Department of Physics

Head of Department:

Tai-Kai NG, Professor of Physics

The mission of the Physics Department is captured by the triangle of teaching, research, and innovation. Physics is the science that deals at the most fundamental level with matter and energy, their interactions, and their transformation. It presents major challenges to the human mind and provides the foundation for engineering and other sciences. By pursuing research at the frontier of knowledge and innovation at the cutting edge of technology, the ultimate goal of the physics faculty is to preserve and nurture a sense of wonder about the natural world, and to impart it to the students as a driving motivation for learning.

The Department concentrates its resources on condensed matter physics with potential relevance to the technological industry. There is a strong offering of core subjects in the fundamental fields of physics. Undergraduates are encouraged to select areas of concentration in the traditional or applied subjects of physics. Faculty and postgraduate research focuses on optical, condensed matter and statistical physics, and includes physics of lasers, solid state, mesoscopic systems, devices, materials, thin films, surfaces, interfaces, liquid crystals, polymers and composites. A focused area of interdisciplinary collaboration that has emerged over the years is nanomaterials and nanotechnology.

A number of central service facilities and interdisciplinary research institutes provide support for the Department's research programs. Particularly relevant are the Materials Characterization and Preparation Facility and the Nanoelectronics Fabrication Facility. The Department is closely linked with William Mong Institute of Nano Science and Technology of HKUST. State-of-the-art facilities for large scale and intensive scientific computation include optical-fibre distributive networks, various workstations, and a parallel processing platform of clustered PCs. The Department has laboratories for laser physics, photonics, new thin-film materials, surface/ interface studies, solid state properties, polymers and liquid crystals, nanostructured layers and clusters, and non-linear dynamics.

UNDERGRADUATE PROGRAMS

Two Bachelor of Science degree (BSc) programs are offered. The BSc program in Physics prepares students for a science-related career, such as sales and technical support in the technology sector, or for further studies in physics and related subjects. The BSc program in Applied Physics, with options in Management Science and Science and Technology, is intended for students with interests in the more applied areas of physics. Upon graduation, they may enter employment in the government and private sectors or pursue postgraduate studies.

Curriculum

Description of the curriculum and courses for the following programs are presented online at *http://publish.ust.hk/calendar :*

- Bachelor of Science (BSc) in Physics
  - Pure Physics Option
  - Physics and Mathematics Option
- Bachelor of Science (BSc) in Applied Physics
  - Management Science Option
  - Science aned Technology Option
- Undergraduate Minor Program in Physics

POSTGRADUATE PROGRAMS AND RESEARCH

As a fundamental science, physics presents major challenges to the human mind and the principles of physics serve as a foundation for engineering and other sciences. The new technologies that physics has spawned are so ingrained in our civilization that their scientific origins are often overlooked. The discoveries of the principles of solid-state transistors which led to the miniaturization of electronic devices, of atomic hyperfine structure and superconductivity which made possible nuclear magnetic resonance (NMR) imaging, and of the laser which underpins present-day information technology are but a few examples. In addition to directly generating technological innovation, physics also indirectly supports progress throughout society by providing tools with which people in other fields create innovations.

Postgraduate programs aim to provide students with a solid grounding in broad physics principles and techniques, an ambience for creative and innovative activities, and opportunities for cross- and inter-disciplinary research. Of all areas, optical physics and condensed matter physics (CMP) have the greatest impact on our daily lives. It is thus natural that the Department places emphasis on these fields. Research programs include both experimental and theoretical aspects of linear and non-linear optics, low-dimensional systems, mesoscopic systems, new materials, microstructured and nanostructured devices, and surfaces and interfaces. A program of regular visiting faculty members and scholars in other specialties helps ensure a breadth of coverage.

The Department of Physics offers postgraduate programs leading to the degrees of Master of Philosophy (MPhil) and Doctor of Philosophy (PhD).

Applicants for postgraduate programs in physics are expected to hold a BSc degree in Physics or a related science or Engineering discipline. Selection for admission will be based on academic records and available results of standardized tests in physics, proficiency in the English language, a one-page essay on reasons for pursuing postgraduate studies, two letters of reference, and a personal interview at the discretion of the Department.

Curriculum

Description of the curriculum and courses for the following programs are presented online at *http://publish.ust.hk/calendar :*

Research Postgraduate Programs:
- Master of Philosophy (MPhil) in Physics
- Doctor of Philosophy (PhD) in Physics

FACULTY AND THEIR RESEARCH INTERESTS

Dr William M. W. Mong Chair Professor of Nanoscience

Ping SHENG (沈 平), BS *California Inst of Tech*; PhD *Princeton*

Research Interests: Physics of disordered materials; complex fluids; liquid crystals; electrorheological fluids; wave localization and multiple scattering; physics of meso-systems and nanomaterials.

Chair Professors

Che-Ting CHAN (陳 子 亭), BSc *Hong Kong*; PhD *Univ of California, Berkeley*
(Director of William Mong Institute of Nano Science and Technology)

Research Interests: Electronic, structural and other physical properties of matter; photonic band gaps; metamaterials; nanomaterials.

Michael M. LOY (雷 明 德), BS, PhD *Univ of California, Berkeley*
(Acting Dean of Science, and Acting Head of Division of Life Science)

Research Interests: Nonlinear optical propagation effects; two-photon coherent transients; nonlinear optical studies of surfaces; state-selective studies of molecule-surface interactions.

George K. L. WONG (王 克 倫), BS, PhD *Univ of California, Berkeley*

Research Interests: Nonlinear optics; optical properties of quantum wells and superlattices; nanostructures of semiconductors, ferroelectrics, polymers and organic materials.

Professors

Michael S. ALTMAN (歐 德 孟), BA *Pennsylvania*; ScM, PhD *Brown*

Research Interests: Surface physics; diffusion and growth, surface step dynamics; structure, magnetism and quantum electronic properties of ultrathin films; electron spin physics; low energy electron microscopy and diffraction; field emission microscopy and spectroscopy.

Pak-Wo LEUNG (梁 伯 和), BSc *Hong Kong*; PhD *Cornell*

Research Interests: Computational condensed matter physics; low-dimensional strongly correlated fermion systems; high temperature superconductivity; application of large scale cluster computing in condensed matter physics.

Tai-Kai NG (吳 大 琪), BSc *Hong Kong*; PhD *Northwestern*
(Head of Department, and Associate Dean of Science)

Research Interests: Mesoscopic physics; non-equilibrium quantum mechanical phenomena; quantum spin systems; strongly correlated metals, Topological matters.

Philip Iam-Keong SOU (蘇 蔭 強), BS *Jinan*; MS, PhD *Univ of Illinois, Chicago*

Research Interests: Growth mechanisms of MBE (Molecular beam epitaxy) - grown thin films and nanostructures; Physics of II-VI semiconductor and metallic nanostructures; structural, transport and magnetic properties of thin films and nanostructures; device physics of UV and visible optoelectronic structures.

Wing-Yim TAM (譚 永 炎), BS *Chinese Univ of Hong Kong*; PhD *Univ of California, Santa Barbara*

Research Interests: Nonlinear dynamics and complex systems; cellular structures; complex fluids (electro-rheological fluids); photonic band gap materials; holographic lithography.

Zi-Kang TANG (湯 子 康), BS *Hangzhou*; MS, PhD *Tohoku*

Research Interests: Physics and applications of carbon nanotubes and other nanostructured materials; ZnO UV light emitting thin films.

Penger TONG (童 彭 爾), BSc *Northeastern*; MSc, PhD *Pittsburgh*

Research Interests: Non-equilibrium dynamics and soft condensed matter physics, including experimental studies of turbulent thermal convection, interactions and structure formation in colloidal suspensions, interfacial dynamics, and biophysics.

Ning WANG (王 寧), BSc, PhD *Univ of Sc & Tech, Beijing*
(Associate Director of Materials Characterization and Preparation Facility)

Research Interests: Materials physics; nano science and technology; low dimensional structure fabrication, properties and applications; materials characterization.

Xiang-Rong WANG (王 向 榮), BA *Wuhan*; MA, PhD *Rochester*

Research Interests: Statistical physics; theoretical condensed matter physics; quantum computation.

Wei-Jia WEN (溫 維 佳), BS, MS *Chongqing*; PhD *Inst of Physics, Chinese Acad of Sc*

Research Interests: Soft condensed matter physics; electrorhelogical (ER) and magnetorheological (MR) fluids; field-induced pattern and structure transition; thin film physics.

Michael Kwok-Yee WONG (王 國 彝), BSc *Hong Kong*; MS, PhD *Univ of California, Los Angeles*

Research Interests: Physics of complex and disordered systems; optimization; multi-agent systems; econophysics; neural networks; machine learning.

Zhi-Yu YANG (楊 志 宇), BS *Fudan*; PhD *Purdue*

Research Interests: Optical properties of nanostructured materials; local resonant sonic crystal; polymer relaxation dynamics; semiconductor interfaces and quantum structures.

Zhao-Qing ZHANG (張 昭 慶), BS *Tunghai*; PhD *Pennsylvania*

Research Interests: Many-body theory; fractals; electronic structure and transport properties in disordered systems; wave propagation and localization in random media; mesoscopic physaics; photonic and phononic crystals; metamaterials for electromagnetic and elastic waves.

Senior Lecturer /Associate Professors

Ho Bun CHAN (陳 浩 斌), BS *Princeton*; PhD *Massachusetts Inst of Tech*

Research Interests: Microelectromechanical systems, Casimir forces, activated switching and critical kinetic phenomena in nonequilibrium systems, micromechanical magnetometers, surface plasmons polaritons, evanescent field coupling in subwavelength metallic structures.

Bradley A. FOREMAN (霍 文 彬), BS, MS *Missouri-Rolla*; PhD *Cornell*

Research Interests: Theoretical semiconductor physics: electrons and phonons in low-dimensional systems; effects of strain in optoelectronic devices; envelope-function theory; high-speed semiconductor lasers; fundamental concepts of quantum mechanics.

Kwok-Kwong FUNG (馮 國 光), BS *Cornell*; MS, PhD *Bristol*
(Director of Materials Characterization and Preparation Facility)

Research Interests: Characterization of crystal structures and crystal defects by transmission electron microscopy; epitaxial passive oxide films on nano-praticles of metals; structural colors in insects.

Nian LIN (林 念), BS *Tongji*; PhD *Hong Kong Univ of Sc & Tech*

Research Interests: Supramolecular self-assembly at surfaces, fabrication and characterization of 2-dimensional coordination nanostructures, single atomic/ molecular studies with low-temperature scanning tunneling microscopy/ spectroscopy.

Kwok-Yip SZETO (司 徒 國 業), BA(Eng) *Toronto*; MA *State Univ of New York, Stony Brook*; PhD *Massachusetts Inst of Tech*

Research Interests: Pattern formation in complex systems; networks; bioinformatics; evolutionary computation; frustrated spin systems; nonlinear forecasting; artificial life; quantum algorithms.

Jiannong WANG (王 建 農), BS *Xi'an Jiaotong*; MS *Inst of Semiconductors, CAS*; PhD *Bristol*

Research Interests: Physics of semiconductor low-dimensional structures; magnetotransport, optical properties and fabrication of semiconductor nanostructures; novel device application.

Kam-Sing WONG (黃 錦 聖), BSc *London*; DPhil *Oxford*

Research Interests: Ultrashort pulse lasers; time-resolved spectroscopy; semiconductor and polymer physics.

Assistant Professors

Shengwang DU (杜 勝 望), BS *Nanjing*; MS *Peking*; PhD *Colorado, Boulder*

Research Interests: Atomic, molecular and optical physics; light-matter quantum interaction; quantum optics; quantum information and communication; nonlinear optics; atom optics; laser cooling and trapping; Bose-Einstein condensation; atom chip; superconducting electronics.

Yilong HAN (韓 一 龍), BS *Peking*; PhD *Chicago*

Research Interests: Soft matter physics; statistical mechanics; digital video microscopy. Interactions, dynamics and phase behavior of colloids; pattern formation; geometrical frustration.

Rolf LORTZ (洛 鶴 夫), MS, PhD *Karlsruhe*

Research Interests: Thermodynamic and transport properties of superconductors and materials with novel electronic properties under extreme conditions: high pressure and strain, high magnetic fields, micro- and nanoscopic samples, thin films.

Visiting Assistant Professors

Tian Wen CHEN (陳 天 問), BSc, MPhil, PhD *Chinese Univ of Hong Kong*

Chi Wai LAI (黎 志 偉), BSc, MPhil *Chinese Univ of Hong Kong*; PhD *British Columbia*
