

HKU SCIENCE FACULTY TAKES THE LEAD IN A NEW ERA OF SCIENCE EDUCATION

The Faculty of Science is introducing a new curriculum structure that entails a major change in the admission policy and the introduction of a "common first year". Beginning in 2007, secondary school students interested in pursuing undergraduate study in any of the science subjects at HKU may apply for admission into the new 6901 BSc Programme. All science students will follow a uniform curriculum structure during their first year. Students may decide to major in a specific subject upon admission or they may decide after the completion of their first year.

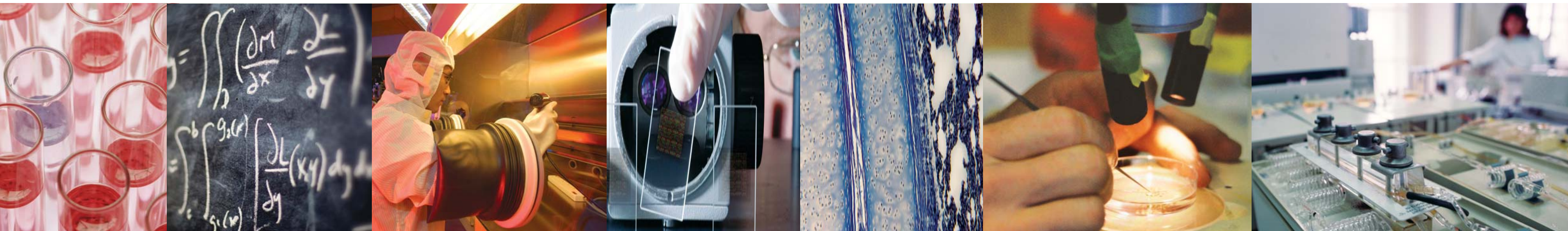
FROM THE EDITOR

Dear readers,

The publication of the second issue of science@HKU coincides with a very important change in the Faculty of Science here at HKU. Instead of applying to individual programmes, Form 7 students may from now on simply apply to the 6901 Bachelor of Science programme at HKU. In addition, students can major and minor in a variety of subject areas at HKU. For instance, one may graduate with a BSc majoring in physics and minoring in earth sciences. And if one works hard enough, one may graduate with a BSc double major in, say, biochemistry and biology. This arrangement gives students the flexibility to choose their theme of study. You will find out more about this new arrangement in the newsletter.

To help protect our environment, you are encouraged to download this newsletter in PDF format from <http://www.hku.hk/scinews>. Last but not least, you could get a HK\$50 book token by correctly identifying the chemical compound on page 6. There, you will also find the answer and the winners of the quiz in our last issue of science@HKU.

Yours sincerely,
Dr H F Chau
Chief Editor



This change in the admission policy and the introduction of a common first year represents arguably the most sweeping change in the history of the development of the science curriculum at HKU. In the reformed curriculum, students will enjoy a greater flexibility in their programme choices. The reform was also implemented to prepare the Faculty for the transition to the 334 new academic structure to be in operation from 2009.

The reform has also opened up opportunities for students to “try out” particular courses before they commit themselves to a specific major, as students may now wait until the end of Year 1 to decide on their major. Also, the switching of majors has now become easier and students may even undertake a major in a subject they might not have been given the chance to study in their secondary school.

All of these options are made possible as the required number of core courses for a student's major is 72 credits,

equivalent to 12 six-credit courses. For reference, the graduation requirement for HKU is a minimum of 180 credits. These requirements have made it possible for students to undertake a minor or a second major, which can be in another science subject or in a non-science field in another faculty. This is particularly appealing to students who desire a broad and versatile training. And those students who want to remain specialized in a specific discipline can still opt to take most courses from just one discipline.

The common first year serves as a prelude to the future four-year curriculum in which university students will be expected to do more general courses during the first two years before moving onto the advanced level courses in studying for their major. This reform is seen to be a step towards training students who are better prepared to cope with the changing needs of society.

Science Majors Revamped

Code-named “14-in-One”, the Bachelor of Science (6901) degree programme allows students in the Faculty of Science to select any of the following 14 science majors during their first year:



Biochemistry
Biology
Biotechnology
Chemistry
Earth Sciences
Ecology & Biodiversity
Environmental Protection
Food & Nutritional Science
Materials Science
Mathematics
Mathematics/Physics
Physics
Risk Management
Statistics

New majors in Astronomy and Atmospheric Science are also being considered. No quotas are set for individual majors. Although this may create an element of uncertainty as to

the number of students who will opt to major in a certain subject, this policy is in line with international practice.

Some students may have already made up their mind as to what major they will follow, long before they are admitted to study science. However, other students may want to explore multiple options before they commit to a particular major. We understand course selection is very important. Our course selection advisors will advise students on the choice of major, course requirement and possible major-minor combination that best suit their interests, abilities and career aspirations.



Capstone Experience Required for HKU Science Students

Science students are now required to complete some forms of experiential learning prior to their graduation. Coined “capstone learning”, this extraordinary learning experience is intended to ensure that all science students have acquired some experience where they are required to set their own learning goals and design their own learning plan; or gain insights into the complexities and challenges of the real work environment; or develop a greater appreciation of a different culture.



To fulfil this capstone experience, students must demonstrate they have participated in at least one form of extraordinary learning experience. This may be an exchange programme in an overseas university, a final-year project, an internship, an overseas field camp or a professional preparation programme.

For this requirement, students are required to gain an equivalent of at least six credits that will then appear in their transcript. This is a move to encourage the use of multiple learning pedagogies and recognize the importance of a total approach to learning that considers the development of attitude and skills alongside knowledge.



Symposium: “A New Era of Science Education: From University Admission Policy to New Curriculum Structure”

In light of the introduction of the Faculty's new admission policy in 2007, a seminar titled “A New Era of Science Education: From University Admission Policy to New Curriculum Structure”, co-organized by the Faculty of Science; the Hong Kong Association for Science and Mathematics Education (HKASME); and the Hong Kong Association for Careers Masters and Guidance Masters (HKACMGM), was held for Science and Mathematics teachers, as well as careers masters from 207 schools.

On July 6, 2006, more than 230 secondary school teachers met at HKU to exchange ideas regarding the new admission policy. Mr Alex Wong of the HKASME pointed out that there are no definite or “one-size-fits-all” ways of making sure students are better prepared for upcoming challenges. However, the way teachers prepare their students should be flexible enough to cater for their different backgrounds and attitudes, and that partnerships with the government, other

schools, parents and other community parties may help to bring in additional resources or new thoughts in preparation for the New Senior Secondary Science Curriculum.

Dr Esther Ho of the HKACMGM appreciated the flexibility of the new admission policy and felt that it is very important for careers masters to understand the new practices so that they can give appropriate guidance to students. However, she did ask, “How would it be different from the study of Integrated Science at the secondary level if students were to just taste a bit of this and a bit of that without having them really concentrate on a disciplinary study?” Professor Allan Cheung of the Faculty of Science responded that the aims of such a new curriculum structure were to open up learning opportunities for all students who have an interest in Science. And that through such learning opportunities, the students could discover their real talents for future development. Any students who have a genuine interest in a particular discipline could follow it by taking higher degrees.



新高中課程之我見

數學系蕭文強教授

前言：去年十月，香港大學理學院和香港數理學會合辦了一個新高中理科課程研討會。會上邀請得兩位中學校長、理科教師、教統局課程組代表及三位理學院教授，分別發表他們對新高中理科課程的意見。

香港大學理學院數學系名譽教授蕭文強教授在研討會中提出了三點看法，分列如下：

一）從課程設計上看得出來，*Science Mode 1*（編按：教統局在今年六月發出的《新高中課程及評估指引（暫定稿）》中，將此課程定名 *Integrated Science*）是小學及初中科學科的延續，主旨明確，架構清晰。要培育現代公民的科學意識，這一科達到了目的。由於課時及內容所限，要裝備學生畢業後繼續攻讀理工科，單憑這一科並不足夠。高中的物理、化學、生物三科，便是為此而設。

如今，因種種原因，莘莘學子被迫只能在三科中頂多選其二，於是 *Science Mode 2*（編按：現定名為 *Combined Science*）便應「運」而生。可惜，此非學子之幸運，只是教改的運程走到這一步，為了要平衡各方爭議，而把三科剪裁拼湊成為一科的權宜之計也！



從表面看，選一科 *Science Mode 2* 加上理、化、生其中一科，便三科兼備，豈不快哉？但箇中將會引發的各種問題，相信前線教育工作者當有切身體會，我們應該聆聽。再者，作為一個由中三升中四的學生，面對 *Science Mode 1*、*Science Mode 2*、理、化、生這五科，選科的時候自有一番迷惘。

二）第二點涉及較廣的層面。有兩個英文詞彙不好譯，若勉強翻譯成中文詞，意思或帶褒或帶貶，倒不如中性的英文詞那麼能夠表達我的想法。這兩個詞彙是「*timeliness*」和「*timelessness*」。

我有個印象，教改常常強調前者，對後者則輕輕帶過。本來學習上貼近生活是好事，諸如全球化、可持續發展、環保、遺傳工程、世貿等等，都是現代公民需要關注的議題。以時事作切入點培養學生綜合多元的本領和技巧是好事，通識教育便強調這一點。這些便是「*timeliness*」。但不要忘記，前人繼往開來，幾千年來為後人累積



了多少知識、學問和智慧，豈可不一代一代傳下去呢？這就是「*timelessness*」了。

有些人提到「要通必先有識」，說的也是這個道理。不能只顧「*timeliness*」而忽略了「*timelessness*」。新高中課程引起的爭議，很多其實可以歸結到這一點上。

三）對教改不滿的意見有不少，但說了好像白說，推行者往往指出持異見者未能「與時並進」。但從另一方面看，其實爭議也無謂，因為到頭來最重要的一環，也就是最起作用的一群，始終是前線工作者，即是眾多的教師。

縱使通識教育科宣傳得更好更活，若弄不好，到時只不過造就了幾個補習社的「通識科天王」！公開試左右大局，乃是現實情況。即使教改推行者聲稱新高中課程設計其中一個理念是淡化公開試的影響，結果還是過不了這一關。為了遷就公開試，總是不願意接受由不少人（包括香港大學理學院意見書）提出來的 *modular approach*！

「任憑風浪起，穩坐釣魚船」。積極地看，如果教師們各自在崗位上努力，各自有清晰的教育理念和紮實的本科修為，大家都為下一代的成長著眼，管它教改不教改呢！但話得說回來，教師和學生都需要充份的發展空間和學習時間、平靜的學習環境和選科的彈性。新高中課程聲稱以此為目標，實際執行的似乎是另一套！

A YEAR OF SUCCESS FOR BSc ADMISSIONS 2006

We are happy to report that this year, the Faculty has admitted 523 students to its BSc and BSc Actuarial Science programmes, which represents an increase of 15% over last year's admissions. In addition to the intake of local secondary school students, the Faculty has seen an increase in the admission of more non-JUPAS, international and mainland students as well as students under the Early Admissions Scheme. While the BSc programme continues to admit quality students with genuine interests in Science, the BSc Actuarial Science programme remains the best programme of its kind in Hong Kong in terms of average AL examination results.



Summer Science Institute July 27 – 31, 2006

The Summer Science Institute (SSI) continues to be a popular programme for secondary school students interested in science. The SSI programme aims to enhance students' interest in science by means of hands-on learning activities, and to introduce them to HKU hall life. This year, 144 students from over 70 local and overseas secondary schools joined the SSI programme, with the theme of "Energy: Past, Present and Future". At the SSI, students attended lectures and workshops on a diverse range of science topics, as well as undertaking a study project that required them to work on a particular research topic, either in the laboratory or in the field, and then to give a presentation on their research findings.



Public Lectures

July 13: Dr Max Bernstein, NASA Research Scientist on "The Search for Life in the Solar System: Lessons from Studies of Meteorites and the Origin of Life"



July 25: Professor Vaclav Smil, Distinguished Professor of University of Manitoba, Canada on "Energy in the 21st Century: Global, Asian and Chinese Perspectives"



SuperSaturday – Accelerated Science

March 18 and April 1, 2006: A one-day programme which provided secondary school science students an opportunity to learn about new scientific advancements through lectures and hands-on activities

3rd International Junior Science Olympiad July to December, 2006

The Faculty of Science has been selected to undertake the training of a select group of young science students to prepare them for the International Junior Science Olympiad. Six students will eventually be selected to represent Hong Kong in the competition in Sao Paulo, Brazil in December, 2006.

HOW SAFE IS OUR FOOD AND WATER SUPPLY?

by Dr Edmund Li, Department of Zoology

Prevalence

Syndicate multinational companies controlling the world's clean water supply; genetically engineered products occupying all the shelf space in supermarkets; pandemic outbreaks of food-borne bacterial or viral infections – scenarios from science fiction or futuristic movies that could actually happen? You might wonder how safe is our food and water supply.

In Hong Kong, despite the fact that we are frequently bombarded by news of chemical contaminants, E.coli infection and bird flu, our food and water supplies are still very safe. Major outbreaks of food contamination are not uncommon in developed countries – recent recalls of salmonella-tainted chocolate products in England and a norovirus gastroenteritis outbreak aboard an Alaskan cruise ship are just some of the incidents hitting the headlines. In the United States, a country that has invested the most on surveillance, food and water safety are still not guaranteed. For sure, it is impossible to achieve a 100% risk-free environment. What matters is the relative risk, and it comes with a price tag!

Monitoring

Reduced risk could be achieved through a more vigilant inspection or surveillance system at the government level, as well as a heightened awareness of personal hygiene at the individual level. Mandatory implementation of hazard analysis and a critical control point (HACCP) at various stages of the food and water processing or handling would be an important starting point. In brief, HACCP is a stepwise process

used to identify and control hazards. Just like good manufacturing practice (GMP), it is an integral component of a monitoring system that reduces the chance of unhealthy or contaminated food products reaching the consumer.

A matter of education

Educating the public is also high up on the agenda. Many food poisoning outbreaks can be traced back to the improper hygiene of food handlers. Furthermore, consumers need to gain a perspective on what actually constitutes a risk. With increased sensitivity, we are able to detect the presence of an extremely minute amount of an undesirable substance in food or water. However, its presence does not automatically imply that the product is unsafe for human consumption. The concept of a tolerable limit or an acceptable daily intake should be introduced to the public through carefully designed education programmes. A typical example is the dilemma of fish consumption and mercury exposure. Consuming fish, particularly those containing omega-3 fatty acids, can reduce cardiovascular problems, but mercury, a toxic metal, is found in fish caught worldwide. Therefore, establishing exposure limits is useful from a public health perspective. Unfortunately, there is no consensus on the safe level of many contaminants among countries, so the situation exists that one man's meat may be another man's poison. Establishing what the safe levels of exposure are requires long-term study and a huge investment so international collaboration would be the way forward. The World Health Organization (WHO) plays a key role in coordinating activities in this regard.

Make a Guess:

SAY NO IF SOMEONE SELLS YOU THIS COMPOUND AT A PARTY! WHAT IS IT?

Prize: \$50 book token

Deadline: Friday, December 22, 2006

Please email your answer (as a chemical or common name in Chinese or English), together with your name and school (for students), to scinews@hku.hk. **FIVE** winners will be drawn randomly from the contestants who give the correct answer.

Answer to Last Issue's Quiz: Female Koel (also called the Asian Koel or Common Koel)

Male and female koels have very different appearances. Males are black, with bright red eyes and greenish beaks. Females are brown, with an attractive pattern of paler spots and bars. The males advertise their presence at HKU in spring and early summer by their distinctive loud calls, "ko-el, ko-el, ko-el, ko-el..." with each repetition on a slightly higher note. Koels belong to the cuckoo family. Like most cuckoos, they do not build nests or look after their own babies. Instead, the female lays its eggs in the nests of other birds, which then bring up the baby koels as if they were their own offsprings.



Winners:

Allen To Wai Lun, Department of Ecology & Biodiversity; Law King Wai, Department of Ecology & Biodiversity; Chan Sin Wai, Aidia, Department of Ecology & Biodiversity; Hung Tun Hei, BSc, HKU; Jessica Young, Department of Professional Legal Education.

質數研究的新發展

數學系助教張偉信博士

二〇〇六年八月二十二日，三十一歲華裔數學家陶哲軒 (Terence Tao) 獲頒菲爾茲獎 (Fields Medal)。菲爾茲獎一向被譽為數學界諾貝爾獎，有港人之子得此榮耀，怪不得香港報章都大肆報導。其實陶哲軒早已被稱為大熱門得獎人，原因是在二〇〇四年他與 Ben Green 解答了如下關於質數算術級數的重要猜想：

對任意 k ，存在無限個 a 和 d ，使得 $a, a+d, a+2d, \dots, a+(k-1)d$ 都是質數。

意思是：給一個數 k ，可以找出無限串由 k 個質數組成的算術級數 (arithmetic progression)。

早在一九三九年，已知有無限串由 3 個質數組成的算術級數，例如 5, 11, 17 或 29, 59, 89 或 11, 29, 47。在 Green 及陶哲軒之前，不知道有否由 23 個質數組成的算術級數，也不知道是否有無限串由 4 個質數組成的算術級數。但注意 Green 及陶哲軒只證明這些算術級數的存在，卻找不出它們！事實上，暫時還未找到 23 個質數組成的算術級數。如何找出這些算術級數，是這個猜想研究的另一個方向。

其實自踏入廿一世紀，質數研究不斷傳來喜訊。首先是二〇〇二年由 Agrawal, Kayal 和 Saxena 發現「多項式時間確定性質數判別法」。這則新聞在香港報章亦有報導，頗受注目。

「質數判別法」是分辨某個數 n 是否質數的方法；判別法有兩種：「確定性」(答案為「是質數」或「不是質數」) 及「機率性」(答案例子是「有八成機會是質數」)；而「多項式時間」理論上是最有效率的。最原始的質數判別法——嘗試以 $1, \dots, n-1$ 去整除 n ，若通通不能，則 n 是個質數——具確定性但極其沒有效率。以前已知有效率的質數判別法，都是機率性的。Agrawal, Kayal 和 Saxena 的發現，因而觸目！但實際上，其方法的效率仍遠不及機率性判別法。

二〇〇三年 Goldston 和 Yildirim 發出稿件，宣佈證明如下定理：

$$\text{假若以 } p_n \text{ 代表第 } n \text{ 個質數，則 } \liminf_{n \rightarrow \infty} \frac{p_{n+1} - p_n}{\log p_n} = 0$$

此則新聞，由與學術界有密切關係的傳媒大肆宣揚，但後來經證明原來存有極大漏洞，最終迫使兩人收回文章。為甚麼會引起這麼大的回響呢？

「學生質數」是相差為 2 的質數對，如 3 和 5、11 和 13、71 和 73、101 和 103 等；是否有無限多的學生質數，是數論中一個重要課題，稱為「學生質數猜想」。上述定理，原來與「學生質數猜想」有密切關係。

二〇〇四年，陶哲軒和 Green 發表了首段所提及的猜想的證明。據說他們是受到 Goldston 和 Yildirim 收回的文稿所啟發的。

二〇〇五年五月，Goldston 和 Yildirim，以及新加入的 Pintz，再次發表文章證明「學生質數猜想」相關定理。這次他們所用的方法與之前那篇收回的大不相同。這篇文章不單被肯定，更被一部分數學家認為是攻克「學生質數猜想」的正確方向！

二〇〇五年十二月二十六日，學術組織 GIMPS (Great Internet Mersenne Prime Search) 宣佈發現新的最大質數是超過九百萬數位的 $2^{30402457} - 1$ ——對上一個是在二〇〇五年初發現的。這消息有如聖誕佳音般出現在各大報刊上。雖然從數學理論層面來看，GIMPS 並未有多大突破，但畢竟這是一個新里程。GIMPS 自成立以來，倚仗互聯網連結多部電腦得出的強大運算力量，已發現 9 個極大質數。GIMPS 下個目標：找出第一個一千萬數位的質數，這是領取十萬美元「EFF 特別獎」的要求 (EFF 是 Electronic Frontier Foundation 的簡稱)。

編按：陶哲軒的母親梁蕙蘭畢業於香港大學，主修物理和數學。

Congratulations

- Professor Chi-Ming Che, Dr Hui Wai Haan Chair of Chemistry, was awarded the 2006 TWAS Prize in Chemistry.
- Professor W K Li, Head of the Department of Statistics and Actuarial Science, has been elected a Fellow of the Institute of Mathematical Statistics.
- Jessica Chu, PhD student in Zoology, received the 2006 Anthony R Means Basic Science Student Award for her abstract "Secretin in the Hypothalamo-Pituitary-Renal System: Implication of Secretin in Regulating Water Homeostasis"
- Allen, Hoi Lun Tai, MPhil student in Mathematics, was awarded the Excellent Student Paper Prize in the area of quality management in the 36th International Conference on Computers and Industrial Engineering held in Taiwan in June 2006. The paper is a joint work with his supervisors Dr Wai-Ki Ching from the Department of Mathematics and Dr Philip L Chan from the Department of Industrial and Manufacturing Systems Engineering, HKU.

Visits by Distinguished Scholars

- Professor T M Rice from the Swiss Institute of Technology will visit the Physics Department at HKU as a University Distinguished Visiting Professor on September 30, 2006, for approximately three months. Professor Rice is a Fellow of the Royal Society, London, and a member of the US National Academy of Sciences. He is a recipient of a number of prestigious awards including the Hewlett Packard Prize of the European Physical Society in Condensed Matter and the Bardeen Prize for the Theory of Superconductivity.
- Professor Patrick A Lee from MIT will visit Hong Kong for about a month starting December 11, 2006. Professor Lee is a member of the US National Academy of Sciences and a winner of the American Physical Society's Oliver Buckley Prize for Solid State Physics and Dirac Medal. Lee is a native of Hong Kong. He will be a joint distinguished visitor of HKUST and HKU.

Recent Events

Public Lecture

- September 14: The two Shaw Laureates in Mathematical Sciences 2006, Professor David Mumford and Professor Wu Wentsun, delivered two lectures at HKU. Professor Mumford's lecture was entitled "Some Glimpses of Pure and Applied Mathematics" while Professor Wu's was entitled "From Ancient Chinese Traditional Mathematics to Modern China's Mathematics Mechanization".



Visit

- The Asia News Editor of the prestigious Science magazine, Richard Stone, visited the HKU Aberdeen Tunnel Underground Cosmic-Ray and Particle Physics Laboratory in July, 2006. Staff from the Physics Department, in collaboration with CUHK, have been using the underground facility to conduct experiments related



to the Daya Bay Reactor Neutrino Experiment. This is an international particle physics collaboration of over 100 scientists. The report based on the visit was published in the July 21, 2006 edition of Science.

Workshop

- The Department of Mathematics and the Institute of Mathematical Research held two workshops in July. The first one, "Workshop in Mathematical Biology and Statistical Genetics", on July 19, 2006, was led by Professor Lai Tze Leung of Stanford University and Dr T W Ng. The second one, "Workshop on Complex Geometry", over July 11 – 13, 2006, was led by Professor Yum-Tong Siu from Harvard University and Professor N Mok, as well as Professor Lai and Professor Siu, HKU's CV Starr Professors, both of whom are distinguished mathematics alumni. They have spent a considerable amount of time in the Department of Mathematics during the winter and summer semesters over the past few years.



Upcoming Events

Open Day

- The Information Day for Undergraduate Admissions will be held on Saturday, October 21, 2006 from 10am to 6pm.

Public Lecture

- First week of November: Professor Jef Teugels from the Catholic University of Leuven, Belgium, will deliver the Patrick Poon Lecture on the topic of reinsurance, and also give a departmental seminar on extreme value analysis. For details, please refer to <http://www.hku.hk/statistics/>.
- Second week of November: Dr Patrick Lee, Professor and Cameron Chair in Cancer Research, Department of Microbiology and Immunology from Dalhousie University, Canada, will deliver the first lecture of this year's Faculty of Science Public Lectures Series entitled "The Use of Viruses as Anti-Cancer Agents". Please visit the Faculty's website nearer the time for full details.

Seminar/Conference

- December 11 – 13, 2006: Workshop on Computational Methods on Nanoscale Systems, to be co-organized by the Departments of Physics and Chemistry.
- December 18 – 20, 2006: Hong Kong Forum of Condensed Matter Physics: Past, Present, and Future, to be co-organized with HKUST.

Apology

science@HKU regrets a mistake made on page 3 of the last issue regarding chemistry students who won the Silver Medal in the 17th Hong Kong Chemistry Olympiad. The three students should have been:

Wong Ka Yu (Year 3)
Au Ka man (Year 2)
Xue Mingyu (Year 1)

We apologize for any inconvenience caused.

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