

Physics (PHYS)

Program Overview

Physics encompasses everything from the tiniest elementary particle to the ultimate fate of the universe, and provides the foundation for all modern science and engineering. Students will learn about exciting topics ranging from quantum computing, superconductivity and nanotechnology to quarks and black holes.

The program offers two options:

- **Honors Physics Option** - This option is intended for students planning to enter graduate school after their UG studies at HKUST. The curriculum provides a strong foundation of courses and requires students to complete a research project and thesis in their final year.
- **Physics and Mathematics Option** - This option is intended for students with a strong interest in both physics and mathematics. It is particularly useful for students who plan to pursue future studies in theoretical physics.

The Physics program provides students with both depth and breadth in their studies. Students who take this program can build a solid and broad background in physics and receive rigorous training in analytical reasoning and hands-on experimental skills. It prepares students for all science-related careers, or for further studies in physics and related fields.

Career Prospects

Since students are rigorously trained in generic skills of analytical and problem solving skills, they are well prepared to take up jobs with diverse natures in both the government and private sectors. Students can work in the fields of education, research and development, technical sales, forensic science, medical industry, commerce, banking, etc.

Introduction

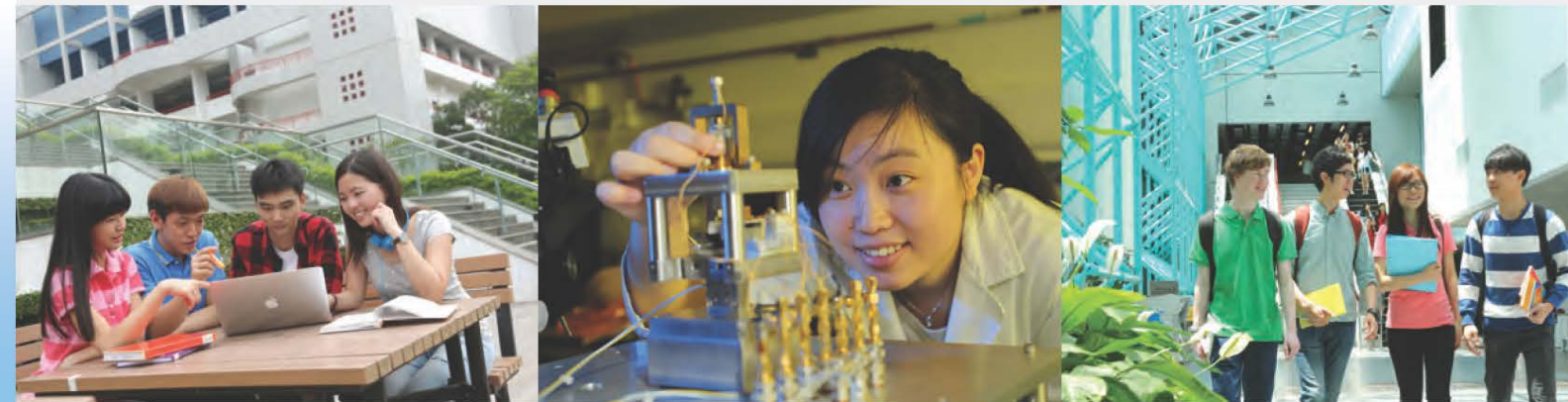
Physics is the science that explores the fundamental laws of nature and their consequences. It provides the foundation for other sciences and engineering. The HKUST Department of Physics, due to its strength in research, has been consistently ranked among 50-100 in the world and No.1 in Hong Kong for many years. The 36 professors (10 of whom, including George Smoot, Noble Laureate in Physics 2006, are fellows of the American Physical Society) pursue research at the frontier of cosmology and high-energy physics, cold atoms and quantum optics, nanoscience, condensed matter physics, photonic and metamaterials, soft materials and biophysics, computational physics and information theory.

The Physics undergraduate program provides students with rigorous training in the broad areas of physics. Together with various undergraduate research opportunities and scholarships, the program prepares students for further studies in physics and related fields. For students who intend to pursue career in industry, education, R&D, technical sales, commerce and banking sectors, the program offers a flexible curriculum catering for their needs.

Program and Curriculum

The BSc in Physics program provides a solid physics curriculum for students with different career aspirations. For students aiming for further studies such as PhD in physics or related fields, they have the opportunity to take advanced courses to build a solid foundation and are encouraged to seek opportunities in undergraduate research. For students with other career goals, the curriculum provides training of analytical and computational skills that will help the students meet challenges in all sectors of society. The curriculum is flexible so that a significant fraction of our students choose to pursue a minor in other subjects in addition to the major degree in physics.

The basic program offers required courses in classical mechanics, electromagnetism, quantum mechanics, statistical mechanics and laboratory courses and many elective courses including Big Bang Cosmology and Inflation, Computational Physics, Lasers and Optical Electronics. On top of the basic program, students who complete additional required courses with strong academic performance will graduate with the following options or track:



■ **Applied Physics Option:** for students planning for a career in industry-related jobs. Students take additional courses in subjects such as material science and optics.

■ **Physics and Mathematics Option:** for students choosing theoretical physics who benefit from extra training in mathematics.

■ **Honors Physics Option:** for students aiming to pursue further studies in PhD programs. Students will take honors versions of courses such as quantum mechanics and electromagnetism. Students are also required to complete a capstone research project.

■ **International Research Enrichment track:** for students admitted into the School of Science International Research Enrichment program. Apart from taking honors versions of fundamental physics courses, students are also required to participate in research projects in foreign universities.

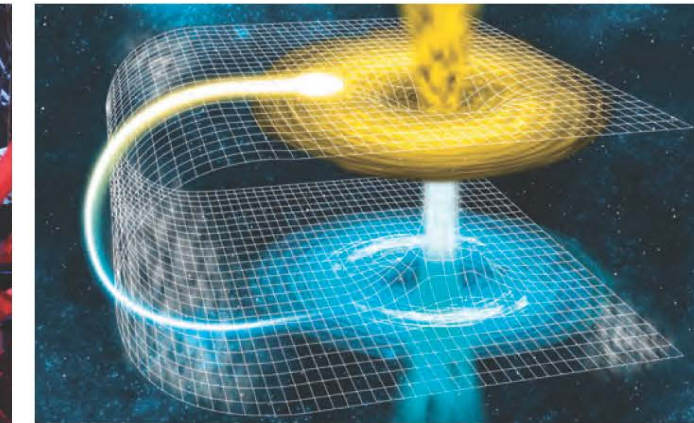
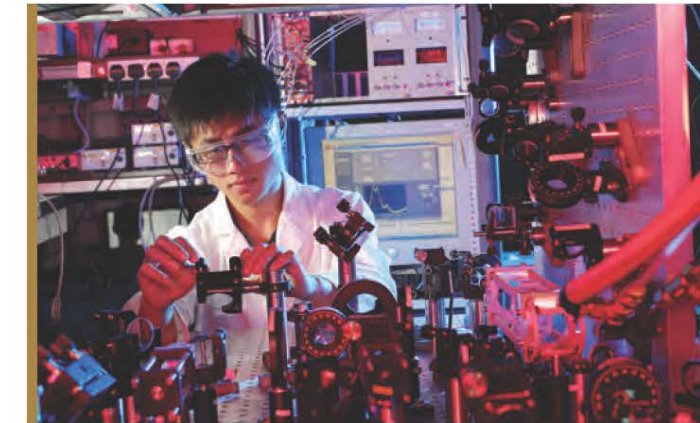
Minor Program in Astrophysics and Cosmology:

This minor program includes new courses in the areas of particle physics, stellar astrophysics and big bang cosmology, most of which are taught by our faculty in the newly-formed Particle Theory and Cosmology group.

Minor Program in Biological Physics

Offered jointly with the Division of Life Science, this program aims to train students to understand biological phenomena from a quantitative point of view and to work effectively in areas that require knowledge of both physics and biology.

Research Highlights



The Particle Theory and Cosmology (PTC) group includes the faculty members working on various problems related to the evolution of the universe from the past to the future. They also study the most fundamental particles in the universe and the interactions between them. The PTC group is recently strengthened by the addition of Prof. George Smoot who won the Physics Nobel Prize in 2006 for his measurement on the cosmic background radiation of the universe.

The Quantum Materials group includes more than ten experimentalists and theorists, studying novel materials such as graphene and other atomically thin materials, semiconductors, topological materials and superconductors. Materials are grown in vacuum conditions and then usually studied at temperatures close to absolute zero degree to probe their quantum properties.

The Soft Matter and Biophysics group consists of six faculty members addressing fundamental questions concerning a broad range of soft and biological systems. These include the nature of colloidal crystals and glasses, interactions between vesicular and membrane proteins based on nanometer-precision fluorescence microscopy, mechanisms of neuronal death, fluctuations in a contact line, dynamics of polymers at an interface and under nanoconfinement, charge separation phenomenon at a solid-liquid interface, and fundamental science questions about water, carbon cycle and clean energy. The experimental works often involve building new instruments or developing new sample fabrication methods. Some theoretical works employ the most powerful supercomputers in the world.

Career Perspectives

The physics curriculum helps students develop a broad range of knowledge and skills, including problem solving, reasoning, numeracy, technical, communication, and information and technology. As such, our graduates have set foot in a variety of careers in both academic and non-academic fields. The majority of the physics graduates who desired to pursue a higher degree were accepted into Ph.D programs at the top universities around the world, including Harvard, Princeton, Cornell, Stanford, Columbia, UC San Diego, etc. Our graduates who decided to pursue a career after graduation found employment in the education, engineering & industry, information and technology, marketing, finance, and banking sectors, etc.



Sharing of our graduates

"I have always been passionate in looking for creative solutions to solve different problems. Starting my business is like a science experiment - you identify a problem, construct a hypothesis, experiment different possibilities. You must have perseverance to strive for the best solution!"

Francis KWOK
Co-Founder & Chief Executive Officer, Radica Systems Limited

"My friend introduced the career of Medical Physicist to me, which I can apply physics in the healthcare setting. My career brings me a lot of satisfaction, as my expertise ensures that the cancer patients can receive quality radiotherapy treatment, with adequate treatment design and proper equipment."

Tony KONG
Medical Physicist, Hong Kong Sanatorium & Hospital

"You are free to choose your own curriculum in the Department of Physics of The Hong Kong University of Science and Technology. I took many advanced courses in physics including some courses for postgraduate. It broadened my horizon in Physics and sparked my interests in Physics."

You have chances to participate in research and learned from the world-class researchers in the Department of Physics of The Hong Kong University of Science and Technology. I started my research in my first semester. Research is challenging and time consuming, meanwhile, it is full of creativity, exploration and enjoyment. I learnt how to conduct research and summarize the results into research papers. These skills are extremely useful in my future careers."

LAM Ho Tat
International Physics Olympiad gold medalist (2012)
Ph.D student, Princeton.