

10-Year Report

Institute of Advanced Studies

Nanyang Technological University (NTU)

Singapore

since 2005



PREFACE

The Institute of Advanced Studies (IAS) at Nanyang Technological University (NTU) celebrates its ten years of achievement.

For the past 10 years, we have hosted numerous Nobel Laureates and Fields Medallists, and also organised many world-class international workshops and conferences which were listed in this report.

IAS @ NTU is modelled after IAS Princeton. Till now, IAS Princeton is still the most famous institute for fundamental research in the world. One of the reasons is that during the formative stage, many top-notch physicists (notably Albert Einstein), mathematicians, scientists and academic staff were based at IAS Princeton.



For the past 20 years, there are about 30 IASs set up all over the world, mainly in Europe and Asia. In Europe, there are IASs in Amsterdam, Birmingham, Jerusalem, Johannesburg, Munich, UCL and Warwick. In Asia, there are IASs in China (Tsinghua), Hong Kong, Japan, Korea and Taiwan. All these newly established IASs are geared to promote pure and applied research and already maintaining an international outreach in the global arena. For IAS @ NTU, we have already established collaborations with CERN, Munich, Tsinghua, Hong Kong and others.

In this IAS 10-Year Report, we provide an overview update of our activities for the past 10 years. We are confident that we can reach greater heights in the years to come.

K K Phua

Founding Director

Institute of Advanced Studies, NTU

Fellow, American Physical Society

D Sc (University of Birmingham)

Contents for the Last 10-Year Program

2005

100 Years of Physics Symposium in Singapore	10–12 Aug 2005
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2006

International Workshop on Spintronics	8–12 May 2006
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International Workshop on Multiscale Analysis and Applications	18–22 Dec 2006
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2007

International Workshop on New Trends in Biomolecular Modeling: From Protein Folding to DNA Compaction	15–16 Mar 2007
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International Workshop on Plasma Applications in Nanofabrication and Photovoltaic Solar Cells	5–6 Jul 2007
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4th Asia Pacific Workshop and 3rd Asia Pacific Conference on Quantum Information Science	30 Jul–2 Aug 2007
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Conference in Honour of the 85th Birthday of Nobel Laureate Prof CN Yang: Statistical Physics, High Energy, Condensed Matter and Mathematical Physics	31 Oct–3 Nov 2007
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Science Education Symposium	2 Nov 2007
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2008

Conference on Particle Physics, Astrophysics and Quantum Field Theory: 75 Years since Solvay	27–29 Nov 2008
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NTU-Tsinghua Joint Workshop on Discrete Mathematics and Theoretical Computer Science	12–14 Dec 2008
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2009

1st International Science Youth Forum @ Singapore with Nobel Laureates	19–23 Jan 2009
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Tsinghua-NTU Joint Workshop on Nanoscience	26–28 Feb 2009
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Les Houches School of Physics Summer Session in Singapore	29 Jun–24 Jul 2009
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Conference on Sparse Representation of Multiscale Data and Images	14–17 Dec 2009
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2010

2nd International Science Youth Forum @ Singapore with Nobel Laureates	18–22 Jan 2010
Conference on Recent Development in Chinese Herbal Medicine	25–26 Jan 2010
Conference in Honour of the 80th Birthday of Prof Murray Gell-Mann	24–26 Feb 2010
Tsinghua-NTU Joint Workshop on Life Sciences	14–17 May 2010
Workshop on Physics with Ultra Cold Atoms	21 Jul 2010
Satellite Meeting of the 15th International Photosynthesis Congress	18–20 Aug 2010
IAS-Julian Schwinger Foundation Joint Workshop: Spontaneous Energy Focusing Phenomena and Multiscale Physics	30 Aug–3 Sep 2010
International Conference on Flavour Physics in the LHC Era	8–12 Nov 2010
NTU-Tsinghua Joint Workshop on Nanoscience	26–27 Nov 2010

2011

3rd International Science Youth Forum @ Singapore with Nobel Laureates	11–15 Jan 2011
5th Asia-Pacific Workshop on Quantum Information Science 2011 in conjunction with the Festschrift in honour of Vladimir Korepin	25–28 May 2011
IAS-MIT Joint Workshop on Emergence in Field Theory	5–8 Aug 2011
1st Workshop on Standardisation of Chinese Physics Terminology	11–12 Dec 2011

2012

1st IAS-CERN School on Particle Physics and Cosmology and Implications for Technology	9–31 Jan 2012
4th International Science Youth Forum @ Singapore with Nobel Laureates	15–19 Jan 2012
International Conference on Pan Shou: A Centennial Commemoration	31 Mar 2012
Tsinghua-NTU Joint Workshop on Number Theory, Discrete Mathematics and their Applications	25–27 May 2012
Singapore School of Physics Session I: Strong Light-Matter Coupling: From Atoms to Solid State Systems	21 May–8 Jun 2012
2nd International Workshop on Photosynthesis: Natural and Artificial Photosynthesis, Bioenergetics and Sustainability	11–13 Jun 2012
International Symposium on Theory and Evidence in Acupuncture	21–22 Aug 2012
2nd Workshop on Standardisation of Chinese Physics Terminology	23–26 Nov 2012

2013

5th International Science Youth Forum @ Singapore with Nobel Laureates	20–24 Jan 2013
1st Global Young Scientists Summit	20–25 Jan 2013
Complexity Conference	3–5 Mar 2013
International Workshop on Determination of the Fundamental Parameters of QCD	18–21 Mar 2013
1st IAS-CERN Workshop on Particle Physics and Cosmology: Status, Implications and Technology	25–27 Mar 2013
5th APCTP Workshop on Multiferroics	22–24 May 2013
9th Singapore-China Joint Symposium on Research Frontiers in Physics	28–29 Jun 2013
Conference in Honour of the 90th Birthday of Nobel Laureate Prof Rudolph Marcus: Fundamentals in Chemistry and Applications	22–24 Jul 2013
Conference in Honour of the 90th Birthday of Prof Freeman Dyson	26–29 Aug 2013
3rd Workshop on Standardisation of Chinese Physics Terminology	22–25 Nov 2013

2014

6th International Science Youth Forum @ Singapore with Nobel Laureates	19–23 Jan 2014
2nd Global Young Scientists Summit	19–24 Jan 2014
IAS-CERN Novice Workshop on Higgs Boson, Particle Physics and Cosmology	7 Feb 2014
International Conference on Flavor Physics and Mass Generation	10–14 Feb 2014
Complexity Conference	2–4 Mar 2014
International Conference and Exhibition on Plague Fighter Dr Wu Lien-Teh jointly organised with the Lee Kong Chian School of Medicine	5–12 Apr 2014
Berge Fest Conference on Quantum Information, Quantum Optics and the Foundations of Quantum Mechanics	22–25 Apr 2014
3rd International Workshop on Photosynthesis: Advances in Solar Fuels and Photovoltaics in Honour of the 70th Birthday of Prof Michael Grätzel	11–14 Jun 2014
The OCPA8 International Conference on Physics Education and Frontier Physics	23–27 Jun 2014
Workshop on the Chemistry of Energy Conversion and the 6th MRS-S Conference on Advanced Materials	22–24 Jul 2014
8th Asian Science Camp With Nobel Laureates & Eminent Scientists in Singapore	24–29 Aug 2014

28th General Assembly of the International Union of Pure and Applied Physics (IUPAP)	5–7 Nov 2014
International Workshop on Exceptional Symmetries and Emerging Spacetime	10–12 Nov 2014
Workshop on Quantum Effects in Biological Systems	2–5 Dec 2014

2015

7th International Science Youth Forum @ Singapore with Nobel Laureates	18–22 Jan 2015
3rd Global Young Scientists Summit	18–23 Jan 2015
International Workshop on Polyelectrolytes in Chemistry, Biology and Technology	26–28 Jan 2015
2nd IAS-CERN School on Particle Physics and Cosmology and Implications for Technology	2–6 Feb 2015
International Conference on Massive Neutrinos	9–13 Feb 2015
2nd Singapore Sustainability Symposium	15–17 Apr 2015
Conference on 60 Years of Yang-Mills Gauge Field Theories: CN Yang's Contributions to Physics	25–28 May 2015
2nd Pan Asia Liberal Arts Education Conference	28–29 Oct 2015
International Workshop on Higher Spin Gauge Theories	4–6 Nov 2015

2016

8th International Science Youth Forum @ Singapore with Nobel Laureates	17–21 Jan 2016
4th Global Young Scientists Summit	17–22 Jan 2016
IAS-ICTP School on Quantum Information Processing	18–29 Jan 2016
Memorial Meeting for Nobel Laureate Prof Abdus Salam's 90th Birthday	25–28 Jan 2016
Workshop on the Evolution of Cells, Genomes and Proteins	1–6 Feb 2016
Conference on New Physics at the Large Hadron Collider	29 Feb–4 Mar 2016
4th International Workshop on Solar Energy for Sustainability: Photosynthesis and Bioenergetics	21–24 Mar 2016

The Institute of Advanced Studies at Nanyang Technological University: Ten Years of Achievement



In 2015, Singapore celebrates its 50th birthday. At the same time, the Institute of Advanced Studies (IAS) at the Nanyang Technological University (NTU), established in July 2005, celebrates its ten years of achievement. IAS at NTU has been formed to identify and push strategic research areas at NTU with appropriate research programs supplemented with high-level international conferences and workshops. These conferences and workshops are organised with the help of eminent scientists to provide NTU's science and technology initiatives with a "Nobel boost": establishing the hallmarks of science at the highest level. Since then, IAS has also organised several successful graduate schools and outreach activities. To shape the strategic directions of the Institute, IAS is advised and guided by a committee of world-renowned scientists, including 11 Nobel Laureates and a Fields Medallist. Mr George Yeo, Former Minister for Foreign Affairs, is the Patron of IAS.

Since its establishment in 2005, IAS at NTU is generally regarded as one of the best Institutes of Advanced Studies in the Asia Pacific region. The Institute hosts a significant number of Nobel Laureates and Fields Medallists every year,

and organises a large number of high impact, international conferences, workshops and schools across many disciplines in the Asia Pacific region. The Institute has helped to forge interdisciplinary research and close collaboration between NTU and major centres of research around the world. It has also inspired numerous talented youths through its many programs to move into a scientific career. Moreover, these events have allowed NTU faculty members and students to interact closely with eminent visitors and speakers from around the world. The multidisciplinary topics that IAS oversees include physics, chemistry, engineering, biomedical imaging, materials science, maths, liberal arts, urban planning, and so forth.

Although IAS is based at NTU, the close rapport with many active scientists and distinguished scholars from all disciplines abroad that has been established through the years has also helped to promote Singapore as a hub for international research and development. This successful model has encouraged the National Research Foundation to engage IAS with the initial planning and organisation of the well-known Global Young Scientists Summit (GYSS) each year in Singapore. The GYSS is modelled closely after the Lindau conferences organised by the Nobel Foundation each year.

IAS received generous financial support from the Lee Foundation. For the past ten years, IAS has organised numerous conferences, workshops, symposiums and graduate schools. Many of these events were co-organised with the National University of Singapore, Tan Kah Kee International Society, National Institute of Education, Ministry of Health and Ministry of Education, particularly through activities in secondary schools and junior colleges. Some of the key events are:

100 Years of Physics Symposium in Singapore (10 to 12 August 2005)

This event was held as part of the celebration of the World Year of Physics 2005. Besides reaching out to the next generation of scientists and engineers, the symposium, organised jointly by IAS and the newly formed School of Physical & Mathematical Sciences at NTU, was also intended to reach out and capture a wider non-physics community.

We were glad that Mr Tharman Shanmugaratnam (current Deputy Prime Minister of Singapore) was able to grace the opening ceremony on 10 August 2005. Keynote speakers invited to the conference included Prof Robert B. Laughlin (Nobel Laureate in Physics 1998), Prof Alex Pines (Wolf Prize Winner 1991), Dr Akira Tonomura (Imperial Prize Winner 1991) and Prof Paul Davies (Templeton Prize Winner 1995).



(from left) Mr Tharman Shanmugaratnam (current Deputy Prime Minister of Singapore) had a cordial conversation with Prof Eng-Chye Tan and Prof Soo-Ying Lee.

An educational forum and a regional cooperation panel discussion took place during the symposium. Both sessions, particularly the panel discussion, was intended to pave the way for better future cooperation between institutions from different countries.

Conference in Honour of Nobel Laureate Professor C N Yang's 85th Birthday: Statistical Physics, High Energy, Condensed Matter and Mathematical Physics (31 October to 3 November 2007)

The special conference in celebration of Prof Chen-Ning Yang's pioneering contributions to physics on the occasion of his 85th Birthday was held at the Swissotel Merchant Court.

In 1967, he attended an International Conference at Nantah's Department of Physics ("Nantah" is the Chinese abbreviation of the Nanyang University, a precursor to the current NTU). In 1971, Prof Yang was appointed as External Examiner for the Department of Physics. He also accepted IAS's invitation to be a member of the International Advisory Committee in 2005. When NTU organised the *37th International Physics Olympiad* in July 2006, Prof Yang delivered two inspiring lectures to students and staff at NTU. During the event, he also launched the NTU's C N Yang Scholars Programme designed for talented students with a deep passion in Science, Technology, Engineering, Mathematics and Research.



(from left) Mr Tharman Shanmugaratnam (current Deputy Prime Minister of Singapore), Mrs C N Yang, Prof C N Yang, Dr Guanling Su (then President of NTU), Prof Bertil Andersson (current NTU President) and Prof Phua Kok Khoo (Director of IAS).

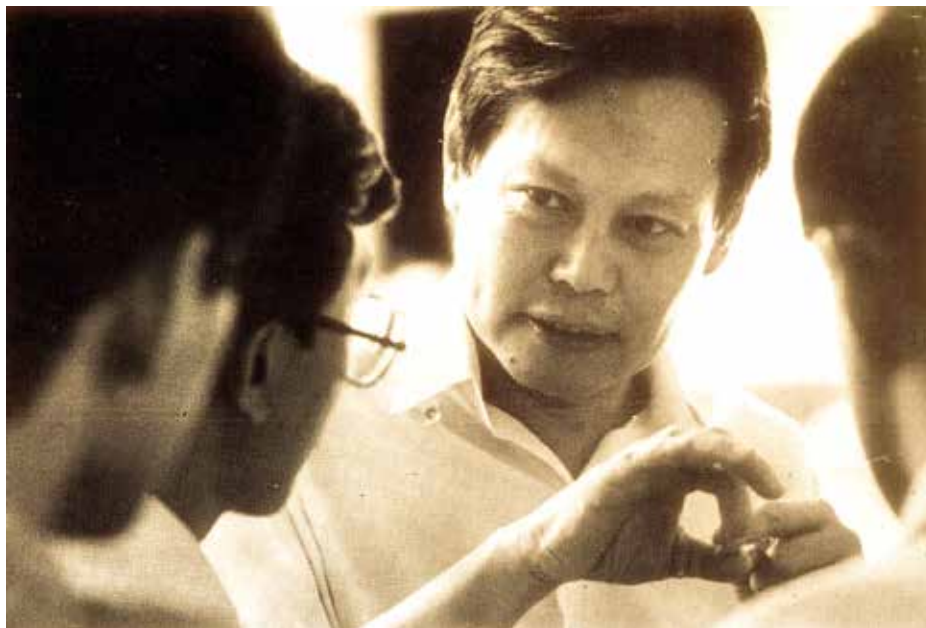


Prof C N Yang and Mr S R Nathan (then President of the Republic of Singapore) at the conference banquet.

We were also happy that the opening ceremony was graced by Mr Tharman Shanmugaratnam (current Deputy Prime Minister of Singapore) on 31 October 2007. The three-and-a-half day programme included presentations by more than 60 invited eminent speakers, local and overseas



The special book titled *Professor Chen-Ning Yang at Nantah* was presented to Prof Yang at the conference.



Prof C N Yang exchanged views with young students during a visit to Nantah in 1976.

Reprinted with permission from *Professor Chen-Ning Yang at Nantah*.

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researchers. The Nobel Laureates speakers were Prof Walter Kohn (Nobel Laureate in Chemistry 1998), Prof Martin Perl (Nobel Laureate in Physics 1995) and Prof Claude Cohen-Tannoudji (Nobel Laureate in Physics 1997).



Prof C N Yang held a cordial talk with Mr Lee Hsien Loong (current Prime Minister of Singapore) (second from left) at the *25th International Conference on High Energy Physics* in August 1990. On the left is Prof Phua Kok Khoo, Chairman of the Organising Committee.
Reprinted with permission from *Professor Chen-Ning Yang at Nantah*.
Copyright 2007, Institute of Advanced Studies, NTU, p. 36.

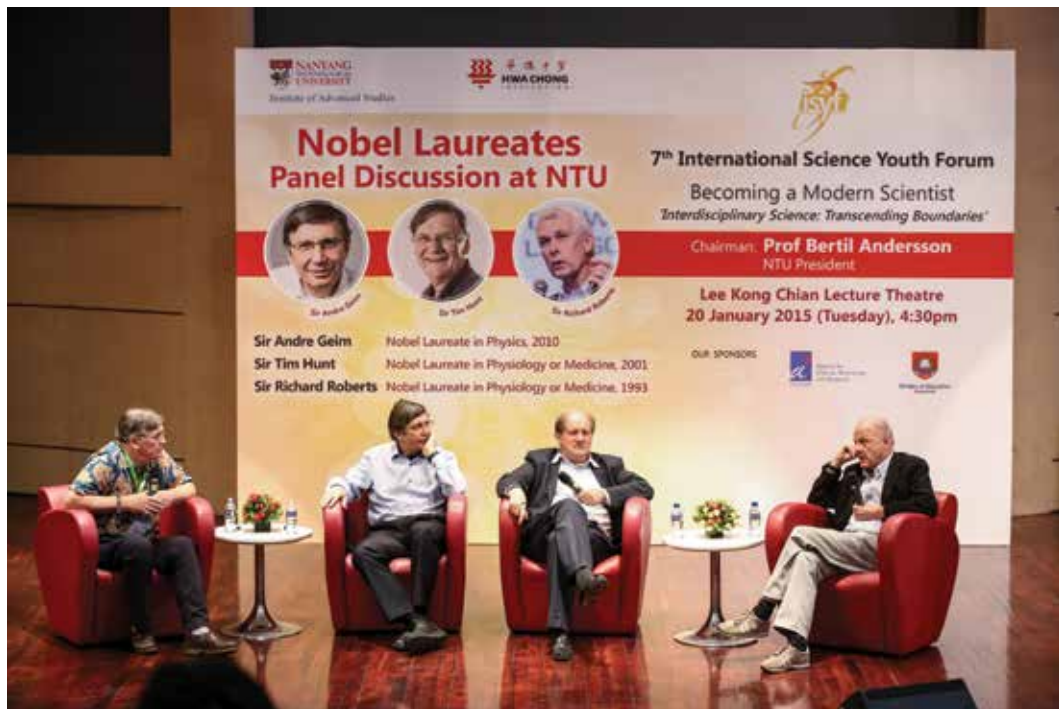
A series of other events were held in conjunction with the unique conference. These included C N Yang's Nobel Laureate room dedication, signing of Memorandum of Understanding between NTU and Tsinghua University, the Science Education Symposium, the Asia-Pacific Meeting on Frontiers in Plasma Physics, as well as a public lecture by C N Yang and renowned Chinese artist, Fan Zeng.

The conference banquet was held on 1 November 2007 at the Ballroom of Swissotel Merchant. Mr S R Nathan, then President of the Republic of Singapore, was the Guest-of-Honour for the evening.

Annual International Science Youth Forums (ISYF) with Nobel Laureates in Singapore

**(19 to 23 January 2009, 18 to 22 January 2010, 11 to 15 January 2011,
15 to 19 January 2012, 20 to 24 January 2013, 19 to 23 January 2014,
18 to 22 January 2015 & 17 to 21 January 2016)**

The annual ISYF is an outreach program organised jointly with Hwa Chong Institution each year. The Forum is conceived as a platform for talented high school students to learn and enhance their interests in science through



ISYF 2015 panel discussion at NTU on *Becoming a Modern Scientist*. (from left) Nobel Laureates Sir Tim Hunt and Sir Andre Geim, Prof Bertil Andersson (NTU President) and Prof Lars Brink (former chairman of the Nobel Physics Committee).

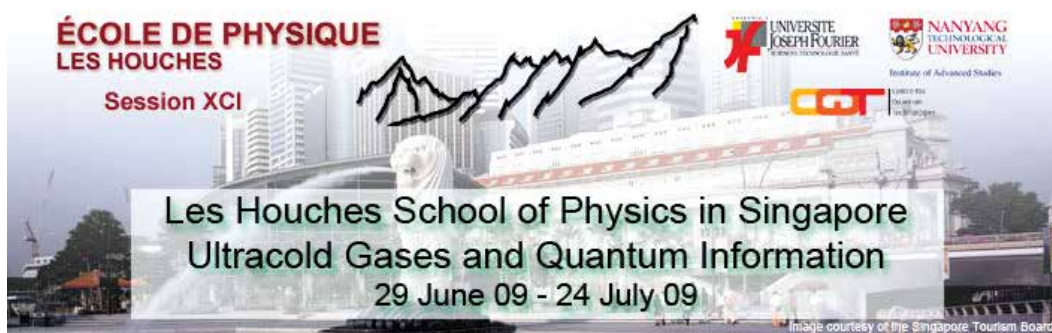


ISYF 2014 participants engaging in an experiment on the embryonic *in ovo* of a chick at the NTU Lee Kong Chian School of Medicine.

intellectual dialogues with leading experts in various scientific fields: Physics, Chemistry, Biology, Mathematics and Engineering. Each year, around five to six Nobel Laureates are invited to share their insights and passion in science with top science students from premier schools worldwide. The Forums are sponsored by the Temasek Foundation (2009 to 2011) and the Agency for Science, Technology and Research (A*STAR, 2012 to 2016) as well as the Ministry of Education.

The residential camp provides an excellent platform for high school students to bond with like-minded high achievers. It is also a rare opportunity to interact with Nobel Laureates and eminent scientists. The Forums help to inspire the students and provide them with a better understanding of the importance of broad-based knowledge, diverse interest, deep passion and tenacity necessary in their pursuit of science excellence.

Les Houches School of Physics Summer Session in Singapore (29 June to 24 July 2009)



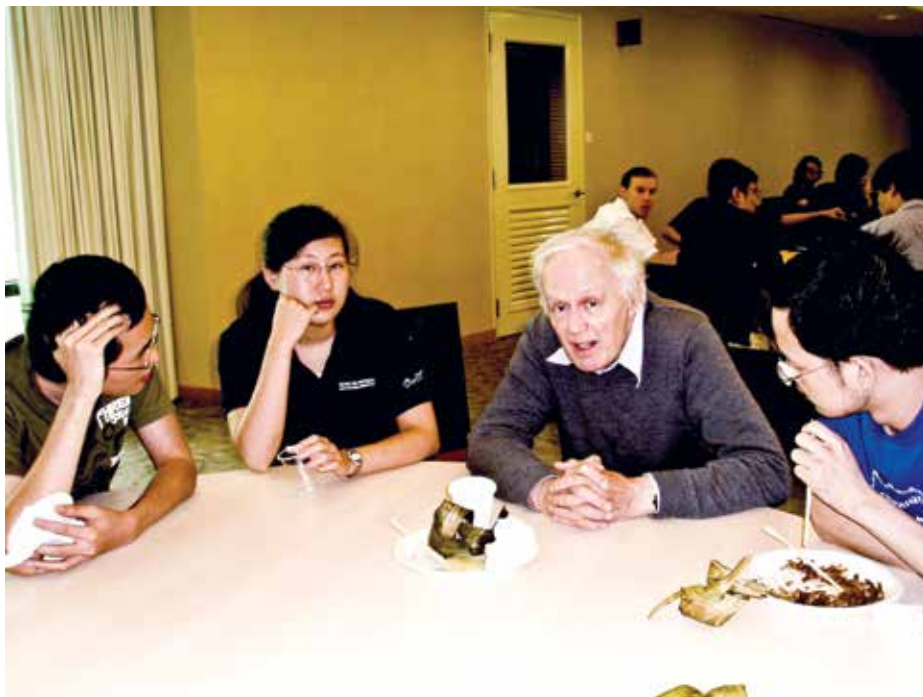
IAS organised the first “Les Houches” Session in Asia.

The one-month summer school held at the Nanyang Executive Centre of NTU was organised by IAS in collaboration with the Les Houches School of Physics in France and the Centre for Quantum Technology. The Les Houches School of Physics, widely known as one of the premier summer and winter schools in the world, is traditionally held in the Rhone Alps in south-eastern France. Session 91 was in fact the first time the prestigious French school was held outside of France since its establishment in 1951.

His Excellency Mr Pierre Buhler, then Ambassador of France to Singapore, graced the opening ceremony. Prof Leticia Cugliandolo (Director of École de



Opening ceremony of the Les Houches School of Physics in Singapore. Seated in the front row from left: Prof Martial Ducloy (CNRS), Prof Leticia Cugliandolo (Director of École de Physique des Houches), Prof Phua Kok Khoo (Director of IAS), His Excellency, Mr Pierre Buhler (then French Ambassador of Singapore) and Dr Guanling Su (then President of NTU).



Participants enjoying a discussion with Nobel Laureate Prof Anthony Leggett.

Physique des Les Houches) gave a presentation on the Les Houches School of Physics in France.

The Les Houches School in Singapore aimed to attract young graduate students and researchers into these very active fields of research frontier. It offered an overview of the latest developments and allowed the participants to share the excitement and challenges of the community with experts in the fields of Ultracold Gases and Quantum Information. More than 110 postdoctoral fellows and graduate students applied for the School and 67 participants were eventually admitted.

Conference in Honour of the 80th Birthday of Professor Murray Gell-Mann (24 to 26 February 2010)



A festival of lectures themed “Quantum Mechanics, Elementary Particles, Quantum Cosmology and Complexity” was held to celebrate Nobel Laureate Prof Gell-Mann’s revolutionary contributions to physics. Many renowned scientists attended the conference, including three Nobel Laureates, Professors C N Yang, Kenneth Wilson and Gerard ’t Hooft. Chaired by Prof Harald Fritzsch and Prof Phua Kok Khoo, the conference included parallel sessions on Particle Physics, Quantum Mechanics and Complexity. The event was sponsored by the Lee Foundation. More than 80 teachers attended the Physics



Nobel Laureates Professors Gerard 't Hooft and Murray Gell-Mann enjoying the conference lectures.

Education workshop which was held in conjunction with the conference. Most of the teachers who attended the workshop thoroughly enjoyed the captivating talks and hands-on activities.

International Workshops on Photosynthesis (18 to 20 August 2010, 11 to 13 June 2012, 11 to 14 June 2014 and 21 to 24 March 2016)

The biennial International Workshops on Photosynthesis were jointly organised by IAS, School of Biological Sciences, School of Material Sciences and Engineering, and Energy Research Institute at NTU, and sponsored by the Lee Foundation.

Chaired by Prof James Barber (Imperial College London), the workshops were attended by many leading experts, including Prof Alan Heeger (Nobel Laureate in Chemistry 2000), Sir Harold Kroto (Nobel Laureate in Chemistry 1996), Prof Rudolph Marcus (Nobel Laureate in Chemistry 1992), Sir John Walker (Nobel Laureate in Chemistry 1997) and Prof Michael Grätzel (Millennium Technology Prize 2010).

In 2016, the *4th International Workshop on Solar Energy for Sustainability: Photosynthesis and Bioenergetics* was specially dedicated to the celebration of the 75th Birthday of Nobel Laureate Sir John Walker and Prof Leslie Dutton FRS, as well as in memory of the outstanding contributions made to this area of research by Prof Joan Mary Anderson FRS, who passed away on 28 August 2015.



Prof James Barber (Imperial College London), the chief architect of the series of workshops on photosynthesis and bioenergetics.



Local and overseas speakers and participants of the 2014 Photosynthesis Workshop.

IAS-CERN Schools on Particle Physics and Cosmology and Implications for Technology (9 to 31 January 2012 and 2 to 6 February 2015)

In January 2012, with the enthusiastic support of CERN, a special three-week long school on Particle Physics, Cosmology and Implications for Technology was organised by IAS. Her Royal Highness, Princess Maha Chakri Sirindhorn of Thailand, was the Patron of the School.

The schools aim to bring together interested researchers to join in the scientific exploration in the exciting fields, such as frontier topics in particle physics and cosmology, and the latest technologies in accelerator and detector physics.

Singapore Deputy Prime Minister Teo Chee Hean launched the first School at the opening ceremony on 9 January 2012. "The IAS School takes the collaboration between NTU and CERN to a higher level, and helps to position NTU as the Asian research hub in the global network of scientific institutions that focus on high energy physics," said DPM Teo. "To stay ahead in the highly competitive arena of scientific research, Singapore must continue to support and recognise high-quality research, forge new links and partnerships, develop new niches of excellence and blaze new trails."

The Straits Times, page B6, 11 Jan 2012

S'pore students on hunt for God particle

IT HAS been called the building block of the universe, but has eluded the grasp of scientists around the world.

Now, students in Singapore are being given a chance to help European scientists find the Higgs Boson particle – or so-called God particle – an ultra-small particle believed to give all matter its mass.

They began doing so this week under a programme run by the Nanyang Technological University in conjunction with the European Organisation for Nuclear Research (Cern), which is at the forefront of the hunt for the particle.

The three-week programme, to be held every two years, will focus on the physics of particles and include lectures and work-

shops by experts in the field.

This batch of participants will also help Cern scientists analyse data from its laboratories to prove that the Higgs Boson particle exists.

The Large Hadron Collider at Cern, a machine that collects information on particles, generates about 15 million gigabytes of data each year.

About 120 students, academics and researchers from Singapore and the region were picked for this year's programme.

Deputy Prime Minister Teo Chee Hean, the guest of honour at the opening ceremony on Monday, said the programme, called a "winter school", will give Singapore students "a high-level platform to keep up to date with the

frontiers of particle physics and technology".

Such short-term schools, traditionally held in the US and Europe during the winter and summer breaks, are meant to help scientists keep pace with developments in their fields and learn about trends in related sciences.

Professor Ignatios Antoniadis, the theory division's head of physics at Cern, said the institute could in the future also collaborate with other Singapore schools and agencies, such as the National University of Singapore and the Agency for Science, Technology and Research.

DPM Teo said the Ministry of Education will send teachers to Cern to enhance their science-teaching methods.

The programme's patron is Thailand's Princess Maha Chakri Sirindhorn, who visited Cern in 2009 and initiated a collaboration between her country and the organisation.

Thailand holds its second workshop with Cern in April.

FENG ZENGKUN

The Straits Times article on the 1st IAS-CERN School (11 January 2012).



The cheerful delegates in a group photograph at the 1st IAS-CERN School.



Deputy Prime Minister Teo Chee Hean (centre) at the launch of the School, accompanied by NTU President, Prof Bertil Andersson (right) and Prof Phua Kok Khoo (Director, IAS).

The success of the School encouraged IAS, together with support from CERN, to organise the 2nd School from 2 to 6 February 2015, as well as two workshops in 2013 and 2014.

International Conference on Pan Shou: A Centennial Commemoration (31 March 2012)

The conference and exhibition in honour of the 100th anniversary of a famous Chinese literary figure, Pan Shou, was jointly organised by IAS and the College of Humanities, Arts, and Social Sciences, and supported by the Tan Kah Kee International Society. An all-rounder in the poetic and academic realms, the late Pan Shou is fondly remembered as the best calligrapher and Chinese poet in Singapore.

Mr Heng Swee Keat (then Minister for Education) graced the conference as the Guest-of-Honour. Mr George Yeo (IAS Patron and former Minister of Foreign Affairs) was unable to attend but he kindly sent a message in support of Pan Shou's important contributions to Singapore's education, cultural and arts identity. Mr Yeo, an ardent supporter of the arts, said that Singapore would have been poorer culturally if not for Pan Shou's literary works. It was therefore meaningful to remind people of Pan Shou's monumental contributions, because "without collective memories, there is no strong community." International speakers hailing from China, Hong Kong and Malaysia, including expert Chinese calligraphers and poets, attended the conference.



Mr Heng Swee Keat (then Minister for Education, centre front row) was the Guest-of-Honour.

**Global Young Scientists Summits (GYSS) (20 to 25 January 2013,
19 to 24 January 2014, 18 to 23 January 2015, 17 to 22 January 2016)**



GYSS 2016 speakers discussed the trends and issues facing the scientific community at a panel discussion. (Photo: National Research Foundation Singapore)

The GYSS is an annual gathering of close to 300 young scientists and researchers from all over the world, who gather in Singapore to interact with eminent scientists and technology leaders including recipients of the Nobel Prize, Fields Medal, Millennium Technology Prize and Turing Award. It is a multi-disciplinary summit, covering topics ranging from chemistry, physics, medicine, mathematics, computer science and engineering. Over a five-day programme comprising plenary lectures, panel discussions and small group sessions, the young scientists and researchers are inspired and encouraged to pursue their scientific dreams. Public talks are also held island-wide where the prize winners engaged the public, students and researchers. These public talks stimulate interest and inject excitement in science, technology and innovation.

GYSS was launched in 2013 by Dr Tony Tan Keng Yam, President of the Republic of Singapore and Patron of GYSS. GYSS is organised by National Research Foundation Singapore. IAS helped to invite some of the speakers including Nobel Laureates and Fields Medallists.



Sir Richard Roberts (Nobel Laureate in Physiology or Medicine 1993) interacting with GYSS 2015 participants over coffee. (Photo: National Research Foundation Singapore)



GYSS 2014 participants get up close with Prof Michael Grätzel, Millennium Technology Prize (2010). (Photo: National Research Foundation Singapore)

**Conference in Honour of the 90th Birthday of Professor Rudolph Marcus: Fundamentals in Chemistry and Applications
(22 to 24 July 2013)**

The conference in honour of Prof Rudolph Marcus' contribution to chemistry was held from 22 to 24 July 2013 with sponsorship from the Lee Foundation. His groundbreaking theory on electron transfer won him the Nobel Prize in Chemistry in 1992. The Marcus theory has since become the dominant theory describing electron transfer reactions that are ubiquitous in chemistry and biology. The presence of many international participants amongst the locals added much diversity to the special occasion.

Prof Bertil Andersson (NTU President) graced the opening ceremony as Guest-of-Honour. Among the 19 international speakers were Nobel Laureate Prof Yuan-Tseh Lee and Millennium Technology Prize Laureate Prof Michael Grätzel.



A joyful Prof Marcus receiving his birthday gift from Prof Bertil Andersson at the conference banquet held at Tanglin Club.

**Conference in Honour of the 90th Birthday of Professor Freeman Dyson
(26 to 29 August 2013)**

To celebrate Prof Freeman Dyson's illustrious career in physics, mathematics, astronomy, nuclear engineering and climate change, IAS organised the



(left) Prof Dyson had a nice chat with Prof Bertil Andersson (NTU President).

(right) Nobel Laureate Prof David Gross delivering his presentation on Quantum Field Theory.



Prof Dyson cutting his birthday cake. Cheering him on were (from left) Mrs Dyson, Prof David Gross (Nobel Laureate in Physics 2004), Prof Shou-Cheng Zhang (Stanford University and Tsinghua University) and Prof Phua Kok Khoo (Director of IAS).

Conference in Honour of his 90th Birthday from 26 to 29 August 2013 with the support of the Lee Foundation. The Guest-of-Honour for the event, Prof Bertil Andersson (NTU President), addressed over 160 speakers and participants who came from different parts of the world to join in the festivities.

The distinguished speakers included Prof David Gross (Nobel Laureate in Physics 2004), Prof Shou-Cheng Zhang (Stanford University), Prof Xiao-Gang Wen (Perimeter Institute), Prof Kazuo Fujikawa (RIKEN), Prof Molin Ge (Nankai University) and many others. There were also public lectures by popular science writers Prof Lawrence Krauss and Prof Phillip Schewe dedicated to Prof Freeman Dyson.

**International Conference and Exhibition on Plague Fighter
Dr Wu Lien-Teh jointly organised with the Lee Kong Chian
School of Medicine (5 to 12 April 2014)**

“Plague Fighter” Dr Wu Lien-Teh was widely considered as the Founding Father of modern medicine for China. He saved millions of lives in the fight against the pneumonic plague of China over hundred years ago. For his “Work on Pneumonic Plague and for identifying the role of the Tarbagan marmot in the disease transmission”, he was nominated for the Nobel Prize in Medicine in 1935.

The conference was organised by IAS and Lee Kong Chian School of Medicine at NTU, the Singapore China Friendship Association and Dr Wu Lien-Teh Society, Penang. A well illustrated and informative photograph exhibition on the life and work of Dr Wu was also on display for one week. Nine distinguished speakers presented interesting anecdotes covering a wide range of aspects of Dr Wu’s life and work. Minister for Health Mr Gan Kim Yong, graced the occasion as Guest-of-Honour. The Ambassador of the People’s



The Minister for Health, Mr Gan Kim Yong (third from right) graced the occasion as Guest-of-Honour and officiated the opening of the exhibition.

Republic of China to the Republic of Singapore, H.E. Duan Jielong, was the VIP guest.

Workshop on the Chemistry of Energy Conversion: From Molecular Design to Advanced Materials & the 6th MRS-S Conference on Advanced Materials (22 to 24 July 2014)

IAS, the College of Science and the School of Materials Science and Engineering at NTU, as well as the Materials Research Society of Singapore jointly organised the workshop and conference in 2014. Chaired by Prof Peidong Yang of the University of California, Berkeley, it focused on the importance of advancement of new materials design and development with efficient energy conversion, so as to provide for a sustainable energy future that does not rely on fossil fuels. The event brought forth many distinguished speakers to share their views on this topic and also showcased the recent development in the field. The opening ceremony was graced by Prof Freddy Boey (Provost of NTU), a materials scientist himself.



(from left) Prof Peidong Yang (University of California, Berkeley), Prof Phua Kok Khoo (Director of IAS), Prof Chowdari (Materials Research Society of Singapore) and Prof Freddy Boey (Provost of NTU).

28th General Assembly of the International Union of Pure and Applied Physics (IUPAP) (5 to 7 November 2014)



The IUPAP 2014 Executive Council at the 28th General Assembly in NTU, Singapore. (from left) Prof Bruce McKellar (current President), Prof Cecilia Jarlskog (Immediate Past President), Prof Sukekatsu Ushioda (Past President), and Prof Stuart Palmer (Immediate Past Secretary General).

The International Union of Pure and Applied Physics (IUPAP), held its 28th General Assembly at NTU in Singapore from 5 to 7 November 2014. NTU President Prof Bertil Andersson was the Guest-of-Honour at the Assembly.

IUPAP was established in 1922 at Brussels with 13 member countries. The Union is composed of members representing identified physics communities. Adhering bodies act through their Liaison Committees. Delegates from these Committees meet in the General Assemblies of the Union, held every three years. Currently, the Union, which is made up of 60 member countries, is governed by its General Assembly, which meets every three years in a different country. The aim of IUPAP is to support and promote physics and the learning of physics worldwide.

The secretariat and administration work for IUPAP had been hosted by the Institute of Physics in London, England for the last six years since 2009. From 1 January 2015, secretariat responsibilities were transferred to Singapore and hosted by NTU. The move of the IUPAP office to Asia acknowledges and

supports the strong growth of physics activity in this region. Observers from ASEAN countries, which are not yet IUPAP members, attended the General Assembly in NTU. IUPAP hopes to build fruitful relations with them and that they will eventually become members of the Union.

2nd Singapore Sustainability Symposium (15 to 17 April 2015)

IAS and the Sustainable Earth Office at NTU jointly organised the 2nd Singapore Sustainability Symposium (S3) at the Regent Hotel. The Ministry of Health, Ministry of National Development and the Ministry for Environment and Water Resources, Singapore lent their support and collaboration and made the event a success.

The theme for S3 2015 was *Sustainable City Design*. The Guest-of-Honour, Permanent Secretary (Environment and Water Resources) Mr Choi Shing Kwok presented some key objectives from Singapore's new sustainability plan. He outlined the important areas of development and change that are being put in place for a more sustainable future. S3 has now become an international platform with a Singaporean flavour for sustainability and urban solutions with a special interest in the challenges faced by cities and city decision makers.



Panellists of the roundtable discussion on water recycling with the Guest-of-Honour Choi Shing Kwok (third from left), Permanent Secretary, Ministry for Environment and Water Resources.

Conference on 60 Years of Yang-Mills Gauge Field Theory: C N Yang's Contributions to Physics (25 to 28 May 2015)

During the last six decades, Yang-Mills theory has increasingly become the cornerstone of theoretical physics. It has widespread applications in statistical physics, condensed-matter physics, atomic and nonlinear optics and nonlinear systems. In May 2015, IAS held a major conference on *60 Years of Yang-Mills Gauge Field Theories* with sponsorship from the Lee Foundation, attracting more than 180 participants from around the world. Many eminent speakers attended the conference, including Nobel Prize winners Professors C N Yang and David Gross, Royal Medallist Michael Fisher, National Medal of Science winner Paul Chu, and many more.

In addition, Professors C N Yang, David Gross and Michael Fisher gave public lectures on their personal perspectives in physics. The conference also included a roundtable discussion on the role of regional labs and hubs in promoting collaboration in theoretical and fundamental physics. Various suggestions were made during the discussion, including strong arguments for creating an Asian version of CERN, where Asian countries could work with scientists from the rest of the world to uncover new levels of fundamental physics.



Roundtable discussion on international collaboration chaired by Prof Ngee-Pong Chang.

During the conference, the NTU C N Yang Scholars also had the privilege of engaging in an informal discussion with Prof C N Yang on 27 May 2015. The scholars were enlightened by his unique philosophy of research work and life that he shared with the scholars with some humour.

2nd Pan Asia Liberal Arts Education Conference (28 to 29 October 2015)

Jointly organised by IAS and the College of Humanities, Arts, and Social Sciences at NTU, the conference aimed to explore concepts and development directions of liberal arts education around the world, and to address issues that universities and liberal arts colleges face in this modern era. The 1st Liberal Arts Education Conference was held in April 2014 at the University of Nottingham Ningbo China. NTU was pleased to be the host of the 2nd Liberal Arts Education Conference which featured eight presidents of renowned universities — Professors Fujia Yang (President, University of Nottingham Ningbo China), Steve Kang (President, KAIST), Chia-Wei Woo (Founding President, HKUST), Pericles Lewis (President, Yale-NUS College), Frank Chang (President, National



Prof Da Hsuan Feng (standing) chaired the roundtable discussion on *Liberal Arts Education in Asia in the 21st Century*.

Chiao Tung University), Peihua Gu (Provost and Vice President, Shantou University), Joseph Sung (President, The Chinese University of Hong Kong) and Wei Zhao (Rector, University of Macau).

Around 120 attendees attended the conference, including high school students, undergraduates and interested members of the public. There was also a roundtable discussion on *Liberal Arts Education in Asia in the 21st Century* which provided useful insights on the state of liberal arts education in different parts of Asia. The 3rd conference will be hosted by Fudan University.

Memorial Meeting for Nobel Laureate Professor Abdus Salam's 90th Birthday (25 to 28 January 2016)

Co-chaired by Prof Lars Brink (Chalmers Institute of Technology), Prof Michael Duff (Imperial College London) and Prof Phua Kok Khoo (Director of IAS), the memorial meeting was held to commemorate and celebrate Prof Salam's numerous achievements and pioneering contributions to physics. Among the speakers were four Nobel Laureates, Professors David Gross, Anthony Leggett, Carlo Rubbia and Gerard t' Hooft. NTU President Prof Bertil Andersson delivered a welcome address at the opening ceremony. The event was sponsored by the Lee Foundation.

The late Abdus Salam was the first Muslim to be awarded the Nobel Prize in science. He was one of the most prolific and exciting scientists of the second half of the last century. Salam believed that "scientific thought is the common heritage of all mankind" and that the developing world should play its part, not merely by importing technology but by being the arbiter of its own scientific destiny. In 1964, he founded the ICTP in Trieste, where thousands of scientists from developing countries have been trained.



Engaging talks by Nobel Laureates at the Memorial Meeting of the late Prof Abdus Salam.

Workshop on the Evolution of Cells, Genomes and Proteins (1 to 6 February 2016)

The workshop was co-organised with the Royal Swedish Academy of Sciences and the NTU School of Biological Sciences (SBS). The event is an outgrowth of the 2014 meeting in Stockholm to celebrate three centuries of science supported by the Royal Science Academy. It seeks to introduce to the Singapore community of molecular cell biologists the newly emergent molecular phylogenomic methods as well as their applications to studies of evolution at the hierarchical levels of cells and protein molecules.

The workshop was chaired by Prof Charles Kurland (Uppsala University, Sweden), and co-chaired by Prof Lars Nordenskiöld (SBS, NTU) and Prof Phua Kok Khoo (IAS, NTU). Among the speakers were two Nobel Laureates, Prof Michael Levitt (Nobel Laureate in Chemistry 2013) and Prof Sydney Brenner (Nobel Laureate in Physiology or Medicine 2002).



Speakers and participants shared camaraderie moments at the Workshop on Evolution of Cells, Genomes and Proteins.

INTERNATIONAL PANEL OF ADVISORS

IAS is advised and guided by a committee of world-renowned scientists, including 11 Nobel Laureates and a Fields Medallist. They are:



Prof David Baltimore
Nobel Prize in
Physiology or Medicine
1975



Prof Aaron Ciechanover
Nobel Prize in Chemistry
2004



Prof Gerard 't Hooft
Nobel Prize in Physics
1999



Prof Masatoshi Koshiya
Nobel Prize in Physics
2002



Prof Yuan-Tseh Lee
Nobel Prize in Chemistry
1986



Prof Anthony Leggett
Nobel Prize in Physics
2003



Prof Douglas Osheroff
Nobel Prize in Physics
1996



Prof Rudolph Marcus
Nobel Prize in Chemistry
1992



Prof Samuel Ting
Nobel Prize in Physics
1976



Prof Chen Ning Yang
Nobel Prize in Physics
1957



Prof Ahmed Zewail
Nobel Prize in Chemistry
1999



Prof Pierre-Louis Lions
Fields Medallist 1994



Prof Shu Chien
University of California,
San Diego



Prof Ping-Cheung Leung
The Chinese University of
Hong Kong



Prof Paul Chu
University of Houston



Prof Gang Tian
Peking University



Prof Peter Goddard
Institute for Advanced
Study, Princeton



Prof Mary Ritter
Imperial College
London



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