Teaching and Research Awards

External Award

Professor J Wang, Professor, Department of Physics, received the *Croucher Senior Research Fellowship Award 2009* for his contribution in quantum transport theory in mesoscopic systems and nanostructures.

University Awards

Professor W T Wong, Chair Professor, Department of Chemistry, received the *Outstanding Researcher Award 2008* for his exceptional research accomplishments on the metal cluster and nanoparticles, X-ray crystallography, lanthanide chemistry, MRI contact agents and luminescent probes for chemical imaging.

Dr P H Toy, Associate Professor, Department of Chemistry, received the *Outstanding Young Researcher Award 2008* for his accomplishments and involvement in developing new methods and tools for improving and simplifying the processes of organic synthesis.

Dr M F Zhou, Associate Professor, Department of Earth Sciences, received the *Outstanding Research Student Supervisor Award 2008* for his guidance to students in the pursuit of research excellence.

Professor J Yu, Professor, Department of Mathematics, was awarded the *Research Output Prize 2008* for his remarkable efforts on the research paper "*The Strong Anick Conjecture is True*", published in *Journal of the European Mathematical Society*, 9, (2007), 659-679. Professor Vesselin Drensky is the co-author of the paper.

Dr S B Pointing, Associate Professor, School of Biological Sciences, was awarded the *Outstanding Teaching Award 2008* for his teaching achievements and dedication in creating a highly motivated learning environment for students.

Faculty Awards

Dr F C C Ling, Associate Professor, Department of Physics, was granted the *Award for Service Contribution 2007-08* to recognize his devotion in serving the Faculty and the community.

Professor J G Malpas, Chair of Earth Sciences and Pro-Vice-Chancellor and Vice-President, received the *Award for Teaching Excellence 2007-08* ro recognize his outstanding teaching performance and his efforts in curriculum development in the Faculty of Science.

Other Achievements

Professor W K Li, Chair Professor, Department of Statistical and Actuarial Science, was awarded the honorary membership of the Hong Kong Statistical Society for his outstanding contributions to statistics profession and statistical development in Hong Kong.

Dr M F Wang, Professor S F Chen and two of their PhD students, Mr Cheng Ka-wing and Ms Peng Xiao-fang from the School of Biological Sciences were conferred the *CIFST Science and Technology Innovation Award (2nd prize)* for their project entitled "Inhibition of Dietary Polyphenolic Compounds on the Formation of Toxic Substances from the Mailard Reaction and the Mechanisms" during the 14th World Congress of Food Science and Technology, Shanghai, 19-23 October, 2008.

Five postgraduate students from the School of Biological Sciences received prestigious awards by the University: Mr Wong Chi-chun Dennis (*Li Ka Shing Prize*), Dr Pon Yuen-lam (*Outstanding Research Postgraduate Student Award*), Miss Huangfu Jieqiong, Miss Suen Yung-lee and Miss Kwok Ho-yan, Amy (*University Postgraduate Fellowship*).

Two undergraduate students, Mr Zheng Hanxia Timothy and Mr Wong Yiu-kay were granted *The Dragages Prize in French* and *Prize of the Royal Consulate General of Thailand respectively* by the School of Modern Languages and Cultures for 2007-08.

Area of Excellence: Center for Marine Environmental Research and Innovative Technology (MERIT), a team combining the efforts of six local universities including HKU, has been designated as the first United Nation PEMSEA Regional Center of Excellence (RCoE) in Marine Pollution. As the institutional member of MERIT, The Swire Institute of Marine Science (SWIMS) of HKU, hopes to contribute more to marine pollution monitoring, assessment and management, and excelling scientific achievements in the field of marine environmental research.

70th Anniversary Lecture Series

February 11, 2009: "Reproductive Social Behaviour: Old and New Evolutionary Theories" by Professor Joan Roughgarden, Stanford University

February 13, 2009: "Darwin, Science and Religion – How History Can Help" by Professor Frank James, The Royal Institution of Great Britain

February 18, 2009: "Science-in-action" Talk and Campus Visit: "Seeing Tomorrow: Decision Making under Risk" by Dr Philip Yu, Department of Statistics & Actuarial Science

March 5, 2009: "Science-in-action" Talk and Campus Visit: "Science - What a Wonderful World" by Professor Marcel Lie Ken Jie, School of Biological Sciences

March 11, 2009: "Seeing Black Holes" by Professor Kinwah Wu, Mullard Space Science Laboratory, University College London

March 19, 2009: "Computer and Mathematics: Problems and Prospects" by Professor Ronald Graham, Computer Science and Engeering, University of California, San Diego

April 3, 2009: "Will China Run Out Of Water" by Professor Chunmiao Zheng, University of Alabama

April 15, 2009: "Is Cancer a Disease?" by Professor Robert H Austin, Department of Physics, Princeton University

Upcoming Events

April 28, 2009: "Science-in-action" Talk and Campus Visit: "Does Applied Mathematics Exist? – A Lesson from Godfrey Harold Hardy" by Professor M K Siu, Department of Mathematics

May 9, 2009: Home-coming Day

For details: please visit www.hku.hk/science

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Faculty of Science Newsletter
香港大學理學院通訊

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From The Editor

Dear readers,

As scientists, we cannot simply bury our heads in our laboratories and care nothing about society. In addition to publishing our scientific findings in professional peer-reviewed journals, we also have the responsibility to disseminate these findings to the general public. In doing so, we sometimes have to work hand in hand with the Media. In this issue of science@HKU, we share with you some of our experience in making science more visible to the general public by working with professionals from the Media.

For science and our Faculty, 2009 is a very special year. This is the 400th anniversary of the first use of an astronomical telescope by Galileo Galilei as well as the publication of Johannes Kepler's *Astronomia Nova*. Hence, the United Nations General Assembly declared 2009 as the International Year Of Astronomy. This year also marks the 200th anniversary of the birth of Charles Darwin and the 150th anniversary of the publication of *On The Origin Of Species*. Last but not least, 2009 is also the year when our Faculty turns 70 years young. A lot of exciting events surrounding these three themes are waiting for you. Please stay tuned.

Yours sincerely,
Dr H F Chau
Chief Editor

Contents

Science and the Media

The Media have become a powerful means for scientists to promote scientific literacy to the general public in the current Age of Information. The media allow scientists to reach out to a wide range of audience and present scientific findings in interesting manners readily understood by the layman. In this Newsletter, Professors L S Chan (Department of Earth Sciences) and Y J Sadovy (School of Biological Sciences) share with us how they worked with television and newspapers to promote greater awareness of particular scientific issues.

Behind the Scenes of the TVB Expedition to Iceland and Greenland

by Professor L S Chan, Department of Earth Sciences

Geologists regard it as a sacred imperative to visit Iceland and Greenland at least once in their lifetime. So when TVB offered me to travel to those places to guest-host the show on vanishing glaciers, I did not hesitate to say 'I do'. For geologist, the trip was a pilgrimage.

Gearing Up for the Trip

The production crew comprised over 12 members, including TVB's General Manager Stephen Chan Chi-wan, and artistes Sammul Chan Kin-fung and Bernice Liu Bik-yee. To prepare for the impending fellowship with the entertainers, I asked a friend to give me a crash course on the latest soap opera hits, and tried to memorize the list of the recent Miss Hong Kong beauties (I still cannot name any of them). The 20-day journey started in Reykjavik, Iceland's capital, and ended inside the Arctic Circle in Greenland in late September, 2008. The first part of the trip was relatively comfortable since Iceland is among the better-off nations in the world, at least before her recent bankruptcy. The standard of living there was so high at the time that we had to dine at the same pizza place every night to save production cost. The Greenland part of the journey was more of a venture into unchartered territories.

Perception Vs. Observation

The two places have a very different geological history. Iceland is tectonically young and vibrant, with volcanoes gushing out lava sporadically. Greenland is barren; it has some of the oldest rocks on Earth. The highlights of the expedition were undoubtedly the trekking trip across the great plate boundary on Iceland between North America and Eurasia as well as the daily northern lights show in Greenland. Photographing northern lights became the most cherished nightly vigil among the crew members and me; we can say that our camaraderie brewed mostly at subzero temperatures.

The expedition in Greenland was enlightening culturally as it was geologically. We had to rewrite the storyline several times since the observations we made were contrary to our original perception of the place. In Kulusuk, a small Inuit (North American group of Eskimos) village with less than 300 people, Stephen, Bernice and I visited a villager's house and watched a drum dance performed by an elderly woman dressed in traditional attire. She was one of the last two inhabitants who could do the tribal dance. I had been expecting to see villagers living indigenously, only to find their accommodation modernly furnished and supplied. There were no igloos on ice nor could I see any villagers wearing sealskins. Sadly, with automobiles and the internet replacing dogsleds and kayaks, the introduction of a modern lifestyle has also brought about the perdition of Inuit tradition and customs.

We were also unprepared for the sight of an unattended dump yard full of plastic containers, old computers and used appliances. Inuits used to draw everything they needed from the earth and sea around them and use shrewdly every bit of what they acquired, but now they have no idea how to treat modern wastes. We were planning to do a story on the pristine beauty of the indigenous village but ended up focusing on the impact of modernization on the natural heritage. Also, we did not anticipate some Greenlanders' reaction on the issue of global warming; they actually welcome the climate change with open arms since the warming is about to introduce farming to their land. While the rest of the world is working collectively on strategies to curtail the temperature rise, the Greenlanders are either unaware of or unconcerned about its effects on other parts of the Earth.

Challenge of Spontaneous Narration

The filming process was quite an experience for me. There were no scripts to follow; the on-site narration was unrehearsed and spontaneous. My role was to look out for interesting features and give my insights on their nature and significance. That was the easy part—what I have been trained to do as a field geologist. The difficult task was to explain the observations in layman's terms without compromising the accuracy of the information. At times I was overly concerned with giving the right information in my quote and my narration would become dull and too technical. Sammul, however, was very artful in filtering the information and articulating it in a way easily understood by the viewers. This is probably when the scientist-artiste collaboration is best exemplified.

Working with Entertainment Characters

The trip was thoroughly enjoyable and full of interesting moments; Stephen's nonstop wisecracks and deadpan gags added much amusement to the trip. In fact, we crowned him the '*King of Lame Gags*'. One evening we stayed in a remotely located town in Iceland where we could not find a restaurant for dinner. Stephen managed to improvise a salad for us using mooncake, chocolate, caviar paste and some leftover food; I was the only one brave enough to devour the mixture. (I am not going to tell how it tasted.) I was also impressed with the professionalism of the team. There were literally less than six weeks between the planning of the trip and the broadcasting of the first episode. My students teased me a lot about whether I was going to sign with TVB. On second thoughts, that might not be a bad idea. After all, many things that happen in Hong Kong's education arena today are already "show business" in nature.

I asked Stephen why he had decided to produce the show while many similar programmes are already available on National Geographic and even TVB's Pearl channels, especially as global warming is not an entertaining and marketable subject. He replied that so far none of those programmes were aimed at the Cantonese-speaking communities around the world; it was also a new attempt for them to bring on board earth scientists in a documentary show. Well, we should give them credits for risking their investment in a possibly unprofitable endeavor.

I was told that the show did well in the viewership ratings. And for me, three names have been added to my list of artiste idols.

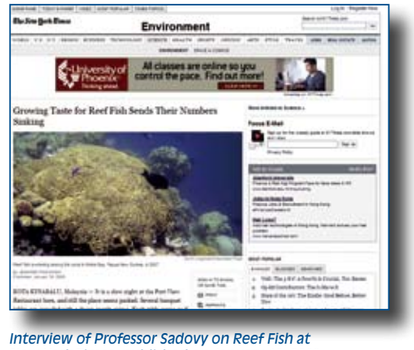
Getting Science to the Media

by Professor YJ Sadovy, School of Biological Sciences

For most scientists, there is enormous satisfaction in finally signing off on the proofs of a publication. With just the final printed article to come there is a great sense of achievement, especially so for those in their early years of publishing. Increasingly, however, for many of the scientific disciplines, publication of the actual science is just a first step. In fields of work that have significant environmental or conservation implications, or address major issues such as evolution or climate change, the need to ensure dissemination far beyond the scientific community is increasingly necessary. Only an educated public can understand debates on scientific matters, appreciate the relevance to their own lives of new developments, or even be inspired to support new policies in ways that could benefit our society.

Opportunities to Reach a Wider Audience

There are many ways to take science beyond the specialist journals. Popular magazines, University or Society publications, editorials or public speaking are obvious candidates as well at TV, radio and newspapers when opportunity arises. These all require sensitivity and a lighter touch with language to ensure that scientific outcomes and concepts are couched in a way that is accessible to a wide audience. There is a lot of competition for airtime and column inches so stories need to be compelling and interesting as well as factual and accurate.



Interview of Professor Sadovy on Reef Fish at New York Times, published on January 19, 2009.

I would like to share a few of my experiences with newspaper stories covering my own work; opportunities to talk about work come through invitations from reporters or by issuing a press release. My passion and area of research lie with coral reef fisheries, especially ones of commercial importance threatened by overfishing. So my research in recent years has focused on the science of extinction risk in fishes, vulnerable life history traits, and fishery management science in tropical fisheries, issues not always easy to convey simply. With the growing recognition that many of the world's fisheries are overexploited has come a much greater interest from the media to cover fishery and conservation stories from the sea. I want to nourish and build upon that interest.

Press coverage on the new book co-written by Professor Sadovy, published in Ming Pao on March 8, 2009.

Delivering Messages Accurately

It took some time before I was able to convey my messages the way I wanted. And I am still learning. I could make my work more compelling by describing the interesting and beautiful species I work with. On the coral reef fish we see swimming in restaurant tanks around Hong Kong, did you know that some are older than you, or may have come to Hong Kong from half way across the planet? Depending on the interview, I could talk about the odd things that the animals I work on do, like change their sex, or teach their young where to go and breed. I try to use examples of fishes that are familiar to readers and occur in local restaurants and markets. For the press release of a recently published book, I and my co-authors had a very short film made to compete with other book releases. This attracted press attention and opportunities for interviews.

I have learnt that it is well worth taking time to explain the broader context of my work to reporters. Often, because they cover many and varied stories, some of the more subtle points of my own stories became lost when the wider issues were not well understood. As one example, I recall a reporter who wanted me to say that people should categorically not eat shark fin. The issue in this case was not the shark fin itself but the fact that, currently, all fisheries for shark fin are conducted unsustainably. In this particular case, biological sustainability was the issue, not food preferences, or the wasteful and cruel practices often associated with shark finning.

Dealing with the Media

Whether for an interview or press release, I always decide upfront what my one or two key messages are, and start with these. I try to express why the work is new and relevant, and how it addresses a particular problem. I use simple rather than technical language and am very careful to avoid making comments off the record; it may be difficult for a reporter to ignore such comments, especially if highly relevant to a story. If the subject matter is particularly controversial or sensitive, I ask for questions from the reporter ahead of time. I am quick to respond to requests for additional information.

Finally, back to my theme, or rather, a plea. I strongly believe that, as scientists, we have a responsibility to communicate our work outside of our immediate peers, especially if it has important social or economic relevance. We should not just sit back and expect others to do this for us. Nowadays, we cannot just be scientists but must also train ourselves to become competent, credible and effective spokesmen (and women) for our discipline.

Opening Ceremony of the Stephen Hui Geological Museum and Launch Ceremony of Faculty of Science 70th Anniversary

The Faculty of Science is celebrating its Platinum Jubilee in 2009, and it has launched its year-long activities at the Opening Ceremony of Stephen Hui Geological Museum on the University Main Campus on January 16, 2009.

Mr William C L Hui, Dr Stephen Hui's son and officiating guest of the Ceremony, said that the museum was always his late father's dream, and it gave him immense pleasure to see it coming into being. "I would like to thank the staff of the Department of Earth Sciences for their painstaking efforts in setting up this museum virtually from scratch," Mr Hui said. In thanking the Hui Family, Professor Richard Y C Wong, the Deputy-Vice-Chancellor and Provost, said: "Generation after generation, the Hui Family have lent their very generous support to the University." Professor S Kwok, Dean of Science, said that the museum provided an attractive object-based learning laboratory for the nature and evolution of the planet to visitors at all ages. "The museum is vital in driving the development of Earth Science education at Hong Kong schools."

Officiating guests and other honorable guests of the Ceremony.

The museum is crowded with visitors.

Professor J G Malpas, Pro-Vice-Chancellor, (left) was showing Mrs Hui (middle) and other guests around.

Mr Edward Yau, Secretary for the Environment, was examining the display with other guests.

Professor S Kwok thanked the generous donation and contribution of minerals from the Hui Family.

Highlights of the Platinum Jubilee

Come and join us if you

- want to meet new and old friends of the same root and have a joyful and memorable reunion;
- want to know more about the Faculty.

Homecoming Day

Date: May 9, 2009 (Saturday)
Time: 2 pm - 6 pm
Venue: Rayson Huang Theatre
The University of Hong Kong

Anniversary Dinner

Date: November 15, 2009 (Sunday)
Time: 6 pm - 10 pm
Venue: Convention Hall
Hong Kong Convention and Exhibition Centre

Contribution to the 70th Anniversary Commemorative Publication

If you wish to share the memorable stories of your university life, interesting experience of the old days, poems and even novel ideas, please write to us. Your contribution can be:

i. either in English or Chinese;
ii. in any literary style or format;
iii. no minimum words but not more than 500 words;
iv. photos which are more than welcome.

A souvenir will be given once your article is selected.

Distinguished Alumni Nomination

The Faculty of Science is proud of its graduates and would like to honour distinguished alumni in various sectors and salute their achievements and contributions to society in the Platinum Jubilee.

We invite you to nominate local and overseas alumni of the Faculty of Science who have one or more of the following achievements:

- have played a pivotal role in science education and scientific research;
- made significant contributions to the community and the world;
- have outstanding achievements in their own profession.

Nomination can be made online at the Faculty anniversary webpage. Your nomination will be considered by a panel comprising Professor S KWOK (郭新教授), Mr Stanley CHU (朱裕倫先生), Mr Shui-ming CHUNG, GBS JP (鍾瑞明先生), Mrs Fanny LAW FAN (羅范椒芬女士), Professor Yum-tong SIU (蕭蔭棠教授), Mr Kai-man WONG BBS JP (黃啟民先生), and Professor Enoch YOUNG (楊健明教授).

For more information, please visit www.hku.hk/science/70th

Darwin 200th Anniversary Public Lecture Series

Interview with Professor Frank James

by Dr Pauline Chiu, Department of Chemistry

The Faculty of Science organized a lecture series on the occasion of the 200th Anniversary of the birth of Darwin. Professor Frank A J L James, Professor of the History of Science at the Royal Institution in Britain, delivered a lecture entitled "Darwin, Science and Religion - How History Can Help" to a packed auditorium on February 13, 2009. Professor James has written widely on science and technology in the nineteenth century and how they relate to other areas of society and culture, for example, technology, art, religion and the military.

After the lecture we interviewed Professor Frank James, on his visit to Hong Kong, his work as a historian of science, and also on the theme of his talk.

FJ: Professor Frank James PC: Dr Pauline Chiu

On Hong Kong

PC: Professor James, on this visit to Hong Kong, how did you find our city?

FJ: I thought that Hong Kong was a wonderful city! Rather than growing horizontally like many global cities, has grown vertically to produce a splendid skyline. Getting round the city was very easy, and the metro knock spots off the London Underground!

On Darwin, Science, and Religion

PC: As a historian, what would you say was the major contribution of Darwin to scientific thought and history?

FJ: Undoubtedly it would be his development of the mechanism of natural selection to account for the evolution of organisms (which was understood to have happened, but not how), and getting evolution accepted as a respectable scientific theory.

PC: In your lecture, you presented that, contrary to popular belief, there had not been a long, historical enmity between science and the religion of the day, Christianity.

FJ: No, and I think that as evidence, one just has to look at virtually all the major nineteenth century natural philosophers such as Michael Faraday, William Thomson (later Lord Kelvin), James Clerk Maxwell and George Gabriel Stokes, all of whom were devout Christians of one form or another.

PC: So how is it that most people have now come to think that science and religion are so at odds?

FJ: This enmity was a concept constructed by some scientific practitioners in the second half of the 19th century, such as John William Draper and John Tyndall. They interpreted some histories, such as the Galileo affair, in a way that the evidence, now available to us, does not support; even though many people today still think Galileo was persecuted for his science, this was just not true. Now, whether these were reasonable arguments to develop at the time, is a subject that would require further historical research. But what they really wanted to do was to remove what they saw as the domination and control of science by the Anglican church, through the university system which had been established by clergy and continued to involve clergy as administrators and teachers, and so developed these historical arguments to suggest that science and religion were in opposition. Darwinism did not start this enmity; but it was used to further fuel this conflict.

On being a Historian of Science

PC: How did you become interested in studying the History of Science?

FJ: I'd always been interested in history, but the way I was streamed in school meant that I ended up studying science.

Science and I parted company in the middle of my second year at university when I asked my tutor whether the reductio ad absurdum method could not have a third option, and was told that would be covered in the final year. Bad teaching, but sufficient for me to seek a different subject which, given my interests and qualifications, meant history of science.

PC: Oops. Let that be a warning to us as teachers!

FJ: Looking back, I think I also see in that incident the beginning of my dissatisfaction with the claim that science is "positive knowledge" and has a special status of being totally unbiased, somehow existing independently of influences from history or human participation.

PC: Can you elaborate on what you mean by "science as positive knowledge"?

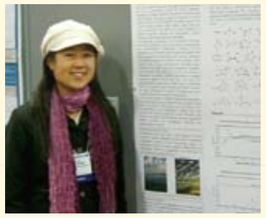
FJ: The whole point of scientific research is to find new knowledge. That must mean that there can never exist a positive, definitive account of the world – if such an account did exist then there would be no need for scientific research! That is not to say that some scientific knowledge cannot be valid over long periods of time, but the displacement of Newtonian laws during the early 20th century by the theories of Einstein, for example, indicates that even the most well established theory can fundamentally alter.

PC: So the historical lesson that we as members of the scientific community should learn is to harbor a healthy degree of skepticism about our theories, and remain open to new possibilities. Advice from history must be good advice!

Professor James' research is focused on Michael Faraday. See interesting link from the Royal Institution of Great Britain:
http://www.rigb.org/contentControl?action=displayContent&id=00000001043

A Touch of Research Project:

Conference Experience of Undergraduate Student



by Miss Tennia Zhao
Year 3, BSc (Earth Sciences)
Poster presenter at 2008 American Geophysical Union Fall Meeting, Dec 15-19, 2008
Participant of 2008 Summer Research Fellowship Scheme, Faculty of Science

My conference experience started as a summer research project on atmospheric and ionospheric anomalies prior to earthquakes. From the moment my two supervisors suggested this topic to me as one of the possibilities for my summer project, I knew this was the one I would choose. It was a tough project in that there was no well-established theories or methodology. However, it was very intriguing to me because the exploration started from natural phenomena themselves instead of theories. The project was an adventure in every step of the way, and what I was able to learn in this process was much more than I could have ever imagined.

Halfway through the project Professor J C Aitchison told me that we might possibly submit the results of this project to a major conference. It was great to hear but I did not believe that it could really happen at all. Somehow, it sounded a bit too good to be true, but it happened! Our submission was accepted and I had the opportunity to present our work at one of the world's largest geoscience conferences. The first day I arrived at the meeting I immediately got lost; it was a huge meeting with 16,000 scientists attending. It blew my mind to see so many exciting people and so much exciting scientific work. My presentation went very well. I stood by my poster for the whole afternoon and in the end I did not want to leave. I talked with a lot of people and got a lot of encouragement and interesting questions.

The project and the conference was an amazing experience for me. I learnt a lot in many ways. I now have a much clearer picture of what scientific research is about, from its philosophical underpinning to the detailed arrangement of a project; from the evaluation of the initial idea to the communication within the scientific community. I learnt how to let the research process be guided by evidences and powered by a curiosity. Above all, however, I think the most valuable things I received in this conference experience are self-confidence and determination. I am surer than ever that I want to be a scientist, and I can start to see myself being one instead of just dreaming about it.

I would like to take this opportunity to thank my two supervisors: Dr K H Lemke and Professor J C Aitchison, who have proved to me that geologists are among the world's most wonderful people. Whatever I have achieved in this experience is a testimonial of their kind guidance, encouragement and support.

Brainteaser

Question:

A piece of English text was modified by substituting each letter in the alphabet with another letter, resulting in the following garbled message:

GH DQVZ WHRNGVL ZWMZV ZLW NWZZWBV ZLOZ OSSWOB DQVZ QCZWH OBW GH ZLW QBPWB QC ZLWGB CBWUKWHTGWV W Z O Q G H V L OHP B GH COTZ W OHP Z ZQRWZLWB JGNN KVKONNA OTTQKHZ CQB DQBW ZLOH QHW CGCZL QC ZLW NWZZWBV GH ZLW ZWMZ ZQ PWTGSLWB O NQHR WHQKRL DWVVORW QHW DOA BWSNOTW ZLW ZJQ DQVZ CBWUKWHZ VADXQNV GH GZ XA W OHP Z ZLWH JGZL O CWJ VDOBZ ZBGONV OHP VQDW RKWVVJQBY GZ GV FWBA NGYWNA ZLOZ ZLW JLQNW DWVVORW TOH XW TQDSNWZWNA BWFWONWP

You are asked to decipher it.

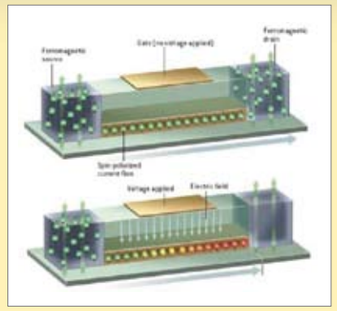
Prize: $50 book token Deadline: May 30, 2009

Please email your answer 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: Enceladus, a satellite of the planet Saturn.

Research of spintronics in the Faculty

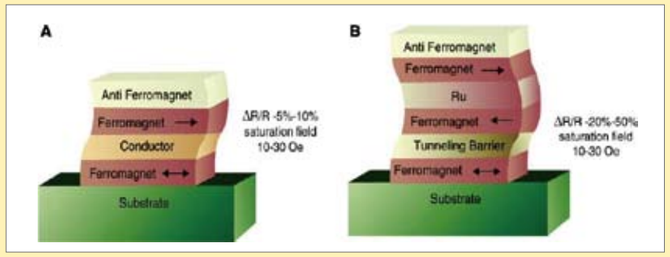
by Professor J Wang, Department of Physics



Schematic setup of the spin field effect transistor proposed by Datta and Das.

The great application of semiconductor microelectronics over the past few decades has changed our life in an essential way. Since the invention of integrated circuit in 1958, the number of transistors that can be placed in an integrated circuit doubled every 18 months, this is the so-called Moore's law. The size of field effect transistor (the central ingredient of microelectronics) has shrunk to 45 nanometers. According to Moore's law, we anticipate that its size will reach atomic limit in about 15 years. Hence, the further development of microelectronic device needs new designing, new structures, new materials and most importantly new working principle. The goal of nanoelectronics is to develop a new technology for this purpose in the near future. This is why almost all the developed countries in the world are working very hard to develop nanoelectronics. One of the most important possibilities of nanoelectronics is the hope of using spin—in addition to charge—for nonlinear electronic device applications. So far, progress has been achieved in several areas of spin-electronics (spintronics) such as the applications of giant magnetoresistive effect, the understanding of material properties of magnetic semiconductors, the improvements of spin injection across a magnetic-nonmagnetic interface, and optical manipulation of spin degrees of freedom. Traditional electronics is based on the flow of charge: the spin of the electron is ignored. Charge current presents physical limits to microelectronics miniaturization, because the heat it generates can damage tiny components that are too close together. The emerging technology of spintronics will make the leap such that the flow of spin, in addition to charge, will be used for electronic applications. A spin current is produced by the motion of spin-polarized electrons; therefore spin current is typically associated with the spin-polarized charge current. Nevertheless, if one can generate an ideal situation where spin-up electrons move to the right while an equal number of spin-down electrons move to the left, then there will be no net charge current. There will be, however, a finite spin current. Because spin-based electronic devices have many advantages including the longer coherent lifetime, faster data proceeding speed and less electric power consumption, the generation, manipulation, and measuring of spin currents are the central challenges in spintronics and have caused an intense interest in recent years. In 1990 Datta and Das proposed a novel concept of spin-field effect transistor which aims to improve the efficiency of conventional transistors by replacing ferromagnetic sources and drains for spin polarized current to pass through a two-dimensional electron gas. The spin precession of conduction electron is controlled by a perpendicular gate voltage through a spin-orbit interaction. To generate spin current one can use a transport phenomena called spin Hall effect originated from spin-orbit interaction: an electric current induces a transverse spin current. Recently, the spin Hall effect has been observed experimentally in semiconductors. To reduce the power dissipation, the notion of dissipationless quantum spin current has been proposed as a result of quantum spin Hall effect that has been realized experimentally in HgTe semiconductors. It is believed that quantum spin Hall current could enable quantum spintronic devices with integrated information processing and storage units, operating with low power consumption and performing reversible quantum computation.

Physicists in the Department of Physics are actively involved in the research of spintronics. The research projects include novel ways of detecting spin current and various novel transport behaviors of spin current. The research team includes Professor F C Zhang, Professor J Wang, Professor S Q Shen and Dr X D Cui.



Schematic setup of spintronics devices: (A) spin valve. (B) magnetic tunnel junction.