“I consider a conference successful only if it has quality, quantity and financial sustainability. I am happy that the ICMAT series has all of these attributes and has been recognised as an icon of Singapore,” commented Prof B V R Chowdari when asked about what attributed to ICMAT’s success (see interview with Prof Chowdari on page 7).

Indeed, as President of the Materials Research Society of Singapore (MRS-S), Prof Chowdari, who is also faculty at the Physics Department, found it most rewarding that the International Conference on Materials for Advanced Technologies (ICMAT) 2011 has promised to be another significant milestone for MRS-S, the main organiser of ICMAT.

The 6th in the series of ICMAT conferences, ICMAT 2011 (27 Jun – 1 Jul, Suntec) was organised in association with the National University of Singapore, Nanyang Technological University and the Institute of Materials Research and Engineering, with the support of the Agency for Science, Technology and Research, the Embassy of France, the Singapore Tourism Board and several other organisations.

The biennial event attracted over 3000 international delegates, the largest ever recorded. There were nine plenary lectures by distinguished scientists including four Nobel Laureates – Prof Ada Yonath (Weizmann Institute, Israel), Prof Albert Fert (Unité Mixte de Physique, CNRS/Thales & Université Paris-Sud (Orsay), France), Prof Andre Geim (University of Manchester, UK) and Prof K von Klitzing (Max-Planck-Institut für Festkörperforschung, Germany), three theme lectures and two public lectures by Nobel Laureates. Consisting of 40 technical symposia covering almost all aspects of materials science, engineering and technology, ICMAT 2011 has promised to be another significant milestone for MRS-S, the main organiser of ICMAT.

NUS President Prof Tan Chorh Chuan who gave the welcome address highlighted that conferences like ICMAT play a critical role in fostering the types of interaction and collaboration among experts in different fields that are necessary to address key R&D issues across disciplines.

Participant Yang Ming from the Condensed Matter Physics Research Group, NUS, thinks that the ICMAT is a wonderful platform for local researchers to interact with international communities. He added, “In this meeting, you can meet many top scientists and listen to great talks, which are really helpful for my research.”
Every two years, a study tour would be organized by PhD students from the Laboratory of Physical Chemistry and Colloid Science, Wageningen University, the Netherlands, during which they would visit universities, institutes and companies that share some of their scientific interests. The aim of the study tour is to stimulate interactions with students abroad through an exchange of knowledge and experiences via meetings and discussions with other scientists that are involved in similar research topics and starting new and interesting collaborations where viable.

This year, 14 PhD students from Wageningen University made a trip to Singapore, Malaysia and Vietnam. The Physics Department played host to them during their visit to NUS on 15 Feb. A seminar was organised which included presentations by some of the visitors as well as students, post docs and faculty from the Physics Department, SMART/MIT and NTU. The Wageningen students also visited the various labs in the Physics Department.

In a letter written to Prof Johan R C Van Der Maarel who facilitated the visit, the students expressed their appreciation for the reception they received here. They enjoyed the joint seminar and the lunch cum discussions. The visits to the various labs were very interesting and they were particularly impressed by the wide range of experimental facilities available in the department. They hope their visit might lead to a continued scientific contact between our department and their group. The whole study tour has indeed been a great experience for all the PhD visitors.

Spintronics in Graphene Conference

The Graphene Research Centre at NUS, directed by Prof Antonio H Castro-Neto, is a newly established enterprise for excellence in graphene research aiming towards being a world reference. The Centre, jointly with NUSNNI-NanoCore, organised its first conference “Spintronics in Graphene” in NUS from 4 – 7 July, 2011, under the supervision of Prof Castro-Neto, Prof Andrew Wee, A/P Kian Ping Loh and Asst/P Barbaros Özyilmaz. The objective was to bring the leaders and pioneers of graphene research, more specifically spintronics (spin-electronics) in graphene, on a common platform for research dialogues and collaboration.

Though it was not meant to be a big-scale conference, speakers were invited from leading institutions and universities of Asia, Europe and USA, including two Noble Laureates, Prof Albert Fert (Unité Mixte de Physique, CNRS/Thales & Université Paris-Sud (Orsay), France) and Prof Andre Geim (University of Manchester, UK).

The conference has helped participants to share the fundamentals of graphene and its industrial limitations as a future material for spintronics device. For me and the researchers alike, it was a great opportunity to interact with and learn from the discoverers and founders of the field.

Contributed by Mr Orhan Kahya
Postgraduate student, NUS Graphene Research Centre
What Our Tutors Say…

They work behind the scenes but are highly sought by students especially during exams! Who are they? They are our dedicated teaching assistants (TAs). Let’s hear what they have to say about teaching physics!

"During one consultation, a student came and asked me how to find the electric potential energy to assemble 3 positive charges and 3 negative charges arranged in alternate manner at each corner of a hexagon. After explaining to him how to solve the problem using some geometry, he replied, ‘This is not physics, this is mathematics.’ I started to ponder whether there is this clear boundary that separates physics and mathematics."  

Chang Sheh Lit

"My favorite moments of teaching have always been when students came alone or in small groups, for then they are more willing to share their genuine thoughts and ask questions that they would be embarrassed to ask in class. Sometimes, a deep philosophical question would surface that we can discuss at length; at other times, a fun request, such as to take a group photo for memory’s sake. These interactions make teaching more memorable for me.”

Jeremy Chong

"As tutors, we always hope that at the end of the day, students will appreciate physics which to me is the beauty of human mind to understand nature. I feel delighted if I could explain physics to a wider audience. Students who lack imagination and mathematical skills need not avoid physics as I believe existing technology could assist students in their learning process via modeling, simulation or live demonstration. My advice to students is to keep learning, practicing and never give up!"

Ng Siow Yee

"Teaching is the best method to learn! Over the past years of teaching, I found that most students were just trying to memorise what were taught without understanding. This makes me realise that only imparting knowledge and problem-solving skills to physics students is not enough. From my own experience, I learn that I have a much better understanding of physical concepts and laws after I started to teach. So I encourage students to study physics from a teacher’s perspective.”

Ng Wei Khim

"From being a TA for the General Elective Modules, I have learned the techniques to teach physics in a more interactive and engaging style. At the same time, I also find it challenging and fun to discuss physics with students from different background. This has helped me to learn how to teach one concept from different points of views. In the years to come, I hope that I can keep improving myself so that I can become a better teacher.”

Qiu Leiju

"Teaching feels like déjà vu of my own student life. Back then it was difficult to avoid the procrastinating-cramming cycle with many distractions that made grade unimportant. Now as a tutor looking at students with the same experience, I wish I was taught earlier that discipline is one life-changing virtue to pick up in university. Teaching also gives me an opportunity to reflect on the physics that I knew or thought I knew (quoting Feynman) for if I could not explain it to my students, it means I don’t really understand it.”

Sotiawan

"They say teaching is a performing art, which I tend to agree. My method of teaching physics is just to use my voice and the whiteboard, with room for improvisation. I prefer this way because it is more intimate, and establishes a strong connection with the audience so that both teacher and students hang onto the essence of the contents presented, just like in the case with performers. Indeed, lots of preparation is involved, which is the challenging part.”

Lim Yen Kheng

"Physics is not easy to master but learning it need not be difficult. Many students find physics hard due to their wrong way of approach. The first major mistake they make is focusing on the minor details and losing out the main concepts. The second is asking questions without thinking deep into the problem. They may over-rely on the lecturer or tutor to solve their problems. Asking questions is good but asking without first pondering on the problem defeats the learning process.”

Tao Ye
DSO National Laboratories (DSO) is Singapore’s national defence R&D organisation overseeing the in-country development of cutting-edge technologies for the Singapore Armed Forces. Spanning the domains across air, land, sea and cyberspace, DSO is an ideal playground for scientists and engineers to do serious work. Dr Teo Kien Boon, the Programme Director of the Physical Sciences Core Programme in DSO and an adjunct associate professor with the Physics Department, shares the role that physics plays in the various fields of research work in Singapore’s largest R&D institute.

Studying physics helps one to understand the underlying physical principle that governs an observed phenomenon or that makes a certain technology or engineered gadget possible. Appreciation of the fundamentals makes it more probable for one to uncover new breakthroughs and the new principles that lead to better technologies. It is also easier to probe the limits of what is possible, something important when trying to find solutions to new and challenging problems.

Many fields of physics are relevant in the work we do in DSO. For example, electromagnetism is very important as it covers several of our core areas such as sensors. An understanding of solid state physics is needed for our work on advanced electronics and materials.

Optics is applied to our lasers and imaging applications, for instance Hyperspectral Imaging (HSI). HSI is widely used in search and rescue missions, medical imaging and sensing of chemical and bio-agents. Spectral measurements can provide rich information pertaining to object detection, recognition and classification.

DSO has invented a new HSI method known as PolarFour. With PolarFour, HSI can be achieved by simply attaching a special, thin attachment to any ordinary camera. This will open up many new HS applications that were previously impractical due to the steep cost and bulkiness of current HS camera systems.

Even more esoteric stuff like quantum mechanics is useful as we embark on emerging technologies such as quantum information and nanotechnologies.

We are always on the lookout for physics-trained graduates who are keen to apply their knowledge to help solve real-life applied problems. They must keep an open mind and be prepared to think out of the box to challenge conventional solutions, as we are often tasked to crack seemingly intractable problems!

Physics has certainly come a long way in the history of DSO. 20 years ago, physics graduates were recruited in very small numbers, mainly to support some electro-optics system work. Today, we have a thriving Applied Physics Laboratory with a high proportion of physics-trained researchers. Our growing community of physicists have also over the past decade successfully applied their unique approaches to achieve breakthrough innovations, with quite a number leading to patents and trade secrets.

Contributed by Adjunct
A/Prof Teo Kien Boon
Defence Science Organization & Physics Department

Awards

Congratulations to our fellow colleagues for being the proud recipients of the following awards!

Annual Teaching Excellence Award 2011
A/P Chung Keng Yeow

Young Researcher Award 2011
A/P Gong Jiangbin

“Seeds of Science” Award
Asst/P Vitor Manuel Pereira

Singapore Science and Engineering Fair (SSEF) Award 2011:
Dr M V Reddy & Prof B V R Chowdari
A/P Sow Chorng Haur

The Physics Dept won a Merit for the Annual Safety and Health Performance Award 2010

Fire Safety Excellence Award for Buildings:
$S11-Gold (Mr Wu Tong Meng)
$S12-Gold (Mr Foong Chee Kong)
$S13-Silver (Mr Wong How Kwong)

A/Prof Gong Jiangbin (second from left), a Young Researcher Award recipient
Discovering Physics - Device-Independent Quantum Science

Why is the blackbody radiation a quantum phenomenon? In a nutshell, because a classical electromagnetic field in a box would behave differently. If you want more details, just open a suitable textbook. But any answer must make reference to the physical system “electromagnetic field in a box”. The blackbody emission profile is remarkable, because you would not expect it from the classical description of that system.

Similarly, the Stern-Gerlach experiment is remarkable because one can guarantee that, before the magnet, there was no preferred orientation of the magnetic moment: therefore, the splitting in two beams is created, not revealed, by the apparatus. Without a careful knowledge of the system and its initial state, a splitting in two beams is not a very exciting observation.

A pattern starts to emerge: in order to assess the “quantumness” of a phenomenon, generally one needs a detailed knowledge of the physical system under study, of the measurements to be performed, and of their classical description. But, in some cases, there is a much more direct path. Specifically, one can certify that two physical systems are entangled without having any notion of what those systems are, nor of which measurements are being performed. And once you have entanglement, you have a resource for secret communication, teleportation, and ultimately quantum computing…

Here is the scenario. I give you a black box containing an alleged quantum system. It can be the electromagnetic field, an electron, an atom, five molecules, a graphene layer, a Bose-Einstein condensate… just anything, and you have no way of knowing, because your only interface is a knob. You can freely choose a position for the knob, allegedly equivalent to choosing a measurement – but, apart from not knowing what is being measured, you don’t even know if anything in the box really changes when you change the position of the knob.

Each time you perform one of these “measurements”, the box gives you an outcome: not the textbook eigenvalues (ℏ/2, ℏω, …) which would reveal something about the system; rather, just a “0” or a “1” appearing on a screen. I give another such box to one of your friends, and I claim its state is entangled with the state of yours. Remarkably, the two of you can check that this is true, even in the situation of total blindness in which I forced you.

This test, fittingly called “device-independent assessment”, exploits the violation of Bell’s inequalities. You have certainly heard these words, but probably in a very philosophical context: a criterion that proves that quantum randomness is not reducible to classical randomness. Indeed, for some time, Bell’s inequalities had been shelved by many physicists as a historical curiosity. But some of us in quantum information science believed that beautiful philosophical ideas must also be useful for something. Since 2007, we know that we were right.


Contributed by A/Prof Valerio Scarani
Centre for Quantum Technologies & Physics Department

Valerio Scarani was born in Milan, Italy, in 1972. He realised his undergraduate and doctoral studies in Ecole Polytechnique Federale de Lausanne. His experimental PhD topic having proved to be of the bottleneck kind, he was ready to move out of academia when Nicolas Gisin offered him a post-doc position in his group in Geneva – as a theorist. Projected by this lucky event in the world of quantum information science, he has worked both on fundamental and applied topics. He joined NUS in April 2007. He enjoys grooming students from UROPS to doctorate, with the help of outstanding post-docs. His effort to invite students to join the weekly CQT soccer games has not been duly rewarded so far, but he stubbornly perseveres in it.

Website: conneqt.quantumlah.org
**4th India-Singapore Joint Physics Symposium**

The aim of the India-Singapore Joint Physics Symposium is to bring researchers (faculties, post docs and graduate students) in various universities, institutes and centres in India in contact with each other as well as with those from NUS.

Held from 23 to 25 Feb at the NUS, the 4th India-Singapore Joint Physics Symposium witnessed 41 invited presentations given by guests from India and faculty from the department. Major topics discussed were condensed matter physics and its applications as well as aspects of theoretical physics and biophysics.

Labs were showcased to visitors and one to one discussions were held to explore possible research collaborations.

**La Trobe-NUS Workshop on Synchrotron & Nanoscale Science**

The La Trobe-NUS Seminar on Synchrotron and Nanoscale Science was held at the Faculty of Science on 23 Jun. The main objective of this first-ever seminar was to find areas of mutual research interest for future collaborations. Principal Investigators from the Department of Physics of La Trobe University as well as those from the Departments of Chemistry and Physics of NUS and the Singapore Synchrotron Light Source shared their latest research works and findings at the seminar.

Prof Mark Breese, Director of the Singapore Synchrotron Light Source, believed the seminar brought about a much better appreciation of what each other is doing besides putting faces to names. It is also important to find out each other’s strength and possible collaborative areas.

About 50 participants were present at the seminar and the general feedback has been positive. “I enjoyed it and found it useful. I will certainly call in at La Trobe for a follow-up visit next time I’m in Melbourne,” added Prof Mark Breese.

**A Day in the Life of ...**

Workshop manager Mr Tan Choon Wah has witnessed the progress of the Physics Workshop for as long as its existence. He is thankful for his team of good men and women who have helped raised the profile of the workshop to what it is today.

A primary role of Mr Tan is to help staff and students custom design and fabricate parts and equipment for research or teaching purposes. The workshop has also been providing assistance to the Science Faculty, CQT, IMRE and NTU, just to name a few. For Mr Tan, working with top researchers and students gives him great satisfaction.

Being the only place in campus capable of fabricating high vacuum parts, Mr Tan makes sure that every job undertaken by the workshop is of high quality. From the distribution of jobs to technicians and interacting with staff and students concerning their drawings and designs to the actual fabrication of products, Mr Tan has hold dearly to his responsibilities. He also sees to it that safety remains a top priority in the workshop. To him, a healthy work environment makes a happy and confident worker.

Mr Tan has received numerous awards including the Teaching Support Award, the Outstanding Service Award and National Day Efficiency Award from the President. Though an avid traveller, nothing beats his home and the Physics Department which has become his second home.

A favourite weekend activity of Mr Tan is walking. A devout Tao believer, he hopes to make the best of this precious life to engage in good deeds.
An Ambassador at Heart

Prof Chowdari shares with Physics Matters the multiple roles he played besides being a physicist.

You recently won the Business Event Ambassador Award from the Singapore Tourism Board. Does it come as a surprise to you? What does this award mean personally to you?

Knowing that there are many who have contributed in one way or the other in promoting Singapore as a Business Event Destination, the Business Event Ambassador Award came as a pleasant surprise to me. Personally it means to me a great recognition for the hard work I have put in over the last 15 years. This reminds me of the “Officer in the Order of Academic Palms” award that I received from the French Government a few years ago.

ICMAT 2009 has won the “Association Conference of the Year” award from among hundreds of entries. What do you think contributed to ICMAT’s success? What are some challenges you face as organiser?

ICMAT is one of the prime activities of the Materials Research Society of Singapore (MRS-S). As President of MRS-S, I initiated the organisation of ICMAT in 2001. So far five conferences have been held and it is gratifying to see increasing participation over the years. The forthcoming ICMAT 2011 is expected to host some 3000 delegates including four Nobel Laureates.

Organisation of ICMAT is the combined effort of the entire materials community of Singapore which has become unified and galvanised as a result. Although a Singapore-born and based conference, it is truly international in terms of organisation and participation. Our policy of providing significant financial support to needy students and participants from developing countries has resulted in large participation from the region, in particular China and India.

The real success of ICMAT lies in motivating academics from different organisations and backgrounds. Sustaining the high benchmark we have set and providing quality programs are demanding tasks. Ferrying participants around rests on good logistics which is another challenge since many distinguished scientists do not prefer the same lodging each year.

I consider a conference successful only if it has quality, quantity and financial sustainability. I am happy that the ICMAT series has all of these attributes and has been recognised as an icon of Singapore.

Tell us more about the NUS-India Research Initiatives.

The NUS-India Research Initiatives is aimed at facilitating and fostering strong research collaborations between NUS and Indian universities and institutes of higher learning. Organised summer intern programs taken up by the Physics, Chemistry and Biological Sciences Departments through the initiatives have achieved great success. They not only contribute to more research interactions but also are potential sources of good graduate students.

Share with us some of your research activities.

I am currently interested in developing new materials for applications in lithium ion batteries and portable power sources. Over the years, my research group has published numerous papers in reputable journals. A number of the materials we have synthesised and characterised are being tested for real applications.

What do you wish to build into our physics undergraduates today? Are there any changes you like to see in the teaching of physics?

A sense of enquiry is the need of the day. I would like all our students to think big, aim high and work for it. Success will follow automatically. I would like to put more emphasis in small group teaching in terms of tutorials and problem solving sessions and also research to be the part of the basic curriculum.

How do you like the roles you play as a business event ambassador, head of research initiatives, researcher and academic?

Each of them is a challenging one. While research and teaching are confined to the laboratory and classroom respectively, the other two roles require considerable travel and public relations. As the Executive Director of the India Research Initiative, I have to keep abreast of any changes and developments taking place worldwide especially in India and nurture the relations through frequent visits to Indian universities and institutes of higher learning.

Bringing MRS-S to an international standing is a challenge. This has been possible through sheer hard work, aspiration as well as my role as President of the International Union of Materials Research Societies. It is indeed gratifying that we are able to achieve a high recognition despite Singapore being small and having no critical mass.

What are some initiatives or roles you have undertaken that you are particularly fond of?

I am particularly pleased being able to leave behind a legacy in ICMAT, Nobel Laureate Public Lecture series (which has witnessed 16 Nobel Laureates giving public lectures in the last 10 years), MRS Singapore, Asian Society for Solid State Ionics (founded 25 years ago; President for the last 15 years) and the Physics Enrichment Camp (initiated 15 years ago; coordinator for the first 10 years). These remain the landmarks of my achievements and I am happy that all these activities have helped others in their professional development. I am equally glad that the Institute of Physics (Singapore) is making use of the Nobel Laureate Public Lectures forum to give away IPS Medals for the best A-level students in Singapore.

Are there any other interests that you pursue and like to share with us?

I enjoy visiting different countries to understand the different cultures. I also provide assistance to several local and international social organisations in their organisation of national and international conferences.
Congratulations Class of 2011!

BSc Students
1 Chen Wei Yang Gary
2 Cheong Hong Bin
3 Ding Jie Han Jonathan
4 Ew Hui Li
5 Fong Xin Yi
6 Khing Umay
7 Li Xu
8 Liauw Kee Meng
9 Liew Sing
10 Su Junyuan
11 Tan Ee Hsin
12 Tan Isaac
13 Tan Yue Chuan
14 Veradej Wisetjarkhun
15 Wan Huaming
16 Wang Boyu
17 Wee Qirong Ronald
18 Wu Gang

MSc Students
1 Afsana Yusuf
2 Bibin Thomas Anto
3 Cheah Wai Kiong
4 Chia Guo Hao
5 Cui Yanjie
6 Fang Yiyuan
7 Jiang Songsong
8 Jiang Yun
9 Lam Mun Choong Mark
10 Lee Jianwei
11 Li Jing
12 Rajesh Tamang
13 Setiawan
14 Shreya Dilipkumar Shah
15 Shi Zhanmu
16 Tan Chek Kiang Joel
17 Toh Chee Tat
18 Wong Chun Mun Reuben
19 Xu Lishan
20 Yun Tao
21 Zhu Gai

BSc (Hons) Students
1 Andrew Bah Shen Jing
2 Ang Peng Siang
3 Angeline Shu Sze Yi (USP scholar)
4 Cai Yu
5 Cavan Chiam Choon Hao
6 Chin Chii Tarrn
7 Chua Ka Ming
8 Chua Wenyi
9 Goh Wei Na
10 Haw Jing Yan
11 Kamalakanan s/o Soundararajan
12 Kan Soon Woh Thaddeus
13 Khoo Shao Ting
14 Le Phuc Thinh (Outstanding Undergraduate Researcher Prize)
15 Lee Kian Wei Jelvin
16 Lee Sin Yi
17 Len Yank Loong
18 Lin Yiteng
19 Liu Yuei
20 Lokender Singh s/o Surendra S
21 Loo Yoke Leng
22 Luigi Joven Singsoon Laurel
23 Mohammad Azhar B Ibrahim
24 Ng Kah Fiee
25 Ong Chia Rui
26 Ong Joo Kiat Kenneth
27 Ong Jun Kok
28 Su Yuansi Wendy
29 Thong Mui Han
30 Ting Yuan Sen (IPS Medal & Jurong Shipyard Prize)
31 Wang Wei Yang
32 Wong Yuan Keng Alex (Lijen Industrial Development Medal & Jurong Shipyard Prize)
33 Yang Varong
34 Zara Ligeng Zhuang
35 Zhou Hangbo (Jurong Shipyard Prize)

PhD Students
1 Alwyn Rebello
2 Andreas Keil
3 Bijoy Kumar Das
4 Chen Yu
5 Chu Xinjun
6 Huang Yuli
7 Lim Zhi Han
8 Liu Yingjie
9 Ng Wei Khim
10 Ong Wei Jie
11 Ow Yueh Sheng
12 Poon Siew Wai
13 Qu Yingli
14 Sha Zhendong
15 Shen Lei (Materials Research Society of Singapore Medal)
16 Sureerat Homhuan
17 Tang Pan
18 Wong Loke Yuen
19 Wu Xiang
20 Xing Guichuan
21 Yang Nuo
22 Zhao Lihong
23 Zhou Mi
24 Zhu Xiaoying

Announcements

Workshop on Emergence in Field Theory
5 - 8 Aug, 2011, Nanyang Executive Centre, NTU, Singapore

4th CSA-IAA Conference on Advanced Space Technology
5 - 8 Sep 2011, Shanghai, China
More info at http://www.csaspace.org.cn/shanghai/

6th Conference of the Asian Consortium on Computational Materials Science (ACCMS-6)
6 - 9 Sep 2011, Binapoli, Singapore

Frontiers of Organic/Inorganic Hybrid Materials for Electronics and Optoelectronics (KOSMOS 2011)
17 - 25 Sep, 2011, Humboldt-Universität zu Berlin, Germany
More info at http://www.hu-berlin.de/kosmos/kosmos2011/

7th Singapore-China Joint Symposium on Research Frontiers in Physics
21 - 23 Sep 2011, Wuhan, China
Contact: A/P Gong Jiangbin, Email: phygj@nus.edu.sg