

PHYSICS

Physics Undergraduate Curricula @ CUHK

2021 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**



For 2021 Entry

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 2021

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)

Preferential HKDSE Score Conversion for Applicants with Outstanding HKDSE Subject Results

To give due recognition to JUPAS applicants with outstanding academic performance in specific HKDSE subjects, CUHK will introduce a preferential HKDSE score conversion scale applicable to admission score calculation. The conversion applies to Level 5 or above. The augmented HKDSE score conversion for 2021 entry is as follows:

Category A - Core and Elective Subjects (including M1 and M2)							
Level	5**	5*	5	4	3	2	1
Score	8.5	7	5.5	4	3	2	1

(Augmented score conversion is highlighted in red colour in the table above.)

Four-year Science Program Broad-based Admission (since 2015)

Programme-specific minimum requirements are detailed below:

個別課程之最低入學條件詳見下表：

Programme 課程	Elective Requirements 選修科目要求		Other Additional Requirements 其他附帶要求												
	Subject 科目	Level 等級													
SCIENCE 「理學」 (JS4601)	<u>1st Elective 第一個選修科目</u> Any one subject from the following: 下列一科選修科目： <ul style="list-style-type: none"> • 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) 	Level 3 第三級	Bonus points would be offered to the 3 rd elective subject in Category A # 第三個甲類選修科目可獲 額外加分 # <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>C</td><td>E</td><td>M</td><td>L</td><td>X</td><td>X</td> </tr> <tr> <td>3</td><td>3</td><td>2</td><td>2</td><td>3</td><td>3</td> </tr> </table> <p style="text-align: center; margin-top: 10px;"> 4C + 2X </p>	C	E	M	L	X	X	3	3	2	2	3	3
	C	E		M	L	X	X								
3	3	2	2	3	3										
<u>2nd Elective 第二個選修科目</u> Any one subject in Category A # 一科甲類選修科目 #	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)

建議科目：生物、化學、物理、數學科(單元1或2)、組合科學、經濟、地理、資訊及通訊科技、綜合科學、科技與生活(食品科學與科技)

Broad-based Science Admission (since 2017)

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

HKDSE Subject	Biology, Chemistry, Physics, Mathematics, M1 or M2, Combined Science, Integrated Science	Chinese or English, Economics, Geography, Information and Communication Technology, Technology and Living (Food Science & Technology)	Subjects in Category A
Weighting	2.0	1.5	1.0

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)

Programme 課程	Elective Requirements 選修科目要求		Other Additional Requirements 其他附帶要求
	Subject 科目	Level 等級	
Enrichment Stream in Theoretical Physics 理論物理精研 (JS4690)	Physics 物理	Level 4 第四級	Mathematics: Level 4 數學：第四級
	Any one subject from the following: 下列一科選修科目： <ul style="list-style-type: none"> Mathematics (Module 1 or 2) (preferred) 數學科(單元1或2)(建議科目) 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) 	Level 3 第三級	Bonus points would be offered to the 3 rd elective subject in Category A 第三個甲類選修科目可獲額外加分

C	E	M	L	X	X	
3	3	4	2	4	3	
4C				+	2X	

Minimum requirement for JUPAS admission

JUPAS Admission Scheme 2021

(JUPAS 4690)

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

HKDSE Subject	Physics	Mathematics and M1/M2	Subjects in Category A*	English/Chinese Language	Liberal Studies and Others
Weighting	Very High	High	Medium	Low	Very Low

* *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 2021)
- **JUPAS Quota: 20**

The STEM Talent Scheme



- 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 ≥ 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)

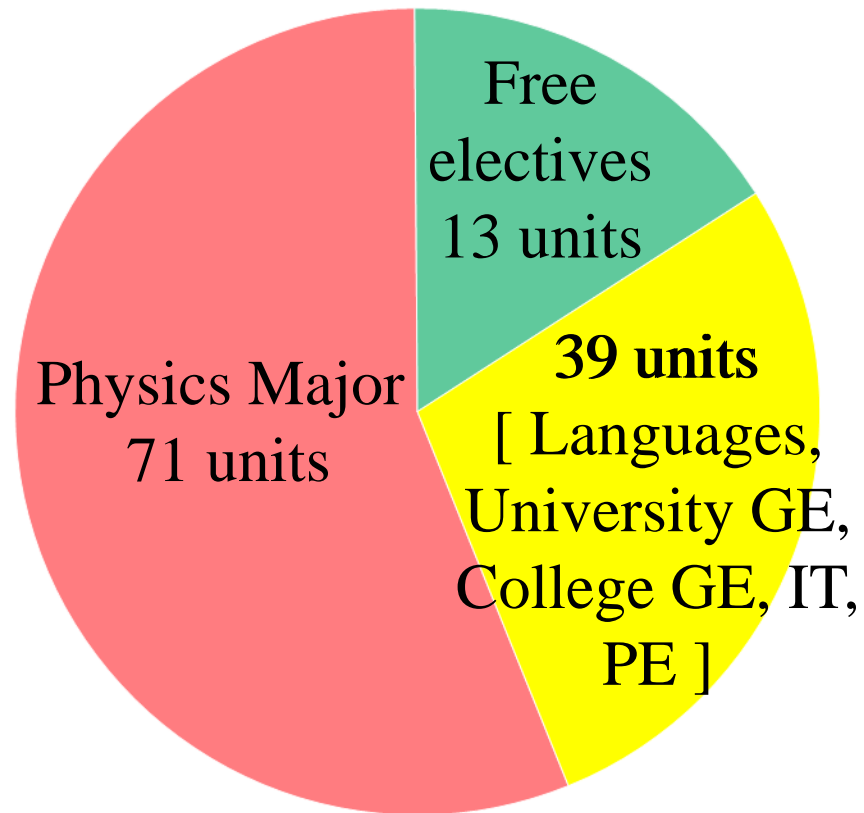
Quota: N/A

JUPAS Admission Score 2020

Subject	CHI	ENG	MATH	LS	M1/M2	Best Elective	2 nd Best Elective	3 rd Best Elective
Upper Quartile	4	4	5*	4	5*	5*	5*	5*
Median	4	5*	5*	4	5	5**	5	-
Lower Quartile	3	4	5*	4	4	5*	5*	5

- **Total Number of Students Admitted = 23 (22 JUPAS + 1 Non-JUPAS)**
- **Total Number of 5** = 18**
- **Total Number of 5** in HKDSE Physics = 10**
- **Ranked as the 8th Top Programme (out of 62 undergraduate programmes/streams in CUHK)**

To graduate from CUHK: at least 123 Units



Major in Physics: 71 units (or more)

Physics (JS4601)

Provide learning experience essential for acquiring our learning outcomes

47 units
Compulsory

24 units
Elective

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

57 units
Compulsory

15 units
Elective

**Enrichment Stream
in Theoretical Physics
(JS 4690)**

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

Streams for CU Physics Students

Aims:

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

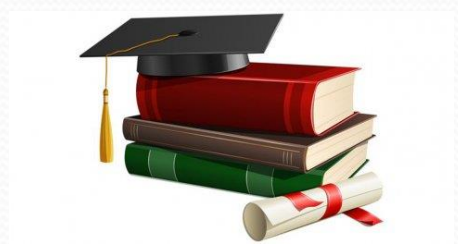
- CU Physics Students may declare at most two* of the following streams by taking the stream-specific courses:

- ❑ **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 Physics-X Streamlined Path



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
- **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 **Mathematics** or **Earth System Science** within the nominal period of study while maintaining academic rigor.
- Total units required: ~ 141 (102 + 39)
Physics-X Others

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 or 1018: University Mathematics or Honours
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*

Topics in Contemporary

Physics Topics of contemporary interest selected both from fundamental physics and from physics with important applications to technology

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

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*

At least 2 courses, 6 units

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

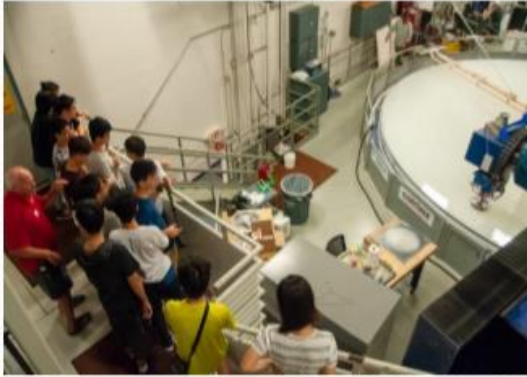
At least 3 course, 9 units

Study tour

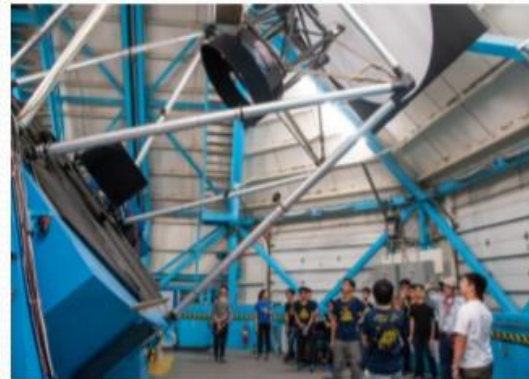
- Firstly introduced in 2017, physics undergraduates work in small groups to conduct a physics-related field work or experiment in an overseas site. The theme of the study tour changes every year.
- 1-unit or 2-unit courses
- collaborate with high schools to add a teaching-learning component
- global exposure + interactions with front-line researchers + learning of forefront research projects

Study Tour 2019

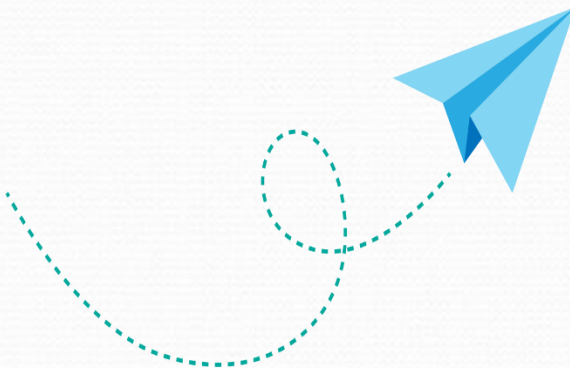
We visited:



Mirror Lab,
University of Arizona



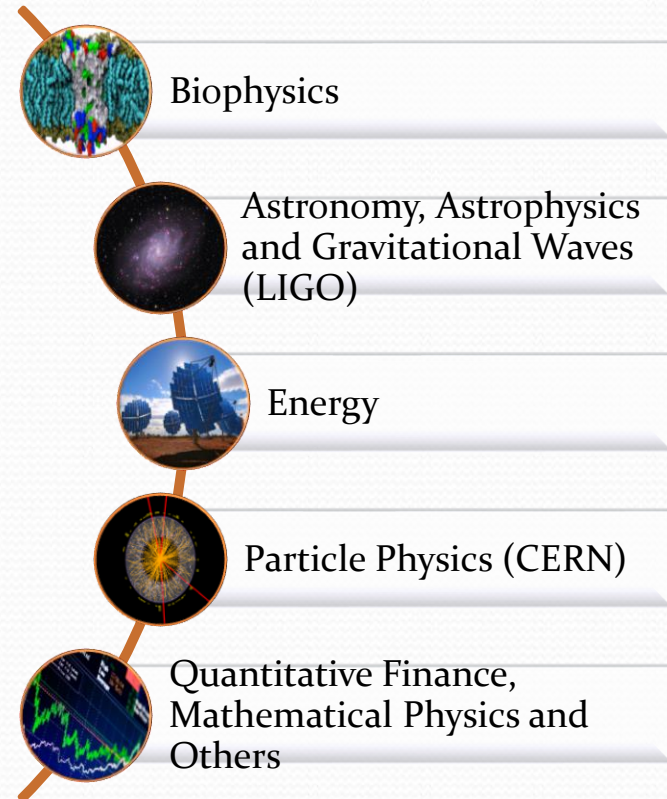
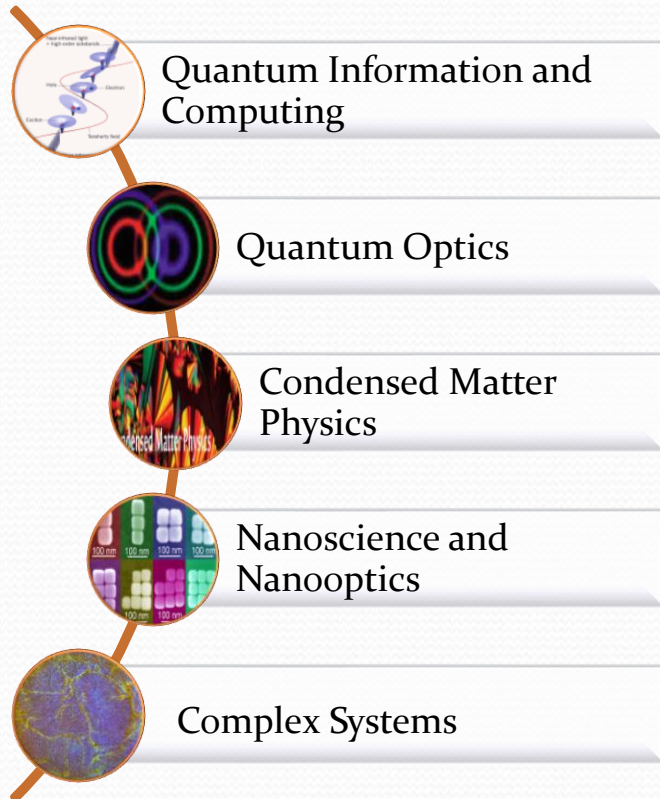
Large telescope,
Kitt Peak National Observatory



Millikan Library,
Caltech

Physics Research @ CUHK

State-of-the-art research in



Undergraduates are encouraged to participate in research!

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



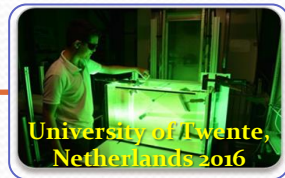
Groundbreaking Discovery in Semiconducting Nanowires Advances Nanotechnology



Discover Hidden Order in Bacterial Collective Motion

Learning Enhanced by Extracurricular Learning Opportunities

SURE – Summer Undergraduate Research Exchange



OPUS – Overseas Program for Undergraduate Students



STAR – Summer Teacher Apprenticeship



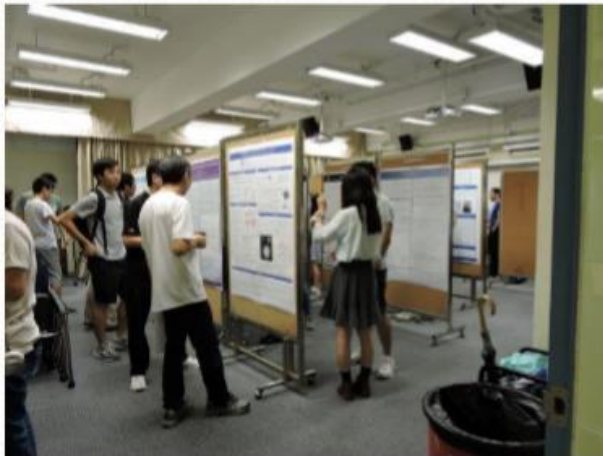
Internships



Learning Enhanced by Extracurricular Learning Opportunities

Summer Internship for Physics Undergraduate Students 2019

- The program provides a formal channel for CU physics undergraduate students to work in physics projects during the summer
- 29 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



Undergraduate Research Experience Grant (UREG)

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

Asia:

The Chinese University of Hong Kong

Nagoya University

Osaka University

Tokyo University



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>

Science Faculty Webpage: <http://www.sci.cuhk.edu.hk/>

