Department of Physics

The University of Hong Kong

Dr Stephen C Y Ng

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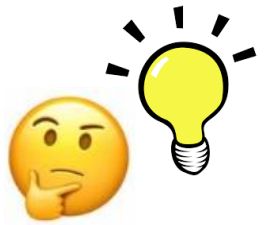
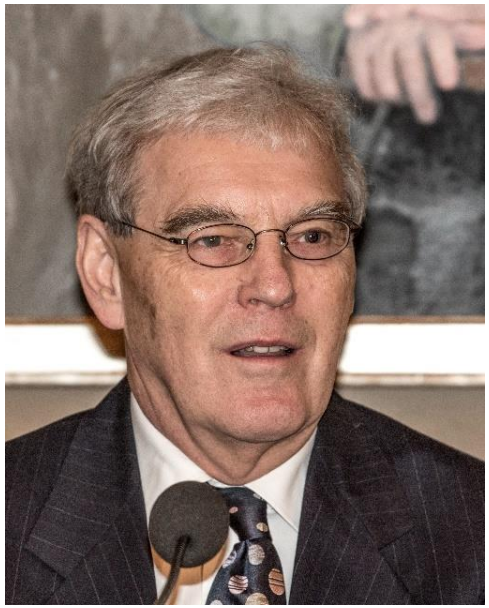
What will I learn studying physics at university?

- 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 …)
- **Working really hard**



Research into academic background of non-physics Nobel Prize winners, starting from most recent (2017)



Richard Henderson
Nobel Prize Chemistry 2017
BSc degree (Edinburgh)
in **Physics** (1966)

James Rothman
Nobel Prize Medicine 2013
BSc degree (Yale)
in **Physics** (1971)

Bengt Holmström
Nobel Prize Economics 2016
BSc degree (Helsinki)
In **Physics, Theoretical Physics**,
Mathematics, Statistics (1972)

TESLA

PayPal

SPACEX

hyperloop | one

Elon Musk
BSc degree (Penn.)
in **Physics** (1997)

Majors and Minors

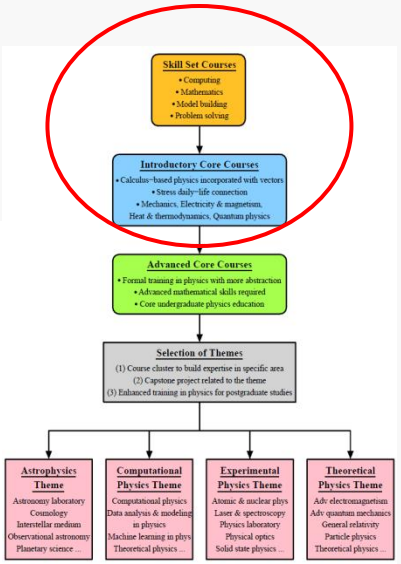
- **Physics Major (96 credits; 16 courses)**
  - Large flexibility in curriculum, lead to diverse career paths
- Astronomy Minor **(36 credits; 6 courses)**
- Physics Minor **(42 credits; 7 courses)**

Majors and Minors

Physics Major (96 credits; 2 SCNC + 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
- **New curriculum structure** for students entering this year!
  - ❖ Learn the "**physics skill set**" first:
    - ✓ Mathematics, problem-solving, model-building, computing
  - ❖ Follow with core courses for physics undergraduates:
    - ✓ Introductory level (Years 1 and 2): fully integrating usage of calculus and vectors; stress daily life connections
    - ✓ Advanced level (Years 3 and 4): formal training in physics with more abstraction and advanced mathematics

Physics Major Year 1 and 2



PHYS 1150 Problem Solving*

PHYS 2150 Method in physics I*
PHYS 2155 Method in physics II*

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

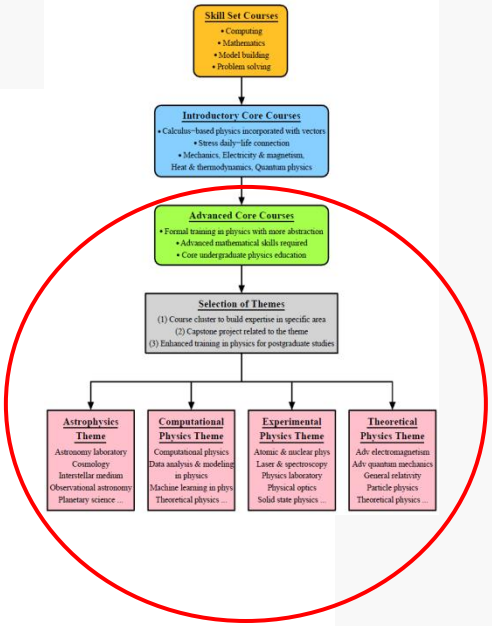
PHYS 2250 Intro Mechanics
PHYS 2261 Intro Thermal
PHYS 2255 Intro E&M
PHYS 2260 Intro Quantum

PHYS 2055 Intro relativity*

Required

* Select 2 out of 4

Physics Major 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

Astrophysics Theme

Astronomy laboratory
Cosmology
Interstellar medium
Observational astronomy
Planetary science ...

Computational Physics Theme

Computational physics
Data analysis & modeling in physics
Machine learning in phys
Theoretical physics ...

Experimental Physics Theme

Atomic & nuclear phys
Laser & spectroscopy
Physics laboratory
Physical optics
Solid state physics ...

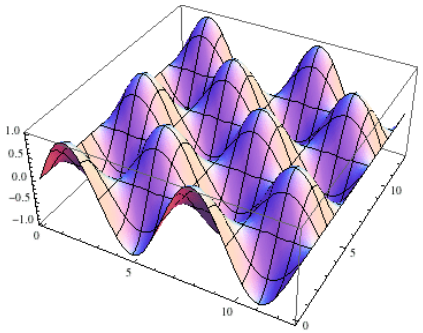
Theoretical Physics Theme

Adv electromagnetism
Adv quantum mechanics
General relativity
Particle physics
Theoretical physics ...

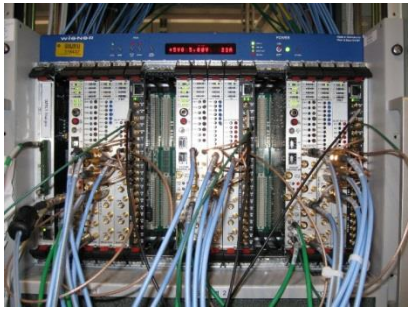
Four optional themes for physics majors

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

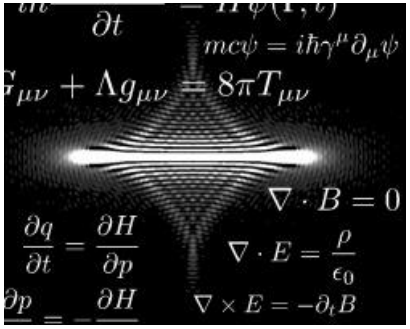
Astrophysics



Computational Physics



Experimental Physics



Theoretical Physics

- Cluster of courses to build expertise in specific areas
- Enhanced training to prepare for postgraduate studies (***Important factor in postgraduate admission consideration***)
- Department issues certificate to graduates upon completion

Capstone Experience

- All HKU students need capstone to graduate
- Students **had to fulfill the 24 credits advanced level core course requirement in the major before taking the capstone course**
- The **earliest** that students are allowed to take capstone course is their **year 3** study
- Capstone offered by Physics Department:
  - PHYS4988 Physics Project (12 credits; full year)
  - PHYS3999 Directed Studies in Physics (6 credits; one semester)
  - PHYS4966 Physics Internship (6 credits; offered in summer only; AND the 24-credit prerequisite requirement fulfilled before the start of the internship)

Majors and Minors

Astronomy Minor (36 credits; 3 intro + 3 advance courses)

- Aim: Provide interested students with a fundamental outlook on the subject, with minimal physics requirements
- **New curriculum structure** for students entering this year!
  - ❖ Introductory level courses (18 credits):
    - ✓ PHYS 1650 Nature of the Universe
    - ✓ PHYS 2650 Modern Astronomy (new course!)
    - ✓ PHYS 1250 Fundamental Physics or PHYS 2055 Intro Relativity or EASC 2408 Planetary Geology
  - ❖ Advanced level courses (18 credits):
    - ✓ PHYS 3650 Observational Astronomy
    - ✓ Two Advanced astronomy electives
- REMINDER: Watch out for pre-requisite requirements!

Study astronomy in HKU

- **Question:** If I want to study astronomy in HKU, should I select the Major in Physics with Astrophysics theme, Major-Minor combination of Physics and Astronomy, or the Minor in Astronomy?
- **Answer:**
  - If you just want a taste in astronomy, then select Minor in Astronomy
  - If you are interested to pursue postgraduate research in astronomy/astrophysics, then EITHER Major in Physics with Astrophysics theme OR Major-Minor combination of Physics and Astronomy would be good
  - *Slightly more restriction for the theme: a 4000-level course, a project in astronomy*

Majors and Minors

Physics Minor (42 credits; 4 intro + 3 advance courses)

- Aim: Provide interested students with a fundamental outlook on the subject, with great flexibility to explore one's interest
- **New curriculum structure** for students entering this year!
  - ❖ Introductory level courses (24 credits):
    - ✓ PHYS 1250 Fundamental Physics
    - ✓ Three introductory physics electives
    - ✓ PHYS1150, PHYS2055, PHYS2150, PHYS2155, PHYS2250, PHYS2255, PHYS2261, PHYS2265
  - ❖ Advanced level courses (18 credits):
    - ✓ Any three advanced level physics courses

- REMINDER: Watch out for pre-requisite requirements!

Majors and Minors

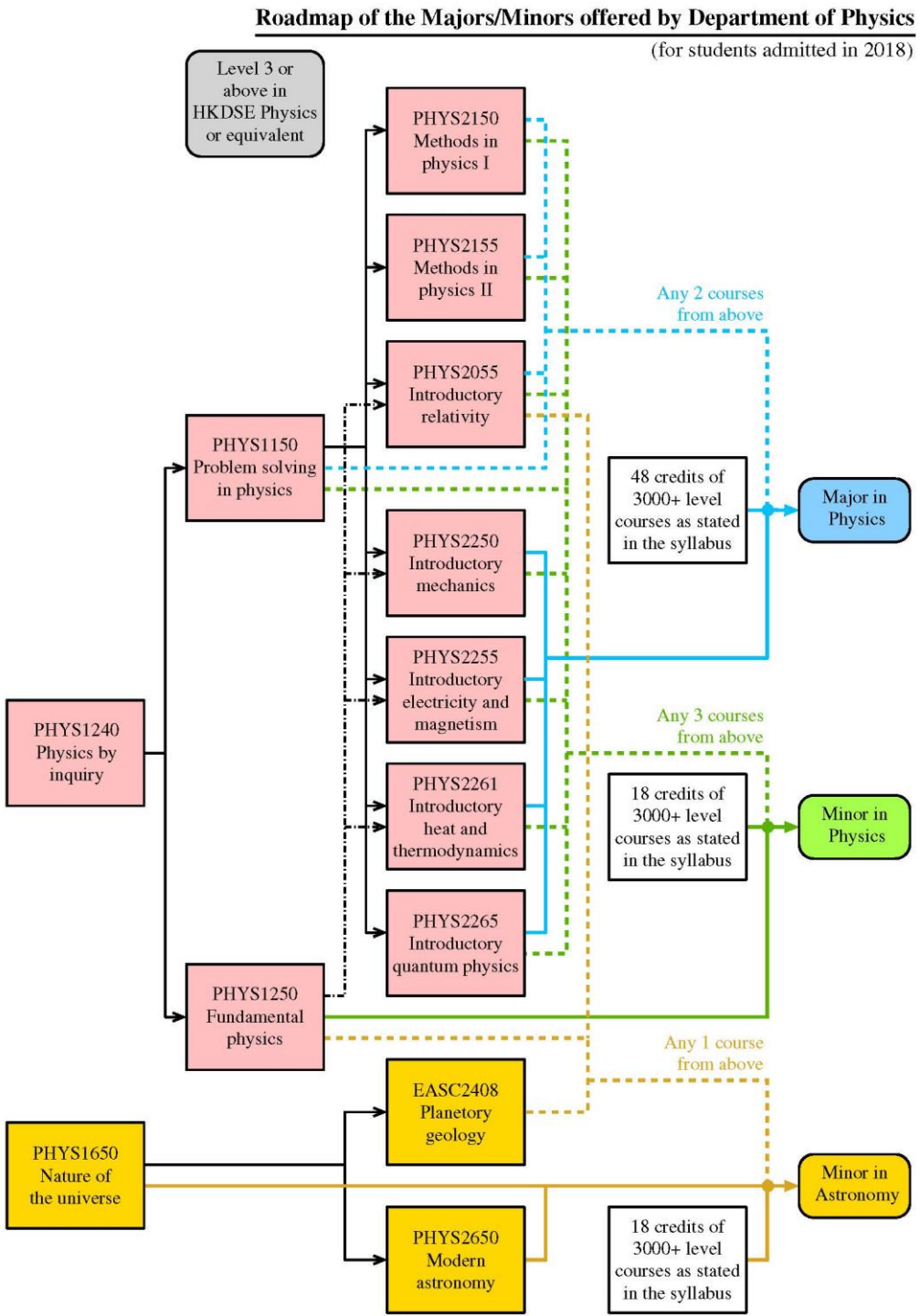
- **The courses required (hence, the number of credits) for the Major listed in the BSc syllabus is the minimum.**

- **Need more for research postgraduate studies! Ask your Course Selection Advisor for details**

Department of Physics
The University of Hong Kong

Click the "Current Students" link at the top

Course Selection Road Map for students entering as Year 1 in 2018-19



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

	Semester 1	Semester 2
Year 1	PHYS1150 Problem Solving XXX XXX XXX XXX	PHYS2250 Intro Mechanics XXX XXX XXX XXX
Year 2	PHYS2150 Method in Physics I PHYS2261 Intro Thermal Physics XXX XXX XXX	PHYS2255 Intro Elect & Magnetism PHYS2265 Intro Quantum Physics XXX XXX XXX

** 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~~

Not counted towards Major requirements

	Semester 1	Semester 2
Year 1	MATH1011 University Maths I PHYS1250 Fundamental Physics XXX XXX XXX	PHYS1150 Problem Solving XXX XXX XXX XXX
Year 2	PHYS2150 Method in Physics I PHYS2250 Intro Mechanics PHYS2261 Intro Thermal Physics XXX XXX	PHYS2255 Intro Elect & Magnetism PHYS2265 Intro Quantum Physics XXX XXX XXX

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

Sample Major in Physics
Year 1 & 2 Curriculum (intensive)

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

	Semester 1	Semester 2
Year 1	PHYS1150 Problem Solving XXX XXX XXX XXX	PHYS2250 Intro Mechanics PHYS2055 Intro Relativity or PHYS2255 Intro Elect & Magnetism XXX XXX XXX
Year 2	PHYS2150 Method in Physics I PHYS2261 Intro Thermal Physics PHYS2265 Intro Quantum Physics XXX XXX	PHYS2155 Method in Physics II PHYS2055 or PHYS2255 XXX XXX XXX } Possible 3000-level courses

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

Sample Major in Physics (astrophysics theme) OR Major in Physics & Minor in Astronomy Year 1 & 2 Curriculum

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

	Semester 1	Semester 2
Year 1	PHYS1150 Problem Solving PHYS1650 Nature of the Universe XXX XXX XXX	PHYS2250 Intro Mechanics PHYS2055 Intro Relativity or EASC2408 Planetary Geology XXX XXX XXX
Year 2	PHYS2150 Method in Physics I PHYS2261 Intro Thermal Physics XXX XXX XXX	PHYS2255 Intro Elect & Magnetism PHYS2265 Intro Quantum Physics PHYS2650 Modern Astronomy XXX XXX

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

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Course Selection Flow Charts

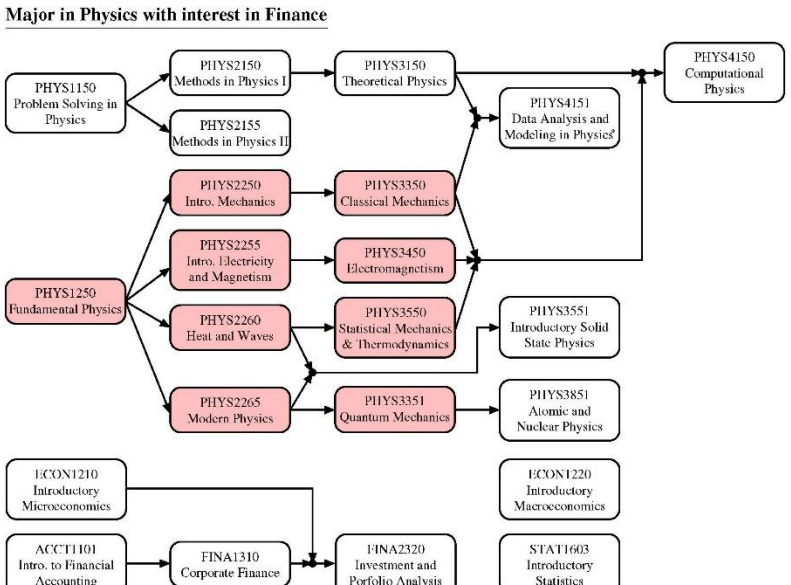
Below provides the course selection advices for some career choices for Physics students. For each career choice, you would find a flow chart showing the recommended courses for each career.

* The course labeled in **pink** are **compulsory**.
* The flow charts are for 4−yr cohort students admitted between **2015−16 and 2017−18**.
* Please note that the flow chats are some **general recommendation** only. You are encouraged to contact our **course selection advisors** directly to obtain the personalized course selection advices.
* If you have questions on a particular course, you are encouraged to contact **course coordinator** directly.

Click the "Current Students" link at the top

Course Selection Flow Charts for students entering as Year 3 in 2018-19

Major	Career Choice		
Astronomy	Research	Education	Marketing
Math/Phy	Research (Theoretical)	Education	Finance
Physics	Research (Experimental)	Education	Finance



Advices 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

Selected research areas & facilities

- **Experimental condensed matter and material science**
  - → characterizations and applications of low dimensional materials
  - → novel optical properties of semiconductor nanostructures
  - → optoelectronics and nanomaterials
  - → wide band gap semiconductor systems: Electrical and optical properties, defects
  - → thin film of novel materials and advanced microelectronic devices
  - → surface science: growth and surfaces of novel quantum materials
  - → **Facilities**: Material Physics Lab, Thin Film Lab, Semiconductor Lab, Optoelectronics and Nanomaterial Lab, Laser Spectroscopy Lab

Selected research areas & facilities

- **Theoretical Atomic and Condensed Matter Physics**
  - → strongly interacting quantum many-body systems: correlated quantum phases and phase transitions
  - → strongly correlated electron systems
  - → topological quantum materials
  - → quantum magnetism
  - → spintronics and valleytronics
  - → quantum transport
  - → semiconductor optics
  - → interdisciplinary study of cold atom physics and condensed matter physics

Selected research areas & facilities

- **Observational Astrophysics**
  - → late stage stellar evolution: SNR, planetary nebulae
  - → stellar formation and cooling flows in galaxy clusters
  - → magnetars and pulsar wind nebulae
  - → Cosmology: cosmic microwave background, large scale structure
  - → **Facility**: HKU observatory (0.4m reflector, radio telescope)
  - → **Facility**: access to ground-based and space observatories: ALMA, EVLA, ATCA, BICEP, Chandra, XMM-Newton, Hubble, Fermi, …
- **Theoretical Astrophysics**
  - → High energy emission from neutron stars and pulsars
  - → Dynamical evolution of planetary bodies

Selected research areas & facilities

- **Quantum Computing and Information Theory**
  - → Quantum cryptology
  - → Quantum key distribution, quantum error-correction codes

- **Experimental Nuclear Physics**
- **Experimental High Energy Particle Physics**

Outside classroom Learning opportunities:

Physics Department Summer Internship Program

Program: ~20% of our final year students participate every year

Requirement: 6-8 weeks in academic / non-academic overseas or locally

Overseas: **Princeton** Univ (w/ Prof D.Tsui 崔琦教授), **Cambridge** Univ (w/ Prof Littlewood), **Harvard** Univ, **Stanford** Univ (w/ Profs S. Doniach, S.C. Zhang, R. W. Romani), **ETH Zurich** (w/Prof T.M. Rice), **Mullard Space Science Laboratory UCL** (w/ Prof K. Wu and G. Aeppli), **UC Berkeley** (w/ Prof. F. Wang), **UCLA, CERN, Caltech** (w/ Prof. Y.L. Yung)

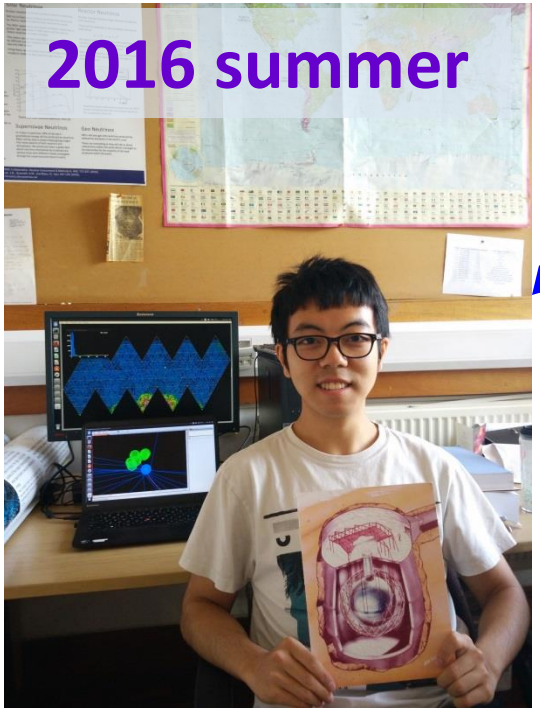
Local: HK Observatory, HK Space Museum, HK Science Museum, Ho Koon Nature Education cum Astronomical Centre, Cinotech Consulting Ltd

Education: Cheung Sha Wan Catholic Secondary School, St Francis of Assisi's College, Yu Chun Keung Memorial College No. 2

Outside classroom Learning opportunities:

CAPSTONE: Overseas Summer Research Fellowship (6-8 weeks)

- Participants engage in research fields of their own choosing; Physics Department **match interest with researchers**
- Reimbursement up to $12,000 per participant



Edward Yang (experimental neutrino physics) with Prof John Tseng, **Univ of Oxford**

Jimmy Lee (experimental particle physics) Prof Aurelio Juste, **ICREA, Spain (Work @ CERN)**

Outside classroom Learning opportunities:

CAPSTONE: PHYS4966 Physics Internship (6-8 weeks)

- Participants engage in actual work to apply their book knowledge
- Department arranged for selected candidates to be interviewed by the institution

Wong Wing (**HK Space Museum**); *Chan Man Yiu, Lam Ka Fai* (**HK Science Museum**)

Tam Chi Kin (**Ho Koon Astronomical Centre**)

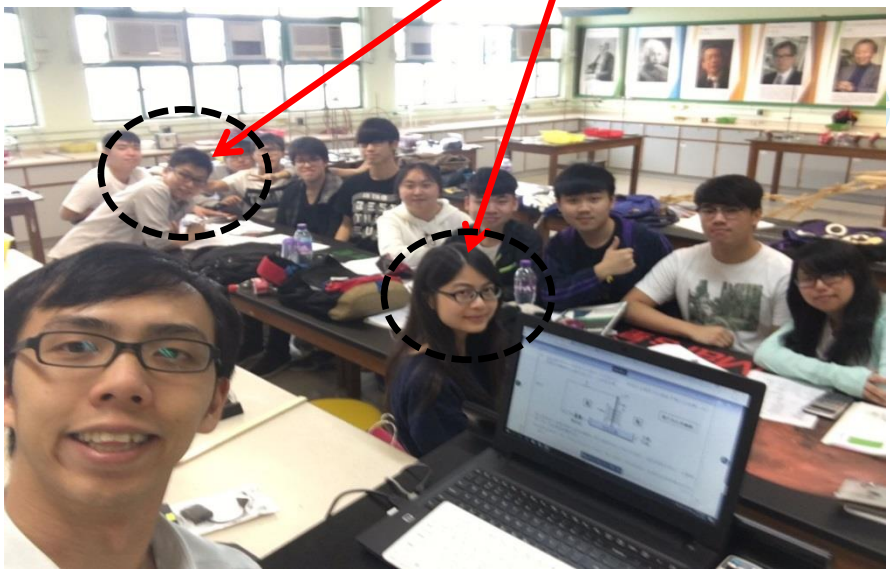
Outside classroom learning opportunities:

CAPSTONE: PHYS4966 Physics internship (6-8 weeks)

- Participants engage in actual work to apply their book knowledge
- Department arranged for selected candidates to be interviewed by the institution

Minnie Wu & Fung Kin Ming (**Yu Chun Keung No 2 Memorial College**) 2017

Wong Wae Ming (**Cheung Sha Wan Catholic Secondary School**) 2016



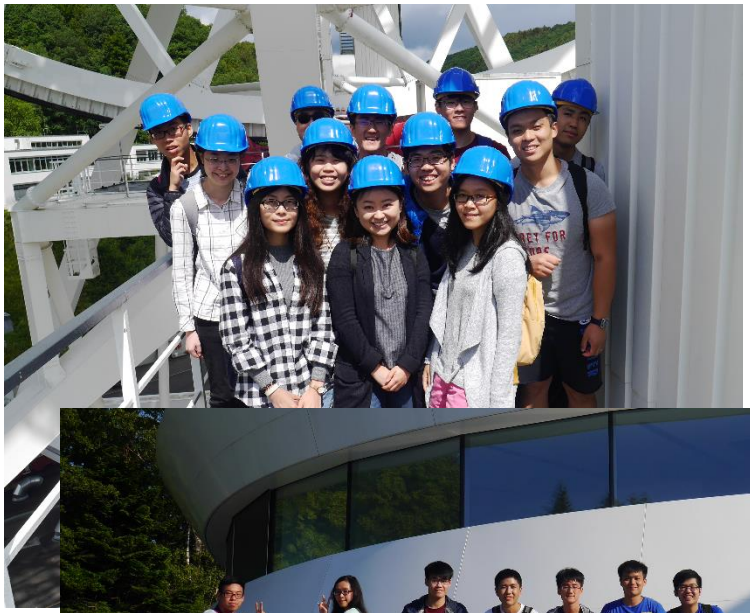
Outside classroom Learning opportunities:

NON-CAPSTONE: Undergraduate Overseas Experiential Learning Activities (~1-2 weeks)

1. Summer School on Observational Astronomy (June 2018)

Lectures and hands-on projects (Airfare + local expenses subsidized)

Max Planck Institute for Astronomy, (Heidelberg, Germany); June 2018



10 HKU students (mostly Year 3 or 4) who have taken Astronomy courses

Outside classroom Learning opportunities:

NON-CAPSTONE: Undergraduate Overseas Experiential Learning Activities (~1-2 weeks)

2. **Summer School on Nuclear Physics at RIKEN, Japan (July 2018)** **Together with Peking University and Seoul National University** (Airfare + local expense subsidized)

6 HKU students who attended nuclear physics enrichment training before

Career Prospects

Government:	Administrative Officer
	Executive Officer
	Scientific Officer (HK Observatory)
	Physicist (Health Department)
Industry & Commercial Firms:	Assistant Manager
	Staff Accountant
	Computer Programmer
	Financial Consultant
	Researcher

Companies include: HSBC, Standard Chartered Bank, Sino Group, others include publishing, communication, logistics companies, etc.

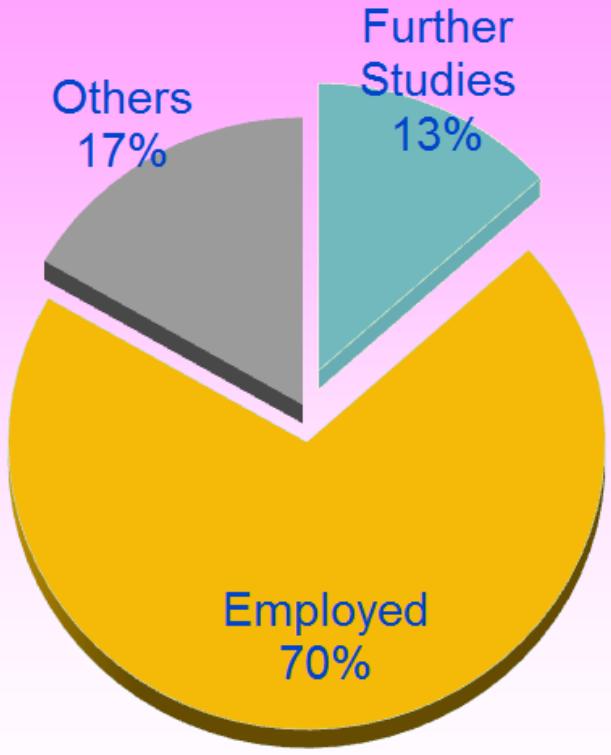
Education:	School Teachers
Research:	Postgraduate Studies

How did our 2016 Physics, Astronomy, and Math/Physics graduates do?

2016 Graduates

Educational Institutions
-**Research Assistant**
City University of Hong Kong
-**Teaching Assistant**
Society of Boys' Centres Chak Yan Centre School

Commerce and Industry
-**Lab Technician**
CMA Industrial Development Foundation Limited
-**Database Programmer**
DBP Solutions Limited



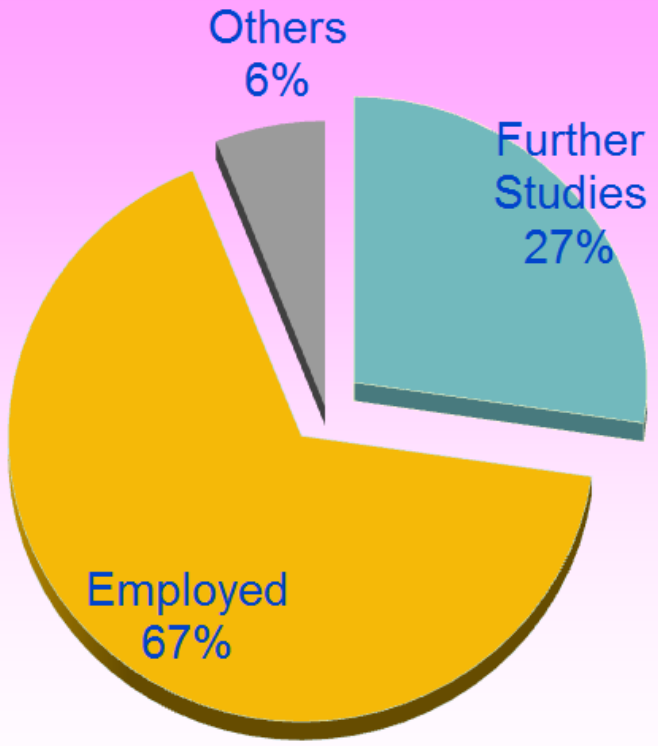
How did our 2015 Physics, Astronomy, and Math/Physics graduates do?

2015 Graduates

Civil Service
-**Enumerator**
HKSAR - Census and Statistics Department

Educational Institutions
-**Research Assistant**
City University of Hong Kong

Commerce and Industry
-**Technician**
Artcom Computer Project Co Ltd
-**Associate Relationship Manager**
MetLife, Inc.

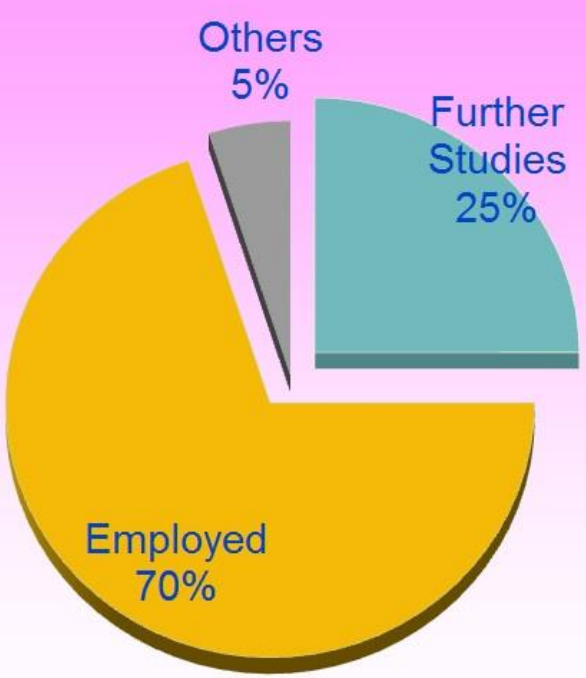


How did our 2014 Physics, Astronomy, and Math/Physics graduates do?

2014 Graduates

Educational Institutions
-Research Assistant
The University of Hong Kong

Commerce and Industry
-Project Engineer
ASM Pacific Technology Ltd.
-Engineer Trainer
Quon Hing Concrete Company Limited



Final advice on course selection

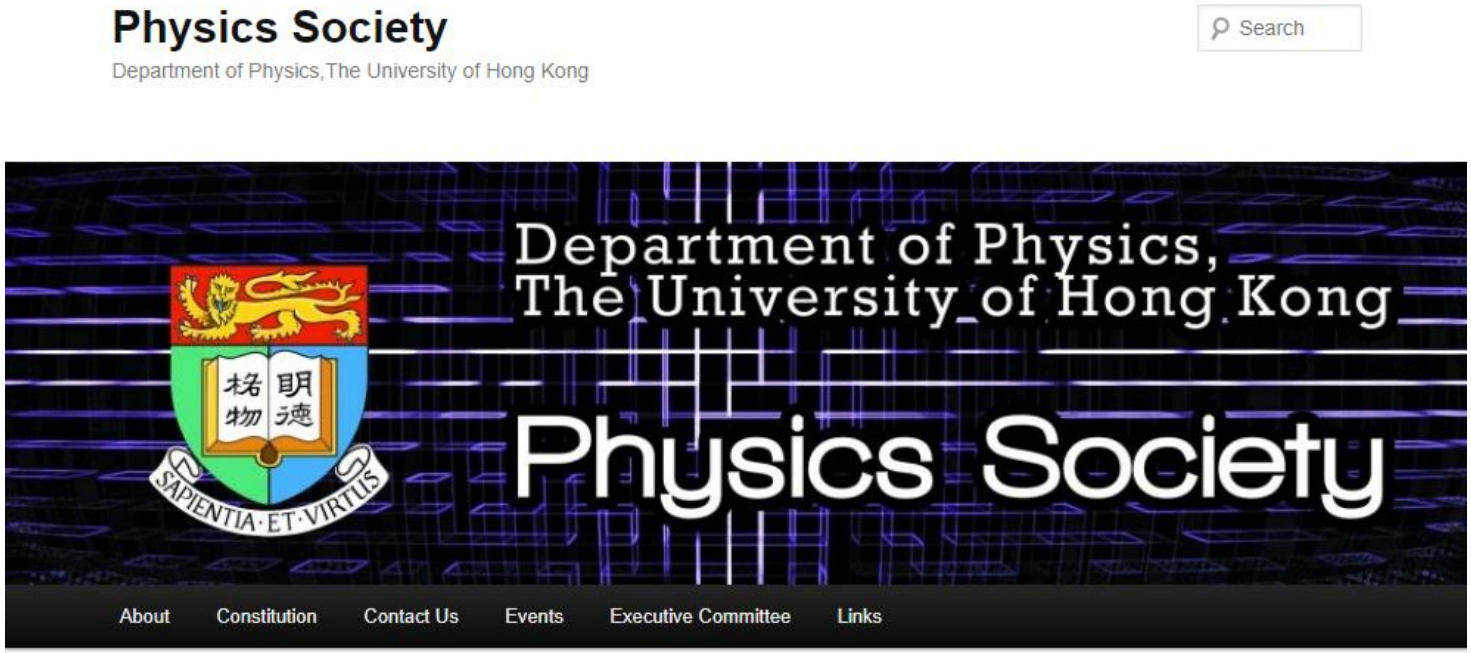
- Plan ahead beyond your 1st year, watch out for semester(s) the course is offered
- PHYS2150/2155 Methods in Physics I/II are essential
- Take more credits to better equip for research
- http://www.physics.hku.hk/students/
- Questions? Come talk to us
  - Course Selection Advisors
    http://www.physics.hku.hk/students/course-information/guideline1819
  - Student Peer Advisers (Thomas Wong, Christina Zhao, Adilet Uvaliyev)
    http://www.scifac.hku.hk/ug/current/advising/bsc/office#peer

Student Peer Advisers in 2018-19

- General roles
  - to **offer advice** in relation to academic studies to freshmen; and
  - to **facilitate** freshmen's **smooth transition** from secondary to university education
- You are highly encouraged to contact the following **Student Peer Advisers (SPAs)** if you have any questions about your study (their contacts can be found at the Faculty's website)
  - Mr Adilet UVALIYEV (BSc Year 2)
  - Mr Thomas WONG Hong Tsun (BSc Year 3)
  - Miss Christina ZHAO Qingqing (BSc Year 3)

Let's talk to our SPAs!

Physics Society



PAGES

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- Events
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  - Career Talk
  - Class Photo Taking
  - Course Selection Counseling Day
  - Inauguration Ceremony
  - O-series

【開Sem飯 Open Sem Rice】

Posted on January 21, 2018

(Please scroll down for English version)
「『100萬既問題：!?
有啲咩野同錢一樣好快無？』
『Sem break!』
『答案係...係啫架』
『恭喜你 我真係恭喜你地獲得100萬，
而家播廣告先』
（～假期從我心中溜走
變成了一切的無奈和不捨～）...」
起身啦 開sem啦