

Physics Matters

Our Distinguished Visitors

For cosmologists like Lord Martin Rees, being able to make progress towards unraveling the mystery of the universe is indeed exhilarating. Here as a Distinguished Lee Kuan Yew Visitor, his lecture "Our universe, and the role of life in it" at the Shaw Foundation Alumni House auditorium on 24 August 2009 was a much anticipated one with audience staying tuned and forthcoming with questions.

Setting our earth in a cosmic context before Charles Darwin's simple beginning, Lord Rees' discourse from Galileo's observation, Huygens probe on Titan to NASA's Kepler Mission opened our minds to the fundamental questions of how our universe begins as a Big Bang, life beyond the Earth and the future of the cosmos.

According to Lord Rees, "the unfinished business of 21st century science is to link together the cosmos and micro world. Until we have that synthesis, we won't be able to understand the very beginning of our universe."

The planet Earth remains a special place in the cosmos. This century is also a defining moment where the human species holds the future of our own planet in its hands, and could "jeopardise not only itself, but life's immense potential".

At the end of the lecture, Lord Rees was conferred with a medal and certificate of Honorary Fellowship with the Institute of Physics Singapore.

Prof Rees holds the honorary title of Astronomer Royal and is Professor of Cosmology and Astrophysics and Master of Trinity College at the University of Cambridge. In 2005, he was appointed to the House of Lords and elected President of the Royal Society. An associate and

honorary member of several academies as well as a recipient of several prestigious awards, Prof Rees has written, broadcast and lectured widely and held various visiting professorships.

The Physics department is honoured to have Sir Anthony J. Leggett with us as a Distinguished Visiting Professor since July 2007.

Prof Leggett, the John D. and Catherine T. MacArthur Professor and Center for Advanced Study Professor of Physics, is currently a faculty member at the University of Illinois at Urbana-Champaign. At the forefront in the theory of low-temperature physics, Prof Leggett was conferred the 2003 Nobel Prize in Physics for his pioneering work on superfluidity.

In his past visits to NUS, Prof Leggett conducted seminars for students, physics faculty and the public. He was keen to meet up with students in particular and was open to consultation. One highlight of his visits was to hold sharing sessions with students to address their concerns face to face.

Faculty members also had an opportunity to consult and interact with Prof Leggett on specific research topics. Besides contributing to the theoretical understanding of normal and superfluid helium liquids and other strongly coupled superfluids, he also has

set directions for research in the quantum physics of macroscopic dissipative systems and the use of condensed systems to test the foundations of quantum mechanics.

Without doubt, Prof Leggett has brought with him a wealth of knowledge and his presence has truly been an extreme encouragement to both faculty and students.

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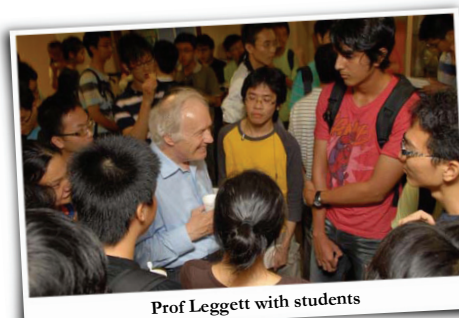
Lord Martin Rees



Prof Rees with physics faculty & students



Sir Anthony J. Leggett



Prof Leggett with students

International Young Physicists' Tournament

In July 2009, a team of five boys from Raffles Institution represented Singapore at the 22nd International Young Physicists' Tournament (IYPT, <http://www.iypt.org/new/>) held at Nankai University, Tianjin, China.

This is the inaugural participation of Singapore in this international physics competition and we were ranked fourth among scientific powerhouses such as France, Germany and the United Kingdom. It was indeed a remarkable achievement!

The IYPT is a very different sort of competition compared to international events such as the International Physics Olympiad. A set of 17 open problems are published almost a year in advance so participants have about a year's time to design and conduct experiments related to the given problems.

They may have to read up on



undergraduate or graduate textbooks or even research journals to gain insights into the problems. They are also required to analyze and formulate mathematical models to make sense of the collected data.

During the preparation process, they are free to consult and discuss with their teachers as well as scientists from research institutes and universities. This is therefore a competition where every serious participant could be a "winner".

The 23rd IYPT will be held in Vienna, Austria, from 9 – 16 July, 2010 (<http://www.iypt.at/>). To determine our national team, the Ministry of Education, Institute of Physics Singapore and Raffles Institution will be holding the first Singapore Young Physicists' Tournament (SYPT, <http://sypt.wordpress.com/>) in January 2010.

The Physics Department of NUS has been instrumental in making the above possible with the enthusiastic support from Prof Feng, the head of the department. Once the national team has been selected, the department will also be involved in the preparations for the competition at Vienna.

Contributed by Dr Yeo Ye,
Lecturer



Hear what some recipients of the Faculty's Teaching, Research and Service Awards 2008/09 shared about what the award meant to them. (Turn to page 4 to find out more)

"There is no excuse for going to the lecture theatre unprepared. Spending time in the preparation is a commitment and respect to our profession and I will continue to do so."

A/P Tay Seng Chuan



"I wish to thank the University and the Physics Department for this award. My sincere appreciation also goes to all the heads and colleagues in the department for the great and memorable working relationship which I had enjoyed."

Mrs June Sung



International Physics Olympiad

The 40th International Physics Olympiad (IPhO, <http://www.iyu.fi/ipho/>) was held in Merida, Mexico on 11 – 19 July 2009. 315 students from 70 countries participated in this international event.

The Physics Department of NUS, in collaboration with the Institute of Physics Singapore, Ministry of Education and National Institute of

Education, was responsible for the selection and training of our students.

The competition included both theory and practical sessions. In the theoretical round, participants had to answer three questions within five hours. The practical round consisted of two experimental questions and lasted five hours. The scores awarded were then added to determine the medal winners.

The Singapore team comprised five representatives who were students from the NUS High School of Math and Science, Raffles Junior College, Anglo-Chinese School (Independent) and Hwa Chong Junior College. The team clinched two gold and three silver medals, placing Singapore in the 8th position. This was the second best result Singapore has attained since its participation in the Olympiad.

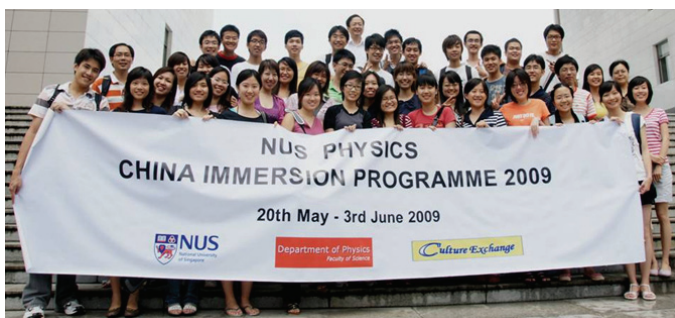
As was the custom, local organiser would play host by arranging visits to places of interest and indulging foreign delegates with cultural performances. This year all participating teams went sightseeing at the Caribbean seaside and explored the ruins of the Mayan temples. Everyone got a chance to also make new friends from all over the world!

In conclusion, the event had enriched the experience of the Singapore team in ways beyond words. Putting medals aside, the team was given an opportunity to challenge physics on an international scale. Furthermore, the many wonderful moments of building friendship in a different cultural setting were unforgettable.

Contributed by Mr Lim Kim Yong,
Scientific Manager,
Science Dean's Office



Physics China Immersion Programme 2009



Group photo at Guangxi University

The aim of the Physics China Immersion Programme (CHIP) is to expose Singaporean students to the Chinese academic environment as well as introduce them to a cultural and modern China.

23 students signed up for CHIP2009 which was held from 20 May to 3 June. We visited a few places in two provinces, namely, Guangxi Minority Autonomy Region and Jiangsu.

Located in the southwest of China, Guangxi borders Vietnam and is home to many minorities. It is still considered an underdeveloped part of China in many ways. In contrast, Jiangsu, which borders the Yellow Sea, is a well developed region since the inception of economic reforms in 1978.

We visited three universities during the trip. Guangxi University is located in the capital city of Nanning. Besides campus visit and briefing by the university

officials, our students had a face-to-face interaction with local students which proved to be a helpful exchange.

At the forefront of teaching and research, Nanjing University in Jiangsu

is ranked the top 5th university in China. A pioneer in many fields such as literature, physics, computer science and business studies, it also houses the National Laboratory of Solid State Microstructures (NLSSMS), a prestigious national lab with many outstanding scientific achievements. At Suzhou, our students also interacted with local students at the historical Soochow University originally founded by the Methodists.

Besides trips to the universities, students also visited agricultural and historical sites, places of interest and an industrial park.

Guangxi is the largest producer of sugarcane and fruits in the country. It also has rich mineral deposits and forestry resources. The situation is totally different in Jiangsu. With the third highest total GDP in China and an extensive transportation network, Jiangsu houses many technological

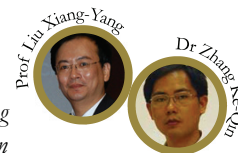
development zones. The visit to the China-Singapore Suzhou Industrial Park, a symbol of the leading edge in economic development in the past 15 years, was indeed an eye-opener to us all.

Our stay in Guilin was unforgettable. Situated in the northeast of Guangxi on the west bank of the Li River, Guilin draws tourists all over and is renowned for its scenic beauty. Many ethnic minorities live here which added to the cultural diversity. We were charmed by Zhouzhuang, a famous water village in Suzhou, with its elegant water lanes and stone bridges and well-preserved ancient residential houses. Local folklore and customs such as serving emperor style banquet left lasting impression on us.

Nevertheless, our brief encounter in such historical places and the museums could only give us a glimpse of the rich Chinese culture and history.

Having visited two distinct provinces, students could compare and contrast between their economic development, education and cultures. They also experienced first-hand the unique modernisation process of a historical China.

Contributed by
Prof Liu Xiang-Yang
& Dr Zhang Ke-Qin
Organizing Committee for CHIP



An agricultural Guangxi



At the China-Singapore Suzhou Industrial Park



Water Village at Zhou Zhuang

The feedback given by students after the trip has been positive and encouraging. Here are some excerpts from students:

“CHIP is a great opportunity to better understand the cultural aspects of China, its infrastructure and of course to simply enjoy China... The cultural exchange left a deep impression on me. It gave me an insight into how the education system works, how pressured students can be to excel academically... I've also gained an insight about their impression of Singaporeans and our society. It's also pleasing to share ideas and discuss opinions about life, education and simple things.”

Reuben Wong

“It was a completely new experience for me... Sight-seeing with visits to the various universities were really interesting. The students were really friendly and hospitable... From this trip I realized that my knowledge of the Chinese culture and history is narrow and limited and I would like to find out more by traveling to the various parts of China and reading up. I have benefited tremendously from this programme and am seriously considering joining it again next year.”

Amelia

“The students were friendly and accommodated me in my incompetency in Chinese. They were especially helpful, offering to guide us around Nanning and even booked a KTV room for us when they knew that some of us like to sing. It was enjoyable to be able to chat with the students and learn about the various cultural and lifestyle differences between them and us. Such valuable experiences would not be gained if I had joined a normal tour group to China.”

Loh Wan Ting

Physics in Action!

Starry starry night, now I think I know ...

The Physics Department offers two GEM modules – Understanding the Universe and Einstein's Universe and Quantum Weirdness – that are related to the field of astrophysics. Both modules are highly popular among students across all faculties as evidenced by the large enrolment (about 330 – 390 students) each semester.

One special highlight of the modules is the star-gazing sessions held almost once a month on a Friday evening. These sessions are conducted in tandem with the tutorials to reinforce the concepts taught in class. Prior arrangements have been made to have the floodlights at the university sports complex switched off during the star gazing sessions in order that students will have a better view of the night sky.

The lecturers, tutors and some graduate students will be around to instruct the students. The latter would also help to set up the telescopes which have reflectors and refractors mounted on sophisticated tracking mounts. All the sessions have been well attended as students love the chance to interact with



the lecturers and tutors under the canopy of the stars.

Another highlight of the modules is the optional weekend stargazing trip (2D2N) to Johor, Malaysia. Students are strongly encouraged to participate in this once-a-semester trip. Away from light pollution, they can then study the heaven's unadulterated glory in all its splendour.

For each trip, our entourage of astronomy aficionados comprises the two GEM module lecturers and tutors, module students (about 40 on the average) and, like the star-gazing sessions, students from JCs and polytechnics as well.

We all enjoy our feast of the sights of the Milky Way, early morning meteors, nebulae and perhaps the International



Space Station, amongst many others of the celestial smorgasbord. Our students are especially thrilled with such trips where they can correlate what they observe in the sky with what they learn in class. We also conduct extra tutorials with students during the trip.

An additional boon is the sumptuous spread of authentic Malay kampung fare for each meal. One may also watch the sunrise or take a solitary stroll along the endless expanse of the Malaysian coastline, to cap off an educational and reflective weekend.

As a lecturer involved, I am especially delighted to have the opportunity to interact with students in all the field trips. Helping them connect reality with what they learn in class is indeed physics in action!

Contributed by A/P Phil Chan



Awards

32 staff from the Physics Department were proud recipients of the Faculty's *Teaching, Research and Service Awards 2008/09*. *Physics Matters* gets close with some of the winners to find out what the award meant to them:

"I have loved teaching since the first time I tried it. What's most enjoyable is seeing my students understand what seems so difficult just a moment before. I'm very grateful for this award which is a great acknowledgement and encouragement from the Faculty and my students. For me, it is not only an honour, but a motivation for deeper commitment towards my students."



Ms Qiu Leiju

"I would like to share and dedicate this award to my very co-operative working team in the Physics-E lab. Without this team, the Physics-E lab will not be able to function so effectively right from the beginning (2002) till now. Last but not least, my many thanks also go to Asst/P Chung Keng Yeow and the department for giving me such a strong support all this while."



Ms Foo Eng Tin

Faculty Teaching Excellence Award

Prof Oh Choo Hiap
A/P Christian Kurtsiefer
A/P Gong Jiang Bin
A/P Sow Chong Haur
A/P Tay Seng Chuan
Dr Yeo Ye

Honour Roll

A/P Chan Aik Hui, Phil

Teaching Assistant Award

Dr Nidhi Sharma
Ms Qiu Leiju

Young Scientist Award

A/P Dagomir Kaszlikowski

Outstanding Science Entrepreneur Award

Prof B V R Chowdari

Long Service Award

Mrs Elaine Cheong
Mr Cheong Mun Yin
Asst/P Ho Kian Hoon, Peter
Prof Lim Hock
Mr Lim Hwa Ngee
Mr Mani Mohan s/o Subhas Balan
Prof Oh Choo Hiap
Dr Rajesh Ramchand Parwani
A/P Sow Chong Haur

Mrs Sung Ah Yoon nee Siew
Mr Suradi Bin Sukri
Mr Tan Choon Wah
Prof Tan Tiong Gie, Bernard
Mr Teo Hoon Hwee
Ms Teo Hwee Cheng
Prof Wang Jian-Sheng
Prof Wee Thye Shen, Andrew
Ms Zhou Weiqian

Outstanding Service Award

Ms Foo Eng Tin
Mrs Lee Soo Mien

Mr Lim Geok Quee
Mrs Phua Swee Wah nee Choo

Mr Tan Choon Wah
Mr Teo Hoon Hwee

Mr Wu Tong Meng Samuel

Discovering Physics - Observing exploding stars with radio telescopes

Energy! $\frac{1}{2}mv^2 - h\nu - kT - mc^2$. As so often in physics, so in astronomy energy plays a pivotal role. The potential energy of tenuous gas in huge clouds in our Galaxy becomes kinetic and thermal as gravity pulls the gas together, heating it while the density increases.

Stars form when enough material (in the sun, 2×10^{33} g or $1 M_{\odot}$ (solar mass)) is compressed into a small enough ball (1.4×10^6 km for the sun). Under such conditions, nuclear fusion releases huge quantities of energy as hydrogen and other low-mass elements combine to form carbon, oxygen and heavier atoms, up to iron.

When a massive star ($> \sim 9 M_{\odot}$) fuses iron, the game is over: no more energy can be extracted by nuclear processes, and the star is doomed. In a tremendous explosion ("supernova" or SN), the core collapses to form a compact, high-density "star", while the outer envelope is expelled at speeds of 10^4 km/s and more. The light from the explosion may briefly outshine an entire galaxy of 10^{11} stars. As for the dense stellar remnant, it will usually be a neutron star, but in rare

cases a black hole may form.

In my work, I have studied exploding stars, the expanding SN envelopes of stars which blew up millennia ago, and the remnant neutron stars (pulsars). Perhaps the most intriguing explosions are those associated with gamma-ray bursts (GRBs): brief, incredibly intense emissions of high-energy photons. Many - maybe all - of these produce black holes.

Initially, the expanding material, concentrated in diametrically opposed beams, moves at relativistic speeds. If we happen to be in the sight line of one of the beams, the Doppler boosting which accompanies its expansion will greatly enhance the emission, produced by particles accelerated to extreme energies in shockwaves. This accounts for the inexplicably high luminosities associated with GRBs (which have been observed from the most distant reaches of space).

Last year, I participated in observations (*Nature*, 455, 183 (2008)) of the brightest GRB to date: an object which could have been briefly seen with the naked eye, though it is nearly 500,000 times more

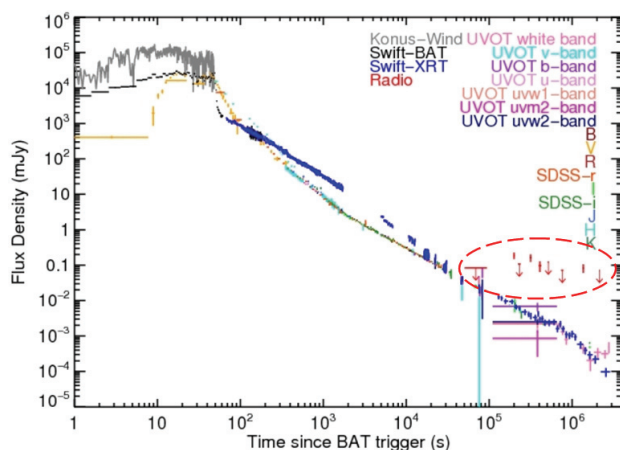


Fig. 1: Observed intensity (y-axis) of the visually brightest GRB as a function of time (x-axis), in energy bands from gamma-rays (black and gray) to radio (in red ellipse).

Prof Richard Strom was born and raised in New York. He earned his B.A. degree in Physics from Tufts University, and M.Sc. and Ph.D. degrees in Radio Astronomy from the University of Manchester (Jodrell Bank), UK.

He recently retired as senior research astronomer at ASTRON (the Netherlands Institute for Radio Astronomy) in Dwingeloo. He is currently professor emeritus at the University of Amsterdam and also adjunct professor of

astronomy at James Cook University in Australia. A visiting professor of physics at NUS in 2007 and 2009, he continues to be active in research and hopes to guide senior students in the NUS astrophysics programme in the near future.

Prof Strom is a past secretary and member of the Scientific Organizing Committee (SOC) of Commission 40 of the International Astronomical Union (IAU) and has been on the

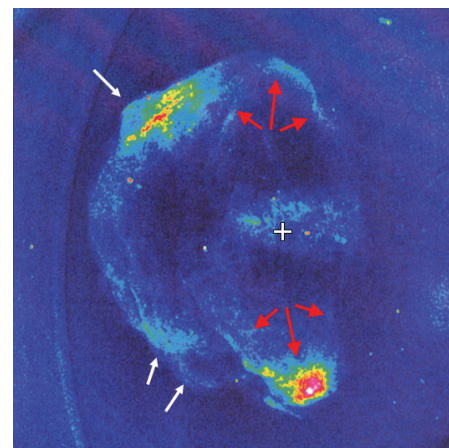


Fig. 2: Map of the radio emission from CTB109, showing the two main "bow-shock" like features (red arrows), and the ends of other structures which may also be bow shocks (white arrows). A white cross shows the approximate location of the central neutron star. (The long, curved feature on the left is instrumental, not real emission.)

What would the remnant of a GRB look like? Would we see some effect of the twin beams, or would this be quickly washed out by the spherical shock front? The fact is that we don't know, but one of the remnants I have been studying suggests a possible answer.

A map of the radio emission from an object called CTB109 (Fig. 2) shows a semi-circular rather than circular outline. Looking carefully at its structure, we can see that the outer edge is formed by loops of emission, which look a bit like the bow wave generated as a ship ploughs through water. Near the centre of CTB109 lies a neutron star which may be sending out impulses of energy to generate the bow shocks. Although the situation is rather different from a GRB, further study of CTB109 will, I hope, help us understand what shapes the remnants of exploding stars.

Contributed by Prof Richard Strom



SOC of numerous conferences. He is a member of several IAU Commissions and has served on time allocation panels for radio, infrared and X-ray telescopes. His research interests include supernovae and their remnants, pulsars, large radio galaxies, radio polarimetry and interferometry, new telescopes, Chinese historical records, and the history of radio astronomy, especially in the Netherlands.

Symposium News - Research Frontiers in Physics, NUS, 22-24 July, 2009

The 5th Singapore-China Joint Symposium on Research Frontiers in Physics was successfully held from 22 to 24 July 2009 on the campus of NUS. The symposium was jointly organized by the Department of Physics, NUS and the Institute of Advanced Studies, NTU.

This was the second time the joint symposium was held at NUS. Four years ago, NUS hosted the inaugural joint symposium. It was subsequently organized by Zhejiang University (2006), Xiamen University (2007) and Suzhou University (2008). There were 47 Chinese delegates, mainly from six major participating Chinese universities, who took part in the 5th joint symposium.

During the two and a half day technical sessions, 57 delegates presented their latest research discoveries which covered a wide spectrum of topics such as graphene, Fe-based superconductors, meta materials, ultracold physics, quantum information and quantum control.

Most speakers from China are well-established senior faculty members or outstanding young researchers with many years of research experience overseas. In particular, four speakers shared about their research findings published in *Nature* or *Science*. All local

speakers from NUS and NTU are junior faculty members. The parallel sessions were well attended by a large number of staff and students from NUS and NTU.

To encourage young students to pursue research in physics, for the first time in the short history of the joint symposium, a number of senior Chinese undergraduates were specially invited to attend the symposium. This turned out to be tremendously beneficial to the students who were deeply impressed with what they learned. One of the participating students wrote after the symposium,

"I have gained so much for the first time both in my knowledge and personal life. I enjoyed the excellent talks by the professors, be it theoretical or experimental... I count myself fortunate indeed to have the opportunity to attend such an important symposium!"

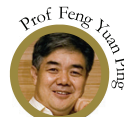
The organisers thanked the generous financial support from the Faculty of Science, NUS, the Institute of Advanced Studies, NTU and the Lee Foundation.

It was decided that Xi'an Jiaotong University and Huazhong University of Science and Technology will host the joint symposium in 2010 and 2011 respectively.

Further details can be found at <http://www.physics/sympo2009>



Contributed by
Prof Feng Yuan Ping,
Chair of Organizing Committee &
A/P Gong Jiangbin, Secretariat



A Day in the Life of ...

"I give my best in everything I undertake daily and also cherish every opportunity to learn, to give and to dedicate my life to a meaningful course." This philosophy of life undergirds Mdm Pang Teng Jar who has been a staff of the Physics Department since 1981.

A recipient of multiple awards including the Outstanding Teaching Support Award and



Outstanding Service Award, Mdm Pang also received the National Day Award (Long Service Medal) from the President two years ago.

As a lab technologist, Mdm Pang takes care of the experimental setup and its maintenance as well as budgeting in the Level 1 Physics Lab. She also guides students on the use of the X-ray diffractometer in the research labs. She takes her wide-ranging administrative duties (from allocating lab duties, computing CA marks to coordinating teaching and examination schedule) in stride and does not flinch from challenging tasks.

What gives Mdm Pang the greatest job satisfaction? "For me, being able to offer

advice and assistance to students in appeal cases who then got their modules gives me a sense of satisfaction." She is also passionate about facilitating students to carry out their experiments safely and smoothly be it in the teaching or research lab.

Mdm Pang enjoys the harmonious working relationship with colleagues who are helpful and cooperative. She is a fan of Hainanese opera and does volunteer work in her spare time. A devout Buddhist, Mdm Pang believes in simple pursuits in life. She hopes our society will become more eco-friendly and that future living and working environment will be designed with greater consideration to the aged and physically disabled.

Physics 1, 2, 3, 4

Physics Matters gets close with four physics majors to find out why they chose physics, their views of the curriculum, any tough challenges they face, their aspirations and their choice of course given a chance to start all over.



My personal experience as a Physics major has been a pleasant one so far. Like any subject, Physics is interesting but can be daunting at times. Physics requires a good sense of how things function and the application of common sense.

Since I was formerly schooled in Physics in my high school, it seems natural I choose Physics as my major. Physics also trains me to be more analytical and the problem solving skills I acquire will always be useful in life. For me the learning experience of a university education is more important than which subject is major.

The Physics curriculum here is more interactive compared to my pre-U education where problems were merely worked out on a board. Concepts learned are cross-linked to other subject areas and one could learn from examples of real life applications.

I found some new concepts difficult to grasp at first as with anything new. For me the way to cope would be to consult Wiki when the contents taught become too 'broad'.

If I had a chance to start all over, I would pick a different major to have a taste of a different field and also to increase my dimension of knowledge.

Teo Qiang Long, Christopher, year 1



In all honesty, I went through most of my early education with no appreciation for physics. It was only at the pre-U level that seeds of interest were planted just as I realised I had not understood physics as thoroughly as I should.

My eventual decision to read physics at NUS was governed primarily by the recognition that physics inculcates and celebrates, among other things, precision and clarity in the thought processes, of which I had a profound lack.

The coursework here certainly does not disappoint in this regard, though the greatest challenge for me was perhaps not with mastering any module. It was rather the question of whether I was in the right place to begin with. Interestingly, the conviction grew within me as I became more intrigued with the subject matter. Admittedly, I have not turned out to be the best student, but the learning experience has been excellent for me as I see myself maturing in various ways and able to put things in better perspective.

It's too early to say what the future holds for me. However, I am convinced that studying physics has not been an exercise of futility. Indeed, given a choice to start over, I would not change a thing.

Vinodhini Selva, year 3

Lim Kai Ming, year 2



Our life revolves around Physics. Many things we come across in our daily life are closely related to or can be explained by Physics. Thinking Physics is part of me so pursuing Physics as my major would open that window I need to further understand the world we are living in.

I like the Physics curriculum here and in particular I enjoy the small class size which offers more interactive lectures and tutorials. In addition, I could get to know everyone in the cohort easily and consult my classmates if I encounter problems in my learning.

The most demanding part of the course would probably be the mathematical skills required in establishing the results. Unfamiliarity with the mathematics and lack of prior practice could pose a huge challenge to anyone. However, with practice and constant usage, I become more confident and better.

Having earned a Physics degree down the road, I hope to embark on teaching, something I am passionate about. I would see myself gladly playing a role to enrich and intrigue our younger generations with knowledge of Physics besides arming them with general knowledge and life skills.

So, Physics would still be my choice given another chance.

Yang Tzyh Haur, year 4

I am delighted to share what I feel about Physics. Let me travel back in time to four years ago... I chose Physics as I disliked engineering. Nah, just joking!

Physics is beautiful and alluring and gives me satisfaction beyond my senses. Here I have great flexibility in choosing the modules. While I feel that some areas of teaching require greater emphasis, I'm thankful to acquire a solid foundation in other areas.



At first I worry if I possess the intellectual capability and creativity to do Physics. A prominent professor once told me he also thinks about this question constantly. This is an assurance in a way to me. I guess I will hang in there even when things get tough. Like those cute PhD comic characters, research has become my passion and I hope to pursue my graduate studies next.

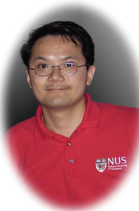
I would still consider Physics given a fresh chance, and mathematics (Physics without mathematics falls apart!). Also I hope to join the Special Program in Science or work along professors. Sure I want to get down to knowing more of my course mates!

Let me end by saying, being 'human particles' that exist for so short time in this universe, let us be appreciative and whine less.

In memory of Dr Roland Su

It is with immense sadness that we bid a final farewell to our beloved colleague Dr Roland Su, who departed on 17 November 2009.

Roland had taught several modules offered by the Physics Department in the past. A caring and devoted academic, Roland will be fondly missed by his students. Colleagues in the department will acknowledge Roland for his dedication to his work and as a mentor to his students.



As an Associate Dean of the Faculty of Science, Roland also contributed actively in facilitating the international student exchange programmes of the Faculty and the University.

An exemplary family man, Roland left behind his wife Carol, daughter Gloria, aged 6, and son Timothy, aged 3.

The Sculptor and His Sculpture

A permanent landmark of the Physics Department since 1989, *Waves and Particles*, a stainless steel sculpture, was a brainchild of Prof Tang Sing Hai.

Prof Tang attended a sculpture workshop while completing his PhD at Stony Brook, New York. This turned out to be the only formal art training he received but it made a lasting impression on him.



The stainless steel sculpture completed in the workshop

Prof Tang is very much a self-taught artist. Over the years he has experimented with different styles and media. His early sculptures were strongly inspired by the fundamentals of science and embodied a timeless dimension.

Waves and Particles was created in commemoration of the 60th anniversary of the Faculty of Science. An idea came to Prof Tang that a sculpture to symbolize the foundation of physics would be most

appropriate for the Physics Department and the occasion. It quickly dawned on him that waves and particles are not only the cornerstone of physics, they could also be readily visualized in three-dimensional art form.

The idea led to sketching on paper and then a scaled down prototype was constructed (see photo). The Physics Workshop undertook the actual construction which lasted about a week. A junk steel pipe was used as the support column. To welcome the turn of the millennium, the sculpture was given a coat of paint in orange and blue in 2000.

Currently a professorial fellow, Prof Tang's research interest focuses primarily on nonlinear optics. He has published more than a hundred scientific papers in international journals. He thinks it was only lately that he has reached his mature art form as a sculptor. He has also turned his attention to the dynamic interplay of human forms in his recent art pieces.

Despite his late arrival, Prof Tang's works had been showcased in local exhibitions and displayed in corporate collections. His *Flying High* was a bronze piece auctioned off in aid of the NUS High School.

In 2008, Prof Tang entered several works in the Beijing Olympic Landscape Sculpture Design Contest which attracted a total of

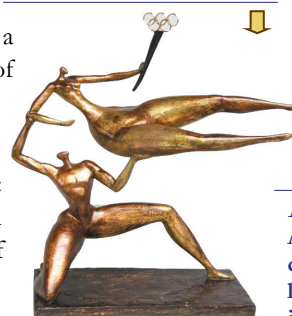


Prof Tang with his prototype in front of *Waves and Particles*

2433 entries from 90 countries. His *Olympic Gold* won an Excellence Award and the sculpture has since been exhibited in many cities in China.

With the Faculty of Science just marking the 80th anniversary, thanks to Prof Tang, *Waves and Particles* is still standing tall after 20 years of rain and shine.

Olympic Gold - A bronze sculpture which won an Excellence Award at the 2008 Beijing Olympic Landscape Sculpture Design Contest



Flying High - A bronze sculpture created in 2001 and later auctioned off in aid of the NUS High School

Announcements

Field Trips:

China Immersion Programme

Contact Prof Lin Xiang Yang, phyliuxy@nus.edu.sg

Germany Immersion Programme, 1 - 22 June, 2010

Contact A/P Thomas Osipowicz, phyto@nus.edu.sg

Public Lecture:

Conference in Honor of Murray Gell-Mann's 80th Birthday

Quantum Mechanics, Elementary Particles, Quantum Cosmology and Complexity
Nanyang Executive Centre, NTU
24 - 26 February, 2010



Contest:

Flying into the Future 2nd Asia Space Exploration Innovation Contest

For details, please go to <http://csaspace.org.cn>

Any comments or suggestions send to:
Phil (phycahp@nus.edu.sg) or
Lydia (phylyampk@nus.edu.sg) or
Kenneth (phybcmk@nus.edu.sg) or
Siew Lee (phykohsk@nus.edu.sg)

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