

Mathematics Enrichment Camp 2013

Date: Saturday, 24 August 2013

Time: 9.00 am to 2.00 pm

Venue: Lecture Theatre 25
Faculty of Science, National University of Singapore

Registration Open!

Organized by



Department of Mathematics

Programme

Time	Activity
8.30am	Registration
9.00am	Welcome Address By Professor Shen Zuowei Head, Department of Mathematics
9.05am	About the Department of Mathematics By Professor Zhu Chengbo
9.15am	Applied Partial Differential Equations: A Visual Approach and Applications By Professor Bao Weizhu
10.00am	"What Should You Do if You Fall Into a Black Hole?" By Professor Brett Mcinnes
10.45am	Tea Break
11.15am	The concept of infinity in Mathematics By Dr Dilip Raghavan
12.00pm	Modeling rare events in complex systems By Associate Professor Ren Weiqing
12.45pm	Lunch
<i>End of Programme</i>	

Abstracts

Applied Partial Differential Equations: A Visual Approach and Applications **By Professor Bao Weizhu**

The lecture illustrates topics of science/engineering, which occur in nature and/or are part of our daily lives. The described natural/engineering phenomena are modeled by partial differential equations, which relate physical variables like mass, velocity, energy etc. to their spatial and temporal variations. Typically these equations are highly nonlinear, in many cases they are also vectorial systems, and they represent a challenge even for the most modern and sophisticated mathematical-analytical and mathematical-numerical techniques. The chosen topics include flows of fluids and gases, granular material flows, biological processes like pattern formation on animal skins, kinetics of rarified gases and semiconductor devices. Each topic is briefly presented in its scientific or engineering context, followed by an introduction of the mathematical models in the form of partial differential equations with a discussion of the most basic mathematical properties, and then highlighted by a series of high quality photographs. The lecture is based on a book with the same title, authored by Professor Peter A. Markowich from University of Cambridge and published by Springer Verlag Heidelberg in 2006.

About the Speaker

Professor Bao got his Ph.D from Tsinghua University in 1995. He had postdoc experience at Imperial College in UK and Georgia Institute of Technology in USA. He joined the National University of Singapore (NUS) in 2000 and currently is Professor at Department of Mathematics, NUS. His research interests include numerical methods for partial differential equations; scientific computing/numerical analysis; analysis and computation for problems from physics, chemistry, biology and engineering sciences.

"What Should You Do if You Fall Into a Black Hole?" **By Professor Brett McInnes**

If you fell into a very large black hole, like the one thought to exist at the centre of our galaxy, you might survive for some time, but the time depends on what you do once inside: for example, it makes a difference if you try to turn around and get out. We will discuss how to maximize your remaining lifetime. To do so, we will introduce the basic ideas of spacetime geometry, and show how it works inside a black hole.

About the Speaker

Professor Brett McInnes is a graduate of the University of Sydney, and has been with NUS for 30 years. He has done research on a wide variety of applications of geometry and topology to physics, including string theory, cosmology, foundations of thermodynamics, particle theory, and applied black hole theory.

The concept of infinity in Mathematics

By Dr Dilip Raghavan

We will look at the various ways in which the concept of infinity gets used in mathematics and how set theory tries to tame this notion by turning it into a rigorous mathematical notion.

About the Speaker

Dr Raghavan received his PhD from the University of Wisconsin--Madison in 2008. He was a postdoctoral fellow at the University of Toronto from 2008 to 2011. He spent 1 year as a JSPS fellow at Kobe University before he joined NUS in 2012. His main research interests are in Mathematical logic, set theory, and general topology.

For further information visit <http://www.math.toronto.edu/raghavan/>

Modeling rare events in complex systems

By Associate Professor Ren Weiqing

Many problems arising from applied sciences can be abstractly formulated as a system that navigates over a complex energy landscape of high or infinite dimensions. Well known examples include nucleation events during phase transitions, conformational changes of bio-molecules, chemical reactions, some extreme events that lead to materials failure, etc. Very often there is a small amount of noise in the system, and it is the noise that derives the system from one metastable state to another. The transition between the metastable states is called rare events. In this talk, I will introduce the mathematical theory and computational techniques for modeling rare events.

About the Speaker

Assoc Professor Ren obtained his PhD from the Courant Institute of Mathematical Sciences at New York University in 2002. He was a member of the Institute for Advanced Study at Princeton (2002-2003) and an instructor at Princeton University (2003-2005) before joining the faculty of Courant Institute in 2005. In 2011, he joined the National University of Singapore and the Institute for High Performance Computing A*STAR. A/P Ren's research has focused on mathematical theory and numerical methods for the study of complex energy landscapes and rare events, analysis and simulation of multi-scale problems, and multi-phase flow and moving contact lines.

Getting to the Camp

1. Take the MRT and alight at Kent Ridge MRT Station.
2. Transfer to Internal Bus Service A1 / D2 at the bus-stop.
3. Alight at the bus-stop in front of the Lim Seng Tjoe Lecture Theatre 27 in NUS.
4. Follow the map and walk to Lecture Theatre 25.
5. For an interactive map of NUS, please visit <http://www.nus.edu.sg/campusmap/>



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Registration Instructions

1. The Registration Fee per person is **S\$30 (GST inclusive)** and this includes 1 tea break and lunch.
2. Payment is by **cheque only**. Please make cheque payable to **National University of Singapore**.
3. Cancellations are **not refundable** although participants can be substituted.
4. Please send the completed registration form together with the cheque **by Wednesday 31 July 2013 to:**

Ms Chan Lai Chee
Department of Mathematics
Blk S17 Level 4
National University of Singapore
10 Lower Kent Ridge Road
Singapore 119076

5. For further information, please contact Ms Lynette Wong (6516 8322, matwongl@nus.edu.sg), or Ms Chan Lai Chee (6516 2762, matclc@nus.edu.sg)