Department of Physics

City University of Hong Kong

The Department of Physics at the City University of Hong Kong was officially launched on July 1, 2017. The Department builds on the excellent tradition of the physics faculty in the former Department of Physics and Materials Science. Since then, the Department has taken a major expansion, now boasting a 26 strong faculty body with diversity.

A rigorous curriculum is a hallmark of the Department of Physics. The goal of our teaching is to equip students with knowledge and critical thinking skills that will enable them to tackle difficult problems throughout their career, and in their life. Our internationally benchmarked curriculum teaches not only foundational courses in physics, but also technology driven courses such as computer modeling and advanced instrumentation. It has allowed our students to enroll in joint degree programs with top universities in the world, such as Columbia University in the USA, to obtain degrees from both universities. The solid physics education has enabled our students to pursue a career of their choice, including scientific research and technological development jobs, medical physicists, financial analysts, data scientists, STEM education, etc.

Faculty members at the Department of Physics are committed to excellence in teaching and research. The Department’s research focuses on the following themes:

- Theoretical and Computational Physics
- Spectroscopy and Imaging
- Quantum Materials
- Soft Matter and Biophysics
- Atomic, Molecular, and Optical Physics

Our focus reflects the growing trend of physics research today. In a recent editorial, the editors of Physical Review Letters remarked, “today’s physics research is much more about interwoven disciplines—physics with chemistry, biology, materials science, and others.”

Physics is Cool, Come to CityU!

OUR VISION
The Department of Physics aspires to become a leading physics department in the Asia-Pacific region.
**Admission Route**

JUPAS Code: JS1208 / Non-JUPAS Code: 1208 / Advanced Standing Entries: 1638A

**Core Courses**

<table>
<thead>
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<th>Course Code</th>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>PHY1202</td>
<td>General Physics II</td>
</tr>
<tr>
<td>PHY1203</td>
<td>General Physics III</td>
</tr>
<tr>
<td>PHY2191</td>
<td>Electricity and Magnetism</td>
</tr>
<tr>
<td>PHY2212</td>
<td>Measurement and Instrumentation</td>
</tr>
<tr>
<td>PHY2213</td>
<td>Advanced Measurement and Instrumentation</td>
</tr>
<tr>
<td>PHY3202</td>
<td>Modern Physics</td>
</tr>
<tr>
<td>PHY3204</td>
<td>Waves and Optics</td>
</tr>
<tr>
<td>PHY3205</td>
<td>Electromagnetism</td>
</tr>
<tr>
<td>PHY3231</td>
<td>Advanced Instrumentation Lab</td>
</tr>
<tr>
<td>PHY3251</td>
<td>Quantum Physics</td>
</tr>
<tr>
<td>PHY3272</td>
<td>Introduction to Solid State Physics</td>
</tr>
<tr>
<td>PHY3290</td>
<td>Thermodynamics</td>
</tr>
<tr>
<td>PHY 4216/</td>
<td>Project/</td>
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<tr>
<td>PHY 4217/</td>
<td>Dissertation/</td>
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<tr>
<td>CSC4003</td>
<td>Co-operative Education Placement Project for Science Students</td>
</tr>
<tr>
<td>PHY3115 &amp;</td>
<td>Introduction to Computational Physics &amp; Linear Algebra and Calculus</td>
</tr>
<tr>
<td>MA2158</td>
<td>OR</td>
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<tr>
<td>^MA2503 &amp;</td>
<td>Linear Algebra &amp;</td>
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<tr>
<td>^MA2508 &amp;</td>
<td>Multi-variable Calculus &amp;</td>
</tr>
<tr>
<td>^MA3511</td>
<td>Ordinary Differential Equations</td>
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**Elective Courses**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>MSE2102</td>
<td>Introduction to Materials Engineering</td>
</tr>
<tr>
<td>MSE3171</td>
<td>Materials Characterization Techniques</td>
</tr>
<tr>
<td>MSE4121</td>
<td>Thin Film Technology and Nanocrystalline Coatings</td>
</tr>
<tr>
<td>MSE4127</td>
<td>Smart Sensors: From Engineering to Applications</td>
</tr>
<tr>
<td>PHY2100</td>
<td>Mathematical Methods in Physics</td>
</tr>
<tr>
<td>PHY3116</td>
<td>Introduction to Soft Matter Physics</td>
</tr>
<tr>
<td>PHY3220</td>
<td>Financial Engineering from a Scientist's Perspective</td>
</tr>
<tr>
<td>PHY4172</td>
<td>Computational Physics</td>
</tr>
<tr>
<td>PHY4230</td>
<td>Radiation Safety</td>
</tr>
<tr>
<td>PHY4232</td>
<td>Radiotherapy Physics</td>
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<tr>
<td>PHY4233</td>
<td>Imaging Physics</td>
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<tr>
<td>PHY4254</td>
<td>Fundamentals of Laser Optics</td>
</tr>
<tr>
<td>PHY4265</td>
<td>Semiconductor Physics and Devices</td>
</tr>
<tr>
<td>PHY4273</td>
<td>Special Topics in Physics</td>
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<tr>
<td>PHY4274</td>
<td>Radiation Biophysics</td>
</tr>
<tr>
<td>PHY4275</td>
<td>Radiological Physics and Dosimetry</td>
</tr>
<tr>
<td>PHY4283</td>
<td>Physics in Medicine</td>
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</tbody>
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^ Students have to meet the specified criteria and obtain the prior approval from the Department for taking this option.

Note: Course offering subject to change. Please visit our Department’s website for the latest full list of courses.

**Admission Requirements**

- Satisfy the General Entrance Requirements of the University with a science or engineering background; OR
- Associate Degree or Higher Diploma Holder in a relevant discipline or other technical qualifications; OR
- Other 13-year school-leaving qualification holder (e.g. IB Diploma, GCEAL)

For further details about entrance requirements and application procedures, please visit the website of our Admissions Office:

http://www.admo.cityu.edu.hk/
Joint Bachelor's Degree Program between CityU and Columbia U

Physics students admitted to the Joint Degree Program spend their third and fourth years at Columbia University in USA, and earn a Bachelor of Science degree from CityU and a Bachelor of Arts degree from Columbia University at the end of their study.

Student Highlights

Cheng, Yuanhao
2018 Graduate; currently pursuing a PhD at Chinese Academy of Sciences, China

“Columbia University is a prestigious university. I have had the chance to interact with many brilliant professors and students. Courses at Columbia are very demanding, but also very enlightening. I have spent a great deal of time reading books, understanding materials, and doing homework. By my self-study and through my discussions with professors and students, I have been able to easily learn whatever I want.

A number of libraries are located on campus, and each of them is furnished in a distinctive style. I have greatly enjoyed the time I’ve spent in each one learning and meeting people.”

Song, Yuan
2018 Graduate; currently pursuing a PhD at Columbia University, USA

“The Joint Bachelor’s Degree Program has allowed me to be engaged in two elite universities in two fascinating cities. Columbia University sees the entire city as its campus. Things that I can do in New York are far beyond my imagination. I’ve met every actor in the play Sleep No More inside the 5-storey McKittrick Hotel. I’ve spent weeks in the Metropolitan Museum of Art to admire history. I have shaken hands with the current World Chess Champion, Magnus Carlsen. New York is a place that is full of possibilities, no matter who you are.

All the assignments that I found challenging [at Columbia] were more inclined to theoretical fields, designed to enhance my understanding of physics, which created a balance comparing to those more experimentally-focused courses at CityU. Having resources at both universities available, I became much more confident in the field of physics.”

Wu, Peilin
2019 Graduate; subsequently pursued an MSc degree in Theoretical Physics at King’s College London, UK

“Studying in the Joint Bachelor’s Degree Program was an extremely rewarding journey… both academically and personally. The biggest lesson that I’ve learned [was the] personal paradigm shift after the expansion of my horizon. Every conversation with a great mind around the campus turned out to be inspiring. Even though a two-year study [at Columbia] might be a bit short in time, it was well enough to peek through the cultural, social, political and religious differences, and those discrepancies really lifted me out of the normal plane of comprehension in a local perspective and granted me a glimpse of the whole picture.”
Undergraduate plus Taught Postgraduate Degree Programme (BSc Physics + MSc Applied Physics)

The Programme aims to nurture elite students through integrated learning. Undergraduate students can benefit from learning research elements normally taught at the postgraduate level. Upon successfully completing the course requirements, students would receive two separate degrees, i.e. a Bachelor of Science in Physics degree and a Master of Science in Applied Physics degree.

For more information, please visit our website: https://www.cityu.edu.hk/phy/ug-plus-tpg

Global Research Enrichment and Technopreneurship (GREAT)

GREAT aims to nurture students who are interested in pursuing a career in scientific research or starting business ventures that involve the use of new scientific discoveries and innovative technologies.

For more information, please visit the website of College of Science: https://www.cityu.edu.hk/csci/academic-programmes/undergraduate-programmes/global-research-enrichment-and-technopreneurship-great

Note: The programmes mentioned in page 4-6 are options under the CityU Talents Programme (HK TECH Tiger) currently available for the BSc Physics students.
Early Research Exposures as Young Scientist

Student Connect - Departmental Tea Gathering

Short Course in Laser by Prof Alain Aspect, the 2010 Wolf Prize Laureate in Physics

Visiting PCCW MCX10 Data Center

Mainland Enterprise Visit

PhD Annual Symposium

Celebration of students' and faculties' achievements

Research Showcase by Students

Overseas Speakers

Seminars by Prestigious Scholars

Short Course in Laser by Prof Alain Aspect, the 2010 Wolf Prize Laureate in Physics

Departmental Seminar by Prof Serge Haroche, the 2012 Nobel Laureate in Physics

Other Activities

Undergraduate Research Attachment Scheme

Students Support Network

Internship Opportunities

Each new student will be paired with one Academic Advisor and one Peer Consultant.

PhD Annual Symposium

Student Connect - Departmental Tea Gathering

Student Ambassadors

Career Talk

Visiting PCCW MCX10 Data Center

Visiting HKT Network Operating Centre

Industrial Exposures

Besides the internship opportunities offered by the College, Physics Department offers final year project attachment to medical physics departments in local hospitals.

Each new student will be paired with one Academic Advisor and one Peer Consultant.

Internship Opportunities

PhD Annual Symposium

Student Support Network

Internship Opportunities

Besides the internship opportunities offered by the College, Physics Department offers final year project attachment to medical physics departments in local hospitals.

Each new student will be paired with one Academic Advisor and one Peer Consultant.
MSc in Applied Physics

This programme provides post-graduate level training in applied physics with highly marketable professional skills in the sub-fields of Bio-medical Physics, Energy Materials Physics and General Advanced Physics. In addition to an advanced physics education, graduates will have solid trainings on applying physical principles to practical problems in specific related professions.

The training and knowledge provided are suitable for employment as medical technical specialists as well as engineers/researchers in electronic and renewable energy industries in Hong Kong, China and other Asian countries. Graduates of this programme will have the flexibility to seek employment in the industry as well as pursuing Ph.D. studies in a broad range of related fields (e.g. Physics, Materials Science, Electrical Engineering, and Mechanical Engineering).

The programme aims to enable students to:
- Acquire an extensive and in-depth physical knowledge of and analytical skills in the various applied physics and engineering fields.
- Develop the ability to apply the knowledge of applied and engineering physics to generate creative and ethical solutions in the working environment.
- Communicate effectively with applied and engineering physics related professionals.
- Apply textbook theories to applied and engineering physics problems.
- Design and conduct experiments, as well as to critically analyze and interpret data.
- Identify, formulate, solve engineering or scientific problems and generate new ideas in the relevant subfields of applied and engineering physics.
- Develop necessary skills to present research findings in a logical manner to the scientific community.
- Recognize the need for, and an ability to engage in life-long learning.

Admission Requirements
- Satisfy the General Entrance Requirements of the University; and
- Normally have an undergraduate degree in a relevant science or engineering discipline; and
- Fulfill the English Proficiency Requirements.

For further details about entrance requirements and application procedures, please visit the website of our Chow Yei Ching School of Graduate Studies: https://www.cityu.edu.hk/pg/taught-postgraduate-programmes

Core Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Specialized Area</th>
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</thead>
<tbody>
<tr>
<td>PHY5501</td>
<td>Modern Characterization Techniques for Materials Physics</td>
<td>All areas</td>
</tr>
<tr>
<td>PHY6501</td>
<td>Advanced Instrumentation and Measurement Methods for Experimental Physics</td>
<td></td>
</tr>
<tr>
<td>PHY6502</td>
<td>Advanced Computational Methods</td>
<td>General Advanced Physics</td>
</tr>
<tr>
<td>PHY6503</td>
<td>Mathematical Methods for Scientists and Engineers</td>
<td>General Advanced Physics</td>
</tr>
<tr>
<td>PHY6504</td>
<td>Physics at Nanoscale</td>
<td>Biomedical Physics</td>
</tr>
<tr>
<td>PHY6505</td>
<td>Modern Topics in Engineering and Applied Physics</td>
<td>General Advanced Physics</td>
</tr>
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Elective Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Specialized Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHY6180</td>
<td>Modern Scattering Methods in Materials Science</td>
<td>All areas</td>
</tr>
<tr>
<td>PHY6251</td>
<td>Advanced Quantum Mechanics</td>
<td>General Advanced Physics</td>
</tr>
<tr>
<td>PHY6252</td>
<td>Statistical Mechanics</td>
<td>General Advanced Physics</td>
</tr>
<tr>
<td>PHY6253</td>
<td>Introduction to Biophysics</td>
<td>Biomedical Physics</td>
</tr>
<tr>
<td>PHY6254</td>
<td>Fundamentals of Laser Optics</td>
<td>General Advanced Physics</td>
</tr>
<tr>
<td>PHY6506</td>
<td>Advanced Electrodynamics</td>
<td>General Advanced Physics</td>
</tr>
<tr>
<td>PHY6521</td>
<td>Advanced Solid State Physics</td>
<td>General Advanced Physics</td>
</tr>
<tr>
<td>PHY6522</td>
<td>Advanced Imaging Physics</td>
<td>Biomedical Physics</td>
</tr>
<tr>
<td>PHY6523</td>
<td>Advanced Nuclear Medicine Physics</td>
<td>Biomedical Physics</td>
</tr>
<tr>
<td>PHY6524</td>
<td>Advanced Radiotherapy Physics</td>
<td>Biomedical Physics</td>
</tr>
<tr>
<td>PHY6527</td>
<td>Environmental Physics</td>
<td>Energy Materials Physics</td>
</tr>
<tr>
<td>PHY6528</td>
<td>Advanced Research in Applied Physics</td>
<td></td>
</tr>
</tbody>
</table>

Note: Course offering subject to change. Please visit our Department’s website for the latest full list of courses.

Research Opportunity
Highly motivated students may be eligible to enrol in a 9 credit course “Advanced Research in Applied Physics” to acquire necessary skills for carrying out independent research in applied physics. Students will have the valuable opportunity to work with faculties on cutting edge research in condensed matters, quantum information, energy materials and biomedical physics.

Professional Career Prospects
- Medical Technical Specialists
- Renewable Energy Engineers
- Mechanical and Electronic Engineers
- Process and Project Engineers in the Semiconductor Industry
- Researchers in Materials Research Institutions
- Further Studies

For further details about our programme structure and other information, please visit our website: http://www.cityu.edu.hk/phy/taught-postgraduate
Doctor of Philosophy (PhD)/ Master of Philosophy (MPhil)

The Department supports both MPhil and PhD studies in the following areas (but not limited to):

- Theoretical and Computational Physics
- Spectroscopy and Imaging
- Atomic, Molecular, and Optical Physics
- Quantum Materials
- Soft Matter and Biophysics

For further details about the programme structure and other related information, please visit our website: http://www.cityu.edu.hk/phy/research-degree

How to apply?

Entrance Requirements

Candidates for the PhD degree should:
- hold a Bachelor’s degree with first class honours (or equivalent qualification) in Physics or related fields from a recognised university; or
- hold a Master’s degree (or equivalent qualification) in Physics or related fields from a recognised university; or
- hold a higher research degree (or equivalent qualification) in Physics or related fields from a recognised university; or
- be a current MPhil student in Physics or related fields in the University who is seeking transfer to a PhD programme.

Candidates for the MPhil degree should hold a relevant bachelor’s degree with first or second class honours (or equivalent qualification) from a recognised university.

Equivalent qualifications mentioned above include relevant professional qualifications and other scholarly achievements recognised by the University.

Applicants from an institution where the language of teaching is not English should satisfy the minimum English proficiency requirements specified by both the University and the College.

Application procedures

Students interested in related field should contact and discuss with their potential supervisors. The applicant is advised to obtain the consent of one of the academic staff members to be his/her supervisor before submitting the application.

For further details of application procedures, please visit the website of Chow Yei Ching School of Graduate Studies: https://www.cityu.edu.hk/pg/research-degree-programmes

Hong Kong PhD Fellowship

Applicants who could demonstrate outstanding qualities of academic performance, research ability / potential, communication and interpersonal skills, and leadership abilities are encouraged to apply for admission through “Hong Kong PhD Fellowship Scheme”.

For further details about this scheme, please visit https://www.cityu.edu.hk/pg/hong-kong-phd-fellowship-scheme

Financial Support and Scholarships

Financial Aid
- Postgraduate Studentship
- Research Tuition Scholarship
- Conference Grant
- Research Activities Fund
- Chow Yei Ching School of Graduate Studies Entrance Scholarships
- Government Grants and Loans
- External Financial Awards/ Assistance

Awards and Scholarships
- Chow Yei Ching School of Graduate Studies Scholarships
- Outstanding Academic Performance Award
- Outstanding Research Thesis Awards
- Chow Yei Ching School of Graduate Studies Outstanding Doctoral Research Award

For further details about scholarship, financial aid & fees, please visit https://www.cityu.edu.hk/pg/research-degree-programmes/scholarships-financial-aid-and-fees

Research Areas

Research focus/expertise in the Department include:

Theoretical and Computational Physics
Condensed matter theory, computational solid state physics, computational electrodynamics, computational chemistry, computational biology physics, quantum computation and information, quantum simulation with cold atoms

Spectroscopy and Imaging
Sophisticated experiments involving quantum beams such as synchrotron x-ray, neutron, electron, coherent light, and NMR, the structure and phase transition in glass and liquids, Boson peak and the dynamics of glass and liquids, quantum interactions such as spin-orbital coupling in multiferroics

Atomic, Molecular, and Optical Physics
Mechanism of noise and decoherence, open quantum system and quantum entanglement, non-equilibrium physics in AMO system, opto-mechanics, photonic crystals and metamaterials

Quantum Materials
Topological quantum computing and Majorana fermions, Dirac and Weyl semimetals, topological and dynamical phenomena, Bose-Einstein condensation, spin-orbit coupling, quantum Hall Effect, transport phenomena, superconductivity, frustrated magnetism, topological superconductors, 2D materials, heterostructures and interfaces

Soft Matter and Biophysics
Dynamics of protein and subcellular processes, emergent phenomena in live cells, non-equilibrium mechanisms in active living matter, biological networks, biological and clinical experiments, novel physics-based data acquisition protocol, instrumentation in biomedical imaging, radiation biophysics, ion-track technology

To learn more about our research, please visit our website: http://www.cityu.edu.hk/phy