



Singapore Mathematical Society 2013 Activities & Events

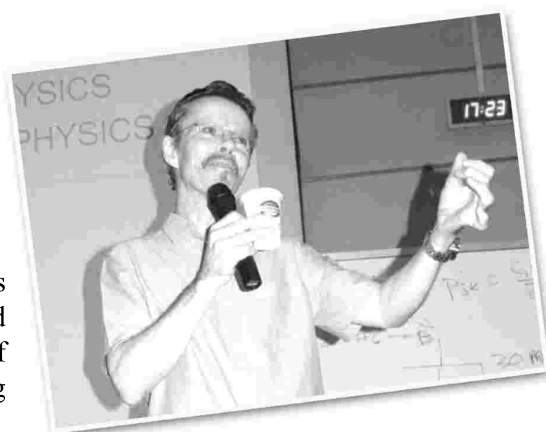


1. SMS Lecture Series

This annual lecture series, which is traditionally organized in conjunction with the Annual General Meeting of the Singapore Mathematical Society, features eminent local mathematicians or mathematics educators to share with the public some of their interests and ideas.

- Date: March 11 2013
- Venue: LT31, National University of Singapore
- Title: **Topology, Geometry and Nuclear Physics**
- Speaker: **Professor Brett McInnes**

Brett McInnes is a Professor at the Department of Mathematics at the National University of Singapore. He has published 76 scientific papers on a wide variety of applications of geometry and topology to particle and nuclear physics, string theory, general relativity, and cosmology.



AMAZING theorem:

$$\int_S K d\sigma = 2\pi\chi(S)$$

This [due to Gauss and Bonnet] says that the total curvature of the surface, a GEOMETRIC quantity, equals a multiple of the Euler characteristic, a TOPOLOGICAL one!! Since, by definition, the right side never changes under any continuous deformation, we conclude that the left side doesn't change either!!!

TOPOLOGY CONSTRAINS GEOMETRY!

Abstract: At the Large Hadron Collider in Geneva, one of the experiments studies what happens when nuclei of lead atoms are smashed together at extremely high speeds [over 99.99% of the speed of light]. The result is the hottest matter ever observed [about 5.5 trillion degrees K]. The behaviour of matter under such extreme conditions is not easily understood using conventional physics. Recently it has been suggested that methods from black hole theory, involving sophisticated techniques from topology and global differential geometry, may be needed to predict its behaviour. I will talk about one such application, in a non-technical way.



2. AME-SMS Conference 2013

This Conference for mathematics teachers is the second joint collaboration between the Association of Mathematics Educators (AME) and the Singapore Mathematical Society (SMS). The one-day programme comprised of lectures delivered by mathematicians and mathematics educators. Three SMS members were invited to deliver lectures for the secondary/junior college teachers.

- Theme: Learning Experiences in Mathematics
- Date: June 6 2013
- Venue: NUS High School of Mathematics and Sciences

Speaker 1: Associate Professor Victor Tan

Title: Ten Ways to Enhance Learning Experience in Mathematics

Abstract: Over the past few years, we have seen the shift in the emphasis of mathematical education. As recommended by MOE, math curriculum should not just focus on the teaching of concepts and problem solving skills, but also the metacognitive skills as well as other soft skills. On the other hand, as a university math lecturer, the speaker has observed over the years the performance of students in undergraduate math classes and noticed the gap in the mathematical training between the junior college and tertiary level. Certain areas of students' pre-university math education need to be looked into. In this talk, the speaker will address the challenges and problems in the teaching and learning of mathematics, and suggest ways to enhance the learning experience.



Speaker 2: Dr David Chew

Title: Probability Through Games

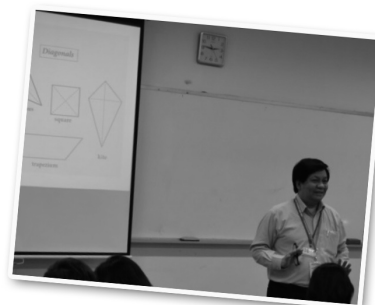
Abstract: Most people have some appreciation of probability, just as most people can enjoy a pleasant tune. However, some of its problems and results can be counter-intuitive. My experience, based on talks I have given, suggests that it is possible to teach advanced ideas in probability to secondary school and pre-university students. A typical talk involves giving a brief introduction to some important concepts in probability and going through selected famous problems. Through simple and fun activities, students were able to gain insights and appreciation of these problems and concepts.



Speaker 3: Dr Hang Kim Hoo

Title: Problem Solving and Posing as Context for Developing Mathematical Habits of Mind

Abstract: This workshop will bring participants through solving some problems in Geometry to demonstrate how problem solving and problem posing can be integrated naturally to explicate mathematical reasoning and develop productive habits of mind in learning and doing mathematics.



3. SMS Distinguished Visitor Programme

The Distinguished Visitor Programme was established by the Singapore Mathematical Society in 1998 with the aim to expose as large and diverse an audience as possible, to the excitement and relevance of mathematics. Through the visit of the distinguished visitor and interaction with the mathematics community, the Singapore Mathematical Society looks forward to enhancing public awareness on the importance of the role of mathematics in society.

Visitor: **Professor Imre Leader** (See Page 2 for an Interview with Prof Leader)

SMS Teacher's Workshop: How to mark hard questions?

- Venue: NUS High School
- Date: August 27, 2013

Abstract: How should one approach the marking of a script from a student that is about a hard problem? How does this differ from marking a 'rote' or 'routine' question like an A-level question? What are the right kinds of comments to make on the script, to help the student?

SMS Public Lecture: Think of a Number

- Venue: NUS High School Auditorium
- Date: August 28, 2013

Abstract: In the game of 'How rich am I?', each player has one minute to write down on a piece of paper the biggest number he can. The winner is the person with the bigger number. What are some good strategies for this game? This is a topic that is extremely open-ended. It is always great fun, even though there are important mathematical points to be made.

SMS Academic Talk: Partition Regular Equations

- Venue: SPMS, NTU
- Date: August 28, 2013

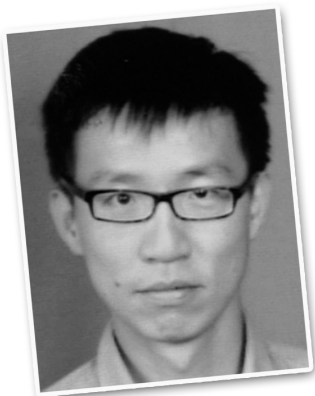
Abstract: A finite or infinite matrix M is called 'partition regular' if whenever the natural numbers are finitely coloured there exists a monochromatic vector x with $Mx=0$. Many of the classical results of Ramsey theory, such as van der Waerden's theorem or Schur's theorem, may be naturally rephrased as assertions that certain matrices are partition regular. While the structure of finite partition regular matrices is well understood, little is known in the infinite case. In this talk we will review some known results and then proceed to some recent developments.



4. Singapore Mathematics Symposium

This is the fourth year the Singapore Mathematical Society organized the Singapore Mathematics Symposium, which is an initiative to promote interaction within this community and to showcase some of the exciting developments originating from Singapore. This year, four prominent mathematicians from NUS and NTU were invited to speak. A poster exhibition and competition for graduate students was also held during the symposium.

- Date: September 27 2013
- Venue: Nanyang Technological University, SPMS-LT1



Speaker 1: **Professor Gan Wee Teck (NUS)**
 Title: **On the Gross-Prasad Conjecture**

Abstract: I will discuss a restriction problem in the representation theory of classical groups, first formulated by Gross and Prasad in the early 90's and subsequently extended to all classical groups more recently. A conjectural answer to this problem, over both local and global fields, is formulated in the framework of the Langlands program. There has been much recent progress on these conjectures and we shall survey some of these.

Speaker 2: **Professor Xu Xingwang (NUS)**
 Title: **Negative Gradient Flow and Non-Linear Boundary Value Problem**

Abstract: In this talk, I will report the recent progress on a well-known nonlinear boundary value problem. This problem is closely related to sharp trace inequality and geometric description of the mean curvature on the boundary among its conformal deformations. The method used is the negative gradient flow.



Speaker 3: **Professor Gopal Pandurangan (NTU)**
 Title: **Distributed Algorithmic Foundations of Dynamic Networks**



Abstract: Many of today's real-world communication networks are highly dynamic, i.e., their network topology changes continuously over time. Examples include Peer-to-Peer (P2P) networks and ad hoc wireless and sensor networks. In P2P networks (e.g., Skype, BitTorrent), the topology changes at a rapid rate due to continuous joining and leaving of nodes; in ad hoc sensor and vehicular networks, the topology changes dynamically due to failure or mobility of the nodes. Performing robust and efficient non-trivial distributed computation in such highly dynamic networks is challenging. In this talk, I will give an overview of our recent results that make progress towards developing an algorithmic theory of dynamic networks. First, I will present a rigorous theoretical framework for studying dynamic networks. Then I will present efficient techniques and algorithms for solving the fundamental agreement problem in dynamic networks. I will also present efficient algorithms for key problems such as information spreading, search, and storage. To complement our algorithms, I will also present almost tight lower bounds for agreement and information spreading.

Speaker 4: **Professor Bao Weizhu (NUS)**

Title: **Ground States and Dynamics of the Nonlinear Schrodinger/Gross-Pitaevskii Equations and Applications**

Abstract: In this talk, I begin with a brief derivation of the nonlinear Schrodinger/ Gross-Pitaevskii equations (NLSE/GPE) from Bose-Einstein condensates (BEC) and/or nonlinear optics. Then I will present some mathematical results on the existence and uniqueness as well as non-existence of the ground states of NLSE/GPE under different external potentials and parameter regimes. Dynamical properties of NLSE/GPE are then discussed, which include conservation laws, soliton solutions, well-posedness and/or finite time blowup. Efficient and accurate numerical methods will be presented for computing numerically the ground states and dynamics. Extension to NLSE/GPE with an angular momentum rotation term and/or non-local dipole-dipole interaction will be presented. Finally, applications to collapse and explosion of BEC, quantum transport and quantized vortex interaction will be investigated.



Poster competition

Winner 1: **Huang Mengmin (Department of Mathematics, NUS)**

Title of Project: **Simulations of Streamer Propagations based on Discontinuous Galerkin Methods**

Abstract: Streamer propagation is an interesting discharge phenomenon in plasma physics. The time scale of streamer propagation is from nanoseconds to microseconds. Due to the reason of such a small time scale, numerical simulations become a more effective way to capture the features of streamer than experiments in the recent years. In this work, we use discontinuous Galerkin methods to solve the physical model of streamer propagation. Our method possesses high resolution and it could be easily extended to different types of discharge regions.

Winner 2: **Gao Fan (Department of Mathematics, NUS)**

Title of Project: **The Residual Spectrum of $Mp_4(AF)$**

Abstract: As a central topic in number theory and automorphic representations, it is important to understand the spectrum decomposition of a global group. There has been significant work done for classical linear groups and low-rank covering groups by many people, for instance Mœglin, Waldspurger and Arthur to mention a few. We are interested in the rank two global group $Mp_4(AF)$ which is a degree two covering of $Mp_4(AF)$. Here the focus is on the residual spectrum. We determine completely the residual spectrum of $Mp_4(AF)$ by implementing the theory of Eisenstein series developed by Langlands etc.

5. Singapore Mathematical Olympiad 2013

• Dates:

- June 4 2013 (Junior and Senior section - First round)
- June 5 2013 (Open section - First round)
- June 29 2013 (Junior and Senior section - Second round)
- July 6 2013 (Open section - Second round)



- The Society conducted the Singapore Mathematical Olympiad (Junior, Senior and Open Sections) in June 2013. A total of 9164 students from 151 secondary schools and junior colleges participated in the various sections of the Olympiad.
- For Junior section, there are 4697 participants from 118 schools. For Senior section, there are 2906 participants from 112 schools. For Open section, there are 1561 participants from 75 schools.
- The SMO Subcommittee 2013 consists of
 - Associate Professor Victor Tan (Chairman)
 - Dr Hang Kim Hoo (Deputy Chairman/Administration)
 - Dr Toh Pee Choon (Junior Section Coordinator)
 - Dr Wang Fei (Senior Section Coordinator)
 - Associate Professor Toh Tin Lam (Open Section Coordinator)
 - Associate Professor Tay Tiong Seng (Second Round Coordinator)



From left: Winning schools of the Junior, Senior and Open sections

- The top 10 ranking for the various sections is given below:

Junior section (Team)	
1	Raffles Institution
2	NUS High School of Mathematics and Science
3	Hwa Chong Institution
4	Raffles Girls' School (Secondary)
5	River Valley High School
6	Nanyang Girls' High School
7	Anglo-Chinese School (Independent)
8	Catholic High School
9	Dunman High School
10	Chung Cheng High School (Main)

Junior section (Individual)	
1	Dylan Toh Shan Hong (NUSHS)
2	Ma Zhao Yu (RI)
3	Tan Likai (RI)
4	Clarence Chew Xuan Da (NUSHS)
5	Zhang Guangxuan (RI)
6	Joel Tan Junyao (Catholic High Sch – Pri)
7	Chua Yu Xuan, Jordan (RI)
8	Bryan Wang Peng Jun (HCI)
9	Goh Hong Pei (HCI)
10	Matthew Fan Xin Yu (NUSHS)

Senior section (Team)	
1	Raffles Institution
2	Hwa Chong Institution
3	NUS High School of Mathematics and Science
4	National Junior College
5	Nanyang Girls' High School
5	Raffles Girls' School (Secondary)
7	St Joseph's Institution
8	River Valley High School
9	Singapore Chinese Girls' School
10	Anglo-Chinese School (Independent)

Senior section (Individual)	
1	Lee Hua Jun, Eugene (RI)
2	David Lin Kewei (RI)
3	Liu Yi Jia (RI)
4	Sheldon Kieren Tan (RI)
5	Tan Siah Yong (RI)
6	Siew Kheng Hun (RI)
7	Yang Shuang Yuan (HCI)
8	Daniel Tan Chee Hian (HCI)
9	Zhao Pengfei (HCI)
10	Yu Letian (HCI)

Open section (Team)	
1	NUS High School of Mathematics and Science
2	Raffles Institution
3	Hwa Chong Institution
4	National Junior College
5	Anglo-Chinese School (Independent)
5	Temasek Junior College
7	Victoria Junior College
8	Dunman High School
9	Raffles Girls' School (Secondary)
10	River Valley High School

Open section (Individual)	
1	Lim Jeck (NUSHS)
2	Sheldon Kieren Tan (RI)
3	Clarence Chew Xuan Da (NUSHS)
4	Tan Pin Lin (NUSHS)
5	Xu Linfeng (HCI)
5	Ling Yan Hao (NUSHS)
7	David Lin Kewei (RI)
8	Liu Yi Jia (RI)
9	The Jiun Harn (RI)
10	Tan Siah Yong (RI)

6. Singapore Mathematics Projects Festival 2013

- Dates:
 - February 16 2013 (Preliminary round A)
 - February 23 2013 (Preliminary round B)
 - March 23 2013 (Festival Congress – Final round)
- This year the Project Festival attracted 14 projects from Junior section and 25 projects from Senior section.
- The preliminary rounds were held at various locations, including Raffle Girls' School, Hwa Chong Institution, NUS High School, River Valley High School, Paya Lebar Methodist Girls' School. Judging panels made up of Mathematicians and school teachers were formed to grade the presentation of each team.
- 5 teams from the Junior section and 6 teams from Senior Section were invited to the Festival Congress held at Commonwealth Secondary School
- The judges for the Festival were
 - Junior Section:
 - Dr Teo Kok Ming (NIE)
 - Assoc Prof Zhao Dong Sheng (NIE)
 - Dr Toh Pee Choon (NIE)
 - Senior Section:
 - Dr Wang Fei (NUS)
 - Dr Ku Cheng Yeaw (NUS)
 - Assoc Prof Tay Tiong Seng (NUS)
- Medals were awarded to the following projects:

Junior section

Silver: Marion Walter's Theorem

by Seow Ling Ern, Fu Wan Ying, Oan Jia Xuan
(Nanyang Girls' High School)

Silver: Pseudo-Randomness

by Tin Jun Hao, Yew Tze Yong, Yip Seng Yeun, Kow Hong Xuan
(Hwa Chong Institution)

Bronze: Blind Spots in Cars

by See Wan Yi Faith, Deborah Chin Jia Min, Thng Hui Min Felicia
(Methodist Girls' School)

Bronze (and Best Overall Presentation): Shortest Travelling Time in MRT

by Sonia Esaki Kanthimathi Nainar Arumuga, Madhumita Narayanan, Srinithi
(NUS High School of Mathematics and Science)

Bronze: Blokus Winning Strategies

by Hsiao I Ann, Yeo Wan Jin
(NUS High School of Mathematics and Science)



Senior section

Gold (Foo Kean Pew Memorial Prize): Computer Solution to Convex 7-Gon Happy Ending Problem via Graph-to-Matrix Transformation

by Liu Changshuo, Philip Ong Zheng Yang, Gao Yuan
(Anglo-Chinese School)

Silver: Skewness of Some Generalized Petersen Graphs

by Zhu Shiyao, Lim Yu Chen, Mok Bingwei, Maurice
(NUS High School of Mathematics and Science)

Silver: Let's Go Bowling!—the Mathematics behind Getting a Strike in Bowling

by Wang Qian, Qu Wenqin, Pu Xijin, Chen Liu
(Nanyang Girls' High School)

Bronze: Generalization of Catalan Numbers Using the Hook's Length Formula

by Choi Yun Young, Liu Hang, Lin Shao Yun
(NUS High School of Mathematics and Science)

Bronze: The Broken Stick Problem

by Ng Chong Yi, Chua Kee Han Daryl
(NUS High School of Mathematics and Science)

Bronze: Master Mafia

by Lang Yanbin, Liu Siyu, Xia Nan
(Hwa Chong Institution)

Bronze: Creative Ruler

by Jovin Chua Jun Wen, Wu Xin Yun Natalie, Yoong Sean Young Edmund, Zhang Jiaheng
(Clementi Town Secondary School)

Best Overall Presentation: The Last Biscuit

by Zhang Wanyue, Tang Jiayun, Li Jiayi, Lu Lu
(CHIJ St Nicholas)



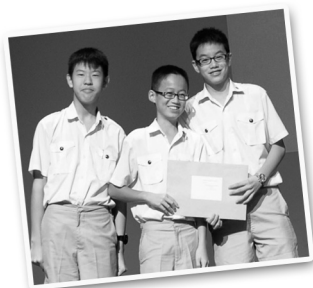
7. Singapore Mathematical Society Essay Competition

This year, to coincide with the "Mathematics of Planet Earth Year", the Singapore Mathematical Society brought back the SMS Essay Competition after a 2 year hiatus. The main objective of this year's competition is to allow students to explore how Mathematics can be applied in various studies of our Planet.

- The competition commenced on 13th March and end on 28th June 2013.
- This year's competition attracted 24 entries for Category A (Secondary 1 and 2), 29 entries for Category B (Secondary 3 and 4) and 44 entries for Category C (JC1 and 2).
- The judges for the Competition were
 - Dr. Ng Kah Loon (NUS)
 - Dr Soon Wanmei Amanda (NIE)
 - Mr Khoo Hock Heng (River Valley High School)
 - Mr Koh King Koon (Raffles Girls' School Secondary)
- The winners of the competition are as follow:

See pages 11 - 23 for the winning essays

Category A



1st: Is God a Mathematician

by Julius Chua Han Xian, Leow Ee-J, Heng Javier (Hwa Chong Institution)(Left)

2nd: Mathematics of Earth Sciences

by Darren Suen Wei Jie (National Junior College)

3rd: Earth: A Planet of Change

by Evelyn Jacob, Chua Li Ying, Amanda Mah (CHIJ ST. Theresa's Convent)

Category B

1st: 3D Model Restoration from 2D Satellite Pictures

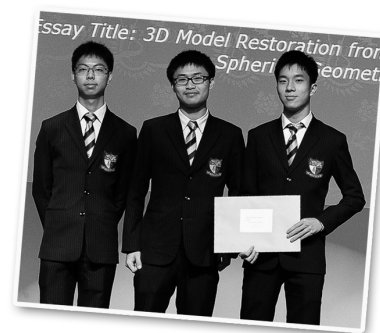
by Spherical Geometry, by Gao Yuan, Wu Shenyang, Bei Yijie (Anglo-Chinese School (Independent)) (Right)

2nd: The motion of satellites

by James Ee Jun Long (Hwa Chong Institution)

3rd: Rate of fluid flow through porous media

by Xu Ming Xin, Kiong Min Yi Kimberly, Yip Juen Chen Nicole (Paya Lebar Methodist Girls' School (Secondary))



Category C



1st: The Mathematical Earth

by Tong Hien Chi (National Junior College) (Left)

2nd: Geodesy and Radius of the Earth

by Le Nguyen Vuong Linh, Liu Tianxiao (Anglo-Chinese School (Independent))

3rd: Mathematics and the Haze

by Ong Ka-Shing, Tan Kwan Wei Kevin, Teow Yong Zhen (Hwa Chong Institution)

8. Annual Prize Presentation Ceremony

- Date: September 07 2013
- Venue: NUS High School of Mathematics and Sciences
- Guest of Honour: **Professor Chong Chi Tat**
(Director, Institute for Mathematical Sciences, NUS) *(Right)*
- The following prizes were given out at the ceremony:

9 prizes for the SMS Essay Competitions

7 prizes for the Singapore Mathematics Project Festival (Junior Section)

13 prizes for the Singapore Mathematics Project Festival (Senior Section)

30 individual prizes and 22 team prizes for the Singapore Mathematical Olympiad (Junior section)

31 individual prizes and 21 team prizes for the Singapore Mathematical Olympiad (Senior section)

31 individual prizes and 10 team prizes for the Singapore Mathematical Olympiad (Open section)

Awards to the Singapore Team to the 54rd International Mathematical Olympiad
(Below)



- Winner of the Gold award for the senior section of the Singapore Mathematics Project Festival also presented their winning projects: “**Computer Solution to Convex 7-Gon Happy Ending Problem via Graph-to-Matrix Transformation**” by Liu Changshuo, Philip Ong Zheng Yang, Gao Yuan from Anglo-Chinese School. *(Right)*



9. Singapore Mathematical Society Masterclasses

This programme is jointly organized by SMS, MOE and the Singapore Science Center. It is a one to two day program targetting at mathematically talented students. It is designed to encourage, inspire and engage young people in the art and practice of mathematics by introducing them to aspects, including applications, which may not usually be covered in the school curriculum. Within each class, students are given the opportunity to explore the subject for themselves, either individually or in small groups, with help being on hand if needed.

- Date: July 2-5, 2013
- Venue: Singapore Science Centre

Speaker 1: Associate Professor Chua Chek Beng (Division of Mathematical Sciences, NTU)
Topic: The Mathematics of Transportation

Abstract: The efficient allocation of resources is essential in the sustainability of a global metropolis such as Singapore. At the core of this lies Transportation Theory, which is the study of optimal transportation and allocation of resources such as material, goods and energy. In this workshop, you will explore two fundamental mathematical problems, the shortest path problem and the transportation problem. You will discover the various algorithms designed by mathematicians over the years to solve these problems, and learn the mathematical techniques involved in proving the correctness of these algorithms. This foundational knowledge will open your door to an exciting branch of Mathematics known as Operations Research.



Speaker 2: Dr David Chew (Department of Statistics and Applied Probability, NUS)
Topic: Probability Through Games



Abstract: A gambler's dispute in 1654 led to the creation of a mathematical theory of probability by two famous French mathematicians, Blaise Pascal and Pierre de Fermat. Today, probability is a thriving mathematical area and has many applications in real problems. In this talk, we give an introduction to important concepts and selected famous problems in probability. Through simple and fun activities, it is hoped that participants will be able to gain insights and appreciation of these problems and concepts.