I/Classical Mechanics), PHYS 1122 (University Physics II), PHYS 1712 (Physics Laboratory I) and PHYS 2041(University Physics III)
Four-year Science Program
Broad-based Admission (since 2015)

<table>
<thead>
<tr>
<th>Programme</th>
<th>Elective Requirements</th>
<th>Other Additional Requirements</th>
</tr>
</thead>
</table>
| SCIENCE 「理學」 (JS4601) | 1st Elective 第一個選修科目
Any one subject from the following:
- Biology 生物
- Chemistry 化學
- Physics 物理
- Combined Science 組合科學
- Integrated Science 綜合科學
- Mathematics (Module 1 or 2) 數學科(單元1或2) | Bonus points would be offered to the 3rd elective subject in Category A #
第三個甲類選修科目可獲額外加分 # |
| 2nd Elective 第二個選修科目
Any one subject in Category A # | Level 3 第三級 |

# Preferred subjects in Category A: Biology, Chemistry, Physics, Mathematics (Module 1 or 2), Combined Science, Economics, Geography, Information and Communication Technology, Integrated Science, and Technology and Living (Food Science & Technology)

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<thead>
<tr>
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<th>C</th>
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<th>X</th>
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<td>2</td>
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</tbody>
</table>

4C + 2X
Broad-based Science Admission (since 2017)

- The Best 5 HKDSE Subjects will be counted (after weighting)

<table>
<thead>
<tr>
<th>HKDSE Subject</th>
<th>Biology, Chemistry, Physics, Mathematics, M1 or M2, Combined Science, Integrated Science</th>
<th>Chinese or English, Economics, Geography, Information and Communication Technology, Technology and Living (Food Science &amp; Technology)</th>
<th>Subjects in Category A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weighting</td>
<td>2.0</td>
<td>1.5</td>
<td>1.0</td>
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</tbody>
</table>

Note: A maximum of three subjects will be weighted heavier in the calculation of total grade points

- Extra Bonus Points will be given to
  - Outstanding performance in interviews
  - Good grades in HKDSE for the 6th and 7th subjects
  - School Principal’s Nominations (SPN)
### Enrichment Stream in Theoretical Physics (ESTP) Admission (since 2015)

<table>
<thead>
<tr>
<th>Programme 課程</th>
<th>Elective Requirements 選修科目要求</th>
<th>Other Additional Requirements 其他附帶要求</th>
</tr>
</thead>
</table>
| Enrichment Stream in Theoretical Physics 理論物理精研 (JS4690) | Physics 物理
Any one subject from the following:
- Mathematics (Module 1 or 2) (preferred)
- Biology 生物
- Chemistry 化學
- Combined Science 組合科學
- Economics 經濟
- Geography 地理
- Information and Communication Technology 資訊及通訊科技
- Integrated Science 綜合科學
- Technology and Living (Food Science & Technology) 科技與生活（食品科學與科技） | Mathematics: Level 4
數學：第四級
Bonus points would be offered to the 3rd elective subject in Category A
第三個甲類選修科目可獲額外加分

<table>
<thead>
<tr>
<th>Subject 科目</th>
<th>Level 等級</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics 物理</td>
<td>Level 4 第四級</td>
</tr>
<tr>
<td></td>
<td>Level 3 第三級</td>
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</tbody>
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<thead>
<tr>
<th>C</th>
<th>E</th>
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<th>L</th>
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<td>3</td>
<td>3</td>
<td>4</td>
<td>2</td>
<td>4</td>
<td>3</td>
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</table>

Minimum requirement for JUPAS admission

4C + 2X
**JUPAS Admission Scheme 2019**

*(JUPAS 4690)*

- The Best 5 HKDSE Subjects will be counted (after weighting) plus Bonus Points for the 6th and 7th subjects

<table>
<thead>
<tr>
<th>HKDSE Subject</th>
<th>Physics</th>
<th>Mathematics and M1/M2</th>
<th>Subjects in Category A*</th>
<th>English/Chinese Language</th>
<th>Liberal Studies and Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weighting</td>
<td>Very High</td>
<td>High</td>
<td>Medium</td>
<td>Low</td>
<td>Very Low</td>
</tr>
</tbody>
</table>

* Subjects in Category A including: Biology, Chemistry, Combined Science, Economics, Geography, Information and Communication Technology (ICT), Integrated Science, Technology and Living (Food Science & Technology).

- Extra Bonus Points will be given to
  - 5** in HKDSE Physics, Mathematics & M1/M2
  - Outstanding performance in interviews (~ May 2019)

- Projected JUPAS Quota: 18 - 22
The STEM Talent Scheme (effective from 2019)

- Special consideration will be given to JUPAS applicants who get “3 or more stars with lowest level 3 or above” (e.g. 5*5*5*, 5**5*3, 5**5**5**, ...) in 3 STEM-related elective subjects# in HKDSE and put the science programmes in higher priority
  - For Enrichment Stream in Theoretical Physics (JS4690), Physics must be one of the 3 STEM-related elective subjects

- The scheme is also applicable for those who satisfy the above criteria but fail to fulfill the minimum requirement in the 4 core subjects (3322) by one level in any one subject
  - Programmes will consider their applications and offer interviews to the potential applicants
  - The application results will be announced as Main Round offer results by JUPAS

#Biology, Chemistry, Physics, Mathematics Extended Module I/II, Combined Science, Integrated Science, Information and Communication Technology, Design and Applied Technology
**Admission Scholarships**

**Objective:**
Physics Department and Science Faculty offer admission scholarships to both local and non-local new undergraduate students on the basis of their outstanding academic performance.

**Criteria:**
1. First year students of Enrichment Stream in Theoretical Physics or JUPAS students admitted through broad-based admission or Non-JUPAS students admitted through broad-based admission who have declared Physics, and
2. Attained best 5 score $\geq$ 29 in HKDSE with good level(s) in HKDSE Physics / Mathematics / M1/M2 or IB score: 40 (out of 45) and 7 in IB Physics (HL) or equivalent qualifications as approved by the Department of Physics/Science Faculty.

**Amount for each award:** HK$10,000 – 40,000 (one-off)

**Quota:** N/A
JUPAS Admission Score 2018

<table>
<thead>
<tr>
<th>Subject</th>
<th>CHI</th>
<th>ENG</th>
<th>MATH</th>
<th>LS</th>
<th>M1/M2</th>
<th>Best Elective</th>
<th>2nd Best Elective</th>
<th>3rd Best Elective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median</td>
<td>3</td>
<td>4</td>
<td>5**</td>
<td>5</td>
<td>5*</td>
<td>5*</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Lower Quartile</td>
<td>4</td>
<td>4</td>
<td>5*</td>
<td>4</td>
<td>5*</td>
<td>5*</td>
<td>5</td>
<td>4</td>
</tr>
</tbody>
</table>

Ordering according to PWGPA (Best 5)

- Total Number of Students admitted = 26 (25 JUPAS + 1 Non-JUPAS)
- Total Number of 5** = 45
- Total Number of 5** in HKDSE Physics = 13
- Ranked as the 6th top programme (out of 61 undergraduate programmes/streams in CUHK)
To graduate from CUHK: at least 123 Units

- Physics Major: 71 units
- Free electives: 13 units
- 39 units (Languages, University GE, College GE, IT, PE)
Major in Physics: 71 units (or more)

Provide learning experience essential for acquiring our learning outcomes

47 units Compulsory

24 units Elective

Physics (JS4601)

Provide flexibility and fit to your plan (further studies, career plan, etc.)
Major in Physics: 72 units (or more)

Provide learning experience essential for acquiring our learning outcomes & preparing for postgraduate studies.

Enrichment Stream in Theoretical Physics (JS 4690)

Choices on theories and math courses to fit to your plan (further studies, career plan, etc.)

- Compulsory: 57 units
- Elective: 15 units
**Streams for CU Physics Students**

**Aims:**
To better guide students on future choices of research directions and help students learn important skills for employment

- CU Physics Students may declare at most two* of the following streams by taking the stream-specific courses:
  - Astrophysics and Particle Physics
  - Computational and Data Physics
  - Quantum Science and Technology Stream
  - Science, Technology And Research Stream, STARS
    (offered by CU Science Faculty)

* Students admitted to Enrichment Stream in Theoretical Physics can declare at most one additional stream
Double Majoring in
\textbf{Physics-X Streamlined Path}

\textbf{Aims:}
To help students build a firm foundation in the two disciplines and prepare them to carry out cutting edge research at the interface of the two disciplines in the future

- A CU student can register for two major programmes with the permission of the departments of the two programmes

- \textit{Physics-X Streamlined Path} provides a way for academically-strong students who want to have an intellectually stimulating and rewarding undergraduate experience to pursue a double major in Physics and a second discipline in either \textit{Mathematics} or \textit{Earth System Science} within the nominal period of study while maintaining academic rigor.

- Total units required: $\sim 141 (102 + 39)$
  \begin{tabular}{ll}
  Physics-X & Others \\
  \end{tabular}
Start-up study pattern for different HKDSE preparations

- **With 1X Physics**
  Starts with PHYS 1111 or 1113 *University Physics I* or *Classical Mechanics*

- **With Combined Science (with physics component)**
  Starts with PHYS 1111 or 1113 *University Physics I* or *Classical Mechanics*;
  [Could also take PHYS 1002 *General Physics* as a make-up course and then move on to PHYS 1111 *University Physics I*]

- **Without any physics at DSE level**
  Contact our physics advisors/teachers
  Starts with PHYS 1001 *Essential Physics*, then PHYS 1002 *General Physics* and PHYS 1111 or 1113 *University Physics I* or *Classical Mechanics*
Recommended Course Selection Patterns
(Year 1)

Faculty Package Courses

PHYS 1111 or 1113: University Physics I or Classical Mechanics
MATH 1010: University Mathematics
a 3rd package course (CHEM 1070 or 1072 recommended)

Recommended Physics Courses
(could be taken in Year 1 Term 2)

PHYS 1122: University Physics II
PHYS 1712: Physics Laboratory I

Plus MATH 2530 or 2010 Advanced Calculus (possibly Y1 T2)

Talk to Physics teachers/advisor and students
Compulsory Courses: 47/57 units

Research Component, Presentation, Project Learning, and Capstone (Various Skills)
2 courses, 4 units or 4 courses, 8 units*

Experimental and Laboratory Skills
4 courses, 5 units

Upper-level Core Courses in Mechanics, Electromagnetic theory, Quantum Mechanics and its applications, Thermal & Statistical Physics
5 courses, 15 units

Upper-level Analytic Skills
1 courses, 3 units*

Student-Centred Learning
2 courses, 2 units

Introductory Calculus-Based Physics Series
1+2 courses, 3+6 units

Analytic Skills
1+2 courses, 3+6 units
(1+1 courses from Math Department)

Basic Computational Skills
1 courses, 3 units*

Other Science Subject
1 course, 3 units (typically Chemistry)

Note: These 3 courses (9 units) are Science Faculty Package Courses.
* for Enrichment Stream in Theoretical Physics only.
Elective Courses (Physics): at least 24 units

Advanced Core Courses
- Classical Mechanics,  
- Quantum Mechanics,  
- Electromagnetic Theory,  
- Statistical Mechanics

Series of courses on
- Computational Physics courses,  
- Methods of Theoretical Physics,  
- Experimental Physics,  
- Astronomy and Astrophysics

Courses on
- Nanoscience and Technology,  
- Optical Physics,  
- Meteorology,  
- Relativity,  
- Nuclear and Particle Physics

More Project Learning / Research Opportunities
- Short Experimental Projects and Theoretical Projects,  
- Senior Project II

Other Physics Learning Experience
claim units for off-campus work relevant to major, e.g., exchange, internship, etc.

All Postgraduate Level Physics Courses
CU Physics has over 100 MPhil/PhD students, a variety of postgraduate level courses are offered

Topics in Contemporary
PhysicsTopics of contemporary interest selected both from fundamental physics and from physics with important applications to technology

Upper-level Courses offered by Other Programs
(e.g., other sciences, engineering) for electives up to 6 units — more flexible, encourage students to plan for their career path
Elective Courses (Enrichment Stream in Theoretical Physics): at least 15 units/could be more

These courses are particularly useful for those planning for graduate studies!

**Advanced-level courses:**
- Classical Mechanics,
- Quantum Mechanics,
- Electromagnetic Theory,
- Relativity,
- Differential Geometry

**Upper-level Physics courses:**
- Statistical Mechanics,
- Solid State Physics,
- Physics of Meteorology,
- Astrophysics,
- Nuclear and Particle Physics

**Upper-level Methods of Theoretical Physics & Computational Physics:**
- Methods in Theoretical Physics II,
- Computational Physics,
- Mathematical Modelling

Plus other Physics Elective Courses

At least 2 courses, 6 units

At least 3 course, 9 units
Study tour

• Firstly introduced in 2017, physics undergraduates work in small groups to conduct a physics-related field work or experiment in an overseas site. The theme of the study tour changes every year.

• 1-unit or 2-unit courses

• collaborate with high schools to add a teaching-learning component

• global exposure + interactions with front-line researchers + learning of forefront research projects
Visits:
NIKHEF,
The Netherlands
VIRGO, Italy
CERN, Switzerland

Research Project:
Measurement with cosmic ray detectors
Undergraduates are encouraged to participate in research!

Physics Research @ CUHK
State-of-the-art research in

- Quantum Information and Computing
- Quantum Optics
- Condensed Matter Physics
- Nanoscience and Nanooptics
- Complex Systems
- Biophysics
- Astronomy, Astrophysics and Gravitational Waves (LIGO)
- Energy
- Particle Physics (CERN)
- Quantitative Finance, Mathematical Physics and Others
Recent Research Highlights

The Daya Bay Reactor Neutrino Experiment
(Breakthrough Prize in Fundamental Physics 2016)

Detection of Gravitational Waves by LIGO
(Special Breakthrough Prize in Fundamental Physics 2016)

Research on the Crucial Role of Magnetic Field in Stellar Formation

Breakthrough in Ultrahigh-speed Optical Communication Research

New Technology Giving Significant Boost to LED Efficiency

Breakthrough in Renewable Energy Development with High-Efficiency Thin Film Solar Cell

Groundbreaking Discovery in Semiconducting Nanowires Advances Nanotechnology

Discover Hidden Order in Bacterial Collective Motion
Learning Enhanced by Extracurricular Learning Opportunities

**SURE – Summer Undergraduate Research Exchange**
- LIGO 2016
- University of Twente, Netherlands 2016
- CERN 2014

**OPUS – Overseas Program for Undergraduate Students**
- UC Berkeley 2017
- UC Berkeley 2016
- UC Berkeley 2015

**STAR – Summer Teacher Apprenticeship**
- Hong Kong Observatory
- Hong Kong Space Museum

**Internships**
Learning Enhanced by Extracurricular Learning Opportunities

Summer Internship for Physics Undergraduate Students 2018

- The program provides a formal channel for CU physics undergraduate students to work in physics projects during the summer.
- 20 CU physics undergraduate students joined the program with financial support from Physics Department.
- Best poster prizes (certificate and book coupon) were awarded to top 3 students.
Aims:
To encourage exceptionally well-prepared undergraduates admitted into the Enrichment Stream in Theoretical Physics and the Physics Programme to participate in research activities offered/arranged by the Physics Department.

Criteria:
1. First year students of Enrichment Stream in Theoretical Physics or JUPAS students admitted through broad-based admission or Non-JUPAS students admitted through broad-based admission who have declared Physics as Major, and
2. Attained 5** in HKDSE Physics or 7 in IB Physics (HL) or equivalent qualifications as approved by the Department of Physics.
Undergraduate Research Experience Grant (UREG)

Amount for each award:
- Each qualified student is awarded an Undergraduate Research Experience Grant (UREG) of the amount HK$ 20,000 for research-related activities for the first year.
- Beyond Year 1, the recipient has to maintain a term major grade point average up to required level to receive / continue to receive the Grant (not more than three years including the first year).
- The unspent portion in one year cannot be carried forward to the next year.

Quota: N/A
In recent years, nearly 50% of physics BSc graduates continue to pursue higher degrees in Physics or related subjects. Each year, about 10 of them are awarded financial supports in the form of teaching assistantships and scholarships to pursue higher degrees abroad including the graduate schools of the following universities:

**USA & Canada:**

Brown University  
California Institute of Technology  
Emory University  
Georgia Institute of Technology  
Iowa State University  
Kansas State University  
Michigan State University  
New York University  
Northwestern University  
Ohio State University  
Princeton University  
Simon Fraser University  
Stanford University  
SUNY Stony Brook  
University of Arizona  
University of California, Berkeley  
University of California, San Diego  
University of California, Santa Barbara  
University of California, Santa Cruz  
University of Chicago  
University of Colorado, Boulder  
University of Connecticut  
University of Illinois, Urbana Champaign  
University of Maryland  
University of Massachusetts Amherst  
University of Michigan  
University of Rochester  
University of Toronto  
University of Washington  
University of Waterloo  
University of Wisconsin

**Europe:**

Cambridge University  
ETH Zurich  
London School of Economics  
University College London  
University of Twente  
The Chinese University of Hong Kong  
Nagoya University  
Osaka University  
Tokyo University

**Asia:**
More Information

Undergraduate Admission Inquiry: ugadm@phy.cuhk.edu.hk
Physics Curriculum Inquiry: physics@phy.cuhk.edu.hk

Physics Department Webpage:  http://www.phy.cuhk.edu.hk